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

Mr Tim Olding, Director, Sassafras Group.

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 the 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. Could I ask you just to state your name, organisation, position and suburb or town base for the record and then take us through for 5 or 10 minutes with your presentation. We will open it up to questions afterwards.

Visual presentation.

Mr OLDING — Okay. My name is Tim Olding. I am the director of Sassafras Group, which is a consulting company based in Yarraville in Melbourne's inner west. My background is about 25 years of automotive engineering. I spent the first 19 years of that at General Motors Holden, where I was manager of engine design for some of the time and ultimately manager of an advanced engineering group which spent time developing hybrid and electric vehicle designs which would go into GM products around the world. Since leaving GM, which was about 2008, I have worked as a consultant in the areas of transportation and energy policy. I then became the chief engineer of a start-up company called EV Engineering, which built a fleet of fully electric Holden Commodores as a demonstration. I was also chief engineer of an electric motor technology company called Axiflux, which was developing advanced electric motors. I have also been vice-president of new technology for an aerospace company called Quickstep, which makes carbon fibre composite components for the defence sector — you know, the F-35 strike fighter and also automotive and land-based defence systems as well.

I suppose I am trying to bring to this committee the perspective of an engineer and a designer who has worked in the fields of both conventional engine and vehicle design and also electric vehicle design. Today I would like to share with you the results of a study which goes to some of the questions people often ask around 'How good is an EV compared to a petrol vehicle in terms of emissions and operating cost?'. I would also like to talk a little bit about passenger vehicles versus diesel vehicles — like large vehicles, buses, trucks et cetera — and also put it all in the context of the energy markets and how EVs can either destabilise or stabilise the electricity supply network. I would just like to show you four quick graphs, which kind of explain the results of this trial that we did a few years ago. I have updated the results to reflect current energy pricing, so what it costs to operate an electric vehicle compared to a standard vehicle is pretty much as you would see it today.

The first thing people often say is that if you run an electric vehicle on the grid, on today's grid, it will probably be more CO_2 per kilometre than if you run a petrol car because we burn brown coal, and all those sorts of arguments. What we did was we actually ran a range of trials, where we took a standard Holden petrol-powered vehicle and the electric Holden and we ran them on five different routes around Melbourne to replicate real-world driving conditions. Rather than theoretical projections of what the comparison would be, this is actual back-to-back: same car, same day, same roads, just driving as you would. We did a high-speed freeway cycle, we did a taxi cycle, we did an urban commute cycle, we did a country commute cycle et cetera, and then we measured the energy, the fuel and the electricity used to calculate those CO_2 emissions and so on.

When you look at the results, the top blue line is the petrol, CO_2 per kilometre. The red is if you were using Victorian-sourced coal as of 2017; this was done in 2012, but we have updated the results to 2017. The green is basically just assuming they are using electricity off the national energy market. And the purple is probably by 2020 where the national energy market would be. One of the great things about it is they get cleaner over time if your grid is going in the right direction in terms of emissions.

The other interesting thing to see is even on today's Victorian power, it is only really on the freeway cycle where you would potentially have worse CO_2 than a conventional vehicle of the same size. So all in all a pretty good story for EVs. I think it is important people understand that what is simulated versus what is real can be quite different, and this is one of the few opportunities that has presented itself to actually do a real back-to-back comparison.

The next one then, when you look at that energy consumption converted into cost, what is it going to cost you to run these two vehicles? The upper two curves are on petrol — the high and low petrol price, so obviously petrol is a variable cost. All I have done with that is I have just taken the highest and lowest over the last six months and said, 'That's what it cost'. Then the electricity price is the same idea: just gone to the market, looked at what I would say is probably a very competitive high-peak, low peak, off-peak pricing for electricity. Now the

electricity prices are far more variable than the fuel price. I could go to another supplier and I could actually move those curves up quite a lot by going to some of the charges, which are quite a lot more for the same price. It has become a very competitive market for electricity now, probably more so than petrol. Once again you can see that it is a reasonably compelling operating cost advantage with electric vehicles.

If you look at it over time, this tries to project what would be your annual payback time for a different annual mileage. You have got an up-front purchasing penalty for an electric vehicle — I have just assumed $15 000, for example — but then, depending on how you use that vehicle over time, the payback could be vastly different. It could be anything from 10 years to recover that purchasing penalty down to as little as one and a half years, depending on how you use it. That tends to drive my thinking towards, 'Okay, time and mileage for vehicles where you get the greatest benefit, obviously, but going to the electric option, particularly when the purchase premium exists'. You have heard from lots of others that that purchase premium will drop, and my sources suggest by around 2022, based on the cost to manufacture a vehicle, an electric vehicle compared to a combustion vehicle should be about the same. Whether the pricing is the same is a very different argument, but the manufacturing costs will pretty much be the same. You can expect obviously that then the payback becomes much easier as the price premium drops.

The question then becomes: are you going to be able to get the vehicle soon? The previous speaker made some really good points. Globally there is going to be lots of electric vehicles. Where those vehicles go will depend very much on the market settings in the different countries. At the moment I think you have heard that there is not a lot of incentive to have an EV in Victoria or Australia in terms of purchasing offsets, privileges such as bus lane access or whatever. In my mind if Australia wants EVs, they are actually in a competitive market to get them into the country — not at a business level but at a country level, because there will be other places in the world where the car manufacturers will preferentially place them based on what the policy settings are in those locations.

We do not make cars in Australia anymore, so there is really no local incentive or local reason why cars would come to this market. It has got to be based on pitching our market compared to the other markets around the world. The key thing is obviously the drive. That decision will be over any tariffs or incentives that may exist, such as the luxury car tariff, for example. You have got to have a market interest, and to date I think there is interest in electric vehicles in Australia but there is not a strong market pull. No one is saying, 'We really want one'. Then you have actually got to have the recharge infrastructure to give people the convenience and confidence to use the vehicles. The range is going up — 200 kilometres, 300 kilometres; I think those sorts of problems will go away a little bit.

I drove one of those electric Commodores for two years. I parked it outside my house, and I charged it up by running an extension cord across the footpath and plugging it into the car, and no-one touched it and no-one interfered with it for two years — anti-trip so no-one tripped over the cord and things like that. Essentially I did all my charging from home, and basically I could use a car with about 160 kilometres maximum range for all my business around Melbourne without trouble. Getting out to 200, 300 kilometres range, I think it will meet all the convenience requirements of most consumers, nearly all consumers.

Psychologically it is also important to have places where you can charge and know where they are so that you do not have to do forward planning about using your vehicle. You need to have information systems that effectively tell you your proximity to the charging locations. It will become less and less of an issue as time goes on. It is one of those things: driving it for several years your anxiety goes down and down and down as your confidence in the product goes up. But those are things that are very, very hard to get into the market psyche, to say, 'I really want one, and I'm comfortable buying one'.

In summary, I think that for passenger cars I would kind of agree with the previous speaker from the FCAI that large volumes of passenger car EVs, into Australia is probably going to take some time unless there are big shifts in policy settings that would make it attractive to put that allocation into this country. On the other hand, I think on the heavy vehicle side there is much more opportunity, particularly in Victoria, for designing and building electric vehicles and providing great economic benefit and environmental benefit to the state.

This graph says the more you drive, the more money you save and the less CO_2 in comparison you generate. A typical taxi might do 150 000 kilometres a year. A commuter bus might do 80 000 to 100 000 kilometres a year. From a logic perspective it would make sense to try and direct your efforts in the early stages, because you are not going to get the passenger EVs in the larger volumes anyway, into what can we do with our public transport

infrastructure that would not only lower our greenhouse footprint but also provide public good in terms of low-cost transportation? Effectively you can be saving a substantial amount of money per year in operating your bus, which then either goes into lower subsidies for that public transport or lower fares for the end users, however the operators of that system want to operate.

And it is the same for taxis, for that matter. London is basically going to zero-emission taxis, and there are several players in the UK which are building for the electric taxis to go into that congestion zone area where they will have zero-emission taxis only. Potentially that is another area where you could start to encourage the use of electric vehicles. It is a purpose-built vehicle. You could actually import an electric taxi — a London taxi, for example — and use that in Melbourne as part of building up over time an electric vehicle population.

The next graph — this is the last one — is just to put this in the context of our energy markets a little bit. This is AEMO, which is the Australian Energy Market Operator, which basically manages our electricity market. You can see that over the next couple of decades they are predicting a great deal more renewable energy into the grid and pretty much the same or less conventional coal-fired or gas-fired energy. Hydro is pretty much fixed because of the limited resource for hydropower.

We are going to go to a grid which is probably substantially more dynamic than it has been in the past in terms of you have got a lot more renewables in that grid. That can obviously be an issue, and we have actually seen some issues related to that, although whether they were truly related to renewables or whether the network in general was not operating robustly is a big question mark. Once you start to put a large network of electric vehicles into the system, and particularly buses, you have the opportunity to start to use the bus network and the recharging infrastructure for the bus network to also be a stabilising influence on the grid as well.

In the last few weeks we have seen how the Tesla big battery in South Australia has already started to have substantial impacts not only on the stability of the grid but also on the cost of providing grid services. One of the things that you need to provide is what is called FCAS, frequency control, or basically grid-stability services. They are actually supplied traditionally by power stations being on stand-by. The Tesla battery has come along and it is basically providing those services at the flick of a switch at a lower cost, and so it is actually driving down the cost of providing those FCAS services. If you have an electric bus network which then has recharge stations built into that network which are run off stationary batteries which are trickle charged from the grid, you do two things: number one, you do not put any high loads on the grid, and therefore not having the surge charge coming out of the grid into the bus, you buffer it through a battery; and number two, you can use that battery as a grid services device at the same time.

If we can take a whole-of-system approach to developing electric vehicle networks, taking into consideration not only the vehicles and the charge stations but also the generating resources, you can probably kill a couple of birds with one stone, create something that is creating value on both sides of the coin — lower transportation cost, more stable grid, with lower grid services costs that go with that.

From my perspective I think that is probably where it makes sense to put the early efforts into electrification of our transport infrastructure. It has the greatest public benefit. For the amount of batteries or the amount of electric vehicle technology you invest in, it is doing more kilometres per year, so its economic and environmental benefits are greater compared to investing that money in a passenger car that does 10 000 kilometres a year or 15 000. My perspective is very much around, early stage, let us look really carefully around what we can do with public transport and buses and ultimately delivery trucks and things like that, because that I think will be an easier pathway into electrification for this country. We also still have the engineering resources and the manufacturing capabilities to design and build those sorts of heavy vehicles. Unfortunately we no longer have the car industry in this country, which is why I am now a refugee from the industry. That pretty much concludes my presentation.

The CHAIR — Thank you very much for that. Right from the beginning, when you say you had your Commodore parked out the front and you had a cord running from inside the house, just for my own benefit, where exactly in the car did you plug it in?

Mr OLDING — Basically where the fuel filler cap is. We actually have a Mennekes European-standard charging port, which we built into the car. I just had a 15-amp power point on the outside of the house and put a robust cable on that. That is not how you normally do it. I do not have off-street parking where I live so it was my only option. I also charged it at work as well, just to show that you can do it with a minimum of

infrastructure in your home, but you have also got to be very confident that the infrastructure is good — in other words, solid wiring, not old, not underrated for the power that you are drawing, those sorts of things. The comments made earlier today about the complexities of putting charging into individual houses — that still exists. We have got old housing stock in Melbourne. It could be easy or harder on any given application.

The CHAIR — How possible is to have a vehicle that can be run both on petrol and electricity?

Mr OLDING — That is effectively a plug-in hybrid. They exist today. One of my last jobs at Holden was designing a hybrid powertrain system that would go into the next generation of the large wheel-drive car. I kind of left that experience going, ' I'd much prefer to design an electric car'. Ultimately if you are designing an electric car and a petrol car, it is going to be more expensive, I think, in the long run. As the battery costs come down and the range goes up, I see less imperative in the city environment to have a plug-in hybrid. In the context of Australia, where you might have regional centres and things like that, they would probably make some sense.

The CHAIR — You mentioned this a couple of times, but do you see a time, if EVs really take off, that we could have a strong and robust manufacturing, or at least assembly, industry in Victoria?

Mr OLDING — For passenger vehicles or for heavy vehicles?

The CHAIR — Well both — either.

Mr OLDING — I think with heavy vehicles it is already happening. In the previous hearings you had representatives from the heavy vehicle industry who are manufacturing vehicles here in Melbourne. That will continue; it is based on an evolution of that industry. The car industry has stopped. To restart it I think would be quite a big task — not impossible. Tesla started from zero and created a global business**.** But it would be a big investment. It would take some time. The nice thing about electric vehicles is they are far more of a modular-type system than a combustion engine in a conventional vehicle. All of your battery systems, all of your powertrain systems, are — I would not say plug and play — modular in nature and you can build up something pretty simply. The body engineering, creating a vehicle body and all safety systems that go with that, is still a large investment. Potentially you could leapfrog and go to driverless. In a future life with a higher penetration of driverless vehicles, potentially the risk of accidents goes down such that the safety engineering maybe can be looked at differently, which would then lower the overall cost of the design and build of the vehicle.

The CHAIR — So you would see the possibility of an electric driverless car perhaps reviving some form of our manufacturing industry in automotive?

Mr OLDING — At some scale. I do not know what size of industry you could generate in Australia doing that, but at some scale. I do know of people working in the space. Nothing is impossible.

The CHAIR — We shall keep our eyes open.

Mr O'SULLIVAN — Thanks for coming along. It is very informative. Can I just go back to your first slide, please? In terms of that, it is very interesting but it is metropolitan. If you live out in the rural and regional areas, where would that sit in terms of those experiments?

Mr OLDING — I think if you are commuting between two regional towns, for example, Albury to Wodonga or something like that — not Albury to Wodonga, but you know what I mean.

Mr O'SULLIVAN — When you are going from Patchewollock to Manangatang.

Mr OLDING — I am a city guy. I do not know about the country. It would be more akin to the freeway cycle.

Mr O'SULLIVAN — So that is at 100 kilometres an hour.

Mr OLDING — Pretty much.

Mr O'SULLIVAN — If it is on a Melbourne freeway, it will not be 100 kilometres an hour.

Mr OLDING — Down to Geelong and back. So the average speed is 80 kilometres an hour on that particular test run.

Mr O'SULLIVAN — So if you are at 100 kilometres out?

Mr OLDING — It would look a little bit worse.

Mr O'SULLIVAN — A little bit worse for petrol or for —

Mr OLDING — For the EV. Basically combustion engines get a bit more efficient the higher you load them. As you drive faster they are actually operating at a higher efficiency point then they would be tooting around the town. Electric vehicles are pretty constantly efficient so it is not a problem, but the power consumption is going up on both vehicles. So the efficiency gain on the petrol one overtakes the difference. That is why the freeway condition is worse for the electric vehicle in terms of CO_2 emissions. The one thing I would say, talking about having Victorian power, is that it is kind of a nebulous concept because essentially we are part of the national electricity market. We are buying from anywhere from Queensland to South Australia. So I put it there because everyone asks the question, but the reality is EV on a NEM 2017 is a much more reasonable way of looking at the problem or the question. Then, as you can see, it is already equal or better under all conditions.

Mr O'SULLIVAN — Can we go back to your fourth slide, which is my next question in terms of the grid. If you look towards the end of 2035, if we have got a million cars in Australia on electricity, have we got the capacity in the grid to be able to have a very large uptake of electric vehicles in, say, 20 years time?

Mr OLDING — It is not something I could answer as a direct calculation or knowledge of my own, but I have done a lot of reading around this area, and most people would advocate that it is not an issue as long as you do time of charge control — so a decent amount of overnight charge, early in the morning when the air conditioning loads on the grid are lower et cetera. So if you have managed charging I think there is vast capacity to power electric vehicles without increasing your overall generating capacity.

Mr O'SULLIVAN — Is it something that governments probably need to have in mind now for the future?

Mr OLDING — Obviously if there are new loads coming into the grid — and not insubstantial loads when you come to heavy vehicles, which want to do fast charging — yes, you have got to plan for it, I would say. It is not something you can do on an ad hoc basis. You have got to think about it — go back to that systems engineering concept of 'Let's make sure we manage this as a total end-to-end system' rather than saying, 'Just worry about cars and someone else can worry about the grid and the in-between section will sort itself out somehow'. That is probably a recipe for blackouts, or something like that.

Mr O'SULLIVAN — I am just thinking about how I would use it if I was in that situation. I am sure that, okay, you drive home from work, you drive into the garage, you pull up at your sort of 5.30, 6 o'clock, and you probably plug it in at that point to recharge it. That is probably the point that you are turning on your air conditioner and TV and you are cooking dinner and whatever else. So it might put a fairly significant load on the system right across the board if everyone is doing it at that same time.

Mr OLDING — So think about it in terms of cars are becoming intelligent. Just because you plug it in does not mean it is charging. You might plug in and it might decide it will run at 10 per cent charging until 11.00 p.m., and then when the electricity price drops it will go to 100 per cent charging. If you have got a three-phase, 15-amp system in your house, then it is more than likely going to be fully charged by 7.00 a.m. So once again it comes down to clever integration of the systems so that you manage those sorts of issues. It comes back to a demand management-type model. They are talking now of using demand management for when we have high peak loads on the grid. It is the same as that. Remember that every car now will soon have a 4G connection — its own mobile connection — to the network, so communicating with the car will become —

Mr O'SULLIVAN — One very quick last question from me: in terms of the Commodore that you built with the electric motor, how does that compare in terms of power and torque ratings compared to the petrol version?

Mr OLDING — In terms of vehicle performance they were pretty much equivalent. There was a 3.6 litre V6, which went from nought to 100 in 8.2 seconds; and the petrol one was 8.5 seconds, or something like that.

So in terms of drivability and performance, they were pretty much on par, and probably the first one was in some ways more enjoyable to drive due to the responsiveness that you get from an electric battery. It was good fun to drive in fact. I wish I still had it.

Ms DUNN — Thank you for your presentation. It has been very interesting. I am interested — even from your own perspective, if you have not looked at this — that in terms of an electric vehicle being part of a household energy consumption, do you know what proportion of your household's energy was taken charging that car?

Mr OLDING — For us it would probably be about a 50 per cent increase because we have got solar power and we had an efficient house designed and built, so it was substantially more.

Ms DUNN — Yes, so it was noticeable from a percentage point of view but not necessarily kilowatts.

Mr OLDING — Let us say the average Victorian or Melbourne house is about 15 or 16 kilowatt hours a day, I think from memory. This battery was 30 kilowatt hours, so to fully charge it would be two days electricity. The reality is each day you probably used less than half of that charge on your daily commute. So it is still going to be a 20 or 30 per cent increase, but once again it is cheaper than buying petrol.

Ms DUNN — Yes, exactly.

Mr OLDING — Or diesel.

Ms DUNN — I just want to follow up on Mr Finn's question about a future in terms of manufacturing. I just wonder if you have any views in relation to, rather than vehicles, componentry? Whether there are options for us here, or has that ship sailed?

Mr OLDING — There is some opportunity. I think Nissan die-casting still make components for the Nissan Leaf down in Dandenong. There are other companies I know of that are still probably in the start-up phase, which are developing battery management technology. I know one of those has just spent three months in Germany working with Volkswagen, so it is the sort of technology that is of interest to large companies.

The previous speaker spoke about Cohda in South Australia. So yes, the answer is there will be activity, not on the scale that we have in the past in terms of all the tier 1 and tier 2 suppliers that fed the local industry. It is hard to say; I think it is probably more on the technology side than on the components manufacturing side.

Mr LEANE — Thanks for the graphs. I have not got a life; on Saturday night I was thinking about this report, and I was thinking that that is exactly the sort of thing we need, so that is fantastic. With your background and expertise and the way technology changes, I am thinking about domestic use. Will there be a day when you will be able to plug your car into a standard 10-amp point?

Mr OLDING — You can. It just changes the rate at which you charge. Initially I did charge it on a 10-amp power point, and I was probably pushing it to the limit, so I thought that I had better put a higher power point in. The important thing is that the car knows what it is plugged into. As long as it knows what it is plugged into, it is a variable power charger on the car side — if it knows it is a 10 amp, it only pulls 10 amps. If it knows it is 15, it will pull 15. If it knows it is three-phase, it will pull three times —

Mr LEANE — And as you said that will mean the difference in the charging rate.

Mr OLDING — Exactly right. The way to think about it is kilometres per hour for charging.

Mr LEANE — So for a vehicle that may not necessarily be used very often during the week a 10-amp power point would not be the worst thing to plug into. But if you want a lot of use out of it, that is where the 15 amp is desirable.

Mr OLDING — Yes. Like I said, the best way to think about charging is, how many kilometres of range per hour can I get. That depends, literally, on the power source that you are plugged into.

Mr LEANE — There has been a lot of discussion around charging infrastructure — public or at councils or at state government level. I had a conversation with someone recently who said that there is some work being

done somewhere around the world where electric vehicles have a self-charging trickle effect as you drive. Have you —

Mr OLDING — That would defy a few laws of physics to do that. One of my jobs with Holden was dealing with all the great ideas that people would send in by letter, and a lot of them were of that nature. Generally, I just explained to them that whenever you convert energy there are losses. Therefore, you cannot drive the back wheels and run a generator on the front wheels and keep moving. You will stop.

Just one other comment in terms of not only on the vehicle side, there are some technology companies working. There are also several technology companies working in the areas of battery recharge. One of them is inverted power, which is actually working with a high-power charging station provider called Heliox in the Netherlands to provide bus charging stations, which have this capability that I mentioned, of buffering the energy in a battery, fast charging the bus, but also providing grid services on the AC side of it. I also believe that they are in discussions with one of the big gentailers here about running a trial in that area. So there are lots of innovative companies around Australia and Victoria which are working in this space.

Mr LEANE — I suppose, getting back to the question around new technology, any infrastructure that is invested in now is not going to be out of date by the time it is rolled out. I think you have answered that question — as in defying the laws of physics.

Mr OLDING — Exactly.

Mr LEANE — Okay. That is good.

Mr OLDING — There is one question that Mr O'Sullivan had to a previous witness around fuel taxation. One potential answer to that question is basically user-pays road service fees based on how many kilometres your vehicle drives each year. Quite a few years ago when we were working on this project a telecom company came to us and said, 'Well, ultimately in the future every car will have a phone SIM card in it and it will be quite easy to track driving distance and the types of roads you've driven on'. So effectively excise is user-pays taxation of a different form, and you could potentially replace it with something else, which is basically a road usage tax based on actual distance, without really any technological requirement above what we have to date.

The CHAIR — Thank you very much indeed for joining us this afternoon. We do appreciate your invaluable contribution. You will receive a transcript in the next week or two. If you could just have a look at that and see if there are any typos or anything like that — not that there will be, I am sure. If you could have a look at that and get back to us, that would be wonderful. Thank you very much for coming in. We do appreciate it.

Witness withdrew.