

TRANSCRIPT

LEGISLATIVE COUNCIL ENVIRONMENT AND PLANNING COMMITTEE

Inquiry into Renewable Energy in Victoria

Melbourne—Wednesday, 16 March 2022

MEMBERS

Ms Sonja Terpstra—Chair

Mr Clifford Hayes—Deputy Chair

Dr Matthew Bach

Ms Melina Bath

Dr Catherine Cumming

Mr Stuart Grimley

Mr Andy Meddick

Mr Cesar Melhem

Dr Samantha Ratnam

Ms Nina Taylor

PARTICIPATING MEMBERS

Ms Cathrine Burnett-Wake

Ms Georgie Crozier

Mr David Davis

Dr Tien Kieu

Mrs Beverley McArthur

Mr Tim Quilty

Mr Gordon Rich-Phillips

WITNESSES (*via videoconference*)

Dr Jonathan Spear, Chief Executive Officer, and

Ms Lorraine Conway, Principal Infrastructure Adviser, Infrastructure Victoria.

The CHAIR: I declare open the Legislative Council Environment and Planning Committee's public hearing for the Inquiry into Renewable Energy in Victoria. Please ensure that mobile phones have been switched to silent and that background noise is minimised.

I would like to begin this hearing by respectfully acknowledging the Aboriginal peoples, the traditional custodians of the various lands we are gathered on today, and pay my respects to their ancestors, elders and families. I particularly welcome any elders or community members who are here today to impart their knowledge of this issue to the committee or who are watching the broadcast of these proceedings. I would also like to welcome any members of the public who may be watching the live broadcast of these proceedings.

At this juncture I will take the opportunity to introduce committee members to you. My name is Sonja Terpstra. I am the Chair of the Environment and Planning Committee. Also joining us today via Zoom we have Clifford Hayes, who is the Deputy Chair; Dr Samantha Ratnam; Mr Stuart Grimley; and Ms Nina Taylor.

All evidence that is taken today is protected by parliamentary privilege as provided by the *Constitution Act 1975* and further subject to the provisions of the Legislative Council standing orders. Therefore the information you provide during the hearing is protected by law. You are protected against any action for what you say during this hearing, but if you go elsewhere and repeat the same things, those comments may not be protected by this privilege. Any deliberately false evidence or misleading of the committee may be considered a contempt of Parliament.

All evidence is being recorded, and you will be provided with a proof version of the transcript following the hearing. Transcripts will ultimately be made public and posted on the committee's website.

So for the Hansard record, could I please ask you to state your name and any organisation you are appearing on behalf of?

Dr SPEAR: I am Dr Jonathan Spear, the Chief Executive Officer of Infrastructure Victoria.

Ms CONWAY: And I am Lorraine Conway. I am a Principal Infrastructure Adviser at Infrastructure Victoria.

The CHAIR: Great. Thanks so much for that. At this juncture I will invite you to make your opening statement. If I could ask you to please keep your comments to about a maximum of 10 to 15 minutes, that way that will allow plenty of time for committee members to ask you questions. All right. Thanks very much, Jonathan and Lorraine. Over to you.

Dr SPEAR: Thank you very much, Chair. I would also like to acknowledge the traditional owners of the various lands on which we are meeting today and pay my respects to their elders past, present and emerging. I am Jonathan Spear, Chief Executive of Infrastructure Victoria, and with me is Lorraine Conway, who is a Principal Infrastructure Adviser with Infrastructure Victoria. As I think you are probably aware, Infrastructure Victoria is the state's independent infrastructure adviser, and in the course of our work we have done quite a lot of thinking about the intersection between infrastructure and climate change emissions reduction. So we are really pleased to be speaking with you this morning on this really important topic that the inquiry is looking into. We made a submission to you which has really summarised both the context of the importance of emissions reduction and infrastructure planning and investment as well as some of the recommendations that Infrastructure Victoria has made to the Victorian Parliament in our 30-year strategy and other advice that Infrastructure Victoria has undertaken.

The first thing I would probably like to point out is that there is a very strong intersection between emissions reduction and infrastructure investment. The emissions reduction aspirations and targets that are in the Victorian *Climate Change Act* are going to require quite significant change starting now and over coming decades if we are to meet those targets, and really it is in a number of key areas. Firstly, we are already on a

journey of transition of our electricity generation and transmission system, but that is a journey that is not yet complete and there are a number of infrastructure-related actions that are going to need to be undertaken to complete that journey to renewable energy generation, transmission and distribution. There are also a couple of other areas of our transport sector emissions and gas sector emissions in which we are less well advanced in terms of emissions reduction pathway that we have been doing some thinking about that is relevant to the committee's considerations. And finally, we are quite conscious of the equity and the land use implications that flow from some of the decisions we are going to need to make as we transition to a net zero emissions economy in Victoria.

One of the key elements that we have identified in a number of recommendations is the big opportunity to have greater energy efficiency, because the more energy efficiency there is, the easier the pathway will be to emissions reduction and the less investments we are going to need to make. Also we get a whole lot of other benefits from emissions reduction. When we look at greater energy efficiency, individual households get to save money and they have a healthier environment to live in. They have a number of other benefits that flow through to our commercial sector, our industrial sectors and government as well. So you will see that in our 30-year infrastructure strategy, where we identified taking action on climate change as the key challenge, there are a cluster of recommendations we have made about energy efficiency, because the sooner we start to make and continue deeper energy efficiency standards and investments, the more benefit we get for that for a longer period of time. So that is why you will see we have made recommendations like greater energy efficiency standards for homes, moving to 7- and then eventually 8-star energy efficiency for homes. You will see we have made recommendations about a home energy rating disclosure scheme, so purchasers of homes are also thinking and aware of this, as are vendors of homes. We have made recommendations about having greater minimum standards for rental properties and social housing as well, and that is particularly relevant because the residents of those buildings tend to be less well off and actually have the most to gain from greater energy efficiency yet often have the least power or the least resources to increase the energy efficiency of the homes they are living in. We have also recommended that Victorian government buildings be made more energy efficient.

Finally, there are a number of opportunities for us to make sure that the prices we pay when we use electricity are giving us a bit of a signal as to when it is good for us to be reducing our energy consumption versus times to be using it. What I mean by that is we have quite peaky consumption of our electricity in Victoria. There are a number of days—we build the network to meet those peaks, which are often very hot summer peaks, and the more we can have price signals but also technology that enable people to reduce their energy consumption where they can at those peak periods, not only does that save them money but it also means we can save many millions of dollars on additional electricity infrastructure investment costs. So that first piece is around energy efficiency.

The second area we are really thinking about is the generation and transmission of renewable electricity. We have obviously got a very big change going on with the staged closure of the centralised Latrobe Valley electricity generation, where we have for decades had centralised generation and transmission of that electricity. What we are seeing now as we move to renewables is that there are lots of renewable energy opportunities throughout the state, but the development of those, the coordination of that renewable development and its connection and transmission to the places where it is being most used is something that we are really working through now and will in coming years. This is really important not only to make sure that we are generating renewable electricity in a way that is staged and planned and helps us deliver that in a way that is most cost effective but there are lots of regional jobs at play here as well. So what we have recommended is that there be continued coordination of renewable energy zones so that there is that connection between the proponents of new energy projects and the local communities are being engaged with how those are done and they understand the context of that and that that is working then into the network.

Speaking of the network, there is obviously real importance in both delivery and transmission of electricity from those renewable energy zones to major sources of demand in Melbourne and regional cities, and of course that needs to be done in a way that is planned and involves consultation with the community as well and thinking about some of those land use social and environmental impacts. The other component of that is the connection of the Victorian network into the broader national electricity market, and we made recommendations about the benefits there are of connecting Victoria to the network in New South Wales and Tasmania in particular because those interconnectors give us greater resilience to our network and allow the national electricity market to work better.

The third large theme I would really like to talk about this morning is those other kind of trickier areas of emissions reduction, so transport emissions and natural gas emissions, both of which are around 15 to 20 per cent of emissions. While there are good steps being taken on transport emissions already, and the Victorian government has got a number of programs in place there to reduce emissions from vehicles and public transport, there is going to need to be retained focus on that emissions reduction. So what that means is acceleration of purchase of zero-emission vehicles, and in particular we have recommended that a date be set, by 2035 at the latest, at which no new internal-combustion engine vehicles are registered in Victoria. This is something a number of jurisdictions around the world are doing, and what it enables us to do is have a greater degree of certainty about reaching net zero emissions by 2050.

There are a number of the other steps that the Victorian government are already taking in terms of educating people about the benefits of zero emissions. Delivering some subsidies towards zero-emission vehicle purchases and delivery of the charging network are also really important complements to that. We think that there is real opportunity for the Victorian government to take a lead on emissions reduction and getting to net zero through its own fleet purchases and also by collaborating with freight fleets around incentives for them to move to zero emissions more quickly.

Natural gas emissions are an important component as well of Victoria's emissions profile, and we are more reliant on natural gas than other states, particularly our domestic consumption. If we are going to reach zero emissions, that is going to have to change. But the thing that we have got to firstly, I think, grapple with is that first challenge, which is that natural gas is less emitting than coal-fired power stations but keeping going with our current use of natural gas will not enable us to get to net zero. So something is going to have to change. The pathway to get to that change is something we are all still grappling with at the moment, but there are a number of options. One is greater energy efficiency and the pathway towards electrification, the second thing is looking at opportunities for hydrogen to be used as a substitute for natural gas as an energy source and the third opportunity is around use of biogas generated from biological sources, and that is something that also has some promise. The technical viability and the economic viability of these gas alternatives are being explored extensively by both governments and private players at the moment, and that is really encouraging. What we do not yet know is whether they will be sufficient to actually deliver what we need, and therefore taking a portfolio of options about gas emissions reduction and investing in multiple options at this stage seems to us like the best move, so that way we are not stuck down one pathway but we have got multiple choices.

Finally, there is some thinking that probably needs to be done if we are going to get to net zero emissions about the way in which we choose to invest in infrastructure and what we value. So we think that there is value in a consistent approach to these scenarios that are assumed when we do business cases for infrastructure and the value that we place on the embedded and operating carbon emissions that are related to the infrastructure use. That is something that is evolving, and there is good practice emerging in business planning, but it is not consistent. If we are thinking about getting to net zero emissions, embedding those practices in our investment decisions is also really important.

Chair, I will probably leave those opening comments there. That gives you a good summary of the recommendations that Infrastructure Victoria has made in relation to this. We have obviously given you copies in the form of the 30-year strategy, our work on zero-emission vehicles and our work on the gas transition, and we are really happy to discuss this further with the committee. Thank you.

The CHAIR: Great. Thanks so much for that, Jonathan. We really appreciate those opening remarks. All right. We will hand over to questions from committee members now. So Mr Grimley—Stuart—we might start with you.

Mr GRIMLEY: Thank you, Chair, and thank you, Dr Spear and Lorraine, for your submission. I have got a question which relates to probably part (b) of the terms of reference, in relation to the economic benefits and implications of Victoria transitioning to 100 per cent renewable energy. It relates to the undergrounding of transmission lines in particular, and I note that currently we have the Western Victoria Transmission Network Project, which is underway and causing a bit of grief with the local community out there. Two of their issues are the safety risk and also the impact on the agricultural industry. So I am just interested to hear your opinion on the pros and cons, I suppose, of the undergrounding of transmission lines.

Dr SPEAR: Thank you, Mr Grimley. We have not done any detailed work and consideration on undergrounding of transmission lines and so you might be better inquiring about that with other witnesses, except to say that we are aware that there are social and environmental considerations at play in this change, because there are going to be really good benefits for communities in terms of jobs and economic development in regions, but the land use implications, social and environmental implications are certainly something that stakeholders have raised with us and we are aware of that reporting in the media. So we think that that is something that does need to be considered seriously, but we have done no detailed analysis of undergrounding versus other options at this point.

Mr GRIMLEY: Okay. Thank you, Doctor. Interestingly, the community and a lot of us are all for renewable energy, absolutely, but it is the cost, I suppose, on those local communities in getting the renewable energy from the regions particularly into the major metropolitan areas that is of concern—how does that play out and how does that work? I appreciate your comment, and I will keep that in mind for future witnesses, so thank you. Thank you, Chair.

The CHAIR: Thanks, Stuart. Mr Hayes.

Mr HAYES: Thanks, Chair. Thanks, Dr Spear. Look, there are so many questions to ask, but I will confine myself to two quick ones if I can. I wanted to ask what the promises and problems of replacing natural gas with hydrogen would be—if you could talk to that.

Dr SPEAR: Yes, certainly; happy to. The promises are that hydrogen can be generated with zero emissions, potentially. We know we can do that. Many of us have done that as a high school science experiment, running electricity through water, and so long as the electricity used to run through that water is from a zero-emissions source and you have got enough water then there are zero emissions from that. So then the capacity to use hydrogen either as a replacement for some of the energy demand for natural gas or in vehicles as well, particularly heavier vehicles, is quite promising, and there is a lot of research being done about that and a lot of investment being done.

The challenges are a few things—firstly, the sourcing of that electricity, the zero-emissions electricity, which you need to generate the hydrogen, and in some instances the sourcing of the water that you need to generate it too. Secondly, there is an economic question about the cost of getting hydrogen down so it is competitive with other energy sources, particularly competitive with just zero-emissions electricity when we are thinking at the longer term. So they are a couple of considerations. The other matter that a lot of industry players think about, as have we, is the compatibility of existing gas pipelines to be used to transport hydrogen. Studies so far have shown that it is pretty viable for up to a 10 per cent blend of hydrogen with natural gas to be used in existing pipelines. Beyond that there are challenges in terms of the technical capacity of existing pipelines. So if they cannot take the hydrogen, we are looking at a considerable cost to replace them, and again we are weighing up, ‘Well, is it better to use hydrogen or is it better to actually invest in zero-emissions electricity and still get to net zero?’.

The last component in terms of the challenge is the end user, right? So in a household sense you would need to change over your appliances or in an industrial sense—some appliance changes as well—to use hydrogen. So there are clearly some challenges involved. Those are not insurmountable challenges, and the prize at stake for zero-emissions hydrogen is really considerable. So it is something that we think is worth investing in and planning for as one of the options that gets us to net zero. Over the next decade or so that is where we will probably know whether that is going to pay off or whether we need to take another path.

Mr HAYES: Thank you for that. My other question is about construction and building construction that lasts longer. Construction and concrete pouring are significant emitters of greenhouse gases. Have you looked at anything to do with making infrastructure stay in place over a longer period of time or anything to do with lowering emissions when we are constructing freeways or buildings or the like, considering most of it ends up in the tip fairly quickly? Building materials make up 40 per cent of what goes into our waste.

Dr SPEAR: Yes, look, it is a great question. It is something that I know industry are increasingly focused on, the state’s project delivery agencies are increasingly focused on and we are too. There are probably three ways to think about this. The first one is in project selection in the first place. So actually one way to reduce emissions is to not build things in the first place, right? We are going to need to build new infrastructure, we are

building lots at the moment that is needed, but if we are properly valuing carbon and we are thinking about our other alternatives to meet infrastructure demand, then that might mean in some instances we do not need to build the infrastructure or do not need to build as much—for example, my earlier opportunity about how if we can have price and technology help people to not use electricity infrastructure at peak times, that allows us to not build as much electricity infrastructure. A similar thing applies to transport infrastructure. The second piece is around when we are building it, being much more aware of building it with lower embodied emissions and building it to last, which is to your point. The third thing is then making sure that we can get the most use out of that infrastructure over its lifetime. Part of that is about maintaining it properly, part of it is about pricing signals for when and how we use the infrastructure, and planning for the relationship between the use of that infrastructure and the broader land use settings that we have. So when we are thinking about getting to net zero emissions, we actually look also at: is there infrastructure we can avoid building? Is there infrastructure we can build with less emissions than we would have with the business as usual? And it is to the credit of many industry and design firms that they are thinking about that. And then: can we use policy and planning to make sure that we get the most out of infrastructure over its lifetime? Those are the key elements, beyond just the generation of the electricity in the first place that we often focus on in this area.

Mr HAYES: Thank you. Thanks a lot, Chair.

The CHAIR: Great. Thanks very much for that. Dr Bach.

Dr BACH: Thanks a lot, Chair. And thank you, Dr Spear, for that presentation. Can I refer to some of your comments about business cases? My interest piqued at that point. If I heard you correctly, you were talking about the need for consistent planning and strong business cases when it comes to infrastructure programs and projects in an effort to seek to ensure that we continue on our pathway to reduce emissions. Do I gather correctly from that that you think that there should be a business case in place before government embarks upon any major transport infrastructure program?

Dr SPEAR: The point is probably a more narrow point than that specifically, which is when business cases are developed that there be consistency of the assumptions of scenarios for climate change in the future that is going to affect the operation and design of that piece of infrastructure but also that there be consistency in the valuation of carbon, both carbon that is embedded in the construction of the infrastructure but also over the course of its life. There are a variety of methods to do that but there is not always a consistent approach, and there would be benefit in that.

Dr BACH: Okay, thank you. I understand. And you said ‘when business cases are developed’, but of course, as the Auditor-General has found, under this government on many occasions there have never been business cases in place for major transport infrastructure projects. So in those numerous instances am I correct in my presumption that it is just not possible then to factor in these matters that you say are really important when it comes to our ongoing journey to seek to get to net zero emissions?

Dr SPEAR: You are probably better off addressing that question to representatives of government who are actually involved in planning of those projects, because Infrastructure Victoria is the independent infrastructure adviser. We are not involved in development of those projects and business cases, save that we do—

Dr BACH: Nobody is. Don’t worry, nobody is.

Dr SPEAR: So you are probably better off addressing that question to those who are involved in the development of those projects.

Dr BACH: Thank you. I will endeavour to do that, and we will see what I get back in response. Thank you very much, Dr Spear.

Dr SPEAR: Pleasure.

The CHAIR: Thanks, Dr Bach. Ms Taylor.

Ms TAYLOR: Thanks for the presentation. It was really, really thorough and really interesting. I was just homing in on the biogas. What does that actually look like, and what are the pros and cons of that? I just thought it would be interesting to explore that in a little more detail.

Dr SPEAR: Yes, thank you. It is a great question and very complementary to the Deputy Chair's question about hydrogen. Biogas is generated from a lot of that organic and green waste and also waste that might otherwise be left from agriculture in the fields and then can be generated into—one of my team members, if you do not mind me using this term, calls it a mechanical stomach. So all this organic material gets put into the mechanical stomach, and it then generates biogas. Biogas is methane, so it is chemically like natural gas, and that means that it has the advantage of being compatible with existing pipelines that we use for natural gas and appliances and so forth. So that has got some promise. Like hydrogen, it is not without some challenges as well in that it requires quite a lot of effort and coordination to gather all of that biological material, digest it and then create the biogas. So the challenges there are around the cost of doing that and whether that is competitive with other energy alternatives, and also whether you can get enough raw material to create a sustainable supply so there is consistency of it. We know that technically it is certainly possible, just like it is certainly possible to create hydrogen. Like with generation of hydrogen, there might be opportunities to do this in particular areas, particularly in regional Victoria or parts of Melbourne where there are large amounts of more predictable organic waste that could be used and injected into the system. So it is one of the options that we think is worth investing in and developing as one of the pathways as we get to net zero emissions. It has got potential jobs for regional Victoria. It is also potentially quite good in avoiding emissions that would otherwise occur, because if not dealt with carefully, this organic waste of course just creates methane, which is a very powerful greenhouse gas.

Ms TAYLOR: Thank you.

The CHAIR: Great. Thanks, Ms Taylor. Mrs McArthur.

Mrs McARTHUR: Thank you, Chair. And thank you, Dr Spear. I am fascinated that Infrastructure Victoria is preparing a 30-year infrastructure strategy for Victoria and yet has not taken into account the best possible transmission method of distributing power and getting it back into the grid. That would seem to me to be the most important aspect of how you would develop an infrastructure plan for energy distribution and collection in this state.

Going to a specific question, the driver for renewables appears to be least cost, jobs and investment, when the focus should be on the impacts on climate change. So what is being done to bring down greenhouse gas emissions or bring greenhouse gas emissions into the assessment of actionable transmission and renewable generation projects? It is essential that AEMO does this so that the projects it approves are consistent with the Australian government's and jurisdictional governments' net zero by 2050 greenhouse gas policies. Underground HVDC, for example, has a significantly reduced CO₂ footprint compared to overhead HVAC, yet it is frequently dismissed due to cost. So what are you doing to ensure that transmission is going to have the least impact for the environment, especially when you do not seem to have assessed underground transmission?

Dr SPEAR: Thank you for your question. We think that when it comes to planning for getting to net zero emissions and the generation and distribution that there needs to be consideration certainly of cost but also of social and environmental impacts, of which of course emissions reduction is one but not the only one of those impacts. On the detail of the energy generation and transmission planning, that is probably really a question that you are better off directing to AEMO. The reason we do not do detailed further planning on that is because AEMO already cover that and it is not our role to duplicate that sort of work. It is the same reason why we have not done detailed assessment of undergrounding of powerlines, because we are aware that others are doing that work and we do not see that as our role to duplicate. So I suggest that that might be a question you could direct to other witnesses, Mrs McArthur.

Mrs McARTHUR: Can I follow on from that, please, Chair. If you are concerned about the social and environmental impacts of energy and its development and transmission, then you should surely be assessing what the impacts are in rural and regional Victoria, where this energy is largely produced. How can you not be interested in how we transmit energy? How can you possibly produce a plan for Victoria without engaging in what are the social and environmental impacts of the transmission process?

Dr SPEAR: We are very interested in all of those things, and we are also conscious that there are other agencies that are involved in doing that detailed planning and it is not our role to duplicate that. In our 30-year strategy we have taken that work into consideration that is already done and underway and looked at what else we think are the priorities when we look across all the infrastructure needs of the state. That is why in the case

of transmission and distribution, the things that we have really highlighted as priorities for the 30-year strategy are the further development of those renewable energy zones and the interstate connectors that are really critical, and I think in doing that one of the things we have highlighted is the importance of engaging with communities to ensure that they are getting the benefits of that both now and over time.

Mrs McARTHUR: Well, can I just say that AEMO do not have any policies supporting climate change and it is not a consideration in any transmission planning. If you are suggesting that there should be proper consultation, then surely you would be aware that the consultation process in actually the transmission project that is being developed by AEMO and others at the moment in the Western Victoria area has been totally inadequate.

The CHAIR: Sorry, Mrs McArthur. Last question from you because we have two other committee members to go through. If we have extra time, we will come back around. So just a final question from you.

Dr SPEAR: Look, I think that is really a matter for you to direct to other witnesses who are actually involved in that process.

Mrs McARTHUR: Yes, but you have just said AEMO have the responsibility. They do not.

Dr SPEAR: AEMO are responsible for the network planning and then there are others who are responsible for the actual delivery of that transmission network. I think that those concerns you have got about the way in which that is being implemented and the consultation—you are probably better directing to those who are actually undertaking that work and that consultation.

The CHAIR: All right. Thank you, Dr Spear. We will go round to questions from others now. Dr Ratnam, over to you.

Dr RATNAM: Thank you, Chair, and thank you so much, Jonathan and Lorraine, for your submission and evidence here today, but also your written submission, which was really comprehensive. I just wanted to look from the point of distribution. It strikes me from what you have presented in terms of us getting to a 100 per cent renewable energy target by 2030—I know that you will have constructed your submission in terms of the zero emissions by 2050 target, so I know that they are two sides of the same coin and you have geared your submission towards that. It strikes me that there are three prongs, correct me if I am wrong here, which are the capacity to generate renewable energy, the capacity to distribute that energy but then also the capacity to consume the energy, so when we talk about energy efficiencies, the consumption of gas in homes, for example, we are going to have to actually change the technology by which people consume the energy. It seems like we have got to address all those three areas if we are going to move to zero emissions and 100 per cent renewable energy.

I was interested in the section in your submission around investments, chapter 3, ‘Investments required to transition to renewable energy generation’, and distribution. You had two main recommendations, which were to augment electricity transmission for renewable energy and resilience, and identify and coordinate priority renewable energy zones. It sounds like in Victoria we are tracking towards this. We are making some progress towards both of these, but more particularly in the renewable energy zones. I was interested in your take on how we are tracking overall from your perspective. Are we on target to meet the 2050 target, let alone the 2030 target? If not, where are we with that kind of distribution infrastructure to be able to get to 100 per cent renewable energy and zero emissions from your perspective?

Dr SPEAR: Yes, sure. Thank you. I think Lorraine may be able to add to this because she has obviously been looking at this as well. But I think there are a couple of important bits of progress. Firstly, the establishment of VicGrid in DELWP is an important part of institutionalising that planning. We think that is a good step and if it could have an ongoing stewardship role as we have seen in other jurisdictions like New South Wales, I think that might be useful so that that coordination and planning is being done. Since the tabling of our 30-year strategy there has certainly continued to be progress made on the Marinus Link and on the VNI West as well, so they are important components of it. But, Lorraine, would you like to add anything to that in terms of the state of progress?

Ms CONWAY: Yes. I think it is probably fair to say with electricity there has been a lot of progress towards it, but the other two areas I have been focusing on, in particular transport and gas, they have probably received

less attention compared to electricity, so there is progress being made there but it is still trying to catch up to that gap as well.

Dr RATNAM: Thank you very much for that response. Following on from that, Lorraine, regarding gas because I know you are doing a significant piece of work at the moment and have referred to that in your submission as well, is the bulk of the work there about the consumption piece of it? So it is about the fact that in a way we are heavily reliant at a household level on gas and the ability for us to be able to consume different types of energy, hopefully renewable energy, in our homes. Is that the major piece, do you think, in terms of the gas transition and getting off gas?

Dr SPEAR: Well, it is not the only piece, so in thinking about the gas transition some of the fundamental components about getting to net zero across the whole energy system apply. So, for example, when we think about gas we should be thinking about energy efficiency.

Dr RATNAM: Yes, right.

Dr SPEAR: So that is a key component, because it is a difficult transition, particularly for industrial users of gas but also households. The more we can do on energy efficiency the easier the task becomes of the gas transmission. When we think about ways in which the existing gas network can be used and whether it might be used in substitution for hydrogen or biogas, as the Deputy Chair and Ms Taylor were raising, we need to be thinking about the role of gas in the broader energy system, how it balances out with energy demand and its cost and emissions competitiveness against our other options.

So we certainly do not think about—and we would encourage the committee not to think about—gas emissions just on their own but rather in the broader scheme of the energy requirements of Victoria and in fact beyond Victoria, because of course our energy network, both gas and electricity, is connected across the eastern states. And so when we do the planning across that, it needs to be considerate of those interconnections. Those electricity interconnectors with Tasmania and New South Wales are important because of the resilience that that gives us, and similarly if you think about gas, we need to think about beyond just the Victorian gas system to the whole of the eastern seaboard.

Dr RATNAM: Great. One really quick final question: are there any big barriers that you all have seen through your observations and work to, for example, that transmission network being upgraded and adapted as quickly as possible? So you have identified the key links the need to be developed. There is some work undertaken towards them. Are there any big barriers and obstacles that we should be watching out for when we are recommending to government where they should invest so that we reduce the barriers or prevent them from even occurring?

Dr SPEAR: Dr Ratnam, is that question in relation to gas?

Dr RATNAM: Yes, and you linked it to the distribution. So there is efficiency, but then also there is the distribution networks as well that will have to be adapted.

Dr SPEAR: The key barriers to uptake, particularly of hydrogen, are going to be the cost competitiveness of it, whether we can generate it at a zero or close to net zero emissions profile and whether we can utilise existing gas networks to transmit and distribute it. There are some key challenges there. Of course there is lots of opportunity there as well, but they are the key barriers. And as I said in relation to Ms Taylor's question before in relation to biogas, it is probably more about getting the raw material and whether we can generate that at a price that is competitive with other alternatives, and that again takes us back to this point about not thinking about gas on its own but thinking about it more broadly.

It is worth emphasising is that this is a transition. We are not going to be able to switch to zero emissions electricity tomorrow or probably even in five years time. That role for gas, both natural gas and other sources, on our pathway to net zero is really important and thinking about that mix of energy across the network and over time is really important rather than just looking at what is just the end state or what is the state right now. We need to think about a smooth transition that reliably gets us to net zero, and that is challenging because there are uncertainties about the technology and about the price competitiveness, particularly of the gas substitutes at the moment. That is why further deployment and piloting and investigations of those other options is really important.

Dr RATNAM: Thank you.

The CHAIR: Thanks, Dr Ratnam. I might ask a question now. I apologise if this is going to sound inarticulate, Dr Spear, but my questions are around the networks, so the transmission infrastructure, and I guess lead on from your previous answer about how we need to transition—like, you cannot just flick a switch and turn it off and have renewables; you have got to transition to get there. I am interested in the system. I guess there are two parts. First of all, how many renewable energy generators would we need and what type, and what transmission infrastructure would we need to do that transition to 100 per cent renewables? What would that look like, then, in your opinion, phased over time? How would we get there? But then also what impact would it have on the existing grid network? I have heard stories of people saying that if we have got too much renewable energy in the system it can cause grid instability and the like, so how would we necessarily overcome those sorts of issues as well? I guess it is about looking forward. What is our current system looking like in terms of our grid and our ability to get renewables into the system, and how can we get there, effectively?

Dr SPEAR: It is a great and really important question because it is at the core of the challenge that we have got here. We have currently got a relatively centralised electricity system out of the Latrobe Valley, and we are increasing the amount of renewables coming on of course, particularly around rooftop solar and from some of those regional areas that have got really great renewable capacity. The other thing we have currently got is that high reliance on natural gas, especially for space heating and especially in winter. That is the current state, and that is going to have to change if we are to get to net zero emissions. What that probably looks like, under almost all scenarios if we are going to get to net zero, is that we have a relatively lesser reliance on gas, even if it is renewably sourced gas, and a relatively greater reliance on renewably generated electricity. It could be a couple of orders of magnitude greater than we currently have in terms of electricity, and that is where the interplay then comes between whether we can regenerate and utilise gas from renewable sources, because if we can do that in a way that is competitive and allows us to use either existing or easily delivered networks, that reduces the level to which we need to move to renewable energy generation and distribution. That is the trade-off, right? The other piece of it is of course reliability. So what the various gases do is help to balance some of the reliability and intermittency challenges in a renewable electricity network, as do things like batteries and other forms of storage. And of course overlaid on top of that is energy efficiency, which means the more we do that and the sooner we do energy efficiency, the easier this all gets.

The CHAIR: Okay, yes. That makes sense. So there are a lot of moving parts to it, it sounds like.

Dr SPEAR: That is right, and there is some uncertainty. But we should not allow the uncertainty to paralyse us. There are some clear pathways that we can take in terms of energy efficiency, renewable electrification and exploration of the alternative gas sources, while using some natural gas during that transition period. They are the elements of the recipe. It is just the mix of that and the timing of that that are the important pieces for us to work through.

The CHAIR: Sure. And I just have one other question. Do you have a view about a national approach to the current grid system? Obviously Victoria has got its own policies in terms of renewable energy and the like, but do you have a view about whether it is preferable to have a national electricity market to, say, the Victorian government moving ahead? I know there are some different policy settings at a national level and then at a state level, so are there any benefits or drawbacks to perhaps not having a national approach and having more of a state-based approach? Do you have a view on that?

Dr SPEAR: Well, I think what we have observed in energy policy over recent years is aspirations on the part of states to have a more certain and sooner pathway to net zero emissions, so that is why we have seen in a number of areas of energy policy states going ahead of the commonwealth government in both some of its policy settings and some of its investments. What we hear from industry of course is that they would prefer a greater level of consistency and that they are generally supportive of getting to net zero in a way that everyone understands and is reliable, and that of course will help system planners like AEMO and other network operators and regulators to all be driving in the same direction.

The CHAIR: Great. Okay. Thanks very much for that. We have got about 4 minutes left, so I will just see if anyone else has got any other questions before we end this session. Sorry, Bev. I will go to Mr Hayes first.

Mr HAYES: Thank you, Chair. Just out of interest, Jonathan, is there any possibility of using hydrogen in a big way in transport, like, say, renewable energy electric cars or buses? Does it mean that you have got to use electricity to make the hydrogen and then turn it back into electricity again, or can it be burned like in an internal combustion engine?

Dr SPEAR: There would absolutely be a capacity to use hydrogen in vehicles. We have actually done quite a lot of work, so the advice on automated and zero-emission vehicles that we provided a copy of to the committee investigated this possibility of hydrogen-fuelled vehicles in some detail. There are vehicles on the road today that are hydrogen-powered vehicles—sedans, freight trucks and also buses—and the relative power to weight of hydrogen fuel cell vehicles versus battery electric ones means that there is a certain advantage to heavier vehicles using hydrogen fuel cells. We are certainly seeing some trials of that taking part in Victoria at the moment, and in Japan for quite some time there have been hydrogen-fuelled vehicles.

Not only does it have those advantages that we were talking about earlier about the zero-emission generation of hydrogen, particularly if you have got a ready source available of, say, solar panels and water, but the only thing that comes out of emissions from the vehicles themselves is then some water. So that has really big public health benefits, because we know that one of the biggest challenges we have apart from the emissions that contribute to climate change is emissions from vehicles that have human health impacts, and so the capacity to substitute hydrogen fuel cell vehicles instead of diesel would have many millions of dollars per year of health benefits to the Victorian community and also deal with some of the amenity issues we see around freight precincts, ports and places like that where communities have concern about the emissions that are coming from vehicles. So there is absolutely opportunity there, and especially if there was a broader use of hydrogen being generated at an economically competitive cost in the economy for other uses that would make it even more attractive to use hydrogen as a fuel source for some vehicles, particularly those heavier vehicles.

Mr HAYES: Thank you.

The CHAIR: We are going to have to move along because it has just ticked over 12 o'clock, but Mrs McArthur, I will give you a very quick question. I just want to say to the rest of the committee members that if you have got other questions that you want to provide to Infrastructure Victoria, we can always provide them on notice, so if you have got more questions we did not get to today we can do that. Mrs McArthur, you have got about 30 seconds.

Mrs McARTHUR: Thank you. Just let us be clear here: you are funded by government, your board members have representatives from Premier and Cabinet, Treasury and Finance, Planning and Environment—

The CHAIR: Sorry, relevant to the terms of reference, Mrs McArthur.

Mrs McARTHUR: Are you independent?

The CHAIR: I will rule that question out of order; it is not relevant. Do you have any other thing related to the terms of reference? If not, we are going to conclude this session.

Mrs McARTHUR: Yes, I do.

The CHAIR: Quickly.

Mrs McARTHUR: Dr Spear, you talk about interconnectors being important. Are you aware that batteries will be replacing interconnectors and interconnectors will become the white elephant of energy infrastructure?

Dr SPEAR: That is not our understanding, Mrs McArthur.

The CHAIR: All right. Thank you very much for your answer, Dr Spear, and of course thank you both very much for your very detailed submissions and the evidence that you have provided to the committee today. We really appreciate you coming in and giving us your time, so I would like to thank you both for your contributions today.

Witnesses withdrew.