



COMMONWEALTH OF AUSTRALIA

Proof Committee Hansard

SENATE

ELECTRIC VEHICLES

Use and manufacture of electric vehicles in Australia

(Public)

FRIDAY, 17 AUGUST 2018

CANBERRA

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SENATE

ELECTRIC VEHICLES

Friday, 17 August 2018

Members in attendance: Senators Bushby, Kim Carr, Patrick, Rice, David Smith, Dean Smith, Storer.

Terms of Reference for the Inquiry:

To inquire into and report on:

The following matters:

- a. the potential economic, environmental and social benefits of widespread electric vehicle uptake in Australia;
- b. opportunities for electric vehicle manufacturing and electric vehicle supply and value chain services in Australia, and related economic benefits;
- c. measures to support the acceleration of electric vehicle uptake;
- d. measures to attract electric vehicle manufacturing and electric vehicle supply and value chain manufacturing to Australia;
- e. how federal, state and territory Governments could work together to support electric vehicle uptake and manufacturing, supply, and value chain activities; and
- f. any other related matters.

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RUTLEDGE, Mr Geoffrey, Deputy Director-General, Sustainability & the Built Environment, Environment, Planning and Sustainable Development Directorate, Australian Capital Territory

Committee met at 08:37

CHAIR (Senator Storer): Good morning, everybody. I declare open the second public hearing of the Senate Select Committee on Electric Vehicles. This is a public hearing, and a *Hansard* transcript of the proceedings is being made. We are also streaming live via the web, which can be found at www.aph.gov.au.

Before the committee starts taking evidence, I remind all witnesses that, in giving evidence to the committee, they are protected by parliamentary privilege. It is unlawful for anyone to threaten or disadvantage a witness on account of evidence given to a committee, and such action may be treated by the Senate as a contempt. It is also a contempt to give false or misleading evidence to a committee.

In addition, if the committee has reason to believe that evidence about to be given may reflect adversely on a person, the committee may also direct that the evidence be heard in private session. The committee prefers all evidence to be given in public, but, under the Senate's resolutions, witnesses have the right to request to be heard in private session. It is important that witnesses give the committee notice if they intend to ask to give evidence in camera.

If a witness objects to answering a question, the witness should state the ground upon which the objection is taken, and the committee will determine whether it will insist on an answer, having regard to the ground which is claimed. If the committee determines to insist on an answer, a witness may request that the answer be given in camera. Such a request may, of course, also be made at any other time.

On behalf of the committee, I would like to thank all witnesses appearing today for their cooperation with this inquiry.

I now welcome the ACT Minister for Climate Change and Sustainability, Mr Shane Rattenbury MLA, and representatives from the ACT government. I note the committee's appreciation for you taking the time to come and speak with us today, Mr Rattenbury. Information on parliamentary privilege and the protection of witnesses in giving evidence to Senate committees has been provided to you.

I remind senators that the Senate has resolved that an officer of a department of the Commonwealth or of a state or territory shall not be asked to give opinions on matters of policy and shall be given reasonable opportunity to refer questions asked of the officer to superior officers or to a minister. This resolution prohibits only questions asking for opinions on matters of policy and does not preclude questions asking for explanations of policies or factual questions about when and how policies were adopted. Officers of a department are also reminded that any claim that it would be contrary to the public interest to answer a question must be made by a minister and should be accompanied by a statement setting out the basis for the claim.

The ACT government has lodged submission no. 48 with the committee. Would you like to make any amendments or additions to that submission?

Mr Rattenbury: No, thank you.

CHAIR: I now invite you to make a short opening statement, and at the conclusion of your remarks I will invite members of the committee to ask questions.

Mr Rattenbury: Thank you very much, Chair, and good morning. I appreciate the opportunity for the ACT government to come and speak to the committee. I will just make a couple of quick opening points. Our submission particularly notes that we've put together a transition-to-zero-emission-vehicles action plan 2018-21, and I thought I'd just speak quickly to the rationale of that.

The ACT government have a goal to have 100 per cent of our electricity coming from renewable sources by 2020. What this means is that our greenhouse gas emissions profile beyond 2020 will see more than 60 per cent of our emissions coming from the transport sector. This defines the challenge for us going forward in terms of what we need to focus on. In that space, we need to address the emissions issue, but we also are conscious of the global movement in new vehicle technologies. So we wanted to make sure that, as a small jurisdiction, we prepared for that global transition—we prepared our community to be ready. But equally we were very conscious of the stalemate, in a sense, in Australia, in that there are no vehicles coming into the country, so the market is not growing, but the market won't grow because nobody's ordering the vehicles. So, in our strategy, we sought to look at the unique role the ACT government could play and how we could drive change.

Our action plan is very short term—it's only a three-year plan—partly because we wanted to make sure we'd put something in place that we just got on with. But also we are conscious that, over the next three years, things will change so much that it is appropriate to come back and look at it again in three years time. We are conscious that other forces will shape things much more than we can.

The key focus in the three-year action plan is a number of specific measures. The leading one, we believe, is that the ACT government have committed to transform our government fleet to 100 per cent electric vehicles over a three-year cycle. The reason for that is that most of our vehicles are sedans that people—our public servants—use to just get around town. They're on a three-year lease cycle. We have taken the approach that, as each batch of those vehicles comes out of its lease cycle, we will replace them with electric vehicles. This will amount to about 600 vehicles over three years.

Announcing this position has had a significant impact and significant positive response from stakeholders, the automakers, because it's the most significant order that's been placed in Australia. We believe that, as a—

Senator RICE: Wow!

Mr Rattenbury: Yes. At the moment, there are around 5,000 vehicles in Australia. You probably have more recent figures than we do. But this is the most significant order, and it is encouraging the automakers to get on board.

We also have sought to invite other, smaller governments—so local councils—to participate with us. We're part of a number of local-council networks. We've invited them to join us as part of our fleet-purchasing strategy because we are conscious that a local council that might only need five or 10 vehicles will not necessarily be able to do what we're doing, but, if they come onto our order as well, it continues to grow the market.

We are also conscious that, in doing this, we will start to turn over vehicles into the second-hand fleet as they go through our cycle, as is the case with government vehicles.

Our action plan also includes the requirement for the installation of vehicle-charging infrastructure in new mixed-use and multiunit developments. Again, the experience we have lived—and this is with our local government and planning responsibilities—is that it's very expensive to retrofit electric charging points into the basement of a large multiunit building because if you build it in at construction point the marginal cost is almost zero. So we've decided to mandate that into our planning laws so that we essentially future-proof these buildings that are going up at the moment in Canberra; we are seeing a significant number of new buildings.

In terms of the recommendations we have made, they're obviously in our submission, and we're happy to answer questions. The key one that I would add is that we would encourage the Commonwealth government to adopt a fleet-procurement program similar to what we have adopted. The ACT government uses a particular fleet company—it's the same as the Commonwealth's—and so that company is now gearing itself up. We've had very positive feedback, again, from the automakers, who said they had had trouble engaging the fleet companies but now that we, as a government, have set this policy, the fleet companies are now going to them and asking questions. If the Commonwealth were to adopt a similar role, we believe that that would have a significant impact.

The last particular observation I would make is: we request that the Commonwealth allow used-vehicle imports. One of the key barriers in Australia at the moment is price, and certainly enabling some used vehicles to come in, I think, will start to assist in Australians appreciating the strengths and the opportunities with electric vehicles. We have plenty more to say, but perhaps I can leave that as our key overview on where we're coming from.

CHAIR: Thank you very much. The issue of emissions by the transport sector is very much of interest to me, in terms of the size of that sector and in terms of overall emissions and, perhaps, the difficulties in addressing it. This is, as you've stated, a major focus of the reasoning behind moving towards electric vehicles?

Mr Rattenbury: Yes. As you'd be aware, the ACT doesn't have a large manufacturing base, and so, historically, 68-odd per cent of our emissions have come from stationary energy sources—space heating and cooling in buildings and those sorts of issues. In moving to 100 per cent renewable electricity, we eliminate those, and so, necessarily, transport comes up as a primary source of emissions. Certainly, in this city, we have the lowest public transport usage of the large cities in Australia, in terms of people getting to work, and a very dominant use of the private motor vehicle for transport around town. Ninety-five per cent of those transport emissions come from private motor vehicle use. So getting our residents to take up the use of electric vehicles is a key way to tackle that emissions profile. It's not the only way; we have a number of other strategies, such as promoting active travel, improving public transport and the like. But, envisioning a future in which the private motor vehicle will be a key source of transport for some considerable period of time, we must act in that space.

CHAIR: As to the interaction with the other councils: these are jurisdictions outside of the ACT—is that correct?

Mr Rattenbury: Yes, it is. We are part of two groupings that are relevant here. One is the climate cities partnership run by the Climate Council. That is: essentially, of local governments all over Australia, they have sought to build a network; recognising that local governments are small and often don't have a lot of policy capacity, they've sought to strengthen people up. We're one of the larger players in that, being that hybrid between a state government and a local government. We are bigger than the other councils, and we felt there was an opportunity there to help them because we're doing something. But also it increases the size of, essentially, the order that we're making, and we think that should help us increase our economies of scale. In the scheme, we are still relatively small, even though our order of 600-odd vehicles is large in the current landscape in Australia.

CHAIR: You're also trialling buses and a hydrogen project as well?

Mr Rattenbury: Yes. We've brought two fully electric buses and one hybrid electric bus into our fleet. So far, the trials on those have been positive. The performance has probably exceeded the initial expectations. The hydrogen vehicles have come about as a result of: for our renewable electricity target, we did large-scale reverse auctions, and part of the requirements in those reverse auctions was for the proponents to include a level of local industry development and various people brought things forward. One of them was a large-scale wind farm, including the provision of an electrolyser and 20 hydrogen vehicles to go with it. It's a partnership between Siemens, Neoen and Hyundai. So we are due to take delivery of those hydrogen vehicles in 2019, and we're currently just determining the site and location for both the electrolyser and the hydrogen refuelling station. We're very conscious, and we've tried in our strategy not to be picking winners in terms of the technology—the hydrogen strategy versus the battery electric vehicle strategy. I think it's unclear which direction that'll go in. I think there'll be applications for both through time. We're trying not to, at least at this stage, preclude either pathway.

CHAIR: Okay. You've also put in place financial incentives for the public. We've talked about the government, but just touch upon the public incentives that you've put in place for the take-up of electric vehicles by private individuals.

Mr Rattenbury: Yes. We have what I believe are currently the most generous concessions in Australia for electric vehicles. We have zero stamp duty at the time of purchase and then an ongoing 20 per cent discount for registration. We have been very conscious of how we provide subsidies. Some people have suggested we should do things like provide free parking, but frankly, given the value of an electric vehicle at this stage, people who are buying them are wealthy people with, I guess, the ability to afford that, and I think that there are some difficult social justice questions around whether we should in fact provide free parking to those people as well. So there are those two financial incentives I've spoken about, but then we've tried to provide some non-monetary incentives as well, such as the ability to use transit lanes, as a way of providing a reward without necessarily giving cash to people who probably don't need cash. I should be clear that we've put a time limit on the proposal of being allowed to use transit lanes, because we are hopeful that in five years time, when that proposal ends, there will be so many vehicles that we cannot have them in the transit lanes or they'll clog it up.

Senator RICE: Thanks, Mr Rattenbury, for your submission and your presentation today, basically showing how the ACT is leading the country. Along with the percentage of new sales—the ACT is equal with South Australia in doing that, at double the national average—you've mentioned the financial incentives. Do you think that's the key point? What are the other reasons why the ACT is leading the country, with almost two per cent of new sales being electric vehicles?

Mr Rattenbury: We have a community that I think are very committed to doing their part to address greenhouse gas emissions. There is probably some level of affluence here that enables some people to get ahead of the curve at a time in which regular priced vehicles are not available. Certainly in terms of financial incentives—and I'm sure the committee will receive evidence on this fact—the experience overseas of what seems to have driven the uptake in other countries has been the provision of government subsidies in the order of, I think, many thousands of euros, particularly in Europe, where this has been the leading policy. That has closed the gap between internal combustion engine vehicles and electric vehicles. I don't think that's a responsibility the ACT government can take on. I think that would need to be a national policy, but that certainly seems to have been the experience from overseas from the research we've done.

Senator RICE: I know that time's short and we're going to have to move on much more quickly than I'd like to. I want to move on to the issues of the fleet and your fleet procurement. Have there been issues you've worked through in ensuring that the fleet that you're procuring is going to be fit for purpose? In particular, are there any

lessons if the federal government were going to join you—and I think that's such a significant potential thing for the federal government to be able to do—in terms of the suitability of the EVs for the fleet?

Mr Rattenbury: There are a couple of points. We've been very conscious that we are right at the beginning of our process, so there are not a lot of lessons learnt yet. But we've been very clear about starting with what we classically call the low-hanging fruit. We've simply gone for our sedan fleet. We're not dealing with emergency vehicles and the Parks and Conservation Service, who go up to the top of the Brindabella Range. They will stick with their more heavy-duty vehicles in the short term, because the technology is not there on those matters yet. So that has probably been a key point.

The other challenge we face is simply the availability of vehicles. We're right on the cusp. Again, others will present on this. There are a number of manufacturers who are just starting to bring in vehicles, so we seem to be coming into this just at the right moment, where we think that reasonably priced vehicles will become available. We hope, in putting our order on the table, that they will choose to bring those vehicles to Australia.

Mr Rutledge: It's been very educational for fleet managers and fleet providers. Often the standard financial model doesn't really apply to electric vehicles so well. Whether or not you run it on a three-year leasing cycle—the value of electric vehicles may be over a longer term, so you might want to consider extended lease terms. That's one thing. An interesting anecdote: when you try and order an electric vehicle from a fleet provider, they still ring you and ask you what fuel card you want, and you say you don't need a fuel card. Those sorts of things have been really educational.

We had the opportunity to speak with the New Zealand government fleet provider. They are also looking at their COMCAR equivalent. I think they'll end up with a BMW 7 Series EV as their COMCAR equivalent and for their ministerial vehicles. We've shared with them, and they've shared with us. They've had to apply a totally different financial model to the way they look at their leasing approach because it's just a new way of looking at vehicles. I think there's been a lot of learning with industry that we've gone through. Because we've been somewhat of a trailblazer, I'm hoping that, as we learn with industry and with our leasing providers, they too will learn. And it's not just with us and councils; as I say, we've had conversations with the New Zealand fleet providers as well.

Senator RICE: It does sound like there's a lot that we're going to be able to benefit from, with you and New Zealand being trailblazers.

Mr Rutledge: We hope so.

Senator RICE: One final thing—you mentioned that it's just sedans that you're looking at at the moment, not heavy vehicles. I note in your plan you were saying that there needed to be a plan for heavy vehicles. Can you quickly comment on heavy vehicles and electric vehicles.

Mr Rutledge: Each of the manufacturers are quite different. If I think of, say, Toyota, their model is that they're going to hybrid in the first instance across their entire range and then they're going to electric after that. I imagine there will be a point where the same technology you see say in a Toyota Prius will be available in a Toyota LandCruiser. I think each of the manufacturers are different. We had a meeting with Mitsubishi, and they talked about their upcoming range. And then last year I had the opportunity, as part of our partnership with Hyundai, to travel to Seoul. They expect to have 25 different types of passenger vehicles available by 2025. They see both hydrogen and electric vehicles across the full Hyundai range, and I think, once you're getting into Hyundais, they're a much more affordable vehicle than what's currently on the market in Australia.

Senator DAVID SMITH: Thanks, ACT government. I've got a couple of questions. Again, some are relating to the fleet. It's good to see the ACT government using its procurement power. I know there's the plan with the 600 vehicles—where is that up to? How many vehicles are now electric and hybrid? This question's got a few parts to it. In that procurement, is there any consideration given to local content, whether that's in relation to components, design or other elements? Are there plans going forward to ensure that comes into procurement processes? I'm interested around the commercial vehicles, because I think that's where the great opportunity for cooperation across local government is going to be, particularly if you think about a lot of your utility vehicles. Do you have any idea about what number of vehicles we're talking about across the ACT? Noting Mr Rutledge's comments about conversations with companies overseas, have those conversations also been about potentially looking at some elements of local manufacturing here in Australia?

Mr Rutledge: Thanks, Senator. I'll start with the last question first. No, our focus hasn't been on local manufacturing. That's not to say it's for that exclusion. There have been those conversations. As I said, we have already placed an order for hydrogen vehicles. We're receiving hydrogen vehicles from Hyundai, so that visit was entirely focused on that. I think the number of vehicles we currently have in the fleet is 17 battery electric and

seven plug-in hybrids, so 24 currently. This action plan was announced earlier this year, and that has really sparked the interest, as the minister said. So we are right at the start of something quite large.

We do have a challenge for commercial vehicles. There really isn't anything on the market here or overseas, but I think that is something that will be coming, and it goes to something the minister said earlier about the hydrogen-electric debate. Many people have come to us and said that they can see hydrogen as being bigger in the commercial transport and electric more in the passenger fleet. There are also plenty who say it will be all electric and plenty who say it will be all hydrogen. I think commercial will be an area where we need to work both with manufacturers and across government, because some of those are big orders, and they're big bespoke orders too.

Senator KIM CARR: I have a few questions. The Australian Capital Territory is unique. You've mentioned already that its socioeconomic standing is unique. Geographically it's unique. It's not just the fact that it's small. In fact, you compared yourself to a local government. That puts it in a different category. I take it, then, that your policy approach is different to how it would apply to other jurisdictions. Would you agree?

Mr Rattenbury: Yes and no. I think there are elements of our policy approach that could be easily replicated by the New South Wales government or the federal government as it touches on things like the fleet procurement. I guess the advantage we have from having state and local government rolled into one is that we've also been able to deal with the planning issues very easily. For example, if the New South Wales government wanted to take this approach, the local governments would tend to have to apply it, so you would get a patchwork effect. But we certainly think quite a few of the elements of our approach are replicable by other jurisdictions.

Senator KIM CARR: What have you done in terms of your assessment on the investment costs and benefits of the program?

Mr Rutledge: We're working through the final numbers on that. I think this is more of a leadership position than a straight financial position, because we see the benefits on the emissions side and the leadership side and also in sending a signal to the market and then, three years down the track, having a fleet of second-hand vehicles.

Senator KIM CARR: Wouldn't you have done a cost-benefit analysis before introducing a policy like this?

Mr Rutledge: We looked at the costs. We saw the benefits as broader than that. So, no, we haven't done a strict cost-benefit analysis.

Senator KIM CARR: What about the charging infrastructure? Have you done a cost analysis on the charging infrastructure?

Mr Rutledge: Charging infrastructure's incredibly interesting. The government has committed to put in 50 charging points this financial year, but also ActewAGL, our local energy retailer, will be launching, I think, their 12th charging station on Monday. They've done that themselves. Tesla also have a number of charging points that they've built. They've made commercial arrangements with different retailers and apartment blocks across the city. We've had a number of conversations with NRMA. NRMA has a large commitment.

Senator KIM CARR: Do you have a cost analysis on that?

Mr Rutledge: The costs of the ACT government's charging stations?

Senator KIM CARR: Yes.

Mr Rutledge: We'll put in 50, and we expect it to cost us around—

Senator KIM CARR: What's the cost of that?

Mr Rutledge: \$450,000.

Senator KIM CARR: Thank you. Have you any preference for local content in that?

Mr Rutledge: We will be going out to procurement, and all of our procurements have a local content element.

Senator KIM CARR: Australian-made?

Mr Rutledge: Not Australian made but a preference for local content.

Senator KIM CARR: What does that mean?

Mr Rutledge: It means that, when we look at procurement, we have a particular weighting for their local industry participation, which would include—

Senator KIM CARR: Does that mean Australian-made?

Mr Rutledge: It doesn't always mean Australian-made. It means local industry participation.

Senator KIM CARR: You'll have to explain that to me. If it doesn't mean Australian made, what does it mean?

Mr Rutledge: It could mean employment of local people, the training of local people or commitment to a trades course.

Senator KIM CARR: There are Australian manufacturers of charging equipment?

Mr Rutledge: Yes.

Senator KIM CARR: Have you had any preference for those?

Mr Rutledge: We haven't gone to market for those charging points yet.

Senator KIM CARR: Is that part of the policy, or not?

Mr Rutledge: It's part of the procurement considerations.

Senator KIM CARR: Is it part of the policy?

Mr Rattenbury: Not expressly, but—

Senator KIM CARR: Why not?

Mr Rattenbury: Because we are at the beginning. We are trying to learn how to do this. So, you make a very interesting point, which we will take on board.

Senator KIM CARR: I would have thought you would start with it—not learn how to do it but start with it?

Mr Rattenbury: One of the struggles we are having is that no-one else has done this. When you are at the front edge you are learning as you go and you are taking the best advice you can get.

Senator KIM CARR: I thought you said before that one of the considerations you are having is industry development?

Mr Rattenbury: I don't think I did say that. If I did—

Senator KIM CARR: I will check the *Hansard*. I thought that is what was said.

Mr Rattenbury: Well, if I did, what I was referring to is that we, as a buyer, I suppose, are trying to provide—

Senator KIM CARR: It is a procurement policy. The question of industry development is fundamental.

Mr Rattenbury: Yes. We think that in actually creating a market we will enable the industry to develop. I think that was the point I was trying to make.

Senator KIM CARR: Is there any particular measure you regard as fundamental in terms of your setting of the targets for the Australian Capital Territory? Is there any particular aspect that is more important than the other?

Mr Rattenbury: We need to make sure we get value for money. We want to hopefully provide a model and some learnings that are beneficial to other jurisdictions. They are our primary objectives, as well as cutting emissions, which I spoke of earlier.

Senator KIM CARR: If you are going to rely on a value for money argument for your procurement, will it be a whole-of-life costing or on the purchase? How will you measure value for money?

Mr Rattenbury: I think you're right about the whole-of-life point. Certainly, the up-front cost of the vehicles is higher, particularly at the moment. But we believe—and we've discussed this with Treasury—that the running costs over time will ameliorate that initial up-front cost. That's where Mr Rutledge spoke of a potentially longer leasing term. They are the sorts of things that we are just working through at the moment to finalise that cost analysis.

Senator KIM CARR: You mentioned that you've gone to a particular leasing company for the procurement of the 600 vehicles.

Mr Rattenbury: Yes.

Senator KIM CARR: Have you set any criteria there?

Mr Rattenbury: I would have to check our details. The reason we have gone to that company is that we have a standing contract with them to provide the ACT government fleet. We have now gone back to them and said, 'As our fleet provider, our contracted fleet provider, as the customer, we would now like you to add this to your repertoire.'

Senator KIM CARR: In doing that, have you said you want so many hydrogen vehicles and so many—

Mr Rutledge: No. We haven't done that. The number of vehicles available is so small and it is new to the fleet provider, as well. We have gone to the fleet provider in the first instance because, as the minister said, we're

contracted to that fleet provider. But we're not 100 per cent committed to staying with that. If our current fleet provider cannot deliver what we're asking for then we will have to go outside of that.

Senator KIM CARR: Have you asked for a cost. Do you have a price cap on terms of vehicles to be provided?

Mr Rutledge: No. We don't have a price cap. We're asking them to do the pricing, and we will make a decision.

Senator KIM CARR: You must have, surely? You have given me a figure of \$450—

Mr Rutledge: \$450 is for charging infrastructure to support a fleet—

Senator KIM CARR: So, that's a separate tendering arrangement?

Mr Rutledge: Correct.

Senator KIM CARR: In terms of the vehicles, you have no price cap?

Mr Rutledge: We're looking for pricing now. Because the pricing of the vehicles is whole-of-life leasing costs, obviously if we lease over five years the price point is—

Senator KIM CARR: Sure.

Mr Rutledge: We haven't come to those—

Senator KIM CARR: If you were buying any other vehicle, there would be a limit.

Mr Rutledge: At the moment, the standard is a three-year leasing cost.

Senator KIM CARR: I understand that. But any other vehicle purchase is based in a range of prices. Why is it any different for electric, notwithstanding that you will assume that the price of electric is substantially higher than conventional vehicles?

Mr Rattenbury: Not necessarily. At the moment, as you are probably aware, I think there are four vehicles available. That's four models, literally. Two of them are Tesla, the BMWi-something and the Nissan Leaf. However, we understand that in the next several months Hyundai will bring two new vehicles into the Australian market, the Ioniq and the Kona, both of which are under \$50,000. So you are starting to see—

Senator KIM CARR: Minister, that is my point: if you're saying you want a vehicle for less than \$50,000, you're imposing a price cap?

Mr Rattenbury: Yes, the government certainly has an expectation that we're not going to suddenly have a fleet of Teslas. That is very clear.

Senator KIM CARR: I'm pleased to hear that. What do they run at—about \$187,000?

Mr Rattenbury: Something like that. We have no expectation. You see the government vehicles around and they are standard vehicles. We are looking to find vehicles on that basis—

Senator KIM CARR: They are about \$30,000 and less—\$25,000, \$20,000—particularly at a commercial rate.

Mr Rattenbury: Potentially, yes.

Senator KIM CARR: At a fleet sales rate, you would probably get a basic Toyota for \$20,000, I would have thought. That's your contrast.

Mr Rattenbury: It depends on your vehicle, but yes.

Senator KIM CARR: I'm talking about a car for a middle-level public servant to run around in. That's what you're providing here. You're not providing it for your off-road vehicles. You're not providing it for your forest services, for instance. You're not providing it for your ambulances. It is only for your basic public service provision. That's right?

Mr Rattenbury: Correct. Yes.

Senator KIM CARR: It's the very light passenger vehicle?

Mr Rattenbury: Yes.

Senator KIM CARR: They're very, very inexpensive vehicles on the Australian market. That's your contrast, surely?

Mr Rattenbury: Yes, it is. That's where we have to strive to get value for money. So, in putting a proposal out there, we are now seeking to draw into Australia, or from within Australia, vehicles that are a lower cost.

Senator KIM CARR: Right. In that context, if you're going to talk about value for money, you're entitled to talk about whole-of-life costing, and there might well be other factors, particularly if you're going to pay a fair bit more. There's quite a substantial premium on any of those vehicles, even for the Nissan Leaf and the others. There's still a substantial premium in terms of local content. Would you agree?

Mr Rattenbury: I'm sorry; I don't quite understand where you're going with the question.

Senator KIM CARR: I'm saying that the premium may well be justified if there's local content.

Mr Rattenbury: Indeed. I would love to buy a vehicle manufactured in Australia.

Senator KIM CARR: You've got to do something about that. Your job as a minister in a government is to actually do something about that, not just wish for it. That's my point. In the policy direction you're setting, the question of industry development has to be a central component. Wouldn't you agree?

Mr Rattenbury: Not necessarily, in the sense that, as the smallest government in Australia, we feel we probably have less ability to influence that. We are trying to do the things we can within our powers. I'd love to see the federal government take on a policy—

Senator KIM CARR: I would agree entirely with you. But the problem you've got is that every government seems to take that attitude. I've seen the ministers in the Queensland government argue the same point: our responsibility is not to take it up; it's someone else's responsibility.

Mr Rattenbury: I would make the point that, if there is a manufacturer in Australia, they now know there is an order available for 600 vehicles. I think that is a leadership position and I think that is encouraging local content.

Senator KIM CARR: It might be 600 over five years.

Mr Rattenbury: Three. Three to four—

Senator KIM CARR: It may well be five.

Mr Rattenbury: Yes, something like that.

Senator KIM CARR: That's right. How many vehicles did you say had been registered in the Australian Capital Territory?

Mr Rattenbury: It is under 300. Last time I looked it was 278.

Senator KIM CARR: How many vehicles in total are registered in the Australian Capital Territory?

Mr Rattenbury: There are about 250,000.

Senator KIM CARR: How long do you think it will take to replace the entire private fleet in the Australian Capital Territory?

Mr Rattenbury: Fifteen, 20 years.

Senator KIM CARR: That's the point, isn't it?

CHAIR: Senator Carr, I think we need to move on. Rex?

Senator PATRICK: I just want to ask a couple of questions. You said in your submission that you would like the Commonwealth government to also support a zero emissions vehicle fleet strategy. Have you actually formally asked the government? Have you been engaged in conversations? Can you give us details around that, please.

Mr Rattenbury: Yes, I have spoken to Josh Frydenberg, who is the federal minister in that space. The first contact we had was in conversations at the NEG negotiations, where I tried to talk to him about this issue as well.

Senator PATRICK: Has he been receptive to your advances?

Mr Rattenbury: To be honest, I think Minister Frydenberg has got a lot else on his plate at the moment, so I don't know that he's entirely focused on it. But we had a good conversation about it, and I think he understood the point we were making.

Senator PATRICK: This question goes to what Senator Carr was talking about. You stated in your submission there could be manufacturing or assembly of electric vehicles, research and development, vehicle servicing, grid integration, et cetera. I'm presuming, on the basis of the answers you provided to Senator Carr, that that's an idea, not something you're actually pursuing.

Mr Rattenbury: Even the purchase of two buses has led us to have to retrain a number of our—it is a government owned, run and maintained bus fleet. So, we've worked with our vehicle mechanics and we've learnt

a lot from that. I think, with a greater investment, I can see—in the first instance, at least—ongoing trade training happening in our city for both the bus fleet and also vehicle repairs.

Senator PATRICK: That is very localised—

Mr Rattenbury: Very localised.

Senator PATRICK: so you're not—if you'll excuse the pun—driving anything here, from a national perspective? You're not trying to put pressure on, talking with other governments, about how that might be achieved. There's a lot of industry in South Australia and Victoria. There's no-one discussing options about how this whole thing might be approached in an integrated manner?

Mr Rattenbury: I got off this point before—but we are a member of the Climate Action Roundtable, which has a number of state and territory governments on it. Through that, there is an MOU to work together on these issues. We are having those informal conversations with other jurisdictions. I guess we liken it to the approach we took on large-scale reverse auctions for renewable energy, where, in going out and buying in the marketplace, we've now had a number of companies established in the ACT. We've got several companies that have headquartered their wind operations in Canberra city, and they are controlling vast quantities of renewable energy, both across Australia and internationally. We've now got a training course at CIT in how to work on wind farms—

Senator PATRICK: Sorry—I was referring to the vehicle industry.

Mr Rattenbury: Yes. I was just drawing a parallel.

Senator PATRICK: Sure.

Mr Rattenbury: That's what we've been able to do in the renewable sector, and so we think that driving a similar approach, by getting started, we'll actually get something moving. At the moment, it's not a very active landscape.

Senator DAVID SMITH: You may not be aware that we've had submissions to this inquiry saying that, I think, the South Australian government is trialling a couple of locally manufactured electric buses. So, it might be worth the ACT government's while considering some of those opportunities, in terms of locally manufactured—

Senator PATRICK: I love it when you support South Australian companies.

Mr Rattenbury: We'll invite them to, as well, yes. Thanks.

CHAIR: Thank you.

PREST, Dr James, Senior Lecturer, College of Law; and Member, Energy Change Institute, Australian National University

STOCKS, Dr Matthew, Research Fellow, College of Engineering and Computer Science, Australian National University

[09:17]

CHAIR: I now welcome Dr Matthew Stocks and Dr James Prest from the Australian National University. Information on parliamentary privilege and the protection of witnesses and the giving of evidence to Senate committees has been provided to you. Dr Stocks has lodged submission No. 108 with the committee. Would you like to make any amendments or additions to that submission?

Dr Stocks: No, that's fine.

CHAIR: Dr Prest has lodged submission No. 101 with the committee. Would you like to make any amendments or additions to that submission?

Dr Prest: No amendments, thank you.

CHAIR: I now invite you to make a short opening statement, and, at the conclusion of your remarks, I will invite members of the committee to ask questions.

Dr Stocks: Our submission primarily has a technology focus, and that's the interest that our group has had in terms of the research and work we have been doing in that space. There's a general inevitability to electric vehicles arriving in the fleet. If we look at our transport emissions, Australia's emissions have increased by about 60 per cent since 1990. If we look at 2005 as the benchmark, it's been about 20 per cent. So, if we're going to do anything, in terms of achieving Paris targets, to share distribution of emission reductions across the various sectors, we're looking at, at least, a 50 per cent improvement in emissions in the transport sector. It's very hard to see that occurring in any other sector other than electric vehicles.

There have been various arguments around whether or not electric vehicles really do deliver those emissions savings, in terms of the fuel source they're coming from, the electricity production. One of the nice things, potentially, from the NEG going through is that it puts a ceiling cap on emissions from the electricity sector, so any shifting of demand from the vehicle sector into the electrical sector needs to be met by clean energy sources, and therefore the emissions benefits are expected to be a total emission reduction from electric vehicles, moving from petrol-driven through to the electric vehicle fleet.

The scale of the change—I think there was commentary earlier around a question on how quickly this could occur. Changes in transport are amazingly quick when they want to be. There's a wonderful photo of New York in 1900 and New York in 1913. When you look at the first photo, you ask: where's the car? There's a single car on Fifth Avenue. Then you look at the photo in 1913, and the game is: spot the horse. So change can occur quickly, but we do have to recognise that fleets are predominantly privately owned and that there is going to be a transition period that is going to take decades or more, simply because of the time it takes for a new vehicle to reach end of life. So, I think, there is a need to start to set that trajectory sooner rather than later, and, in our view, setting emissions standards is the key driver that the federal government can use to try and drive that transition.

There are clearly other benefits, from not just an emissions point of view but a pollution point of view. NO_x, benzene, particulate matter are all much, much lower from electric vehicles than they are from ICEs. There is lower noise pollution and much less environmental waste, in that there is no need for maintenance, in terms of oil, brake pads, air filters, fuel filters—all of those sorts of aspects. The environmental benefits extend well beyond emissions.

Economically, once capital costs come down, then the running costs are lower. This is one of the primary reasons we need federal leadership around emissions standards. The work that was done around setting emissions standards for appliances has just really started to flow through now. You are seeing a reduction in electricity use through the setting of standards through the eighties and nineties, and gradually, as the entire appliance fleet has changed over, over that period of time, we are seeing energy use in those sorts of areas being much lower.

One of the challenges we have is that customers are not good at recognising running costs as distinct from capital costs. We're very good at looking at, 'This vehicle is \$20,000 versus \$25,000.' We find it harder to go, 'What does that 10 per cent in running costs mean to me over the life of the vehicle?' It's one of the areas that the federal government can provide leadership around, helping drive towards that lower entire cycle. There are negatives. There is going to be changes in the employment mix. So, as I said, maintenance-wise there is going to be much less need for maintenance on electric vehicles, compared to conventional ones, so there's definitely going to be a need to look at how to transition those people out of those industries.

A lot of our interest is around infrastructure. This is where things like the ACT government and potentially the federal government looking at trying to shift their fleets to electric vehicles is going to be important, not so much to drive down the cost of the vehicles but to understand the implications from an infrastructure perspective of changing those fleets over. The need for charging infrastructure and how we go about charging the vehicles has a huge impact on how we will change the electricity sector to support this. If everyone goes home and charges their vehicle when they pop home at five o'clock on a fast charger, there is no question the grid is going to break. Whereas if we can be much more clever about our charging and distribute it across the day and at times of low energy use then it will be beneficial and reduce network costs, because we can use the network much more efficiently. To learn those things means we need to have a certain number of electric vehicles moving around and being tested, and government probably best placed to do this. The ACT government and also the potentially the federal and state governments are moving into that space for the learning opportunities. That's a high-level summary of what we covered off in our submission.

Dr Prest: My submission focuses on the legal aspects and the opportunities for legislation by federal parliament and an attempt to clarify the discussions, so we're focusing on matters of Commonwealth responsibility. So, for example, on page 4 of my submission I set out areas where it is clearly the responsibility of state and territory governments. That's under the heading of 'State, territory and local laws'. I set out some of the basics, which you obviously would be well familiar with, about heads of power that could be used by the parliament here to legislate with respect to electric vehicles.

Let me just take you to an overview of my submission first. For the benefit of the committee, I provided in the appendices a number of international examples, by way of comparison, to show what is happening in other countries. I provided a brief overview of some of the incentives in other nations. For example, there is an appendix, 'Overview of tax incentives for electric vehicles in the EU by country'. That's at page 15 onwards. That sets out examples of how the tax mechanisms have been used throughout the 27 EU countries to address questions of zero emission vehicles.

That's one of my main intentions in the submission. I also talk about Australia acting on the question of vehicle emissions and the transport sector. It does have national security implications as well. As you would be well aware, there has been a conversation about Australia's noncompliance with the charter of the International Energy Agency in terms of our obligation to keep stocks of liquid fuel reserves. We have been non-compliant for several years in relation to our obligation to other members of the IEA to keep those fuel reserves. So, obviously, a move to electric vehicles is assisting Australia to become more independent of international shocks that might occur within the liquid fuel supply. That, in a sense, is clearly a federal responsibility. In my submission, I call for federal leadership and that is one basis for that.

On page 3, I refer to emissions responsibilities under international climate law. Clearly, if we are to reach our targets under the Paris agreement, we are going to need to look at how we decarbonise in the transport sector. In 2023, a global stocktake is scheduled to take place under the Paris agreement. If we are not prepared for the likelihood that other countries will raise the bar in terms of emissions reduction ambition, we will then be caught behind that international pressure to lift our game in terms of emissions reduction. Also, one of the bases for legislation is to meet our international obligations under climate. First of all, obviously, the use of the corporations power would be a basis for enacting legislation generally in relation to electric vehicles.

On page 5, in an attempt to focus the debate, I set out nine particular areas for federal leadership on electric vehicles. I will quickly go through them. The first is setting national targets. That may be in either policy or legislation. I recommend short-, medium- and long-term targets. Those targets don't necessarily have to be tied to a particular policy mechanism; they could just give a clear direction to the market and an expectation to international investors about where Australia is hoping to go to. The second—and I think Matt has already mentioned this—is the question of emissions standards for conventional vehicles and the taxation position of conventional vehicles. That obviously has an implication for electric vehicles. So that is another area for federal leadership.

And then there is the tax treatment of electric vehicles. I have said in my submission that that is one of the main levers of policy for the federal parliament. In order to clarify discussion, I have set out on page 7 a table which gives a list of these policy instruments and attempts to set out who is most likely to be responsible—which level of government. You can see that I have ticked the areas where the federal parliament could take legislative action to create a policy environment to accelerate the uptake of electric vehicles.

If you want this sector of industry to go ahead, the aim is to introduce some policy mechanisms which will accelerate mass market volume. And then, at some later stage, you can look at narrowing down the availability of those mechanisms and phasing them out. But, if you want to accelerate the uptake of EVs, there is a case for

policy intervention and legislative intervention in what you might describe as the market. In terms of saying there is a free market approach, clearly there are already some tax incentives for conventional vehicles and tax exemptions for conventional fuels. Some of those obviously have a rationale in terms of providing cheaper diesel fuel to the primary producers of Australia. But in this broader context I think we need to review as a whole whether it is appropriate to be providing cheap fossil fuel vehicles to people to, for example, minimise their income tax under salary sacrifice arrangements.

CHAIR: Thank you. Dr Stocks, I thought your discussion of charging infrastructure was quite interesting in terms of your concerns and also the positives that could come out of that. Could you speak a bit more to that?

Dr Stocks: One of the things that we're going to see within this change is that we are now going to start to stress the electricity system. To change the entire transport fleet from ICE vehicles to electric vehicles is probably in the order of a one-third increase in Australia's electricity demand, so it is a very significant step up. However, how charging is going to occur is still an open question. There is range anxiety, and people are saying we need really fast chargers so that you can charge five, 10 or 15 minutes—whatever the magic number is that looks like petrol. But, for a lot of use, that isn't actually needed. Most trips are only in the order of 15 to 20 kilometres and, really, all that vehicles need is a top-up. So there is a tension at the moment around how we get electric vehicles popular—and that is range anxiety, and that needs fast chargers. But, if everyone has a fast charger sitting at home and they come home at 5 o'clock and plug in their vehicle, the grid will break; there is no question that that is not going to work. So I think there is an opportunity for people to start to put in significant heavy distributions of electric vehicles—and the government fleet is a great example of that—where they can actually see where those problems are going to occur and start to help industry recognise where those problems are and work out what the regulations and incentives need to be in order for that to be a net positive where we are using the network positively rather than a net negative.

CHAIR: If most people are taking short trips and they are just topping up, why would we think the system is going to break? Effectively, if they are using a fast charger, they will just be topping up.

Dr Stocks: We have done the calculations assuming that everyone in Sydney has their driving patterns. New South Wales has wonderful data around travel times, travel distances et cetera. If you take that information and assume that everyone charges as soon as they get home—if you have it you like to just plug it in and forget about it—then the peak demand in the early evening will be at least double and probably more like triple. There are significant stresses associated with uncontrolled electric vehicle charging because we are increasing demand by one-third. We can be clever about when that energy is being used. We can switch it into times of energy excess or low-demand times. The existing network is a very expensive part of our current bill because we anticipated that demand was going to keep increasing through the last decade, and so we overbuilt the network to account for that and, therefore, our network costs have gone up. So we want to try and make sure that this transition occurs in such a way that the existing infrastructure can manage that transition as much as possible; and, until we start to see the stresses in the system, it is very hard for planners to go, 'I really need to make sure that we do this,' or 'We need to make sure that this regulation is in place to make sure people are incentivised to behave in a different fashion.'

Senator PATRICK: So you are saying: work with the engineers, not the politicians?

Dr Stocks: No. The engineers can do it; it is actually the social science side of it that is going to be the challenge. How do we make sure that people are incentivised to do the right thing? Technology? I can program that tomorrow.

Senator PATRICK: But you can have a car that you can plug in that doesn't actually start charging until the right time, that starts charging at an optimal time.

Dr Stocks: But I need a customer to say, 'That's what I want,' or 'That's what I need.' Regulations and incentives are the two tools that you can use so that the customer goes, 'I can recognise that there is a need to behave differently.'

Senator PATRICK: I think one of the Nissan options you mentioned in your submission was to charge back into the network. I would have thought that with Tesla wall banks and other such products, in some sense, you are taking something that is not quite optimised for that to do a task that something else that is optimised for it can do.

Dr Stocks: It is an open question. There are two sides at the moment. Tesla is taking the view that an electric vehicle battery is an electric vehicle battery and nothing else. Nissan are taking a different view—that that battery has potentially more use. One of the aspects of network costs is that what we are paying for is not the average electricity use; we are paying for the peaks. When the electricity system is stressed, that is when we need to upgrade transformers and make more build. There is an open question that still needs to be decided: is it a net

good thing to have electric vehicles helping to meet those peaks and can we reward customs enough that it actually makes sense?

Senator PATRICK: You said that all these lithium ion batteries that perhaps don't last the life of a car—it depends on what the life of a car is—get shipped off to South Korea for disposal. That is throwing the problem away. What does that involve?

Dr Stocks: I wouldn't be looking at it quite the same way in a decade's time. That is talking about where we are today. Electric vehicle range is important. Electric vehicles have a more limited battery life than stationary energy. As battery capacity decreases, you are likely to say: 'I don't want this battery anymore; I want a new one.' That battery still has a significant life potentially for other applications like replacing a Tesla Powerwall in stationary energy, where I don't actually care if I put in another three batteries—instead of putting in 10, I put in 13—because there is no real space cost. So I suspect that a lot will go into re-use rather than recycling, to begin with. Once we get to a point—

Senator PATRICK: But this will be a cell with a particular form, shape, size and capacity optimised for the vehicle, I would have thought—and you are taking that and—

Dr Stocks: Yes. People are very clever at recognising where there is an asset that has value. Re-use is a preference ahead of recycling—every day. If there is a large enough market and people can see the opportunity, they will go: 'Okay, how do I reconfigure this battery to this?' The fundamental piece of a car battery and any other battery is the same little cell. There is no difference across all these lithium ion batteries; they come in a standard form, factor and what have you. So it is more a question of how I get that into the use I want.

Senator PATRICK: But, going to the question of disposal, it is like tyres: landfill is about the only option. Can you dismantle the lithium iron battery and find other uses for it? Are we creating another problem?

Dr Stocks: No. Once we reach the end of that life, the lithium and cobalt and those materials have significant value and then you would go through a recycling process. As to whether that is in Australia or overseas, my crystal ball is not good enough for 10 years. Probably, it depends a bit on the decisions that you make around encouraging where that sort of industry has to occur.

Senator PATRICK: Obviously you are factoring in and considering things like loads on the NEM. Are you aware of the ESB taking submissions in relation to the prospect of electric vehicles being far more common into the future?

Dr Stocks: There is a lot of work going on with the ESB, AEMO and various of the local providers—Evoenergy. There are a whole variety of organisations who do realise that electric vehicles are coming and there is going to be change.

Senator PATRICK: Would you say it has been designed into the NEG? Or is it not significant enough at this point in time to make sense?

Dr Stocks: The NEG, to a large extent, is doing two things. One is to set an emissions cap. If there is a need for more demand, electricity providers have to meet that demand and they have to recognise the carbon emission implications of that. There is also a reliability requirement within that. So AEMO will be monitoring how energy demand and energy supply change over time and they can then send out a signal to say: 'Do we or do we not have enough dispatchable power to ensure that the system is reliable?' The comments I made earlier around how that charging occurs are important. People like AEMO are recognising that that is coming and that, if you use that charging in a reasonable fashion, we can have lower network costs and, if it is unreasonable, we might have higher costs. So people are certainly aware of that and see it coming.

Senator RICE: I want to ask you a follow-up question in terms of the interaction of the NEG and the demand under the NEM. You are saying that, if we had electric vehicles having a 30 per cent increase in our electricity demand, because there is a carbon cap under the NEG, that would effectively mean that all of that extra demand would then have to be met by zero carbon electricity?

Dr Stocks: In my understanding, that is the way the legislation is written, yes.

Senator DAVID SMITH: Dr Stocks, what opportunities do you see for local research and possible advanced manufacturing in the electric and autonomous vehicle space, noting that there's a proud history in some associated technologies with organisations such as Seeing Machines? What sort of report would you like to see from both local and Australian governments to potentially support research and industry development here in the local region?

Dr Stocks: There are certainly opportunities to recognise that this is one of the core areas in which Australia has a need for change and development. Setting transport and the changes needed in transport as part of our

research priorities would be an important part of setting that. I think that, in general, continued federal government support around research and development so that the ARC continues to be strongly supported in terms of research activities within the universities and places like ARENA to ensure that they're able to continue to support the changes that are needed—obviously, from a financing point of view, I think the Clean Energy Finance Corporation is available to support clean technologies, and I think electric vehicles fit under their remit. So I think all of those areas can continue to be supported and have the potential to grow if we want to see more activities in those areas.

Dr Prest: Senator Smith, do you mind if I chime in briefly? Over the years, we've had this tax treatment for the Australian film industry. For example, you could have a tax incentive for EV- and zero-emission-vehicle-related activities, so an R&D incentive.

Senator KIM CARR: Dr Stocks, you were formerly the AutoCRC for Accelerate Australia?

Dr Stocks: We undertook some work for the AutoCRC.

Senator KIM CARR: Is this is submission from the AutoCRC?

Dr Stocks: No. The milestone submissions were made toward the AutoCRC.

Senator KIM CARR: Have they endorsed this submission?

Dr Stocks: We did not request them to endorse it. The AutoCRC has—

Senator KIM CARR: No, but the people associated with it. You did the research for who, then?

Dr Stocks: The AutoCRC was concluded, I think, in 2017.

Senator KIM CARR: So it's wound up?

Dr Stocks: It's wound up.

Senator KIM CARR: I see. So you're saying that, in your modelling, the uptake of the electric vehicles will lead to a one-third increase?

Dr Stocks: To move all of land transport, so across heavy commercial vehicles. Commercial and light passenger vehicles are about 20 per cent, and another 13 per cent is to do with rail and heavy transport.

Senator KIM CARR: That's where you get the one-third from, is it?

Dr Stocks: Yes.

Senator KIM CARR: That's all vehicles?

Dr Stocks: All land transport.

Senator KIM CARR: Right. Your submission says there are 18 million vehicles registered at the moment. Is that right?

Dr Stocks: Yes.

Senator KIM CARR: Okay. I just checked the ABS website. It's probably 19 million plus now. How long do you think it will take to move Australia's 19 million vehicles given the average age of a vehicle is 10 years. That means at least 50 per cent of our road fleet is in excess of 10 years old. In your assessment, how long will it take to move all of that?

Dr Stocks: That depends very much on the assumptions you make about when the transition starts, but I would be very much in line with what the ACT government said in the previous one. I would suggest 2040 is, on current trajectories, roughly where you'd be looking at it. I would be expecting in the late 2020s that, on a whole cost of—

Senator KIM CARR: The late 2020s?

Dr Stocks: No, I was going through. I expect that in the late 2020s we will see a transition to more than half of the passenger vehicles sold being electric vehicles simply based on trajectories for batteries and the cost of ownership. And then you're looking at something like that 10-year time horizon to shift the fleet as vehicles age.

Senator KIM CARR: So people will be buying conventional vehicles for the next, what, 15 or 20 years?

Dr Stocks: No. That's how long it will take to get rid of the existing stock. I would suggest that, by about 2030—

Senator KIM CARR: there won't be any more conventional vehicles.

Dr Stocks: I would suggest that the numbers will be very low.

Senator KIM CARR: I see. What the FCAI are saying to us is that the international developments in electric vehicle technology and production indicate that the new technologies are unlikely to reach price parity with

conventional internal combustion engines until the mid-to-late 2020s. Would you regard that as a significant factor?

Dr Stocks: Yes. I think that, once you hit price parity, the pendulum will swing very heavily towards electric vehicles.

Senator KIM CARR: But that's not till the mid-to-late 20s. That's, of course, when you get range parity and solid-state battery technology.

Dr Stocks: I think this is entirely consistent with the number that I suggested.

Senator KIM CARR: Yes. I want to be clear what that means, particularly with regard to the Chinese fleet. Would you agree?

Dr Stocks: China's an interesting one because they have different drivers. They can see their pollution. So I expect that in China change will occur much more rapidly than in Australia, where we don't really have the same health impacts of particulates. If you talk to anyone about emissions in China and they don't talk about greenhouse gases, they talk about what they can see. So there's a much more direct impact and a need for change.

Senator KIM CARR: It is a much more serious problem, if you live, for example, Beijing.

Dr Stocks: It is a much more immediate, detectible problem.

Senator KIM CARR: Okay. You say a one-third increase in terms of our electricity system that will be required to meet that demand will be met by the NEG. Is that what you're saying?

Dr Stocks: What I'm saying is that it is reasonable to assume that the emissions from those vehicles are going to be zero net emission because there is going to be a need to increase the electricity supply from low-carbon-emission sources because there is a ceiling for electricity emissions set for the NEG in which, even if electricity demand increases, the level of emissions is capped.

Senator KIM CARR: I see. It's just that I understood that the modelling for the NEG did not see any new generation capacity.

Dr Stocks: No, it didn't. I wouldn't suggest that the modelling for the NEG is an exemplary example of applied policy.

Senator KIM CARR: I just wanted to follow your line of logic through. There's no generation capacity on that proposition from any source?

Dr Stocks: Sorry, there is. Rooftop solar is the only new generation assumed post-2021 in that modelling.

Senator PATRICK: There were a number of sites that were mentioned as being underway in that document of the Commonwealth. It was actually within the modelling.

Dr Stocks: There are assumptions through to 2021 that occur under the current policy framework in terms of new wind and solar farms entering.

Senator PATRICK: But they listed about 20 or 30 of them, actually.

Dr Stocks: Yes, and, if you look on the Clean Energy Regulator's website, there's 8,400 megawatts of new build expected by 2021 and then zero from 2021 to 2030. I just struggle to believe how—

Senator KIM CARR: This is the point. Under this proposition, you get this massive expansion in demand but no new capacity poured into the system.

Dr Stocks: The assumptions on demand there is a weak scenario. The expectation is that demand will be flat to 2030 for the NEG modelling.

Senator KIM CARR: Okay. I just wanted to clarify that. With regard to the battery technology itself from your submission—I do thank you for the submission; it is very detailed in terms of the technology we know about at the moment—you're saying 10,000 charges is about the life of a battery?

Dr Stocks: That's a typical life.

Senator KIM CARR: That's what's expected at the moment? That's what is believed? Because it's not really known, is it?

Dr Stocks: There are reasonable numbers around understanding the life now. I would suggest that the 10,000 number—

Senator KIM CARR: But it's still guesswork. Tell me: does the 10,000 figure include slow charge or fast charge?

Dr Stocks: Yes, there is a dynamic there. One of the aspects is that vehicle manufacturers will respond to customer need there. They will adjust the ability to fast-charge or slow-charge depending on what warranty—

Senator KIM CARR: That's my point. We don't know. And we don't know about the guarantees, because they vary from country to country.

Dr Stocks: Yes.

Senator KIM CARR: That's why local capacity is quite important in terms of protecting consumers, protecting Australians to make sure we understand these things in terms of our local capacities. Would you agree?

Dr Stocks: Unfortunately, I think this is stepping outside my expertise.

Senator KIM CARR: Okay. You have provided us with a lot of information about what you say is your expertise in terms of battery life.

Dr Stocks: From a technology perspective, not from a—

Senator KIM CARR: I think you made the point that we don't know. We don't know what the life of the battery is at this point. For instance, if it's rapid charge, what's the battery life?

Dr Stocks: I think it still is the case that manufacturers will warrant for a certain period, and so, if you look at Tesla's warranties, for example, they do have a guarantee for a certain period of time, and I believe the company would stand behind their warranty if they then found that that life was not met.

Senator KIM CARR: It goes to the value of the vehicle. It goes to a whole series of measures, doesn't it?

Dr Stocks: Yes.

Senator KIM CARR: It's not a simple matter, though, is it? Battery is probably the most important component of an electric vehicle.

Dr Stocks: It would be the highest-capital component and probably the highest-risk component.

Senator KIM CARR: I didn't see much on depreciation in your modelling. What's your view on depreciation?

Dr Stocks: At the moment, depreciation is very, very high on electric vehicles because there's a high perceived risk.

Senator KIM CARR: Does that affect the cost and the value in terms of whole-of-life costings?

Dr Stocks: It all depends on which person gets the benefit. The person who buys a cheaper depreciated car with the whole-of-life—

Senator KIM CARR: We've already discussed this factor. There are nearly 20 million vehicles on the road at the moment. The people that own them have quite a big interest in the value of those vehicles. That goes to the issue about how quickly you turn them over. That's why they're over 10 years old. It goes to the question of how much you can afford. It goes to your income. It goes to all the social questions around these issues, doesn't it? It's not simply a technology matter; would you agree?

Dr Stocks: Yes. The entire economics of vehicle purchasing is a tremendous amount of social science as much as there is technology associated with that.

CHAIR: I think I have to let Senator Rice have a question.

Senator RICE: Thank you both for your very informative submissions. Dr Prest, I will start with you. You go through a range of initiatives that the federal government in particular could undertake in order to encourage the uptake of electric vehicles. You comment, in looking at the tax incentives, that in the EU the review of the tax incentives for EVs in the EU show that all except three member nations out of 28 offer a range of tax exemptions or grants. You've obviously done the international comparison. How does Australia's current range of very limited incentives compare with other developed countries'?

Dr Prest: As far as federal tax measures to encourage or accelerate uptake of EVs, I would say there aren't any that are specifically tailored to zero-emission vehicles. So, yes, we're out of step with what's happening in the EU.

Senator RICE: And in other developed countries around the world?

Dr Prest: Here we need to draw the distinction between legislative measures and policy measures that may be introduced without legislation, but I think most of the provisions in tax in the EU would be based in legislation.

Senator RICE: And they're all things for which the federal government could have policy change.

Dr Prest: I suggest, if the committee wants to delve into that further, to directly contact the EU delegation or individual member country representatives who would give you a more direct provision. My information's come mainly from the European Automobile Manufacturers Association. That's readily available on the internet.

Senator RICE: Terrific. Thank you. In your very useful table of legal and policy instruments by level of government, I couldn't see vehicle emission standards there, yet both of you have mentioned that vehicle emission standards are key?

Dr Prest: Yes. I suppose I was taking a slightly pragmatic approach that I don't see tighter vehicle emission standards being introduced federally in the near future. While somebody might make a normative statement that, yes, they should be, I was really working with the context that I thought was directly related to EVs rather than indirectly related. So, yes, the whole context of pollution-control standards can drive the uptake of EVs. If you look at the example of California, I think clearly their provisions relating to air pollution and auto standards led to development of the EV sector in California over a number of years.

Senator RICE: Dr Stocks, you also talked about the importance of vehicle emission standards in supporting EVs. How important do you see them as being?

Dr Stocks: I think it's the big picture lever that sets direction. If we have a desire to make Paris targets, then we have to start about how that fleet is transitioning. We've had conversations that the fleet doesn't transition overnight; it takes pretty much from now until 2030. If 100 per cent of new sales were electric vehicles today, it would be something like 90 per cent in 2030. If there isn't some big picture direction that says, 'This is where we want to move emissions', then it's very hard for there to be a drive for manufacturers to make change.

Senator RICE: If, as you think is going to be the case, Dr Prest, we're not going to have vehicle emission standards in the near future, how much is that going to hold us back?

Dr Prest: I think there's a range of interventions that you can make, and some would be regulatory, to direct that. For example, I've mentioned in my submission that there are a number of nations that have proposed to phase out conventional fuel vehicles. That's already happening around the world, particularly in Europe. That is an indication of the policy directions set in those nations. That is obviously a regulatory approach. They say, they won't allow fossil fuel vehicles to be sold in the future, for example, after 2040, and they make that policy decision now. I do set out some information about that in my submission.

It is possible to have both policy mechanisms operating at the same time—a regulatory approach plus an incentive. A regulatory approach relating to fossil fuel vehicles and a range of incentives relating to electric vehicles. Or the parliament might elect to just go with some incentives and other federal legislative action. I've set out nine different areas there for federal legislation relating to electric vehicles. I might just go to one, if that's okay. Just a clarification: some of these areas have uncertainties and question marks, and where there's legislative uncertainty it makes companies reluctant to invest. In terms of electric vehicle charging infrastructure, the National Electricity Rules make it unclear about whether, if a DNSP distribution company were to provide electric vehicle charging points and then sell that charging, for example, at \$2 per charge, this would mean that they would need an exemption from acting as a retailer. There are those kinds of questions where perhaps the technology is moving ahead faster than the National Electricity Rules. There may be a need for an amendment or provision of the rules relating to, say, the ring-fencing requirements which, for various good reasons, attempt to prevent market control by vertically integrated oligopolies.

Senator RICE: So you think that there's a strong need for governments to focus and get the regulations aligned with supporting electric vehicle manufacturers?

Dr Prest: My overall take-home point here is that, if we look at international comparisons, Australia's policy direction and legislative direction to the market, as far as the future of zero-emission vehicles, is relatively an empty space. There's not much happening. I've provided lots of examples of what could be done.

Senator RICE: Dr Stocks, your statement before was that you felt by 2030 there would be very few internal combustion vehicles being sold. How much is that going to depend upon the policy framework and the initiatives that are being put in place over the next couple of years?

Dr Stocks: Clearly, you can put up barriers that slow that down, and you can put in carrots that speed things up. There are opportunities for that to be brought forward if government was wanting to be more aggressive around those targets.

Senator RICE: Do you think the suite of measures currently being proposed would absolutely enable us to have pretty much 100 per cent of new vehicle sales being electric by 2030, if we wanted to?

Dr Stocks: Yes.

Senator RICE: Thank you.

CHAIR: We must move on. Thank you very much.

Dr Stocks: Thanks for the opportunity.

JAFARI, Mr Behyad, Chief Executive Officer, Electric Vehicle Council

[10:00]

CHAIR: I now welcome Mr Jafari from the Electric Vehicle Council. Information on parliamentary privilege and the protection of witnesses and giving evidence to Senate committees has been provided to you. The council has lodged submission No. 100 with the committee. Would you like to make any amendments or additions?

Mr Jafari: No, thank you.

CHAIR: I invite you to make a short opening statement. At the conclusion of your remarks, I will invite members of committee to ask questions.

Mr Jafari: Thank you for inviting me to be here today. I will start with who we are. The Electric Vehicle Council represents a range of companies, from across Australia's economy, looking to invest in the electric vehicle market here in Australia. The companies are looking for support and guidance from government. The reason they are looking for that support and guidance from government, first, is to be clear that the electrification of road transport benefits our society. What we have seen around the world is governments recognising that every electric car on the roads means healthier people; reduced carbon emissions; increased energy security, particularly for Australia, as a country that doesn't make much petrol but does make its own electricity; reduced cost of living, because electric vehicles are cheaper to run; and, what we are here to discuss today, the very important opportunity to increase industry investment and create new jobs in the marketplace.

All of those benefits that I mentioned, are, unfortunately, benefits that a single company cannot capture on its own. We look to governments to capture those societal and macro-economic benefits and create a national policy to say they are supporting the transition from an old technology, petrol and deasil, towards a new one, electric.

That decision has been underway for about a decade and has largely been made, globally. The automotive sector does know with certainty that their future is in electric vehicles.

The question for us here in Australia, because, unfortunately, we have not had a national policy in place, is that each year we've continued to fall one year further behind. Now we're about eight or nine years behind what is the global average for just the market of electric vehicles. Regarding the concern of how we can develop and increase greater investment for the electric vehicle industry, the greatest barrier we see is that, with no market in place, it's very hard to justify bringing your investment to this country, even though there are particular advantages to doing so. There are advantages across the value chain, from mining, refining, processing, manufacturing, assembling, the vehicles themselves, the batteries inside them, and the technologies and services that go to support them.

In particular, what we see as the immediate step that we need to take is making sure that Australians have access to newer technologies and improved efficiency in the vehicles that they are able to drive. That access helps to simulate growth in the marketplace in the first case, and then we can also develop a road map to follow on to that to say where we, as a country, would like to participate inside the industry it. Today, for e-mobility, for electric vehicles, that is recognising that this is an industry that is already well underway and that electric vehicles are a gateway for the future of mobility in connection with autonomous vehicles as well. It is ensuring that we have a role to play inside that entire market for the decades to come.

Something that is clear now, because that global decision has been made, is that there is no further opportunity for us to get any further industry investment out of the traditional vehicle market—out of petrol and diesel internal combustion engines. All the opportunity exists in the future of mobility. With some certainty, this will come to Australia. The question is: do we get access to the technology decades later than everyone else, after the industry has been developed, or are we there at the leading edge of it and starting to consider what slices of the pie we want to carve out for ourselves?

Senator RICE: I want to start with what you have just been focusing on. We've got world leaders who are leading the uptake of electric vehicles and we have got Australia lagging a long way behind—you said eight to nine years behind. Where are the world leaders at? How much bigger are their sales than Australia's? Why do you think that's the case? Is there Australian exceptionalism there? We've had some evidence that Australia's a big country—we're sparse settlements—and that's a factor. How much is that a factor compared to policy frameworks?

Mr Jafari: I think it's an important point. Other speakers today have addressed it. We are talking about a transition towards electric vehicles. Importantly, we have a technology today that is able to serve somewhere around 15 to 20 per cent of the market as it exists. Every year we see the capability of the technology increasing and the cost of it decreasing. These are jurisdictions overseas that are looking at, somewhere around the mid-2020s, the up-front cost of an electric vehicle being cheaper than an internal combustion engine. How can we best

prepare ourselves both to have access to the technology as it gets better and to make sure our consumers have access to the technology. Also knowing that once an electric vehicle manufacturing plant is built it's not going to suddenly move anywhere else. So how can we make sure we get that investment first, so that when we get the large scale coming we're in the best position. We've already got the plant and equipment built in our countries.

There are certainly leading jurisdictions—places like California, the Scandinavian countries like Norway and the Netherlands, Europe and then China and Asia—that are far ahead, further than everyone else. What we particularly need to look at in Australia is that globally electric vehicles sale, on average, make up about two per cent of new vehicle sales, that was the figure in 2017. It will be higher again in 2018 and again in 2019. In Australia that figure was 0.2 per cent so 2,284 electric vehicles.

Senator RICE: We're in order in magnitude—10 times smaller.

Mr Jafari: In order of magnitude, yes, 10 times less. The first thing that we need to look at, if we want to be participants inside of this new industry, is we need to at least be in the middle of the pack. Certainly, the opportunity to be leaders is much more exciting but it's very hard for us. We speak to a lot of potential investors who want to do exciting new things in Australia. But the first thing they need to look at is if you don't have a market there yourselves, or if you have a market that is so far behind the rest of the world, it makes it very hard for me to justify bringing my investment to Australia, even though some of that investment does also include exporting within our region and globally. The first important thing that we need is to have the market place here. What the market sends a signal for, and what policy sends a signal for, is that we are a country that is taking this transition seriously and we are supporting the transition.

Senator RICE: So at least in the middle of the pack? At the front we have some countries—Norway is 35 per cent or something—

Mr Jafari: Around 35 per cent—

Senator RICE: In fact, we're over 100 times behind where the leaders are.

Mr Jafari: It is important in terms of the way to lead. What we see with most countries is that by the time they reach about one to 1.1 per cent of market share being electric vehicles they're able to then set a target of saying, 'By 2040 it will be 100 per cent of our market'. They're able to do that, because supporting the initial portions of the market—getting to two per cent or getting to five per cent—is very difficult for a new technology, because it's competing against an old one that's been there for over 100 years. Once you have that, you then start to get quite a lot of industry investment—whether that's in models being built in your country, models being made available to your country or charging infrastructure being deployed. And then a lot of exciting new services, like car sharing being deployed using electric vehicles as well.

Then there is also familiarity with the product. Consumer awareness is very different when your neighbour has an electric vehicle. You are able to have the conversation with them and see that actually there are quite a lot of benefits for me to drive one as well.

Senator RICE: The critical thing then is going to be government policy and incentives that get us to that two per cent rather than the 0.2 per cent mark?

Mr Jafari: That's exactly right. We've seen it work time and time again overseas. In fact, in Australia with the rooftop solar market we saw the same thing work as well with incentives to help get the market off the ground in the first place, to get the ball rolling. They need to be short-term incentives. They should be withdrawn at some point, because industry is sustainable on its own. We're close enough to zero—0.2 per cent is really close enough to zero. Getting to about that five per cent requires some support.

Senator RICE: Is there anything in the Australian exceptionalism argument, that there's something about Australia that means that it's more difficult for us to get to that two per cent, or is it just policy settings?

Mr Jafari: I think sentimental work and awareness are the biggest issues. What we consider to be the biggest barriers in Australia are the low model availability and the high-cost of those models. We're a large country. We need charging infrastructure. There is low consumer awareness. None of those are electric vehicle challenges; they are Australian market challenges. And, really, the people who want to invest to overcome those challenges require certainty. That certainty is provided everywhere else in the world through government policy by saying (a) we'll support you in the short-term and (b) in the long-term we're going to have a coordinated plan for both supporting and integrating this technology. Without that being in place, the question is around: we do want to invest, and we will likely eventually invest in things like charging infrastructure that needs to be built here. The thing is: every year you fall one year further behind. So, if we invest today, are we going to get our returns in two years time or 10 years time? If it's 10 years time, we're not going to bring our money to Australia—we're going to spend it elsewhere.

Senator KIM CARR: You're arguing that the whole-of-life cost of electric vehicles is much lower than petrol or diesel. Is that the proposition?

Mr Jafari: The operating cost of the vehicle is lower. Of course, there are the challenges today in the fact that the up-front cost of the vehicle is higher, and there are knowledge gaps around issues like depreciation. But they're the barriers that we as a market need to—

Senator KIM CARR: I hear this all the time, and I'm just wondering whether or not the whole-of-life cost of the vehicle is actually cheaper?

Mr Jafari: Today it's a barrier where it's not, because looking for an alternative—

Senator KIM CARR: That statement's not true then, is it?

Mr Jafari: Pardon?

Senator KIM CARR: The whole-of-life cost is not true—that the electric vehicle is cheaper than a conventional vehicle?

Mr Jafari: Where you have access to a like-for-like vehicle. For instance, globally there are \$30,000 electric vehicle models available. That's cheaper than running a \$22,000 or \$25,000 vehicle.

Senator KIM CARR: The issue is whole-of-life cost.

Mr Jafari: Yes.

Senator KIM CARR: You're saying that the electric vehicle is cheaper?

Mr Jafari: It is cheaper, but only once you have overcome barriers in your marketplace. For instance, earlier today we discussed the issue of depreciation. Depreciation is an issue because there's not a lot of data available, and people are asking questions like: what is the risk associated with reselling an electric vehicle? These are things that are being overcome globally that haven't been overcome in Australia.

Senator KIM CARR: If it is cheaper, then the argument for subsidisation falls away.

Mr Jafari: The issue with subsidisation is that there's an issue inside of the market that people buy based on the up-front cost. Of course, the issue with up-front costs is, much like an air conditioner or a fridge, the cheapest one that you can buy is the least efficient one—it's had the least done to it to make it more—

Senator KIM CARR: Sure, but we are subsidising very wealthy people at the moment. What's the argument in favour of that?

Mr Jafari: Absolutely—the argument is to make sure that lower-priced models that are already available in the rest of the world are brought to Australia.

Senator KIM CARR: So the crappy vehicles get subsidised—is that what you're saying?

Mr Jafari: There are electric vehicles available globally that cost \$30,000 to \$40,000, but they require higher volumes. As I mentioned, we sell about 2,284—

Senator KIM CARR: They're a bit like golf carts, wouldn't you say?

Mr Jafari: No, vehicles like the Toyota Prius Prime, the Ford Fusion, the Ford F-150—

Senator KIM CARR: You said, 'The Toyota Prius'. Did you mention the Toyota Prius?

Mr Jafari: There's the Toyota Prius Prime, which is a plug-in hybrid version of the Toyota Prius—so we have the hybrid but not the plug-in hybrid. There's the Ford Fusion electric. There are, again, a range of these vehicles, but they are required to be able to make 3,000 to 5,000 sales to make a return. In Australia we only sell 2,284 of the vehicles, so they're not being bought here, whereas high-end luxury vehicles are being bought.

Senator KIM CARR: As a minister, I put a fair bit of money into the Toyota Prius, which was made here. I thought that was justified because it was made here—there were jobs and there were all sorts of other flow-on benefits in terms of the technology transfer that came. We actually took that out of Thailand to do that. The problem is that we couldn't get people to buy it. What do you think is the impediment with the Toyota Prius? It didn't have the range problems. It was a very good-quality vehicle. What do you think the problem was?

Mr Jafari: What I would say is that, in terms of vehicles that are more efficient as well, starting with encouraging them to be manufactured here is certainly a good place to begin. But there is still an issue inside of the market where people look very heavily at: how much does the vehicle cost and what's the sticker price for it? The less efficient one costs less and the more efficient one costs more, even though I actually save a lot of money every year. It costs me less in petrol, so I can make that money back. It's a high justification for someone to make. If they see one that's \$20,000 and one that's \$26,000, the \$26,000 one is actually going to be cheaper for them to

own, but it looks more expensive right away. So there's a bit of consumer awareness that can go there and, as we mentioned as well, things like incentives are really targeting that up-front cost.

Senator KIM CARR: Let's turn to the question of the charging infrastructure. There are domestic manufactures there. There might well be a case for—

Mr Jafari: Global awareness.

Senator KIM CARR: public support for Australian capacity there.

Mr Jafari: Absolutely.

Senator KIM CARR: What sort of cost do you think is involved?

Mr Jafari: It depends on what type of charger you're speaking about. What we call level 2, a normal charger, costs about \$1,500 per unit. Fast chargers go for between \$50,000 to \$250,000 for a bowser-style one.

Senator KIM CARR: How much do you think the public should pay for that?

Mr Jafari: What we see—particularly in the Electric Vehicle Council—is that private investment interest is probably highest in the charging infrastructure sector. There are companies who want to roll out charging infrastructure. Again, their question is, 'For us to do it, we need to know that there are going to be electric cars that people want to use and charge.'

Senator KIM CARR: Sure. You are saying it's \$250,000 for the fast chargers.

Mr Jafari: Yes.

Senator KIM CARR: How much do you think the Commonwealth should pay for that?

Mr Jafari: What we have put in our submission, I think, is if you put in place a grant to provide matched funding for some projects—

Senator KIM CARR: What, 50 per cent?

Mr Jafari: Yes, 50 per cent, but we've asked about putting aside a pool of money for roughly \$15 million. Again, what we look for in public charging is that when people already want to buy electric vehicles, there's a factor of how many public chargers are available. It is really supporting that initial roll-out of a backbone. How can I drive from Sydney to Brisbane? Are there a few chargers available? Then, from there, increasing the rate of public chargers falls to private investment.

Senator KIM CARR: In terms of the hydrogen recharging facilities, what's the cost there?

Mr Jafari: I couldn't tell you, honestly. Hydrogen is another exciting area where the R&D is expecting that somewhere in the 2030s and 2040s we will see more investment. It's very hard for us to participate in the new technology area because we're so far behind in the current technology.

Senator KIM CARR: We could have manufactured a hydrogen vehicle in this country with Toyota if we hadn't chosen to push the industry offshore, which is what this government's done. So there are clearly political directions that can be followed. You're saying you're not aware of what the costs are of hydrogen?

Mr Jafari: Of hydrogen infrastructure?

Senator KIM CARR: Yes.

Mr Jafari: The issue with hydrogen infrastructure more so is that there's an entire backbone required for it. We have an electricity network, for instance, and we're just talking about building the—

Senator KIM CARR: Does your council cover the hydrogen?

Mr Jafari: We don't as much at the moment. I think you have already heard from Hydrogen Mobility Australia as well. Largely, our council looks at the current state of the market globally, and we're very far behind.

Senator KIM CARR: I've got the picture. What sort of support do you think should be provided to local manufacturers to get into the electrification of the Australian auto fleet?

Mr Jafari: For people looking to do local manufacturing—obviously, that means a range of things, including building the cars—the first thing they are looking for is where the market is for the products here in Australia. The biggest macro push we can provide is actually generating the market for electric vehicles and providing certainty that the market will continue to grow over years to come. Then, on an individual basis, there will be companies that will come to you and say: 'Okay, now I'm sitting at the table. Now I'm actually interested in that investment. Let's talk about what I need in order to bring my investment to you here.' The problem right now is that they're not sitting at the table because they're seeing everybody else is taking off on EVs and we're not.

Senator KIM CARR: So you don't have a view about what we should do with regard to manufacturing?

Mr Jafari: I think the most important thing we can do is make it certain that we are supporting the transition to electric vehicles.

Senator KIM CARR: I see. I have to correct the record: it wasn't the Prius but the Camry that we supported. It was a bigger vehicle. I always thought that was more suited to the Australian market. I think there had to be 8,000 vehicles sold, and they had difficulties with the 8,000. Do you have any notion of how that's going now?

Mr Jafari: How Camrys are going now?

Senator KIM CARR: How is the hybrid Camry going? Or don't you regard that as an electric vehicle?

Mr Jafari: No, pure hybrid. If they don't run on electricity, we don't count them as electric vehicles.

Senator KIM CARR: You don't regard the hybrid vehicles as electric?

Mr Jafari: No, we don't. We don't do as much work about it, largely because they don't require any significant policy support to date. They are cheaper to run. The answer is getting people to buy them. Governments should buy them themselves because the total cost of ownership is already lower. With electric vehicles, where there is the infrastructure, they require certain policy support to encourage transition.

Senator DAVID SMITH: One of the things I'm finding completely confusing is there being quite a number of submissions that suggest that there's almost overwhelming confidence that the market share of electric vehicles will just rise by itself. So whilst I understand it's at 0.2 per cent, we have manufacturers who are looking to transition 100 per cent by a particular time. The challenge for me to understand is why there's such a view that we're really going to need to have to encourage this market in that, by some point, the manufacturers will be effectively supporting, whether it's hydrogen or whether it's electric vehicles. It seems very strange to me sometimes to be focusing on that market side. I do wonder whether it actually makes more sense to see how we can actually take advantage of what is inevitably going to be a much more significant change to the state of the industry here in Australia.

Mr Jafari: Absolutely. Those two things are very heavily interrelated, as you can appreciate. A market is what helps develop an industry. So, to your point around where we see projections for rises in market uptake, our first concern is that, when the up-front cost of electric vehicles in the mid-2020s becomes cheaper than internal combustion engines, that is what the technology will be capable of globally. Those markets that have taken early action to support electric vehicles will be seeing models being deployed, will be seeing a lot more investment in ancillary services in electric vehicles and will be seeing sudden uptake—so going from five per cent to 95 per cent very quickly. With a country like ours, which is suited to electric vehicles—we're a developed country; we have high employment and a high-income-earning population—if we haven't taken those actions, there will be some costs in internal combustion engines and people will be looking for places to dump those old vehicles, essentially. Australia has, unfortunately, traditionally been a bit of a dumping ground for old, less efficient internal combustion engines because we haven't had mandatory standards in place. So our tail for receiving older technology vehicles will possibly be longer. We will get more electric vehicles later than everybody else. That's very closely linked to industry. Again, if the market isn't here and it is growing everywhere else, as it already is today, the investment in supporting the market will continue to occur overseas as well.

Senator DEAN SMITH: I think, for example, a related submission says that every Volvo from 2019 will have an electric motor. General Motors has made a big call to move to an emissions-free future. You have about 20 different models coming onto the market. For me, it's obvious that the price is going to come down significantly here.

Mr Jafari: Absolutely.

Senator DEAN SMITH: And that's going to be the big driver of the market share. But the challenge is that we've got an opportunity to actually be part of that market here, locally in Australia.

Mr Jafari: That's absolutely correct. It is looking at these early stages, while there is a cost premium attached, then we're very gradually move from zero to five per cent, where those investment decisions are being made. We know that sometime in the mid-2020s there will be quite a lot of growth because the technology costs of batteries will come down. But the question is, between now and then, where do we base our industry? Where do we start investing, whether it's producing the vehicles or technology to support the vehicles, charging infrastructure? Really, right now, it's: how quickly can we accelerate our market for that zero to five per cent of the market to encourage people to come and invest here?

Senator KIM CARR: It's an entirely different battery—that's the issue. The battery technology will be different. It's entirely different technology coming into the electric vehicle fleet in that period. The solid-state battery is an entirely different method from the lithium-ion battery—is that the case or not?

Mr Jafari: When we talk about the up-front costs of electric vehicles being lower—

Senator KIM CARR: Can I get an answer to that question?

Mr Jafari: that is based on current battery technology improving over time. So sudden step changes like solid-state batteries sort of fall into that 'maybe' category of, if they come, that will be very different, yes.

Senator KIM CARR: We're actually talking about the deployment of what will be an obsolete technology in seven years? Is that what you're saying to us?

Mr Jafari: With solid-state batteries, for one thing, there's no certainty. People are trying to develop that technology, along with a range of different technologies. But, certainly when it comes to possible future technologies, we don't have the opportunity to grasp them at all because we're so far behind with the current rate of technological growth.

Senator RICE: Can I summarise. What I hear you saying is that 100 per cent electric vehicles are coming.

Mr Jafari: Yes.

Senator RICE: If we have the right policy incentives here, they will come earlier—

Mr Jafari: Yes.

Senator RICE: and we will have a chance to benefit from a whole range of manufacturing and support and we will have a cleaner vehicle fleet more quickly. But, if we don't do that, we will still get 100 per cent vehicles, but the tail will be longer and we won't be able to benefit from that.

Mr Jafari: That's exactly right. It will happen to Australia slower than to everyone else, and we'll be technology takers rather than having the opportunity to be technology makers.

Senator RICE: With your expertise, what do you reckon the dates for those two are likely to be?

Mr Jafari: Acting earlier and acting later?

Senator RICE: Yes.

Mr Jafari: What we see is the rapid growth stage around 2024-25. That's particularly where we're looking. Around 2024 we expect to see a small SUV electric vehicle being cheaper than a small SUV internal combustion engine. That's because most of the investment's occurring there because that's the fastest growing segment of vehicles globally. Moving from 2025 to 2030, we expect to see it moving from five per cent to somewhere over ninety per cent of all new vehicles—

Senator RICE: Pretty close to 100 per cent by around 2030, as the ANU people said? And the alternative, the slow tail?

Mr Jafari: The alternative is highly uncertain. There are, as we mentioned, companies that have already invested in plant and equipment to build internal combustion engines and are continuing to seek to offload those. Anywhere from our 2025 occurring five years later, 10 years later or 15 years later—that uncertainty is very high for us. We don't know.

Senator KIM CARR: And you'll see electric vehicles that can service the interior of Australia—is that what you're telling us?

Mr Jafari: Absolutely. The technological capability of electric vehicles is continuing to grow. This is where we say today—

Senator KIM CARR: I want to repeat that: the interior of Australia?

Mr Jafari: The interior of Australia. Absolutely everywhere. Electric vehicles have the capability to serve inside of urban areas. It's probably not suitable for absolutely everybody, someone who needs to travel 1,000 kilometres—

Senator KIM CARR: I thought you said everyone; 100 per cent—yes or no?

Mr Jafari: That is today versus where the technology is going. Providing that support today ensures that when the model of vehicle is available that can serve the interior of Australia—we want to make sure Australians have access to the technology. Another benefit of providing those incentives right now is that the latest technology continues to be either designed and developed or, at the very least, deployed here. Whereas, not providing that support means that Australians are waiting longer and, importantly, paying much more in petrol and running costs.

Senator PATRICK: I know from previous conversations I've had with you that you are aware of companies that have attempted to set up in Australia. Without revealing any commercial sensitivities, why have those companies not gained traction?

Mr Jafari: I would say there are companies who see competitive advantages for setting up in Australia and are attracted to the Australian market. The largest question that they're asking us back is, 'We see where the global electric vehicle market and industry's going globally, and Australia has'—

Senator PATRICK: The burden of my question is directed at companies that have been trying to set up here for all of those reasons but have been fettered in some way or not supported in some way, presumably by government.

Mr Jafari: There are a number of companies that do anything from manufacturing to assembly to providing technological solutions in the electric vehicle industry here. Again, they're seeing that their rate of growth is very slow.

Senator PATRICK: I understand. I'm trying to get to what has stopped them. I get that they're keen. What has stopped them? In your experience, what has stopped the people that have been pushing this, trying to get it to the Australian market?

Mr Jafari: Even the ones who are here and who are participating, the thing that has stopped them the most is that our market is still quite stagnant. Our market hasn't grown at the same level as everyone else's—

Senator PATRICK: Have they sought government assistance?

Mr Jafari: They've sought government assistance. The biggest help that we can provide for them is to grow our market for electric vehicles.

Senator PATRICK: I'm trying to get right to the nub of the point. Why has the government not responded, be it state or federal, to advances by companies wanting to set up here? What have these companies asked for and what has the government been unprepared to give, and why?

Mr Jafari: It does fit very much inside the context of what we're discussing here as a committee—

Senator PATRICK: I'm after the answer. Do you know the specifics of that? Have companies come to you and said, 'We've tried to set up, and these are our frustrations'?

Mr Jafari: The frustrations are uncertainty about when our market will grow—

Senator PATRICK: No, the frustrations with government. What is government not doing to help these people? I'm not interested in the commercial aspects. I want to know what government is not doing—

Senator RICE: They're not helping to grow to market.

Mr Jafari: That's exactly right.

Senator PATRICK: I understand that. I get that point. But these companies have come specifically asking for funding assistance, for land or for something.

Mr Jafari: No. Again, their biggest barrier really is—we do need to see that there is a nationally coordinated policy in place to support the market for electric vehicles.

Senator PATRICK: Are you concerned that if you criticise government here you're not going to get support?

Mr Jafari: No. My criticism of government is that there should be a national policy to support the transition towards electric vehicles and—

Senator PATRICK: So they've been slow on policy—I get that, and that's made clear in your submission. I'm just trying to get to the point that you, as a council, can, in some sense, shield other companies that would be a little bit reluctant to tell us what government aren't doing to support those companies. As the council that can shield and protect those companies, this is your chance to say, 'This is what government hasn't done that, had they done, these companies would be setting up here now.'

Mr Jafari: Again, it is the point that I'm getting towards. The luxury of there being specific problems for the one project that I want to set up isn't really a space that we're in at the moment. We know what a national policy to support the transition to electric vehicles looks like, and we want to see that in place to give us some certainty to say, 'It's worth our time coming to and investing in Australia.' Without the government providing a policy that says: 'In the short-term, we'll provide things like incentives to grow the market. In the long-term, we're going to set targets for electric vehicles,' the attraction starts to fall away for being here. The next part of that, looking at specific projects, of 'What can you help provide me?' is that there are funding pools in place for things like clean energy, new energy or the automotive sector, but they're largely serving other needs. For instance, if I can draw your attention to the Automotive Transformation Scheme—it's something you'd be aware of, Senator—it's a pool of funding that was developed that was in place to help support the existing market that is here in Australia. Of course, the market has transitioned in that time; it's been disrupted and transformed. There are now companies

saying, 'We want to set up in Australia, and we'd like to seek some grant funding. But, because we're not already operating in the country and we're not providing previous services, we can't tap into that funding.'

Senator PATRICK: And there's a threshold in the ATS. Senator Carr can probably help me out here. It's something like 10,000 cars or 30,000 units, which doesn't help a start-up—

Mr Jafari: Creating about \$500,000 worth of value.

Senator KIM CARR: But you can get a national interest test. There are many companies that have, but has anyone tried?

Senator PATRICK: I guess that's where I was trying to get to. I know of companies, and I know you know of companies, that have approached government and said: 'I'm prepared to set up here in Australia. I may need some help.' I'm just trying to work out why they're not set up and why they haven't moved on from their plans.

Mr Jafari: The processes that are already in place usually don't apply to them. That's usually the simplest way to go: to say, 'This bucket of funding exists and I can apply for it.' The alternative, to ask for a special exemption or ask for something new to be set up, is exhausting. You need to find out who to speak to. Developing new policy takes years. It takes them a lot of time, and they're, of course, companies operating on very low margins and off of very low bases themselves. They have the opportunity to cooperate through an organisation like us but, again, it's not fast enough. Where we see those pockets of funding, like those provided through the Australian Renewable Energy Agency or through the ATS, the status quo, the simple way of applying to them is to say, 'We're not already producing in Australia, therefore we don't fall into the category.' The other option for us is to try to get a meeting with the minister or try to get a meeting with someone in the department: (a) we have to first find out who we should be meeting with and (b) what we should be telling them. How does all of this work? We're not a government relations company; we're a manufacturing company of some sort. It becomes burdensome for them. There are other companies right around the world that are throwing everything they can at attracting that investment to them. They say, 'Well, if it's going to be burdensome here versus very easy and very attractive somewhere else, we're going to go somewhere else.'

Senator PATRICK: Thank you. That was very helpful.

Mr Jafari: Glad I got there in the end!

CHAIR: Thank you very much, Mr Jafari, for your submission and your appearance today.

Mr Jafari: Thank you for having me.

Proceedings suspended from 10:34 to 11:08

van DRUNEN, Mr Neil, Policy Manager, Association of Mining and Exploration Companies

PEARCE, Mr Warren, Chief Executive Officer, Association of Mining and Exploration Companies

CHAIR: Welcome. Information on parliamentary privilege, the protection of witnesses and the giving of evidence to Senate committees has been provided to you. Your association, AMEC, lodged submission No. 20. Do you wish to make amendments or additions to the submission?

Mr Pearce: No.

CHAIR: I now invite you to make a short opening statement and at the conclusion of your remarks I will invite members of the committee to ask questions.

Mr Pearce: Our association became involved more broadly in this area as a consequence of our member companies looking to get into a value-adding space around processing and refinery for lithium and other battery materials. AMEC, in partnership with our members, commissioned a report, which we provided to the committee, which outlined the opportunity for development of a lithium processing and refining industry in Western Australia. For our end, our member companies are primarily exploration or mining companies, we now have a wide range of companies exploring or mining battery minerals in Western Australia, but also across Australia. They are now quite legitimately looking to process or value-add to their materials to see if they can get into a greater part of the value chain. That seems to be an incredible opportunity for Western Australia, but also for our member companies. In order to achieve that, there are some barriers that our report has tried to identify, primarily being that our member companies are mid-tier or small-cap mining companies. They don't have large balance sheets and they require support to find investment to build these types of facilities. Also, in order to move into that space, we're capable explorers and miners but we are not processors or refiners. We need to access the proprietary knowledge and technical expertise to undertake that successfully. To make that possibility a reality, our organisation has been promoting the opportunity for partnerships between international companies that hold this knowledge and Australian mining companies. That's probably all I would like to say up-front.

CHAIR: A key point I would like to touch upon—noting, as you say in your submission, the size of the opportunity if this further step were to be taken down the value chain in electrochemical processing—is that the share of the total value in the next eight years would be exponentially larger. I would like you to expand upon that step, in terms of the assistance that small-cap mining companies could need to obtain the expertise from partnerships of companies in that space. Could you expand on that, please?

Mr Pearce: We're happy to. If you look at page 4 of our report *A lithium industry in Australia: a value chain analysis for downstreaming Australia's lithium resources*, you can see that, essentially, we've broken the value chain into the five steps toward the creation of manufacturing of batteries: the first step being mining concentrate; the second step being refining and processing; the third step being electrochemical processing; the fourth step being the production of battery cells; and the final step being the assembly of batteries. Along that chain, we show a number of graphs through the report that estimate the amount of value at each point in the chain at a point in time. On page 4, we estimate that in 2017 the value from the mining and concentrating end—the upstream level—was worth about \$870 million to Australia, plus an additional \$70 million from other parts of the world. If you look down into the second stage there, you can see that that's already moved into a growing value ply, but it is a space in Australia that currently offers no service. So, we dominate the first stage of the value chain—the upstream end—but at this point in time we participate in no other steps.

If you carry forward to the graph on page 8, which looks at the same value chain in 2025, the projections have increased markedly, even at the upstream end. We have gone from \$870 million to \$7.8 billion of Australian value, but by the next step you're at \$41 billion, or \$43 billion across the world, heading towards a total value chain of \$1.3 trillion. We're at the small end of that. We're getting the least value for our participation in the chain. If we can move our way down the chain we can start to add value. For our members, as I have outlined, it's challenging to do, because we don't have the financial resources to step into that space to undertake the capital infrastructure builds, without seeking private investment capital or finding a participating partner who can bring that investment capital with them. Also, because processing and refining of lithium and other battery minerals is a considerable learning that has been developed over many, many years of research and development, in order for us to get into that space we would need to partner with companies that have access to that technology and are willing to share it. That's why we focus on looking for partnership or joint venture opportunities for investment with Australian companies. If you look at practical examples of what's happening on the ground in Western Australia now, that's pretty much how the projects have developed. The Greenbushes Lithium Mine had investment from international companies Tianqi, a Chinese company, and Albemarle, an American company—they purchased an equity stake, or purchased the mine—but it also invested to build processing facilities in

Kwinana. Western Australian company Kidman Resources partnered with SQM, a South American company, to invest into a processing facility in Kwinana. Our members bring the mineral and the mining material and provide the supply. They bring the knowledge and expertise to value-add. That's how it's worked pretty well.

It's important, we believe, to try to move away from the situation where we are mining and exporting our resources but watching the value added to them overseas. We dig them up and ship them out. We want to see if there is an opportunity to value-add in Australia to create new opportunities, create new value, and create new jobs. That's what our member companies are focused on. That's why we have been driven into this space.

CHAIR: One of your recommendations is a short-form national economic impact study on the potential of exporting lithium and lithium-based products. Do you feel that that's an absolute necessity, in terms of a further report or impact study, or do you think we have the information already in place?

Mr Pearce: I don't think it's an absolute necessity. At the time we released the report in January of this year, there was very little available at either state or federal government level, understanding what the economic opportunity actually was. One of the biggest challenges we found in this space over the last year has been trying to bust the conventional wisdom that Australia can't do downstream processing, that we can't be cost competitive, and that we're not likely to be able to attract this kind of investment or industry in Australia. The recommendation about a short-form national economic impact statement was really about saying that we need a credible body—someone within government or external—to be able to spell out the opportunity in a way that governments could pick up and understand and then be able to make decisions on, in terms of the way in which they allocate their own resources.

Senator KIM CARR: You have raised some concerns about proposed changes to the R&D incentives. Can you outline what they are?

Mr Pearce: The proposed changes to the R&D tax incentive have the potential to impact the growth of a future battery-minerals processing industry, primarily because R&D is a major component for mining operations in development, particularly when they go through a pilot plant stage. Essentially, that's our proof of concept, where we have to be able to demonstrate we're able to provide our customer with the product that we promised. In this space, where you have companies that are stepping into new territory, needing to develop their own processes or expertise, there's going to be some investment. The examples that have been in the public domain are the rare-earths project near the Western Australia-Northern Territory border, the Northern Minerals project—George Bauk, the managing director, has been quite clear that, if the R&D tax changes had been in place several years ago, given the amount of money they were able to receive from R&D that underpinned that project, their project would not have been able to go ahead. That's a significant project for Australia and it's a significant project for the world. It's the only heavy-rare-earths project outside of China. When they looked at making these changes to the R&D tax incentives, clearly government had good vision about the types of companies already in the system, but it is difficult to predict, I suppose, the companies that potentially would come through. Future industries are therefore less visible. Our concern is that, in this space where we're trying to encourage companies to get into processing and refining and potentially into electrochemical processing into the third stage, there is going to be a significant R&D component to that and we wouldn't like to see that opportunity lost as an unforeseen consequence of the change.

Senator KIM CARR: You obviously would like to see a battery manufacturing industry established in this country. Have I read you correctly on that?

Mr Pearce: Yes. Obviously, our members aren't likely to play at the far end of the value chain. We're not battery manufacturers or electric vehicle manufacturers; we're explorers and miners. But there's an opportunity for us to develop into processing and refining companies as well. Beyond that, other companies could come into that space. That would be very beneficial for our members because there would then be a local market to sell their product into. Primarily, our companies are Australian based companies and Australian focused companies, and there is a general desire to see this opportunity proceed.

Senator KIM CARR: A question arises. It's not just lithium you need for the development of batteries. Other parts of the cycle include cobalt and nickel. Are there any issues that relate to those parts of the supply chain?

Mr Pearce: It's not supply chains. I think the critical advantage for Australia is that we have all the minerals that you need to make a lithium-ion battery in the one place, or they are available to be mined in Australia. Most are currently being mined. What we are trying to do is broaden the conversation from it being simply around lithium refining to understanding that, really, there are opportunities for downstream processing in a range of materials: graphite; nickel, which is already taken place, and there are some expansions being proposed by Nickel West and BHP; cobalt, for a processing and refining space there; and manganese. There are currently prospective

projects in all those spaces taken place in Western Australia now. The opportunity is actually broader than just the lithium opportunity; there's actually a wider battery minerals opportunity. It's important to be successful across a wide range of those commodities in developing processing and refining. If you're able to do that and create those precursor elements in Australia, then you'll have a much greater opportunity for tracking investment into the next stage, which is electrochemical processing, because all the materials they will need will then be available here, rather than needing to import them to make that industry work.

Senator KIM CARR: We've got ample reserves of copper, graphite, manganese, cobalt, nickel, rare earths. Do you think we can do all of those things?

Mr Pearce: I think we can do all of those things. I think we don't have a wide prospectivity for rare earths. However, there is substantial opportunity within existing projects.

Senator KIM CARR: What's the main obstacle to developing it—not just digging it out of the ground but actually processing it in Australia?

Mr Pearce: There are a few obstacles, I suppose; however, some of them seem to be smaller obstacles than might have been thought. There is a reality around cost competitiveness. Companies looking at investing into these facilities could potentially do so overseas, and considerably cheaper, on both a capital expenditure basis and an operational basis. However, that cost differentiation is becoming smaller. Places like China are no longer as inexpensive as they once were. Wages are rising, capital expenditure costs are rising and the fact that companies are already choosing to invest in Australia now suggests that it is commercially viable under the current circumstances. The next issue is that you're starting to see other countries start to incentivise investment into this industry in their own countries. That's the space Australia will have to look at closely to understand what is on offer in terms of incentives and subsidies by other governments because that will be a significant impact around where that investment ends up.

Senator KIM CARR: To what extent is this a question for national policy and to what extent is this a matter for state policy, given that I understand the royalties that go to the Western Australia government are around \$400 million a year? Would that be correct? Can you confirm that?

Mr Pearce: Yes. That's for lithium, and it's heading north. I think they're projected to go to \$700 million by the end of the forward estimates.

Senator KIM CARR: What's the revenue that goes to the Commonwealth from these projects?

Mr Pearce: It's income through a range of other taxes: corporate tax, income tax, payroll tax.

Mr van Drunen: This isn't just a Western Australia story. There are also at least two lithium projects in development in the Northern Territory and we have a number of members that are moving to develop graphite in South Australia.

Senator KIM CARR: I appreciate that, but you're saying that you think the Commonwealth should be providing the subsidies, not the state?

Mr Pearce: Right now what we're saying is: someone needs to be watching what is taking place in terms of incentives and subsidies in other countries. We're not actually proposing subsidies or incentives at this point in time. We don't think, at this point in time, that is likely to be helpful when we're still at the very preliminary end of the emerging market.

Just to take your earlier question, Senator, there is a role for national and state governments separately. The state governments roles are around facilitation and approvals, ensuring that land is identified and available for these developments and assisting companies moving through the approvals process quickly. There is a substantive operational role in that space. At a national level, there's an importance that there is a national strategy around this—that the national government is taking an investment attraction role and really getting that opportunity out and trying to bring back potential investment and companies to look at opportunities in Australia. I think those governments need to work hand-in-hand to be successful in this.

Senator KIM CARR: I want to be clear about this. You're saying there is no need for public subsidies for this, yes or no?

Mr Pearce: No. What I'm saying is we have not been calling for them. What we are asking the government to do is monitor what is taking place, and if in that assessment it becomes clear that incentives or subsidies will be needed to support the growth of the industry then government should certainly look at it.

Mr van Drunen: Senator, I could draw your attention to the report, *The path forward: Supporting the development of a Lithium and Battery Minerals Industry in Western Australia*. The first sentence under 5 Financial Incentives says:

AMEC does not consider financial incentives are currently necessary to attract investment to Australia.

Our recommendation is that we call for monitoring, and it's exactly as Mr Pearce has outlined: we have got companies that are willing to do further processing in Australia and they're doing at the moment without financial incentive.

Senator KIM CARR: The R&D tax incentives, though, are, of course, a form of public subsidy, aren't they?

Mr Pearce: I would accept that, but I think it is an important scheme. I'm sure you'd agree, Senator.

Senator KIM CARR: Thank you.

Senator PATRICK: My understanding is that a lot of these lithium mines have full offtake agreements. In essence, they have all of their capacity likely to be sent offshore. Is that correct?

Mr Pearce: That's pretty accurate around the current circumstances. What's taken place is that, to underwrite the projects, many companies here have provided or have made agreements or contracts around offtake from their development of their mine. However, all of those projects have potential stages or expansion stages where offtake has not currently been agreed. So, although the initial offtake in the first stage of the mine development in many cases has already been sold or contracts have been entered into for it, future expansions that will then be supported by the revenue generated from the sale of the products of the first stage can be put into the second stage, where no agreements have yet been made and the Australian company will have a greater opportunity to look at other options.

Senator PATRICK: In terms of your representation, you're suggesting that you're focusing on, obviously, the first stage and moving into the second stage, because the companies that do have lithium deposits are actually members of your—

Mr Pearce: Yes, that's correct, our association, yes.

Senator PATRICK: When you say that you are not seeking any public financial support, that in some sense stops at stage 2. There could be other companies at stages 3, 4 and 5 that might very well enjoy, along with R&D subsidies, other assistance.

Mr Pearce: Absolutely. I would not claim to speak for any more than our member companies, but our member company interest in this space, or a direct interest in this space, is in the first two stages of the value chain—in mining and in processing and refining. As you go down that chain it looks likely that a greater level of assistance would be required to be successful in that space. However, there are other companies that will enter into that space, other Australian companies and other representative bodies, and I wouldn't propose to speak for them.

Senator PATRICK: We know, for example, that there's a possibility for there to be lithium batteries in the Future Submarine project, where Defence might assist walking back from stage 5 towards stage 2. And there is a policy from the South Australian Liberal government in relation to battery subsidies for regular consumers. Are you tying that together, or would you say simply no-one is tying that together, hence the lack of a national strategy?

Mr Pearce: I think work is now taking place in the internal government environment to pull those strategies together, at both state and federal levels. But, at this stage, there's not a public strategy that identifies how we connect those dots or how governments are assisting companies to connect those dots. I think there appears to be considerable opportunity in South Australia. The South Australian government and departments have focused on that defence opportunity and, quite clearly, there is a strategic need that may underpin that opportunity. Certainly, we have been very supportive of their steps, or their work, in that process.

Senator PATRICK: Yes, the bottom line is there's a lot of opportunity there. I know that your organisation has been speaking to the government, and you'd be well aware that I've asked a number of questions about how we support this chain. Is the federal government being responsive to your advocacy?

Mr Pearce: We believe so. In fact, we've been very, very pleased with the reception we've received at all government levels. However, I think, in this space, understanding the development of future and new industry is somewhat challenging. People need to get their heads around exactly what that might look like and the very wide range of factors around it. We have seen very strong support, particularly from our minister, Minister Canavan, but also from his colleagues, Minister Ciobo and Minister Frydenberg. We're yet to see that support move into a public announcement or a publicly announced direction. However, we're confident that they are working on that and something may be available soon. So we're looking forward to seeing where government comes out on that and how we're able to assist that work.

Senator PATRICK: We might poke them at estimates again.

Senator RICE: Continuing on with that, you've got some support, but you say in your submission that there is approximately two years before the global lithium supply chain solidifies. I take it from that, from what you've been saying, that, really, time is of the essence, that we need to see action soon, otherwise it's going to become more costly or more difficult. How much will we be missing the boat if we don't act in the next two years?

Mr Pearce: That is absolutely the tenet of our report, that there is a window of opportunity here, and there is a very short window of opportunity. Our report puts that at about two years. What you're seeing in the global lithium battery minerals market is, at the moment, quite chaotic. At some point, that will get worked out and firmed up, and the major companies at the other end of the value chain will have sorted out their global supply chains. Once that takes place, it's very difficult to shift how those supply chains operate. So, if Australia and Australian companies are able to secure a place within that value chain, then we'll be able to hold onto it. If we're not able to secure it, once that supply chain sets, it becomes much, much more difficult and much, much more expensive to be able to break into it, because other facilities have already been built. So not only do you have to be cost competitive on builds and operational expenditure; you've also got to overcome the cost of building a new facility when one's already been built somewhere else.

Senator RICE: There are some pretty significant dollars at stake. You're estimating a \$2 trillion industry by 2025, globally. If Australia does get its act together and acts soon, what proportion of that industry do you think could be in Australia?

Mr Pearce: I can't speak in proportions, but I would say this: there is tremendous opportunity. The reality is the demand requirements are simply going to outstrip our ability to supply them. So, really, there's an open opportunity for us. I will note, though, that, in our report released in January, probably now those estimates around the value chain in this industry are somewhat conservative. Many other reports have forecast a much higher player value.

Senator RICE: In terms of being at the end of the value chain and being producers of the fully manufactured batteries, is this going to be possible without electric vehicle uptake in Australia? How significant would the domestic market for those batteries be on the willingness or interest in developing the fully manufactured battery?

Mr Pearce: I can't speak authoritatively about that. I can say that in conversations our association's had with vehicle manufacturers, one concern that has been expressed here is a lack of local demand for electric vehicles—more a low or late take-up—that would help underpin Australia's investment in that space. However, I think they would be better placed to make that argument. One of the many things we've seen over the last 12 months, in putting these reports together, is that the take-up of renewables, battery storage, has been very significant in Australia, and there's no reason to think that the local demand won't be there. It may arrive a little later than it would in other places, but I think there are certainly indications that local demand will be very strong.

Senator RICE: So if we could consolidate local demand, it would help consolidate the development of the full value chain.

Mr Pearce: Yes, I'd agree with that.

Senator RICE: We were talking earlier on this morning about some different battery chemistries and whether lithium-ion batteries will be superseded by something else in the future. How confident are you that lithium-ion batteries are going to be around and be the basis for electric vehicles and other batteries well into the future?

Mr Van Drunen: Our understanding is that lithium-ion batteries have the first-mover advantage. They'll be the primary battery going forward. There will be other specialty batteries, using vanadium and other metals, but, at the moment, we are seeing electric vehicle companies and companies that produce mobile devices, like Apple, that are primarily using lithium-ion batteries. Because they're the established battery, the market is moving towards them, primarily.

Mr Pearce: Yes. I think it's reasonably clear that lithium-ion batteries will dominate the next 15 to 20 years while new technologies are developed. Competing technologies may or may not prove to be better in other areas, though it's important to remember the lithium-ion battery's been in development since the early 1990s.

Mr Van Drunen: Yes, since 1991.

Mr Pearce: It's taken 25-plus years to get to this point. So for a new technology to emerge and—

Mr Van Drunen: Supersede.

Mr Pearce: supersede lithium-ion batteries it's going to take some time, and certainly the commentary around the future of the industry or the conventional wisdom seems to be extremely strong that lithium-ion batteries will dominate this space for the foreseeable future.

Senator RICE: All the more reason to get in sooner and ride the wave.

Mr Van Drunen: Yes.

Mr Pearce: Absolutely.

CHAIR: Thank you very much, gentlemen. Thank you for your evidence here today.

Mr Pearce: Thank you. We appreciated the opportunity to appear.

GILTINAN, Mr Robert, Senior Policy and Public Affairs Adviser, National Roads and Motorists' Association

TRUMPER, Mr Tim, Chairman, National Roads and Motorists' Association

[11:38]

CHAIR: Thank you for attending today. Information on parliamentary privilege and the protection of witnesses and giving evidence to Senate committees has been provided to you. The NRMA has lodged submission 78 with the committee. Would you like to make any amendments or additions to those submissions?

Mr Trumper: No.

CHAIR: I now invite you to make a short, opening statement. At the conclusion of your remarks, I will invite members of the committee to ask questions.

Mr Trumper: We're delighted to be here, and thank you for the opportunity. On behalf of the NRMA, I'd like to thank the committee for calling this important matter to society. The NRMA is an iconic organisation with a proud history spanning nearly 100 years. Since 1920, we have grown to represent 2.6 million members, while remaining true to our heritage. We were born to keep people moving. As a large member organisation representing urban, regional and rural communities with varying needs and priorities, we're well aware of the vast changes in mobility that are upon us. We're a customer-centric mutual and we constantly talk to our members to seek out their opinions on how we can better serve them. Our members tell us that they are deeply concerned with the cost of living, congestion and pollution. That's what drives us to take a leadership role in supporting the mass introduction of electric vehicles in Australia.

There's research that tells us that 40 per cent of motorists are already considering electric vehicles as their next car and, in the age group under 25, it's 58 per cent. We find those figures high, considering the very early stages of this journey. We can't ignore the supply side of the equation, with the bulk of the major car brands now pivoting to electric vehicles. We're seeing billions invested overseas, and many—like Hyundai, Renault, Nissan and others—are on the journey to providing much lower cost, affordable vehicles which will be targeting various consumer segments. The NRMA is committed to ensuring that Australia is ready to embrace the new mobility options that reduce cost, boost convenience, improve safety and increase personal and national productivity. With the right policy choices, we think Australia is on the verge of some very good new things for our society. They would include a lowering of the cost of mobility, particularly in regional areas with larger fuel costs, a step-change in the exposure to our fuel-security issues, improvements in national health standards and lower emissions in the Australian transport sector.

Through member engagement, we have identified that access to public charging infrastructure is the greatest barrier to electric vehicle adoption today. We are believers in the adage that, when you solve the consumers' trust and lower the prices for consumers, adoption follows quickly. That is why we released a paper previously on electric vehicles and, at a similar time, pledged \$10 million to the construction of Australia's largest non-proprietary electric vehicle fast-charge network. This will be free to our members. This foundation investment is our commitment to our members and society that we are believers in this. With the support of the Australian government, the NRMA hopes to greatly increase the future investment in electric vehicles, which can drive a lot of change through our regional and city communities.

In addition to the charging infrastructure, the NRMA and the Electric Vehicle Council have identified reforms to help prioritise the transition to light fleet. Our new policy proposal, Recharging the Economy, provided to the committee as an attachment to our written submission, details these suggested reforms. On behalf of the NRMA, I commend the establishment of this committee and sincerely thank its members for the opportunity to be here today. I welcome any questions.

Senator PATRICK: You're saying that the biggest impediment is, in fact, the charging arrangements. Of course, that's quite a significant problem for a very large country—a country the size of the United States, with far fewer people. You might have heard Senator Carr asking questions about the sort of funding one might reasonably expect the taxpayer to bear or is it simply a case of organisations like the Clean Energy Finance Corporation, or perhaps others, providing assistance? What's the barrier? And how do we knock that down?

Mr Trumper: Thank you for the question. In our policy paper, we've drawn attention to a few initiatives we think are important. The government is the biggest owner of the fleet in Australia. The government owns more cars than anyone else, and the commitment by the government to have 25 per cent of its fleet as electric vehicles would send a very powerful message that this is real and it would help stimulate the supply. We're seeding a network, but others will seed networks too, and that's good. The commercial side of this will come from a fair bit

of private investment. We're also asking the government to look at the luxury car tax. It was put in place to protect an industry which is no longer here, unfortunately, so we have tax barriers on electric vehicles and we think they could be removed. We've also got some initiatives around loans for consumers to put lower-priced charging initiatives into their home, to be able to buy electricity in a smart way for electric vehicles in their home. They're amongst some of our initiatives in the document.

Senator PATRICK: Your submission creates an argument that's almost a productivity argument, even for government, if you're suggesting that governments adopt far more vehicles. Is that correct? It looks like, on the analysis, you're saying there's hundreds of dollars to be saved per annum just on fuel costs.

Mr Trumper: Yes, that's right. The fuel costs here are significant, and the savings come through over time. The further you drive, the more you save. So, yes, there's a productivity issue there, for sure.

Senator PATRICK: You say the NRMA is putting in charging points across New South Wales. Can you describe that a little bit?

Mr Trumper: Yes, and we've got a few in Victoria and a few in Queensland. We've mapped out where we want to put them, and we're going to start in the regions. We've already started that. In Jindabyne we've installed one already. That's really to encourage our members to get confidence that you can now go on a long journey and know at the other end you can charge your vehicle.

Senator PATRICK: How are you funding that?

Mr Trumper: We are using our own capital to fund that. We are future facing for our members. Our members get the benefit over time. It's free for our members to use. It's a service for our members.

Senator PATRICK: Would you mind sharing with the committee how much money you're spending?

Mr Trumper: In the public domain, we've committed \$10 million to do that.

Senator PATRICK: And how many charging points are we getting for that?

Mr Trumper: It's about 50. They're fast-charge networks.

Senator PATRICK: You say they're not in operation yet but—

Mr Trumper: Three are. We've just started, but the plan is underway to commit them all.

Senator PATRICK: How long will it take to roll that out?

Mr Trumper: We are hopeful we will be well established by the end of next year.

Senator PATRICK: So are we likely to see all the NRMA members driving electric cars in the next few years?

Mr Trumper: We are supporters of it. Obviously we are technology agnostic. We can't be 'This is the right technology.' That's not our position to be that. But we are very member-centric, so we detect what our members want. At the moment, they're very interested in this, and so we react to what our members are interested in.

Senator PATRICK: Is the uptake in New South Wales greater than in other states? I think South Australia is actually quite good, isn't it?

Mr Trumper: I'm not sure of that. I could take that on notice if you like.

Senator PATRICK: Okay.

Mr Giltinan: Just to add to that, we've launched just recently charging stations at Sydney Olympic Park, Wallsend and Jindabyne. We had hoped to have more complete at this point in time. We struck a couple of hurdles dealing with local government in terms of assessment and development assessment. None of them had previously received a development application for a fast-charging station. So we've been working through that process and we hope to be able to ramp things up from this point forward.

Senator RICE: You noted in your submission that recent research has shown that the cost of electric vehicles in the UK, the US—California and Texas—and Japan is now less than that of petrol vehicles. I presume you're referring to the overall running costs, not the up-front costs.

Mr Trumper: That's right. We are seeing changes on both sides of that. We are seeing changes in the supply side, where the price is coming down, but we are referring to lifetime ownership.

Senator RICE: What's your analysis of where we are at with regard to that in Australia at the moment?

Mr Trumper: It's so fluid because the prices are changing as they come in, but today most of the cars that you can buy that are electric are more expensive. But we are really thinking about how that will look as the new supply comes into the market. We are following the car makers who are saying they've got brands coming that they think will be around the \$35,000 to \$50,000 mark for Australia. That starts to get a bit closer. But just to

clarify that point, supply of charging stations is a big barrier. Purchase price is also a big barrier. They are two big barriers.

Senator RICE: Given we've heard quite a lot of evidence already about the importance of getting to a critical mass to really allow the whole industry and uptake to take off, do you think that there is a role for government policies and incentives to get us to overcome the initial hurdle of where there is both a price differentiation and the charging issue?

Mr Trumper: No, we do, absolutely. That's why I think the luxury car tax is the one that's sitting there right now. If the government fleets—state, federal and local—were committed to buying a lot of electric vehicles, that would actually stimulate a lot of imports into Australia, and more volume drives the price down.

Senator RICE: I noted your chargers are going to be free for your members. Are you working with your equivalents in other states?

Mr Trumper: We are.

Senator RICE: Is it much the same as your roadside assistance in that you can have reciprocal deals across states? Will we see that being the case?

Mr Trumper: I certainly can't speak for what their business is—I won't do that. But under our parent association, we're doing lots of collaborative work around what other car clubs could be doing with electric vehicles, for sure.

Senator RICE: Would you see that offer of free charging for NRMA members to be an important part of your member offer into the future, just like you join for your roadside assistance and you join for your charging?

Mr Trumper: We do. We think long and hard about this and we think the future is going to be a lot more electric. We're always thinking, 'What is it that our members will want in 10 years' time and 20 years' time?' That's what this is about, for sure.

Senator RICE: Finally, you note in your market with regard to what impact electric vehicle uptake is going to have on fuel excise and revenues to the government. It's not a problem at the moment given it's only small but it's going to become a problem in the future. Do you have any thoughts about what you see as alternative revenue for government if we do have that decline in fuel excise, as is going to occur?

Mr Trumper: We have a view that distance based charging is more equitable. We don't have a firm view on how that is executed but we think, over time, distance based charging will be needed.

Senator RICE: And that will go hand in hand with the penetration of electric vehicles into the market?

Mr Trumper: There'll certainly be a tax impact as fuel taxes go down.

Senator DAVID SMITH: With that rollout of charging stations, are you looking at partnering with Australian companies? As you'd be aware, there are Australian companies leading the charge, if you like, in manufacturing charging stations.

Mr Trumper: We are using Tritium at the moment. We're in that discussion of who's the right supplier. We're actively making sure it's the right thing for our members. But we're an Australian based organisation and, where we can be Australian, we will be.

Senator DAVID SMITH: Great response. Without any hint of bias, I'm travelling from Canberra to Sydney. What would a journey look like in terms of charging stations along that sort of route?

Mr Trumper: We're basically doing the work as to where these will all go. We've done the preliminary work. These are round numbers. We're saying roughly every 150 kilometres we want to have one to enable our members to feel confident to move.

Mr Giltinan: Just to add to that, we took the position that we would want to provide widespread coverage for our members. We've taken the position that we want to do this early because we know that the change is coming. In addition to our current network, we have applied for regional growth funding through the Australian government. Should that be successful and we progress, we can then potentially rollout an additional 80 chargers to give greater density to the existing network that we're rolling out, and then also potentially to connect the western parts of Victoria through Gippsland right up to Sydney, which will virtually connect all of the south-east corner of Australia and connect with the Queensland super highway network. That's something we're hopeful of obtaining because that will give us really good coverage along the whole eastern seaboard.

Senator KIM CARR: The NRMA's a premier motoring organisation in the country. There's the RACV and the equivalent in Queensland so you'd be aware the number of vehicles on the road at the moment. How long do you think it will take us to get to 100 per cent transfer to electric vehicles?

Mr Trumper: We would take that on notice and give that a lot of thought, if it helped you. I don't want to just pick a number out of the air.

Senator KIM CARR: No, I'm pleased you have because it's one of those glib answers we get. In particular, given that you have members all over the state of New South Wales and you understand what 'remote' means in New South Wales, 150 kilometres doesn't get you very far in parts of New South Wales.

Mr Trumper: No, we're aware of that.

Senator KIM CARR: So what do you say about people who live in remote areas? How do they get service?

Mr Trumper: It's going to need more investment from society, the commercial world and government. I think we're right at the start of this. People will obviously be able to charge in their homes. When I read about the rollout of petrol stations when Henry Ford built his first car, I think they built 10,000 in 10 years, those sorts of numbers.

Senator KIM CARR: You're talking about fast chargers that we've heard are \$250,000 a hit. There is an issue about the types of technology we use, first of all. That's assuming we get the regulatory regime right in terms of the actual national standards; we haven't even got that. There are questions about whether or not we should have hydrogen or lithium, or whether or not we go to the different types of electric batteries. Have you given any thought to questions about the rapid nature of the technological change that's actually occurring within the electric industry itself?

Mr Trumper: We have and we are conscious that what we are seeding will be redundant too. You can't predict what the best—

Senator KIM CARR: It could be quite rapid. Do you agree with that proposition?

Mr Trumper: I've worked in technology in my whole life. It's impossible to predict. There could be something tomorrow morning that none of us know about.

Senator KIM CARR: That's right. The motor manufacturers are telling us that it won't be until the middle of the twenties that we even get price parity with the new technologies that are coming in—that's with range. People's attitudes will change when they can actually buy a product that's about the same price, but that depends upon a substantial technological change within the industry. Have you given much thought to that question?

Mr Trumper: In round numbers, the amount of capital going into electric vehicles around the world is, some are saying, somewhere between US\$50 billion and US\$100 billion. That is a lot of money and that will find things that people don't know about today. Whatever they find is likely to drive the price lower, so we'd be confident the price here will fall as technology scales. But the precise answer I don't feel qualified to provide.

Senator KIM CARR: I will ask you some technical questions about safety. Have you given any thought to those issues? Have you had a chance to look at any of the other submissions that have been presented to this committee?

Mr Trumper: I have not.

Mr Giltinan: In terms of safety, we were obviously born on a platform of safety. ANCAP recently have tested approximately six battery vehicles, and they have found there is no difference in terms of collision impacts compared to those traditional equivalents. Potentially, we would say that these vehicles could, at one point, be safer when solid-state batteries come to market, as they are non-combustible. Also, given the nature of an electric vehicle, the battery weight is placed along the floor of the vehicle, so it lowers the centre of gravity and also creates an environment where it is easier for the manufacturer to achieve weight distribution. On those grounds, it should actually make handling of the vehicle and also, potentially, braking better. We would see that there's no detriment, in terms of safety, in electric vehicles and, in fact, there may be a slight benefit.

Senator KIM CARR: There have been a couple of submissions. If the secretariat gets the chance, could they be drawn to your attention? I wouldn't mind your response to those issues that have been raised around the question of safety. There are two aspects. There's the actual handling of the batteries, and I think there is still some controversy about that. There are issues about end of life of batteries: what do you do with them?

There's the issue about the relationship between the charging system and other people that are trying to use the grid, like workers who actually use the grid, given that there are safety issues associated with that. So if it's possible for us to provide that for you to have a look at, I would be interested in your responses to that. Then there's the question about warranties and matters that go to the life of batteries. Again, as a consumer organisation, I would be interested in your response because you're not wedded to any particular brand or committed to any manufacturer, so your assessment would be interesting. I would be interested in your

assessments on those questions, given the international differences that appear to be emerging on that matter as well. Thank you very much.

Senator RICE: I have one question. Senator Carr was rightly focusing on the problems of remote areas with our current rollout of chargers. Are you confident that we can develop a charging network that can serve remote areas as we roll out cars? Just reflect upon the history of rolling out fuel stations, say, across remote New South Wales at the beginning of the car era.

Mr Trumper: The more remote it is, the more help it will need. I think in the dense areas the commercial world will probably sort that out, and that's why we've started in regional. I think that's probably an area where we would be looking for the government to help people like us and others, because I think that's where the investment will mostly likely need to start.

Senator RICE: We had those problems in the early days of internal combustion engine as well, didn't we?

Mr Trumper: Yes.

Senator RICE: And people still run out of fuel in remote areas across Australia, so it's not just a problem of electric vehicles.

Senator KIM CARR: You can carry a jerry can, but there is a substantial technological difference in trying to carry a charger in the back. There is also the issue of hydrogen, which has a much broader range and is much more comparable with existing technologies as well. I would be interested in your assessment on that because you're also technology neutral, aren't you?

Mr Trumper: We are.

Senator KIM CARR: Are you rolling out any hydrogen?

Mr Trumper: Not at this time. We're watching the space. We are watching that space closely.

Mr Giltinan: To add to that, we're absolutely technology agnostic. I would say the reason we have made the commitment to roll out at least \$10 million worth of chargers is our research has shown that battery electric vehicles are probably the way forward, especially for the light vehicle fleet. Having said that, we would absolutely explore opportunities in fuel cell vehicles, because ultimately they can potentially both be zero emissions, which is a good thing.

CHAIR: With regard to remote areas, there is also the issue in terms of plug-in electric vehicles providing the ability to utilise petroleum as well as electric. So that anxiety of running out of electricity and battery storage can be assessed for people in those areas. I would see that as a necessary part of a consideration in terms of the need for charging infrastructure in very remote areas.

Mr Giltinan: That's right, Senator. Our technology is obviously fast chargers, but there are also destination chargers and home chargers. Ours are primarily mid-journey chargers for people who would like to undertake a road trip, for example. But for those people who are commuting in their own local towns, overnight home charging or destination charging at supermarkets and those types of things may suffice for the vast majority.

Senator KIM CARR: You said you had a trial—is that right? You've had a trial already?

Mr Trumper: We are rolling out our commitment.

Senator KIM CARR: But you haven't trialled it yet?

Mr Trumper: We've built some.

Mr Giltinan: We've built three.

Mr Trumper: I wouldn't call it a trial, because it's a commitment, but we've certainly installed a couple.

Senator KIM CARR: So there are no results in yet in terms of your assessment?

Mr Trumper: It's very early.

Mr Giltinan: They're currently operational, but they've only just been turned on, literally, in the last couple of months.

CHAIR: We need to move on. Thank you very much.

Mr Trumper: Thank you for your interest and thank you for your time.

CHAIR: Thank you for your evidence today.

HANNA, Dr Liz, Senior Fellow, Fenner School of Environment and Society, and Climate Change Institute, Australian National University

MARKS, Professor Guy, Chief Investigator, Centre for Air pollution, energy and health Research

JOHNSTON, Dr Ingrid, Senior Policy Officer, Public Health Association of Australia

[12:04]

CHAIR: Welcome. Information on parliamentary privilege and the protection of witnesses in giving evidence to Senate committees has been provided to you all. Do you have any additional comments to make on the capacity in which you appear?

Dr Hanna: I'm representing myself at the moment for this panel, but the background expertise I bring to this is that I'm chair of the World Federation of Public Health Associations Environmental Health group and I also chair the climate change group of the Australian College of Nursing. I have researched climate change in human health at the ANU for over a decade with Professor Tony McMichael, and I'm currently honorary at the ANU through their Fenner School of Environment and Society and also their Climate Change Institute. I'm here, clearly, to speak of health—that's my background, that's my world, that's my expertise.

Prof. Marks: I'm a respiratory physician and epidemiologist, and I'm here as the principal investigator of the NHMRC Centre of Research Excellence on air pollution, energy and health research.

CHAIR: Dr Hanna, you have lodged submission 3 with the committee. Would you like to make any amendments or additions?

Dr Hanna: Amendments are nil. But, assuming you are quite familiar with the contents of that, there are a few points that I would like to stress.

CHAIR: I will come to that in a second, with your opening statement. Dr Johnston, you have lodged submission 33 with the committee. Would you like to make any amendments or additions?

Dr Johnston: No, thank you.

CHAIR: Professor Marks, you have lodged submission 63 with the committee. Would you like to make any amendments or additions?

Prof. Marks: No, thank you.

CHAIR: I now invite you all, and Dr Hanna first, to make a short opening statement. At the conclusion of your remarks I will invite members of the committees to ask questions.

Dr Hanna: On that point of any amendments, I'm quite happy to forward documentation, references and sources either at request or to send through some extras if that would be of benefit to the committee. The key things I was wanting to highlight from my submission are that the transition offers substantial health benefits. Parliamentarians are elected to serve the Australian public. We have been hearing quite a bit about the economic costs, and of course everyone is concerned about their own financial security and the cost of things, but people place a high regard on their health. So I remind senators and everyone in parliament at every opportunity that I ever get that health is really a priority for Australians.

The current carbon based fuel source is very detrimental. There's been quite a bit of research in terms of the health costs and the health imposition because of the fumes from our current fleet, so we urge the parliament to urgently do everything it can to assist the transition. Another key thing is that the fumes are highly irritating. They cause inflammation and in the long-term they cause scarring and damage which results in the full range of respiratory problems. We have an expert, so I will omit some of those details and let him carry some of those forward. But they result in a range of problems.

With the recent thunderstorm asthma outbreak, an enormous number of those people did not know they had respiratory conditions and respiratory sensitivity. They were not diagnosed with asthma and they were not diagnosed with underlying respiratory disease, which highlights that, at a population level, there are many of us who are wandering around at the moment with already irritated lungs. The World Health Organization is arguing that nine-out-of-10 people are now breathing polluted air and one in about 11 per cent of the global population are dying because of exposure to polluted air. Of course, this doesn't need to be the case. It's on the basis of that that we urgently argue.

The other major point that I'd like to stress is, again, we've been hearing of the economics and the cost and the outlay of rolling this thing out, but what never seems to be factored in to those calculations is the avoided costs when you shift away and you remove a burden of disease. The costs are huge. They send most treasurers quite

pale. The OECD estimated that the economic cost for Australia was \$5.8 billion in 2010. It had increased by \$2.9 billion over the previous years, which is virtually a doubling. If we extrapolate that doubling from 2010 to 2015, the cost would have been \$11.6 billion. Today that would be a massive \$17.4 billion, approximately.

Senator RICE: That's the cost of air pollution?

Dr Hanna: That's the cost of air pollution in Australia from traffic.

Senator RICE: From transport?

Dr Hanna: Yes. That was the estimate. Of course, that tends to be a cost to the health sector. The added cost, of course, is the economic burden on families for days, weeks and years and from premature deaths. It means (a) they lose their earning capacity (b) the society misses all the effort and cost that was put into their training and expertise, and (c) the society misses the additional contribution that people make to society not only as productive workers but in mentoring, parenting and caring et cetera. It's very difficult and, because the figures are so large, those figures tend not to be calculated. It's so overwhelming—what could be seen as an expensive exercise—to roll out charging stations or, indeed, for government support to make that push across. As with most things in public health, the returns from the expenditure for prevention and health in dollars, only from the government purse, would range between one-in-three to one-in-75. Even if people are not interested in the health arguments, the economics underpinning health and prevention is an overwhelming argument.

CHAIR: We may move on to Dr Johnston's short opening statement.

Dr Johnston: I'd first of all like to apologise on behalf of my colleague Dr Peter Tait, the convenor of our Ecology and Environment Special Interest Group, who is unable to be here today because he's unwell. The Public Health Association of Australia welcomes the opportunity to appear before this committee today to present information on electric vehicles in Australia. The issue is important to the PHAA for three reasons: firstly, the health benefits from reduced use of internal combustion powered vehicles; secondly, the health and environmental benefits of reduced fossil fuel use; and, thirdly, the opportunity it brings to consider individualised vehicle use in Australia.

Air pollution from vehicle emissions results in thousands of deaths and yet the technology exists to massively reduce this pollution through the use of no-emissions electric vehicles. We can avoid these deaths and so we must—there's a moral imperative to do so. Unfortunately, it's not as simple as that. Replacing conventional vehicles with electric vehicles will only lead to significant health benefits if it's done properly. Recharging electric vehicles using electricity derived from burning fossil fuels won't actually help all that much. With so much of Australia's electricity reliant on fossil fuels currently, it won't be as simple as setting up a network of electric car recharging stations.

However, the transition to cleaner energy sources is under way in Australia. It's certainly a slow transition, with years of political procrastination putting the brakes on real change. Regardless of the overwhelming evidence about climate change, the stonewalling continues in some quarters. But time has run out for those who've argued that it's just too expensive. The economics are now speaking up. With renewables now cheaper than coal for new power stations in Australia, the prospects of being able to establish a network of electric car recharging stations that use clean electricity are improving. Policy decisions to increase the use of electric vehicles in Australia can and should work in conjunction with policy decisions to increase the proportion of renewable electricity generation in Australia. Due consideration of how to establish a network of electric vehicle recharging stations, and the renewable energy to power them, will require a detailed analysis of how and when people use their cars, and where and how far they travel. This provides an ideal opportunity to include in the analysis how to increase active transport options.

Switching from conventional vehicles to renewable-energy-recharged electric vehicles will have significant health and environmental benefits. However, the heavy reliance in Australia on individualised vehicle use will remain. Lack of physical exercise and fresh air, and social isolation, will not be addressed through this switch. Ultimately, increased investment in and prioritisation of public transport and active travel are required. The planning involved in the switch to electric vehicles provides an opportunity to do just that.

With the purchase of a vehicle being a major investment for most people in Australia, a transition to electric vehicles will happen over a period of years. During that period, the availability and affordability of the cars themselves, the availability and affordability of batteries for the vehicles, the availability of recharging stations, and the time taken to recharge will all need to change to ensure that the switch is easy for Australians. Electric vehicles in Australia are currently a niche market. For the economic, environmental and health benefits to be realised, they must become an easy, logical and sensible option for most people. Those changes will require policy support. The PHAA supports the widespread uptake of electric vehicles, recharged through renewable

electricity, and combined with an increase in public transport and active travel, and thanks the committee for this important inquiry.

Prof. Marks: You are going to hear a very similar story from all three of us, I suspect; although we haven't colluded in bringing this to you!

I would agree with my colleagues here that electric vehicles are clearly an important step in the right direction towards reducing population exposure to the effects of traffic-related air pollution; specifically, particulates and oxides of nitrogen. This will have substantial benefits for respiratory, cardiovascular and other health outcomes. It will have effects on reductions in premature mortality, and also on other aspects of morbidity. However, I think we do need to be aware of some limitations and some contingencies in considering this. We need to consider this in the context of a life-cycle analysis for electric vehicles. As others have pointed out, this particularly relates to the source of electricity: if the electricity is generated by fossil fuel sources, then, clearly, that's only going to remove the health effects from one site to another site. We need to also consider the manufacture, distribution and, in particular, the disposal of the batteries—all of which have potential health effects. The other aspect of this is traffic congestion and the health consequences of that. Replacing single-user petrol- or diesel-powered cars with single-user electric vehicles will not solve the problem of congestion. We need to think about multi-user transport, and we need to think carefully about urban design and walkability, as ways of reducing congestion and improving the physical activity that people have. None of that will be addressed by switching from petrol to electric vehicles. We also need to consider the other emissions that come from vehicles, other than from the engine of the vehicle. In fact, even petrol vehicles are now becoming much cleaner than they used to be. The relative proportion of emissions attributable to the engine is reducing. We now have particulates from tyre wear and brake wear and road dust, all of which make significant contribution to the particulate burden. Again, that will not be overcome by a switch to electric vehicles.

In summary, I think single-user vehicles are with us for a long time to come and they're an important part of the transport mix. I think transition to electric vehicles is an important step in the right direction towards improving population health, but it does remain important that we consider these other contingencies that I mentioned. Thank you for the opportunity to present to you.

Senator RICE: Thank you very much, all three of you, for your very important contributions to our deliberations. You all outlined the current costs of air pollution and the potential benefits, both the health benefits and the huge economic benefits, of getting rid of that pollution by shifting to cleaner vehicles. It seems that the evidence we've got is that shifting our light vehicles—cars—to electric vehicles pretty quickly, with the right policy framework, is going to be straightforward. Set the framework and it will happen.

How much of that air pollution you're talking about is from light vehicles, from cars? How much is from heavy vehicles, where it's going to be a longer process and a bit more difficult, I can see, for heavier vehicles to make that transition?

Prof. Marks: I think that's a very important point. In fact, light petrol vehicles have become much cleaner over a period of time. So not only is the contribution of tyre wear and brake wear and so on significant but the relative contribution of heavy vehicles to the air pollution mix is much greater now than it used to be. I can't quote for you the proportion, off the top of my head, but I do know that heavy vehicles are a substantial proportion—particularly diesel powered heavy vehicles—of the contribution to air pollution. It will be important to deal with them in the transport mix if we want to reduce the transport related contribution to air pollution and its health consequences.

Dr Hanna: On that point, we would urge that if light vehicles were the first tranche of this there would be sustained efforts to, subsequently, roll this out to heavy vehicles. The other component is that it is very difficult without the knowledge. So, again, we'd urge some investment in finding out those figures.

Senator RICE: We need to do the research. It's just not acceptable that we haven't got updated research, to be able to pick apart what impact—

Dr Hanna: Indeed. A lot of the research is quite old now.

Senator RICE: Are the health benefits likely to be focused in particular areas? We mostly talk about health benefits for people who live in cities, when we're talking about the health benefits of cleaning up our vehicle fleet.

Dr Hanna: The health effect is, basically, dose response. If you're exposed to higher concentrations over a longer period of time, your risk is higher. Therefore, those living in the air sheds where these are—anyone that's flown around will see the layer of pollution that spreads out. You can see it if you're flying, even, around the Grampians and the distant hills way out yonder. The air mass will transport out, so, ultimately, everyone is

affected—in utero too, because some of these will cross the barrier. So the poor little bubs popping out are carrying a burden even from scratch.

Prof. Marks: It relates to congestion. Congestion happens in cities. Most transport happens in cities. Most people are exposed in cities. Where there's a concentration of people you have more emissions, and you have more people exposed. The two things tend to go together. But you're right; this can happen anywhere. There are issues about off-road vehicles as well. Off-road vehicles and off-road diesel are significant contributors, and that is an issue, for example, in mining communities and so on. It comes back to the heavy vehicles question.

Dr Hanna: One other thing is the trend, which is the good environment trend, to stop the urban sprawl and concentrate people in cities. Just the demographic changes of what we are doing are increasing the concentration, or the percentage, of the population today—25 million, as we know—that we're throwing in.

Senator RICE: Exactly. We're increasingly urbanised.

Dr Hanna: One of the issues with public health—because we're conflicted in so many ways—is that we're trying to push people onto bicycles, but if you are cycling, of course, your respiratory rate increases and you're exposed to more toxins.

Senator RICE: I know. Yes.

Dr Hanna: It would be so much easier for that message—get out on your bike, get out and go walking—if the air were a bit cleaner, rather than it being: go out and expose yourself to really polluted air. That is a problem for us.

Senator RICE: Do you have a view as to the mechanisms to get the shift; in particular, the role of vehicle emission standards? That is one thing I'd like you to comment on. How important are they going to be to reducing pollution, including carbon emissions? Also, what is the potential of clean air zones such as other cities around the world have—that is, cordons and not allowing polluting vehicles into the centres of cities?

Prof. Marks: I don't have strong views or strong evidence about particular strategies that would be most effective. The evidence is: the lower the population exposure, in total, to particulate and nitrogen dioxide air pollution, the better. So any strategies that are associated with reducing exposure are beneficial.

Our current way of controlling air pollution is to set a level and say that if you're below that level you're safe and if you're above that level you're not safe. In fact, the evidence doesn't support that approach. The evidence would suggest that all reductions in air pollution will result in health benefits and all increases in air pollution will result in harms. So, wherever we are, we should be trying to reduce further. My advocacy would be for continued improvement and continued reduction in population exposure to particulate and nitrogen dioxide air pollution.

Dr Hanna: You can draw the corollary to lead and lead petrol. Initially, we thought blood lead levels were okay and kiddies wouldn't have cognitive impairment. Of course, as more and more research came out, the safe levels in the regulations came down and down. We realised that exposure was harmful even at lower levels. Again, it gets back to—and I'm not really apologetic for being research and evidence based—actually needing the work to be able to do it. It would be impossible to think that, as new research was done, we'd find out that it's actually less harmful. Without question, with everything we do, when we go and find out we find it's not as safe as we thought. Of course, it's at population level and there are always the vulnerable. If we get back to the fact of thunderstorm asthma, we would argue that the population is presensitised. So we need to reduce it.

Senator RICE: So basically we need to be taking action to clean up our vehicle fleet as quickly as possible and as much as possible. Is anyone doing any work, or interested in looking at the work, on the timescale of the change, the health benefits and the related economic savings? We've heard this morning that essentially, a hundred per cent, electric vehicles are coming; it's going to happen. If we have the right policy frameworks and incentives we can make it happen sooner. We could get, say, a hundred per cent of new vehicle sales by 2030. It sounds like, with the right policy framework, that's achievable, with lots of benefits for Australia. If we don't do that, polluting vehicles will continue to be sold into the Australian market, we'll be the dumping ground for them, and we'll have a longer tail. It seems to me there'd be a big difference in, and benefits to, moving more quickly rather than more slowly.

Prof. Marks: Certainly, that's the case. One aspect of the tail is that the health effects are long-lasting. So the people who are now exposed—

Senator RICE: Reduce it by a year, and you have 20 years of—

Prof. Marks: including in utero and in early life, are people who are going to live for a long time with adverse health effects attributable to these exposures. So it's not just the delay in the short-term benefits of exposure; it's the fact that long-lasting adverse health effects are being accrued in people who are currently being exposed. And,

the longer we're exposing people, the more people are going to live with those health effects. So, there are benefits of moving sooner rather than later—that's definitely the case.

Dr Hanna: In answer to the second part of your question, yes, there are people interested in doing the work. It's a matter of whether there's funding available—whether it be a direct tap on the shoulder or an urgent call through the NHMRC for tenders to go in. Again, if the process was looking at who are the key researchers in this area and letting them do it—or by a tender process—there are people who are very, very interested.

Senator RICE: It's important research.

Senator DAVID SMITH: Dr Johnston, in your organisation's submission, there was reference to a total life cost comparison between, I think, a Corolla and a LEAF. That was quite useful, because that's obviously what one of the challenges is going to be. Can you step through that life cost analysis in a bit more detail.

Dr Johnston: I would have to take that on notice, because I don't have the study with me.

Senator DAVID SMITH: That's okay.

Dr Johnston: It was to demonstrate the importance of being able to make this realistic for people, and the sorts of policy support that might need to be in place until cost parity happens, which, as we've heard, is some time away.

Senator DAVID SMITH: I think it's very useful for the committee. I thank the association for going through that.

Dr Johnston: I'd certainly be happy to take that on notice.

Senator DAVID SMITH: Thanks.

Senator PATRICK: I'll start off by saying that I don't doubt that pollutants are harmful, but this is just testing a bit of the evidence that's put forward. I would imagine that we've seen over time—my first problem is just understanding how you isolate pollutants from all the other things that occur to establish that they have this much effect on life expectancy or some disease versus some other troublesome thing we run into in our everyday lives. How do you isolate pollutants to a cause or link them to a—

Dr Hanna: The process is quite different. Epidemiology is the study of that thing, so you go through comparing groups that are exposed to those that are not, and then you run the stats through as the difference in rolling that through. I'll pass over to a respiratory physician for the specific differences in those, but the science and the methodology are very much available to do that. It was one that we highlighted with the difference between dying from smoking and not, and it was a matter, again, of sorting out the people who actually smoked versus those who don't smoke and who gets the cancer—

Senator PATRICK: That's much easier to sort out than people who walk around in the street who get exposed to pollutants. Are you comparing Sydney to the country? The other thing is, over time, our emission standards have got much better. What I'm ultimately getting to is that, over time, as our emission standards have dropped, has the effect been half, three-quarters? Normally, the cleaner you get, the less low-hanging fruit there is. I just wonder whether we've got so close that we know life expectancy is up and we've got to a point where going to electric doesn't make a big difference or it makes a huge difference. I'm just trying to understand that space.

Prof. Marks: I think you've raised a number of interesting questions and important questions. It is complicated. It is difficult, and it's not straightforward to demonstrate those associations you're describing, because, as you point out, we're all exposed to the air. The exposure is ubiquitous.

Senator PATRICK: And there would be latencies, I'd imagine, as well.

Prof. Marks: Yes. Our knowledge and the statements that we've all made about health effects are based on a whole set of different types of data—everything from laboratory data; experiments done in cells and in animals; exposure chamber studies, where you put people in an exposure chamber and you make physiological measurements during exposure to clean air, polluted air and so on; to epidemiological studies, where you compare people who live in one city with people who live in another city and people who live in a third city, and you look at the differences in air pollution levels. You take account of other factors that might differ between those cities to try and deal with what's called 'confounding', to deal with other factors that might explain—and to isolate the effect to the effect of differences in air pollution.

What we are dealing with is a confluence of evidence from a whole range of different sources, all of which point in the same direction, towards adverse health effects. There does seem to be pretty consistent evidence from a number of different studies. The technology for this is improving. Our capacity to measure air pollution more accurately, now almost down to the place where a person lives, rather than the whole city, is improving. Our

capacity to measure a whole lot of different specific health outcomes is improving. The science underpinning this has improved over time and the improvement in the science has been associated with more certainty about the evidence of adverse health effects.

Senator PATRICK: But it's not exact, is it, because of the complexities and perhaps some errors and some latencies?

Prof. Marks: Sure. There is uncertainty in all the estimates that we make, but there is no real uncertainty about the nature of the fact that there's an association. One current area of concern is one of the areas that you just suggested. Air pollution levels in Australia are, in fact, amongst some of the lowest in the world, if we compare ourselves to China and India. What is not known is the nature of what we refer to as the dose-response relationship. There has been an assumption that all the adverse effects are up here at the higher level and once you get down below a certain level there are no further benefits to be gained. But, as we learn more and more about lower levels of exposure—we're doing this sort of research in Australia at the moment—we're learning that, even at these very low levels, where we are now, there are health effects to be observed, and, therefore, gains to be made, as I was alluding to before, by further reductions. That's one of the contributions Australia can make to research in this area. We are in the area where other countries aspire to be in the future by reducing their air pollution levels. Can they get further benefits from reductions? That's the question.

Senator PATRICK: To be clear, I'm not doubting in any way; I'm just trying to explore the space a little bit. In some sense, if we took all the cars in Shanghai and made them electric there'd be, perhaps, a huge change in health outcomes versus if we took all the cars in Canberra—which is relatively clean, with fewer vehicles and good emission standards—and made them electric. The difference may well be chalk and cheese. I am just trying to understand the space.

Prof. Marks: There are two elements to that. One is: what is the relative contribution of vehicle fleet, for example, to the air pollution exposure in that environment? That's one issue. It may be that in one city, as compared to another one, there are a whole lot of other sources of air pollution and that changing the vehicle fleet is not going to make a major contribution to air pollution. So that's one dimension of the question you're asking. The other, which I think is what you're really getting at, is: will there still be a benefit from reducing exposure to air pollution for health? My answer to that is that we don't know for certain at these very low levels at the moment, but the suggestion would be that there is no bottom level, and that wherever we are further reductions will have further benefits, but that's the area which we're investigating at the moment.

Senator PATRICK: I'm asking this question because it helps me work out, when you're talking about the benefits of electric vehicles—and clearly there are lots of them—where you weight the health, notwithstanding what you said, that people are very interested in health, but where you weight the benefit, whether it's right up the front or whether it's simply that reduced carbon, for example, might have more weight.

Prof. Marks: I can't answer that question relative to all the other benefits, because I'm not an expert in the relative weight of all the other benefits, but I can say to you that health is an important co-benefit, and that's the sort of area that we are interested in. The health benefits of improving air quality are an important co-benefit associated with the other benefits that you've been discussing here around electric vehicles. It's hard to quantify.

Senator RICE: A point that was raised in your submissions but not in many others—and it's certainly one that we're not talking about—is the health benefits of tackling climate change and the importance then of decarbonising our transport system, to add to our efforts to tackle climate change. I know we're running out of time, but could you give us a quick grab on that?

Dr Hanna: Again, it gets back to the long-term effects, both health and economic. Places like Canberra are making great positive moves in terms of decarbonising their electricity sector, and we certainly now need to move on to others, particularly when it's so easy. We've got alternatives that are sitting there ready and available. As far as the impact of health goes, we are seeing what's happening with climate change around the world at the moment. It's gone quite crazy. Even Siberia is burning. That's outrageous. Fifty degrees is already happening, and it will soon happen—much sooner than we initially estimated—in terms of hitting 50 in Perth, Adelaide and Melbourne. My own research is into human tolerance of this extra heat and the fact that that's going to really diminish our activity as well as our health. Of course, it won't help poor little babies born at the moment in terms of what the likelihood of their future happiness is going to be if, by 2070, we are looking at three degrees more, because the planetary climate at the moment, with just one degree of warming, is wreaking havoc. And already the growth in disaster recovery is exceeding global growth in economic development. We've already passed that point of going backwards in terms of having to just recover where we were rather than actually trying to get better, which actually further emphasises that it's a really important investment to make whatever change we can as soon as possible, again because the consequences will be so long-lived.

CHAIR: Thank you very much. We will conclude there. Thank you very much for your evidence today.

HARRIS, Dr David, Research Director, Low Emissions Technologies, Energy, Commonwealth Scientific and Industrial Research Organisation

LOVATT, Dr Howard, Team Leader, Electrical Machines, Commonwealth Scientific and Industrial Research Organisation

McLEAN, Dr Keith, Director, Manufacturing, Commonwealth Scientific and Industrial Research Organisation

[12:44]

CHAIR: Welcome. Information on parliamentary privilege and the protection of witnesses in giving evidence to Senate committees has been provided to you. I note you don't have a submission, so I now invite you to make a short opening statement. At the conclusion of your remarks, I will invite members of the committee to ask questions.

Dr Harris: I'll do my opening remarks on behalf of our team. Firstly, thank you for the invitation to appear today and to provide further information relating to electric vehicles. Also thank you for including some of the issues around the role of hydrogen technologies in hydrogen fuel cell electric vehicles, which are an important part of the mix.

As you're aware, we have a portfolio of research and capabilities relative both to electric vehicles and the systems in which they work. For example, the hydrogen membrane technologies are the first of their kind in the world. We do welcome the opportunity to clarify for the committee some of the roles that CSIRO plays and can play in the potential use of these vehicles and other relevant technologies in relation to their use and manufacture in Australia—importantly, the development and implementation of infrastructure and systems to support these transitions. That's one of the really important aspects of the electric vehicle transition, and that is pretty much specific to the location and the nature of the way we use them in Australia; the infrastructure and the environment we have here is quite different to many others.

Across those infrastructure requirements we're doing quite a lot of work to both battery electric and fuel cell electric cars—for example, accelerated development of hydrogen production, storage, transport, export and utilisation of fuel cell systems, not just in Australia but potentially to supply renewable, low-emissions energy all around the world. The global market for hydrogen's expected to grow over the coming years, and we have abundant resources and technologies amenable to production and export of that resource. That could be an entire new industry for Australia—exporting renewable energy, for example. Of course, that technology would coexist with battery electric vehicles and, for some time, with existing transport options in the Australian transport fleet. So the infrastructure and the integration of the systems is critically important in this transition.

A couple of specific examples that I will comment on, where we are working on relevant and related technologies, are looking at the system benefits and the potential benefits of transition to renewable and low-emissions fuels for transport applications, including fuel cell and battery electric vehicles. That includes technoeconomic and social studies and how the systems can synergistically integrate together. We're looking at the development of relevant supply chains, including hydrogen fuels; second-life applications and recycling for batteries; and activities through the entire value chain and life cycle of lithium batteries—for example, mining and resource production, battery development, battery applications and second-life and appropriate end-of-life management and recycling. Some of the specific battery technologies we're working on include developing ionic liquids as an electrolyte to improve battery safety and next-generation batteries using, for example, lithium sulphur and other materials that could halve the weight of current car batteries, which is important in the future.

We're also looking at developing a broad renewable technology framework. This now goes a bit beyond just vehicles, because as these systems develop, many of our energy systems actually coalesce. We start to bring together some of our chemical process, our grid systems, our renewable energy and our transport. So we are looking across the energy spectrum, all the way from cleaner coal utilisation technologies to smart grids, integration of more renewables and load management—all of which can be targeted towards how increased electric vehicles may well impact on our electricity system and on our energy networks.

We're here today to try and provide some detail across our broad portfolio of work on battery electric vehicle and hydrogen fuel cell electric vehicle related work to try and provide some framework and some help for you in your inquiry. For example, we've recently contributed to the Adelaide-built Bustech electric bus demonstrator through our colleagues in manufacturing, and also the Chevrolet Volt vehicle, which we understand is being demonstrated here today. We're happy to answer any questions you might have and we'll respond as best we can, but, given the range of our work and the breadth of the technology, I'm sure there will be areas where we may not

be across the finer details. We may need to take some issues on notice to consult with our colleagues as necessary. I'm the research director in CSIRO Energy. Keith and Howard are with CSIRO Manufacturing. So, between us, we do cover a fairly wide range of what CSIRO's doing in the area, but, as you're aware, there are many other aspects of this system. Thank you.

CHAIR: Thank you very much.

Senator KIM CARR: Why is there no submission from the CSIRO?

Dr Harris: We discussed the possibility of a submission, but, by the time we were invited to this, with the breadth of things that were going on, we simply weren't able to corral the resources across the whole organisation to do that, and that's why we focused on the specific aspects that we have.

Senator KIM CARR: Is that your explanation—you didn't have enough time?

Dr Harris: No. We weren't aware, until only days ago, of the nature of the inquiry. It was only brought to our attention—

Senator KIM CARR: So you haven't read the terms of reference?

Dr Harris: Yes.

Senator KIM CARR: You have?

Dr Harris: Yes.

Senator KIM CARR: When did you see the terms of reference?

Dr McLean: I personally saw them on Monday this week.

Senator KIM CARR: That wasn't enough guidance for you to write a submission?

Dr McLean: There are a lot of things going on, I guess. That's just—

Senator KIM CARR: You didn't have enough time—it comes back to that, does it?

Dr McLean: Yes. For me personally it does. I'm just back from a month's leave.

Senator KIM CARR: I'm very disappointed, that's all. I've often said you're the premier science organisation of the Commonwealth of Australia. You have a very significant capacity with regard to batteries. You used to have significant capacity in manufacturing. No doubt you'll tell me you still have.

Dr McLean: Yes.

Senator KIM CARR: And you don't have enough time to write a submission?

Dr Harris: In the process, a call was put out to the whole organisation letting us know that this was happening and seeking relevant experts and relevant inputs that could make a submission for that, and, by the time that came in, just this week, we had enough for us to be able to present what we have, but there was not sufficient time across the organisation to pull that together.

Senator KIM CARR: Would you be prepared to prepare a supplementary submission?

Dr Harris: That's what I was going to suggest.

Senator KIM CARR: Given the standing the CSIRO has within the Commonwealth of Australia, I regard this as grossly inadequate.

Dr Harris: We would be prepared to now prepare a submission. We now have the information and we can prepare a submission to the inquiry on notice.

CHAIR: I'd like to invite you to do so. I believe we issued an invitation to make a submission on 4 July. There may be a communication issue that will be investigated, but I would like you to do so. Thank you.

Senator KIM CARR: I'd be interested to know, given your expertise in this field, as to what your view is about the likely developments in battery technology as far as electric vehicles are concerned. Do you have an assessment in terms of what you expect will happen in terms of the movement from the current battery technology that's in predominant use compared to, for instance, hydrogen and what's referred to as solid-state batteries?

Dr Harris: The batteries in the vehicles and the batteries in the charging station systems as well—

Senator KIM CARR: Yes.

Dr Harris: As I mentioned, we have groups looking at components of those batteries, specifically ionic liquids and different battery chemistries. CSIRO is certainly contributing to that. We don't have a battery manufacturing program that I'm aware of, but I'd be happy to invite my colleague to comment on that.

Dr McLean: CSIRO manufacturing, as you know, is basically the home of material science in CSIRO. We have work within our business unit in the battery space. The organisation has had that for a considerable period of time, as you know. We're currently doing a lot of work in the lithium space—on lithium-sulphur batteries, for instance. That is an area of work that we've been conducting for a number of years. In addition to that, we're looking at the whole value chain from the starting material to the chemistries, starting to look at manufacture. We are speaking to companies within the country now. That's at a very early stage, but we are speaking to some of the battery manufacturers here about how we might be able to help them. There's also some work starting to happen in the recycling space.

As part of the organisation's investment in its future science platforms, there is a proposal in front of the executive team and the Science Council, at the moment, to have one of our future science platforms on this whole lithium value chain. And the battery work there may be applicable to automotive, but, as we also heard, it's applicable to other areas as well. There are other materials, obviously, that can be used in the battery space, whether that's graphite, whether it's aluminium and manganese or other minerals. We're speaking to producers and helping people in the graphite area, specifically, as well. There is certainly work going on in our business unit around the advance of electrolytes for improved battery systems and battery efficiency and battery safety.

Senator KIM CARR: I'm particularly interested in what your projections are, in regard to your assessment—it's analysis I'm looking for—in terms of what you consider to be the directions of the technological development for batteries. In your submission, when you get to write that, can you attend to that?

Dr McLean: Yes, absolutely.

Senator KIM CARR: What can you tell me about silicon carbide and gallium nitride based switching systems?

Dr Lovatt: They are very interesting and relevant, and relatively new, technologies. Availability in the marketplace at the moment isn't great for them, but I'm sure it will improve and we are most definitely actively experimenting with them at the moment, although we have not to date persuaded any of our commercial clients that that is the best option for them.

Senator KIM CARR: The committee's been told that by 2015 the development of these particular technologies will revolutionise the existing AC power grid. It will transform the grid so that we'll be able to adapt the entire approach to the electric vehicles system, right through from the charging to the operations of vehicles. Would you agree with that assessment?

Dr Lovatt: I'm not an expert on grids to offer a comment. I can explain to you what the technology does. It will reduce the size and weight and increase the efficiency of things like battery chargers and power factor correction on grid. I guess it will come down to an economic argument. Unfortunately, I'm out of my depth, at that point, to comment. Sorry.

Senator KIM CARR: It's been put to us that this will include the issue you mentioned of battery charging but also motor drivers, the actual drive train of the vehicle itself. Would you agree with that assessment?

Dr Lovatt: Yes. It will definitely improve the drive train.

Senator KIM CARR: And that technology will be widely available within the next 15 years.

Dr Lovatt: We are not developing that technology, so I don't know timescales. They are improving every year. We ran a project two years ago and we looked at them again this year, and there was a distinct improvement. So it's heading in the right direction but we're not involved, directly, in the development. It's speculation.

Senator KIM CARR: The reason I ask you these questions—you may not be involved directly in those particular projects—is you provide advice to the Commonwealth not just on the projects you're specifically involved with but with scientific advice on these types of issues, do you not?

Dr Lovatt: I haven't personally, no.

Senator KIM CARR: The CSIRO. You're not here just to represent your business units, as they're called these days, you're here to represent the CSIRO more widely, are you not?

Dr McLean: True.

Dr Lovatt: I don't know the answer to your question but I'm happy to investigate for you.

Senator KIM CARR: That's what I'm looking for. In your submission, if you could provide us with that technical advice as to the CSIRO's assessment—and that's not irrefutable. It's contestable. All of this is. We have to look to people who have some technical impartiality when it comes to the assessment of these questions,

particularly when it goes to the matter of public policy. If it's true that there are going to be substantial changes in electric vehicle technologies that will render vehicles obsolete very quickly, we ought to know that.

Dr Lovatt: I'm happy to do that for you, Senator.

Senator KIM CARR: Thank you very much. Do you do any assessment on safety issues? I know CSIRO is currently involved in a number of safety disputes in other areas, but do you do any assessment on electric vehicle safety questions?

Dr Lovatt: We certainly have on battery systems, but not in general for the whole vehicle.

Senator KIM CARR: No. I'm not saying that you should replicate the work of ANCAP, but on the question of battery technology, for instance, are you doing any assessment there?

Dr Lovatt: Yes, we have for a number of clients. Lithium batteries have a whole suite of different lithium chemistries and the characteristics of an individual chemistry are quite different. One of the major things we have done for clients is assess which of the suite of technologies is best for their application. Safety is often one of the—

Senator KIM CARR: In your submission can you look at the issue of safety as well please? We would appreciate, even if it is a literature review, your understanding of these questions. There is another issue I'm concerned about, given the manufacturing unit has expertise in this field. There is an argument that the production process for electric vehicles is actually cheaper than for conventional vehicles because of the different method—rather than the current production line for a conventional vehicle, which is best summed up perhaps by the Toyota method, the Scandinavian method. Do you have any assessment on whether or not that is the case in terms of changing the business model for the production of vehicles?

Dr Lovatt: It's certainly true that the production of the drive train component is much simpler for an electric vehicle than it is for a conventional vehicle. The rest of the vehicle though I would argue is much the same. You'll just see that effect, which is true, for the drive train component.

Senator KIM CARR: If you could have a look at that in your submission, that would be very useful for us. I understand that you do a lot of work in hydrogen. Do you think that the Japanese are the leaders in this field?

Dr Harris: On different aspects of it, yes. We work with the Japanese looking at hydrogen supply sources. There's work on hydrogen utilisation. The Japanese certainly lead us in manufactured fuel cell development and direct utilisation of hydrogen. We certainly have a history in that. Our focus has really been on the infrastructure and the development of a hydrogen supply chain for particular fuel cell vehicles or pure hydrogen applications.

Senator KIM CARR: So do you look at the question of hydrogen production?

Dr Harris: Yes. Hydrogen production currently, as you are probably aware, mostly comes from gas conversion and other fossil fuels but we certainly have worked on advanced electrolysis technologies and others for producing from water. We've even got work on solar thermal high-temperature hydrogen production.

Senator KIM CARR: Yes, and do you have any assessment on costs on that issue, whether gasification or electrolysis?

Dr Harris: Hydrogen production from gasification is cheaper. Gasification and gas reforming is currently the worldwide commercial method for doing that, and that is the cheapest method so far.

Senator KIM CARR: Do know by what factor?

Dr Harris: Hydrogen of the order of \$3 a kilogram or thereabouts. The current sorts of targets for renewable hydrogen are of the order of \$10 to \$15 per kilogram dispensed for vehicles, so, yes, it's more expensive than current applications but it's a high-value application.

Senator KIM CARR: Are you familiar with the pilot in Gippsland?

Dr Harris: Yes, we are.

Senator KIM CARR: Are you a party to that?

Dr Harris: We have some role in supporting that work, mostly through the coal gasification aspects of the project, understanding the performance of that particular coal in those technologies.

Senator KIM CARR: That's reliant on carbon capture and storage, is it not?

Dr Harris: For that to be a low or zero emission end product it would rely on managing the CO₂, that's correct.

Senator KIM CARR: Is that a big inhibitor to the development of that to a commercial scale?

Dr Harris: It's a cost. We are now talking about converting brown coal to hydrogen for use in transport, it's a different set of circumstances than conversion of coal through combustion to make power. That application, CO2 capture and storage, is a significant cost component of the overall process. When we move to hydrogen production, as I said, of the order of \$10 to \$15 a kilogram and using vehicles, the cost of carbon capture and storage, as projected by the project proponents, is around 10 per cent or less of the cost of the product, so it becomes more feasible.

Senator KIM CARR: I would be interested if your submission could cover that question as well—the comparison in terms of future technological development. The Chief Scientist has issued a paper this morning on the deployment of hydrogen. He is arguing that it is actually a more efficient and more effective means for the electrification of the transport infrastructure. Your assessment of that paper would be very useful.

Senator RICE: I wanted to clarify, in terms of the cost for carbon capture and storage to the cost of producing hydrogen from brown coal, you were saying that at the moment from natural gas hydrogen per kilogram it is about \$3?

Dr Harris: The market price of hydrogen changes. Of the order of \$3 a kilogram and it's all done in different terms. But \$3 kilogram is of the order of the current price of hydrogen.

Senator RICE: Using renewables and electrolysis is currently in the order of \$10 to \$15.

Dr Harris: Of that order. It depends where you are. The dispense cost of hydrogen in California, I think, is US \$16 a kilogram for their trials for this sort of application.

Senator RICE: What sort of cost are we looking at for hydrogen from brown coal with carbon capture and storage as part of it?

Dr Harris: A big part of that project is transport to Japan. The costs of hydrogen production at that plant, I don't know. The plant's not built and there's a lot of design work still to go. The target price for landed hydrogen in Japan of that project, and it's a significant project so I am relying on the information I have from them, is of the order of \$10 per kilogram. But in the longer term there are, obviously, expectations to bring that down.

Senator RICE: You would also expect the cost of hydrogen being produced by electrolysis and renewables to come down over time as well wouldn't you?

Dr Harris: Yes, of course.

Senator PATRICK: I will point out, this might be helpful to you, that I asked a question at the last estimates session on your involvement in lithium. You have given a great four page response and that might be part of the start of a submission to this inquiry, just to help you out. Senator Carr has been exploring how rapidly these things change. There are a few technologies you are working on. Lithium sulphur batteries, for example, with two times to five times the energy density sounds quite exciting. How long have you been working on that particular technology? If you were asked to place an estimate on when you think that would be in production and in the commercial market what timeframe would you expect?

Dr McLean: I will probably take that on notice, other than to say that it's an area we have been working in for the last few years. The exact start date, I don't have that immediately to hand. The second part of that was?

Senator PATRICK: When would you project it becoming a commercial product?

Dr McLean: Let me take that on notice.

Senator PATRICK: Scientists never want to commit to that. I understand that. I have an R&D background, running an R&D seller, so I know how hard it is. Is it a year, two years or 10 years? That is what I am trying to understand. There is another technology, ionic liquids, that you are working on. Once again, you've worked on it for some time. Is it likely to go to market shortly?

Dr McLean: For some of the work we have been doing there, we have been partnering with commercial entities. We are working on that technology currently and, again, I can get our experts in that space to give you an estimate.

Senator PATRICK: What I am getting at is to answer the question of Senator Carr, where he was exploring how quickly these things change. I have hung around submarines for many years, talking about lead acid cells and lithium ions and other technologies, and you generally land in one spot. Lead acid cells have been around for a long time because they don't have heating problems or they don't have maintenance problems—lead acids do but lithiums don't. A lot of these technologies end up not being very useful in a general application. So maybe the ultimate question is: noting all of the requirements for a car, when are we likely to see a change in technology? I presume, if there is a change in technology, there is a change in capacity. But it could be form, fit and function and just slot into a vehicle giving more capacity, I presume.

Dr McLean: We certainly answer that in our submission. Just to follow up a little bit on what you said there, we are working with a company currently in South Australia looking at some of our technology for incorporation into future submarine.

Senator PATRICK: And I hope that none of your people were hurt in the accident earlier this week—there was an accident. I know the company you are talking about. I think there was an explosion there this week. There are two people in hospital there, unfortunately. In regards to end of life, in your answer to me, and this relates to some questions that I asked before, you say that lithium battery recycling in Australia is very limited with only three per cent of batteries sold currently being captured and sent for recycling offshore. As volumes of waste batteries grow, an emerging problem of landfill waste increases and hazards such as chemical leakages from pieced batteries or even fires may occur. That actually paints a very different picture to evidence they we received before, that as the electric vehicle market grows, everything is going to be wonderful. I don't know if you can sort of talk to that now or whether it is worth putting something in your submission that says, 'As that market grows, how do we solve that problem?' Is it a problem? How do we solve it?

Dr Lovatt: To make one observation on that, with a vehicle it is a lot easier to capture the battery at the end of life because there is already significant infrastructure for recycling the vehicle as a whole and the batteries could be an add-on to that, whereas, like your phone or your laptop batteries, it is much harder to actually capture the battery at the end of life.

Senator PATRICK: So there is a differentiation between general use, where you say three per cent, and the car world? Are you saying it is quite different?

Dr Lovatt: Currently the car world is very good, but the major manufacturers, like Toyota and Tesla, take responsibility for the whole of the battery life, so the recycling of those is excellent at the moment.

Senator PATRICK: Could you perhaps look at some of the submissions that give indications of market and come back and provide the committee advice on this?

Senator KIM CARR: In submission No. 91 from the University of Adelaide, there are a couple of professors there from the Centre for Automotive Safety Research and the School of Electrical and Electronic Engineering who made some comments on the safety question.

Senator PATRICK: The line of questioning I have is simply relating to hydrogen. With an electric vehicle, you come along and you plug something in. My experience, having done a bit of sea time on submarines that use fuel cells, is that the refilling of the metal hydride containers that would normally safely contain hydrogen—it is hard to store; you need special storage for hydrogen. In the car world, is there similar complexity and similar safety-related issues?

Dr Harris: I don't know about refuelling submarines. But the refuelling of cars with hydrogen—it's a gaseous hydrogen, so it's a gas tank and not a metal hydride storage, and it's in the gas phase. It's done with a high-pressure gas dispenser and that looks much like the connecting of your LPG gas car. It looks very similar. We did a demonstration of this just last week at CSIRO. It is very high pressure. Some are 300, some are 500 and some are 700 bar. That's the tank system. The reason for those high pressures is to give a large amount of hydrogen and, therefore, a large range.

Senator PATRICK: So the density of the hydrogen that you store translates to a range—

Dr Harris: More hydrogen gives you more distance.

Senator PATRICK: That's where I am going to—the safety aspects of that.

Dr Harris: The safety aspects of that, like any fuel dispensing, have to be addressed in developing those fuel stations. Certainly in Europe, Japan, Asia and the US, where those fuel stations are being rolled out now, the leading companies—one of them is Linde, for example—have a very strong focus on safety, and even the portable systems that we used the other day. It's designed intrinsically to contain that hydrogen gas.

Senator PATRICK: And the Europeans generally have really good safety regimes. I presume that it's a much more expensive recharging station than an electric-charging station. Would that be fair?

Dr Harris: I really don't know. We don't have commercial charging stations in Australia. I really don't know the precise cost. We could certainly look into what the costs are in Europe and other places where they're used, but I don't have that information with me.

Dr Lovatt: Just to further comment on that: the infrastructure is quite similar to compressed natural gas. It's a similar technology; a similar pressure is used for the tanks and for the feed station, so it's largely an established technology.

Senator PATRICK: I presume you use general oxygen from the surrounding environment. That's the other component that normally goes into a fuel cell.

Dr Harris: Yes.

Senator RICE: I know we're running short of time. I look forward to seeing a comprehensive submission, and having you back to then discuss some of the issues raised in that submission would probably be the best way of proceeding. I am also interested in covering the role of potentially hydrogen-fuelled vehicles here in Australia, with the hydrogen economy—hydrogen is an export industry—and also your new technology of being able to store hydrogen as ammonia and use that as a storage medium. The only other area that I was interested in was CSIRO's *Low emissions technology roadmap* that you developed last year. Are you able to answer a couple of questions about the role of transport in that?

Dr Harris: I'm not sure!

Senator RICE: Essentially, it was basically setting out a road map for reaching 26 per cent reductions by 2030—our Paris target—and then I think net zero by 2050. I'm interested in what role decarbonisation of transport plays vis-a-vis stationary energy in that road map.

Dr Harris: I would have to review that and get back to you. I'm happy to put that in a submission. That was a set of scenarios, and the scenarios were there to paint various pictures. They weren't meant to be predictions. I would be happy to review that and include that in the submission.

Senator RICE: Reflecting upon the importance of decarbonisation of transport in meeting our emission targets.

Dr Harris: Sure.

CHAIR: Thank you very much for your evidence today. I look forward to the submission and a further opportunity.

DOWLING, Mr Paul, Associate Director, Investment Research, Clean Energy Finance Corporation

FRISCHKNECHT, Mr Ivor, Chief Executive Officer, Australian Renewable Energy Agency

HAENKE, Mr Peter, Manager, Energy Productivity, Australian Renewable Energy Agency

JORDAN, Mr Tim, Director, Investment Research, Clean Energy Finance Corporation

[13:19]

CHAIR: Welcome. Information on parliamentary privilege and the protection of witnesses in giving evidence to Senate committees has been provided to you. ARENA, you have lodged submission 99 with the committee. Would you like to make any amendments or additions to that submission?

Mr Frischknecht: No, thank you, but we would like to make an opening statement.

CHAIR: Yes, I will certainly invite you to. Clean Energy Finance Corporation, you have lodged submission 31 with the committee. Would you like to make any amendments or additions to that submission?

Mr Jordan: No, thank you.

CHAIR: I would now invite you to make a short opening statement. At the conclusion of your remarks, I will invite members of the committee to ask questions.

Mr Frischknecht: ARENA was established via legislation in 2012 and is funded through to 2022 with the aim of improving competitiveness of renewable energy technologies and increasing the supply of renewable energy in Australia. Of our \$2.1 billion in funding, approximately \$400 million is remaining to be committed. We have four investment priorities. One of these is improving energy productivity, and that includes transport. Under this priority, we aim to demonstrate how different technologies and approaches, including electrification and fuel switching, can reduce costs for consumers while increasing the competitiveness and uptake of renewable energy.

Our submission to this inquiry focused on the three electric vehicle related initiatives that ARENA has directly supported through funding. The first is in relation to ClimateWorks Australia, which was a wide-ranging project that investigated the role of EVs as part of Australia's transition to a low-emissions economy. There's a recent version of the report that provides a snapshot of EVs in 2017, which is publicly available. Secondly, EV Energy is a project that's currently investigating methods to accelerate EV adoption, grid infrastructure impacts and ensuring that EVs are powered by renewable energy. That project should be completed very soon. The results will be publicly available and will be made available to the committee. The third is an Energeia report commissioned in partnership with the CEFC, and it's a strategic review of EV charging infrastructure as well as some future scenario modelling.

In closing, the world is at the beginning of a once-in-a-century energy transition. It's about not just fossil fuels to renewables but also analogue to digital and centralised to decentralised. The move to EVs is an inevitable part of that transition, and ARENA will continue to facilitate that shift. We will work in both the transition of EVs and the energy sector as a whole. Thank you.

Mr Jordan: The CEFC sees the electrification of Australia's light vehicle fleet as an important part of reducing Australia's emissions over time. The CEFC has financed around 10 per cent of electric vehicles on the road in Australia to date through our partnership arrangements with banks and other providers of vehicle finance. With ARENA we commissioned Energeia, a specialist consulting firm, so that we could better understand the market for EV charging infrastructure. Energeia estimated the required investment in the charging network. They projected EV sales under some different scenarios. They discussed policy measures used overseas to drive EV uptake, and they discussed the impact on electricity demand from EV charging. The Energeia study is the most comprehensive and up-to-date analysis of the EV outlook from an Australian perspective that we're aware of, and we commend it to the committee, as you formulate your report. The CEFC will look to support electric vehicles in Australia where there's a financing gap, consistent with our objective of facilitating the flow of finance into clean energy. We look forward to the committee's questions today.

CHAIR: Mr Frischknecht, I was interested in the developments in South Australia with the 1,600 South Australians through the South Australian Strategic Regional Electric Vehicle Adoption Program. What is the status of that, in terms of the report that might come from that? When might that be completed?

Mr Frischknecht: Within the next couple of months. We'll get it to you as soon as possible.

CHAIR: Are there any initial statements coming from that study that you'd like to share with us?

Mr Frischknecht: I don't know of any of the conclusions. I can certainly share with you what's part of the study if you want me to walk you through that.

CHAIR: No, that's alright; it's detailed in the submission. I thought it might be of interest. We'll just move forward.

Senator RICE: Thank you for appearing. I agree; your Energeia report is a really terrific, comprehensive resource for the committee. I want to take you through some of findings of that report, particularly the levers that will help to drive the EV uptake. Can you take us through the key levers that the report identified as necessary to encourage EV uptake?

Mr Jordan: There are essentially three key barriers that the report identifies. One is the up-front cost premium for electric vehicles. As the committee knows, electric vehicles are more expensive than internal combustion engine vehicles. In Energeia's model, reducing the cost difference to the equivalent of two years of savings from lower operating costs sees mass market uptake. When consumers can look two years ahead and see that the up-front cost is saved through lower operating costs, mass market penetration really accelerates.

Senator RICE: So they're identifying that you need to some financial subsidies or incentives to do that.

Mr Jordan: While the premium is large, their argument is that some up-front cost support would help but that over time, as the cost of batteries declines, the size of that support would decline until it reaches the point where it would be inevitable that there would be a take-off in EV sales when the cost of EVs naturally crosses over with that two-year savings point.

The second barrier they identify is the model range. Essentially, there aren't enough models on the market to meet consumer preferences for style and number of seats. At the moment there are only five EV models on the market, but Energeia identifies something in the order of 20 or 22 by 2020. Once consumers have a wider range of choice, that's an important enabler they identify for mass market uptake.

Senator RICE: What are the best ways of overcoming that then? Is it mandating import companies to bring models to market? Is it fleet procurement?

Mr Jordan: They're the kinds of initiatives they talk about. They identify fleet procurement as a powerful measure because it gives manufacturers confidence that there'll be a market. They talk about relatively small numbers of vehicles needing to be committed to under a procurement target to induce a manufacturer to bring that model to market.

The third key barrier they identify is the need for a charging network. Trying to understand the market for charging was really what we were focusing on in commissioning this report. They find that about 70 per cent of charging would be done at home by at-home private charging, but there's a residual need for about 30 per cent, to be met by combination of local access charging—on a service station model—and intercity regional charging, which together would make up that 30 per cent. The CEFC is interested in identifying the business model and the market size for that private infrastructure market.

Senator RICE: What role do they see for fuel efficiency standards and vehicle emission standards in driving the uptake?

Mr Jordan: They list it as one of the options that would improve uptake.

Senator RICE: How significant?

Mr Jordan: Among the levers that policymakers can use is fuel efficiency standards. The full list has things like direct financial incentives for procurement targets. Import fuel efficiency regulations is another one they identified. Overseas, there have been prospective bans on internal combustion engines. That's a powerful signal to the market. Then there's a list of other measures that, in their experience from overseas, play a smaller role, including things like exemptions from road tolls, free parking, priority lanes for electric vehicles and free charging. But, in the survey data they point to, those are less important to customers.

Senator RICE: The other really nice part of your report was when it looked at projections. There are the three scenarios of no intervention, moderate intervention and accelerated intervention. Can you talk us through what the rate of penetration of electric vehicles into the market would be under those three scenarios. Certainly we've already heard today that electric vehicles are coming; it's just a matter of when.

Mr Dowling: We have two graphs in our submission. The first one looks at the share of EVs and total sales, and the second one looks at how those sales flow through to the total fleet. I'll just step you through the three scenarios. On the first graph of EVs and shares in sales, starting at the light blue line, that's what Energeia have called their no-intervention scenario. That's a scenario where industry and policymakers in Australia don't provide any additional supportive policy to what's already in place, and so the gains in electric vehicles that are driven by international policy and OEM responses to those international policies flow through to Australia to see a take-off point. Energeia have identified the difference between the early adopter part of the market and then this take-off

point that leads to mass market penetration of electric vehicles. Under the light blue scenario, Energeia sees that, in the case of no additional policy support or industry support for electric vehicles, the take-off will be in 2027. Then moving back towards the left we see the dark blue line where Energeia have modelled what they have called a moderate intervention scenario, which is a mix of potential policy support from all three levels of government—local, state and federal—and responses by industry that would lead to the take-off point happening in 2021, which is six years earlier than the no-intervention case.

Senator RICE: Only three years away, yes!

Mr Dowling: Exactly, very close. Then they also modelled an accelerated intervention scenario where the goal was to get to almost 100 per cent of the Australian fleet by 2050 being electric vehicles. They saw that even more aggressive intervention by both policymakers and the industry would be required, and that would lead to a take-off point of 2020 for the accelerated intervention case.

Senator RICE: That's the second graph there. That's 100 per cent of the actual fleet. So they're saying that, with accelerated intervention, you could reach 100 per cent of the fleet, not just new sales by 2050?

Mr Dowling: Correct—100 per cent in Australia of the light-duty vehicle fleet.

Senator RICE: I was trying to read down the graph in terms of 100 per cent of new sales. For accelerated intervention, you've got 100 per cent of new sales being at about 35—

Mr Dowling: Prior to 2040, yes.

Senator RICE: And that would be put off under 'no intervention' until what year?

Mr Dowling: 2045-ish.

Senator RICE: With that accelerated intervention, are we talking about the full suite of initiatives that are mentioned in the report that we just talked through before?

Mr Dowling: It doesn't require the full suite of initiatives. Energeia identified quite a wide range of policy levers at all levels of government. You don't require all of those to be optimised. In the report they identified the actual amount of financial incentive that's required and that, for the accelerated uptake case, it's \$5,500 worth of equivalent incentive by 2019 in order to see the accelerated uptake case. And that can be achieved with a selection of those policies that they identified; it doesn't require all of the policies.

Senator RICE: And then things like fuel-efficiency standards and fleet procurement as part of the suite of measures as well?

Mr Dowling: Certainly they could be. Those are some of the major levers. If just a couple of the main levers were pulled then that would probably be enough to accelerate the uptake considerably.

Senator RICE: So that's very achievable then.

Senator DAVID SMITH: Looking at that analysis, with no intervention, basically, we're still looking at a drift upwards to 100 per cent anyway. Does that 'no intervention' include not rolling out public charging infrastructure? What's the actual granularity in what you mean by 'no intervention', 'moderate intervention' and then obviously 'accelerated intervention'?

Mr Dowling: It is in regard to the range-anxiety-addressing network. It's a prerequisite for all of these scenarios. Energeia identified that three key drivers were required, which Tim mentioned before: a reduction in the up-front purchase price, more models available and the charging infrastructure to address range anxiety. Addressing range anxiety is a prerequisite for all of the uptake scenarios. Within the no-intervention case, as Energeia has called it and modelled it, they assumed that the range anxiety network—similar to what NRMA has already described here today—is in place already.

Mr Frischknecht: I would add that the cost of a minimalist fast-charging network is actually relatively modest. ARENA and the CFC are currently entertaining proposals from private parties who would like to build a very basic, minimalist connection between Brisbane and Adelaide, for example, down the major highways, and the cost for that would be in the order of \$20 million total cost. So we're not talking large amounts of money.

Senator DAVID SMITH: I think, in reading the difference with moderate intervention, there's at least an assumption that there's an accelerated rollout of the charging infrastructure. When the NRMA were in here, they indicated the potential need for support, particularly if you're looking into regional Australia, for that charging infrastructure.

Mr Dowling: Certainly there's a difference between the year that Energeia models that the regional networks are in place. So, for the accelerated and moderate intervention scenarios, those networks are in place sooner than in the no-intervention scenarios.

Senator RICE: And that they require government support for that to happen in those remote areas, presumably?

Senator DAVID SMITH: I would have thought so, yes.

Mr Frischknecht: It's a classic chicken-and-egg situation: because of the range anxiety, whether perceived or real, of people wanting to go on a long trip once in a while, you need to have it; it's a necessary condition. But it's not sufficient to trigger the uptake.

Mr Jordan: A signal from, say, fleet procurement will reinforce the business case for a privately built charging network as well—a signal that there'll be hundreds of new vehicles on the road. We've fed into the business case that a proponent will come to us and ARENA to make the case for financing a new development. So there's a mutually reinforcing set of—

Senator RICE: Exactly—these factors are all interconnected, and so you need to have the suite of them.

Mr Jordan: That's right.

Senator RICE: Implement the suite of them, and you will get synergistic impacts.

Mr Jordan: That's right.

ACTING CHAIR: The CFC's submission says that the charging networks require a \$1.7 billion investment by 2040. Is that your best guess?

Mr Jordan: That's the outcome of the Energeia modelling. They've used a unit cost for each charger—

ACTING CHAIR: So it's a model—that's all it is?

Mr Jordan: Yes.

ACTING CHAIR: I suppose we need to look at the assumptions.

Mr Jordan: That's right.

ACTING CHAIR: So that's for the charging network. I notice that the ARENA submission says you've already spent \$1.18 billion on 376 projects.

Mr Frischknecht: That's everything that ARENA has done.

ACTING CHAIR: Sure, but this is in electric vehicles?

Mr Frischknecht: No, not in electric vehicles.

ACTING CHAIR: I see.

Mr Frischknecht: It's everything. So large-scale solar farms—

ACTING CHAIR: Sorry, that's your entire investment portfolio?

Mr Frischknecht: That's correct.

ACTING CHAIR: It's not just on electric vehicles?

Mr Frischknecht: Yes, that's right.

ACTING CHAIR: Sorry, I'm a bit confused then. Does your mandate have a finite period?

Mr Frischknecht: The mandate does not, but our funding—

ACTING CHAIR: Does? You run out of money sooner or later?

Mr Frischknecht: ends in 2022.

ACTING CHAIR: How much money have you got left?

Mr Frischknecht: We have \$400 million available to commit.

ACTING CHAIR: What did you have to begin with?

Mr Frischknecht: It was \$2.1 billion.

Senator PATRICK: It was cut. It was larger than that, wasn't it?

Mr Frischknecht: Yes. When I first started in the role in 2012—when ARENA was established—the total funding envelope was \$3.2 billion. There were a couple of cuts along the way—in fact, three different ones—

Senator KIM CARR: And you've got a rate of return? Is there a mandated rate of return?

Mr Frischknecht: No. So that's the CEFC. ARENA is on budget. It's concessional finance, so, on average, we don't get the money back. In fact, often—

Senator KIM CARR: So yours are grants, are they?

Mr Frischknecht: Yes, often it's a grant. It is a grant, but some of the grants are recoupable.

Senator KIM CARR: How much money have you spent on electric vehicles?

Mr Frischknecht: It's been a very modest sum because it's only been those three studies to date. I don't have the number here, but we can take that on notice.

Senator KIM CARR: Thank you, if you wouldn't mind.

Mr Frischknecht: Call it a million dollars—something like that.

Senator KIM CARR: Do either of the organisations represented here today have any particular mandate to encourage Australian manufacturing?

Mr Frischknecht: No, that's not part of our mandate. However, it is part of our mandate in the transition to renewable energy to maximise the benefits of that to the countries which—

Senator KIM CARR: Sure, but that's a very broad concept.

Mr Frischknecht: Yes, but—

Senator KIM CARR: Does the word 'manufacturing' appear anywhere in your mandate?

Mr Frischknecht: It does not.

Mr Jordan: Nor ours.

Senator KIM CARR: Do you think it should? Or is that a policy question that you'd prefer not to answer?

Mr Frischknecht: It's a policy question, but it is something that we look at when we make investment decisions. We look at the jobs and we look at the regional impact and that sort of thing.

Senator KIM CARR: Sure. In terms of the work of this committee, one of the terms of reference is a question that goes to manufacturing. There's the charging network, for instance. There are Australian manufacturers of charging equipment. Should they be given preference?

Mr Frischknecht: That's a policy question. But we certainly take that into account when we're doing our assessments of the broader impact. There are secondary impacts. The primary impacts are: transition to renewable energy and the adoption of EVs in this case, for example. But we look at the secondary impacts, which are, for example: what are the Australian jobs and what are the regional impacts that are positive?

Senator PATRICK: Is it only Pty Ltds that get your grants?

Mr Frischknecht: No.

Senator PATRICK: So overseas entities can also apply?

Mr Frischknecht: No, we have two different programs. The main applicant needs to be an Australian corporation for one of the programs, and for the other one it's universities or corporations.

Senator PATRICK: If you have a contract for a million dollars, do you track how much a Pty Ltd or a corporation spend locally here in Australia?

Mr Frischknecht: We don't track the procurement amount. I'll take an example from outside the current sector. The majority of the costs for large-scale solar farms are construction and civil costs. However, the panels themselves and the inverters are significant—usually they add up to 30 per cent or 40 per cent of the total. They're imported.

Senator PATRICK: But there are South Australian companies, for example, that make panels. So you don't look, in this case—

Senator KIM CARR: Inverters come from Victorian companies.

Senator PATRICK: Yes. You don't look to that in your submissions?

Mr Frischknecht: We may look at it, but it's typically not a deciding factor.

Senator KIM CARR: Suppose the Commonwealth were to change its procurement guidelines and make that more explicit, would you be able to accommodate it then?

Mr Frischknecht: We'd obviously comply with any guidelines that apply to us.

Senator KIM CARR: But it would require a change in procurement guidelines?

Mr Frischknecht: We don't do the procurement. It's the projects that do it.

Senator KIM CARR: But if the procurement guidelines applied to all Commonwealth agencies that provide finance and it included those that provided finance such as yours, then it would apply to you, wouldn't it?

Mr Frischknecht: If it applies to us, we'll certainly put it into place, yes.

Senator KIM CARR: And is that the only impediment, at the moment, to you providing direct assistance to Australian companies?

Mr Frischknecht: We provide plenty of assistance to Australian companies but with an objective of the transition to renewable energy. However, manufacturing can be part of that, so, at the moment, we're looking at some EV proposals that relate to manufacturing and manufacturing those vehicles in Australia.

Senator KIM CARR: You're looking at specific company projects, are you?

Mr Frischknecht: Yes. They're still early in our assessment process, but we're looking at them at the moment.

Senator KIM CARR: I presume they're covered by commercial-in-confidence arrangements at the moment?

Mr Frischknecht: Yes, they are.

Senator KIM CARR: So you can't tell us who they are?

Mr Frischknecht: No, I can't.

Senator KIM CARR: That's all right. Do the scenarios that ARENA has put forward in its submission include hydrogen fuel cells?

Mr Haenke: I'm not sure which scenarios you're—

Senator KIM CARR: In regard to the Energeia studies—and the point you make is that we need additional moneys for investment for the recharging infrastructure—do the scenarios go to all EVs, including hydrogen?

Mr Haenke: Energeia considered fuel-cell electric vehicles, but considered that, in the time span of the period that they were looking at, the EVs had a competitive advantage over fuel cells.

Senator KIM CARR: They had an advantage?

Mr Haenke: That was Energeia's conclusion.

Mr Frischknecht: EVs have an advantage over the hydrogen-powered EVs, which are also—

Senator KIM CARR: Is that one of the assumptions in this work?

Mr Frischknecht: I don't think it's an assumption. There actually are some paragraphs in the report that address the relative merits of hydrogen electric vehicles versus battery electric vehicles.

Senator KIM CARR: The report's not in your submission, is it? It's just a summary.

Mr Frischknecht: The report is public, and it has been public for a while.

Mr Haenke: Yes.

Senator KIM CARR: But we haven't got a copy, have we?

Senator PATRICK: It's mentioned in the submission, I think.

Senator KIM CARR: I know it's mentioned, but I thought you only provided a summary of the report itself; is that right?

Mr Jordan: We provided a link.

Senator KIM CARR: I haven't seen it, that's all. Thank you very much, if that's the case.

Senator RICE: Energeia was discussing the accelerated through to the no-intervention models. Does the report cover what the extra cost to government would be of the initiatives and incentives for the accelerated scenario compared with the no-intervention scenario?

Mr Jordan: They didn't offer a total estimate. It would be possible, given their sales forecast, to estimate it. But they didn't publish one, no.

Senator RICE: Would you be able to do that for us?

Mr Jordan: It would depend a lot on policy choices that would make it difficult to come up with a definitive estimate.

Senator RICE: It would be a really useful piece of information for the inquiry to have, because we've heard about the massive benefits—public health benefits, pollution benefits, benefits for the Australian economy—of having earlier intervention and earlier adoption of electric vehicles. For us to be able to weigh up whether we could achieve that through this extra cost would, I think, be really valuable.

Mr Jordan: We could talk to Energeia and see if there's some sensible way of presenting those results—

CHAIR: What prospective arrangements does the Clean Energy Finance Corporation have with charging infrastructure companies in terms of its mandate of providing financing to such initiatives?

Mr Jordan: As Ivor mentioned before, we're in direct discussion with a number of charging infrastructure providers—relatively small ones. There's global interest in recharging network companies. We've seen several global energy majors in recent months buy charging infrastructure providers in order to better understand the market, recognising that this transition is inevitable and that they'll need to adjust to a high-EV-penetration world. The discussions we're having with charging providers are commercially sensitive, but they're active and interesting discussions.

Senator PATRICK: I have a question on notice for ARENA. Could you provide, on a confidential basis, the names of the companies that are currently trying to get something up in terms of manufacturing vehicles here in Australia? That would allow us to then potentially call them as witnesses. We heard evidence today from the Electric Vehicle Council, but it's difficult. There are lots of barriers. It might be useful for us to get direct input from those companies.

Mr Frischknecht: I'd suggest, Senator, that we contact the individuals involved and ask them to reach out to you. I'm sure they'd be very happy to do so if they haven't already. They may already be part of the process. I just don't know.

Senator PATRICK: That's helpful. The Clean Energy Finance Corporation is funding vehicles, and it looks like you're funding finance companies who are funding, then, individuals who buy electric vehicles. Why is that necessary? What advantage does the consumer get? Is it a lower interest rate that would cause your corporation to offer that funding?

Mr Jordan: We're interested in supporting the electrification of the vehicle fleet, and providing a small concession in the financing rate for vehicles is one avenue for doing that, so you're correct. Through banks and other vehicle finance organisations, we provide concessionality. I think it's in the order of 70 basis points, so it's quite a small amount of concessional finance at a slightly lower interest rate.

Senator PATRICK: It's not that I don't trust banks, but are you checking to make sure that they are passing that concessional rate on to the customers, compared to other loans?

Mr Jordan: Yes. That's a condition of our financing arrangement with them.

Senator PATRICK: That's different to 'Are you checking?' There's a condition on a contract; then there's auditing and verification on a contract.

Mr Jordan: I have no reason to believe we don't. I might have to come back to you on the precise mechanics of our—

Senator PATRICK: May I ask that you check that and provide some information to the committee?

Mr Jordan: Certainly.

CHAIR: In the interests of moving forward, we will conclude there. Thank you very much for your evidence today and your submissions.

Proceedings suspended from 13:53 to 14:19

FUMEI, Ms Sarah, Project Manager, Climateworks Australia

CHAIR: Welcome. Information on parliamentary privilege and the protection of witnesses giving evidence to Senate committees has been provided to you. You have lodged submission 46 with the committee. Would you like to make amendments or additions to the submission?

Ms Fumei: No, thank you.

CHAIR: I now invite you to make a short opening statement. At the conclusion of your remarks, I will invite members of the committee to ask questions.

Ms Fumei: I thought I would start with a brief explanation of why Climateworks is interested in the electric vehicles space. Climateworks was founded by the Myer Foundation and Monash University to help translate research on climate change into action. Part of that research is our deep decarbonisation report, which looked at the pathway Australia can take to get to net zero emissions while still growing the economy. We will need to achieve this as a signatory of the Paris Agreement. We found that there are four essential pillars for achieving decarbonisation: ambitious energy efficiency, low-carbon electricity, fuel switching from fossil fuels like gas and petrol to electricity generated from renewable sources, and offsetting any remaining emissions through things like carbon forestry.

Moving from internal combustion engine vehicles to electric vehicles is an important part of the third pillar and is essential to enable decarbonisation of the transport sector. Transport is one of the fastest-growing sources of greenhouse gas emissions in Australia, with road transport projected to grow by 14 per cent to 2030. Electric vehicles could reduce emissions from transport by nine megatons in 2030, representing about six per cent of the emissions reductions required in that year to meet Australia's Paris agreement target.

Electric vehicles could also have benefits for jobs in the economy. Electric vehicles could generate Australian jobs in sales, charging infrastructure deployment and potentially the manufacture of batteries and electric vehicle components. We are already starting to see this. For example, Tritium, based in Brisbane, is a designer and manufacturer of electric vehicle chargers and employs 200 people.

Electric vehicles also have benefits for public health. Experts estimate that air pollution from vehicles caused 1,715 deaths in Australia in 2015, which is more than the road toll. Through reducing air pollution in cities, electric vehicles could help to address this issue.

As with any new technology, there are a number of barriers to the uptake of electric vehicles that we need to overcome. A major barrier to electric vehicle uptake in Australia is the lack of models available in the lower price ranges, and the higher up-front cost of electric vehicles in comparison to equivalent internal combustion engine vehicles. Recharging concerns and consumer awareness are also barriers. The average age of a vehicle on the road in Australia is 10 years, so if we fall behind on electric vehicle uptake, we are locking in a lot of emissions that could be avoided to help us meet our Paris agreement target.

Government has an important role to play in unlocking the benefits of electric vehicles. There are a number of policies that could help to encourage the uptake of electric vehicles in Australia. I'm just going to focus on a few that we think are important. The first is vehicle emissions standards. Vehicle emissions standards would set an average emissions requirement across a manufacturer's fleet and would thereby encourage manufacturers to sell more electric vehicles with zero tailpipe emissions.

Financial incentives for the purchase of electric vehicles are also important. As I've just mentioned, the major barrier to electric vehicle uptake in Australia is the lack of models available in the lower price ranges and the higher up-front cost of electric vehicles in comparison to equivalent internal combustion engine vehicles. Providing financial incentives for electric vehicle uptake can help to address this barrier. While we expect the cost of electric vehicles to decline in the future, this is a temporary measure that could help to encourage greater uptake, which would enable manufacturers to bring cheaper models to Australia.

Another important policy for government is fleet purchasing. In 2017 governments across Australia purchased more than 38,000 vehicles for their fleets, providing an excellent opportunity for governments to lead by example on electric vehicle uptake.

In conclusion, increasing the uptake of electric vehicles would have strong environmental, economic and health benefits for Australia, and government policy will be essential in unlocking these benefits.

CHAIR: Thank you very much. I'd like to focus on the transport sector in particular. It seems a major part of the focus by Climateworks and is of interest in terms of both the greenhouse gas emissions aspect and the pollution aspect. You said it's one of your three pillars and that there's growth in this sector and a major opportunity for emissions and pollutants reduction as well. Could you speak a little bit more about that?

Ms Fumei: Yes. Transport is an important part of Australia's emissions. Road transport contributed about 15 per cent of Australia's emissions in 2016-17. That's expected to continue to grow by 14 per cent to 2030. It's one of the fastest growing sectors for emissions in Australia, the transport sector overall. It's a very important emissions reduction opportunity for Australia. Partially, this is because it's one of the sectors where reducing emissions produces an economic benefit. That's because one of the important ways to reduce emissions is to improve the efficiency of vehicles and, over the long term, electric vehicles can help to do that because they're more efficient than internal combustion engine vehicles in converting energy into movement. It's producing net economic benefits rather than costing something to reduce emissions in the transport sector, which makes it a valuable opportunity for reducing emissions to get to our Paris Agreement target. If we don't reduce emissions in the transport sector we'll have to reduce them in other sectors, which may not have the same economic benefits.

CHAIR: Thank you. You spoke about the issue of vehicle emissions standards, as they currently are, as being a strong foundation for increasing electric vehicle uptake. As I understand it, we're still waiting upon the response from the ministerial forum on emissions standards. Has Climateworks been providing information to that forum and other forums, and do you have further information on emissions standards that you'd like to share with us?

Ms Fumei: We've been engaged in the ministerial forum on vehicle emissions standards. I'm not sure where it's at, at the moment. As far as we know, it's—

Senator RICE: It's on the minister's desk, I think.

Ms Fumei: Yes. I think they've done the regulatory impact statement. We provided submissions to the regulatory impact statement and the discussion paper, so we've been providing advice to government on that and we've engaged directly with the minister and with departmental staff to talk about the benefits we see to vehicle emissions standards. We see vehicle emissions standards as a really important opportunity. Improving the efficiency of vehicles is an excellent opportunity to reduce Australia's emissions, because it has net economic benefits.

The government's regulatory impact statement modelled three options for vehicle emissions standards, and the strongest standard also had the most economic benefits. The standard would provide 65 megatonnes of abatement by 2030, \$27.5 billion in fuel savings and \$13.9 billion of net economic benefit. So it's an important policy and would provide benefits for the Australian economy and for emissions.

CHAIR: Electric vehicles, obviously, have emissions that are far below that. I think it's 105 grams of CO₂ per kilometre.

Ms Fumei: Yes. We think emissions standards would provide encouragement for the uptake of electric vehicles in a couple of ways. One is they would show manufacturers that Australia is serious about reducing emissions from the transport sector. The vehicle emissions standards cover 80 per cent of the world's cars, so the fact that Australia doesn't have them is a potential signal to manufacturers that we're not serious in this area. That's one important part of it. The other important part is that with zero tailpipe emissions it would provide a real incentive for manufacturers to sell more electric vehicles to meet the average targets across their fleet. We think it's a really useful policy, in terms of providing savings to consumers and bringing electric vehicles to Australia.

Senator RICE: Thank you very much, Ms Fumei, and thank you, Climateworks, for all the work you've done in this space, in particular your last report on the state of electric vehicles in Australia. I think it's a really important body of evidence to bring to our inquiry. I want to continue with vehicle emissions standards and their importance in driving electric vehicle uptake in Australia. As you noted, the 105 grams of CO₂ per kilometre standard has the net economic benefit, but the government modelled three different levels, didn't it—there was 105, 119 and 135. What's your assessment as to what difference each of those three levels would make? How important is it to have a standard at 105, compared with 135?

Ms Fumei: A target of 135 would only provide 25 megatonnes of emissions reductions, in comparison to a target of 105, which would provide 65 megatonnes of emissions reductions. It would only provide \$5.8 billion of net economic benefit, in comparison to the \$13.9 billion provided by the 105 target. So it's a big difference.

Senator RICE: How much influence do you think having different standards would have on electric vehicle uptake?

Ms Fumei: Having a less stringent standard would provide less of an incentive for manufacturers to sell the zero-emission electric vehicles to meet the standard, because it wouldn't be as hard to reach the standard.

Senator RICE: Have you done any work looking at what the different standards would mean for electric vehicles?

Ms Fumei: I think I'd have to take that one on notice. I'd have to have a look and see.

Senator RICE: In terms of having to bring in their whole fleet to meet a standard, presumably—I mean, if you've got a lower standard, they'd have to bring in a greater proportion of their fleet as zero-emission vehicles, to meet that standard. Presumably that in itself would encourage greater numbers of EVs to be entering the market.

Ms Fumei: Yes, that's what we'd expect.

Senator RICE: One of the things that overseas constituencies have done with their standards is to have electric vehicle multipliers that help their manufacturers meet their CO2 targets by, essentially, pushing more EVs into the market. Would you see that as being a potential way for us to get more EVs into the market?

Ms Fumei: Yes. That's a potential extra incentive to add to vehicle emissions standards, to add encouragement to manufacturers to bring electric vehicles into Australia, and I think that was proposed under the government's model as well. It's just something that would need to be reviewed over time, to look at the emissions impact of providing an extra incentive and if that's impacting on the overall outcome of the target.

Senator RICE: And, presumably, doing something like that doesn't cost government very much at all. Since the net economic benefits of having cleaner vehicles is positive, by doing that it's actually going to be a positive cost to the economy, and no cost to government.

Ms Fumei: Yes. We'd expect that from emissions standards.

Senator RICE: The other part of your report that I want to focus on is the work you've done with Australian consumers. It said that almost half of all Australians were open to purchasing an electric vehicle if they were in the market for a car—yet we're in a situation where very few new electric vehicles are actually being sold here. Do you think your research shows that it's not people's attitudes towards EVs but that there aren't enough of them, and that there are other measures that are needed—rather than the changes that are needed to change people's attitudes towards EVs?

Ms Fumei: Yes, we definitely see the price issue as the most important one for consumers. We found that consumers would be open to buying an electric vehicle, but their openness to buying an electric vehicle is greatly increased if that vehicle is the same price as an internal combustion engine vehicle. So, while consumers are interested, they might not be interested if it costs more to buy the vehicle up-front. So we think that they're interested and ready, but the price issue is a bit of a barrier at the moment. And, through things like financial incentives to encourage electric vehicle uptake, we can help to overcome that barrier and also help to encourage the manufacturers to bring more models to Australia.

Senator RICE: Given what we know—people are saying that older people have range anxiety, and the fact that there are so few vehicles most people don't have any experience of them—I'm remarkably surprised and pleased about the high numbers that your research shows of people who are open to considering them. Do you have any information about trends over time? How quickly is the acceptability of electric vehicles likely to change, for example, as the price differential reduces?

Ms Fumei: I guess the evidence would probably just be the overseas evidence that shows that in countries where you do have that financial incentive to encourage electric vehicle uptake—for example, Norway, where, I think, it's about \$7,000 worth of incentives on something like a Nissan Leaf—you do see much higher levels of uptake. I think up to 28 per cent of the passenger vehicle fleet being sold each year is electric vehicles. I think that shows that consumer uptake can accommodate much higher uptake than we're seeing at the moment. I guess the fact we're seeing people answering surveys and saying that they're happy to consider buying an electric vehicle indicates that it's not that there's a difference between Australia and Norway; it's that Australians are interested, just the same as other people around the world, but we just don't have the price parity to allow us to take those opportunities up.

Senator DAVID SMITH: A number of submissions have talked about setting a government fleet target of about 25 per cent for all new light passenger vehicles by 2025. What is the size of the government fleet at the moment?

Ms Fumei: The federal government, or the—

Senator DAVID SMITH: This is from your own submission. Was it meant to be a reference to the Australian government fleet?

Ms Fumei: When we talk about governments using their own fleets to encourage electric vehicle uptake, we see that as something that can be done across all levels of government. I think federal and state governments have the opportunity to do that, and we're already seeing some state governments working on that—for example, the ACT. We're also seeing the opportunity for local governments as well.

Senator DAVID SMITH: Do we know what the numbers in those fleets are? I think the ACT government said earlier today they had 600 vehicles that fit into that category. It would be interesting to know. I'm always curious about the almost arbitrary percentage figures, and it possibly makes more sense when you understand the whole size, the numbers there.

Ms Fumei: I'm not sure about the whole size of the fleet. I know that there were 38,000 vehicles sold that governments purchased for their fleets last year. I'm not sure what the operating size of each of those fleets is. A substantial chunk is being bought each year, but I'm not sure what the overall size of the fleet is at the moment.

Senator DAVID SMITH: It would just give us a better idea in terms of its capacity to impact on, initially, the uptake of EVs and then how it might impact on the second-hand market at some point too. Allied to that, I thought you made some interesting points in your submission about opportunities for manufacturing in Australia. I think you—and I think a company that might have made a submission, ACE—made reference to other potential companies that might come in. Do you think it might make sense, if governments were to use their procurement power to set a figure of something like 25 per cent—or, in the ACT's case, they're looking at 100 per cent of certainly the sedan component of their fleets—to marry that up with not local content, because I realise that seems to be a bit too broad, but certainly local manufacturing components for such vehicles?

Ms Fumei: Yes, I think that's something that could be looked at. I think that's definitely worth looking into—

Senator DAVID SMITH: to encourage. I mean, obviously, that would then encourage a local EV manufacturer, so you'd give some certainty to those companies that might be looking—

Ms Fumei: I think that's definitely an opportunity that should be looked at.

CHAIR: Thank you very much for your evidence today.

Ms Fumei: Thank you.

CHAIR: Thank you for attending.

CASS, Mr Daniel, Strategist, The Australia Institute

RICHARDSON, Mr David, Senior Research Fellow, The Australia Institute

Evidence from Mr Cass was taken via teleconference—

[14:40]

CHAIR: Information on parliamentary privilege and the protection of witnesses in giving evidence to Senate committees has been provided to you. The Australia Institute have lodged submission No. 1 and a supplementary submission with the committee. Would you like to make any amendments or additions to those submissions?

Mr Richardson: No. I just point out that there are two separate submissions.

CHAIR: We'll address both of them. I now invite you to make a short opening statement, and at the conclusion of both of your remarks, I will invite members of the committee to ask questions.

Mr Richardson: Thank you for the opportunity to be here today. My submission concentrates mainly on a small but very profound point that I think is critical in evaluating policy in this area—that is, we can't evaluate any changes in emissions as a result of new electric vehicles by looking at the average emissions intensity of the existing coal fired power stations or the electricity supply generally in Australia; when we're looking at a marginal increase in demand for electricity represented by electric vehicles, we have to look also at the incremental supply associated with that. We would submit that, almost everywhere you look around the world, fossil fuels are being phased out, and any increases in supply are being met by renewables. In fact renewables are doing more than that; they're also replacing existing fossil fuel generation. That means the marginal addition to demand for electricity is being met by clean energy now in Australia. The critics say electric vehicles are no greener than the electricity they use, but in fact our incremental supply is pretty well entirely green. I'm happy to elaborate on those points.

Since we made our submissions, it has become apparent to us that road funding has become an important issue. People are arguing that, without as many petrol engine cars on the roads, we're going to see a reduction in fuel tax. I'd like to remind the committee that the Australian government has not hypothecated fuel tax towards roads since 1959. That's important to bear in mind when you hear some of these sorts of claims. That's it for me. I have probably overstepped my short introductory remarks here.

CHAIR: Okay. We'll turn to Mr Cass.

Mr Cass: Hi, Senators. I will keep my introductory remarks really brief. The institute wanted to support David's submission with reflections on broader issues, which is what I've done in my submission—and I hope it's of value. The only thing I wanted to say up-front is that, like renewable energy technology more broadly—in particular, solar and batteries in homes—EVs are probably an unstoppable trend. You should never be certain with trend forecasting, but they've got a life of their own. Even though the Commonwealth has not had a strategy for this sector, Australians are voting with their wallets. I think it's incredibly timely and encouraging that the committee is considering the issue, because it's a real one already and the market is growing. Anything we can do to help would be wonderful.

CHAIR: Thank you very much. I know, Mr Cass, you're also involved in possibly the production of earlier reports by The Australia Institute—maybe that was you, Mr Richardson—

Mr Cass: Yes, that's correct.

CHAIR: regarding the four recommendations. I think you've noted them in this submission here as well for Australia as a whole, and they go to the terms of reference of the inquiry. I thought you might want to speak to those four recommendations and perhaps the third one would be of interest—a scheme to reduce the up-front cost of electric vehicles without cost to the budget. Could you speak about the third one—I think you had a French term for it.

Senator RICE: Bonus malus.

CHAIR: If you could speak to that as well as the issue at hand, that would be great.

Mr Cass: Gladly. Briefly, I'll summarise the other four for the committee. We did—correctly, as you said—publish two reports on the issue with respect to Tasmania and nationally. The four policies were a luxury tax exemption for electric vehicles, which I think various others have canvassed already and it's reasonably well known as a concept. The second is charging station rebates, and I think that does need to be part of a larger plan for charging stations. I've made various comments about the need for the Commonwealth to monitor standards so we don't end up with rail gauge diversity replayed in charging standards. The last one, which will I go to briefly, was allowing EVs to use bus lanes in congested areas. It's not the most significant of all measures, but it's nice at

the beginning of a transition to offer a bit of encouragement—a little nudge, if you like—to the adoption of a technology we wish to see more of.

The most substantive measure, as you pointed out, is indeed the third one. Excuse my French or Latin: bonus malus is the term. It's highly regarded. It's worth investigating in detail. The International Council on Clean Transportation says, 'It is now the absolute best way to do things. In brief, the idea is to use a fee based structure, rather than a tax or an incentive from Treasury and back out again: put a fee on activity we want to see less of and use that to give a rebate to an activity we want more of. The trick is to work out exactly where the pivot point is, which is the point below and above where the payments change direction from more-polluting down to less-polluting vehicles. Defining that is really the key. Then there are some other detailed aspects of design which can be tweaked. The French have constantly reformed their scheme over the years and now have, as I said, what is considered the best in the world. Sweden has implemented the same scheme, and on 1 July this year it came into force. The full value of the transfer from polluting to zero emissions in Sweden will be about \$10,000 per vehicle. Obviously, in Australia that would be a fairly considerable rebate and I would imagine would constitute a really powerful incentive for the purchase of zero-emission vehicles.

It's worth noting, given there's a policy process already under way with regard to vehicle emissions generally, that this scheme can fix or address both issues; the first issue being the general level of emissions of vehicles, and the second being the promotion of EVs specifically. EVs get the best benefit in that bonus-malus scheme because they have zero tailpipe emissions. But all lower-emissions vehicles would be nudged forward in the market, so over time this could be a very powerful transport policy for the country.

Senator RICE: Are there equity issues associated with it? Basically it's saying you'd have the same level of subsidies, effectively, for really, really expensive cars as well. Basically you're also suggesting to get rid of the luxury car tax. How would you deal with the equity issues potentially associated with that?

Mr Cass: That's a very good question. As with all clean energy policies, they are designed specifically for the energy outcome. You're absolutely right: there's always a huge question about the equity outcome. The bonus-malus scheme is not designed to solve that second set of issues. I don't have an answer to exactly how it could be implemented in Australia. But absolutely, you're right: the idea of people being penalised for having old cars that they have trouble maintaining anyway and effectively subsidising very wealthy families is an issue. You would definitely want to address that before you implement something. As with a lot of the trade-offs, it could be that you need to solve the equity issue through the general taxation mechanisms which are meant to support a fairer society. When that's done well, any inequities that come from clean energy policies are less significant, because you dealt with the equity directly and in the proper manner.

Senator KIM CARR: You're proposing a \$10,000 subsidy per vehicle. There are nearly 20 million vehicles in Australia. It doesn't take long to work out that that's quite a lot of money. Do you expect the Commonwealth to pay out that sort of money? Is that the proposition?

Mr Cass: No. Just to clarify, I'm not proposing a \$10,000 payment for anything, for anyone. What I have done is now to—

Senator KIM CARR: I thought that's what you said.

Mr Cass: I will explain. I've noted that Sweden's level of maximum rebate in the bonus-malus policy as it's implemented is about \$10,000 per electric vehicle. It's not a proposal of mine that it be \$10,000. I'm simply noting a fact. The second issue is how the scheme moves the money around. The whole point of this is that it's revenue-neutral to government. If someone chooses to buy a very large, very powerful SUV that is highly polluting, then they pay the highest fee. If someone chooses to buy a relatively efficient petrol car, they would receive the rebate. That's the whole point of the scheme: it's revenue neutral to government. But having said that, I think it's fair for governments to pay for things that they want more, and tax to stop things they want less of. I wouldn't rule out using tax and transfers in addition to a fee-based scheme.

Senator RICE: And it would only apply to new vehicles. So in terms of old polluting vehicles owned by low-income people—

Senator KIM CARR: The point is that you want to transfer the entire fleet across to electric vehicles. I presume that's the submission being put to us. How long do you think that would take? In the Australian Institute's view, how long is it going to take to transfer the nearly 20 million vehicles we have registered that at the moment?

Mr Cass: We have not done our own modelling there. The data we referred to and reprinted in the report comes from others. For example, Bloomberg New Energy Finance does global projections to predict that 30 million electric vehicles will be sold per year by 2030. That's obviously a vast number. The Australian Energy

Market Operator has done some detailed analysis of Australia alone for its integrated system plan, which I'm sure you have all considered because it's an excellent, important piece of research. The scenarios there range from 526,000 vehicles by 2030 in the weak, to 3.9 million in the strong across the NEM by 2030. So it's likely, according to AEMO, that even with a set of policy failure you would have in the order of hundreds of thousands of these vehicles in the NEM by 2030. It gets back to the point I was making at the start. It's like solar and batteries: you can't stop EVs even if you wanted to. What can you do is see them come in, accentuate the benefits, mitigate the drawbacks and make the best decisions for the country as a whole.

Senator KIM CARR: The bulk of the evidence we've heard so far is that the projections of the take-up post-2025, which would see an additional demand on the national grid of about a third—in all the modelling we've seen with this NEG, there's no new capacity being created post-2021. Where's this electricity going to come from?

Mr Cass: A one-third increase in electricity demand is not something I have ever heard, but I would certainly take that information on notice and can get back to you, if you can have someone send the reference. You're correct: the NEG doesn't really work as a mechanism to solve generation supply issues generally. That's a separate debate, and a very important one. According to AEMO's detailed modelling, electric vehicle gross demand will increase on the NEM by 2030 to about one to five per cent; then by 2038, as you point out, with increased rates of consumption of EVs, up to 14 per cent in two states. So you're correct—it could be anything from one to five per cent by 2030, which certainly is an amount worth considering. I think the key here is not to be scared of EVs, but to see the actual potential of this technology to help the transition out of coal, which, as we know, is fairly inevitable. Batteries can provide what's known as vehicle-to-grid services. This is very important and interesting. The battery in the car can be used to deliver energy or stability services to the grid. As various authorities have stated, this is a very important set of services for an economy such as ours, which is making a transition, belatedly perhaps, from coal to more responsible forms of generation.

CHAIR: I think the figure this morning was that the increase of a third was due to the transition of the whole fleet, every vehicle in Australia.

Senator KIM CARR: It's immaterial. The point is that there's no new capacity coming on stream post-2020.

Senator RICE: According to the NEG.

Senator KIM CARR: That's the current model we have before us. I want to know where the electricity is coming from, that's all. Given that coal is going to remain part of the system on all the models—what is it at the moment: 75 per cent of the system?—even at that point, you're still going to have probably 50 per cent that's got to be coal. If we're in New South Wales it's black coal, and in Victoria it's brown coal. I'm just wondering where this additional electricity that is going to reduce the emissions is going to come from?

Mr Richardson: We do read every day about some new solar plant coming onstream, either within or outside of the NEM, with BlueScope commissioning its own power supplies and this sort of thing, and when they have to. I think there's a big story about having oligopolies in charge of our markets, but, when they have to, they are increasing supply.

Senator KIM CARR: All I can go by is what's before us at the moment—not wishful thinking but what's actually before us.

Mr Richardson: No, no. We are seeing marginal increases in the supply, and we've seen renewables going up to I think it's around 12 per cent now.

Senator KIM CARR: Nowhere near the capacity to meet the suggestions you've got in your submission.

Mr Cass: Well, it would. Under a sensible RET or comparable scheme, you would certainly see that kind of growth. But, yes, generally speaking we do need a plan for generation in the grid, and that's certainly the important work before all levels of governments and COAG.

CHAIR: The increase in demand, I think, is shown to be more readily responded to by renewable energy, such as in the uptake of solar rooftop sources, which, in a state like mine, are quite prevalent and therefore have the opportunity to assist in the charging of electric vehicles at the home. I was interested, Mr Cass, in the graph on page 21 of your submission with regards to the reserves of battery minerals in the world—

Mr Cass: Yes.

CHAIR: and your viewpoint on the prospects of the industry manufacturing abilities and the supply-side elements of use of these materials in batteries in Australia.

Mr Cass: Yes, I think it's an incredibly important issue and one that I only really started to read about in any detail in preparing the submission to your inquiry. We are a superpower in this basket of minerals—strategic minerals. It's a word you might throw around rhetorically sometimes, but according to the analysis commissioned

by Regional Development Australia, including very significant reports commissioned by RDA, Professor Wills and other authors have shown that there is a basket of minerals that are now strategically important for the development of the economy across a range of technologies—that is, EVs and many other energy technologies, such as magnets for wind turbines and a range of other high-tech applications, from oil-cracking catalysts to scanners, jet fighter sensor systems, robotics and so on.

As you point out, these are very important. Indeed, the EU and American governments have defined their own lists of strategic minerals or materials, and they overlap substantially with the minerals in the graph that you indicated, on page 21 of my submission. I would turn people's attention to the fact that Australia is not just first; if we compare our bar to the sum of the next two, China and Brazil, we're still bigger. We have a dominant position in proven reserves of these minerals against the second- and third-place getters. So, obviously, there is huge potential. The modelling that I've referred to is all done by them, so we as the institute can't comment in detail on that, but the estimate provided in the reports I cited was that a mineral strategy of this kind could be worth in order of \$50 billion a year within a decade, which does seem like a remarkably large figure.

What I was hoping to explore was not just the mining of the minerals but the refining and possibly even the manufacture of batteries and related parts for EVs and other technologies. We know, due to the good work of various committees in the parliament, that the multiplying effects on the economy through jobs and other mechanisms of having manufacturing here for export are considerable. So again I reiterate that we're not the experts in this, but we cited other's research and think it's particularly important for the committee to get a sense of the benefits and possible policy interventions that could be used to maximise them for the economy.

CHAIR: I think you touch upon it in section E of your submission with regards to, as you term it, the ethics of batteries and the opportunity that Australia has vis-a-vis some other countries in terms of being not just a reliable but a more ethical supplier to some of this global demand. Is that right?

Mr Cass: That is correct. That's an important issue for the battery industry. The mining conditions in the Democratic Republic of the Congo are far from desirable. We cited research from others, but Amnesty International are highly authoritative and they point out the use of children as young as seven scavenging for rocks containing cobalt, which is a vital part of these technologies. Indeed, I think Australia has a great potential role there if we mine them responsibly, which we should and could do, to provide the resources for ethical batteries and, indeed, other supply chains. As I said, the minerals, beyond just lithium and cobalt, include strategically important materials that will be in demand into the foreseeable future across sectors of the hi-tech economy. So, again, if Australia does that correctly, I think that would be a huge benefit to consumers around the world.

CHAIR: The demand for these minerals is relatively small in Australia. I imagine increased uptake would generate some further market here, but most of the opportunity is really in export.

Mr Cass: Correct. The estimates in the report's for Regional Development Australia were that we capture something like 0.53 per cent of the value for lithium in Australia. But I flag that there are now advanced plans to build a lithium-ion manufacturing facility in Adelaide, and there are other proposals being mooted. So you're entirely correct that the bulk of the value would be the export market, but it could very well be that we have a small but important manufacturing sector here around batteries and possibly other related EV parts, which could be for the domestic and export markets.

CHAIR: As an example, I think you note here the July 2018 Western Australian government proposal to create a 'Lithium Valley' industrial hub in Western Australia.

Mr Cass: Yes. It is very ambitious. I note in the report that they have already talked to the EU about providing some kind of guarantee of supply across this basket of strategic materials. So this has geopolitical significance. Western Australia often has a very independent attitude, but it's probably the Commonwealth's responsibility to really grapple with those international dimensions.

Senator RICE: Mr Cass, I wanted to ask you about the relationship between transport, decarbonising our overall power needs and our Paris targets of 26 per cent reduction of emissions by 2030. Has the Australia Institute done any work looking at what the role of decarbonising transport has to be if we are to meet that 26 per cent reduction by 2030 target?

Mr Cass: Good question. I don't think we've done detailed analysis going forward, but we do regularly publish the National Energy Emissions Audit. The June publication included data that specifically looked at the impact of petroleum emissions and shows that, as you say, it's definitely a crucial issue for meeting the Paris targets. So, the graphs that I extracted from that audit into page 11 of my submission show that electricity generation emissions have dropped about 10 per cent from mid-2011 to the end of 2017. It happened that it was

almost entirely nullified by a rise in gas emissions of about three or four per cent and petroleum of about seven per cent. If every benefit in emissions we get from electricity decarbonisation for stationary energy is undermined by the growth of emissions from tail pipe exhausts, because we buy bigger, more exciting and faster petrol cars, then it's a huge issue. I can't say what we would find if we did the modelling going forward, but there is no doubt that it's absolutely an important factor.

Senator RICE: If we're going to get to our 26 per cent reduction, we know the debate over whether that should therefore mean a much greater reduction in stationary energy. But, at the very least, if you're going to have a 26 per cent reduction right across the board, you'd have to be looking at least a 26 per cent reduction in transport, and we're so far away from doing that. So, the role of clean energy electric vehicles is obviously going to be critical.

Mr Cass: I think that's entirely right. I would return briefly to the point—because it reinforces your point—that EVs certainly can pose challenges to the grid, but they will also be a resource. In some economies they are already working out how to use them as a resource to make the grid more reliable and therefore less expensive during this transition from synchronous generation to centralised and asynchronous generation. If we step back, there is a comprehensive value to EVs beyond just dollars per unit of emissions abated. There is also potentially a grid services benefit, which is critical, given we need the grid to maintain its reliability as we make the transition to clean energy.

CHAIR: Thank you very much, Mr Cass and Mr Richardson.

BENNETT, Ms Helen, Assistant Secretary, Energy Security Branch, Department of the Environment and Energy

EVANS, Ms Jo, Deputy Secretary, Climate Change and Energy Innovation, Department of the Environment and Energy

FOULDS, Mr Alex, Executive Director, Surface Transport Policy Division, Department of Infrastructure, Regional Development and Cities

POWER, Mr Trevor, Head of division, Industry Growth Division, Department of Industry, Innovation and Science

RICHARDS, Dr Gary, General Manager, Advanced Technologies, Department of Industry, Innovation and Science

RYAN, Ms Annie, Grants Administration, Department of Industry, Innovation and Science

WERNER, Ms Stephanie, General Manager, Land Transport Policy and Safety, Department of Infrastructure, Regional Development and Cities

[15:12]

CHAIR: Welcome. Information on parliamentary privilege and the protection of witnesses in giving evidence to Senate committees has been provided to you. I remind senators that the Senate has resolved that an officer of a department of the Commonwealth or of a state shall not be asked to give opinions on matters of policy and shall be given a reasonable opportunity to refer questions asked of the officer to superior officers or to a minister. This resolution prohibits only questions asking for opinions on matters of policy and does not preclude questions asking for explanations of policies or factual questions about when and how policies were adopted. Officers of the department are also reminded that any claim that it would be contrary to the public interest to answer a question must be made by a minister and should be accompanied by a statement setting out the basis for the claim. The Department of the Environment and Energy has lodged submission No. 72. Would you like to make any amendments or additions to that submission?

Ms Evans: No, we're happy to leave it at that.

CHAIR: The Department of Industry, Innovation and Science has lodged submission No. 112 with the committee. Would you like to make any amendments or additions to that submission?

Mr Power: No.

CHAIR: The Department of Infrastructure, Regional Development and Cities has lodged submission No. 111 with the committee. Would you like to make any amendments or additions to that submission?

Mr Foulds: No.

CHAIR: I now invite you to make short opening statements and at the conclusion of your remarks I will invite members of the committee to ask questions.

Ms Evans: I speak on behalf of all my colleagues. We don't have any opening statements. We're happy to go straight to questions.

Senator KIM CARR: Who is the lead agency responsible for the development of overall government policy on electric vehicles?

Mr Power: I would say that we work co-operatively across all the portfolios.

Senator KIM CARR: That's not what I asked you. Who is the lead agency?

Mr Power: From my perspective, obviously the industry department takes a lead on—

Senator KIM CARR: The industry department?

Mr Power: The development of the industry component—

Senator KIM CARR: Where will I find in your submission a statement of the government's overall strategy for the development and growth of the electric vehicle sector in Australia?

Mr Power: What I said first was that we work co-operatively across all the departments. From the industry department point of view we take a lead on growing industries across Australia and the enablers to do that.

Senator KIM CARR: Where will I find a statement, in any submission, that highlights the government's overall strategy for the development and growth of the electric vehicle sector in Australia?

Ms Evans: I think the place where you will find the closest to what you are looking for is the existence of the Ministerial Forum on Vehicle Emissions, and the terms of reference for that body specifically makes—

Senator KIM CARR: You're on emissions. I'd like to know who is responsible for the overall strategy for the development of electric vehicles in the Commonwealth of Australia?

Ms Evans: As I was saying, included in the terms of reference, which unfortunately I don't have with me, but my colleagues may be able to give me, there is an explicit reference in that ministerial forum—which is Minister Frydenberg and also Minister Fletcher—to looking at the development of infrastructure to support electric vehicles.

Senator KIM CARR: Is it true that the government does have an overall strategy, Mr Power?

Mr Power: I would say that the government has strategies. If we're talking about growing industries, of which electric vehicles is one of course, and the manufacture of, then the government has a strategy across all of those industries. The government has focus areas that it has laid out in relation advanced manufacturing, medical technologies—

Senator KIM CARR: I'm pleased to hear that. Mr Power, where will I find a copy of this statement, this strategy? Where will I find that articulated in a coherent form?

Ms Evans: Again, I'm going to point you back to the terms of reference of the ministerial forum. They are doing the work that is relevant to the kinds of questions you ask.

Senator KIM CARR: The ministerial forum?

Ms Evans: That's correct. The terms of reference for that are in the public domain. It includes a range of things but it also includes—

Senator KIM CARR: So, it doesn't exist at the moment?

Ms Evans: The output from the forum?

Senator KIM CARR: Yes. The strategy does not exist at the moment?

Ms Evans: In the form of the strategy that you were describing, they have not produced a document of that nature yet.

Senator KIM CARR: There is no statement or strategy that you could draw my attention to now? Is that the case?

Ms Evans: That is correct.

Senator KIM CARR: Taking you through the submissions, if we look at the submission from the Department of the Environment and Energy, is it accurate to suggest that the department's view is that no additional measures are required to stimulate electric vehicle adoption in Australia by consumers?

Ms Evans: Are you reading from our submission, because I don't believe we said that?

Senator KIM CARR: I'm just saying I can't find any reference. It talks about the take-up from the CFC, it talks about ARENA, and it talks about the Australian Energy Market Operator and energy networks, but there's no specific reference to any additional measures that are required. Would that be an accurate statement?

Ms Evans: Our submission describes what the government currently has in place. If we were to provide policy advice on additional measures, we would do that to the government—not in a public submission.

Senator KIM CARR: So you're not proposing any additional measures?

Ms Evans: Not in this submission, no.

Senator KIM CARR: If I take the Department of Industry's submission—

Ms Evans: I do have to again remind you of the reference I've made a number of times to the Ministerial Forum on Vehicle Emissions, which is looking at policy questions.

Senator KIM CARR: You've made a number of references to a forum. You have indicated on a number of occasions you've got a forum which has not produced the strategy.

Ms Evans: The government has a forum.

Senator KIM CARR: It's not your fault; it's the government's fault. That's the question I've asked you: has the government got an overall strategy for the development and growth of the electric vehicle sector in Australia? The answer has to be no. I will ask the Department of Industry, Innovation and Science: where do I find the analysis in your submission as to future directions, the state of the industry and any assessment in terms of the strategy that should be applied? Can I find that anywhere in your submission?

Mr Power: Senator, what we've tried to lay out in the submission is, if you like, the measures that the government has in place to support manufacturing.

Senator KIM CARR: I could have got that off your website, Mr Power. I could have got that off your website. I would have perhaps at least got a document that is a little more recent than five years, which is what you produced for this committee's report—a five-year-old photograph from the suppliers for the 2013 Tesla Model S.

Mr Power: Senator, what our submission contains and goes through is the measures that the government does have in place, a number of which touch elements of the supply chain or entities that are producing or are working in areas that could and do supply into electric vehicles. We've tried to provide some examples there about some of those recent programs. So, for example, you're aware—

Senator KIM CARR: You know I'm familiar with the recent programs. What I want to know is what's happened to the Department of Industry, Innovation and Science, where you don't seem to have the capability to provide advice to a parliamentary committee on the direction of the industry? No analysis in your submission and no understanding, it would appear, as to what's actually going on in the industry, but a series of essentially website references to current programs.

Mr Power: What we've also provided or tried to provide in that submission is examples of a number of entities and how the government's programs have interacted with those entities to support some of the Australian companies to be involved in the future production of electric vehicles.

Senator KIM CARR: The Department of Infrastructure, Regional Development and Cities: you're responsible for the National Policy Framework for Land Transport Technologies 2016-19. Is that correct?

Mr Foulds: That is the framework adopted by the Transport and Infrastructure Council, which is the representative body under COAG of state, territory and Commonwealth transport ministers.

Senator KIM CARR: Were electric vehicles included in that statement?

Mr Foulds: At the moment they are not, but they are expected to become part of that as that framework develops.

Senator KIM CARR: Why weren't they?

Mr Foulds: Again, I would say that we are working with states and territories on land transport technology and that technology at the moment is in relation to automated vehicles, and automated vehicles and electric vehicles are on a convergence—there's no doubt that the two technologies are coming together at the same time—and the future will be connected transport, electric and automated, increasingly. So that framework and the work program associated with it are designed to move in that direction, specific electric vehicles issues are not part of the strategy at the moment but are expected to become so, and jurisdictions—all of them—are very supportive of that move and that direction.

Senator KIM CARR: So what you've told me today, from the three departments: there's no strategy, there appears to be no effective analysis being undertaken and you don't even include at this point electric vehicles in the National Policy Framework for Land Transport. Commonwealth policy development in this area is in a pretty parlous state, isn't it?

Ms Evans: I think you're asking for an opinion.

Senator KIM CARR: Fair enough. I think you've gathered my opinion. Thank you.

CHAIR: But no doubt there's reference to international developments that are occurring in the development of the current policies. The Department of Infrastructure and Regional Development and Cities reference developments in Denmark. What activities are occurring with regard to international developments for the consideration of the future iterations of the framework action plan?

Mr Foulds: The future of that plan, the next iteration—and Ms Werner may have the date when it will apply—will be done in consultation with jurisdictions and under the aegis of the Transport and Infrastructure Council and other entities, such as the National Transport Commission. The purpose of it is to provide a framework for the large changes that are occurring in transport technology, the movement towards mobility as a service, the movement towards increasing electrification and automation. So at the moment it is concentrating on automation, and the NTC is doing work in relation to a safety assurance system, which is designed to provide model law, model standards, that would apply in automated vehicles which, as I said before, are increasingly likely to be electric when they reach full automation. That strategy provides the framework whereby insurance, who's in control and decisions around road rules need to change to allow for the change-over between what we

currently have as a fleet, through to ultimately a fully automated and—probably in the fullness of time—electric fleet. I don't know if that answers your question.

CHAIR: It does somewhat. Just to clarify, the ministerial forum was established on 31 October 2015 and—

Senator KIM CARR: They're still working on it.

CHAIR: Yes. I want to understand is there any information on a response with this ministerial forum? Did you indicate that before?

Ms Evans: The ministerial forum is still discussing—there's three elements of the work in particular that they are doing.

Mr Foulds: The ministerial forum, as you know, has the Minister for Urban Infrastructure and Cities and the Minister for the Environment and Energy. That forum has met a number of times and they're progressing the government's consideration on a range of fuel efficiency, noxious emissions and fuel quality issues, but the government and the forum have not reached a landing on those at the moment.

Senator RICE: I will start with emissions and Department of the Environment and Energy's submission. On page 5 your submission, where you outline some information about transport sector emissions, you note that they're projected to steadily increase to 112 million tonnes of CO₂-equivalent by 2030. What scenario is that increase based on?

Ms Evans: In terms of the electric vehicle element?

Senator RICE: Yes.

Ms Evans: Our projections include the assumption that we will have approximately 15 per cent of new light vehicle sales being electric vehicles by 2030, which is a relatively conservative estimate.

Senator RICE: Certainly compared to the information we have been given.

Ms Evans: There are a lot of other estimates out there that think it could be much more aggressive than that. We based our projections on analysis that was done by CSIRO and ABMARC, and we thought that a reasonable assumption when we made the projections. So that is where we've landed. The implication of that is that there would be about 1.1 million electric vehicles on the roads by 2030. So the scenario where those emissions are growing at that rate includes those assumptions.

Senator RICE: You talk in your submission about the carbon emissions of an electric vehicle on the current grid compared to an internal combustion engine vehicle. We have talked about this at estimates before, but I think it is worth having this on the record for this inquiry.

Ms Evans: Using a national average—in fact, in any state in Australia—our analysis says that, for a comparable vehicle in terms of size and capacity, an electric vehicle would have a lower emissions footprint than a regular petrol engine vehicle. It varies by state. As you can imagine, in Tasmania there is a significant reduction in emissions compared to a regular vehicle. I think the state where there is the least reduction is Victoria. Even there, we see an improvement over the use of a petrol vehicle. The comparison in Victoria is 178 grams per kilometre for a petrol engine vehicle and 157 grams per kilometre for an electric vehicle. So there is a significant improvement even there and, as electricity grid emissions intensity improves over time, that differential will become even more substantial.

Senator RICE: That's right—as we get more renewables into the grid, the emissions of the electrical vehicles—

Ms Evans: It is already a benefit, even today; and, over time, there would be a greater benefit.

Senator RICE: In terms of meeting our Paris targets, we have a commitment to reduce emissions by 26 per cent by 2030. Our government has said our electricity grid will have a 26 per cent cut. That means all the other sectors would similarly have to have a 26 per cent cut. In contrast, transport sector emissions are forecast to increase even under your current scenarios. Can you see any way that there would be a 26 per cent reduction in transport sector emissions?

Ms Evans: The work that is underway through the Ministerial Forum on Vehicle Emissions is looking at fuel efficiency, fuel standards and noxious emissions. The expectation is that, through that process, you would identify any additional policies or measures that are required in the sector.

Senator RICE: So, basically, government acknowledges that the current policy of having only 15 per cent electric vehicles by 2030 isn't going to be enough.

Ms Evans: Just to clarify: it is not a policy that there be that percentage; it is our projection.

Senator RICE: The government acknowledges that the projection of having only a 15 per cent uptake of electric vehicles by 2030 won't be sufficient?

Ms Evans: That is not a view expressed by the government. They have work underway as to what else can be done to affect emissions in those sectors. There are other existing measures. The safeguard measure, for example, applies to the transport sector as well. So, when we say everything is growing, it is driven largely by light vehicles but the sector overall includes the other parts of it—the heavy vehicles too.

Senator RICE: But they are relatively small. As you say, it is largely light vehicles.

Ms Evans: The main driver of the growth are light vehicles.

Senator RICE: Going back to that projection: at the moment, even if we have better fuel efficiency and other measures that are currently being looked at in the ministerial forum, is there any scenario where, by 2030, we can have a 26 per cent reduction in transport emissions with only 15 per cent electric vehicles?

Ms Evans: You are asking: if we limited electric vehicles to only 15 per cent, could you reduce the emissions as far as they need to be? I would say the answer to that is no—just mathematically. But, as we discussed before, our assumption in the projections is that it is 15 per cent. There are many other studies around that suggest the uptake will be much faster than that. So, when we do our next projections, it may well be that we will update our own assumptions, and so you will see the emissions profile in transport fall simply by what is already happening in the market.

Senator RICE: So what you are saying is that it looks extremely likely that we are going to have to have more than a 15 per cent electric vehicle share if we are going to have transport emissions reducing to the level needed to meet our Paris targets?

Ms Evans: A range of things can happen. Electric vehicles are only one thing in the sector. You can simply have fuel efficiency improvements in regular vehicles as well.

Senator RICE: But you just said we wouldn't be able to meet the targets with 15 per cent electric vehicles.

Ms Evans: I think it would be very hard to get to the point of having emissions 26 per cent below 2005 levels in the transport sector without an uptake of electrical vehicles that is faster than our projected 'business as usual' uptake.

Senator RICE: We have had an excellent submission and evidence given to us today by ARENA and the CEFC in their Energeia report. That report outlined five key areas of incentives that they felt were needed to accelerate the uptake of electric vehicles. In fact, the report says it is possible to reach 100 per cent of new vehicle sales by the 2030s and 100 per cent of the fleet by 2050. Among those measures we have purchase incentives, procurement targets, fuel efficiency and bans on internal combustion engines. Are any of those measures currently being investigated by the government?

Ms Evans: This report has been produced as part of the work that the government has been doing for the Ministerial Forum on Vehicle Emissions. This report is under consideration, so I don't think I am in a position to elaborate on what we are doing on any individual one.

Senator RICE: Is the government doing any work looking at purchase incentives?

Ms Evans: As you would have already heard from the Clean Energy Finance Corporation when they were here earlier, they already have a program in place where they are providing incentives through the banks to allow the purchase of electric vehicles. So that is already something the government is doing.

Senator RICE: One bank. So that is the only work the government is doing on purchase incentives?

Ms Evans: I think that is the entire program.

Senator RICE: And procurement targets?

Ms Evans: As I said, this whole report is a consideration in the Ministerial Forum on Vehicle Emissions.

Senator RICE: But you are currently not exploring any options?

Ms Evans: Are you asking me whether I am giving advice to the government on these matters?

Senator RICE: Yes.

Senator KIM CARR: She can't answer that question.

Ms Evans: I can't answer that question.

Senator RICE: I am asking you whether there is work being done in the department in the area of procurement targets that could lead to advice to the government.

Ms Evans: This is a piece of work that has already been done. The department has been aware of the work that has been commissioned by ARENA and the CEFC. As a group, as a collective, as the Commonwealth, we have been looking at these questions. There is work underway and you have seen it in the public domain. The department has been involved, through discussions as well, in making sure this kind of work is being done for consideration by the government. But we are not doing anything separate from this.

Senator RICE: You are not doing anything separate from the work that has been done by ARENA and the CEFC?

Ms Evans: No.

Senator RICE: And in the area of regulation of imports?

Ms Evans: It is the same answer.

Senator RICE: And in fuel efficiency regulation?

Ms Evans: That is the work of the Ministerial Forum on Vehicle Emissions. Obviously, all of the agencies in front of you here have been supporting that forum and providing advice.

Senator RICE: The other area I want to touch upon is in the Department of Industry submission. You talk about the falling revenue from fuel excise and potentially the need for other measures to make up for that falling revenue from fuel exercise. What work is being done in that area by the department at the moment?

Mr Power: I will just confer with my colleagues about where it is best to take that. We are certainly aware of the issue around excise.

Mr Foulds: Perhaps I could offer an answer in relation to road related revenue as electric vehicles become more common on the roads. As it currently sits, the projection is that, towards 2050, we would break even in relation to the amount of revenue equalling the cost of roads at the moment. That would be because, under current projections, the use of liquid fuels would reduce and the excise on those would reduce. The government has been looking at how that can be addressed. As you would be aware, there is public consideration of road user charging in the fullness of time.

Senator RICE: 'In the fullness of time'!

Mr Foulds: I say that because it is not something that will happen overnight; it is a 10- to 15-year arrangement to introduce, or even discuss, things like road user charging and the way that might go. You know that the government has been giving consideration to that and that is publicly available.

Senator RICE: Things seem to be happening very slowly in this space. We have heard a lot today about the potential for electric vehicle uptake to really take off. How long has it been since the announcement that we are going to a study, headed by an eminent person, into road user charging?

Mr Foulds: I think it was announced in 2016.

Senator RICE: So it is two years since that study was announced. At estimates, I have asked about when this study was going to get underway. I think the last time I asked that question the answer was 'imminently'—and we've heard nothing more. Can you give me an update as to when the government is actually going to start doing this study?

Mr Foulds: As I said, the government will have more to say on the eminent person's—

this **Senator RICE:** Imminently?

Mr Foulds: It will have more to say in the coming—

Senator PATRICK: Do you have a time frame?

Mr Foulds: I don't have a time frame.

Senator RICE: Meanwhile, things are choofing along—and it seems that we are on a very slow train with regard to road user pricing.

Senator DAVID SMITH: I have a quick question for the Department of Infrastructure. In the submissions that the CEFC made today, they suggested that there is going to be a need for a \$1.7 billion investment in infrastructure to support charging stations by 2040. It was surprising that there wasn't anything in the department's submission about the infrastructure that is connected to electric vehicle uptake in relation to not just infrastructure but the impact on regional communities—because there are obviously going to be particular challenges across regional communities. I would be interested to know whether these matters are under consideration.

Mr Foulds: The short answer is yes. And it is recognised and understood that industry is leading a lot of the charging infrastructure and that the charging infrastructure will be directly related to uptake. It is one of the issues

in relation to the reasons that people will purchase electric vehicles. Range anxiety, battery capacity and the ability for people to know that they are within 150 kilometres of a fast charging centre are understood by government and under consideration. The ministerial forum is also looking at infrastructure as part of its terms of reference—and infrastructure includes things like that.

CHAIR: I understand that the Automotive Transformation Scheme is for the transition of the industry, that registrants have to meet a threshold production requirement and that it is about businesses that have already made a financial commitment to carry on business in Australia—companies that are already in the automotive field. I asked at estimates whether new companies looking to build electric vehicles could obtain some funding from the scheme. I think the answer was no, and so my question was whether there have been any businesses that have had the minister's permission to apply for registration on national interest grounds. Has there been any success in that area?

Dr Richards: There's been a lot of success in—

CHAIR: In that specific area, in terms of companies that don't meet the requirements of already being in the industry to obtain assistance from the scheme to enter this industry?

Dr Richards: I might, if you bear with me, just discuss the structure of the scheme. The initial eligibility is that you are the thing that's being funded—that is, you're a motor vehicle producer. The premise is that you've made a vehicle, at a minimum. To automatically register to the scheme, you need to pass production thresholds, as you've mentioned. If you are a motor vehicle producer and you don't pass those, you can apply to the minister to have that part of the eligibility waived, but you must still be a motor vehicle producer. So that premise remains. I think you asked the question around a form of start-up provision, for a new entrant company. You must still actually have made a vehicle and you must have financial commitments to take gain from the scheme, because the start-up provisions actually apply to your making a claim. So you have to be a motor vehicle producer, you have to have national interest if you don't pass thresholds and, because the payment system is premised on payments on a sales cap from your previous year's production, obviously there would be no claim possible for a start-up company, so they can claim against some of the generalities of their investments in that start-up activity. Then, after 12 months, their payment scheme is according to their previous year's production as per normal in the scheme. Historically, over the life of the scheme, that is extremely rare. I think there has been one company entered on those terms in about the last eight years.

CHAIR: We've also heard the difficulty of the transport sector in making emissions reductions in line with the Paris Agreement. I would have thought that this would be an opportunity for companies that are looking to provide vehicles with zero emissions. It could be a means of assisting that target.

Dr Richards: The policy objective of the scheme is quite clear around the sustainability of an automotive industry. There are criteria on national interest consideration that do address the environmental sustainability, so there are provisions in the considerations for a company in the minister's consideration of waiving the threshold requirements of eligibility that would be assisted by having a low-emissions vehicle.

Mr Power: Just to summarise, I think what Dr Richards is saying is that that scheme remains in existence and there is an ability for, for example, an electric vehicle manufacturer to apply under that scheme in the way that Dr Richards set out. It is just the case that someone who is able to apply needs to produce a vehicle and then access the scheme under those national interest provisions that Dr Richards talked about.

Dr Richards: To clarify, components and services as well as the production of vehicles qualify, and there is support available to companies supplying into the global supply chains with components.

CHAIR: That is good information to know.

Senator PATRICK: In one of the submissions we have, basically it stated that the Australian government is eight to 10 years behind in respect of electric vehicles and a national policy. Is there any one person or division somewhere in the government that has a responsibility for electric vehicles and encouraging the take-up here in Australia and indeed benefiting from the take-up, either from a user's perspective or from an industry perspective?

Mr Power: We went through this briefly with Senator Carr. From an automotive industry point of view, the department of industry takes the lead on that and we run the measures that we've just talked about in relation to the Automotive Transformation Scheme and the broader manufacturing sector, of which electric vehicles could be a part, of course. Across government, there is quite an array of initiatives. We've been talking about infrastructure and vehicle emissions. In relation to the industry component of that, particularly manufacturing support for automotive, then the department of industry would take the lead.

Senator PATRICK: I'm always moved by Admiral Rickover's statement that, if you can't point at the single person in charge, there's no-one in charge. I'm hearing about the ATS scheme, where there might be some

involvement with electric vehicles. Emissions is another area. Is there anyone actually coordinating this across government and producing a policy that would steer us in the right direction?

Ms Evans: I'm at risk of sounding like a broken record here, but the point of coordination is a ministerial forum that was set up.

Senator PATRICK: A federal ministerial forum?

Ms Evans: Yes, a federal ministerial forum. It's the Ministerial Forum on Vehicle Emissions. That's got the minister for major projects, territories and local government, the minister for the environment, and the minister for resources, energy and northern Australia, whose titles have all been slightly amended since then. That's the make-up of that forum. It's a coordinating group that is doing the work collectively.

Senator PATRICK: What is the function of the forum? Do they have multiple functions?

Ms Evans: The terms of reference add a number of things. The focus at the moment has been on fuel efficiency, on noxious emissions and on fuel quality. Amongst their terms of reference they also have looking at future infrastructure to support new vehicles, including funding available through the Clean Energy Finance Corporation and the Australian Renewable Energy Agency. So it was always envisaged to look at new technologies, including electric vehicles and what might be needed to support them.

Senator PATRICK: There are elements of electric vehicles, but no-one's really taking responsibility for this. Even at the ministerial forum level, they're looking at things from an emissions perspective, but electric vehicles do a lot more than that. Indeed, in your submission—

Ms Evans: Yes, but the ministerial forum is taking a broad view.

Senator PATRICK: Sure. Is one of the three ministers is the person in charge? Do any one of those ministers dominate in respect of responsibility, and do they have their own set of KPIs in respect of electric vehicles?

Ms Evans: I can only point you to the terms of reference for that ministerial forum, which is joint between the three ministers.

Senator PATRICK: I'll take that as no. It's a rudderless ship, basically, we've got here. We've got some people putting effort in. The vessel's moving in some direction, but no-one's really coordinating the direction.

Ms Evans: I would disagree with that assessment, because the ministerial forum is coordinating work for the government and we've quite a lot of activity already going, which has been expressed in our submission and in the submissions of the various agencies.

Senator PATRICK: I presume the ministerial forum produces minutes.

Mr Foulds: No, they don't produce minutes as such.

Senator PATRICK: They don't produce a record of what's said at these meetings? There's no directions issued, no actions taken?

Mr Foulds: The forum has met three times. That's not to say that action isn't taken, because the work of the forum is undertaken by the departments that sit under that forum. The other element that exists, which, again, we mentioned earlier, is that the regulatory issues around automated vehicles—heading towards electric vehicles and others—also have a state and territory component. That's looked at through the COAG—

Senator PATRICK: I just want to focus on the question: are minutes taken?

Mr Foulds: I understand, Senator.

Senator PATRICK: Do you have officials go along that take notes?

Mr Foulds: The forum has met without officials and with officials.

Senator PATRICK: How do you know what happens there? This is a most unusual procedure for government—for government officials to meet and not take notes or to not take minutes, a record. That's really quite strange.

Mr Foulds: It's a meeting between the ministers as they constitute the ministerial forum. They will conduct those meetings with officials, and the readout from that constitutes the instructions and the development work that is undertaken by the departments that sit under that. That's how the process of government works in relation to ministers directing departments to conduct work.

Senator PATRICK: I presume you somehow know who may have attended. On notice, for each of the departments, I ask that you provide to the committee the notebooks of officials that have attended insofar as there are notes relating to electric vehicles. Everyone's okay with that?

Mr Foulds: We'll take it on notice, thank you.

Mr Power: We'll take it on notice.

Senator PATRICK: Thank you. In respect of Energeia's projections—you said you're familiar with them, Ms Evans—there were three projections: no intervention, moderate intervention and accelerated intervention. In terms of the ministerial forum and the direction running around the departments, which of those lines are we supposed to be on? Has a decision been made as to whether we're on one of those three lines?

Ms Evans: Senator, we also canvassed similar ground earlier. All three of those lines have a more ambitious view of the uptake of electric vehicles than what is in our current official projections, for example, of greenhouse gas emissions and what would happen in the transport sector. They're all modelled scenarios by Energeia; they're not necessarily a policy pathway that has been agreed by the government, in any case.

Senator PATRICK: Are you expecting some agreement at some point with the ministers forum? Is anyone providing input to the ministers forum that would enable them to make a decision as to the trajectory—

Ms Evans: They have access to this report, and they have access to other information from us, and they will continue to develop along those lines. But I'm not saying that it's a choice of one of those scenarios or another.

Senator PATRICK: Sure. I'm really just trying to get out where the federal government is at in terms of stating some objectives in this space. Clearly it's coming. We are going to get vehicles. And it will affect excise, as you've suggested. It will affect a whole range of things. If no-one's got a plan, you can't deal with the effects of this, positive or negative. That can't be the situation we're in, can it?

Mr Foulds: Senator, I don't think it is. The ministerial forum haven't reached a landing on any of these issues, but they are considering it. They are consulting with peak bodies. They're consulting with many of the people who have provided submissions to this committee, and they are taking notice of what those people are saying and the impacts. The ministerial forum—and the government—have yet to reach a decision and a landing.

Senator PATRICK: Mr Foulds, you were talking about excise before. Clearly, you have some understanding of the cost implication. Has Treasury modelled over the forward estimates, or has your department modelled over the forwards and beyond, what you expect to happen in relation to excise?

Mr Foulds: The CSIRO worked with BITRE last year to investigate the potential future impacts of disruption and associated implications for road related revenue and expenditure. That report is due out later this year. That's the modelling that I'm aware of in our department. I can't speak for Treasury.

Senator PATRICK: Obviously there would be assumptions going into the models as to what you expect the uptake of vehicles to be; otherwise, the model would make no sense. On notice, can you please provide the committee with what assumptions have been provided from government to the modellers.

Mr Foulds: I'll take that on notice, Senator.

Senator PATRICK: Thank you. I'm also just wondering. There's obviously a report coming out on energy security. It almost looks like part of the strategy that we've got in relation to energy security—and I'm not saying this is a bad thing—would be relying on the fact that there will be electric vehicles coming.

Ms Bennett: We are undertaking a review of liquid fuel security that's due to go to government by the end of this year. We'll certainly be looking at what the impact of, say, the increased uptake of electric vehicles would be, but certainly it's not correct to say that we're relying on that in order to meet our security needs.

Senator PATRICK: I didn't expect that to be the answer. Again, in that study, you must have provided some idea of uptake. Can you please, on notice, provide the committee with your department's input into that review.

Ms Evans: At the moment we're from the same department, so the uptake rates are the same.

Ms Bennett: Exactly the same.

Senator PATRICK: Sorry, Mr Foulds is from a different—

Ms Evans: Correct.

Senator PATRICK: It doesn't mean you've told two different—

Ms Bennett: In fact, the Liquid Fuel Security Review will take into account a range—there's a range, as Ms Evans has already said—of uptake predictions, so we will look at the full range.

Senator PATRICK: And provide those to the committee?

Ms Bennett: We'll be looking at that in the context of the Liquid Fuel Security Review. We're in the process of still getting all of that information, so I'm not able to provide that to you.

Ms Evans: We can't provide you anything more than what I've already put on the record today, which is that our assumption is 15 per cent by 2030 of new vehicle sales. We talked about that earlier. I can write it down again for you, but I can't provide anything more.

Senator PATRICK: No, I apologise. I was out of the room, so I apologise with respect to that. That's the number that's been provided for this other study; is that correct?

Mr Foulds: I'd have to take that on notice. I don't know.

Senator PATRICK: There's one answer for the department, I presume?

Ms Evans: From the Department of the Environment and Energy, that's our current uptake assumption.

Mr Foulds: As you will have heard, Senator, there are a range of assumptions. Bloomberg, for example, suggests that new vehicle sales of electric vehicles will be six per cent, or could be up to six per cent, in 2025 or up to 28 per cent in 2030. Then other departments have said it could be 1.4 in 2025 or 4.7 in 2025.

Senator PATRICK: I'm just trying to understand what the government is using. I understand that there are a range of estimates and there are bands. The government must have at least some understanding—

Mr Foulds: I will come back to you on that.

Senator PATRICK: That will be appreciated. I think the chair is about to wind me up, so thank you very much.

CHAIR: Senator Dean Smith, please ask a question.

Senator DEAN SMITH: I'm correct that the National Freight and Supply Chain Strategy has actually been completed and released now?

Mr Foulds: No, it hasn't. It is underway at the moment. The inquiry has been completed. The inquiry was conducted by a panel of industry experts, supported by the department as the secretariat, and that completed its report within the last three months. It has a number of recommendations in it that were put there by the expert panel from industry.

Senator DEAN SMITH: Is that what we call the final report that was due in March 2018?

Mr Foulds: No, that's the final inquiry report, which is an input into the strategy. The Freight and Supply Chain Strategy is being developed with all jurisdictions and will be agreed to by the Transport and Infrastructure Council under the COAG arrangements. The expectation is that that strategy will be the first national freight and supply chain strategy with a national view sitting over all jurisdictions.

Senator DEAN SMITH: When is that due?

Mr Foulds: That's due in the end of the first half of 2019.

Senator DEAN SMITH: To what extent has electric vehicle technology been incorporated into that inquiry's work?

Mr Foulds: Specifically it hasn't, but technology has. If you look at transport technology overall, the use of data, for example; the use of first-mile last-mile investment opportunities; the ability for tracking the use of other technologies, which could include electric vehicles or include everything from—it's not a specific strategy that looks at individual technologies, and it's still under development, so I can't answer the question in its entirety. But, if you look at the inquiry report, it will show the things that are considered to be important priorities in having a freight and supply chain strategy later, and: what are the pinch points now? What are the things that matter? What can be changed, or what is recommended for consideration for change, in relation to regulatory changes, infrastructure changes and maybe policy as well? Some of them are short, medium and long term.

Senator DEAN SMITH: There's this misapprehension that electric vehicles only refer to passenger vehicles, when in fact we've seen electric vehicle technology for light commercial vehicles; we've seen Hino produce what I would call large trucks—

Mr Foulds: Yes, that's correct.

Senator DEAN SMITH: I'm curious to know: to what extent are those sorts of technological developments and the infrastructure that might be required to support them being discussed and incorporated in the final—

Mr Foulds: As I say, the strategy hasn't been done, but technology in its broadest sense is an input into the freight and supply chain strategy. Under that, jurisdictions will have their own—hopefully—matching and interlocking freight and supply chain issues. It's important that the whole of technology is taken into account in transport, because those are the things that will defeat congestion and make supply chains work more smoothly. It's one of the things. But specifically at the moment the inquiry report doesn't deal in electric light vehicles or

heavy vehicles in that way. It does talk about the need for infrastructure investment in the broad, which can be quite narrowly focused as well.

Senator DEAN SMITH: When we look at future emissions and growth in future emissions, to what extent can we break that down between passenger vehicles, light freight vehicles and heavy road freight vehicles?

Ms Evans: We can. I think our emissions projections documents have that breakdown in them. Certainly we have it by light commercials and—

Senator DEAN SMITH: These are the emissions—

Ms Evans: Yes. You were talking about greenhouse gas emissions, I assumed.

Senator DEAN SMITH: Yes, I think it's a footnote in your—

Ms Evans: Yes, that's right. The Department of the Environment and Energy produces those projections fairly regularly, and the last set would have a breakdown along the lines of what you just indicated. That's in the public domain.

Senator DEAN SMITH: I think it only talks about passenger and light vehicles. I don't think it talks about heavy road freight vehicles.

Ms Evans: I've got a breakdown that includes cars, light commercial vehicles, buses, rigid trucks, articulated trucks, motorcycles.

Senator DEAN SMITH: Excuse me. I need to listen—so a bit more slowly. You said cars and light vehicles?

Ms Evans: Light vehicles, buses, rigid trucks, articulated trucks, motorcycles, domestic aviation, domestic shipping, railways and other transportation—so that's the whole transport sector.

Senator DEAN SMITH: Thank you very much.

Ms Evans: That's all from our emissions projections document, which is in the public domain.

Senator DEAN SMITH: And which is footnoted in your submission. Thank you.

CHAIR: As there are no further questions, I'd like to thank you all for your evidence given here today. I would like to thank the witnesses who have given evidence to the committee today.

Committee adjourned at 16:07