T R A N S C R I P T

STANDING COMMITTEE ON THE ECONOMY AND INFRASTRUCTURE

Inquiry into electric vehicles

Melbourne — 13 February 2018

Members

Mr Bernie Finn — Chair
Mr Mark Gepp — Deputy Chair
Mr Jeff Bourman
Ms Samantha Dunn
Mr Khalil Eideh
Mr Shaun Leane
Mr Craig Ondarchie
Mr Luke O'Sullivan

Participating members

Mr Cesar Melhem
Mr Gordon Rich-Phillips

Witnesses

Ms Claire Johnson, CEO, Hydrogen Mobility Australia.

The CHAIR — This committee is hearing evidence today in relation to the inquiry into electric vehicles. The evidence is being recorded and is also being broadcast live on the Parliament's website. Welcome to this public hearing of the Economy and Infrastructure Committee. All evidence taken at this hearing is protected by parliamentary privilege, therefore you are protected against any action for what you say here today, but if you go outside and repeat the same things, those comments may not be protected by this privilege.

I would invite you to state your name, your position, your organisation and the suburb or town in which you are based, and then speak to us for five or 10 minutes and then we will go to questions. Thank you.

Ms JOHNSON — Thank you. My name is Claire Johnson. I am the CEO of Hydrogen Mobility Australia. We are a recently established national industry association that is representing Australia's emerging hydrogen sector. Our membership comprises vehicle manufacturers, energy companies and infrastructure providers, specifically BOC, BP, Caltex, CNH Industrial, Coregas, Hyundai, ITM Power, Siemens, Toyota and Viva Energy. Our members are all involved in initiatives spanning the entire hydrogen value chain, including hydrogen production, export, stationary power applications, energy storage and of course transport.

Our vision is a hydrogen society for Australia, built upon clean and renewable energy, including hydrogen-powered transport. We recognise that the collaboration between industry and government will be essential to support this mission and take advantage of this exciting opportunity for the country, and we are grateful for the opportunity to appear here today.

While I understand this inquiry has primarily focused on battery electric vehicles, these represent just one technology option in the electrified vehicle field. Hydrogen fuel cell vehicles are similarly powered by electricity, but they present another alternative for delivering reduced transport emissions, both here and nationally. However, I should note that it is the position of our association and our members that both battery electric vehicles and hydrogen fuel cell electric vehicles can coexist and in fact complement one another with their differing characteristics. Specifically while battery electric vehicles may be more suited to city driving, where shorter distances are the norm, hydrogen fuel cell electric vehicles provide longer range and an efficient refuelling time of about 3 to 5 minutes, which is similar to a petrol or diesel vehicle. Like a battery electric, hydrogen fuel cell cars also emit no carbon dioxide and no pollutants, and the only emission from a fuel cell car is water.

At the end of 2017 almost 6500 hydrogen fuel cell electric cars had been sold globally, predominantly in Europe, the US and Asia. Manufacturers with fuel cell electric cars in the market include Toyota, Hyundai and Honda. Mercedes is also soon to launch a plug-in hybrid combining hydrogen fuel cell and battery electric, demonstrating the complementary nature of the technology in a single vehicle.

In terms of the commercial transport segment, this is where hydrogen's advantages are particularly pronounced. This includes range, short downtimes due to quick refuelling and reduced weight versus battery electric. Hydrogen buses, for example, are now being adopted by fleets around the world due to these particular benefits, and heavy duty fuel cell trucks, forklifts and trains are also being rolled out globally.

In relation to Australia's progress in introducing hydrogen transport, both Hyundai and Toyota, who are members of HMA, are committed to this marketplace and have introduced a small number of fuel cell cars for education and promotional purposes. For the past two or so years both these brands have been sharing the technology with government, industry and the general public, and Hyundai has also recently announced that it will be bringing 20 units of its second generation fuel cell car, the Nexo, to Australia by early 2019, and these will be used by the ACT government fleet.

What inhibits the introduction of widespread implementation of fuel cell cars in Australia at this point in time is hydrogen refuelling infrastructure. We do see this changing, however. Hyundai has a permanent refuelling station at their headquarters in Sydney at Macquarie Park, and Toyota has recently acquired a portable refueller that sits on the back of a semitrailer that lives at its Altona facility in Melbourne. In addition, in the last 12 to 24 months we have seen a number of state and local governments commit to hydrogen infrastructure projects, including South Australia, the ACT and the City of Moreland in Melbourne. The City of Moreland project in particular is supported by the Victorian government and will see a fleet of hydrogen rubbish trucks rolled out. These rubbish trucks will be built by a local manufacturer, Iveco, in Dandenong, and they will then be converted from diesel to a hydrogen fuel cell drive train.

We believe that these commitments demonstrate that hydrogen is set to play a growing role in the transport sector in Australia. This is also consistent with overseas practice, where government support has been integral to early stages of the technology to support the transition of the market through infrastructure support and support for vehicle uptake by financial and non-financial incentives. In Australia our association has been working with the federal government as it develops its approach to encourage the uptake of zero-emission vehicles through the ministerial forum on vehicle emissions led by Minister Frydenberg and Minister Fletcher, and we also note recent statements from Minister Frydenberg calling for improved coordination of federal and state governments to encourage the adoption of zero emission vehicles, which is very encouraging. To ensure success in transitioning our fleet we also believe that a coordinated plan at all levels of government will be needed to support the proliferation of green transport options in Australia, which as mentioned prior is consistent with approaches taken overseas, where government works in partnership with industry.

Finally, I note that hydrogen does not just represent a transport fuel. As mentioned earlier, the mission of our association is to realise a hydrogen society for Australia. This essentially means an economy where hydrogen is used as the major power source. The creation of a hydrogen society achieves three main objectives: first is the reduction of the burden on the environment through reducing CO_2 emissions; second is the diversification of energy sources — hydrogen can be produced through renewable energy and can also promote sustainability and supply of energy and also reduce our dependence on fuel imports; and third, it will generate economic benefits through creation of new jobs.

In conclusion, the upcoming Tokyo Olympics in 2020 will be known as the hydrogen Olympics, where the Japanese government is aiming to realise a hydrogen society and to showcase a multitude of hydrogen applications to the world. Australia has an opportunity to export this hydrogen to Japan, and Arena and CSIRO in particular announced last year that the export of renewable energy in the form of hydrogen to countries such as Japan will be prioritised by both agencies in recognition of this opportunity.

Victoria specifically has an opportunity to play a significant role in the hydrogen export sector. Through our existing wind and solar assets the state could export clean energy to the world and in parallel develop a domestic hydrogen energy sector that supports the rollout of a hydrogen-powered transport fleet. Once again, thank you for the opportunity to engage with the Victorian Parliament as it develops its approach to zero emission vehicles. I also urge the panel to consider the hydrogen economy as a means to achieve its 2050 carbon emission objectives, and I am also happy to step you through the model car if the technology is of interest.

Mr O'SULLIVAN — Absolutely.

The CHAIR — I think we probably should do that now.

Ms JOHNSON — Wonderful. As mentioned prior, there are a number of hydrogen fuel cell vehicles in the marketplace now. This is a model of the Toyota Mirai. The Mirai was launched in 2014. It is manufactured in Japan. It is currently on sale in Japan, in the US and in Europe. This car is powered by hydrogen gas — so compressed hydrogen gas. The refuelling is exactly the same as a petrol or diesel car, in that you will pull up to a refuelling station and fill your car up in a very similar way. As I mentioned, the refuelling time is about 3 to 5 minutes.

How this vehicle works specifically is, as I said, you refuel as per normal, with a nozzle. You pump hydrogen gas into the two tanks at the rear of the car here, so it is compressed to a certain level. So it is very pressurised hydrogen gas. These two tanks take about 5 kilograms of hydrogen. When you drive the vehicle, oxygen will come through the front grille. The oxygen will go through the car and into what they call the fuel cell stack. At the same time the hydrogen from the two hydrogen tanks in the rear will exit those tanks and also meet the oxygen in the fuel cell stack. In the fuel cell a chemical reaction will occur between the hydrogen and the oxygen to create electricity. The electricity then goes to the motor at the front of the car and drives the vehicle, the same as what an electric car would. The only difference is that the electricity is actually generated inside the vehicle instead of charging it from the very start.

This car, as I mentioned, takes 5 kilograms of hydrogen, which is about a 550-kilometre range, so it is quite comparable to a petrol or diesel car. This car has no CO_2 or no pollutants that it emits, and the only emission is water. The water exits the rear of the vehicle and is almost pure enough to drink. If the water exited directly from the fuel cell stack, you could drink the water — it is completely pure. It does pick up some chemicals as it

exits the car through the pipes, but many people have drunk the water and they are still standing today. So that is a very cool characteristic as well.

Toyota currently has three of these cars in Australia. They acquired a portable refueller. As they do their showcase around the country, sharing the technology, they take that refueller with them to refuel and support those vehicles. Are there any questions?

The CHAIR — Yes, I reckon we have got a few.

Ms JOHNSON — Lovely.

The CHAIR — Thank you for that. It was very interesting. The source of the hydrogen gas, where do you get that from?

Ms JOHNSON — Hydrogen gas can be generated in quite a few ways. Hydrogen itself is the most abundant element in the atmosphere. It is colourless. It is odourless. It is the first element on the periodic table, which means it is the lightest, and it is actually the smallest element as well, but hydrogen in its natural state always bonds with another element — for instance, water. Hydrogen bonds with oxygen to create water, so you always need to go through a chemical process to separate the hydrogen on its own. This vehicle for instance needs about a 99.9 per cent purity of hydrogen gas, so there needs to be a separation process.

To do that separation there are really two sort of frameworks or pathways. One of those is through a process called electrolysis. Electrolysis involves a process where water and electricity are used in an electrolyser machine. That water is then separated through the use of electricity, which separates the hydrogen from the oxygen. So through that process the hydrogen is separated. It is then compressed, and you are able to fuel a vehicle such as this. If the electricity that is used to separate the water is from a renewable source, then it is completely green. That is one pathway.

The other pathway — and the most common way of hydrogen being produced at the moment — is through natural gas. There is a process called steam reforming. Again that also is able to produce hydrogen and also obviously has some carbon dioxide emissions associated with that pathway.

The CHAIR — Great; thank you for that. Now, you mentioned new jobs, and that is always something we are interested in. What sort of jobs, and how many do you think we are looking at?

Ms JOHNSON — Sure. Look, it depends on exactly what sector you are talking about. The technology is still in its infancy. They are in the marketplace, so it is tried and tested. But similar to battery electric vehicles, there will be technology advances that will occur over time to make these cars more efficient. There are R and D opportunities in the hydrogen space. As we know, Toyota, Holden and Ford have all retained R and D capability in Australia post the closure of local manufacturing. Development of technology such as this represents opportunities for them through the advancement of hydrogen fuel cell technology. That is one opportunity.

Where the jobs will be predominantly created is through export. Hydrogen has been said to potentially be a export industry for Australia — bigger than LNG is the speculation at the moment, so it is a very exciting opportunity. We are seeing a number of projects that are being explored at the moment, and we envisage that there will be jobs created through the implementation of facilities that will essentially allow us to produce hydrogen in Victoria and then to export that to the world. Through the R and D and the export, I think that is where we will predominantly see the job creation.

Ms DUNN — Thank you for your presentation today. I am interested in terms of — you described that electrolysis process — how much water do you need to create it? You talked about 5 kilos of gas going into a car; what sort of water would be required to actually make that amount of hydrogen gas?

Ms JOHNSON — I do not have the specifics on me in terms of the volume of water required.

Ms DUNN — I am happy to take it on notice; I am very happy.

Ms JOHNSON — I will take that one on notice.

Mr LEANE — I do not think it was 5 kilos, though, was it, that you said?

Ms JOHNSON — This vehicle in particular takes about 5 kilograms of hydrogen gas.

Ms DUNN — Just to use that as an example — 5 kilograms.

Ms JOHNSON — Yes. The water that would be required specifically, I would take that on notice.

Ms DUNN — Sure; that is fine.

Mr LEANE — I suppose the costs are in refuelling.

Ms JOHNSON — Sure. In terms of the refuelling infrastructure itself, the stations at the moment are predominantly being rolled out in Japan, Korea, the US and parts of Europe. California alone has 30 stations at the moment, and they are growing those over time. They have really built a network of stations, and we have seen about 3000 cars sold in California alone so far. California is the one marketplace that has publicly disclosed their figures for the cost of infrastructure in that state, and in terms of refuelling stations, it depends on the capacity. It is generally about a $1 million to a $10 million investment for a station, so it is a significant up-front capital cost. On average stations are about $3 to $5 million, and they will be able to service approximately 50 vehicles a day. Government has been very supportive of the infrastructure rollout in California in particular to support some of those up-front capital costs and because the return on investment will be slower as the number of vehicles in the market obviously is not there just yet. These costs will of course decrease over time.

What we are seeing is hydrogen stations are actually sitting side by side with pre-existing petrol and diesel stations as well. For instance, with our membership of BP and Caltex, they already have the network, they have the infrastructure, the land. In many instances it is a case of utilising that land to insert infrastructure for a refuelling station. So it sits under the canopy, just the same as petrol or diesel.

Mr LEANE — I suppose California is a good example. So you said there was about 3000 —-

Ms JOHNSON — Three thousand vehicles.

Mr LEANE — vehicles. Are they privately owned or are they —

Ms JOHNSON — It is a mix. Some of them are privately owned. There are also fleet vehicles as well; also lease arrangements as well. What Toyota has done is provide lease arrangements for new purchases, and so that is another model as well that is being rolled out.

Mr LEANE — So the personal cost of running a hydrogen car compared to a traditional petrol car?

Ms JOHNSON — Yes, sure. Over in the states it is approximately US$10 for 1 kilogram of hydrogen gas. So to fill a vehicle such as this, which is 5 kilograms, you are looking at $50 to fill the two tanks, which gives you about a 550-kilometre range. This vehicle in particular sells for US$57 500. Then the California government at the moment is providing an up-front rebate of US$7000. This was higher several years ago, but it now sits at 7000.

Mr LEANE — So $50 to travel 500 —

Ms JOHNSON — 550 kilometres.

Mr LEANE — I might ask you an unfair question: what would petrol cost in California to travel that distance?

Ms JOHNSON — Of course petrol prices are very low in the States because the excise tax is a lot less than what it is here, so I do not know specifically.

Mr LEANE — That is fair enough.

Ms JOHNSON — But of course it is about volume as well. As I mentioned, many of the refuelling stations in California are servicing less than 50 vehicles per day, so you are only generating enough hydrogen to support that size of fleet. As those volumes increase, of course costs will come down.

Mr LEANE — Thanks.

Mr O'SULLIVAN — That is fascinating, and Mr Leane asked a few of the questions that I was going to ask, but I have got some others. The power output from the hydrogen cell, how does that compare to an electric or petrol vehicle?

Ms JOHNSON — Hydrogen is a very energy-dense substance when compressed, so these vehicles are actually more efficient than an internal combustion engine in terms of petrol or diesel. The efficiency is there. The advantage of a hydrogen fuel cell over an electric car is that you can simply increase the range of a hydrogen car by increasing the capacity of the tanks. That is why a hydrogen fuel cell is very effective in trucks and buses et cetera — all you need to insert is a larger tank. With a battery electric vehicle, however, you need to increase the size of the battery, which of course adds weight, and it adds cost as well. So we see that the efficiencies of the hydrogen fuel cell may well accelerate over and above electric cars over time.

Mr O'SULLIVAN — Is this system compatible with electric cars, or is it in competition with electric cars?

Ms JOHNSON — We actually see them as coexisting, so both Toyota and Hyundai, who are members of our association, are investing heavily in battery electric and fuel cells. So we actually see both vehicles sitting side by side in the marketplace. As I mentioned before, the advantages of hydrogen are predominantly the range and the refuelling time. Where we think they would be particularly advantageous in the beginning is in commercial fleets. As I mentioned, the infrastructure is quite expensive for these stations, so a back-to-base model would primarily be the first entry for hydrogen fuel cell transport in Australia whereby a fleet that returns to a base each night will utilise that same refueller.

The good thing about hydrogen refuelling infrastructure as well is that it is consistent across all brands and across all transport types. So a bus, a car or a forklift can all utilise the same refuelling equipment, which is a real advantage. What was the remainder of your question?

Mr O'SULLIVAN — I can probably take you to the next area I want to ask questions in. In terms of taking this to the next level, I asked questions earlier about how electric cars could be transformed in a farming sense — I have got a farming background, I am from a regional community — in terms of using them for tractors, headers and so forth. How does that compare? Is it already used in the mining sector? I guess that is the intermediate step before you probably use it in a pure, heavy agriculture sense as well.

Ms JOHNSON — Yes, the mining sector is certainly very interested in this technology, as is the defence sector because these vehicles actually emit less heat than internal combustion engines so you cannot identify them as effectively. Also there are less moving parts. Essentially the fuel cell stack has no moving parts whatsoever, so it means you do not need as much tooling and spare equipment to service these vehicles too.

In a farming context we are seeing the utilisation of hydrogen trucks and also forklifts as well. The application, as I mentioned, is really around commercial transport in the beginning. That is where we see that the clear advantages will be, particularly for those organisations that maintain a fleet with a back-to-base model.

Mr O'SULLIVAN — I guess in a farming sense you do not have that back-to-base application as much. If I am out on the header in a paddock that is way out the back, how do I bring the hydrogen to the header? You do not take the header to the hydrogen.

Ms JOHNSON — No, you do not. It would be exactly the same as your petrol or diesel vehicles that you are utilising now. It would really be no different, and that is the advantage with hydrogen fuel cells. We have already overcome a lot of the psychological challenges with the perception of plugging in electric vehicles and making sure that you plug them in each night. These you fill up at your service station, similar to a petrol or diesel car. A farm may well have equipment on site to do that, but typically you would not install that sort of equipment at home. You would go to a refuelling station to do that, and it is a similar thing with these vehicles as well.

The CHAIR — Thank you very much, indeed. Just one last question: how often would a hydrogen vehicle have to be serviced?

Ms JOHNSON — The servicing requirements are less. One of the considerations of some in the service and repair sector is that these actually do not need servicing as frequently as your normal internal combustion engine. The servicing is, I believe, every one to two years, so it will decrease the demand for the servicing that we typically see at the moment.

The CHAIR — So the industry of mechanics and people like that will not be all that thrilled at the prospect, I would have thought.

Ms JOHNSON — We see that there are opportunities to retrain. There is a huge amount of opportunity here in software development as well. We are really seeing in the service and repair sector that those mechanics are skilling up into the technology space as well, so we see that jobs will just shift into a different space rather than disappearing altogether.

Mr LEANE — Just doubling up on yours, what is the life of a vehicle like that compared to a combustion one?

Ms JOHNSON — In terms of hybrid cars, hybrid is really the stepping stone for these vehicles. The life of a hybrid battery is generally about 10 years. These vehicles also have a small battery inside of them for the purposes of running your lights and for starting up your vehicle, so approximately around that length of time for the battery.

Ms DUNN — I have just a couple of questions, one on servicing, although I assume with servicing that wear and tear on tyres might still be an issue, so it is probably about what distance you drive as well that feeds into service frequency in relation to hydrogen cars. But the other thing I meant to ask earlier is whether there is any difference in safety in comparison to a petrol car, which has got a tank of fuel attached to it as well.

Ms JOHNSON — Sure. That is one of the challenges that we need to overcome with hydrogen cars, the safety perception. Hydrogen is no less safe than petrol or diesel; it just has a very different set of characteristics that need to be managed. Europe in particular has regulations, codes and standards to deal with hydrogen refuelling and the vehicle itself. This particular vehicle, the Toyota Mirai, has a five-star rating. It is equivalent to Australia's ANCAP — it is a Japanese ANCAP. The hydrogen fuel cell tanks actually undergo both gunfire and bonfire testing. You can shoot a gun at these tanks and they will not burst.

Also, the advantage of hydrogen is that, as I mentioned before, it is a very light gas, so if it does escape, as long as it is not in a compressed area, it will actually simply float upwards. There are not any issues with polluting the waterways, for instance. That is an advantage as well.

The CHAIR — Thank you very much indeed. That was a very interesting and worthwhile presentation, I thought. Very soon, in the next couple of weeks, you will receive a transcript of the proceedings today. If you could have a read of that, and if there is anything that jumps out at you that needs to be rectified, please let us know — only typos and things like that. If you could do that, that would be marvellous. We thank you for coming in. It is much appreciated.

Ms JOHNSON — Thank you.

Committee adjourned.