REPORT ON PROCEEDINGS BEFORE

LEGISLATIVE ASSEMBLY COMMITTEE ON TRANSPORT AND INFRASTRUCTURE

INQUIRY INTO ELECTRIC BUSES IN REGIONAL AND METROPOLITAN PUBLIC TRANSPORT NETWORKS IN NSW

At Sydney on Wednesday 18 March 2020

The Committee met at 10:10.

PRESENT

Ms Robyn Preston (Chair)

Mr Chris Minns
Dr Marjorie O'Neill
Ms Eleni Petinos
Mr Gurmesh Singh

The CHAIR: Members, witnesses and those in the public gallery, I welcome you. We ask that anyone who is feeling unwell or has returned from overseas within the last 14 days, please leave the hearing room now. I welcome you to this public hearing for the inquiry into electric buses in regional and metropolitan public transport networks in New South Wales. Before we start I acknowledge the Gadigal people, who are the traditional custodians of the land. Today we are hearing from bus operators and manufacturers, union representatives, energy companies and stakeholders representing people with disability. A number of witnesses will be taking part in the hearing via telephone. We also have the member for Kogarah, Mr Chris Minns, taking part via telephone. Hopefully we will acknowledge his presence when we do contact him.

I declare the hearing open at 10.10 a.m. In addition to the witnesses present, we have Mr Trevor O'Brien from Scania and Ms Olivia Laskowski from Siemens taking part via telephone. Also, welcome Mr Minns.

DAVID MEAD, Vice President, Volvo Buses Asia Pacific, affirmed and examined

DAVID EVANS, Director, Engineering and Production, ARCC Pty Ltd, affirmed and examined

TREVOR O'BRIEN, Product Manager, Scania Australia Pty Ltd, via teleconference, sworn and examined

OLIVIA MAY LASKOWSKI, Promoter of Electric Vehicle Charging Infrastructure, Siemens, via teleconference, affirmed and examined

The CHAIR: Before we start, are there any questions about the hearing process?

Ms LASKOWSKI: No, not on my behalf.

The CHAIR: Would any of you like to make a short opening statement before we begin the questions and I ask that you keep your statements to no more than two minutes. This will allow more time for questions from the Committee.

Mr MEAD: At Volvo we have no doubt that electric vehicles will play a future in New South Wales transport. For many years now we have delivered electric vehicles in other markets. But I point out that those markets do not require climate markets using renewable forms of energy for the production of electricity, markets that are heavily subsidised and markets where bus life is well under what we see in New South Wales and Australia. We have a view that we would like to put in our opening comments that self-charging electric buses to date have been somewhat dismissed as a viable alternative and economically responsible option.

We have a longer history than charged electric vehicles. We think self-charging electric buses or hybrid buses as some would call them, are available today. They are operating in other states in Australia, can be built here in New South Wales and deliver outstanding environmental and economic results. With a capability to run in electric mode for extended periods we see them as a viable alternative requiring zero investment in infrastructure, no operational penalties, no increase to the cost of maintenance and most importantly, deliver a lower carbon footprint than a fully electric bus in New South Wales.

The reason I say that is that an electric bus in New South Wales today will require approximately 790 grams per kilowatt hour of energy, whereas hybrid or self-charging electric buses can be as low as 365 with biofuel or 700 using standard diesel. Whist we talk about a zero carbon footprint, that will not be achieved using electric buses. We are simply moving the carbon footprint from the city and we are putting it in the outskirts of Sydney and into regional New South Wales with the use of electric buses. Again, if the objective is to reduce the carbon footprint, we think there are alternatives to the full electric bus and the definition of such.

The CHAIR: I invite those on conference call, if you could put your phone on mute before you speak, that would help with the clarity as well. David Evans, did you want to speak?

Mr EVANS: Yes, just quickly. I work for a company called ARCC, the full title is too long to spurt out, but we are probably Australia's only manufacturer of lightweight aluminium chassis. We are currently building two prototypes, one is battery electric, the other is hydrogen filter. Just like David, we feel that battery electric is probably the harder option to introduce in cities. That is why we are focusing on hydrogen, especially if you can produce the hydrogen through a clean energy source. We are currently building two prototypes.

The CHAIR: I also invite Mr O'Brien or Ms Laskowski to speak if you would like to make a statement.

Mr O'BRIEN: It is interesting just reiterating a lot of David's comments. We understand that changes are coming; things must change. Electric buses, high capital cost, distribution infrastructure, battery technology and second use. There are clear amenity gains from reduced noise levels of electric vehicles and the energy consumption of the ancillary systems are some of the major challenges. Then I do see one of the most interesting points and David did touch on it, where you talk about emissions neutral energy sources. Electric vehicles today,

with our level of renewable energy and carbon neutral energy generation in Australia, will be worse for the environment.

A lot of the information we see today comes from countries that have got almost untapped energy resources either from nuclear or from hydro and they will clearly have a low carbon impact. We, with our coal generation, still have a little bit of a challenge there. Also, following on from David's comments there, we do see hybrid vehicles as a bridging solution until we do transition to the full electric transport. They are available here and now to get started rather than waiting for what could be a long and expensive transition, but inevitable transition, into electric transport.

The CHAIR: Ms Laskowski, did you wish to make a statement?

Ms LASKOWSKI: I guess from the conversations I have had with bus operators across Australia, one of their concerns is that the buses that are available may be paired with a charger from that original equipment manufacturer [OEM], and they want the ability to make sure that, when the supply panel is released, they are able to choose universal or agnostic charging hardware. That is important also because a lot of the providers, Siemens included, of high-power charging infrastructure can meet both high-power charging requirements that some of the OEMs are not able to achieve at the moment, where they pair a charger with the bus. So it is just making sure that there is ability for bus operators to have choice.

Mr GURMESH SINGH: Operating conditions and requirements for buses vary across the state. What conditions impact the performance of electric buses in both regional and metropolitan areas? I would not mind getting that feedback from a few different people.

Mr EVANS: I think the main conditions that will affect it is air-conditioning, climate control. We have done a lot of experimentation, run a lot of numbers, with an electric bus operating without air-conditioning or heating you get about one kilowatt-hour per kilometre. With air-con or heating operating you are up to about 1.3 kilowatt-hours per kilometre, so you are losing a lot of energy powering your air-conditioning. That is one of the major issues. Then, looking at hill climbing, there are quite a few hills in Sydney, it does put a strain on the motor and the energy that you are using, but then the benefit of coming down the hills is that you gain energy with regeneration. There are a couple of issues, but none of them are really insurmountable to the engineering that we have.

Mr MEAD: In terms of other conditions, I suppose the off-bus conditions, to address the question is grid availability and grid infrastructure. I think that there is a requirement even at the moment to create a baseline for bus depots in both metropolitan and regional New South Wales to actually understand what the capability is today. Then, if we look at a scenario of complete electrification, or 100 per cent, what that is tomorrow, and look at that gap, because I think that will guide all of us largely on the infrastructure investment required to make this transition over time. The condition of the availability of energy or electricity at any given point is a key condition for that outcome.

Ms LASKOWSKI: I have two points, just following on from the previous comment about the grid. This is new terminology for bus operators, so a completely new world of technology and language for them. They are not necessarily familiar with how to approach, how to find out, what their current grid constraints are and what their current load is. If Transport for NSW could take the approach of helping to guide bus operators through that. Organisations like ourselves do those grid studies for bus operators, but there is a gap before they reach out to providers like ourselves, which can do those studies, that Transport for NSW could fill to help bus operators understand what is the process they need to undertake. The other one would be that there is changing battery technology out there that would allow for greater distances beyond lithium-ion. For regional and rural areas those advancements in battery technology could help the buses that need to travel long distances in between charging.

Mr O'BRIEN: I would just like to repeat the comment there regarding the consumption of the ancillary equipment with our obvious needs for the air-conditioning and heating nearly 24 hours a day, every day of the year, the load on the system and the availability of clean energy. We need to remember that we hear a lot of discussion here about zero-local-emission vehicles. All that is doing is cleaning up Sydney, which is good, but pushing the problem somewhere else until we get some low-carbon energy sources or sufficient low-carbon energy sources. But nothing is impossible and everything certainly can be fixed.

Ms ELENI PETINOS: To each of you who are here today, thank you very much for your time. I would like to get an understanding from each of you as to what you consider the learnings to be from other jurisdictions that have introduced electric buses. Whether you want to highlight a positive and something we could adopt, or a negative, which you would encourage us to steer away from, in each of your experiences what learnings should we be taking away?

Mr MEAD: I think most of our learning in the Asia-Pacific area—and I think this is important—the comments around climate come from Singapore. Singapore has a moving people strategy, or the land transport authority strategy towards 2040, where they have taken a view on electric and autonomous vehicles. In doing that they have a clear view that their fleet will not be 100 per cent electric and electrically charged. There will be a place for hybrids, there will be a place for electric, there will be places for a mix of vehicles. The reasoning behind that relates to transport security. Of course, if we have a fault in the grid and all of our vehicles are electric then the ability to move people may be restricted, but they also see a reliance on a single fuel source. Whether it be hydrogen, like Mr Evans said, or electric or hybrid, this mix of fleet gives a level of security to government.

Their process of testing and introduction has also been measured. They put in place 50 hybrid vehicles in the last 12 months and are about to take 60 electric vehicles. That size is interesting. For us the learning there is that doing one bus or four buses is really easy. Scaling electric is difficult. The scalability for competence, for staffing, for support, all of the things that we see required for a diesel bus, is still there with electric. So having support, having after-hours support, having trained technicians, parts and warehousing capability, those types of things do not go away when we move forward. I would say their approach has been slow and steady.

The other learning we have there certainly is around climate. The comments that Mr Evans and Kevin have both made, we see anywhere up to 50 per cent of the buses' energy being used on climate, so on the air-conditioning in vehicles in Singapore. Whilst they have a higher humidity than we do here in Sydney, they do not have the peak temperature days that we do. They do not get up over 40 degrees. That would be one learning.

The other learning I point to would be the hybrid trials run here in New South Wales around eight or nine years ago. I think that they demonstrated clearly that when a technology is adopted when it is not ready the trial will fail. I think that that has I will say scarred self-charging electric vehicles, or hybrids, because everyone remembers what happens with those vehicles, and so it is a learning very close to home that I think is relevant to the discussion.

Mr EVANS: I agree with everything that Mr Mead has said. We have learned a lot through our sister company, which has sold the most electric buses into Australia, based on a Chinese chassis. We have done a lot of research, gathering figures on what the buses can achieve. Some have been operating 600 kilometres on a charge, but they are on a particularly easy bus route. Others are getting around 350 kilometres a charge, so we are understanding how far the buses can go, how well they are operated. Learning from what the customers think when they are travelling on the buses. There are a lot of comments on the Transport for NSW website and Facebook page, which is encouraging.

But we are also learning a lot from what they are doing in Europe and America and that is one reason why we are concentrating our main prototype on hydrogen. Just having a look at how we can develop with various other companies producing hydrogen, using hydrogen and transporting it, operating our buses using hydrogen—it is still an electric bus. It still has a battery but the fuel is hydrogen. It is a lot easier and safer to produce than it used to be and fuel cells are more efficient. So based on what we have found around the rest of the world, we are kind of focussing on hydrogen than just having batteries. When you look at full battery fleets around the world you get to a point where you can no longer have battery buses and be able to charge them. You have a depot, and you can have maybe up to 10 buses that you can charge either overnight or during the day, depending on how you are operating your service, but once you get past 10 buses the cost of actually refuelling with hydrogen comes down a heck of a lot.

So if you have got three or four hydrogen buses it is very expensive but once you get a larger fleet you have only got one refuelling place similar to CNG [compressed natural gas] so your cost of operating buses then comes down. Battery buses and operating those buses using current grid is going to be hard for New South Wales because the cities are not designed to take that amount of energy to charge the buses.

Ms LASKOWSKI: I think a couple of things that we have seen—if we look at New Zealand, which I guess is a little ahead in terms of the number of fully electric buses they have on the road, their work safe guidelines at the moment do not actually cover higher power DC charges. That has caused a bit of a road block for getting high-powered charging into the country which operators want but the protection requirements for those charges are not laid out in the guidelines. So I would encourage the guidelines locally to ensure that they cover high-powered charges in terms of the protection requirements.

Some of the stuff we know about in the way that public transport authorities have implemented electric bus routes—Singapore, and New Zealand is looking to do this as well, the Singapore Public Transport Authority has put opportunity charges at layovers that multiple bus operators can access. So it is shared infrastructure. New Zealand is looking to do the same in Auckland and that also just reduces the onus on operators to introduce all the charging infrastructure at their own depots and increases the redundancy for charging infrastructure access.

It is interesting what they did in Qatar. There was a huge tender out in Qatar. What they did they specified that only tier 1 providers of charging infrastructure could tender for that. The reason behind that was they did not want charging infrastructure to come from an OEM where the charging infrastructure could only be used with that OEM. They wanted to make sure all the charging infrastructure they put in was compatible with any bus that they might buy in the future. It would also to ensure that they had access to the higher power charging infrastructure which is also only available for tier 1 providers at the moment. The other one thing I would say is, we see in areas where they have done full depot conversion of 60 plus buses at a depot, load management software has been critical to the full conversion of those depots just to reduce the overall peak demands that those buses would otherwise incur if they all plugged in at the same time.

Mr O'BRIEN: Just a couple of thoughts but most of it has been well and truly covered off so far. We need to understand that there is not just one solution for this between opportunity charge and depot charge. Fuel security was important. The other thing that Olivia touched on there was technical skills and regulations. We are very light on tier 4 regulation and instructions and even training in dealing with the high voltage that comes with electric vehicles. So that is something that will need to be addressed. I think the rest of it has been covered off quite well.

The CHAIR: When I talk about electric buses this topic arises. How would you see bus manufacturers and operators dispose of electric batteries. Mr Mead, do you want to comment on that?

Mr MEAD: Yes, I can. It is a growing field. I think that our experience to date overseas where we have used batteries on self-charging or hybrid vehicles we are seeing the development of a second life industry. In our major markets in self-charging electric or hybrid we have sold thousands so it is starting to become an issue. The largest use we are seeing, and that we are investing in, is the use of energy storage for residential property. So the battery has a second life storing energy in an off-peak scenario that can then be fed back to the grid. So it is being used as a supplementary level of energy storage to re-feed the grid after use. After it has reached, I suppose, its life on the bus, the second life, with minimal changes to it, is actually in storage where the demand is not as sharp as in a bus where it is on off, in that type of scenario. We are seeing it. It is a developing industry but one that is nowhere near its maturity just yet.

The CHAIR: As an addendum to your comments, what are you looking at the typical life span of a battery for a bus?

Mr MEAD: I think to Mr Evans' points before about topography and climate and all of those things have an impact. The good news is they are longer than what we thought they were when we started this journey.

The CHAIR: What were they?

Mr MEAD: We thought they were around five years. Our hybrid buses in places like London now are out at eight and nine years on the first battery life. That extension and that ability to manage, I think, the technology has developed in that same amount of time where we can manage what a battery does. A little bit like Olivia said, we can manage both off-bus and on-bus. So we can tell a bus to go into electric mode in a shopping strip or past the coffee part of a particular suburb. We can do that by telling the vehicle what to do either by GPS or by looking at the state of charge of the battery. Those types of things have allowed us to get that life out further and that is continuing to develop.

Mr EVANS: We have got to similar sort of research. Using batteries as home storage is widely used in China now.

The CHAIR: Are there any comments from Mr O'Brien?

Mr O'BRIEN: No. I think that is covered off pretty well. The development of battery technology is leaping ahead on a daily basis. The management of how the power is put into the battery and taken out of the battery, the voltage and the pressure, for want of a better description, of how it is put in, is key to the longevity of the battery. But that second life and even recycling eventually is another whole industry that needs to be developed.

Ms LASKOWSKI: I think it has been pretty well covered and I trust the markets will find innovative solutions to second life batteries. I am sure there are lots of businesses that will spring up finding good uses for them. There is a recycling centre that has been set up in Singapore local to the region. That is also in place for when those second-life uses come to an end as well. Reiterating what Mr O'Brien said, advances like lithium titanate batteries, for example, have a much longer lifetime than lithium ion and those are becoming increasingly looked at by bus owners.

Dr Marjorie O'NEILL: I would like a little bit more information regarding where the current technology is at the moment. What is the distance or travel time for them particularly taking into account all these conditions that are potentially unique to Australia compared to places like London?

Mr EVANS: Currently with buses operating in Sydney at the moment and in Brisbane they are getting around 350 kilometres for a charge. There are buses at Sydney airport that operate and they are getting around 600 kilometres—it is just a different way they are operating. We are looking at obviously different battery technologies. Lithium ion, you have the same amount of battery, the same weight, as you would do with the lithium titanate system but you would have more kilowatt hours, so that gives you a longer distance per charge but then you have to charge them over three or four hours or overnight for eight hours. With the lithium titanate they are a fast-charge technology so you could have less kilowatt hours but they are denser but then you can charge them more often, discharge them more often.

The distance you travel is less but then you have opportunity charging stations at the end of turnarounds so you are kind of moving your charging from the depot to out on the street. With hydrogen, 39 kilograms of hydrogen will get you around about 400 kilometres, with a small 40 kilowatt lithium titanate battery on board. The battery is used as a buffer so your fuel cell produces the energy, it goes to the battery and then it powers all the systems. We have noticed in London they have been operating hydrogen buses for seven or eight years now. There are eight being operated by Town Transit, who are owned by Transit Systems and is now owned by SeaLink they run for about 16 hours a day. They are using around 15 kilograms of hydrogen a day. And now in Europe hydrogen is becoming a bit more prolific just because they can produce the hydrogen a lot easier with their hydro and all the solar and wind. They are using nuclear.

We are learning as we go and battery technology is going to improve so in five years' time we will be covering the distances that we need to cover. I might add that some of the tenders in some of the states, especially New South Wales, they insist you cover 350 kilometres. We have done some experimenting with that on buses with our phones and tracked the buses and on average buses do about 220 kilometres per day, so you actually reduce the amount of fuel you need to carry. It means you carry less batteries. Current diesel buses carry about 300 litres of diesel which is 600 kilometres worth. You are already carrying too much fuel anyway. The less weight you carry the further you are going.

Mr MEAD: To answer the question about the operational elements is that people love to talk about range, we are talking about range here. I think we will see a change and people talking about the energy available so when we compare what one bus can do compared to another bus we will actually talk about the energy available. Because, if both of them have the same energy it is likely the range will be the same. I think still that in a number of places around New South Wales certainly we are not at a point where we would replace a diesel bus with an electric bus in every place. I think going back to one of the earlier questions about operators' anxiety in this is that many of the routes then become a customised solution or a project on their own.

Like the guys have talked about, whether it is depot or opportunity charged charging, whether there needs to be adjustment to the timetable, where there needs to be additional dead end and turnaround, there are still some operational points because we are not yet at a point where a one for one swap can be made. We see then in other cities where the job of four diesel buses is now being done by seven electric. That is purely to allow for the crossover for charging in the middle of the day or the different times of the day to allow that range. So, while some routes can be achieved not all can be achieved. That gets very difficult because for an operator it means assessing the topography, the timetable, in a way or with a level of sophistication that maybe we have not thought about in the past.

Mr O'BRIEN: I would like to add to the comments about the operational conditions. One of the single biggest differences that we see from Europe is our average speed and obviously higher speed needs more energy to get that mass up but it also does generate the opportunity for regeneration when we brake. The surveying and the route management and route assessment really is a case by case basis.

Ms LASKOWSKI: I only add that it really depends on the route the bus is taking and the frequency of stop-starts and the gradients of the route have an impact on how far it can go with a certain battery capacity because there is regeneration that comes into play.

Mr GURMESH SINGH: We spoke about hydrogen fuel cells earlier. I want to know what are the issues we will need to overcome to make sure hydrogen is more widely used?

Ms LASKOWSKI: I think it is a supply topic at the moment. Seeing as Siemens are a big advocate of hydrogen in Australia we have been pushing it for a long time and we do see it as another viable way to reduce emissions in the bus sector. The issue at the moment is supply and until supply is readily available I think that you will find that bus operators will not be able to move to hydrogen vehicles.

Mr GURMESH SINGH: What do you mean by supply with a little bit more clarity?

Ms LASKOWSKI: There are very few large scale hydrogen electrolysers in Australia at this moment. There are a few small ones that have been built mainly with a particular customer in mind. The ones that we are aware of are in Tonsley, South Australia. Then there is another one being investigated up north in Queensland and they will be significant electrolysers attached to wind farms; true green hydrogen. At the moment there is not sufficient supply to convert all 8,000 buses in New South Wales to hydrogen buses. Does that make sense?

Mr O'BRIEN: First of all hydrogen and fuel cells is the end game, this is the ultimate with the self-contained energy source on the vehicle. That is where we will end up at some stage but I think the single biggest challenge for that at the moment is the cost of a fuel cell. They are certainly becoming more and more popular and as with everything more manufacturing will create more competition and reduce prices over time. David could probably give us an idea of the capital cost for the infrastructure hardware cost of a fuel cell as compared to a conventional diesel or biofuel or even hybrid or traditional vehicle charged electric bus. Capital cost would probably be the biggest thing at this stage.

Mr MEAD: I think there are a couple of things to consider quite directly. When you look at the operators running hydrogen today; a hydrogen bus depot looks very different to a normal bus depot. Handling hydrogen, which is a volatile gas, some of the depots that we see in places like London at the moment have a sensor every couple of metres on the wall and we have to have an enclosed depot for working on the vehicle. There is a safety element around it. I think the other thing we would say is that going back to where is the emission made? So, this well to wheel approach.

If you still have to put hydrogen in a truck that has a diesel engine and move it 500 kilometres then you have created a secondary emission from that. Like Ms Laskowski said, until you get to that widescale refining and getting it close to the source you have a lot of supplementary elements to it. I think that is one of the challenges or the questions, what is the most efficient use of each energy we have. Hydrogen will still require electricity to produce it. So like Ms Laskowski said, when you can become renewable, great, but until that point you are using electricity.

Would that electricity be more efficient put into a bus or put into making hydrogen? There are the trade-offs. It is like the old discussion we had about compressed natural gas. If you take the CNG off one gas bus in Sydney you can run four electric buses if you burn it and make electricity. All those trade-offs and the most efficient use of the energy are the key, but that comes from looking at a well to wheel type analysis and not just the emission, as Mr O'Brien said before, in Sydney. Are we moving emissions and carbon footprint from the city and putting it somewhere else, is the challenge.

Mr EVANS: I could talk about hydrogen all day.

The CHAIR: I thought so.

Mr EVANS: Basically, production of hydrogen is an issue. There are not that many hydrogen production facilities in Australia. There are a few big ones, there are a few small ones. There is one being built out at Eastern Creek in Sydney at the moment by Jemena. There is one being built in Victoria, one in South Australia and one in Queensland. There are companies that are producing or looking at building larger production facilities. One of the issues with building a large hydrogen production facility is what you are going to do with the hydrogen. You can export it—we are the largest exporter of hydrogen to Japan. You can use it in buses and trucks and cars—we do not have any buses and trucks and cars at the moment, so that is why we are trying to build one.

Yes, getting hydrogen to the depot can be an issue. I went to a recent Australian Renewable Energy Agency [ARENA] briefing and it wants somebody to build a 10 megawatt hydrogen production facility with its funding. I thought it would probably be a better idea if you built 10 one-megawatt production facilities closer to where you actually need it, because Mr Evans is correct: if you are going to transport the hydrogen from a larger production facility where you want it, you can get hydrogen-powered trucks—they are still not available in Australia—but having a smaller production facility at the depot or close to the depot would be a much better way of doing things. There are also other methods of getting hydrogen to where you need it. Jemena is proposing it puts hydrogen into the natural gas lines and then extract that at the depots. We know that Leichhardt has a gas refilling service there, so they can take the hydrogen from that gas anyway. There are lots of different ways of producing hydrogen and getting hydrogen to where you need it. The critical thing is actually getting buses and trucks to use the hydrogen, because if you make the hydrogen you have got to use it.

The CHAIR: Deputy Chair, do you have any questions?

Mr GURMESH SINGH: Yes, I could keep going. We saw in Coffs Harbour recently a trial of a driverless bus. How do you feel that electric buses will help foster driverless technology going into the future?

Mr MEAD: I think the more and more electric components on a bus allow for control. For example, on a number of even diesel buses now we have electric steering, we have electric doors. When you put more and more electric components onto a vehicle of any type you give more control, because you can control them by software and other things. It is fair to say that electric is a precursor to full autonomy and that full driverless-type scenario. They are not mutually exclusive but they certainly help each other. I refer back to a previous example in Singapore, where they are looking at electric and then autonomous and this 10- to 15-year roadmap to get to a driverless vehicle. Our view is it will take that long for a genuinely driverless vehicle that goes in mixed traffic at normal road speed. By the time we get there, the electric technology in 10 years' time will probably be around the same point. Certainly they are linked together by the ability to control things on the bus. The electrification of steering and other elements makes it easier.

Mr O'BRIEN: Yes, that was a good summary there by Mr Mead. I think the key comment there was that we need to understand that we are not just going to have these things pottering around at five kilometres an hour in a closed environment. Autonomous buses need to operate in regular traffic and at regular speeds and full of passengers. There is a lot to be done, but we are well and truly on the way, absolutely.

The CHAIR: Mr Evans, would you like to add to that?

Mr EVANS: No, I think it is pretty much covered.

The CHAIR: Any further comments? Ms Laskowski?

Ms LASKOWSKI: No, it is all covered. Thank you.

Ms ELENI PETINOS: We have been talking a lot through this morning about I suppose reducing emissions or the consequence of looking at electric or hydrogen in terms of an emissions framework. Would you advocate that there are other benefits to looking at changing the mix of the bus network outside of the emissions targets or conversation?

Mr MEAD: There definitely is. I think the biggest elements are noise, so noise pollution. There are enough studies now—in Europe they would have a hard link between noise and silent zones to health, so that there is a very firm link between investment in health services and noise of public transport. I think the other one—and again, it is not exclusive to, say, a hybrid vehicle but it is something we do—is the lift on road safety. Going back a little bit to the previous comment, this ability to control lifts up road safety, pedestrian safety et cetera. Of course, we have to manage the fact that we have a vehicle that is silent, so we have to let people know that it is there. There are ways to do that now with artificial pointers that we see in other markets. But they would be the two big ones: safety and the direct link between health. In some cases, we see operators and governments providing funding back to transport via the savings in health based on the contribution. There are those hard links we start to see in some of the studies being done in Europe.

Ms LASKOWSKI: I agree on the noise front. I would also just like to personally encourage Transport for NSW to look at its ferries and consider them going electric as well, because travelling on an electric ferry would be a far more enjoyable experience than going on one with a motor. The other, of course, is exposure to diesel particulates and the health benefits associated with reducing public exposure to diesel particulates. We see this particularly in other industries like the mining sector, where they are very conscious of underground miners being exposed to diesel exhaust and have spent a lot of money to reduce that exposure. They are now looking at electric alternatives, with reducing their carbon emissions being one target, but a clear target for them is health benefits to their employees.

Mr EVANS: I agree with what has been said. Travelling on an electric bus is a far more enjoyable experience than travelling on a diesel bus, especially one that is 20 years old. You are sitting in the back of the bus with the noise, getting fumes in, and then if you are standing at a bus stop and the bus pulls up you are getting choked by the bus as well. Again, you have to look at the safety aspects of things. I know that a lot of people are concerned, especially nowadays with people with their headphones in and staring at their phones. Generally if I have got my head down and there is a kerb I stop and look, but you always get people who just step out. We have got to consider those things as well.

Mr O'BRIEN: The noise aspect is the clearest one, but I suppose it is an exercise in whilst we say, yes, we do not just want to push the pollution and emissions from the city to the country, the city with its population density is obviously where the benefits are going to come. Value for money and bang for buck with patronage and just the hours of operation of an STA bus, for example, in Sydney as compared to something regional—the benefits will be dramatic converting to electric in Sydney.

Ms ELENI PETINOS: Due to the comments that you have just made about the silent nature of electric buses, I understand that raises a need for noise emitters to be fitted onto the vehicles so that not only pedestrians

but other road users are aware of the presence of the bus. Can you take the Committee through any issues that would prevent or limit the use of noise emitters in New South Wales?

Mr MEAD: I do not know about the regulation, but apart from the regulatory environment—

Ms ELENI PETINOS: Not necessarily for the regulation.

Mr MEAD: Apart from that, then absolutely not. There are two ways that we do it. One is that it is a constant emission of low noise to make people aware that the vehicle is there. The other is to actually put that warning onto the bus when the pedestrian is in range, so you can actually sense that the pedestrian is there.

The CHAIR: So it picks it up as a sensor?

Mr MEAD: Exactly, from a sensor. But there is no technical obstacle to doing that. I think if we go back to a self-charging electric bus, or a hybrid, as some call it, you can do that today. We can have them running silently in Sydney with emitters and all of those things without infrastructure, without those other elements. That is something that we can do on those vehicles with no technical obstacle.

Mr EVANS: Yes, the technology is there to do it. There is a company in Europe that sells white noise speakers for buses. I saw it at the Brussels show. It is just a speaker and a system that emits noise. It is really easy to do.

Mr O'BRIEN: Yes, and typically that is only really required at low speeds. You do not need a bus making warning sounds at 60 kilometres an hour. It is only where you are in the area interacting with passengers and the side-view cameras, radar, warning systems, yes, they are all available today, so that should not be a challenge.

The CHAIR: Thank you. Any further comment, Ms Laskowski?

Ms LASKOWSKI: No further comment.

The CHAIR: Ladies and gentlemen, thank you so much for your contribution today. It is very appreciated. I think you have made some very good points. Committee, is there anything else you wish to comment on?

Mr GURMESH SINGH: I have one further question. I hope it is a quick one. With the future, looking 15 to 20 years out, if we are at the point of going driverless, we see a lot of buses now basically being the same size, about 50 to 60 passengers. Do you see a reduction in bus size looking two decades out, or an increase in bus size for that matter?

Mr EVANS: No, I think buses will remain the same. You would probably look at smaller buses for smaller areas. On housing estates there are already some Hino Ponchos running around on on-demand services. That would be your first and last kilometre, as they are talking about it at the moment for mass transit systems. Your first and last kilometre is always going to be the important bit, where people are getting to and from the main bus depot or the train station. So you can use smaller vehicles for that and they can be autonomous. I think the larger vehicles to carry masses of people in the cities to get to work or whatever is still going to happen.

Mr O'BRIEN: Yes, I think if you have a look at the situation today, we have everything from double-deckers to articulators. Brisbane is going to be trialling a bi-articulated vehicle. It really is horses for courses and per application and depending on the number of passengers and the transport task you wish to carry out. As we are today, we are very adaptable, or the industry is very adaptable, to the different circumstances. I do not see that changing.

The CHAIR: Ms Laskowski?

Ms LASKOWSKI: No further comment.

The CHAIR: Thank you so much for appearing today. We may send you some further questions in writing. Your replies will form part of your evidence and be made public. Would you be happy to provide a written reply if you are asked to?

Mr MEAD: Yes.

Mr EVANS: Yes.

Mr O'BRIEN: Yes.

Ms LASKOWSKI: Yes.

(The witnesses withdrew.)

(Short adjournment)

GUS DEFALCO, Compliance, Training and Policy Manager, Interline Bus Services, affirmed and examined

JOE OLIVERI, Director, Operations and Maintenance Manager, Interline Bus Services, sworn and examined

GREG BALKIN, General Manager, New Technology and Innovation, Transit Systems Pty Ltd, via teleconference, sworn and examined

The CHAIR: Ladies and gentlemen, I am Robyn Preston, your Chair. Our Committee members greet you with open smiles. We will ask you questions through them. Thank you very much for joining us today. Before we start, witnesses, do you have any questions at the moment?

Mr DEFALCO: No, I do not.

Mr OLIVERI: No.

Mr BALKIN: No questions.

The CHAIR: Thank you. As part of the formalities, we offer you the time to have an opening statement if you would like to do that. Are any witnesses wanting to make an opening statement?

Mr OLIVERI: No, I am good.

Mr DEFALCO: I am fine as well, thank you.

Mr BALKIN: I am fine as well, thank you.

The CHAIR: Thank you. We might move to Committee questions.

Dr MARJORIE O'NEILL: Thank you very much, and thank you for coming in and for phoning in. Firstly, what are the risks that you think may need to be addressed to ensure that, if there is a rollout of electric buses, that it would be efficient and it would meet passenger needs and community needs?

Mr OLIVERI: The risk we see is the amount of time the vehicle will be on the road. Technology I do not think is there for the same time as the diesel bus is going to be on the road. In saying that, I still believe at the moment that diesel buses are a better way to serve the public. They are not environmentally as good as an electric bus, be it powered by a coal-fired power station. But, in saying that, we are just about to do tests on two vehicles and we are hoping that we can simulate our diesel time that the bus is on the road with the drivers. The other thing that seems to be creating less power and more power draw from the vehicle is the acceleration of the bus. It is very, very fast.

An electric bus is very powerful compared to a diesel bus. We do not have a time limit for the bus to take off and to get back into the flow of traffic. We ask the drivers to be professionals and judge their entry into the traffic flow. I have personally driven the electric bus. It is very, very fast. We have asked for it to be slowed down. We think that is part of the way we are going to increase the capacity of the vehicles to do what we call a double shift. So we use one bus to do two parts of a shift. That is part of the thing that we are asking the electrical bus people to manage for us.

Electrical wires—we believe, and we have been discussing this with the electric bus people, besides not having an engine, an internal combustion engine, it has an electric motor and whole lot of batteries. The bus is heavier. According to the electrical bus people, the first thing you do is pull the fuse and then start working on the bus. Anything electrical, you get an expert to come in and do it or you train up your staff to do it. That is about all I can say on that part of it.

There is one thing more that I do think will happen and that is extra wear because of the extra weight on the vehicle itself. The tyres will wear out quicker. The suspension will wear out quicker. It has to—it is running three or four tonne more weight in the vehicle. Some of the electrical bus suppliers that I have spoken to have said that some of the tyre wear will be almost 50 per cent more. So, yes, there are savings—no oil changes, no transmission, no maintenance in the engine compartment but you still have brakes, you still have tyres, you still have suspension that wears out, you still have cars bashing into buses and buses bashing into cars. So the maintenance is still there; it is just a different way of doing the maintenance The thing that I have looked at is how much extra maintenance to the things that we take for granted—like tyres, brakes—how much extra, putting on this extra weight to the vehicle, is going to put into the wear and tear of the chassis—call it the chassis. That is one type of bus.

The other type of bus that has the engines, or the electric motors, on the wheels, there is also—and it is a bit technical—as you know, when you go around the corner one wheel turns faster than the other. With the electric motors on the wheels, they want to tend to go straight because of the power supply. So there has to be a computer programming to make sure that when it goes around the corner one wheel pushes less than the other wheel and that creates more wear into the tyres. As I heard before, everyone is talking about battery recycling. Well, if this increases the tyre wear, we have got to get rid of rubber. You wear out tyres much quicker, front and back. I think that answers your question, sort of.

The CHAIR: Thank you. Are any other witnesses wanting to comment.

Mr DEFALCO: Can I just seek clarification on that question? Are you asking for risk in the sense of health and safety to the public and drivers?

Dr MARJORIE O'NEILL: I guess there is a variety of it, right? What are the risks to be able to ensure that if you rolled out electric buses—one, risks in terms of passenger expectations, so you spoke about in terms of their capacity, how they run. I think you also touched on the fact that there might actually be a skills gap—

Mr OLIVERI: Yes.

Dr MARJORIE O'NEILL: —in terms of the maintenance of it, so that is a risk.

Mr OLIVERI: Yes.

Dr MARJORIE O'NEILL: If we roll this out, there seems to be a skills gap in terms of being able to maintain, uphold this. This seems to be a gap now in terms of the other assets that are needed to maintain it.

Mr OLIVERI: Correct.

Dr MARJORIE O'NEILL: So I am talking about it more broadly. If we were going to run this, what are all of the risks—passenger expectations, in terms of training, compliance, regulation?

Mr DEFALCO: I would just like to comment on the health and safety to the public and also the drivers. I, myself, have a slight disability, which is hearing. Everyone has been talking and the submissions that I have read talk about visually impaired people, those sorts of things. So I think the other thing that needs to be looked at is the members of the public who are hearing-impaired, you cannot tell when someone is hearing-impaired but you can obviously tell when someone is visually impaired. If these buses emit a low noise level, whether the vehicle is coming from behind or forwards, the hearing-impaired person has no chance of knowing there is a vehicle behind them. Particularly, we have a lot of hearing-impaired people who are driving vehicles as well on the road. Many times I have been caught out: Oh, there is a siren somewhere, where is it? I am not sure whether it is coming from behind me, in front of me, beside me or what not. So I think there needs to be some sort of consideration on that level. Thank you.

The CHAIR: Just following up on that, are there recommendations that you see would work so that hearing-impaired people could have a good experience with electric buses?

Mr DEFALCO: Nothing comes to mind straightaway. From my experience working in the hearing-impaired industry as an educator many years ago, the technology for hearing-impaired people is very limited. They either have a guide dog as well now or there is a flashing light somewhere that indicates: Hey, your phone is going off or there is someone at the door of the house or whatnot. I do not know how you can overcome that?

The CHAIR: Could flashing lights on the outside of the bus help?

Mr DEFALCO: Again, only if you are facing the bus, but if the bus is behind you are not going to hear the bus. You have got that issue there. I do not know how you could overcome that, particularly those who are significantly hearing-impaired. Cochlear implants—they have a very good level of hearing but there is a lot of deaf communities, so to speak. They do not take up hearing aids or anything like that so they are profoundly deaf. In other words, they might hear a rumble but I am told that the tyres will not make noise either now, so you will not know.

Ms ELENI PETINOS: Thank you for your time today, gentlemen. I am just following up on the conversation that was just had, specifically in relation to the deaf community. The previous witnesses this morning indicated that in other jurisdictions, due to the silent nature of electric vehicles, a lot of them are fitted with noise-emitting technology to assist with this. Is this something you are aware of or are your comments made not being aware of the noise-emission technology?

Mr DEFALCO: Not being aware of that.

Mr BALKIN: Perhaps if I can make comment?

Ms ELENI PETINOS: Sure.

The CHAIR: Mr Balkin?

Mr BALKIN: I am interested in making comment on the risk factors as well, so hopefully we will get the opportunity to revisit that because we operate five electric buses in Sydney at our Leichhardt bus depot. We have been doing that very successfully since July last year. So we have real-life experiences of operating these buses in Australia's largest city. Certainly, as far as the pedestrian awareness, it is certainly probably a bit wider than people with hearing issues. It is also people who have headphones and are distracted on their mobile phones who are also at risk of a bus impacting with them, or not realising that there is a bus in close proximity.

So we have been working with various technology partners to identify whether there is some technology through a crash-avoidance system that can be adapted to identify pedestrians who may come into the path of a vehicle, but also whether we have some sort of audible alarm on the bus, similar to a tram, that is regularly sounded, or whether it is more of a manual process where the driver will signal if a pedestrian is in the way or as they are approaching a bus stop.

We think a regular sort of sound would be unacceptable to the community. We noticed that there is certainly sufficient road noise, depending on what the ambient noise is like, but there is noise emitted by the tyres. We have air conditioning systems for the batteries, which also gives a sense of noise. I think as an industry we would look at adopting whatever technology there is to make sure it is safe for potential customers but also for potential pedestrians and other users of the road.

Ms ELENI PETINOS: Thank you, Mr Balkin. Given that you have just indicated that you are interested in contributing to Dr O'Neill's question around the risks to be addressed to ensure the rollout of electric buses is efficient and meets passenger needs, I invite you to make comment on the previous discussion that was had.

Mr BALKIN: Yes. Certainly we have operated these buses now since July last year, as I mentioned. They have been very well-received by the community. We operate through the inner western suburbs of Sydney. We started off with four key routes and quickly realised that these buses were coming back to the depot regularly after 200 kilometres of travel and about 16 hours of operation with almost 40 per cent charge, so well within the operating regions. Our average speed in Sydney is about 16 to 17 kilometres an hour. The brake regeneration is about 30 per cent. These buses are exceeding all of our expectations. They are well-received by passengers and mechanics feel it is an opportunity for them to get their skills improved by working on these buses. Passengers are saying that this is fantastic. It is amazing how well-received it is. These are now part of our fleet. They do exactly what every other bus in our depot does, so it has certainly been a good news story.

The issues we have experienced are more around the capacity. They tend to carry less passengers because of the 18-ton weight limit on New South Wales roads. That is a function of the weight of the bus without passengers, adding passengers and coming within that envelope. Certainly weight, as Mr Oliveri said, is something that needs to be considered.

The grid capacity to the depot—at Leichhardt depot, the depot was built in 2009. We assumed that the electricity supply and the functions of the depot would allow for electric buses. We found very quickly that our estimates were incorrect. I think we have spent close to $300,000 to run a new distribution board and electric cabling to set up the chargers to charge just eight buses; we have five. So we can charge eight at one time. Any more than that, we would need to upgrade the substation, which is a discussion with others to make that happen.

What we have found is that instead of having five to six hours' worth of charging each night, the buses are coming back with such a charge that they are only taking two to three hours to charge. The dynamics we thought originally was that we would charge four or five buses a night. We can actually charge multiple banks of buses sequentially, even opening up opportunities to charge electric buses during the middle of the day on what we call a broken shift. Straight away from what we thought was a maximum of eight buses, we believe at Leichhardt through operational efficiencies we can actually charge close to 30 electric buses with the same infrastructure we have currently got. That is some of the good news.

With brakes we find that the drivers—we specifically trained and selected our drivers based on their driving skills and their customer relations skills. We are finding that the brakes are not needing to be adjusted or replaced at the same level as a diesel or CNG bus because the drivers are driving using regeneration techniques. The charge time, as I said, is much better than what we thought. Servicing of the vehicles is only a fraction of the time that we would normally do with lube changes and so forth with a diesel bus. So we are starting to see efficiencies, but you are not going to get efficiencies if you got five buses. If you look at it, one mechanic for 16 or

18 buses—you need a substantial fleet before you start seeing labour changes. All that will come with volume, as will the opportunity to reduce the capital costs for the buses and the infrastructure.

The CHAIR: Thank you. Following on from your comments there, Mr Balkin, the changes that would need to be made to existing bus depots to service electric buses—I would like a comment there and I invite the witnesses to comment.

Mr BALKIN: Leichhardt depot is one of the newest and one of the largest depots in Sydney—in New South Wales. It is owned by the state government. We are the trustees of that under our operating contract. As I said, we had assumed what the cost would be to do electrical work. It turned out to be more than just a long extension lead. It needed significant upgrades to the depot distribution board and cabling, so that has come in around about $300,000. We did some similar sort of exploratory work at our Smithfield depot and our Hoxton Park depot, both owned by the company, and that was coming in at the same sort of cost—about $300,000. It is a significant cost.

We also explored the opportunity of installing solar panels because, as Mr Oliveri mentioned earlier, we are still getting our electricity through the grid, which is coal-fired power stations. We wanted to take the next step and use renewable energy, so we then engaged suppliers to scope the provision of hot solar panels at Leichhardt depot. We can map out at about 500 kilowatts, which is a significant-sized solar array, but then that is only any good for charging buses in the middle of the day. What do we do with the buses at night-time that come in late at night and need to be charged? You then look at an energy storage system or batteries for the depot. Then you can add another $1.3 million. All of a sudden you are starting to come into a significant capital investment. Now there are not many bus operators, given the term of their contracts, who are prepared to invest that sort of money in infrastructure.

The CHAIR: Mr Oliveri, would you care to comment?

Mr OLIVERI: Yes. I agree with Mr Balkin. I have been scoping the fit-out to trial the buses—two buses at the end of this month. I am struggling to get 100 amps into the place. No-one is looking at it. They said, "You have to upgrade the whole grid." It is south-west Sydney—our bus depot is—and there is nothing built there yet except for a bus depot and next door there is a lift mob that is going to do it. I said, "Look, all I want is 80 amps. Just give me 80 amps. I can try the bus and then I will put the 1000-amp application in to upgrade." Internally the bus depot has foreseen that electric and hydrogen buses were going to come, so I have designed the depot so I can just put the infrastructure in.

We have had power companies come in and Origin Energy apparently has got a new electric vehicle section. I only found this out three weeks ago, so I am talking to Origin. Endeavour Energy that owns all the poles—they keep on sending me to a level three electrician. All he wants to do is make a lot of money. I said, "I am not paying $200,000 to get 80 amps into the place. That is ridiculous." So I have been looking at the battery energy storage thing. Our depot is only two years old now so it is still pretty new. We are looking at solar panels—1000 amps to come into the unit. They tell me that that will do 40 buses. I spoke to Transport and they said, "Keep on going. Give us some costs for that." The hardest thing I have found so far with everyone is trying to get power in south-west Sydney. I do not know what it is like in the city but in south-west Sydney—I mean, they tell me the power is there, but they want to modify and change everything for 80 amps. That is ridiculous.

I am doing a trial. But once we get that trial up and running we think that, as Mr Balkin mentioned, we are going to get close to 350 to 400 kilometres mark. Our buses do average about 22 kilometres an hour, a little bit faster than the city buses, which is good for us. Tests so far say that those buses that have been testing elsewhere are getting 320 kilometres. I need the buses to run for 16 hours. If they can run 16 hours—the electric bus we are talking about—I do not think we will have a problem. Yes, I can put them on split shifts and all that kind of stuff, but when you get new vehicles you want to put all the new stuff on the road as long as you can because it is new and it lasts longer.

As the old stuff gets older it wears out quicker, more parts have to be changed and it costs more money to run. Yes, if Greg's thing is right then I think we should be right with electric buses. The infrastructure to get the power to the bus depot is the main problem that I see. It is really, really hard to talk to people when you cannot go direct to Endeavour Energy and you have to go through a third party because my electrician started the conversation. As I said, all they want to do is "Yes, you've got to pay this." I do not want all this infrastructure spend—it is not my problem. I have paid my rates. I have paid the contributions, put the power there. It is industrial where we are and I think more bus companies will have the same problem. Greg is right. Are we going to spend $2 million to $3 million for an eight-year contract? I do not think so.

The CHAIR: An interesting point.

Mr OLIVERI: Can it be done a different way? Yes. We have been in business for 60 years, our family, and I do not want to get out of the industry, but moving forward with electric hydrogen—and I have not spoken about hydrogen because I am really, really concentrating on the electric issues because our Minister, our Government wants electric buses so I am looking at it. There is another bus on the market that is 18 months away that will probably be four tonne lighter. It is a full carbon fibre bus. I do not know if Greg has seen it, I think he has. It is a challenge because carbon fibre is very hard to work but they tell me it is going to work. I have also been told that they want to manufacture in Australia which is a tick for us. Instead of being manufactured overseas it will be manufactured here. That bus there, they guarantee me, 500 kilometres per charge because it is about 3.5 tonne lighter than the normal electric bus.

It is a little bit more expensive, that is the other thing. They are more expensive buses for now. I think as battery technology moves forward it will enhance the vehicles. I have spoken to Toshiba people—if nobody minds—that makes batteries. They are the people who said that their batteries should last the life of the bus but——there is a "but" to it—they will only guarantee me 270 kilometres a day. I said that is not good enough. He said, we will have to manage with pantographs and all that kind of stuff that I have seen. I said that is not an option either because there is no way in the world I go and spend all that kind of money on an eight-year contract on pantographs at Liverpool Station, Campbelltown Hospital, Minto Mall and Oran Park. It is just ridiculous. You would not spend that kind of money unless you had a continuous contract. If you did you would look at it and say, at no cost to the Government, we will spend the money, we will do the buses.

The hydrogen thing, I was a hydrogen man from day one when I first talked about it. They are telling me that all the infrastructure that has to be done to the workshops and all that kind of stuff, I do not know. I have not seen a hydrogen workshop in Australia. I have seen it overseas. It did not look any different to me except for the sensors. Most of the hydrogen vehicles I have seen have had the engine pulled out and the hydrogen cell put in the back of the bus. My deal with that, and I asked the Chinese people, "Why can't you put the motor up the top with the gas?" They go "We don't know." I said "To me it is logical. Hydrogen is lighter than LPG. It is lighter than air. It goes up into the atmosphere. Why would you have it down the back of the bus where it can seep into the cabin of the bus?" They just said "I don't know".

When I did go overseas and have a look at some of the hydrogen buses there, they are starting to put the tanks and the cell on top of the roof. Comments to that is we have gas buses here and the chassis or the frame of the gas bus is broken because there is 300 kilos or whatever amount of weight in the roof, I think that is past tense. All that has been sorted out with engineering. Personally I think if we can get hydrogen that is the way to go because of the less infrastructure you need. I am going to ask for 1,000 amps to go into my bus depot. Now 1,000 amps is 40 buses with batteries. If I take that 1,000 amps of the batteries away, I can probably only charge 10 buses. And I take the solar away because the solar makes it cheaper alternative because you charge back to the grid.

Hydrogen, as far as I know and all my calculations and all my reading—I got these Ballard people sent out a thing saying that fuel cells now become 70 per cent cheaper. A year ago the Chinese told me that the cell is $450,000 on its own when I looked at them. Another company told me it is only $150,000. Ballard just released a newsletter saying it had dropped its cell price 70 per cent—that is even better. I think electric will stay. We have got to get hydrogen. That has to become more available. I think that is the main thing that is stopping everyone from doing the hydrogen thing. That is all I can say.

Mr BALKIN: I can make some comment on that if you like.

The CHAIR: Just before you do, Mr Defalco do you want to make further comment?

Mr DEFALCO: Yes. I think with hindsight when you first asked for an opening statement I thought it was probably not the time but as Joe Oliveri said we are a family company that has been operating 50 years now in region 2. The reason for bringing this up is because we were advised, on my understanding, to purchase some land in Leppington which is a growing area outside of Campbelltown and establish a depot. The reason for bringing that up, because we were talking about infrastructure, is that being the first non-industrial set-up in a particular area of Leppington we have been struggling with the local council trying to even build a depot there. We have met all the requirements as for the development applications. We spent a lot of money developing our depot out at Leppington but as Joe was saying we have been asked to trial two electric buses. We are excited about this but again we seem to be having to jump hurdles all the time to actually have a go at doing this trial successfully mainly because of local council and bureaucracy at the same time.

The power stations want to be part of this but again we have to jump hurdles. We are a small family business that has been operating, like I said, for 50 years. We have just over 100 buses and employ about 150 drivers plus administration staff and workshop, sometimes we become despondent when we are trying to do

the best we can yet we are always jumping these hurdles for local government or electricity suppliers. I thought in terms of this infrastructure it was better to say that.

Mr BALKIN: We operate hydrogen fuel-cell buses in London. We have done so since 2013. We are the second longest running hydrogen operation in the world. We started off with eight fuel-cell buses built by Wrightbus. The last two were Van Hool buses in November 2017. We have certainly got experience with hydrogen fuel cells in one of the largest cities in the world. We have a dedicated workshop facility in our Lea Interchange bus depot in London, but that was built in, say 2012, and very much sort of over-specced.

In today's terms a CNG workshop, a workshop that currently maintains CNG buses, is quite a small modification and systems enhancement to get that workshop facility up to servicing hydrogen fuel cell vehicles. Hydrogen fuel cell vehicles are electric vehicles. An electric vehicle is an electric vehicle whether it is battery or pantograph or whether it is hydrogen fuel cell. The only difference is that there is a fuel cell on board the bus which actually generates electricity to charge the batteries or some other electrical treatment as well. When you talk about electric buses, they are both the same.

The hydrogen fuel cell one has got a hydrogen fuel cell. Operationally-wise, we believe that hydrogen fuel cell can cohabit with battery charging. We do not see a need now, I think technology has moved on so fast, for opportunity charging or en-route charging. If we can get 200 kilometres a day for a bus, that covers our needs for two shifts because our average speed is so low.

Infrastructure-wise, we did a road show about 18 months ago now. We called and did presentations for every state government other than Tasmania, where we spoke to transport ministers and key people. It was the first time that we had Ballard, the fuel cell manufacturer, ourselves, Wrightbus, ENGIE, energy provider and ITM Power, who makes electrolysers. It was the first time the Government had ever had all the players in the room. It was a light bulb moment. It certainly realised this was not future technology, this exists now and can be deployed.

The downside of hydrogen is it is twice the cost bus-wise than diesel bus. What we are saying to state governments is that you are buying a diesel bus anyway in some sort of form for your contracts. You might be paying $450,000, $500,000 for a diesel bus. That is going to be in service for 20 to 25 years. Whatever decisions you make today, the legacy is going to be around for a long, long time. What we are saying, and we have been engaging with federal agencies such as ARENA to say how can we bridge the gap between the cost the state government is paying now for a diesel bus and cover that gap to what a hydrogen bus would be? An electric bus battery fits about halfway in that sort of cost line.

The conversation to have is we can get some sizeable hydrogen capabilities in Australia, we can develop a hydrogen capability centre of excellence and convert other industries into manufacturing hydrogen buses. How do we commercialise hydrogen? Does one side of the fence have a 100 bus depot and the other side has a forecourt, as they are rolling out in Europe? How do you get the hydrogen? Two methods—one is either manufacture it onsite, which really does become challenging with the electricity supply or do you have it delivered, as you do with diesel via tube trailer? All those opportunities are there. The technology is there now and Mr Oliveri is right, technology will change in the next couple of years. What we are talking about now might be old hat. We certainly support both propulsion systems.

Mr GURMESH SINGH: It is good we have some owners of bus companies here today, because I want to talk about business models and whether you see that the current business models for bus operators will continue or whether there might need to be a shift in business models going forward with electric and hydrogen.

Mr OLIVERI: Some of the big operators would hope, I think, that it continues. Us family based companies, we have been running buses for a long time. We know that government always looks at dollars and cents. In our family we are always looking to make sure that we do not cost too much, because if you do, someone is going to find out. A bureaucrat will find out and say, why are they costing us this much and these people are costing us this much? You have got to be efficient and you have got to give a service to the government because that is who our—can I call you bosses—that is who the bosses are. We are running public transport for the New South Wales people. We have always prided ourselves in being very efficient. Can we continue this? I do not think we can, especially if we are going to go to electric and hydrogen buses. Is the government going to fork out more money? Short-term, yes, absolutely.

To set up the bus depot, some suppliers are wanting 15-year contracts and when we discussed that with Transport for NSW and the same with us, we said no. We are not wearing a 15-year contract, but something around a seven year contract, put the infrastructure in to run electric or hydrogen buses I think will be somewhere there. The other word is that the Government will not do anything unless you give them the depot. That is fine too, but try and get property, even in southwest Sydney where everything is being developed, it has taken me four years just to build a depot. It is the most ridiculous thing I have ever heard in my life. There are so many things

you have got to jump through to build a depot. But, that is the way it is. You live with it, put some money aside and do the thing.

For us it needs either longer contracts or a turnover, until something is wrong or there is something wrong in the system. I think the model has to change. The big boys are fine. You have got the Trans-Systems, the Transdevs, now Busways has gotten onto the bandwagon. They are big fellows. They might have the money to do what they are doing. We would like a change back to continuous operations, as long as you meet criteria, what is the difference? You are just going to put it out for tender, all the solicitors, the lawyers, the accountants make a lot of money—because I know how much they charged me when I went for my first tender. I do not know how much they charge the Government, but I can imagine how much the Government gets charged to make sure that the Deloittes, the solicitors and everyone puts everything into the right place.

Mr BALKIN: Maybe I could make some comment?

The CHAIR: Please, Mr Balkin.

Mr BALKIN: We operate 2,500 buses, so we are one of the big players I suppose you would call us. Up till just recently we were very much a family owned business. What we are finding now is that we are getting approached regularly, as others, on power purchase agreements and packaging which is starting to create some really innovative offers to convert what would be capex into more of an opex and spread that cost over the term. Very true, contracts are usually seven or so years. By the time you make these decisions, you are probably a couple of years into your contract and you have got a few years to go. Some of those decisions will be deferred and may never be taken up. It has really got to be looking at the term of the contract to give more certainty over longer periods so these investments can be material over the period of time. The Government really does set the levers with this. We are required to buy all of our buses through Transport for NSW procurement panel. They negotiate the costs of buses and we basically select the bus suited for the needs after approval from Transport for NSW.

I understand there will be some electric buses on that panel, which I understand will be out fairly shortly. That sort of cost, then, is built into your contract payments going forward. It is a matter of the value of that asset at the end of the contract, whether it transfers to the government, whether it is a bus or whether it is a depot. Our two depots in western Sydney, we were very fortunate, we built them probably in just over 12 months to two years. With electricity, I do not see that is an impediment to building a new depot, as long as Ausgrid can supply the electricity to you. I think there is some good news there, but it really does need government to be a partner in this and not expect the operator to do the research, invest in this new technology with no certainty going forward beyond the term of the contract. We are finding that in other jurisdictions. We are building a new depot in another state. We are looking now at what do we need to not even have a diesel fuel tank on site. That whole depot will be electric.

We are working with governments to bring in hydrogen fuel cell vehicles, but the stumbling block is always the cost. Who is going to pay for this? Well, the operator cannot. It has to be state government, probably with the support of the Federal Government initially and, in some cases, it might even be local government where you are looking at how they can leverage off some of their other assets, such as sewage treatment works. There is innovation around hydrogen production, electricity generation, for those sort of facilities. Straightaway you are looking at co-locating some of your bus depots or some of your infrastructure to leverage off commercial opportunities, or for existing infrastructure that is looking for oxygen supply, or looking for electricity supply or some commercial opportunities. Governments have to buy at state and federal level, and also local government where appropriate.

The CHAIR: Thank you. Any further comments?

Mr DEFALCO: I think the business model works. I do believe it needs to be improved upon for family businesses. I am not sure so much about the big players. But, at the end of the day, it is really the Government's agenda that worries the small business operators. There are quite a few of us left in New South Wales, particularly the mums and dads out in regional New South Wales. When there is no transparency it becomes a problem for the small business operator. It is simple as that.

The CHAIR: Thank you very much for your time today. It is very much appreciated. If there are any further questions from the Committee, are you prepared to respond to those if you receive them within a week?

Mr OLIVERI: Yes, absolutely.

(The witnesses withdrew.)

ALAN SMITH, Member, Transport Workers' Union, sworn and examined

NIMROD NYOLS, NSW Lead Official, Transport Workers' Union, affirmed and examined

The CHAIR: Thank you for joining us today, gentlemen. Welcome to the hearing. I note that Mr Mick Pieri is an apology for today, so we have the two gentlemen in the room who are able to speak. Before we start, do you have any questions of the hearing process?

Mr NYOLS: No.

The CHAIR: Rest assured, we are quite a gentle Committee here. We welcome you today and we will enjoy your comments. You have made the oath and affirmation. Would you like to start with a short opening?

Mr NYOLS: Thank you, Chair. Thanks to the Committee for allowing us to follow up on our submission. Just generally, we did cover a few main areas. Our main focus obviously, being a trade union representing all of the drivers in both the public and private sector in New South Wales, is predominantly around safety issues affecting the drivers specifically, but also in terms of their interaction with the community. Whilst we did submit some information, we are not going to profess to be experts about how the electricity network operates, other than I do understand there are some serious issues about delivery and just the power requirements to run a bus fleet. For instance, the depot that Mr Smith operates out of in Leichhardt, my understanding is that, if that was to be wholly electrified, that would require a substation and delivery of power would be the equivalent of powering quite a substantial suburb on a daily basis.

Obviously there are some hurdles but, generally speaking, we are absolutely in favour of a cleaner environment for everyone in the community. Hopefully if we do keep progressing—because obviously where Mr Smith is working, that is where the trial of the up to six electric buses are operating now— if that is electrified than we are not burning coal to keep less particulates coming out of the vehicles, but pushing them somewhere else. I think there is a key thing, because we have direct contact and experience seeing how these trial buses are operating, there are some quite significant safety issues that we—whether it gets expanded, but even the existing vehicles—believe need to be addressed about the extra demands on the drivers, because there is a lack of noise.

I am not a bus driver, I am a professional trade union official, but Mr Smith can attest to the difficulties that they have to operate in with the community, particularly with pedestrians now that everyone is connected to devices like an appendage to their body, they have experiences on a daily basis where they can nearly run over pedestrians. If an 18.5-ton vehicle is coming down the road and it is silent and you are relying on hitting a horn or ringing a cowbell, whatever the mechanism is, it is definitely going to increase the chance of injury or death. There are things that we can do that are avoidable, so this is a great opportunity I think to highlight some of those issues. Yes, but generally we are definitely in favour of these developments.

The CHAIR: Mr Smith, would you like to add to that?

Mr SMITH: No, I think Mr Nyols has pretty much summed it up. I am more wanting to talk about the aspects of training new drivers and existing drivers. I have been driving for over 30 years and I find these buses disconcerting because of the lack of noise and the fact that—

The CHAIR: Can you just expand on what you mean by that?

Mr SMITH: Yes. The bus does not develop any engine noise, so, first, as a driver you are not really aware of what it is doing until you put your foot on the accelerator and then it starts moving. If you are not paying attention, that vehicle is moving before your brain has actually switched onto the fact that it is moving. A lot of older drivers point-blank do not want to drive electric buses because it does not feel right to them, if that makes sense. A lot of new drivers are getting minimum amounts of training on these buses—I know it is only a trial—and I do not believe they have the experience necessary to deal with that kind of fairly revolutionary vehicle. When they are out on a public street they are not really fully aware of what pedestrians can do. I have had pedestrians step in front of me.

I have had a number of near misses in the 30 years of driving that I have done, including one gentleman who had stepped off, and I missed him, but his five-year-old son had stepped off behind him. I only just missed him because I could not see him until the last minute. The dad stepped back up on the footpath and there was a five-year-old boy. It was a pretty rapid crash. Luckily I was only going very slowly, but everyone on the bus did the head snap.

The CHAIR: Mr Smith, are you actually driving any of the trial buses?

Mr SMITH: I have driven them but that was in a diesel bus a couple of years ago, that particular one. My point being that, in an electric bus, pedestrians, if they do not hear them, they are not really aware that they are there. I mean that might sound a bit strange but as Mr Nyols said people are glued to their devices and quite often are involved in a conversation with somebody else and their brain is somewhere else. They are not really thinking about their own personal safety. The driver has to be really switched on to make sure he is not going to have a pedestrian event. I have been a driving instructor for the past 12 years with my previous employer State Transit and under RTA and RMS guidelines pedestrian awareness was a very big issue as part of the training and assessment process. I feel that the new people coming onto the driving scene really need a lot more training than what they are getting for these vehicles.

Ms ELENI PETINOS: Mr Smith, would it be fair to say that your comments in relation to general safety and awareness around the lack of noise are completely transferable to passenger vehicles, ordinary motor vehicles which you would appreciate are becoming more and more frequent on the road network as major manufacturers do move to producing hybrid and electric vehicles?

Mr SMITH: Yes, that is also quite relevant to those vehicles.

Ms ELENI PETINOS: Your experience as a bus driver is no different to the experience of an ordinary driver who is also learning to adapt to what is becoming a more frequent scenario?

Mr SMITH: I have only been a passenger in an electric vehicle—I have not driven one myself but I have driven electric buses. Generally speaking the cars are faster to brake, easier to brake and more responsive. A heavier vehicle, I think you would understand, takes a bit longer. If the driver is distracted by something, which is one of our main problems—there is an event out there involving cars and the driver can be distracted from looking on the footpath side of the road while they are watching, say, a rear-end collision or something that has happened on the right-hand side—if a new driver is not fully aware these events can distract them from what is happening on that side, the people who are not hearing this large vehicle are more inclined step off in front of it. If the driver is not really up to speed with what he or she should be doing, a 19 tonne bus is going to make a bit of a mess of a pedestrian who steps in front of the vehicle.

Ms ELENI PETINOS: Is that a matter of training as opposed to adopting caution to a new technology which seems to be part and parcel of modern day life?

Mr SMITH: A good question. New people get so much information thrown at them when they are learning to drive a bus. We quite often repeat things several times, several dozen times even, that the general lack of experience of a new driver that it feels so overwhelming when they go out by themselves that their capability of being distracted is more than of an experienced driver. An experienced driver will know that "Hang on that's happened over there but I've got to check out what is happening over there." Being aware of more than occasionally highly irrational behaviour of pedestrians in regards to their own safety can be quite surprising for everybody.

Ms ELENI PETINOS: I completely appreciate everything you are saying. What I am trying to get to for the purposes of our inquiry is you are noting some challenges—

Mr SMITH: Yes.

Ms ELENI PETINOS: We are accepting your evidence of some of those challenges. Instead of saying the technology is bad, what can be done to overcome the challenges?

Mr SMITH: I am not saying the technology is bad, I am saying that, yes, there needs to be possibly some kind of noise production device on the front of the vehicle to alert pedestrians.

Ms ELENI PETINOS: Are you familiar with noise emission technology that an earlier witness said is fitted on to electric vehicles?

Mr SMITH: No, I am sorry. I was not aware of that.

The CHAIR: Is that something that may be of benefit?

Mr SMITH: I think it would be, yes.

Mr NYOLS: The six trial buses that are currently operating in Sydney do not have anything on them.

The CHAIR: The drivers are not experiencing that luxury?

Mr NYOLS: They are hitting a panel to notify, like, awareness that we are here. If I could just add one thing in terms of from the driver experience? Since 2012 the bus industry is operating in a completely different environment under new contractual arrangements that were brought in by the Government and Transport for NSW

and there are a lot of ongoing operational on-road pressures on the driver that previously they did not have. The city is bigger and it is a lot harder for the driver. The existing issues that they are dealing with on a continual basis just operating the bus, in terms of managing the passengers and disruption from their issues about timetabling.On-time running is a huge operational pressure because all the contracts they have got on-time running, like key performance indicators. They can be fined if they do not meet their 95 per cent on-time running targets. Operationally there is a lot of pressure on the drivers just to run the existing system and then you add on top of that they have got to have a lot more constant awareness about everything else operating.

It is not only being aware about what passengers and other road users are doing, they have got to try to make themselves aware that they actually know that they are aware that the bus is there. Maybe it was an over-simplistic solution we put forward about having a familiar sound but obviously for blind or vision-impaired people they need some kind of trigger with which they are familiar. I do understand, I think, Japan being an early adopter of new technology, like in the last few decades, with it inventing electric cars, my understanding was they made it mandatory that they had to have like existing kind of combustion engine car sounds attached to them. It is just an added pressure on the driver.

The issue of the age of the drivers in the industry, that Mr Smith touched on, I think is quite pertinent because these are experienced drivers in the industry and like all things in terms of changes it is difficult to deal with. So we are seeing a lot of the older experienced drivers leaving because it is not like the industry or the society they grew up in and it is just too confronting or difficult and they retire early or they go on to do other things. We are getting a lot of younger people are coming in with very minimal training. It is basically the general practice these days that you can come off the street with a car licence and then you can be trained up to drive an 18 tonne vehicle within two weeks. There are some shorter periods of time but it is just way too quick. Then we are going to be in a situation that continues with an electrified fleet on top of that, I just think there are a whole heap of red flags out there on which we need to get on top.

The CHAIR: It is good to know. It is good to have your feelings on that.

Mr GURMESH SINGH: One of the main things that you guys have spoken about so far has been pedestrian safety issues. What are some of the other challenges that we need to look at with electric buses from a union perspective?

Mr NYOLS: Just generally, quickly, on limited exposure to mainly these trial ones because as I understand it 99.9 per cent of the global fleet of electric buses are in China and I have not had that opportunity yet to see them, but just some operational issues. When you start the vehicle you do not know it is operational and there are some triggers about doors opening. They are having at the moment some difficulty making sure that the things that signify that the bus is up and ready to go, like Mr Smith said, you could launch off because you do not even know it is going. I am not an expert on it but there seems to be some technical issues about making sure there is consistency of performance of the vehicle.

A bit of a strange one, but the current situation now at the Leichhardt depot when the drivers come in and hook it up to recharge at the end of shift and there have been some problems—maybe it is a lack of training or whatever—about how that is occurring. We have kind of got some concerns about how safe that is at the moment. It is really the operation of the vehicle and the fact that it is so silent, seems to be our biggest thing from the union's perspective.

Mr SMITH: If I can add to that? I have personally noticed since I have been with Transit Systems for the past six months, especially in the city, a lot of push bikes and motor cycles come up between the bus and another vehicle. With an electric bus they do not know the bus is moving because they cannot hear anything. They are on their phone—I would just like to say that, yes they do use their phone when they are riding or they are looking at their phone for a destination. They put themselves into very precarious situations and if the driver is not really switched on to look for those vehicles before they move there is a very high risk of injury or worse in that scenario.

Mr GURMESH SINGH: Can I ask either of you to elaborate on the driver experience aside from the pedestrian safety? How has the driving experience differed to that of diesel or gas buses?

Mr SMITH: I have driven a couple of electric buses now but I requested not to be sent out on the road with passengers because I found them so different in my experience that I wanted to get a bit more training just running special with a trainer next to me. Having been a trainer myself I know how important it is to have that extra set of eyes watching giving relevant information, safety information. On an open road with not much traffic, plenty of room either side, it is a lovely vehicle, except when people decide to change lanes either because they cannot hear you or they cannot see you or both. In the city where it is fitting the bus in tight spaces and as I say there are other vehicles around you and pushbikes and motorcycles and pedestrians running across crossings

against a red light, whatever, it is disconcerting. It is alien to what I am used to. It takes a bit of getting used to. I would appreciate, and the management has given me the opportunity, to get a bit more training before I choose to go out and do a run in public with passengers.

Mr NYOLS: If I can just add to that. From other drivers that I have spoken to that have been out on the road one of the biggest problems they have, it does not mean it is not resolvable, but the difference between the diesel powered motors and these electric buses is the pick up, the response to get going. It has a bit of a lag so it is a bit dead. I have had general reports of that. It is a bit concerning if you need to get across an intersection or get out of the way. You do not have the same acceleration off the standing start that you do in a combustion engine.

Mr GURMESH SINGH: Because that is the opposite of the feedback from passenger cars, they are far more responsive. How does that translate into the passenger experience? Is it more comfortable for passengers?

Mr NYOLS: I do not know. I am not even going to profess to make a claim on that one.

Mr SMITH: The passengers are more interested in the smoothness of the ride and the comfort of the seat.

The CHAIR: Are they experiencing that in the trial?

Mr SMITH: Good question. I am sorry I do not know.

Mr NYOLS: I cannot answer that.

The CHAIR: No doubt there will be data provided after the trial for that.

Mr GURMESH SINGH: You said you have had no runs with passengers?

Mr SMITH: I have had no runs with passengers.

Mr GURMESH SINGH: Amongst other drivers that you may have spoken to have they experienced good feedback from the passengers as they are getting off the bus or any feedback at all?

Mr NYOLS: I have not had any negative feedback so that is maybe an indication. In my role if there is a problem that is what you hear about. So the fact that I have not heard it is a problem in terms of it is electric so you are not having the gears you would expect it to be a smoother ride. It is maybe some of the issues about if it cannot get off the mark quick enough and you are in the middle of the city and we have a lot of instances where the bus gets caught across an intersection trying to turn and we end up dealing with red light camera fines and all that kind of stuff. That could have an impact in terms of the driver behaviour about how they handle congestion and traffic but it should be a smoother ride.

Dr MARJORIE O'NEILL: I have a couple of questions. Firstly, the two weeks training and the lack of training that has been identified as an issue. Who has set the two weeks?

Mr NYOLS: My understanding of how it operates is they are authorised RTOs, or registered training organisations, and they are authorised by RMS to train people up to then go for their licence. I assume it would be Transport for NSW.

Dr MARJORIE O'NEILL: Would it be fair to say that the two weeks is not enough and it should be increased?

Mr NYOLS: Absolutely.

Dr MARJORIE O'NEILL: How many hours of training do you think would be better and more suited?

Mr NYOLS: I am not a heavy vehicle driver. From the union perspective?

Dr MARJORIE O'NEILL: From a worker, from a safety perspective because that also translates to passenger safety and pedestrian safety?

Mr NYOLS: Even the two weeks from the union's perspective I would like to see a minimum of a couple of weeks of a driver being out on the road without having passengers learning how to do routes. That is not offered. In terms of the quality of training to get your licence upgraded Mr Smith is probably much better suited to answer that one. This is a non-expert opinion; I think it is way too short. If you have not got a heavy vehicle licence it is just jumping out of a car and getting into a bus in Sydney traffic and off you go. That is basically how things are operating now. In terms of the union's involvement we have been lobbying all of our operators and the Government for probably eight years about needing to develop much better training for people. The reason it has become so short is because of the turnover of drivers in the industry and they have been desperate to fill the driver seats. There has been a lot of economic pressure. That is what happens, it gets shorter and shorter.

Dr MARJORIE O'NEILL: I am happy to hear more broadly about how you think the training could be improved for drivers as well?

Mr SMITH: In the 12 years I was a trainer, which ended about a year ago, when I first started training a person would come in with a car licence and we would have two weeks training. After the first week we would make a decision whether we keep going or stop, or even less time than that if they did something really dangerous, and I would say to the boss, "This person really does not know what they are doing, I think we had better get rid of them". Generally speaking the average driver with the right amount of training could complete the training course, sit their test, get their licence and then go out with another person for five days who would show them where to go.

Towards the end of my time as a trainer we were getting a lot of people in that had got their licence in one or two days from a private company on, generally speaking, an eight metre long truck with a concrete block on the back of it, double back axle, for a HR [heavy rigid] licence. They somehow would get through with a couple of hours training and a couple of hours assessment and congratulations there is your ticket. Then they would come to us and we would have five days to make a decision as to whether they would progress up to being an employee of the company. In some cases the person was so obviously under-trained that we would can the training on the first day. Sometimes they would be quite acceptable and get through the five days or even less before we could make that recommendation to the boss that we employ them as a driver with what we call a BOT1 showing them where to go.

I found on a number of occasions in the last 12 months with State Transit that people would come in with their licence and they did not have any idea what they were doing when it came to driving a bus. They may have been a truck driver but they have no concept of the size of the vehicle and the amount of space as it was turning the corner. There were some occasions, perhaps one in 10 of those people coming in, at the end of the day I would have to have a discussion with the boss and say, "I do not think we can get anywhere with this person, they need to go and drive a smaller vehicle first in the city for a couple of months before they know what they are doing".

Dr MARJORIE O'NEILL: I want to clarify what you said, this is coming out of private RTOs who are doing this training?

Mr SMITH: Yes.

Dr MARJORIE O'NEILL: What do you then see as the major risks of this lack of training and putting these ill-trained people on the road?

Mr SMITH: People having collisions with other vehicles, with pedestrians or fixed objects, not having the experience to know that they need to go slowly and carefully rather than rush. A lot of people tend to rush because they feel there is pressure on them to do a run on time or something like that. They do not really have the experience to see all the hazards involved on the road or fixed objects next to the road. We have had some fairly serious prangs with new drivers—not women new drivers—but the new drivers can be involved in some real doozies, simply because they have gone a bit too quick into something and they should not have done.

Mr NYOLS: If I could just add onto that, the training issue is not just about driving the vehicle. It is about understanding what the job is and how to deal with the public on the bus. Some years ago, I think going back to 2007 or something like that, we actually had a kind of like tripartite training model that was developed between the industry, the union and the government. There were issues there about how to do conflict de-escalation, because we have huge issues about drivers being abused and assaulted. All of that has gone out the window.

Dr MARJORIE O'NEILL: When did that go out the window?

Mr NYOLS: I think 2007 was about the end of it. We keep harping on about trying to get it reinstated but it has fallen by the wayside in terms of particularly heading towards more competitive tendering models, in terms of who is going to be paying for it. That has always been the issue now. They do go hand in hand—not just being able to drive the vehicle but, like Mr Smith said, there is not much point getting a licence for a heavy rigid because you have driven a rigid truck. That is not a bus.

Mr GURMESH SINGH: Madam Chair, I am just wary that we are veering away from electric buses.

Mr NYOLS: Yes, sorry.

The CHAIR: I was just thinking the same. What we should be doing is looking at electric buses as such. I think we have deviated into a general training issue. I want to bring that question back but further to your point, if I may. You talked about a lack of training for those who are trialling the electric buses. You feel that that should have been a greater period of time?

Mr SMITH: Yes.

The CHAIR: Those who are actually drivers of these trials: On average, how much experience would they have had in the industry driving buses? Are we talking about people who have come off the street or are they people who are veterans in the industry?

Mr NYOLS: Currently, with the trial that is operating here out of the Leichhardt depot, it is basically put your hand up if you want to have a go at driving the electric buses.

The CHAIR: But they are experienced drivers already?

Mr NYOLS: There is a variation.

The CHAIR: What is the newest driver in time spent in the industry, for example?

Mr NYOLS: The shortest that I am aware of is drivers who have started when Transit Systems took over the contract, which would have been 1 July 2018. We are talking only a couple of years' experience.

The CHAIR: So they are not off the streets?

Mr NYOLS: Well, not that I am aware of, but that may be occurring. I cannot categorically answer that.

The CHAIR: I do not think Mr Minns has joined us at the moment. He is our other Committee member who was coming in by phone. Are there any other comments or questions from the Committee?

Mr GURMESH SINGH: Do we still have time?

The CHAIR: We do have a little bit of time.

Mr GURMESH SINGH: I would just like to follow up again on the training of drivers. Do you think in the long term—it is obvious that the industry is headed this way over the next couple of decades, whether we like it or not. Do you think it will be difficult to implement training to overcome those issues around pedestrian safety that we spoke of earlier in the hearing?

Mr NYOLS: No, I do not think it is difficult. It is just really going to be the issue of how it is to be provided to make sure that it is uniform, particularly with the franchising or privatisation of Sydney Buses, that there are industry standards that are applied to it so it is not just based on people submitting tenders for contracts and then providing their own training. It is not difficult. There are just some dollars and cents issues involved in it and we just require the engagement of the Government and Transport for NSW to commit to it.

Mr GURMESH SINGH: Sydney, being quite a diverse city in terms of its—the Eastern Suburbs, where Dr O'Neill's electorate is, is quite different for instance to the north-west of the city where pedestrian traffic is a lot, lot lower. Do you think that perhaps in situations like that where your pedestrian volume is so much lower and you have got wider streets, for instance, out in the north-west might be very different to an electorate like Coogee where the roads are narrower, older and altogether probably more challenging for a bus driver?

Mr NYOLS: Yes, you are spot on there. The city is divided into all sort of different worlds and operationally it is incredibly different. For instance, close to Leichhardt depot, down in the peninsula at Balmain, I cannot even work out how half these drivers get down there without smashing stuff on a daily basis. In the eastern suburbs and operations out of the Waverley depot in particular, yes, it is very trying. But that is current now, in terms of the vehicles and the drivers being trained, that there are different operational environments.

Mr GURMESH SINGH: I am not a bus driver, but I could imagine that the average speeds in certain sections of the city might be much higher than they are as you get closer to the city.

Mr NYOLS: Yes. That kind of reflects also in just the operational environment of particularly the inner city and the eastern suburbs, the mass congestion—you look at the performance of those regions. This is not a public versus private issue. It is not political, but it is just the reality is that it is so much harder to get—

Mr GURMESH SINGH: It is the geography.

The CHAIR: Yes, the geography is different.

Mr NYOLS: Yes, it is just so much harder to get around. It is the same as if we are in a car. You know to get from one side of the city to the other, you are doing well if you want to get it on a timetable. It is very challenging.

The CHAIR: The Committee may ask questions in writing to you. Would you be able to respond to those within seven days if that is the case?

Mr NYOLS: Most definitely.

Mr SMITH: Yes.

The CHAIR: Gentlemen, thank you so much for your time and your contribution today. It has been much appreciated.

(The witnesses withdrew.)

(Luncheon adjournment)

SARAH FORBES, Executive Manager, Gemilang Australia, affirmed and examined

MARK EDMUNDS, General Manager, Energy Storage and eMobility Solutions, Toshiba International Corporation, sworn and examined

TOBY ROXBURGH, Managing Director, Electromotiv, via teleconference, affirmed and examined

DAMIEN BROWN, Commercial Director, Australian Bus Corporation, via teleconference, sworn and examined

The CHAIR: As a formality I would ask you if you have any questions of the procedure today?

Ms FORBES: No, thank you.

Mr EDMUNDS: No, thank you.

Mr ROXBURGH: No, thank you.

Mr BROWN: No, thank you.

The CHAIR: I will ask whether each of you would like to make a short opening statement before we begin with questions, the statement can be up to two minutes.

Mr EDMUNDS: No, I do not have a particular statement. I am happy to help the Committee with any questions you might have.

Ms FORBES: I work for two different companies. You have heard this morning from ARCC, an Australian chassis manufacturer, and Gemilang Australia is an aluminium bus body provider in the country and I am here to assist where I can.

The CHAIR: Mr Roxburgh, would you like to make an opening statement?

Mr ROXBURGH: Yes, please. My company, Electromotiv Pty Limited is Australia's first turnkey renewable refuelling provider. We provide diesel replacements in the form of electric and hydrogen buses and truck refuelling. What we do includes the battery lease within the vehicle, the charging infrastructure, the renewable energy and the on-site works. Typically that is linked into a similar contract with operators where they will pay the same amount for a bus and we have a dollar per kilometre delivery. So, day one operators and governments can have cheaper vehicles to operate on their fleet without additional upfront costs. We operate in New Zealand and Australia. For example, in Queensland we are looking at saving over $1 million on the fleet of existing bus infrastructure. We do not believe you have to gold plate the grid or have the costs that we have seen in media that New South Wales is estimating. We can see 30 per cent utilisation of assets powering across the electricity sector. We would typically be above 70 per cent utilisation and optimise transport and grid to ensure that people get the health benefits and the renewable benefits and climate change and other zero emission benefits out of vehicles.

The CHAIR: Mr Brown, would you like to make a statement?

Mr BROWN: I represent the Australian Bus Corporation, or ABC, the owner of Precision Buses and Bustech. Together the Australian Bus Corporation, with these two manufacturing entities, is Australia's second largest bus manufacturer by volume. We are currently producing around 300 buses a year. We have delivered around 1,200 buses into the New South Wales operating networks for both government and private clients and in 2016 we developed Australia's first electric bus from the ground up; not an imported chassis with a locally built body but a fully integrated product developed from the ground up. Our primary message for the parliamentary inquiry today is that the capability, engineering and expertise exists in Australia to service the technology change that the New South Wales Government is seeking to drive and to implement.

We do not need to be net importers of technology. We have the existing capability which is evidenced by the people that are participating today. We have the sovereign capability to manufacture the vehicles and the rolling stock and the supporting componentry and infrastructure here in Australia. The policy position that the

New South Wales Government has taken facilitates the development and establishment of a local industry that will provide high-end jobs and economic activity in Australia and in New South Wales for many years to come. We are 100 per cent supportive of that position and believe that the industry, and in particular our company, is very well placed to provide that solution.

The CHAIR: At this point in time I will open the questions to the Committee members.

Ms ELENI PETINOS: Thank you for your time this afternoon. I would really like to pick up on that last comment made in relation to having the ability to manufacture and produce high-end jobs in New South Wales. Can you give the Committee further information as to what you were touching on then?

Mr BROWN: Yes. Thank you for the question and the follow-up. At present we employ around 250 people directly manufacturing buses for the Australian market. We have done that for a number of years now and in November last year there was an acquisition of Bustech to create the larger Australian Bus Corporation. We now have three active manufacturing sites; one in Burleigh Heads in Queensland, one in Adelaide in South Australia and one as a joint venture with the Elphinstone group in north-west Tasmania. The framework and the infrastructure that the business currently has is well placed to manage and deliver that technology transition.

The core skill sets for the business will not change. The manufacturing element of the business and the skill sets will be acquired through a different technology vehicle but essentially the high-end engineering and the advanced manufacturing capability of the business will be applied to a different task. We are not talking about the wholesale change in the capability of the business needed to respond to this challenge. The core capability of the business exists. What I will acknowledge is, in order for us to take the position we have in terms of a leadership position in the industry in Australia to date, we have acquired and developed specific capability to respond to zero emissions electric drive train buses.

That means that we have hired new engineers with specific capabilities primarily from the European market. We have developed our own capability through a graduate program, junior engineer hires to support the existing bus experts in this space. The other thing we have done is partner with local expert organisations and Mark Edmunds is in the room. We have a long history with Toshiba. We have had engagement with Toshiba since 2015 in developing our electric bus products. That has been a successful partnership over that time.

Where we see the opportunity that the policy direction from the New South Wales Government provides, we see the opportunity through strong messaging on what government wants and then the ability for our business to invest and respond to that with a very clear outcome in mind. That has been lacking in Australia to date and there is now—in my view, the last six months have had more activity and clear policy direction from the Australian market than the previous six years combined.

One of the first major steps was the Brisbane City Council's decision to make the Brisbane Metro project 100 per cent electric. That is a circa $200 million program just on the vehicle side—sorry, the charging and infrastructure as well—as part of an overall $1 billion project, or $1 billion-plus, depending on what the price is when they are finished. But the New South Wales announcement was also very significant, being the largest market in Australia. That provides a strong basis for businesses like ours to invest against—to invest in people, to invest in research and development and to invest in a product position so that we can have that product available to respond to the demand that will inevitably come out of the New South Wales market.

There is absolutely no reason to look overseas for that capability. To be very blunt, importing products from overseas and whacking a body on top is interesting, maybe, but it is not particularly inventive or productive for the Australian and the New South Wales economy. The high-end jobs that are created are in the engineering division and in the advanced manufacturing division and those jobs should be maximised through this process. I am not talking about subsidising that through grants or higher prices or whole-of-life costs that are not comparable or competitive. We have shown with the existing technology that we are more than competitive with European products and over the life of the assets we are certainly more competitive than some of the products coming out of Asia. We do not see any change to that position as we move into electric and, in the future, hydrogen as well.

Ms ELENI PETINOS: You may have already covered this off in the comments you have just made, which I very much appreciate, but is there anything you would like to add in terms of what support would be needed to expand and ensure the long-term viability of electric bus manufacturing in New South Wales?

Mr BROWN: Yes. I think it is very simple. If there are volume commitments or volume certainty from the market, we will invest against that. The challenge at the moment is: The volumes are quite low and there is no certainty as to when and in what volume those orders will be made. With current technology, there is a fairly consistent run rate out of New South Wales, just based on the average age of the fleet. The average age of the fleet determines the replacement program and, ultimately, the number of orders available in the market. But whilst they

are not allocated to us, as a manufacturer, as a body-builder or to any other body-builder, there is a reasonable degree of certainty on an annual basis in terms of the volume coming out of New South Wales and the other jurisdictions in Australia.

In order for the transition to electric to be supported by our industry and invested against by companies like mine, a degree of certainty of the rate of adoption and the order volume coming out of New South Wales, at least in the short to medium term, would be highly supportive of that investment that we will make. That is it in a nutshell. I do not think there is anything more than that. Government grants around training of people, whether that be apprentices who need new skills to respond to this type of technology—they might go into the manufacturing side of the business, they might go into the operating and maintenance side of the business to support the vehicles in the field—those things are really important but, from our perspective, if we are talking purely around supporting local manufacture, it is certainty of volume going forward.

Ms ELENI PETINOS: Thank you. I might change gears slightly. Earlier today, with several of the witnesses we have been discussing the quiet nature of electric vehicles and whether electric buses being silent is actually a good thing for commuters or whether it has impediments and challenges that need to be overcome. Do any of you present today have a view on the nature of electric vehicles and their noises and whether we need to fit them with, say, noise emitters so that pedestrians are more aware of them?

Mr ROXBURGH: We are agnostic on vehicles. We have a vehicle in the Australian Capital Territory fleet, in Canberra. We have also been helping with Brisbane Metro as well. We were on the winning consortium for Brisbane Metro. An electric bus, I think, should be treated similar to light rail. We actually have a driver horn that goes, "ding ding, ding ding", just like light rail, so as the driver approaches intersections or areas where pedestrian activity is occurring, they advise them that the bus is there and that they are approaching.

I think the attractiveness of a vehicle where people can come on board and listen to their music, without the sound of a diesel engine beside the ear, is very attractive, so minimising noise within the vehicle is a great benefit, and the smoothness of electric vehicles. Electromotiv's view is that we need to get as many people on buses as quickly as possible before autonomous vehicles come on the road and the public fleet needs to be clean, green and attractive, and electric buses provide that. So, the electric drivetrain, and hydrogen in the future, is there to enable that—of course, noting that they do need those alarm signals but, from what we have seen so far, it does not need to be always on and can be aligned with light rail. Does that make sense?

The CHAIR: Mr Edmunds, would you like to add to that?

Mr EDMUNDS: In fact, the United Nations has got a committee looking at electric vehicles and they have already brought out some guidelines for noise levels of electric vehicles. That has not trickled to Australia yet but it will not be too hard for that to be connected in. That is with the concept that, particularly when they are travelling slow, the risk for the passengers or the people round the vehicle might be present and they have simply said that they should have a noise level of at least something, and it has been documented.

The CHAIR: I had a question based on the comments that have been made by some of the witnesses just recently. The lifespan of a current bus compared to the lifespan of an electric bus—can any of the witnesses give me some information on that?

Ms FORBES: I can. Mr Roxburgh, and Mr Brown as well, can probably extend on this. There are a lot of different ways that you can package electric vehicles up that is different to diesel now. Diesel comes with an engine. The OEMs [original equipment manufacturers] would have a lifetime warranty on it of, say, a million kilometres before the engine has to be replaced mid-life or sooner. Some of them extend well beyond that and European engines are very, very good nowadays. The same can be said for electric batteries. The chassis and the bus body can be separated from the batteries as a completely separate asset and at its half-life can be replaced out.

Batteries now have an operational lifespan for a bus of around about eight to 10 years, depending on how you use them. Depending on the battery manufacturer, anything from 100 per cent down to up to 65 per cent state of charge is still great use for a bus. Thereafter they can be repurposed into homes or businesses, perhaps for another five years, but thereafter there is an issue about what happens to recycling batteries. Where they are at volume, recycling batteries, which inevitably are dug out of the ground, is something that we want to do long-term. It is something that we have to consider as a nation.

Just going back to Mr Brown's point about manufacturing and local capability—I could not agree more. Putting a bus on an overseas chassis to do exactly what a diesel bus does—you have heard this morning that even in the longest routes in New South Wales there is no need for a bus to go 400 kilometres a day. It does not need to carry 300 litres of diesel to go 600 kilometres. Part of the reason we have that is that operating contracts from New South Wales do not want the possibility that a bus—for traffic or for a crash or whatever reason—cannot have a driver swap in and out and then go back on a second route service. So if we are looking to do a like-for-like

replacement of electric vehicles or hydrogen or hybrid vehicles for buses that are traditionally long haul, I think that is something that we really need to think about again.

The CHAIR: Thank you. Would anyone else like to comment on that?

Mr BROWN: I agree with all of the comments made today or made under this question. In terms of the useful life of the bus as an asset we have created an electric bus that is designed for a useful life of what Transport for NSW is currently requiring, which is 20-plus years. As with a diesel bus there will be certain components that require either an overhaul or replacement throughout the life of that vehicle, but the superstructure of the bus itself—our bus in particular is made from marine grade stainless steel. It is an integrated chassis and body product so where components need to be changed they can be.

I might let Mark Edmunds talk specifically to batteries because I think one of the very important points to make is that all batteries are not created equal. There are different applications for different chemistry. The batteries have different properties and they all have redeeming factors or factors that need to be considered for the specific operational requirements. One electric bus has different properties than another electric bus and both may not be suitable for the same operational requirements. For example in Europe the direction at the moment with the major traditional bus manufacturers—your Volvo, Mercedes and Scania—is that they have gone for very small battery packs but opportunity charging.

They are servicing a market that has opportunity charge infrastructure whereas in Australia we have been primarily range-based. Whilst we do not have the infrastructure yet, we are looking for range-based buses. We have a product that is somewhere in between, where we have a fast-charge capability but we are providing a large battery. I think that is an important point to make. I might leave that there. I know Mark Edmunds can talk a bit more to the specific properties of the battery that both we use primarily for our products and also—Mr Roxburgh might be able to confirm this—I think it is being used for the Brisbane Metro project.

The CHAIR: Mr Edmunds, would you like to comment next?

Mr EDMUNDS: Yes. I can give you some information. I think from a structure point of view we are probably not a body builder or a chassis builder but we can observe that the techniques being used are going to be equal there in life expectancy. The electric bus has less friction wear and tear than a normal bus, so that has the potential for many components to last a lot longer. One of the challenges there for the bus is going to become the battery system. Depending on which chemistry you have used sometimes that is going to be a consumable item and need to be replaced. Maybe there is a good two-to-one or three-to-one choice there—whether you might need to change the battery several times in a lifetime or you might choose a battery technology that can last a whole lifetime.

There are some little opportunities. Some people have deliberately chosen a very small battery and to change it frequently because they have made more space for passengers. In fact maybe compared to a diesel engine there is a little bit more choice there for the vehicle designer and the route operator to think about how to lay that out. I think in choosing whether that would be a barrier to go forward—I do not think there is anything inferior as an electric bus to a diesel bus. It is potentially longer. The comparison I can make is railways. The electric locomotives or electric trains are probably doing a little bit longer than maybe some of the diesel asset component change-out.

The CHAIR: Thank you. Mr Roxburgh, would you like to comment as well?

Mr ROXBURGH: Yes, please. We are agnostic on vehicles. As I said, we wrapped the whole thing. It is very important as a business that we make the best commercial decision. We are comfortable with the life of buses for the 20-year plus requirement for New South Wales. It is up to that contract requirement and renewal to there. For example, Queensland focuses on 15 years within the contract. Batteries have a variable load. We at Electromotiv provide a 25-year warranty, if required. We would do the swap-out of the batteries when required. We also then reuse them in a stationary application after the bus. We can use them to firm renewables to provide battery backup for renewables on the grid and then we will recycle them. We guarantee a full circular economy solution and we again use Australian technology and companies for that recycling.

Going back to your point on local benefits in New South Wales I strongly suggest that New South Wales have a local benefits requirement in their tenders, just like the Australian Capital Territory have done for renewable energy and Victoria are doing as well. They are both very strong examples of local benefits. In Queensland we are seeing—for maybe an order of 10-plus buses you could have health, financial, economic and environmental benefits of over $30 million over three years if you do it correctly. So there are huge amounts of benefits that we can see for New South Wales. I personally would like to see some southern New South Wales manufacture. There are some really good options around Queanbeyan where they have already got Defence and other suppliers, so we could grow manufacturing in a number of regional areas. I think that would be important.

I understand a lot of buses are being manufactured in Victoria that are arriving in southern New South Wales and Queanbeyan, et cetera. I think there is a benefit there to really drive the change. Most manufacturers are saying to me, "I can provide assembly. What can I do locally? If you give me at least an order of 10 or 20 maybe I can move manufacturing from another state to your state for this situation." I think that is a really good opportunity that we should capitalise on in giving some long-term contracts and long-term viability. It does not need to be additional cost. I think the infrastructure can be wrapped in a way that the end user, which is what we are targeted on, has got the cheapest price for public transport, and then we can afford more vehicles for the same price.

The CHAIR: Thank you. Would any other witness like to make a further comment?

Ms FORBES: Just one more on top of that: I think where we can focus on localisation of manufacturing, of supply of componentry, that is really important for Australia generally with any industry, and in particular bus manufacturing. With the exit of the automotive industry, we do not want to see another industry go down. The comment about manufacturing in New South Wales is interesting. Whilst it is fantastic with a city bus replacement nationwide of, say, between 500 to 600 vehicles a year it would likely be unrealistic for every bus manufacturer, whether they are an OEM or a body builder, to set up a part assembly in every state to satisfy that need.

I would encourage any kind of Australia local content to be welcomed in New South Wales as well as other states. If you look at the rail industry—for example, Alstom, Bombardier in Victoria—again, without the certainty of volumes of build, when they are going to come throughout the year, it has really hindered their ability to retain staff. Fluctuations in staff are horrendous and enterprise bargaining agreements are used to scale up and scale down as needed, which does not provide industry with certainty.

Mr GURMESH SINGH: Just on manufacturing locally, in other jurisdictions in other parts of the world where electric buses have been taken up, have they typically manufactured or started a manufacturing industry from scratch or have they borrowed technologies from other parts of the world?

Ms FORBES: I cannot speak for other parts of the world. If you could focus on an existing industry elsewhere and piggyback off that, whether it is by way of joint ventures or whether it is utilising downtime in rail manufacturing and then supplementing those skills for bus manufacturing, for example, that would be helpful.

Mr ROXBURGH: Also the charging infrastructure, we are talking reasonably high voltage battery storage, which can be outside or in the vehicle. Your high-voltage electricians, companies such as Toshiba, are very strong in mobility as well as stationary products. It is not just a case of talking mobility. It needs to be looked at as a whole in terms of what local assembly and manufacturable parts can be within that supply chain. If you do require a local benefit and you have got clear weighting in the tender, that allows all the OEMs to show—and maybe you have got a higher weighting for New South Wales and slightly less for Australia and then significantly less for overseas, or not at all—people then can blend each of those and really focus on getting the economic benefits on where it is. It might make sense for engineers to be in another State, for example, but then some local assembly here to take advantage of where you have got stuff already. I think it needs to be looked at.

We will be doing electric tanks, we will be doing electric infrastructure for renewables. There is a whole interface within zero emissions. I think it is wonderful now to have a New South Wales zero emissions framework and policy for 2050. Transport is one—especially with the carbon [inaudible], it is number two. That is why Electromotiv was formed three years ago to really focus on this and make a difference on the zero emissions. I sat on the Australian Capital Territory Climate Change Council, for example, for five years. It needs to be taken as a whole and integrated with that, and the resilience into that as well. If a refinery is not able to be operated due to a virus or an incident, having locally made electric vehicles powered by Australian renewable energy makes a lot of sense and provides the resilience that we need in these changing times.

Mr BROWN: I would like to echo some of those comments as well and just point to existing successful models in bus procurement and rolling stock procurement, particularly from Victoria, South Australia and Tasmania; Brisbane City Council as well, and I know that Queensland is further developing its procurement models as well to recognise local content. In the case of South Australia and Victoria in particular there is a recognition of tier one and tier two suppliers within that local content. What I mean by that is there is an assessment of the true local value of each component. That is really important, because if you have simply got a warehouse where the majority of your componentry and materials is being imported from overseas and then invoiced through to a manufacturing entity, that does not give a great deal of local value. That is a pretty common model to give an appearance of a high degree of local content, but you scratch the surface of that model and it is clear that there is not a great deal of Australian companies that are participating and Australian jobs that are contributing to the bill of materials for that product.

We are big supporters of being held to account to local content obligations that we have agreed to. In the case of government contracts, we have a 10-year supply contract with the South Australian Government. We have had a three-year supply contract with the Tasmanian Government. In both cases we are manufacturing them locally in that jurisdiction and in both cases we have very strict local content obligations that both deal with the value of local materials procured and the number of jobs and hours that are applied to the manufacturing task locally. I think the headline statement of local content is important, but the application of that policy and the detail in which that policy is assessed and enforced is critical. In South Australia's case, it has the Office of the Industry Advocate, which is a nonpartisan office that runs independently of the department of transport. It negotiates, assesses and enforces the local content obligations that companies make when they send us the South Australian contracts. It has borrowed that model—borrowed, stole, whatever you want to say—from the Victorian Government, because the Victorian Government in structuring its local content obligations was very, very detailed in how it did that.

That is the only way, through those models—and they do not necessarily have to be the same as what those jurisdictions have done. They can be applied to suit the New South Wales experience and outcomes that the New South Wales Government is looking for in particular. But without those measures in place the broader outcomes from the policy will not be achieved. That is our experience in participating in those tenders and then forming and committing to those obligations. We have seen our employment numbers maximised in those local jurisdictions and the participation of local companies, both within those jurisdictions and then within the Australian community more broadly, has been maximised through that structure.

Ms FORBES: If I could just add to that and maybe just give a bit of a differing opinion to Mr Brown's, on the one hat I work for ARCC. It is an Australian-built, Australian-manufactured, Sydney-designed chassis. Gemilang Australia is an aluminium-bolted, Lego-style bus. It could be part-assembled here or overseas or in a different jurisdiction, if you wanted to; on the other side, as Gemilang Australia, with a BYD electric chassis, which is obviously an overseas electric chassis. We have got 23 of them in the country. We are the largest current supplier of those vehicles into Australia. Most of them exist in airports in Sydney and in Queensland, and then the first four have been operated at Transit Systems, who you heard from earlier today, at its Leichhardt depot in a public fleet.

The comments around local content and its enforcement in each jurisdiction are really important. However, I just caution New South Wales against how probative really high local content could be. There is a reason why electric buses have been able to be implemented in New South Wales, whilst Victoria has only just got their first one. If there is a really strict requirement to build it, to source all of your components locally, to create thousands of jobs in the process of doing it, we run the risk that technology will come and go and we are able to test and integrate it into the community. But, by the same token, as Mr Brown says, we cannot be a country that just imports vehicles from overseas.

The CHAIR: Is there a balance?

Ms FORBES: I think there has to be. South Australia is a great example. Mr Brown, correct me if this figure is wrong, a 40 per cent local content for the value of the vehicle being Australian or locally sourced is great. In Victoria it is 60 per cent. It is really probative. There are some Australian suppliers who are not able to supply into a market, especially with diesel vehicle original equipment manufacturers being overseas, they are European. They are all manufactured overseas. They are imported. There are not a lot of local things that can be done to that vehicle after it arrives before building a body on it. Then it falls on the bodybuilder to change its entire business model, swap out all its components, in order to meet that 60 per cent whole vehicle probative figure.

The CHAIR: Interesting times that we are in at the moment.

Mr BROWN: Could I comment on that?

The CHAIR: Yes, please. Is that Mr Roxburgh?

Mr BROWN: Sorry, it is Damien Brown. There are two different models that we manufacture. In South Australia we have a chassis partner in Scania and the local content requirement within that contract structure was less than say in the Tasmania example. In the Tasmanian example we are building an integrated product. We have done that by building locally in that jurisdiction, maximising the activity locally through manufacturing our own chassis from the ground up and maximising the local content within that jurisdiction in terms of the suppliers to our operation being located in Tasmania. Not all of them obviously, because there is not that capability, but a high percentage. Then all of the direct manufacturing jobs are local in Tasmania.

It is really important to point out that we also won that tender based on price. We have to bring products into this market based on essentially a fixed price and very competitive priced market. There is no appetite for governments to pay a premium in price in order to achieve those local content outcomes. It might be prohibitive

for some business models to do it, but I do not think it is prohibitive overall; it can be done. Where I think the challenge is right now is giving the runway to the industry to achieve that through certainty of policy and certainty of forward orders. If those things are there, I do not think it is prohibitive to say that we want these local economic outcomes. I think they can be achieved.

The CHAIR: Any further questions from the Committee?

Ms ELENI PETINOS: We have covered so much today, I am very grateful for all of the evidence you have provided. Before we let you go I want to ask about charging infrastructure and if any of you have a view whether charging should be done at stop, at the end of the trip or at the depot?

Mr ROXBURGH: At Electromotiv we have all options and believe that a mix, and even hydrogen for some applications as well, is warranted. For instance, some depots we are seeing that we have some overnight charging and fast charging as well in the middle of the day between shifts and then for Brisbane Metro, that is obviously very fast charging. You have got end of trip and in the middle, so there are number of locations and you have got high frequency of vehicles. It depends on the application and the optimisation is there to say these are the routes, this is a requirement or if you want to go to the top level, these are the people and this is where you want to get the people to speak. Then the system can adapt.

Going forward I think we will have on demand smaller electric vehicles, as well as larger ones. You can optimise a solution and get your best bang for your buck. That is part of what we do, charging infrastructure, is working with all the different suppliers of batteries and chargers to ensure that we optimise that. We may have, for instance, a couple of 300 kilowatt chargers for the quick turnaround if the bus is late. Then we may have some 200 and then we even may have 50 kilowatt overnight or a mixture of overhead and plug-in so that we have got flexibility for that fleet and those buses to be deployed where they need to and how they need to be provided; if that makes sense.

Mr EDMUNDS: May I add something to that? In our study we found that maybe to keep an open mind to all those technologies. What is the right mix is heavily influenced by the operational requirements and they are very dynamic and changing depending on who that operator is. The other little thing, today we are probably limited with range by the battery technology. That will change over time. If we did the modelling and money was sensitive, which usually at the end of the day it is, a mixed solution often was popping up as a good way to go, because if we think about doing demand management on the grid—a little bit at night-time, a little bit in the daytime—is spreading that around. You might not need as much infrastructure to do that. If you can do some charging out en route, it means you are not going back to the depot to have a charge. I think if we are driving the most economic model, we would see a mix of those answers.

The CHAIR: Ms Forbes, would you like to comment?

Ms FORBES: I could not agree more with what everyone has said. There is a place for all of them. It will rely on government to allow charging infrastructure to go en route, if that is something that is needed. Not all buses need to go 500 kilometres, 300 kilometres as you have heard earlier. There is a place for smaller battery buses, en route, opportunity charge. There are places for when they go longer haul that need to come back to the depot and charge overnight. There is a place for hybrid and there is a place for hydrogen.

The CHAIR: Any other comments from the witnesses?

Mr BROWN: Yes. I agree with what everyone has said. We see the example at the moment in bus operations where investment and infrastructure add to the overall efficiency of the network. The example at the moment is where driver rest break facilities are invested in outside of the depot. The reason why those facilities exist is so that dead running of buses is reduced and the number of dead hours, which is the number of hours the driver is active and being paid but not providing a service or a revenue generating passenger pick-up service. It is the same principle with opportunity charging, there will be an overall network efficiency question where infrastructure is invested in to lower the number of vehicles required to deliver the transport task overall, lower the number of kilometres required to deliver the network overall and lower the number of hours required or dead hours to deliver that network overall. The industry is already equipped to assess networks on an efficiency basis, plan those networks and identify where that infrastructure is best placed to be invested in.

The initial question was which solution, in depot or on network, do we think is preferred or best? The answer is it depends. I echo the comments that it is the operational requirement overall that would determine the outcome for that particular network. In the case of Brisbane Metro, the only solution was to have en route charging because of the nature of the vehicles, the high frequency of the network and the requirement to have a smaller battery pack with frequent charging to support that service, which is running seven days a week with a long span of hours. Again, using Brisbane's network as an example, the remainder of the bus network will not have a requirement like the Brisbane Metro project.

It will be a much more traditional bus network, which may have an opportunity for an overnight charge solution for the majority of the fleet and then, where the infrastructure is available in the city, potentially on the busway or at other layover areas, a fast charge top-up capability might be there to extend the range of that bus throughout the day, or to reduce the requirement for those buses to return to a depot for that charge. We will see that develop as network design responds to electric buses, as that comes into play through network design and the scheduling of services. If we follow the European example, it primarily started with in-depot charging and then progressed to more opportunity charge as the industry and the technology was adopted more and more. I think my best guess is that that is how it will evolve in Australia as well.

The CHAIR: Looking at the ease of recharging and then how that could be adapted to regional routes when you have long distances, rather than the trial that we are doing in an inner-city area, which is more accessible, how do you see that playing out? If I could invite comment from any witnesses.

Mr ROXBURGH: I think if you provide the route and the requirement, I think industry can invest. It can bring a large amount of private capital to support certainty. National Express, the coach provider in the United Kingdom, has just gone electric. They are now an electric route, so they are the longer route coaches. I think we are working with some providers in New Zealand, for example, to provide truck and bus opportunities. So if you have third-party providers you could have a number of operators and a number of providers who are charging on that infrastructure. You may want to seed it with some trials or having that local benefit and certainty of contract, but that allows people to put your electric service station or en route charging that is there for heavy vehicles so then you can come and support economic growth through a number of different fields at once. They have looked at that in Victoria, for example, having three operators charging at one park and ride.

The CHAIR: Any further comments?

Mr EDMUNDS: I think the only other comment I would add to that is the thing around the range per day or the range per route. If you are talking regional, but they are not longer routes, it really is no different, but the challenge will be at the very longer routes.

The CHAIR: Yes.

Ms FORBES: You took the words right out of my mouth.

The CHAIR: Ms Forbes, you were going to say the same thing?

Ms FORBES: Yes.

The CHAIR: It is a challenge if there are longer routes involved and there is no infrastructure established at the moment.

Ms FORBES: Yes, it depends whether it is a regional depot with 10 buses that do a regional service within the city there, or whether you are talking about city to city where you are going hundreds of kilometres, in which case I would suggest that there is a place for hydrogen. If you have a windfarm that is creating renewable energy that is linked up to an electrolyser, whether it is on site or within a community, then the capital cost of putting in that electrolyser might circumvent having to run all the cables for provision of electricity.

Mr ROXBURGH: I would add to that. If you can keep the procurement as wide as possible, you will be pleasantly surprised as to what industry can come and commit to and invest in to accelerate development of the areas by allowing them to have space or flexibility to do generation out in the regions and optimise hydrogen and electric. Both are electric drivetrains, hydrogen is just a gas battery and it is seven times safer than CNG buses already. So while electric is cheaper at the moment, it makes sense for long range to start looking at hydrogen options.

Ms ELENI PETINOS: I was very keen to pick up on the comment about hydrogen, because we probably have not explored it as much today as we should. I understand that hydrogen has a larger range associated with it, but what are some of the issues which may need to be overcome to make hydrogen a more viable part of the solution?

Ms FORBES: Ms Petinos, we need a whole day to talk about this.

Ms ELENI PETINOS: Or the short version?

Ms FORBES: It all comes back to certainty of supply. Nobody worries about where diesel is coming from. It comes in tube trailers and then you can sign 15- to 20-year deals with the Government rebate for the supply of that diesel. If you are going to produce hydrogen in Australia, there has to be long-term, constant supply of it in order for industry to invest in the infrastructure, then for the humble bus manufacturer to build it and then

for the bus operator to operate those buses. There has to be a local demand and then an offtake agreement to supply that.

Mr GURMESH SINGH: Can I just ask a follow-up to that statement? Is that a bit of a chicken and egg argument around what is going to come first, the hydrogen or the need for it?

Ms FORBES: Absolutely.

Mr GURMESH SINGH: So what is going to come first, the hydrogen or the need for it?

Mr ROXBURGH: At Electromotiv we are assisting on both sides. We wrap the whole supply chain for the hydrogen to provide certainty. We are looking at at least six hydrogen buses at the moment in New Zealand and Australia and we would like to ramp that up. We also provide flexibility so fleet operators can move from electric to hydrogen when they want to. I think the Government can have that. I think having more projects with a number of vehicles, that will incentivise more supply. You have to ratchet both up together. But, again, flexibility as to how that is approached and allocating "we need this service and it needs to be zero emissions" that the solution may be for Electromotiv to provide you electric buses for the first three years and then hydrogen for the next 15 years and wrap the price around that. That gives you some security and guarantees and also ensures that I am buying renewable hydrogen. I can give a contract to the local wind, solar or hydrogen provider.

The CHAIR: Thank you. Ms Forbes, did you want to add to that?

Ms FORBES: I am a little overwhelmed with how much could be said and how little time we have. If anyone has not read Dr Finkel's report, he does really stress that without a domestic market, a domestic supply and domestic demand, it will not ever take off. If you look at the comparison between liquefied natural gas [LNG], Australia is currently the second largest exporter of LNG in the world. It took us 30 years to do that. From the first time we pumped it out to export it, it took 30 years. It is unlikely that, given the learnings we have now, it would take 30 years to export hydrogen but, again, with the chicken and the egg scenario, if the demand is there and the commitment is there, then industry will rise to the occasion, whether it is providing hydrogen, hybrids or electric vehicles for those services. Provide the problem and let industry come up with the solution.

Mr GURMESH SINGH: Just one last follow-up, if I may. I know we are talking specifically about buses, but do you foresee the automotive industry in general taking up hydrogen before buses, will this happen in conjunction, or will buses take it up first?

Mr ROXBURGH: We are actively working to get 40-ton truck hydrogen vehicles, give them the range requirements to happen alongside hydrogen buses. Yes, I think trucks and buses will happen at the same time. For small passenger vehicles it is a higher pressure and a higher cost and I think it does not make as good financial sense as the heavy vehicles at the moment.

Mr GURMESH SINGH: Do you agree with that Ms Forbes?

Ms FORBES: Yes, I agree with that. Buses, long-haul trucks, ferries—they are all back-to-base products if you are going to invest in the hydrogen manufacturing or the storage. If you have vehicles that take a large volume, say, buses at 39 kilogram, obviously trucks are a lot more and then I think Hyundai do a car with anywhere between four to six kilograms of hydrogen and it probably takes them a while to get through that as opposed to a heavy vehicle.

The CHAIR: I want to raise a couple of points. The Committee has heard comments about the life span of batteries and the re-usability of them. I seek your comments and opinions on the disposal of batteries that cannot be used any further and their life span has been exhausted. As responsible, active participants in this industry how can that be dealt with?

Mr EDMUNDS: My favourite subject is batteries. I think out of the different kinds of batteries, the way, maybe, you should analyse any of the products is to think about that life cycle of how many tonnes of battery waste we might create at the end of that lifetime. The recycling industry is capable to take that back in and reprocess it once it gets to the end of life. Depending on what battery technology was chosen, some are very simplistic and are almost like consumable disposal, put them in and then at some time they have used their useful life. And then there are some other technologies out there now that maybe you can use them on the vehicle for so many years and even when you take them off the vehicle you could now use them for a second purpose. So we start to talk about second life and third life which might not be as demanding as a vehicle application but still using that useful life and we are maximising the time before that might go to waste—or recycling, it will never go to waste. What you have to think about is how many tonnes or kilos are going to go into that waste stream—

The CHAIR: Yes, I am talking landfill.

Mr EDMUNDS: Yes, landfill. A lot of the materials can be recycled but it is the cost of that process to break it down. It is really like re-mining and re-manufacturing. So that is very energy intensive. So we probably want to minimise that burden at the end of the time. I think at this time in the maturity of batteries there is wide choice of products available but I think operators and governments can probably assess those attributes, match the route, match the circumstance and possibly after 10 years technology will drift again and there will be other choices starting to come in.

The CHAIR: Is this creating a new industry?

Mr EDMUNDS: I think so, yes. In Europe there is an interesting observation that recycling industries are actually getting involved in that second life. So you might pull this battery apart into little sub-components and you test those and you might be able to repurpose it. Rather than rely on the operator or the single manufacturer, industry is being set up by government usually as a starting point and they are starting to think about how to maximise the time before it has to be repurposed or recycled.

Mr ROXBURGH: I would like to say that you should mandate the recycling of the battery and the lithium and the product stewardship should be adhered to and then the cost will then be integrated into the model and ensured that they are repurposed and recycled. That is something Electromotiv do for all our products so we are comfortable that the batteries that we provide will be re-used and then recycled. Currently the lithium battery costs for recycling are a little high but with some volume those costs will fall significantly and I believe the industry will be able to price that into the project and give the outcomes that New South Wales requires.

The CHAIR: The Committee may send you further questions in writing and your replies will form part of your evidence and will be made public. We request that the response be within seven days of receipt of those questions. Is that acceptable?

Mr EDMUNDS: Yes.

Ms FORBES: Yes.

Mr BROWN: Yes.

Mr ROXBURGH: Yes, certainly happy.

(The witnesses withdrew.)

SALLY AURISCH, NSW/ACT Coordinator, Blind Citizens Australia, via teleconference, affirmed and examined

BRUCE MAGUIRE, Lead Policy Advisor, Government Relations and Advocacy, Vision Australia, via teleconference, affirmed and examined

MARK TONGA, Chair, Disability Council NSW, via teleconference, sworn and examined

CASEY GRAY, Member, Disability Council NSW, via teleconference, affirmed and examined

The CHAIR: Are there any questions? If there are no questions do you want to make a statement.

Mr TONGA: I have no statement.

Ms AURISCH: I will read my statement. Blind Citizens Australia recognises that switching to electric buses provides an economic and environmentally friendly option to the current diesel vehicles. While we, and the broader community of people who are blind or vision impaired, support this initiative we recognise that the silent nature of the vehicle presents a significant challenge for people who are blind or vision impaired as they cannot hear the vehicle approaching when they are preparing to cross the road. As a result we present three recommendations before the trial of electric buses commences.

Recommendation one is that an acoustic vehicle alert system [AVAS] be installed into all electric and hybrid vehicles including buses. An AVAS enables a minimum sound emission when the vehicle is idling or travelling between zero and 20 kilometres per hour while travelling forward or in reverse, thus maximising the safety of people who are blind or vision impaired. This initiative has been taken in London and echoes the work of the World Blind Union and European Blind Union for a standard that is now in place for sound emitters from electric and hybrid vehicles, including electric buses.

Recommendation two is that electric buses contain a provision for onboard announcement to further enhance the safe and independent travel of people with disability. Recommendation three is that user testing be

undertaken prior to the rollout of electric buses. Blind Citizens of Australia would like to request that public consultation, including user testing, occur prior to the implementation of these recommendations. This will enable user testing by individuals who are blind or vision impaired to achieve truly accessible transport with the implementation of electric buses across the transport network.

The CHAIR: Is there anyone else who wishes to make a statement?

Mr MAGUIRE: Yes. Thank you for inviting us to give evidence to the Committee this afternoon. Vision Australia is the largest provider of services to people who are blind or have low vision across Australia. We support more than 25,000 clients each year including about 8,000 in New South Wales. We work collaboratively with other organisations in the blindness and low vision sector to best represent the needs and interests of people who are blind or have low vision. When I began my working life in 1978 I travelled on two buses each day. Sometimes the experience was good and sometimes it was not, primarily because the driver forgot to tell me when the bus had reached my stop.

Forty years later and technology has come a long way. Buses are still an important form of public transport in Australia but using them still presents significant challenges for people who are blind or have low vision. In our submission to the Committee we express the hope that the introduction of electric buses would be seen as an opportunity to incorporate innovative solutions such as automated audible announcements of recent and upcoming stops and an app based signalling system that would allow a person who is blind or has low vision to let the driver of an approaching bus know that they wanted to catch it. The most critical feature that electric buses must have is an acoustic vehicle alerting system so they can be heard when idling or travelling at slow speeds.

The research that Vision Australia conducted with Monash University in 2018 showed very clearly that electric vehicles pose significant safety risks for people who are blind or have low vision because they are near silent. One thing is for sure, if you walk in front of an electric bus because you cannot hear it and you do not know it is there you will not have the chance to do it again. We are pleased that the Commonwealth Government has recognised the importance of making electric vehicles audible to pedestrians who are blind or have low vision and we expect that in due course all electric vehicles will be required to include a noise making device.

We ask that the Committee ensure that such a requirement applies to all electric buses from the outset. We believe that electric buses certainly have the potential to help make our communities more liveable. Vision Australia is keen to work with the New South Wales Government to ensure that people who are blind or have low vision are not left behind while everybody else catches the electric bus.

Ms GRAY: Thank you for providing the Disability Council NSW with an opportunity to comment to the inquiry into electric buses on the New South Wales public transport network. Electric bus adoption in public transport fleets is growing all over the world and the council supports the introduction of this technology in New South Wales. Along with the positives the electric fleet brings to our environment we would like to see the design team consider the needs of people of all abilities and bring positives into the world of universal design.

The key points that the council recommends to this inquiry are: the expertise of the Accessible Transport Advisory Committee [ATAC] should be used to discuss accessibility as part of the design process and not towards the end when it is too late to adjust or enhance any design issues for people with disability. ATAC is the trusted advisory committee established by Transport for NSW. Co-designing with people with disability and carers is part of the design program from conceptualisation to the finished product.

Ensuring that people with disability in regional New South Wales are catered for and have access to transport when required. Ensuring that employment opportunities for people with disability is a part of the discussions. This should be achieved by keeping targets for employing people with disability such as drivers, maintenance workers, providing cadetship opportunities in the sector such as engineering, as well as providing scholarships for people with disability. We should look at procuring from organisations that employ a diverse workforce including people with disability and those supporting them.

Mr GURMESH SINGH: Earlier there were statements around acoustic vehicle alerting systems and stop announcements. How should these work in the opinion of everyone here?

Ms AURISCH: My understanding is that the acoustic vehicle alert system emits sounds whenever the vehicle is idle and when it is travelling between zero and 20 kilometres either forwards or in reverse. Generally, once a vehicle reaches a speed over 20 kilometres an hour the wind resistance makes enough noise that one can hear it safely and that is why the 20 kilometres an hour is a rough suggestion based on what has been happening internationally. As far as audible announcements, it is preferable that they are installed on all buses and that a driver does not have an opportunity to turn off this mechanism. Announcements would have to be automated so

they can be reliable and consistent and they are made at relevant cross sections and stops along the route, as well as having the ability to announce any changes that may occur due to changes in traffic conditions as well.

The CHAIR: Just picking up on what you said there, have you had the opportunity or any of the witnesses, to catch a train on the Sydney Metro Northwest?

Ms AURISCH: Yes, I have.

The CHAIR: Have you noticed an improvement or a catering for vision-impaired passengers on that line?

Ms AURISCH: I believe that some measures were undertaken to try and improve the safety of vision-impaired and blind travellers. The effectiveness of some of those measures still probably leaves a little to be desired. I know that there have been inconsistencies with the announcements as well as train doors not always lining up with platform doors. There definitely are some things in place; however, there is still some room for improvement. In saying that, I am an infrequent user of the line, so it could have improved in the couple of months since I have travelled on it.

The CHAIR: Thank you, that is good to know. I invite anyone else to comment on Mr Singh's question too.

Mr MAGUIRE: Just to add a little bit to what Ms Aurisch said, there are a number of international standards and regulations that govern the noise and the level and the activation and deactivation—what speeds the AVAS should begin operating from. The European Union has a number of regulations; the United States has regulations. The one that is most relevant for Australia, because of our treaty obligations, is United Nations general regulation No. 138, which goes into technical details around the nature of the acoustic vehicle alerting system.

Just in relation to the audible announcements, the newer buses, which do have automated audible announcements, we believe are working well. However, we have heard of instances where the driver has disabled the automated announcements because they do not think they have got any passengers on the bus who are blind or have low vision, so you do not need them. We would certainly say that that is a feature that should not be available to a driver, because if the driver disables the announcements then they obviously are not effective.

Ms ELENI PETINOS: I just wanted to flesh out a little bit whether there was anything that could be done to make it easier for passengers with a disability to use electric buses should they be implemented more widely in this state.

Mr MAGUIRE: I can only comment on people who are blind or have low vision. As we have already talked about, the acoustic vehicle alerting system: the audible announcements so that we can identify the destination that we want. The other opportunity that we think exists is to include technology that will allow a person who is blind or has low vision to hail a bus. At the moment that is a significant problem, particularly when you have at a multi-route bus stop—as many are these days—a number of buses that are parked in a line and you have to find the one you want. You do not have much time, and if you do not know which bus is there or the sequence of buses in the line it can be very difficult to find the bus before it goes.

We know of one project that is about to be trialled, we believe, at Willoughby called Project Halo, which is an app-based signalling system. The person who wants to catch the bus has an app on their smartphone and they use that app to send a signal to the driver of the bus that they want and the driver of the bus gets an alert on their dashboard indicating that the person wishes to catch the bus. This project has been driven by a vision-impaired student from the Queensland University of Technology and I believe it is soon to be trialled. We recognise that not everyone uses smartphones, but we think that for people who do use smartphones this kind of app solution, if it is found to be successful in the trial, may well offer a solution to what has so far been a very intractable problem to solve.

Mr TONGA: I just want to comment that since we know that disability is a diverse cohort in the community I would humbly suggest that having a committee that has diverse experience and could contribute to the design phase of these projects would bring out lived experience of people in the community who are using technologies so they could contribute to the design and find a common platform that everyone can use. I am a big supporter of co-design.

The CHAIR: I have a question in relation to passengers in regional areas. Do they face different situations and do we need to look at a different modelling there for them to be able to use electric buses with much more ease?

Ms AURISCH: Living in a more regional area, I think one of the biggest problems here is the design of bus stops and, therefore, your ability to access a bus. I know that for a lot of places where I catch a bus there is

no kerb and guttering, there is no concrete place to stand and wait. That can cause several issues. The ramps that make a bus accessible to wheel-walkers, wheelchairs or just to reduce the step up or down to people: they often do not come as low as ground level, so they can be very hard to access off, say, uneven grass or some of the dirt edges that we have here. That is definitely something that might need to be taken into consideration if we are looking at rolling out the buses in areas that do not commonly have kerb and guttering and actual bus stop platforms and shelters in place already.

The CHAIR: Is that something that is a real difficulty at the moment? How are users adapting to that?

Ms AURISCH: It limits the choice of bus stops that you have. It may mean that you have to travel further from your home or from the place where you need to board the bus to find a place that is actually suitable, which can be an inconvenience. It can also just be that the buses are not accessible at all to you. If you cannot get safely to a place because of your disability to catch one then you do not have an option but to use another method of transport.

Mr TONGA: I would just add to Ms Aurisch's comment, it is about integration of design. We do design the buses but also pathways and bus stops. It is all part of the package and it allows for the user experience. It is not just people with disabilities, people who are elderly and mothers with prams and people with luggage. We are trying to look at it on a holistic frame.

The CHAIR: Thank you. Any further comments?

Mr MAGUIRE: As well as what Ms Aurisch and Mr Tonga have said, I just add that the importance of being able to identify the correct bus and being able to identify your destination is especially important in regional areas where buses may be less frequent than in metro areas. If you miss the bus you may have to wait longer and stops are further apart. If you get off at the wrong stop, there may not be any other option for you to get back to the one you want for quite some time.

The CHAIR: Very good points. Would anyone else like to comment on that? Ms Gray? No need to if you do not want to. I just want to make sure everyone has a chance.

Ms GRAY: Thank you. In terms of the audible announcements, like Mr Tonga said, the benefit for all users—for instance, those with anxiety or cognitive differences would really benefit from audible announcements as well.

The CHAIR: Thank you. I am going to ask for a question from Dr O'Neill now.

Dr MARJORIE O'NEILL: Thank you, everyone, for making yourselves available. I have a couple of questions. I will just ask this one first: Trials of electrified buses are currently actually underway in the inner west. Have your groups received any feedback, specifically about these trials, of passenger experiences?

The CHAIR: Is there anyone from the witness group who would like to comment?

Ms AURISCH: We have not received any feedback from members at the moment. However, we are quite happy to go out and see if anyone has experienced the buses and provide that feedback if that would be helpful.

The CHAIR: We might see if we can make sure that the information is passed on to you as to the routes and where the stops are so you can actually participate in that. It is a very good point to raise.

Mr MAGUIRE: Similarly to Ms Aurisch, I am not aware that we have received any feedback but we would be very happy to try to get some.

Mr TONGA: We will take the question on notice and respond, and go back to the Accessible Transport Advisory Committee and find out if there has been any feedback.

The CHAIR: I will just make a point there. It is not a condition of the trial to actually have an invitation to specific groups out in the community but it is public knowledge that the buses are being trialled in that area, so it might be an idea if patrons who want to try that are able to access that themselves. I would invite them to do that. Any further questions, Dr O'Neill?

Dr MARJORIE O'NEILL: I just have a question: Have your different groups been consulted at all by bus manufacturers to date around the design of the electric buses?

Mr TONGA: I will take that question on notice and respond. I have to find out.

Ms AURISCH: No, we have not been contacted by any manufacturers.

Mr MAGUIRE: Neither have we.

The CHAIR: I will throw it back to the Deputy Chair, Mr Singh.

Mr GURMESH SINGH: No further questions from me.

Ms ELENI PETINOS: I might just return to some of the earlier comments that we made around, I suppose, the silent nature of electric and hybrid vehicles. I understand that the Blind Citizens Australia submission to the Committee raised issues relating to the silent nature of these vehicles and there have been witnesses earlier today who have given similar testimony regarding their concern around the silent nature of the vehicles that are currently in use, even in the trials.

Could the witness from Blind Citizens Australia, particularly, elaborate on the issues that they have outlined in their submission? If any of the other witnesses have concerns about the silent nature of the vehicles, feel free to raise them at this time.

Ms AURISCH: Our concern is that when the bus is idling or travelling at a very low speed—so that could be when it is pulling into or away from a bus stop or potentially in heavy traffic—it does not make enough audible sound so that when someone is preparing to cross the road and they are relying solely or primarily on their hearing, particularly if they have a hearing impairment as well this impact is compounded further, they may not hear the vehicle approaching and, therefore, they may think there is an appropriate time to cross the road, step out and be involved, potentially, in what could be a serious or fatal traffic accident. The implementation of the audible vehicle alert system would ensure that the vehicle made adequate noise even if it was travelling at a low speed, including if it is travelling in reverse, which is another thing to consider as well. That would increase the safety of someone who is preparing to cross the road because they would be able to hear it even in circumstances where one cannot see it. Does that answer the question or can I go further?

Ms ELENI PETINOS: Absolutely. Following on from that, what I wanted to know is: is there a difference in the way you perceive your interaction with electric and hybrid buses as opposed to electric or hybrid automotive vehicles, so passenger vehicles or cars?

Ms AURISCH: The concerns for us remain the same. We would like to ensure that all electric and hybrid vehicles, including buses or cars, had this acoustic vehicle alert system to ensure the safety of the people who are crossing the road. We do not want to limit this to just buses.

Mr GURMESH SINGH: Can I ask a follow-up there? What has been the experience to date with electric passenger vehicles, considering that over the last two years we have seen a rapid increase in electric passenger vehicles?

Ms AURISCH: Mr Maguire, I was actually going to say you might be better placed to answer this because of the research that Vision Australia has done with the road crash investigation unit.

Mr MAGUIRE: Vision Australia commissioned Monash University Accident Research Centre in 2018 to do some research into the experiences of people who are blind or have low vision with hybrid and electric vehicles. What they found was that 35 per cent of people who are blind or have low vision have had either a collision with a hybrid or electric vehicle or a near collision with a hybrid or electric vehicle.

Mr GURMESH SINGH: Sorry, can you just repeat that statistic? Was that 50 per cent—five-zero?

Mr MAGUIRE: Thirty-five per cent.

Mr GURMESH SINGH: Thirty-five, sorry.

Mr MAGUIRE: In addition to that they found that 74 per cent of people who are blind or who have low vision are experiencing increased levels of stress and anxiety when walking or crossing roads because of the presence of hybrid and electric vehicles. We know that, I think, by 2050 the prediction is that 90 per cent of Australia's vehicle fleet will comprise hybrid or electric vehicles, so without anything being done to make these vehicles more detectable to pedestrians, particularly people who are blind or who have low vision, then we are really concerned that people who are blind or who have low vision will find it extremely unsafe to venture outside, particularly when crossing roads. If it would help the Committee, I am happy to provide a copy of the report that was produced from this research.

The CHAIR: Thank you. That would be appreciated.

Ms ELENI PETINOS: Are there any other constraints on the introduction of electric buses into the public transport fleet?

The CHAIR: No comments from any of the witnesses? Are you interested in anything in particular, Ms Petinos?

Ms ELENI PETINOS: Just that we have obviously spoken about the lack of audio signalling and we have done that quite at length during this session. I just wanted to know from the perspectives of the organisations that you represent if there were any other impediments that you have that you wanted to raise with us today in terms of the introduction of electric buses as part of the public transport fleet in this state.

Mr TONGA: I just want to add that the consultation part is imperative for any introduction of this project for people with a disability.

The CHAIR: I think you have really been able to elevate that this afternoon by just having you here and participate in the public hearing and, looking at your submission as well, you have raised that platform, thank you. Are there any other comments from the Committee? Any questions that you would like to ask further to that? Are there any closing comments from the witnesses that I can invite you to address the Committee about?

That being said, I would like to thank you very much for contributing to today's hearing. If we do have further questions, we may send them to you in writing and 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? Can I ask each of you on the phone conference call to say yes or no please and state your name?

Mr TONGA: Yes.

Ms GRAY: Yes.

Ms AURISCH: Yes.

Mr MAGUIRE: Yes.

The CHAIR: Thank you very much. Should you receive any questions, we would request a response within seven days of receiving that in writing. In the meantime, I would like to thank you very much for your participation. You may leave the conference call now.

(The witnesses withdrew.)

(Short adjournment)

ELIZABETH MOLYNEUX, General Manager, Energy Market Regulation, AGL Energy Limited, via teleconference, affirmed and examined

JANE BUTLER, Manager, New Business Distributed Energy, AGL Energy Limited, via teleconference, affirmed and examined

The CHAIR: Welcome, everyone. Thank you for joining us a little earlier. Could AGL ensure that only the witnesses who are invited to participate in this call attend please? Anyone else from AGL is invited to view via the public website.

Ms MOLYNEUX: I apologise, Chair. With the current coronavirus challenges we are remotely working. It is quite challenging but we have now arranged a different platform for us to listen on, thank you.

The CHAIR: Can I just check to see who is on the line now please? If you could state your names.

Ms MOLYNEUX: Elizabeth Molyneux from AGL.

Ms BUTLER: Jane Butler from AGL.

The CHAIR: Is there anyone else on the line? Silence? Hopefully, that means we can go forward from there. I understand that you might have a question in relation to this hearing process. Is there anything? I invite you to ask a question at this point now.

Ms MOLYNEUX: My only question is one of logistics, Chair, which is: I understand Ausgrid is no longer appearing at this session and, given the current external situation with the COVID-19 virus, we are very pleased to be presenting at this session but, equally, any time that could be returned to us would be appreciated as well.

The CHAIR: What was the specific question, Ms Molyneux?

Ms MOLYNEUX: It is really just to ask whether this session is going to go for its entire proposed length or whether, once you have finished asking questions—

The CHAIR: As long as it needs to go for and we are comfortable with exhausting all questions and responses. We are happy to invite that. We are just starting a little earlier and we are grateful that you were able to join us a few minutes earlier because we were finished with our previous call, so we want to move that forward. We are happy to exhaust all questions and give you that full opportunity.

Ms MOLYNEUX: Thank you very much.

The CHAIR: Any other questions on the hearing process?

Ms MOLYNEUX: No.

The CHAIR: Because we have a teleconference, if you could mute your phone when you are not speaking, as a courtesy. Also, if you could state your name for the Hansard record before you speak each time, thank you. There is an opportunity now for a short opening statement followed by questions. The statement would be no more than two minutes. This will allow more time for questions from the Committee. I would invite either or both of you to make an opening statement.

Ms BUTLER: Elizabeth Molyneux will be making an opening statement.

The CHAIR: Thank you, Ms Molyneux.

Ms MOLYNEUX: We welcome the Committee on Transport and Infrastructure's inquiry into the opportunities and challenges associated with the electrification of the New South Wales bus fleet and are grateful for the opportunity to appear at today's public hearing. AGL is one of Australia's largest integrated energy companies. In New South Wales AGL operates solar, wind, gas and coal generation, supporting local communities and thousands of local jobs as well as retailing energy to 1.5 million consumer electricity and gas customer accounts in New South Wales alone. In addition AGL is continually innovating our suite of distributed energy services and solutions for customers of all sizes. These behind-the-meter energy solutions involve new and emerging technologies such as energy storage, electric vehicles, solar photovoltaic systems, digital meters and home energy management services delivered through digital applications.

Historically AGL has also had experience working with bus operators on the design, installation and operation of refuelling infrastructure for compressed natural gas bus fleets in Australia. As we noted in our submission, the transition to electric buses presents valuable and achievable opportunities for New South Wales. In particular the electrification of the New South Wales transport network, if powered by new renewable energy sources, will make an important contribution to New South Wales' emissions reduction ambitions, complementing the NSW Electricity Strategy, NSW Climate Change Policy Framework and recently announced measures to support electric vehicle uptake.

We would like to focus our statement on this fundamental link into the electricity system as this is the defining feature of an electrified bus network and the source of the key opportunities and challenges. In our view the success of the transition of the bus fleet will rest on it being approached as an integrated energy and transport planning exercise. The electrification of the New South Wales bus fleet would represent a substantial increase in New South Wales electricity demand. Our own estimate is that this would be in the order of about half a terawatt hour increase in total annual demand and up to 640 megawatts of peak demand. To put this in perspective, half a terawatt hour is around three-and-a-half times the annual output of our large-scale solar plant in Broken Hill or double the output of our Nyngan solar plant.

There would be a variety of options for supplying this demand, from increased centralised provision to charging in bus depots or even en route. Determining the most appropriate and efficient solutions for New South Wales will depend on a number of factors, hence our emphasis on an integrated planning approach. The nature of the bus network's geographical distribution across New South Wales means that routes will traverse through areas of the distribution network with varying capacity to manage an increase in energy demand and through areas of New South Wales with varying abilities to accommodate distributed charging options. This offers choices around charging infrastructure and smart charging platforms, vehicle selection—for example, vehicles with varying range, carrying capacity and cost—and energy supply, and involves consideration of the benefits of a uniform approach across the network versus one that differs between bus networks and geographical zones.

It follows that a range of stakeholders should be brought together to contribute to a strategic and operational road map of the journey to electrification. Transport providers can provide expertise on the procurement and operation of buses. Networks like Ausgrid will have important information and insights around the strength of its network and costs of different connection options. Integrated energy companies like AGL can offer deep experience in a range of energy supply options and managing customer experience outcomes. AGL can also offer experience in orchestration and in smart charging by demand and location to try and avoid the risks to the grid.

Our learnings here are continuing to expand. For example, our Peak Energy Rewards Managed for You program in New South Wales is co-funded by ARENA and the New South Wales Government. It is in its second year of a three-year trial investigating remote charging management during peak events, how consumers engage with their distributed energy resources and how this technology may be operated at scale. Moreover, our virtual power plant [VPP] in South Australia is the largest VPP of its kind in Australia and is exploring the potential for broad-scale orchestration.

There is no Australian precedent for a full-fleet bus electrification. If managed properly through proper planning and engagement with all stakeholders in the energy and transport supply chains, New South Wales could well set the precedent and lead the way for other Australian states and cities to make the same transition. AGL would be pleased to lend expertise to this integrated energy and transport planning exercise. I have finished my opening statement.

The CHAIR: Thank you. Ms Butler, did you need to add anything further to that comment and statement?

Ms BUTLER: No, thank you. That completes our opening statement.

The CHAIR: Thank you. I am going to work from my right to my left with the Committee to see if they have questions to you. My first opportunity is for Dr Marjorie O'Neill.

Dr MARJORIE O'NEILL: Firstly, thank you very much for taking the time to join us. You note that in the planning for the electrification of the bus fleet it is important to consider all aspects of transport procurement. Can you talk more about the planning for an electric bus fleet and what this would look like and the importance of it?

Ms MOLYNEUX: Yes. If I consider what the main considerations are in the bus fleet—and please, if I am not answering the specific question, just pull me up. There are some aspects we need to consider in taking up electric buses. One of them is how we source the likely significant new energy supply to meet this sort of demand. One of them is how the actual infrastructure will be integrated into the distribution network. And then the last one is actually sourcing the e-buses themselves—the appropriate batteries, the appropriate fleet, et cetera.

I think the electrification of the fleet, with respect to New South Wales' electricity demand, is obviously an area where we would see AGL playing a particularly important role. We would be making a broad assumption that due to broader decarbonisation ambitions we expect there is a desire to supply the bus fleet using some sort of firmed renewable generation. Those options could include some more centralised aspects, which might make use of renewable assets that we already have, or decentralised sources such as solar battery systems potentially located at depots. A combination of centralised and decentralised sources of energy might be the most efficient outcome. We would support a competitive market procurement process that we would participate in to try and source that new energy supply. That is probably one of the key benefits that AGL—the key expertise that AGL could bring to this sort of program.

In terms of the second point—how the actual infrastructure would be integrated into the distribution network—that becomes a technology question. We have a number of factors that we would need to consider: the size of the batteries in the buses and the different upgrades that bus depots would be required to make. That would actually have to be some sort of cooperative planning approach, I think, between an energy company such as ourselves and the specific network provider. The third aspect, which is actually sourcing the e-buses, would presumably be more in the realm of the actual transport companies, although we would have a view perhaps on the sorts of batteries that would be most appropriately used in such vehicles. Does that give a sense of what you were asking?

Dr MARJORIE O'NEILL: Yes.

The CHAIR: Thank you. Any further comments, Dr O'Neill?

Dr MARJORIE O'NEILL: Yes. You touched on the benefits of co-locating bus charging facilities. Can you just expand on that a little bit more?

Ms MOLYNEUX: Co-locating with solar batteries and things like that? That is your question?

Dr MARJORIE O'NEILL: Yes.

Ms MOLYNEUX: That is an option. I think there are many ways that you could power the buses. Looking at the different parts of a distribution network, each distribution network has areas in the distribution network that can be strengthened or that have constraints. A properly planned access to the different points of a distribution network that could be used for inserting decentralised charging would be important. I think that Ms Butler might be able to speak to this more specifically. Ms Butler?

Ms BUTLER: Just expanding on that point, our approach being one of integrated planning really is supporting Ausgrid's submission to this inquiry, in that one of the big barriers to the capital cost for the infrastructure associated with charging electric buses is potential upgrade costs at a depot location or a charging location to the local distribution network. One option to offset those costs is to have local solar and co-located batteries, which would potentially be cheaper in some cases than a new network connection. But without understanding the capacity of the local network it is impossible to predict these things. Hence, we are recommending the integrated planning approach. Does that answer your question?

Dr MARJORIE O'NEILL: Yes, it does.

The CHAIR: Thank you. Just following on from that and looking at charging of electric buses to help support the grid—can you elaborate on that, please?

Ms BUTLER: Yes, I am happy to take that one. We are not sure whether or not there is opportunity there, but certainly that is something that could be explored through potential pilots of trials. Obviously what is paramount is the operation of the bus service and its carrying capacity and key performance indicators associated with customers. But if there is any idle time when the buses are charging there is potentially opportunity to explore things like a solar sponge during the day, if there is excess renewables on the grid during the day—that buses could potentially soak that up. That is an interesting thing that could be explored through pilots and trials.

The CHAIR: How do you see that in comparison with other countries? Is that something that they are actively doing at the moment?

Ms BUTLER: I would have to take that question on notice. I do not have any specific information. I would say Australia's solar penetration is much higher than other countries, so the potential opportunity here is also higher.

The CHAIR: So it would perhaps introduce a new style of technology ability that is not found in other countries that do not have the solar capacity?

Ms BUTLER: Possibly, yes.

Ms MOLYNEUX: I do not think we are really in a position to comment.

The CHAIR: That is fine. If you wanted to, you could take that on notice. Ms Petinos, would you like to ask a question?

Ms ELENI PETINOS: Thank you, Madam Chair, and thank you, ladies, for making yourselves available this afternoon for us. I just wanted to pick up on that comment that was made about solar. Whilst you just indicated to the Committee that you do not necessarily have the information about other jurisdictions, do you have any further information about what the solar mix may potentially look like that you could elaborate on for the Committee's purposes at this time?

Ms MOLYNEUX: Can I just clarify the question? When you are talking about the solar mix are you talking about within the bus network itself?

Ms ELENI PETINOS: Within the bus network and the specific example that was just given by whomever of the two of you just gave the last piece of evidence.

Ms BUTLER: I will take that one. Just to clarify, when I used the term "solar sponge" I was talking about excess solar that is available in the wider grid from large-scale and small-scale renewables, not necessarily the solar that is produced locally on site from a particular bus depot. Although there would also potentially be opportunity there, where applicable.

The CHAIR: Would that be reliable, though?

Ms MOLYNEUX: The idea with renewables is to firm up the renewables. Of course, solar is only reliable as solar when the sun shines. But when we talk about firming renewables we would be talking about a solar-battery combination located at depots, potentially. So we are not suggesting this is the only way of powering and electrifying buses. It could equally come from the centralised grid. But also it could come from decentralised energy solutions such as a solar-battery combination decentralised across different depots. They are simply options; neither are requirements. It could be a combination and probably would be a combination of the two.

The CHAIR: You have not got any particular modelling that you are referring to from other countries that you are pulling this information from?

Ms MOLYNEUX: Not specifically regarding bus fleets. Ms Butler, is there something you would like to talk about in relation to solar-battery systems?

Ms BUTLER: Look, it is probably a question more for Ausgrid, who unfortunately were not able to appear. But we do work a lot with network businesses such as Ausgrid and our understanding is that due to the increased penetration of renewables more widely in the grid there is a large amount of solar, which creates high voltages, for example, during the middle of the day. And so there is potential benefit to the local network if you increase the load at that time to help bring down that voltage. We are talking about network support benefits.

The CHAIR: Thank you. Mr Singh, did you have a question?

Mr GURMESH SINGH: Yes. It was on a slightly different topic. Earlier today we had numerous speakers talk about hydrogen powered vehicles. Our fairly limited understanding of hydrogen production is that it is quite energy intensive. I would like to get some of your comments around hydrogen electrolysis and where you see the future in that moving?

Ms MOLYNEUX: I think hydrogen is worthwhile considering in the longer term. It certainly does currently involve a great deal of energy to make and I think that we can see a future for very heavy vehicles using liquid hydrogen is more of a five to ten year horizon, and buses would be at the lower end of that heavy vehicle use. We cannot really comment other than it is something that Australia should look at as a fuel, but it is not a near-term fuel that we would consider, in particular for the purpose of making the bus fleet more renewable.

Mr GURMESH SINGH: I consider 10 or 15 years to be the near future. In respect of planning for something long-term, and if we are looking beyond 2030 and looking at our carbon goals out to 2050, there was talk earlier this morning of a wind farm which powers hydrogen, I think it was Queensland or Victoria. It was not in New South Wales. What are your thoughts on whether this is something that AGL, as an energy company, is looking in the future at making the hydrogen itself rather than just providing the energy, considering it is an energy source?

Ms MOLYNEUX: It is something that we have looked at, at a very high level. At this point in time it is not economic to produce hydrogen from our own wind farms, but we are always looking at all options. But it is not something we are pursuing immediately.

Mr GURMESH SINGH: What would it take to build the demand side of it? Would you wait until there is an industry pull for this product or are you working with industry groups to look at that timeline?

Ms MOLYNEUX: We are involved with some of the industry groups but essentially the economics behind producing hydrogen do not stack up currently. To be clear, there are other renewable options.

The CHAIR: Ms Butler, is that you speaking now?

Ms MOLYNEUX: It is Elizabeth continuing. Just to be clear, hydrogen is a renewable energy source. Other renewable options are better and more efficient from an economic point of view, currently.

Mr GURMESH SINGH: At this point in time for what we are looking at, is that what you are saying, just for clarity?

Ms MOLYNEUX: At this point in time, that is right, yes. At this point in time, other renewable options are more efficient economically than hydrogen.

The CHAIR: Committee members, are there any other questions you would like to ask? I am looking around the room but it seems to be that we have exhausted our questions. I am throwing it back to our witnesses if you would like to speak further or elaborate on your submission, we are happy to listen.

Ms MOLYNEUX: I do not think we have anything more to say at this point.

The CHAIR: There may be an opportunity for further questions from the Committee to send to you in writing. Your replies would form part of your evidence and be made public. Would you be happy to provide written responses to any further questions you receive from the Committee?

Ms MOLYNEUX: Yes, of course.

The CHAIR: If that was the case, we would ask that you respond within seven days of receiving the question in writing. Would that suit you?

Ms MOLYNEUX: Yes, just if I could put a small caveat on that, given the current external circumstances managing the virus, our sign-off processes might be delayed by a couple of days.

The CHAIR: That is fine. We are in extenuating circumstances.

Mr GURMESH SINGH: If that is the case, maybe flag it that you might need extra time for sign-off once we provide you the questions, if it comes to that.

Ms MOLYNEUX: Certainly.

The CHAIR: Are there any closing points that you would like to raise with us?

Ms MOLYNEUX: I think the only closing point in that AGL does support the electrification of the New South Wales bus service and we think it is a very sensible policy for the New South Wales Government. We emphasise the need for integrated planning around that.

The CHAIR: There being no further comments, I thank you for participating today.

(The witnesses withdrew.)

The Committee proceeded to deliberate.