ELECTRIC VEHICLE COUNCIL

STATE OF ELECTRIC VEHICLES

AUGUST 2019

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Executive Summary

The State of Electric Vehicles has been prepared by the Electric Vehicle Council – the national peak body representing the electric vehicle industry in Australia. This report provides data and insights into the electric vehicle industry in Australia and highlights the actions taken and needed to accelerate the electrification of road transport.

The global electric vehicle market continues to grow exponentially, stimulating further industry investment. Due to its unique position in the electric vehicle supply chain, Australia has a once in a lifetime opportunity to develop a robust domestic industry, creating career opportunities for years to come.

Our lack of national co-ordination and support has resulted in stagnant uptake and restricted some of this potential. While 2.1 million electric vehicles were sold globally in 2018, Australia lagged behind with 2,216 sales in the same year. Encouragingly, 2019 has seen a rebound with electric vehicle sales figures for the first half of the year 90% higher than for the same period in 2018.

Consumer choice is also increasing with the number of electric vehicle models available in Australia expected to jump from 22 as of August 2019 to 31 by the end of 2020.

Meanwhile, the availability of public charging infrastructure has increased by over 140% in the last year and by 400% since 2017. The national network now comprises 1,930 electric vehicle charging stations.

Consumer awareness and attitudes to electric vehicles continue to improve according to a survey of 1,939 Australians undertaken for this report. In the 2017 *State of Electric Vehicles* report, 19% of those surveyed said they had done some research into electric vehicles while this year that number had more than doubled to 45%. Indeed, 51% of those surveyed said they would consider purchasing an electric vehicle or were currently researching electric vehicles with an intention to buy.

When asked about price, 69% of respondents indicated they would be willing to buy an electric vehicle if they had the same upfront price as fossil fuel equivalents. The proportion of people willing to pay more upfront for an electric vehicle increased from 4% last year to 7% this year, suggesting a greater appreciation for the advantages of electric vehicles. Consumers' primary concerns continued to be range and price, while the most popular government policies were public charging infrastructure, price subsidies, and home charging discounts. The majority of respondents said that if they owned an electric vehicle, they would power it using renewable energy.

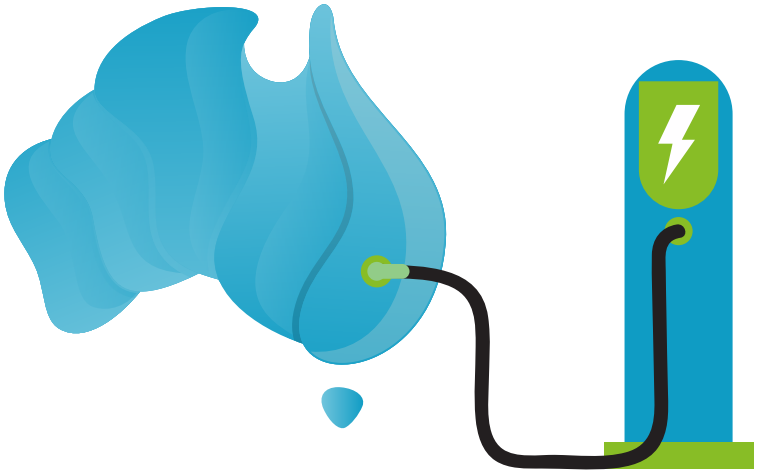
This report also highlights the important role of corporate and government fleet procurement in facilitating a rapid transition to electrification. Fleets make up 52% of new vehicle sales and serve as an important source to the second-hand market. Through their co-ordinated purchasing power, fleet transition plans also serve to demonstrate demand to vehicle suppliers and the public charging infrastructure industry.

With significant mineral resources and a highly skilled workforce, Australia could benefit economically at every stage of the electric vehicle supply chain. Numerous Australian innovators are already succeeding locally and overseas. Increasing the domestic electric vehicle market has the potential to reinvigorate automotive manufacturing in Australia and create tens of thousands of jobs in new adjacent industries.

Australia continues to have no national electric vehicle policy, despite such policy being instrumental to the success of markets with strong electric vehicle adoption rates. While the Federal Government is currently developing a strategy due for completion in mid-2020, it is more important than ever that this strategy is supplemented by strong policies by state and territory governments.

For this report, the Electric Vehicle Council collected data on state electric vehicle policies. This revealed that there are only minor commitments to the electrification of road transport from governments at this level, despite a strong desire to capture the benefits of electrification.

State and territory governments suggested they are waiting for national policy direction from the Federal Government. How this relationship continues to play out and shape the market will be a key determinant for Australia's immediate success in developing a strong and vibrant e-mobility sector.



Chapter 1: Market

Sales and Uptake

The global electric vehicle market has continued its rapid expansion with more than 2.1 million new electric vehicles sold in 2018, a growth of 64% from 2017.[1] A number of policies from leading countries have continued to drive and support industry investment; a market that first took five years to reach one million sales has now grown by a further million in only six months.[2]

Australians purchased 2,216 electric vehicles in 2018, a drop of 3% from the 2,284 models sold in the previous year. In the latter part of 2018, Australia's electric vehicle market saw an overall decrease in annual sales, however, this reflects the contraction in the market of all new vehicle sales.

Sales have increased from 670 electric vehicles in the first half of 2018 to 1,277 electric vehicles in the first half of 2019 (excluding Tesla).

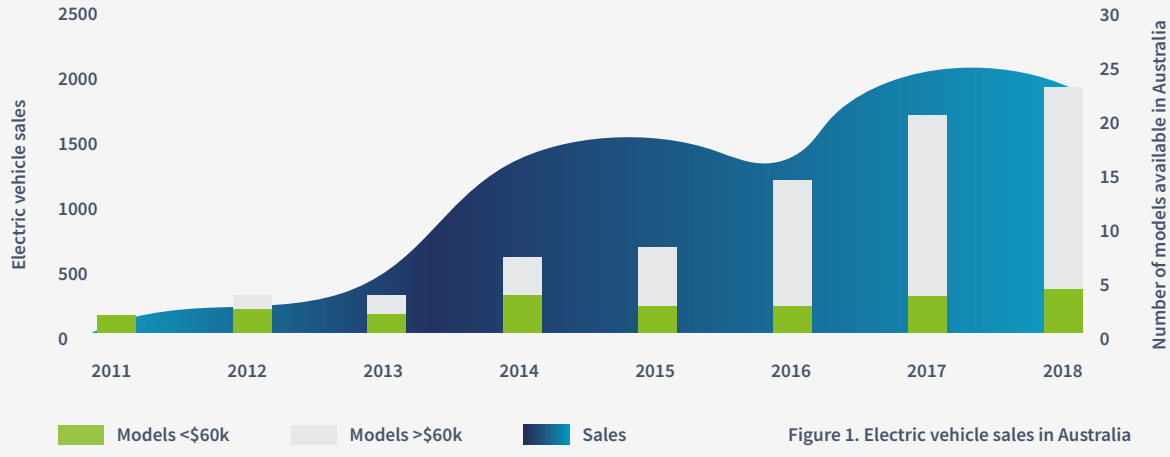


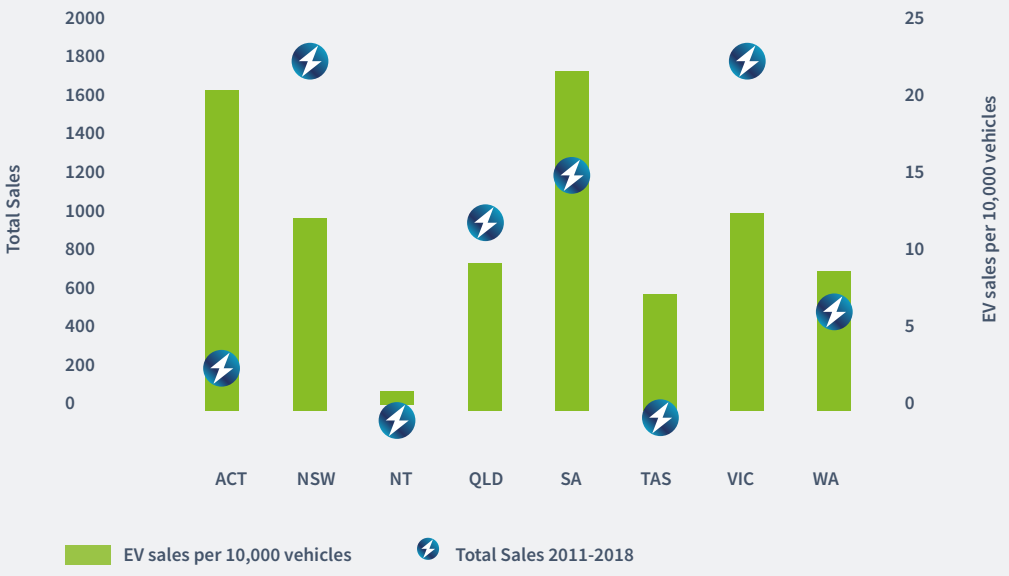
Figure 1. Electric vehicle sales in Australia

1 EV Volumes (2018)
2 Bloomberg NEF (2019)

More recent figures show much more positive growth with 90% more electric vehicles sold in the first half of 2019 compared to the same period in 2018.[3] That was despite national vehicle sales falling 8.4% in the same timeframe.[4] With model availability increasing, particularly in the sub-$60,000 segment, the stage is set for strong growth throughout the rest of 2019 and into 2020.

Business fleets continued to be the largest buyer of electric vehicles in 2018, accounting for 63% of total sales. Private purchases made up a significant 33% of sales, with government fleets buying only 4%. The low level of government uptake is particularly concerning given the poor performance of vehicle fuel efficiency in government fleets compared to private and business vehicles.[5] Government electric vehicle fleet targets – such as the 10% target in NSW – should result in growth in this segment in future years.

Electric vehicle market penetration differs across Australian states and territories. Victoria continues to have the highest number of total electric vehicles with 1,725 sales from 2011-2018 (excluding Tesla). However, as a percentage of new car sales, South Australia and the Australian Capital Territory outperform others with 21 and 20 electric vehicles purchased for every 10,000 vehicles sold respectively.



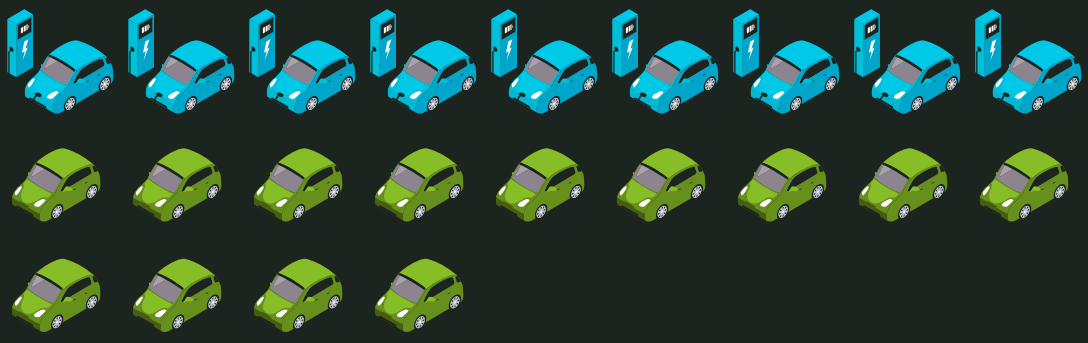
3 This figure does not include Tesla sales which are not yet available.
4 The New Daily (2019)
5 The National Transport Commission (2016)

Vehicle Availability

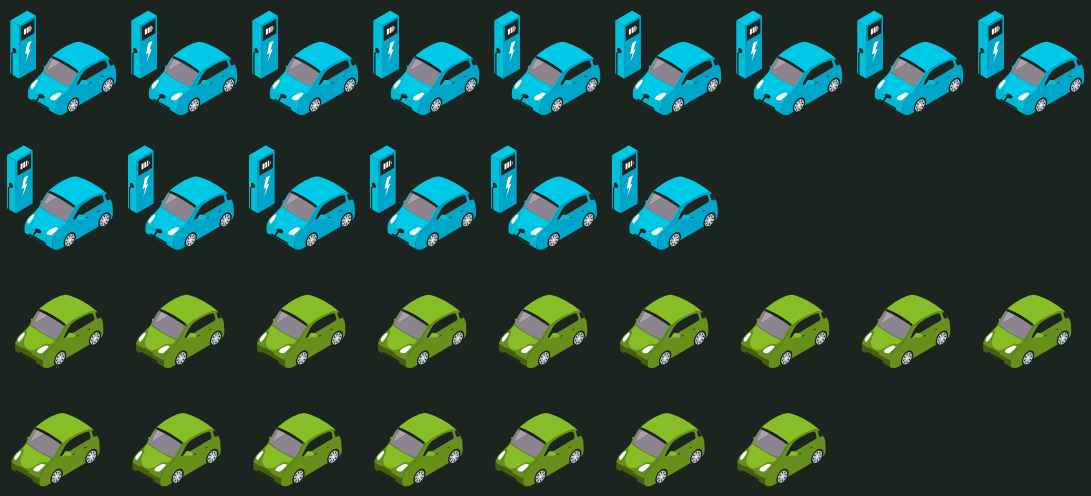
In Australia, there are currently 22 electric vehicles on the market. Nine of these are battery electric vehicles (BEVs) and 13 are plug in hybrids (PHEVs). Six of these vehicles are under $65,000 AUD. The largest vehicle segment is the SUV.

By 2020, it is expected that nine more electric vehicles will be available: six BEVs and three PHEVs. Electric vehicle model availability in Australia is currently limited due to a lack of fuel efficiency standards, high upfront vehicle purchase costs, and lack of policy support.

ELECTRIC VEHICLES IN AUSTRALIA TODAY (9 BEVS AND 13 PHEVS)



ELECTRIC VEHICLES IN AUSTRALIA IN 2020 (15 BEVS AND 16 PHEVS)



Please see Appendix 1 for the electric vehicles available in Australia now and to 2020.

Carmakers go electric

It is important to note that carmakers are working towards electrifying their fleets. Already, there has been over $300 USD billion invested in the electrification of global vehicle models.[6]

New partnerships are emerging to promote accelerated research and development phases in the transition to electric vehicles.

Please see Appendix 2 for total fleet electrification commitments.

The role of fleets

Corporate and government fleets have the potential to drive the electric revolution in Australia, making up 52% of annual new vehicle sales.[7] Commitments to fleet electrification are important as they can demonstrate vehicle demand to carmakers, are an important source of supply to the second-hand market, and provide impetus for the roll out of charging infrastructure.[8]

There are multiple benefits associated with the electrification of fleets:

Environmental: fleet decarbonisation shows a commitment to sustainable practises and dedication to action on climate change. It is also a way to meet sustainability commitments such as the 2015 Paris Agreement on Climate Change.

Economical: total cost of ownership calculations improves the business case for electric vehicles due to their lower operating costs.

Social and health: electric vehicles can lead to improved driver experiences and reduced driver fatigue as a result of less noise, fumes and vibrations.[9]

Reputational: fleet electrification demonstrates an ethical and forward-thinking organisation that is on top of emerging technologies.

In 2017, the Climate Group began their global initiative EV100 to bring together companies that are committed to the electrification of their fleets by 2030. Today, these commitments total two million vehicles. Currently, no Australian companies are part of the initiative. In contrast, five New Zealand companies – out of a total of 50 participants globally – have committed.[10]

6 Reuters (2019)
7 Australian Financial Review (2018a)
8 International Energy Agency (2019)
9 ANC (2019)
10 EV100 (2019). These include: Air New Zealand, Christchurch Airport, Genesis Energy, Mercury, Meridian Energy.

City of Canterbury Bankstown Electric Fleet Vehicles

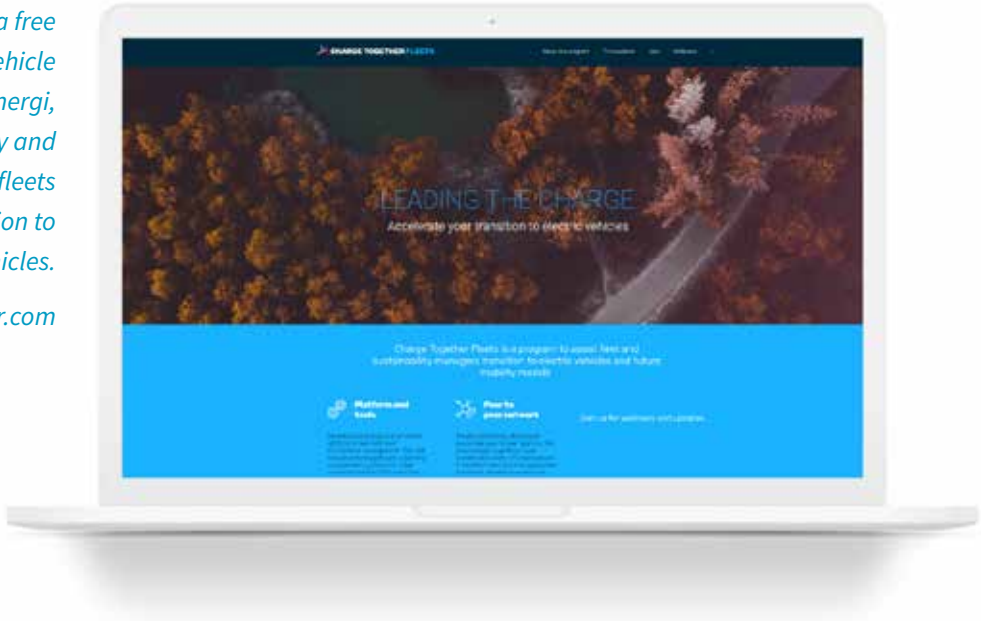
However, there have been movements towards electric fleets in some state governments, local councils and businesses. The transition is often driven by sustainability policy, which encourages the use of electric vehicles to reach carbon emission reduction targets and sustainability goals. As vehicle prices fall and more models become available, this decision is increasingly made for economic and convenience benefits.

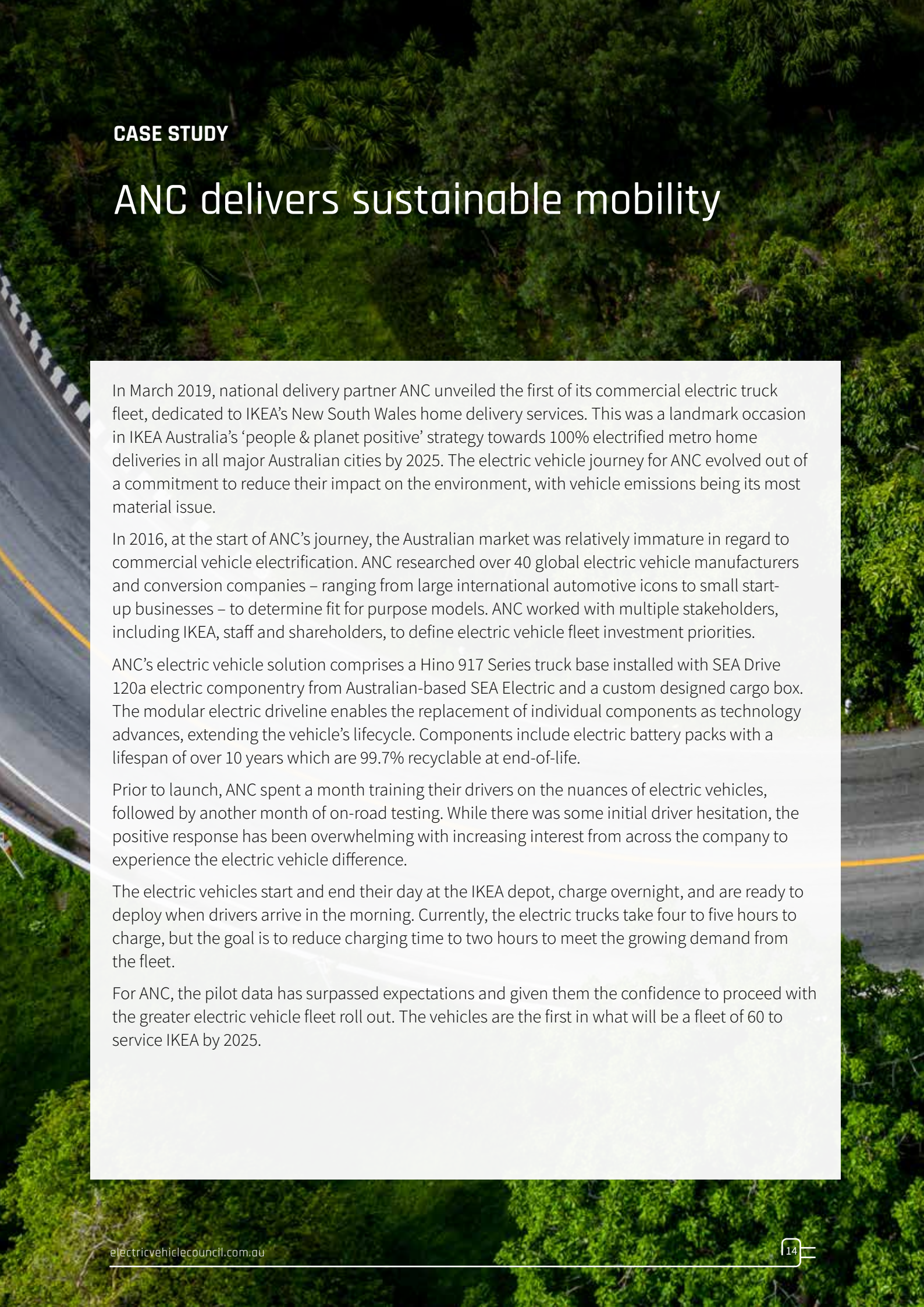
Some notable examples include Moreland City Council, City of Canterbury Bankstown, City of Sydney, ACT Government, IKEA, Melbourne Water, and Australia Post.

In order to see an increase in electric vehicle adoption in fleets, companies must be equipped with the right knowledge to make the switch to electric vehicles. Understanding electric vehicles, charging infrastructure and total cost of ownership will allow businesses to begin the transition.

Charge Together Fleets is a free program led by the Electric Vehicle Council and developed by Evenergi, with support from industry and government partners, to help fleets plan and manage the transition to electric vehicles.

www.chargetogether.com





CASE STUDY

ANC delivers sustainable mobility

In March 2019, national delivery partner ANC unveiled the first of its commercial electric truck fleet, dedicated to IKEA's New South Wales home delivery services. This was a landmark occasion in IKEA Australia's 'people & planet positive' strategy towards 100% electrified metro home deliveries in all major Australian cities by 2025. The electric vehicle journey for ANC evolved out of a commitment to reduce their impact on the environment, with vehicle emissions being its most material issue.

In 2016, at the start of ANC's journey, the Australian market was relatively immature in regard to commercial vehicle electrification. ANC researched over 40 global electric vehicle manufacturers and conversion companies – ranging from large international automotive icons to small start-up businesses – to determine fit for purpose models. ANC worked with multiple stakeholders, including IKEA, staff and shareholders, to define electric vehicle fleet investment priorities.

ANC's electric vehicle solution comprises a Hino 917 Series truck base installed with SEA Drive 120a electric componentry from Australian-based SEA Electric and a custom designed cargo box. The modular electric driveline enables the replacement of individual components as technology advances, extending the vehicle's lifecycle. Components include electric battery packs with a lifespan of over 10 years which are 99.7% recyclable at end-of-life.

Prior to launch, ANC spent a month training their drivers on the nuances of electric vehicles, followed by another month of on-road testing. While there was some initial driver hesitation, the positive response has been overwhelming with increasing interest from across the company to experience the electric vehicle difference.

The electric vehicles start and end their day at the IKEA depot, charge overnight, and are ready to deploy when drivers arrive in the morning. Currently, the electric trucks take four to five hours to charge, but the goal is to reduce charging time to two hours to meet the growing demand from the fleet.

For ANC, the pilot data has surpassed expectations and given them the confidence to proceed with the greater electric vehicle fleet roll out. The vehicles are the first in what will be a fleet of 60 to service IKEA by 2025.

"Our fleet consists of over 760 trucks, vans, utes, and crane trucks so the investment in three electric vehicles is just the beginning in ANC's electric vehicle journey," says ANC Managing Director James Taylor. "We can only have a meaningful impact by working in partnership with industry leaders, clients, and suppliers to speed up the transition to electric. ANC is ready for the challenge and has other major retailers ready to commit to electric vehicles."

The pilot identified several benefits of electric vehicles for drivers, including:	**Key challenges in sustainable mobility in 2019:**
Improved capacity compared to diesel equivalent	Going beyond metropolitan deliveries – to reach comparative coverage and routing from an electric vehicle single charge
Improved productivity from increased cargo capacity	Higher upfront costs of the vehicles and charging equipment
Improved health and safety as the electric drive train omits the noise, vibration and heat usually generated by diesel engines	Total cost of ownership modelling is more challenging than the traditional diesel vehicles as data and depreciation is less known.
No fuel (petrol/diesel) costs	Limited choice of commercial electric vehicle suppliers in the Australian market
Reduced maintenance costs provide the opportunity to reach cost parity or less (which is the ultimate aim)	Lack of centralised and relevant trusted information to draw from
	Lack of collective industry discussion to prioritise the Australian market with manufacturers
	Lack of government support, including incentives and public infrastructure.

ANC's commercial electric truck fleet

Chapter 2: Charging infrastructure

Charging infrastructure investment

Investment in a national electric vehicle charging infrastructure network is necessary to allow for a smooth transition to the electrification of the transport sector. It is essential to plan for electric vehicles along highways, in new developments, in regional Australia, and in urban centres. The importance of a national charging network is highlighted in Infrastructure Australia's high priority initiatives for the nation.[11]

Investment in charging infrastructure has grown, with national, state and regional projects announced by the private sector, motoring groups and local governments. These forward-thinking companies, councils, and organisations are taking the lead in driving the country to its electric future.

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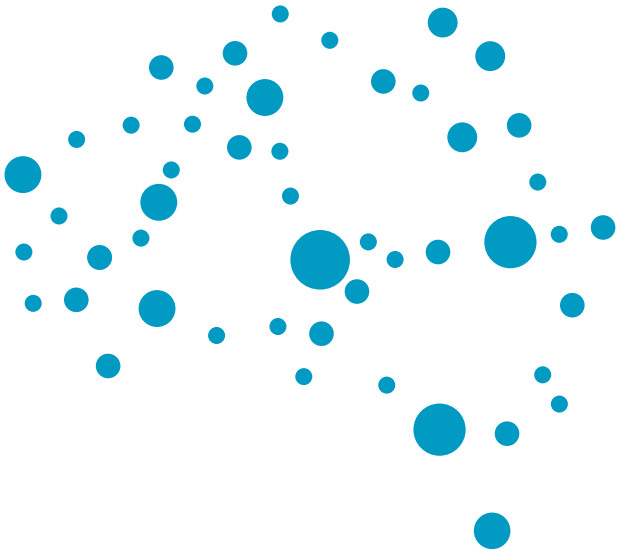

11 Infrastructure Australia (2019)

Some of these have been outlined below:*

Group	Investment in EV charging infrastructure
Alice Springs Airport	2 EV charging stations
Beaconhills College & EVolution	Solar EV charger project: installation of electric vehicle charger powered by solar panels
Blacktown City Council	10 Smart poles (with Wi-Fi and EV charging)
Chargefox	21 Charging sites (42 charging stations) with funding from Australian Renewable Energy Agency (ARENA), the Victorian Government and Australian Motoring Services (RACV, NRMA, RACQ, RAC, RAA and RACT)
City of Adelaide	42 EV charging stations across the CDB and North Adelaide
City of Wanneroo council & E-Station	20 AC charging stations
Evie Networks	80 charging stations across 42 sites managed by US company EV Connect
Mirvac	38 universal EV charging bays, 14 Tesla Supercharging bays and 31 Tesla destination chargers in 12 centres nationally
Moreland City Council	10 EV chargers (including 2x 50Kw DC fast chargers)
NRMA	40 electric vehicle fast chargers to cover 95% of members' road trips
Queensland State Government, Department of Transport and Mainroads & Chargefox	Phase 2 of the Queensland Electric Superhighway to increase the number of chargers to over 50
RAC WA	11 locations in Perth and South West WA with fast-charging DC stations
Stockland	31 centres with 50 chargers from Cairns to Melbourne
Synergy	EV Home plan: discounted rates and bonus charging for EV owners
Tasmanian Government	ChargeSmart program provides $600,000 funding for public charger installation
Tesla	29 Supercharger stations and 593 destination chargers nationally with plans for 12 more superchargers
Urbancom & EVSE	Installed the largest number of EV chargers in an apartment building in Lane Cove: each of the 40 apartments come with a 7kW EV charger
Vicinity & Perth Airport	2 electric vehicle charging bays
Waverley, Woollahra and Randwick councils	Network of 6 public charging stations

*This is not an exhaustive list, rather an insight into charging infrastructure investment.

Public charging infrastructure

The International Energy Agency (IEA) estimates there were 144,000 public fast (DC) chargers and 395,000 AC chargers worldwide at the end of 2018: an increase of 24% from 2017.[12]

In Australia, the upwards trend has been more dramatic. The number of public charging stations increased by 143% between June 2018 and July 2019.[13] Since 2017, the number of public chargers has increased by over 400%.[14] This rapid increase is attributable to strong investment from the private sector.

The increase in electric vehicle charging infrastructure is significant to electric vehicle adoption in Australia, given the positive correlation between the number of publicly accessible chargers, and the number of electric vehicles sold.[15] The provision of public charging infrastructure can help to alleviate range anxiety for Australian consumers who are considering an electric vehicle as their next car purchase.

As of July 2019, total number of electric vehicle charging stations (AC and DC) in Australia is 1,930. Below, this number has been broken down by state and power supply (AC/DC).

The number of **DC charging** stations is outlined below:

State	NSW	ACT	VIC	SA	QLD	TAS	NT	WA	Total
# of sites	37	5	17	4	27	2	0	18	110
# of stations	110	10	47	14	45	2	0	23	251

The number of **AC charging** stations is outlined below:

NSW	ACT	VIC	SA	QLD	TAS	NT	WA	Total
539	34	356	184	321	54	5	186	1,679

12 IEA (2019)
13 Electric Vehicle Council (2018)
14 Electric Vehicle Council (2017)
15 European Automobile Manufacturers Association (2019)

CASE STUDY

Tritium: The world-beaters from Brissy

When driving around Europe, it might come as a surprise that around one in five of the DC fast chargers you see is Australian made.

> a case study in Australian strengths

In the late 1990s, a group of University of Queensland students designed a solar-powered car and took third place in the World Solar Challenge. Twenty years later, David Finn, Paul Sernia and James Kennedy are now world leaders in developing electric vehicle chargers. Indeed Australia's Chief Scientist Alan Finkel labelled them "a case study in Australian strengths."

David, Paul and James founded Tritium in 2001 as a micro-business selling parts for solar cars. Today, the company focuses on electric vehicle chargers and employs more than 300 people with offices in Brisbane, California, and Amsterdam.

"In 2011, we shifted focus to DC fast charging infrastructure because we saw that as a really critical piece of infrastructure that's needed for the mass market adoption of e-mobility," said Tritium co-founder, Paul Sernia who is now Tritium's Chief Product Officer.

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"In 2011, we shifted focus to DC fast charging infrastructure because we saw that as a really critical piece of infrastructure that's needed for the mass market adoption of e-mobility," said Tritium co-founder, Paul Sernia who is now Tritium's Chief Product Officer.

"We focused on overseas first because that's where the market is. In countries such as Norway and some states in the US, government policy has made it more attractive and easier for people to buy an electric vehicle, and these are the areas where charging infrastructure is needed," Sernia said.

"We have not followed the traditional path of local success preceding global success, instead we subscribed to the fundamental and sensible approach to 'follow the market'. But the Australian market is starting to catch-up to the world."

In 2018, Ionity chose Tritium to supply 100 high-power charging sites across European highways. Each site has an average of six 350 kW stations – connecting major transport links across Germany, France, the UK, Norway and Sweden.

In May 2019, Tritium signed a second deal to supply an additional 120 Ionity sites – making them the biggest supplier to the world's largest and fastest electric vehicle charging network.

"We chose to partner with Tritium because they have a world-leading technology and have shown they can develop and deliver their products quickly," said Ionity CEO Michael Hajesch.

In Australia, the NRMA, Evie Networks, and ChargeFox are using Tritium's Veefil-RT 50kW DC Fast Chargers in their major electric highway infrastructure developments.

Tritium says its Veefil range of fast chargers have been recognised as the most technologically advanced in the market. The size, weight, and unique liquid-cooling systems significantly reduce the cost of ownership through lower installation, shipping, and maintenance costs. The Veefil has also revolutionised the look and style of fast chargers, making them more of a streetscape asset.

But Tritium isn't finished with innovation. In April 2019, they opened the largest R&D facility for electric vehicle chargers in the world. The new facility, located at their Brisbane headquarters, will help increase production rates and allow for much faster time-to-market, while further enabling developing technologies that will continue to power electric vehicle markets worldwide.

"By the end of 2018, we were adding an engineer to the team every week, on average. In engineering circles, this growth rate is unheard of. But as Tritium continues to expand, this rate of growth is absolutely necessary to cater to demand for DC fast charging and high-power charging," said James Kennedy, Tritium co-founder and Chief Technology Officer.

The Brisbane global headquarters now provides more than 200 local jobs across sales, support and marketing, R&D and engineering.

"We located this facility in Brisbane because we've always had a lot of support locally, from both the state and local governments," Sernia said.

"The employee talent pool in Brisbane is fantastic, and this city is very attractive to any overseas employees who come to work for us here. For a truly global company we don't think it matters where we are based.

> By the end of 2018, we were adding an engineer to the team every week, on average.

"We recognise that things are really starting to ramp up now in the Asia-Pacific region, particularly in South East Asia and Australasia, which makes our established base in Brisbane even more important than ever before.

"It has also been very important that we have a physical presence in our two key geographic markets, Europe and the USA, which is why we opened our offices in Amsterdam and California.

"Being adaptable to the market opportunities has been a key part of our success so far and will be for us in future," Sernia said.

Tritium DC Fast Charger

Chapter 3: Consumer Attitudes

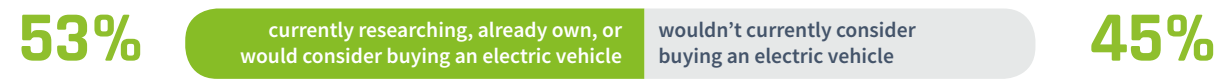
A survey carried out by the NRMA, RACV, and RACQ on behalf of the Electric Vehicle Council asked motorists from New South Wales, Victoria, and Queensland about their awareness and perception of electric vehicles. The total number of respondents to the survey was 1,939.[16]

Consumer attitudes towards electric vehicle ownership

The survey made it clear that Australians are now well aware of electric vehicles with 100% of survey respondents saying they have heard of electric vehicles and 45% of respondents saying they would consider purchasing one. Compared to last year's *State of Electric Vehicles* survey, a significant increase was observed in the group of respondents "currently researching EVs to buy" which – at 6% – was more than triple 2018's figure of 1.8%.

As such, the combined groups of people who would consider purchasing, currently owned, or were currently researching EVs to buy accounted for 53% of respondents. This represented a steady increase from 48% in last year's report.

In a separate question, 45% of respondents said they had spent time researching options for purchasing an electric vehicle. This is a drastic increase from the 2017 *State of Electric Vehicles* report where only 19% of those surveyed said they had undertaken any research into electric vehicles. It is clear that Australian consumers are increasingly interested in what electric vehicle options are available and that a growing group are willing to spend time considering whether such vehicles are well-suited to their needs.



16 The NRMA received 490 responses, RACV received 1,287, and the RACQ received 162.

CURRENT ATTITUDES TOWARDS EV OWNERSHIP

"Which of the following statements best describes your current attitude towards buying an electric vehicle?"

Consumer attitudes towards electric vehicle prices

The second part of the survey asked respondents to consider how price might influence their willingness to buy electric vehicles. As has been observed in previous research, the price of electric vehicles remains a key issue for consumers, reflecting the historical lack of model availability in lower price ranges in Australia – although this is set to begin changing (see Model Availability section).

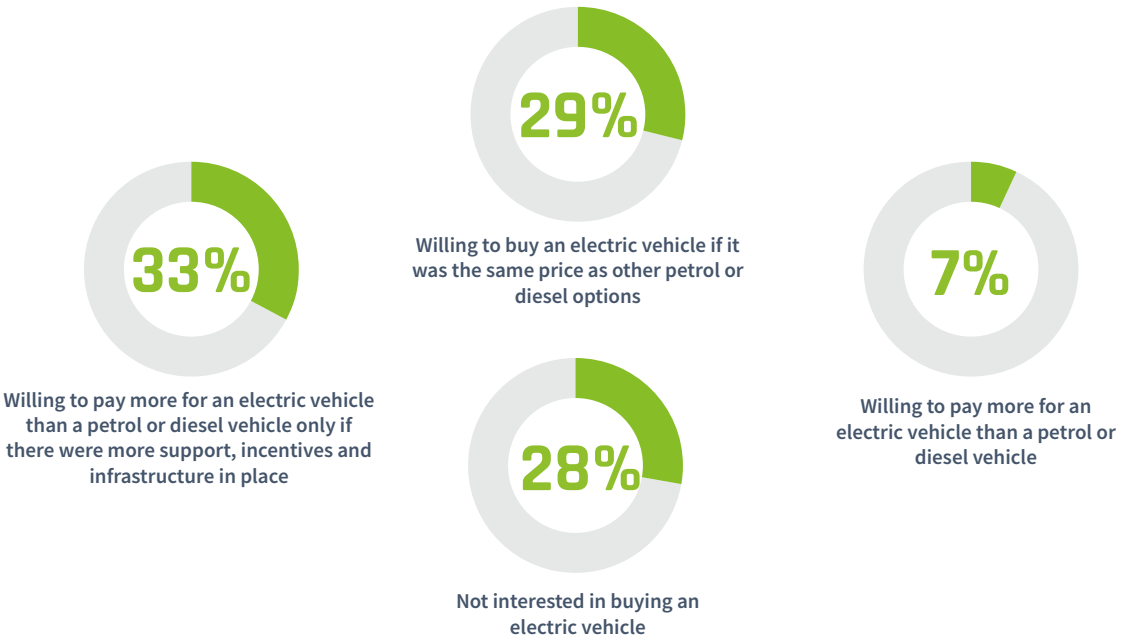
The results reflect substantial international evidence that government policy can have an impact on consumer decision-making. While 45% of respondents indicated they would consider buying an electric vehicle in the current market (see "Current attitudes towards EV ownership"), that number jumped to 69% in a scenario where electric vehicles were the same price as equivalent fossil fuel vehicles.[17]

Within that group, 40% of all respondents said they would actually be willing to pay more for an electric vehicle, although most of those (33%) were only willing to do so if there were more support, incentives and infrastructure in place. Last year, only 34% of respondents were willing to pay more, suggesting that a strong year of media coverage for electric vehicles has gone some way to highlight the short- and long-term benefits of electric vehicle ownership that make a higher initial purchase price worthwhile. This is further evidenced by the fact that the number of respondents who would be willing to pay more regardless of incentives was notably higher this year (7%) compared to last year (4%).

17 This figure includes those willing to pay more for an electric vehicle currently (7%), those willing to do so if there were more support, incentives, and infrastructure (33%) as well as those who would be willing to buy an electric vehicle if it were the same price as fossil fuel options (29%).

WILLINGNESS TO PURCHASE AN ELECTRIC VEHICLE

"Which of the following statements best describes your attitude towards electric vehicles?"



Consumer perceptions of electric vehicle drawbacks and benefits

The primary concerns for consumers continue to be "range anxiety" and purchase price. When asked what three features would most discourage them from purchasing an electric vehicle:

- **73%** of respondents nominated the distance able to be travelled per charge
- **71%** of respondents nominated the price of an electric vehicle compared to petrol or diesel

Respondents were also asked to choose three features that would most encourage them to purchase an electric vehicle:

72%
of respondents chose the convenience of recharging

67%
of respondents chose lower running and maintenance costs

49%
of respondents chose environmental benefits

In addition to the Electric Vehicle Council's survey questions, NRMA respondents were asked to choose the most important benefit of electric vehicles to them. Environmental benefits were valued most highly and chosen by 34% of respondents. Decreasing Australia's reliance on liquid fuels followed at 14% and improving health standards at 12%.

THE BENEFITS OF ELECTRIC VEHICLES THAT ARE THE MOST IMPORTANT TO AUSTRALIANS

34%
Reducing vehicle emissions for environmental benefits

14%
Decreasing Australia's reliance on imported liquid fuels

12%
Reducing vehicle emissions for improved national health standards

11%
Reducing the average cost of purchasing and maintaining a vehicle

8%
Establishing new domestic industries to support electric vehicle requirements

7%
Increasing energy generation with more renewables

Consumer attitudes towards government policies

Government policies have been vital to encouraging the transition to electric vehicles globally and similar measures continue to have support in Australia. Recent surveys and polls have shown public support for ambitious measures to support electric vehicles.[18]

Respondents to this survey were asked to choose three government policy measures that would encourage them to purchase an electric vehicle.

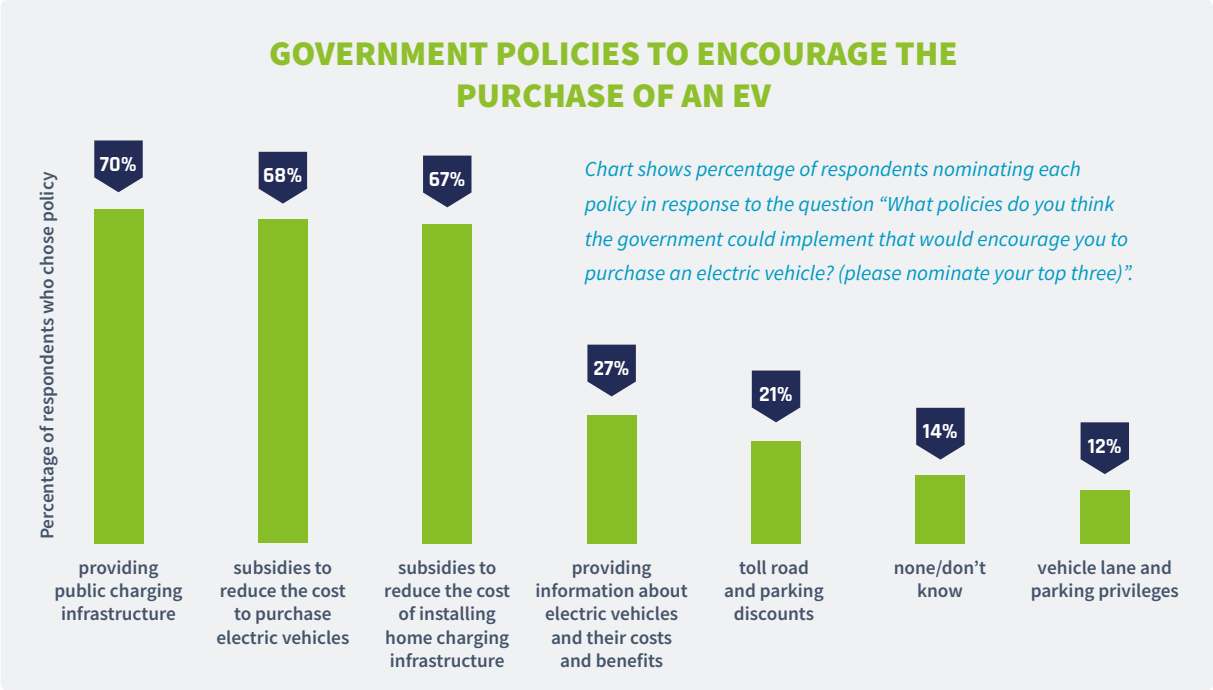
Government policies that support the provision of charging infrastructure, reduce the cost of purchasing an electric vehicle, and reduce the cost of installing home charging were each in the top three policies of around 70% of respondents.

Other supportive measures by government ranked as secondary drivers. These included providing information about electric vehicles (27%) and toll road and parking discounts (21%).

These figures have changed negligibly from last year's *State of Electric Vehicles* report and continue to reflect our understanding of how purchasing choices are made in the vehicle market, where upfront, or 'sticker' prices, play a much more important role than cost of ownership considerations.

Markets that have been successful at encouraging electric vehicle uptake have policies focused on reducing upfront purchase costs through rebates or tax reductions.[19]

18 Climate Council (2019); The Australia Institute (2019)
19 The International Council on Clean transportation (2016)



Perceptions on charging speed

As previously noted, various charging considerations can both encourage and discourage the purchase of an electric vehicle.

The importance of the availability of different types of chargers (fast, public, workplace) was ranked by respondents on a scale of one to ten.[20]

- **70%** nominated public fast charging as important, with only 13% considering it unimportant.
- **41%** nominated public charging as important, with 25% considering it unimportant.
- **38%** nominated workplace charging as important, with 35% considering it unimportant.

International studies have shown that the majority of electric vehicle charging in early market segments occurs at home or the workplace.[21] However, due to the influence of public charging infrastructure on consumer comfort, electric vehicle market growth is not possible without it.[22]

In fact, when asked if public charging did not matter as they could charge at home, 58% of respondents disagreed, compared to only 15% who agreed. [23]

As global electric vehicle uptake moves away from the early adopters to the mass market, it will be important to monitor electric vehicle charging behaviour, so as to invest in the correct electric vehicle charging infrastructure to support consumer needs.

When asked how they would source electricity to power electric vehicles, 51% of respondents answered they would use renewable energy sources, 22% of respondents were not concerned with where their electricity would come from and 26% of respondents answered they 'don't know' where they would source their electricity for charging.

20 1-3 is "unimportant" while 8-10 is "important".
21 Transport and Environment (2018)
22 Sierzchula et al (2014)
23 Respondents were asked the degree to which – on a scale from 1 to 10 – they agreed with the statement "Infrastructure is not a concern, I know I can charge at home"

THE IMPORTANCE OF DIFFERENT TYPES OF PUBLIC CHARGERS IN CONSIDERING THE PURCHASE OF AN EV

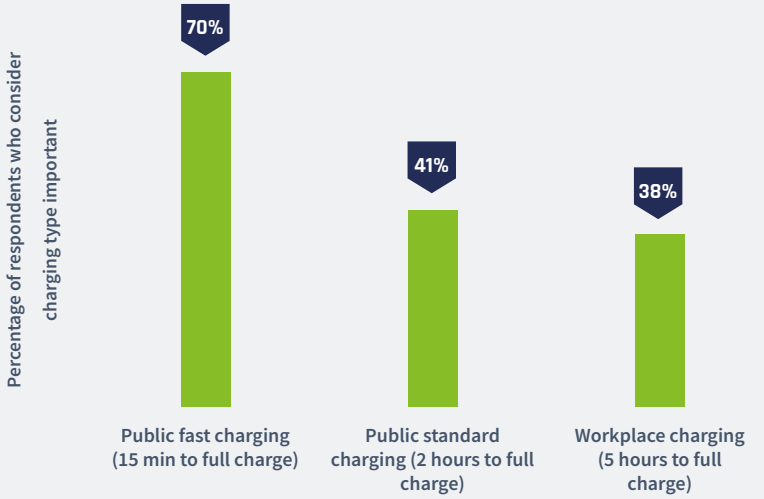
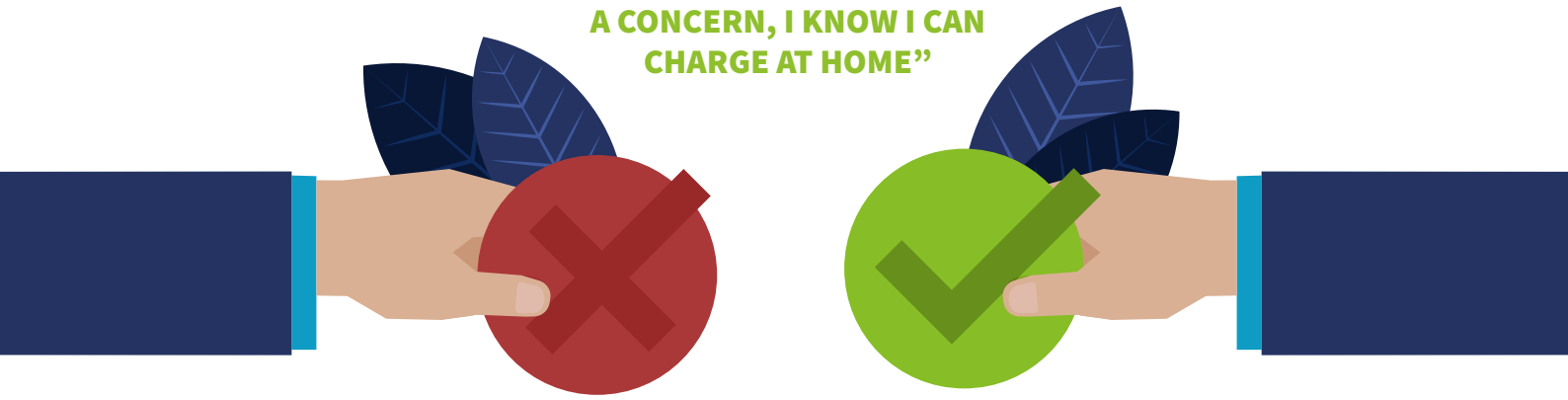


Chart shows percentage of respondents who rated each type of charging 8 to 10 in response to the question "How important is the availability of different types of charging infrastructure to your decision to buy/own an electric vehicle? Please rate out of 10, where 0=Not at all important to 10=Extremely important"

"INFRASTRUCTURE IS NOT A CONCERN, I KNOW I CAN CHARGE AT HOME"



58% DISAGREE

15% AGREE

Running costs

While electric vehicles (EVs) currently have a higher purchase price relative to their fossil fuel vehicle (FFV) counterparts, they have substantially lower running costs over the life of the vehicle and therefore, may already be the lower cost option for some drivers.

The cost of recharging an electric vehicle is significantly less per kilometre than the cost of refuelling with petrol, even during periods of high electricity prices and low petrol prices. Electricity prices are also more stable from week to week, compared to petrol prices which fluctuate daily.

Servicing an electric vehicle also costs less because there are fewer components in an electric vehicle and therefore fewer parts to maintain or replace.

	EV	FFV
Energy usage per km	0.150 kWh[24]	0.106[25]
Electricity/fuel cost	$0.33/kWh[26]	$1.44/L[27]
Cost per km	$0.05	$0.15
Average annual travel	12,600km[28]	
Average annual costs	$623.70	$1,923.26
Fuel savings	**$1299.56 per year**	
Five-year savings	**$6,497.82**	

True cost impacts will depend on each individual vehicle and driver. An extensive Total Cost of Ownership (TCO) calculator developed by Evenergi and designed to help drivers compare whole- of-life costs can be accessed at: https://electricvehiclecouncil.com.au/about-ev/cost-calculator/

Total lifecycle savings from electric vehicles will become even greater within the next five years. While electric vehicles currently have a higher purchase price relative to fossil fuel vehicles, their upfront cost is expected to reach parity from 2024,[29] mostly due to falling battery costs.[30]

Transport costs account for 16% of household expenditure, following only housing and grocery expenses.[31] Therefore, electric vehicles have the potential to provide a significant benefit to household budgets in the future.

Electric Vehicle Council analysis shows that an electric vehicle owner could potentially save around $6,500 in fuel costs over five years compared to owning an internal combustion engine vehicle for the same period.

24 Queensland Government (2019)
25 Australian Department of Infrastructure and Regional Development (2017)
26 Australian Energy Market Commission (2018)
27 Australian Institute of Petroleum (2019)
28 The Australian Bureau of Statistics (2018)
29 BloombergNEF (2019)
30 The International Council on Clean Transportation (2018)
31 ABS (2017)

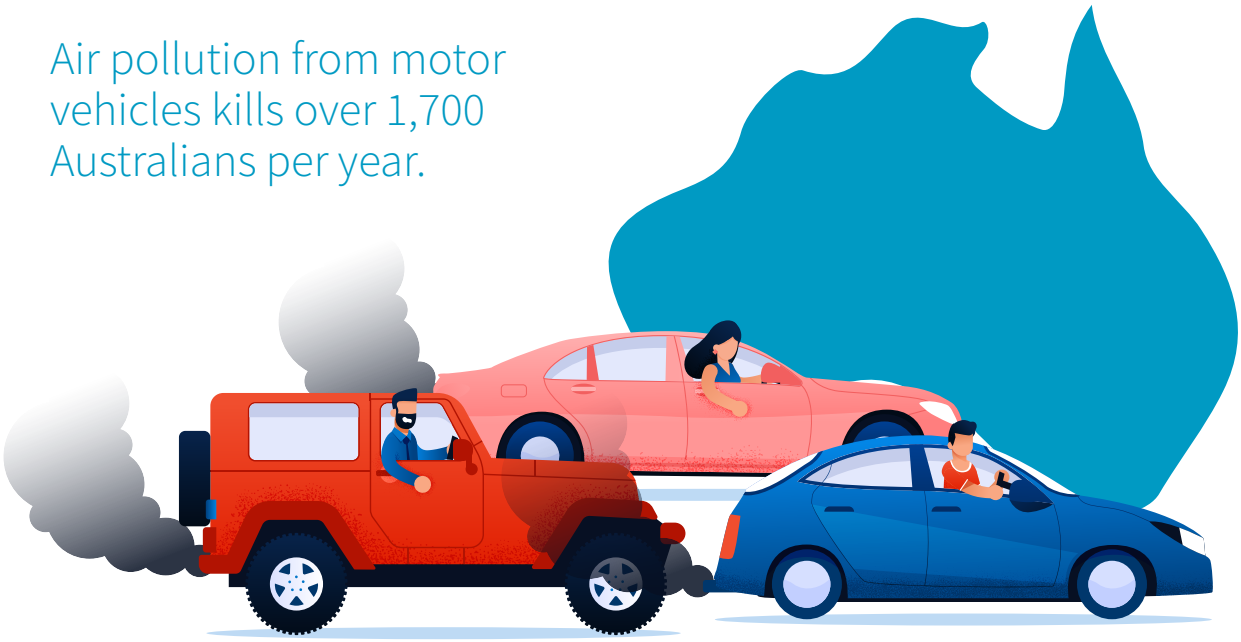
Health benefits

The World Health Organisation (WHO) considers air pollution to be the single greatest environmental danger to public health globally.[32] At the same time, a wealth of international evidence shows that there is no safe level of air pollution. The existence of any air pollution causes negative health impacts.

The OECD estimates that approximately half of the health impact of air pollution is due to motor vehicles.[33] This is because, unlike with industrial or agricultural processes, motor vehicle pollution is pumped straight onto our streets where we live and breathe.

To make matters worse, air pollution disproportionately affects the most vulnerable members of society including unborn babies, children, the elderly, and those with pre-existing health conditions.[34]

Air pollution from motor vehicles kills over 1,700 Australians per year.



32 World Health Organisation Regional Office for Europe (2017)
33 Organisation for Economic Co-operation and Development (2014).
34 New South Wales Health (2013)

> Each battery electric vehicle that replaces a fossil fuel vehicle could save around $2,400 in health costs.

Australia is not exempt from this global phenomenon. Air pollution from motor vehicles kills over 1,700 Australians per year.[35] The EVC released a report this year, *Cleaner and Safer Roads for NSW*, that investigated the health impact of vehicle emissions in Australia's largest state. It was found that vehicle emissions were responsible for 21,000 serious health impacts annually and 60% more deaths than motor vehicle crashes.[36]

The same report estimated that each fossil fuel vehicle creates average health costs of $7,110 over a ten-year period.[37]

Battery electric vehicles produce zero exhaust emissions so widespread adoption of these vehicles would make marked improvements to Australia's air quality. C*leaner and Safer Roads for NSW* estimated that each battery electric vehicle that replaces a fossil fuel vehicle could save around $2,400 in health costs.

Fossil fuel vehicles are also a significant source of noise pollution. Victoria's Environment Protection Agency estimates that social costs due to noise amount to $250 per vehicle per annum.[38] By applying that figure to Australia, we can estimate the annual social costs from vehicle noise to be $4.8 billion.[39] Electric vehicles, particularly heavy electric vehicles, are much quieter than their fossil fuel counterparts and would help reduce this harm.[40]

35 Schofield et al. (2017)
36 Electric Vehicle Council (2019)
37 Electric Vehicle Council (2019)
38 Victorian Environment Protection Agency (2013).
39 Number of registered vehicles in Australia is 19.2M see Australian Bureau of Statistics (2018c).
40 Electric Vehicle Council (2019)

CASE STUDY

Tri-Councils triumph in EV-readiness

Waverley, Woollahra, and Randwick Councils this year became the first councils in NSW to provide public on-street electric vehicle charging stations.

Electric vehicle owners can now charge their vehicles while they catch some Eastern Suburbs sun – with EV chargers now installed at Bondi Beach, Double Bay, Coogee Beach and Randwick – and more set to open at Bondi Junction and Maroubra.

The chargers, which are powered by renewable energy, are being installed and managed by JETCharge.

At the launch in June 2019, which was emceed by TV personality and local resident Osher Günsberg, Randwick Mayor Kathy Neilson said, "This project is an example of our shared determination and eff orts to enact change at a local government level to help the environment for future generations."

The work began in 2016 with a community survey that received hundreds of responses. 70% of respondents said that installing public chargers would make them more likely to buy an electric vehicle.

Soon after, the Tri-Councils were involved in the Climate-KIC 24-hour Climathon organised by EnergyLab and UNSW. Participants pitched possible solutions to the problem of "how to get micro-communities to adopt electric vehicle use".

> This project is an example of our shared determination and efforts to enact change at a local government level to help the environment for future generations.

Ideas from that event, community feedback, council research, and case study work done by a Sydney University Masters student all led to the conclusion that successful projects overseas tended to be very public and visual.

"It's easier to install off -street charging in buildings or carparks," says project lead Anthony Weinberg. "But the high profile and premium on-street locations give you visibility. They're a constant visual reminder that change is on the way."

The Tri-Councils are also leading the way when it comes to EV-charger regulations – a necessity when approximately 65% of their residents live in multi-unit dwellings and apartments. This has meant changes to the Councils' Development Control Plans (DCPs), which set the requirements for new developments. The changes will mean that during construction new buildings must have an electrical circuit

that can accommodate between 10-20% of lot owners charging their vehicles at the same time, plus dedicated EV chargers in visitors parking.

The new regulations will be able to serve as a blueprint for other councils as the EV transition ramps up. The Tri-Councils are similarly assisting shopping centre and car park operators who are becoming increasingly interested in installing chargers.

“It’s about Councils showing leadership, and once uptake has grown to a critical threshold then the market takes over and it becomes embedded,” says Anthony. “It’s very much like solar. The councils led the charge on solar around 2010, and now it’s a huge industry with 20% of households nationwide and is seen as a way to reduce energy bills for low income households. Councils have a real role to play in the beginning to make the transformation happen.”

Launch of Tri-council public electric vehicle charging stations, Bondi

Chapter 4: Industry Development

Australia is well-positioned to participate in the global electric vehicle supply chain. With our mineral endowment, research and development expertise, and skilled workforce, Australia is already seeing shoots of industry development and job creation.

However, there remains scope to create more economic opportunities and be a global leader in the electric vehicle industry. Australia could see industry development and job growth in a wide range of sectors, including:

raw material mining and processing

battery manufacturing, recycling and repurposing

charger manufacturing, installation, operation and maintenance

electricity generation, grid connections and grid upgrades

civil and road works

EV and EV component manufacturing

technology, software and mobility services

"Lithium prices have tripled since 2010 and global battery consumption is predicted to increase five-fold in the next 10 years, driven by a global shift to electric vehicles in some markets and off-grid storage to support renewable energy development,"

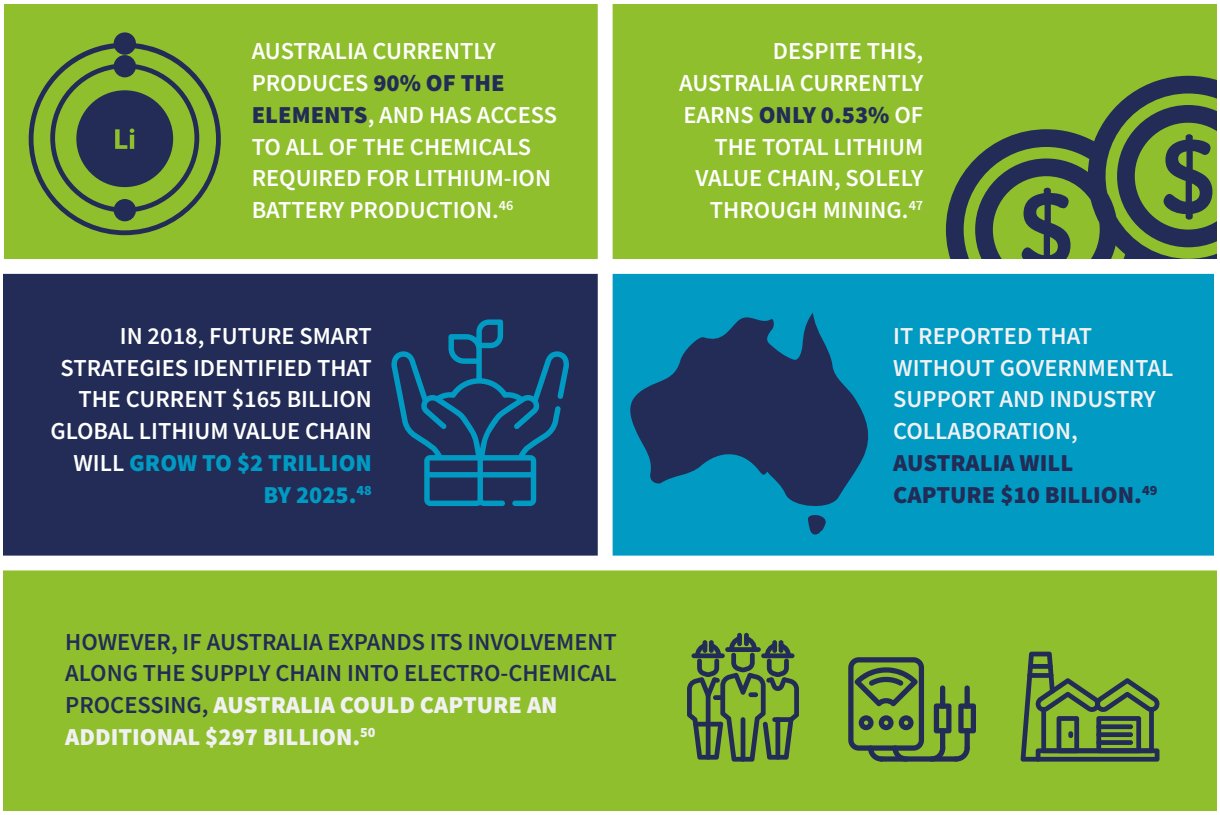
"As the world's largest producer of lithium and with mineral reserves covering 90 per cent of the elements required in lithium-ion battery production, we have an enormous opportunity to leverage off this rapidly growing industry."

Senator Matthew Canavan, Minister for Resources and Northern Australia, Dec 2018

Lithium Valley

Global investment in electric vehicle battery production is driving the demand for lithium up, and the cost of batteries down. In 2010, the average cost of a lithium-ion battery was US$1160/ kWh; by 2018 it had dropped to US$174/kWh.[41] Considering the lithium-ion battery pack is the most expensive component of an electric vehicle,[42] this is a significantly positive driver for industries across the electric vehicle supply chain. The falling price of lithium-ion battery packs is the primary driver to achieving price parity with fossil fuel vehicles.[43]

The Austrade report *The Lithium Ion-Battery Value Chain* cites forecasts from Frost & Sullivan where the growth of electric vehicles from 2017-2023 will increase global demand for lithium-ion batteries by 32.4%.[44] Given that Australia holds the third largest reserve of lithium globally (over 18% of the world's economic resources), Australia is well placed to benefit from a strong, domestic, downstream supply chain of lithium-ion batteries.[45]



Currently, the mining industry in Australia exports lithium ore to battery manufacturers (predominantly in Asia), resulting in a missed economic opportunity.

41 Bloomberg NEF (2018)
42 The International Council on Clean Transportation (2019)
43 McKinsey & Company (2019)
44 Australian Trade and Investment Commission (2018)
45 Australian Trade and Investment Commission (2018)
46 Australian Trade and Investment Commission (2018)
47 Australian Trade and Investment Commission (2018)
48 Association of Mining and Exploration Companies (2018)
49 Association of Mining and Exploration Companies (2018)
50 Association of Mining and Exploration Companies (2018)

The recent report, *Lithium Valley: Establishing the Case for Energy Metals and Battery Manufacturing in Western Australia* detailed the economic case for participating in lithium-ion battery related mining, refining, and secondary processing. The report found that almost 100,700 direct and indirect jobs could be created in Western Australia by 2025.[51] The number of potential jobs would further increase if Australia developed a battery manufacturing industry.

Domestic battery production could benefit companies such as GFG Alliance, SEA Electric, BYD, and ACE EV whose investments will be the first in Australia's modern automotive manufacturing industry.[52] Onshore production means they would not have to import internationally produced batteries containing Australian lithium. A downstream lithium supply chain could see lithium mined, processed, and manufactured into batteries for onshore electric vehicle manufacture and assembly.

In April 2019, the Future Battery Industries Cooperative Research Centre (FBICRC) was awarded $25 million in funding from the federal government for research to support Australian development of mineral processing, battery manufacturing, deployment, reuse, and recycling.[53]

There are already movements into battery manufacturing in Australia:

- Energy Renaissance has plans to build Australia's first battery gigafactory in the Northern Territory[54]
- The Queensland Government is conducting a large-scale energy storage feasibility study with Imperium3 for a 15GWh Gigafactory in Townsville[55]
- Lithium Australia is seeking to supply ethically and sustainably sourced materials to the battery industry on a global scale and has lithium cathode powders produced in Australia available for specification testing[56]

"Australia has a once-in-a-generation opportunity to transform into a major processing, manufacturing and trading hub for lithium-ion batteries.

"At the moment Australia produces about half of the world's lithium, but once it's mined out of the ground, it's shipped offshore, with all of the value-creation activities such as processing and battery manufacturing occurring overseas."

Senator Simon Birmingham, Minister for Trade, Tourism and Investment, Dec 2018

51 Regional Development Australia (2018)
52 For more, see the Local Manufacturing section
53 Minister for Industry, Science and Technology (2019)
54 ABC (2018)
55 Queensland Government (2018)
56 Australian Trade and Investment Commission (2018)

Lithium-ion battery recycling and repurposing

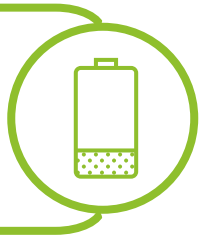
> The CSIRO suggests Australia could lead the world in the re-use and recycling of lithium-ion batteries.[57]

The development of a domestic lithium battery production and recycling industry could facilitate the emergence of a circular lithium economy in Australia, potentially managing lithium from extraction to recycling and securing jobs and investment across the industry.

In Australia, the low uptake of electric vehicles means the industry has not fully developed, providing the opportunity for businesses, organisations, and carmakers to develop onshore battery management strategies. Currently, most recyclers in Australia collect lithium-ion batteries and export them for recycling. Therefore, the value associated with the recoverable valuable metals is lost from the Australian economy.

SECONDARY LIFE USES OF ELECTRIC VEHICLE BATTERIES ARE COMMONPLACE IN THE ELECTRIC VEHICLE INDUSTRY. CARMAKERS ARE INNOVATING SECONDARY USES FOR LITHIUM-ION BATTERIES.

AN ELECTRIC VEHICLE BATTERY REACHES ITS END-OF-VEHICLE-LIFE AT BETWEEN 70% AND 80% CAPACITY,[58] HOWEVER THIS DOES NOT MEAN THE END OF THE BATTERY'S UTILITY.



IT CAN STILL POWER LESS-DEMANDING APPLICATIONS SUCH AS RENEWABLE ENERGY STORAGE AND EMERGENCY BACKUP POWER.[59] BY 2025, IT IS EXPECTED THAT APPROXIMATELY THREE QUARTERS OF USED ELECTRIC CAR BATTERIES WILL BE REUSED BEFORE THEY ARE RECYCLED.[60]

CARMARKERS HAVE IDENTIFIED THAT THESE SECONDARY USES CAN MAKE EXTRA PROFITS FROM THE SAME PRODUCT AND REDUCE HOUSEHOLD ELECTRICITY BILLS.[61]

57 Australian Trade and Investment Commission (2018)
58 Podias et al. (2018)
59 Jiao and Evans (2018)
60 Australian Financial Review (2018b)
61 Bloomberg Businessweek (2018)

Additionally, there are concerns in the resource recovery industry that exporting waste batteries for recycling does not guarantee they will be sustainably processed at their final destination.[62] However, carmakers are investing in recycling plants and closed loop battery programs to sustainably manage end-of-life EV batteries.[63] There is the opportunity for these programs to exist in Australia and there is already movement into the industry. Australian-based Envirostream opened the first lithium recycling plant in 2018 after receiving a grant from Sustainability Victoria, and Western Australia based minerals company Neometals has awarded a contract for a pilot recycling plant in Canada.[64] A national strategy would help to coordinate the industry, attract investment, and demonstrate demand to suppliers.

> It is vital that the Federal Government does not wait for the influx of electric vehicle batteries, but rather prepare Australia for its potential leadership role in battery recycling and repurposing.

Hyundai, BMW, Nissan, and Renault are currently developing home battery products that extend the lifecycle of electric vehicle batteries a further six to 10 years[65] and new partnerships are emerging as car manufacturers seek to capitalise on secondary battery uses. Australian company Relectrify repurposes end of life electric vehicle batteries into secondary uses.[66] Through partnerships with the Volkswagen Group and 4R Energy (subsidiary of Nissan Motors), they are developing secondary life battery solutions. Encouraging investment in this industry could see Australia become a competitive player in the global battery storage market.

Internationally, governments are legislating the way electric vehicle batteries are managed once they reach their end-of-vehicle-life. China, where nearly half of the world's electric vehicles are sold, has published draft regulations for a 'traceability management platform' that tracks the life cycle of electric vehicle batteries, and is developing policy to support domestic recovery plants.[67] Europe also has regulations that make carmakers responsible for the life cycles of their batteries.[68] Currently, there is no regulation in Australia that specifically mandates end-of-life electric vehicle battery management. However, the Australian Battery Recycling Initiative (ABRI) is a group of battery manufacturers, recyclers, retailers, government bodies, and environment groups that works to promote battery collection for recycling, safe disposal of all batteries, and responsible battery stewardship. The Electric Vehicle Council is a member of the ABRI Battery Stewardship Council.

62 Envirostream (2019)
63 Please see appendix for details
64 Sustainability Victoria (2018)
65 Electrek (2019)
66 Nissan X Opus concept. Daimler and The Mobility House. Getec, Remondis BMW, Umicore, Vattenfall & Northvolt, Hyundai Motor Group & Wärtsilä. Nissan & Eaton Industries.
67 Tawaki (2018)
68 Financial Times (2017)

> When I first raised the prospect of bringing car manufacturing back to Australia almost two years ago, the immediate reaction was that Australia was simply not competitive in this space or it wasn't an industry of the future, one that had run its course here. Bluntly put, the vehicle industry had passed us by and others were simply better at it then we could be. I beg to differ."
>
> Sanjeev Gupta, Executive Chairman, GFG Alliance

The safe disposal of lithium-ion batteries in a sustainable and environmentally suitable way will become increasingly important as the adoption of electric vehicles and stationary energy storage rises.[69] The CSIRO suggests that mining companies could partner with recycling plants to develop an onshore closed loop lithium-ion battery industry. Lithium Australia recently acquired shares in lithium recycler Envirostream, highlighting the emerging appetite for closed loop battery management to occur in Australia.

It is vital that the Federal Government does not wait for the influx of electric vehicle batteries, but rather prepare Australia for its potential leadership role in battery recycling and repurposing.

Local employment and manufacturing

The development of industries along the electric vehicle supply chain will also lead to significant job creation in Australia.

The *Recharging the economy* report found that switching from liquid fuel to electrified transport infrastructure would result in a net increase of 13,400 jobs by 2030 and real GDP increase of $2.9 billion (based on achieving BEVs comprising 57% of new car sales by 2030).[70] This net increase offsets job losses in industry sectors such as fuel resources and motor vehicle and parts manufacturing.

The global electrification of transport provides a massive opportunity for Australian businesses to generate local, green, and highly skilled jobs. Many of these jobs could be created in small-medium enterprises and regional communities. A European study found that the majority of new jobs created by electric vehicles in Europe will be for electrical contractors, who are mostly small and medium-sized enterprises.[71]

69 Department of Environment and Energy (2016)
70 Electric Vehicle Council, NRMA, St Baker Energy Innovation Fund, PwC. (2018)
71 The European Association of Electrical Contractors (2018)

Australia could also see the development of a modern automotive industry, allowing recently retrenched automotive workers to find new employment. Australia already has a ready supply of skilled workers and significant infrastructure in place to support the development of an electric vehicle manufacturing industry, particularly in regions that formerly hosted automotive manufacturing facilities. These areas have vocational education providers that could specialise in the skills required, networks for import and export, and are close to established supply chains.[72]

Below are some examples of existing investment and employment in the electric vehicle industry:

GROUP	INVESTMENT IN EV INDUSTRY
ACE EV	Partnership with Aldom Motor Body Builders to assemble up to 15,000 electric vans, utes, and cars in Adelaide by 2025. Up to half of the parts will be made in South Australia, with the rest to be imported.[73]
BHP	Trial of light electric vehicles at Olympic Dam in SA.
BYD	Signed a letter of intent with Adelaide-based Evant Group to develop and produce electric cars (a seven-seater SUV, a compact SUV, and a sedan) for the Australian market in 2020. Pre-assembled vehicles will be sent to Adelaide for adaptation.[74]
Clean Energy Finance Corporation	Vehicle finance programs with ANZ, Eclipx group, Firstmac, Macquarie, METR to incentivise purchase of low and zero emissions vehicles.
GFG Alliance	Plans to build its first electric vehicle production line in Australia within the next two years.
La Trobe Valley Authority, La Trobe City Council and SEA Electric	Collaboration to find an appropriate site for an assembly facility.
Nexport, Macquarie Group's Corporate and Asset Finance (CAF) and BYD	Distribution and sales of light electric trucks.
Nissan	The Nissan Casting Australia Plant designs and makes automotive components, including electric vehicle parts. A planned new electric vehicle technical training centre will employ 460 people.[75]
Tritium	Currently employs over 200 staff in Queensland in engineering, automotive and high-tech roles to design and manufacture electric vehicle chargers.
SEA Electric	Planned factory in the Latrobe Valley is expected to employ up to 500 workers over the next five years. The factory will assemble commercial van products and is expected to be up and running by 2021 and generate about $200 million in economic activity.[76]
Tafe Gippsland and SEA Electric	Partnership to prepare Latrobe Valley workers for employment in the EV industry.
Volgren	Production of electric buses, due for passengers in 2019.
Voltra	Production of E-cruiser: 100% electric drive for underground mining.
Wesfarmers	$776 million acquisition of WA lithium miner Kidman resources.

72 Parliament of Australia Senate Inquiry (2019)
73 ABC News (2019)
74 The Driven (2019)
75 Victorian Minister for Jobs, Innovation and Trade (2019)
76 La Trobe Valley Authority (2019)

CASE STUDY

Girt by SEA: The innovative Australian company shaking up the EV landscape

Back in 2013, Tony Fairweather – now Group Managing Director of SEA Electric – was collaborating with Australian universities to investigate the commercial applications of electric vehicles technology.

The verdict was that electric vehicles are particularly well-suited for base-to-base operations and urban delivery. The problem was that the research also showed that those business models would only be viable if battery prices fell to less than $300/kWh. That benchmark wasn't expected to be met until 2022.

Instead, it happened in late 2016. Six months later, the first SEA Electric vehicle was on the road.

"The technology is moving incredibly quickly," says Tony.

The rapid advancement has allowed SEA to expand its operations just as quickly, producing SEA Electric branded electric vehicles, licencing out their proprietary electric vehicle drivetrain, and electrifying a wide range of commercial internal combustion engine vehicles.

For Tony, the benefits for business is only part of the equation. The other part is pollution. Australia's heavy vehicles produce thousands of tonnes of CO^2 every day and are primarily fuelled with diesel which pumps significantly more harmful particulates into the air than petrol. Luckily, heavy vehicles are perfect for electrification.

"You have a lot of space in a truck's chassis. Where the engine and gearbox used to be, you can put in battery pods and behind that you have the electric motor," Tony says.

> Everyone wants to know how much it costs. That's the wrong question. The question should be, "'Why are we doing this?'" Tony says.

One of SEA's big innovations is their onboard charger. Most electric vehicles require commercial operators to install chargers on site, but SEA's system places the charging mechanism on the vehicle itself. Then all that's needed is access to a standard 3-phase outlet already used by many commercial and industrial businesses.

"That means our vehicles automatically have access to one of the biggest charging networks in the world," Tony says.

SEA announced in October 2018 that it would be opening a factory in Victoria's La Trobe Valley. That process is well underway with SEA already bringing jobs to the region.

> The mindset has to be that there's no boundaries. The technology is here, it's available, it's ready

Now this Australian innovator is getting attention from overseas. SEA is currently in negotiations with carmakers and vehicle up-fitters in the United States and Tony is confident this is just the beginning.

"The mindset has to be that there's no boundaries. The technology is here, it's available, it's ready," says Tony. "If someone wants to be part of the transition to a sustainable future, they can. We're making it happen today."

SEA Electric's customised vehicle range

Chapter 5: Policy

State policies

State and territory governments have a important role to play in accelerating the transition to electric vehicles. The Electric Vehicle Council sent a policy survey to each state and territory government, to detail their current commitments to the electrification of road transport.

The Electric Vehicle Council identified three main areas of policy that governments could use to accelerate uptake of electric vehicles: overarching EV policies, consumer policies, and industry support policies and asked Governments about their commitments to them.

The survey identified that:

- Only **half of the governments** have EV fleet commitments
- Only **two state governments** have plans to procure electric buses for public transport.
- **Most governments** have committed some funding to public charging infrastructure.
- **Only one government** has EV readiness requirements for new building/precinct developments.
- Consumer policies are widely non-existent; however, **four governments** offer incentives of some form.
- **Only two states** have policies to support the electric vehicle industry.

State and Territory Government responses are summarised below:

Overarching EV policies

	WA	ACT	NSW	NT	QLD	SA	TAS	VIC
EV target								
Government fleet target		✓	✓		✓	✓		
Public outreach and education campaign			✓		✓	✓	✓	
Electric Public Transport (e.g. buses) procurement plans			✓			✓		
EV readiness requirements for new building/ precinct developments		✓						
Public EV charging network investment		✓	✓		✓	✓	✓	✓
EV inclusion in government purchasing preferences		✓				✓		

Consumer Policies

	WA	ACT	NSW	NT	QLD	SA	TAS	VIC
Home charging installation subsidy						✓		
EV registration exemption/discount		✓			✓			✓
Stamp duty exemption for EVs		✓						
Other EV purchase incentive								
Preferential lane access for EVs (e.g. bus lanes)		✓						
Toll discounts for EVs								
Preferential EV parking access or free/ discounted parking						✓		
Discounted/free public EV charging						✓		
Other non-financial incentives					✓			

EV Industry Policies

	WA	ACT	NSW	NT	QLD	SA	TAS	VIC
Industry development plan					✓	✓		
Financial incentives						✓		
Non-financial incentives								

EV SNAPSHOTS

What are State and Territories doing?

Northern Territory

- Cross jurisdictional working group
- Charging infrastructure included in new urban infrastructure in Darwin
- EV categorised as 'small car' for registration purposes

Western Australia

- Taxi Plate buyback scheme: EV taxi operator exemption
- $53 million Future Battery Industries Cooperative Research Centre, with $6 million funding from the State Government
- Western Australian Future Battery Industry Strategy
- Renewable Hydrogen Council
- Western Australian Electric Vehicles Working Group
- EV charging station operators are exempt from electricity retail licensing

South Australia

- Fleet SA set a target of 30% ZEV by 2019 for the Govt fleet which has been surpassed (currently 41%)
- Public outreach has been via Green Drive Days with AEVA(SA)
- Grant funding under Northern Economic Plan to develop 2 x BEV buses for use in metro fleet
- Future Mobility Lab Fund provides financial support for Autonomous EV trials and new mobility services
- Climate Change Strategy – under development by the Premier's Climate Change Council including a focus on transport emissions
- Battery Minerals Strategy – under development.
- Demand Management Trials ($30m in funding)
- City Car Park Smart Charging Project delivered by the Adelaide City Council
- South Australian Hydrogen Roadmap

Tasmania

- Tasmania EV working group
- Autonomous bus trial in Hobart 2019
- Tasmanian Government's EV ChargeSmart Grants Program: $600,000 in grant funding to support fast, destination and workplace chargers.
- TasNetworks EV Fast Charger Support Scheme
- Tasmanian State and Local Governments Smarter Fleets Program

Queensland

- Consumer awareness website: The Future is Electric
- Phase 2 of the Queensland Electric Super Highway is under development
- Battery electric vehicles registered in QLD attract the lowest registration fee
- Queensland Electric Vehicle Committee (QEVC)
- Invested $2.5 million in Tritium
- Queensland Hydrogen Strategy 2019-2024

New South Wales

- Target for all NSW agencies of 10% new passenger vehicles to be electric or hybrid by 2020/21
- Customer information platform (jointly developed by TfNSW and Evenergi)
- Trial of electric buses commences in Sydney Bus Region 6, operated by Transit Systems
- Trials of zero emission buses
- Co-investment in regional fast chargers ($3 million) and slow chargers in commuter carparks ($2 million)
- Co-leading the transport stream work as part of the development of the National Hydrogen Strategy

Australian Capital Territory

- At least 50% of all newly leased fleet passenger vehicles will be zero emissions vehicles in 2019–20 (where fit for purpose)
- All newly leased passenger fleet vehicles will be zero emissions vehicles from 2020–21 (where fit for purpose)
- An annual vehicle registration discount of 20% for zero emissions vehicles
- Zero emissions vehicles can use transit lanes until 2023

Victoria

- Investment in ultra-rapid and fast chargers at 7 locations
- $100 discount in annual registration
- Government fleet has purchased one Hyundai Ioniq
- VicPol has a Tesla for its Highway patrol fleet provided at Wangaratta

National policy

In stark contrast to most OECD countries, there remains no national electric vehicle policy or strategy in place in Australia.

In January 2019, the Senate Select Committee on Electric Vehicles released its final report after a six-month inquiry, chaired by then Senator Tim Storer. The Inquiry represents the most significant action to date on EVs at the national level and the report has provided a non-partisan evidence base to inform and support the development of national electric vehicle policies.

The Senate Committee concluded that widespread uptake of electric vehicles would deliver significant economic, environmental and health benefits to Australia. It also identified that electric vehicles would create opportunities for growing industries such as: charging infrastructure manufacturing and installation; battery manufacturing, recycling, and repurposing; related mining and processing activities; and electric vehicle research and development.[77]

The Committee recommended that:

> Australian governments should prioritise the development of a national EV strategy and an inter-governmental taskforce to lead its implementation. National EV sales targets could be set to deliver certainty to business and consumers, and careful examination should be given to policies that may be introduced to reduce the upfront cost of EVs and improve their price competitiveness with internal combustion engine vehicles.[78]

Other recommendations proposed that the Australian Government should:

- consider establishing a national EV target for the federal government vehicle fleet
- coordinate with industry on the rollout of a national public charging network
- introduce more stringent vehicle emissions standards and establish a new CO2 standard
- undertake a consumer education campaign on EVs
- develop and implement a 10-year EV manufacturing roadmap
- fund apprenticeships and traineeships in the local EV and associated manufacturing sectors
- work with stakeholders to prepare a 10-year plan detailing priority electricity network infrastructure upgrades needed to manage demand from EVs
- explore necessary amendments to National Construction Code to make all new dwellings 'EV charger ready'

The Federal Government is currently preparing *A National Strategy for Electric Vehicles* which is expected to be finalised in mid-2020.

77 Parliament of Australia Senate Inquiry (2019). P. xv
78 Parliament of Australia Senate Inquiry (2019). P. xv

APPENDIX

1 – Vehicle model availability[79]

Vehicles available now:

Manufacturer	Model	BEV/PHEV	Segment	Price (RRP)	Battery size	All electric range (up to) km	0-100km/h (seconds)
Audi	Q7 e-tron	PHEV	SUV	$139,990	17.3 kWh	56	6.2
	A3 e-tron	PHEV	Small car	$62,490	8.8 kWh	50	7.6
BMW	i8 Coupe	PHEV	Sports	$318,900	11.6 kWh	55	4.4
	i8 Roadster	PHEV	Sports	$348,900	11.6 kWh	55	4.6
	i3	BEV	SUV	$68,100	42 kWh	260	7.3
	i3s	BEV	SUV	$69,900	42 kWh	260	6.9
	Countryman	PHEV	Mini	$57,200	8 kWh	19	6.8
Jaguar Land Rover	I PACE	BEV	SUV	$119,000	90 kWh	470	4.8
	Range Rover Sport	PHEV	SUV	$128,200	12.4 kWh	48	6.7
	Range Rover	PHEV	SUV	$175,101	12.4 kWh	48	6.8
Hyundai	Ioniq Plugin hybrid premium	PHEV	Sedan	$45,262.00	8.9 kWh	63	10.6
	Ioniq Electric premium	BEV	Sedan	$49,259.00	28 kWh	230km	10.2
	Kona	BEV	SUV	$59,990.00	64 kWh	449km	7.6
Mitsubishi	Outlander	PHEV	SUV	From $45,900	12 kWh	54	N/A
Porsche	Cayenne	PHEV	Sports	$145,500	10.8 kWh	36	6.2
	Panamera	PHEV	Sports	$280,000	14.1 kWh	51	3.8
Renault	Zoe Intens	BEV	Small car	$49490	41 kWh	300	14.5
	Kangoo MAXI Z.E.	BEV	Van	$49990	33 kWh	200	22.4
Tesla	Model S (various trim)	BEV	Sports	$108,100-142,300	100 kWh	490km -650km	2.6-4.2
	Model X (various trim)	BEV	SUV	$116,500-149,600	100 kWh	425km-550km	2.9-4.8
Volvo	XC90 T8	PHEV	SUV	$124,900	11.6 kWh	43	5.6
	XC60 T8	PHEV	SUV	$92,990	11.6 kWh	45	5.3

79 Original equipment manufacturers provided this data to the Electric Vehicle Council in June 2019.

Vehicles available in Australia in the future:

Manufacturer	Model	BEV/PHEV	Segment	Price (RRP)	Battery size	All electric range (up to) km	0-100km/h (seconds)	Date available
Audi	e-tron	BEV	SUV	$TBC	95 kWh	400	5.7	Mid 2020
BMW	330e	PHEV	Sedan	$77,257.30	10.3 kWh	60	5.9	Q4 2019
Hyundai	Ioniq Electric premium (Model Year 2020)	BEV	Sedan	TBC	38.3 kWh	294km WLPT	TBC	2020
Mercedes	EQC	BEV	SUV	$150,000 TBC	80 kWh	450	5.1	2019
Nissan	Leaf	BEV	Small car	$49,990 + ORC	40 kWh	270 WLTP	7	August 2019
Porsche	Taycan	BEV	Sports	-	-	-	-	2020
Tesla	Model 3	BEV	Sedan	$66,000-$85,000	100 kWh	460-560 (NEDC)	3.4-5.6	August 2019
Volvo	S60	PHEV	Sedan	$85,990	11.6 kWh	49	4.4	September 2019
	V60	PHEV	Wagon	$87,990	11.6 kWh	49	4.6	September 2019
ACE EV*	Cargo	BEV	LCV	$40,000	30 kWh	200-250km	7	Target Q2 2020
*planned	Yewt	BEV	Ute	$40,000	30 kWh	200-250km	7	Target Q3 2020
	Urban	BEV	Small car	$45,000	30 kWh	200-250km	7	Target Q4 2020

2 - Global OEM fleet electrification commitments

Manufacturer	Commitment
Audi	15 EVs by 2025 800,000 BEVs and PHEVs by 2025 to account for 1/3 of total sales Expected $14billion euro investment in electric mobility by 2023 New battery architecture *Premium platform electric (PPE)*
BMW	25 models in showrooms by 2023 Electric mini by 2020 $340 million investment in Leipzig EV plant. $225 million in Munich battery plant.
Daimler	130 electrified vehicles (including PHEVs and FCEVs) by 2030 Smart (brand) all electric by 2020 Will purchase more than 20 billion euros ($23 billion) worth of battery cells by 2030 Half of Mercedes-Benz passenger car sales will be plug-in hybrids or all-electric by 2030. Carbon-neutral passenger car fleet by 2039.
Fiat	BEV Fiat 500e by 2020 12 BEV, PHEV and hybrid propulsion systems across 30 different lines of vehicles by 2022 Plans to electrify 15-20% of heavy vehicles Maserati (Fiat-Chrysler) 4 BEVs & 8 PHEVs by 2022. Alfa Romeo electrified, with 7 PHEVs $10 billion investment in EVs

Manufacturer	Commitment
Ford	$11 billion in investment in EVs 24 PHEV models and 16 BEV models by 2022 Reduce operational greenhouse gas emissions by 30% by 2025 $500 million investment in Rivian
General Motors	20 BEVs by 2023 Commitment to a future with zero emissions $300 million in assembly plant for Chevrolet EV
Honda	Reduce carbon dioxide emissions in products by 30% by 2020. Aim to electrify two-thirds of all automobiles by 2030 Urban EV on sale in 2020 Will buy EV batteries from GM $180 million investment in EV/battery plant in Thailand and $130 million in India
Hyundai/Kia	$20 billion investment in 5 years in EVs, AVs and batteries. 14 BEVs, 12 PHEVs and 2 FCEVs by 2025. Building an EV platform
Jaguar/ Land Rover	Expects EVs to account for 20% of sales in medium term Introducing mild hybrid, PHEV and BEV to all models starting 2020 Cell supply deal with Samsung SDI EV investment $2.34 billion
Jeep	PHEV & BEV Wrangler by 2020 PHEV Renegade by 2022 5-year electrification plan (June 2018) includes 10 PHEV and 4 BEV
Mazda	BEV by 2020 PHEV by 2021 Partnered with Toyota to develop electric platforms Will only sell PHEVs and BEVs by 2030
Nissan	Alliance with Mitsubishi and Renault to invest $11.5 billion to develop new powertrains and electric technologies - 12 electric Renault-Nissan-Mitsubishi vehicles 8 BEVs by 2022 $335 million in an EV and battery plant in Thailand $10 billion investment in EVs
Porsche	Electric Macan by 2022 50% BEVs by 2025
Renault	9 BEVs by 2022 $220 million joint venture with Brilliance to build electric commercial vehicles in China $10 billion investment in EVs
Tesla	$5 billion for capex for 2019-2020 $5 billion investment in new battery plant in China

Manufacturer	Commitment
Toyota	Net zero emissions across the global supply chain by 2050. Aims to sell 4.5 million or more hybrids and PHEVS, and 1 million BEVs and FCEVs (approx. half of global sales) by 2025. 10 electric models available globally from 2020 across all vehicle segments Collaboration with Panasonic and PEVE for batteries includes new collaborators CATL and BYD Collaboration with Subaru on the e-TNGA platform (architecture for EVs) Plans for ultra-compact BEVS Concept-I RIDE in 2020, Concept-I WALK in 2020, with a scooter in 2021 $2 billion to develop electric vehicles (EVs) in Indonesia over the next four years, starting with hybrid vehicles $13.5 billion to 2030 on battery technology Joint venture with Mazda and Denzo to develop and build EVs Electrified versions of all models by 2025
Volkswagen	$50billion set aside for EV battery purchase Aspires to sell 1 million EVs annually by 2025, starting 2020 with I.D electric hatchback 70 new electric models by 2028 with projected number of vehicles to be built on electric platforms 22million. Comprehensive decarbonisation program & carbon dioxide neutral balance by 2050 $30 billion investment in EV portfolio by 2023 with EV share in group fleet at least 40% by 2030. 400 fast charging stations in Europe by 2020 (the IONITY network). Volkswagen AG will invest in Ford Motor Co.'s autonomous-car partner Argo AI (valuation of about $7 billion) Skoda: 2 BEVs, 3 PHEVs - 25 per cent of all its sales to be electrified by 2025
Volvo	50% of sales fully electric by 2025 All new models from 2019 available as either hybrid, PHEV or BEV 1 million electrified cars on the road by 2025

3 – OEM plans for electric vehicle battery recycling

- A Nissan Sumitomo Corporation joint venture opened a plant in Japan, specialising in the reuse and recycling of lithium-ion batteries. Nissan also uses batteries to power street lighting.
- Box of Energy uses battery modules from Volvo hybrid cars to store rooftop solar to power elevators and lights.
- Daimler joined subsidiary Mercedes-Benz-Energy to launch projects using EV battery packs for stationary storage.
- Daimler, the Mobility House, Getec and Remondis have partnered on a battery storage project.
- Fiat works with e-waste recycler IT Asset Partners (ITAP) to test individual battery cells for resale or repurpose.
- GM is backing up its data centre in Michigan with used Chevy Volt batteries.
- Honda and the American Electric Power announced research into uses for end-of-vehicle-life batteries.

- Hyundai Motor Group and Wärtsilä have collaborated to use EV batteries in energy storage.
- Nissan and Eaton Industries are developing home solar battery storage systems in the UK.
- Renault and Connected energy are collaborating to give a second life to electric vehicle batteries for energy storage systems.
- Renault is using EV batteries backing up elevators in Paris.
- Renault Renewable Storage on Porto Santo Island.
- Tesla currently works with third party recyclers to process scrap and end-of-life batteries and is also developing a unique battery recycling system at Gigafactory 1 in Nevada, with an end goal of a closed-loop battery recycling process.
- The Volkswagen group has plans for a pilot recycling plant in Salzgitter in 2020, and long-term plans to recycle 97% of its raw materials.
- Toyota will install retired batteries outside 7-Eleven stores in Japan next year to store power from solar panels to run the drink coolers, fried chicken warmers and sausage grills inside the stores.
- Umicore is working with carmakers such as Audi and BMW to develop closed-loop recycling programs.

Reference list:

ABC (2018). *Energy Renaissance still energised to build lithium-ion battery 'gigafactory' in Darwin but waiting on approvals.* Accessed on 29 July 2019: https://www.abc.net.au/radio/programs/nt-country-hour/energy-renaissance-gigafactory-plans-for-darwin-seeking-approval/10615230

ABC News (2019). *ACE EV to sign agreement to build electric vehicles in Adelaide starting in 2020.* Accessed on 29 July 2019: https://www.abc.net.au/news/2019-05-14/ace-electric-vehicles-to-be-assembled-in-adelaide/11109132

ANC. *ANC deliver new 100% electric vehicles to New South Wales home delivery market.* Accessed on 29 July 2019: https://ancdelivers.com.au/electric-delivery-vehicles

Association of Mining and Exploration Companies (2018). *The Path Forward to a battery minerals industry in Australia.* Accessed on 29 July 2019: https://amec.org.au/Public/Advocacy/AMEC-Submissions/The_Path_Forward.aspx

Australian Bureau of Statistics (2017). *Household Expenditure Survey, Australia.* Accessed on 29 July 2019: http://abs.gov.au/household-expenditure

Australian Bureau of Statistics (2018). *Average kilometres travelled by passenger vehicles in 2017/18.* Accessed on 29 July 2019: https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/9208.0Main+Features112%20months%20ended%2030%20June%202018?OpenDocument

Australian Department of Infrastructure and Regional Development (2017). *Fuel economy of Australian passenger vehicles – a regional perspective.* Accessed on 29 July 2019: https://www.bitre.gov.au/publications/2017/files/is_091.pdf

Australian Energy Market Commission (2018). *Databook – 2018 Residential Electricity Price Trends.* Accessed on 29 July 2019: https://www.aemc.gov.au/market-reviews-advice/residential-electricity-price-trends-2018

Australian Financial Review (2018a). *Car fleets are big business in Australia.* Accessed on 29 July 2019: https://www.afr.com/news/special-reports/car-fleets-are-big-business-in-australia-20180521-h10c3o

Australian Financial Review (2018b). *What happens to used electric-car batteries?* You may be surprised. Accessed on 29 July 2019: https://www.afr.com/business/energy/what-happens-to-used-electriccar-batteries-you-may-be-surprised-20180628-h11ynt

Australian Institute of Petroleum (2019). *AIP Annual Retail Price Data.* Accessed on 29 July 2019: https://www.aip.com.au/aip-annual-retail-price-data

Australian Trade and Investment Commission (2018). *Investment opportunities in Australia's lithium ion battery value chain.* P. 30. Accessed on 29 July 2019: https://www.austrade.gov.au/local-sites/singapore/news/investment-opportunities-in-australias-lithium-ion-battery-value-chain

Bloomberg Businessweek (2018). *Where 3 million Electric Vehicle Batteries Will Go When They Retire.* Accessed on 29 July 2019: https://www.bloomberg.com/news/features/2018-06-27/where-3-million-electric-vehicle-batteries-will-go-when-they-retire

Bloomberg NEF (2018). *Electric Vehicle Outlook 2018.*

Bloomberg NEF (2019). *Electric Vehicle Outlook 2019.* Accessed on 29 July 2019: https://about.bnef.com/electric-vehicle-outlook/

Climate Council (2019). *Australians say electric cars are the future – new poll.* Accessed on 29 July 2019: https://www.climatecouncil.org.au/resources/australians-say-electric-cars-are-the-future-new-poll/

Department of the Environment and Energy (2016). *Waste lithium-ion battery projections.* Accessed on 29 July 2019: http://www.environment.gov.au/protection/publications/waste-lithium-ion-battery-projections

Electrek (2019). *Tesla is developing a 'unique battery recycling system'.* Accessed on 29 July 2019: https://electrek.co/2019/04/16/tesla-battery-recycling-system/

Electric Vehicle Council (2018). *The state of electric vehicles in Australia: Driving the momentum in electric mobility.* Accessed on 31 July 2019: https://electricvehiclecouncil.com.au/resources/#Resources_Report

Electric Vehicle Council (2019). *Cleaner and Safer Roads for New South Wales.* Accessed on 29 July 2019: https://electricvehiclecouncil.com.au/resources/

Electric Vehicle Council, NRMA, St Baker Energy Innovation Fund, PwC. *(2018).* Recharging the economy. P. 6. Accessed on 29 July 2019: http://electricvehiclecouncil.com.au/wp-content/uploads/2015/05/Recharging-the-economy.pdf

Envirostream (2019). *The Envirostream Story.* Accessed on 29 July 2019: https://envirostream.com.au/the-envirostream-story/stakeholder-and-customer-engagement/

European Automobile Manufacturers Association (2019). *Correlation between electric sales and availability of charging points (update).* Accessed on 31 July 2019: https://www.acea.be/statistics/article/interactive-map-correlation-between-electric-car-sales-and-the-availability

EV100 (2019) EV100 Members. *Accessed on 31 July 2019:* https://www.theclimategroup.org/ev100-members

EV Volumes (2018). *Global EV Sales for 2018 – Final Results.* Accessed on 29 July 2019: http://www.ev-volumes.com/country/total-world-plug-in-vehicle-volumes/

Financial Times (2017). *Rise of electric cars poses battery recycling challenge.* Accessed on 29 July 2019: https://www.ft.com/content/c489382e-6b06-11e7-bfeb-33fe0c5b7eaa

Infrastructure Australia (2019). *2019 Infrastructure Priority List.* Accessed on 29 July 2019: https://www.infrastructureaustralia.gov.au/news-media/media-releases/2019/2019_02_14.aspx

International Energy Agency (2019). *Global EV Outlook 2019.* Accessed on 31 July 2019: https://www.iea.org/publications/reports/globalevoutlook2019/

Jiao, Evans (2018). *Business Models for Repurposing a Second-Life for Retired Electric Vehicle Batteries.* Accessed on 29 July 2019: https://www.researchgate.net/publication/323083212_Business_Models_for_Repurposing_a_Second-Life_for_Retired_Electric_Vehicle_Batteries

La Trobe Valley Authority (2019). *New Partnership for Latrobe Valley skills.* Accessed on 29 July 2019: https://lva.vic.gov.au/new-partnership-for-latrobe-valley-skills/

Lithium Australia (2019). *Battery recycling made easy.* Accessed on 29 July 2019: https://lithium-au.com/wp-content/uploads/2016/11/04042019-Battery-recycling-made-easy.pdf?utm_source=Investors&utm_campaign=6784435dbf-EMAIL_CAMPAIGN_2019_03_21_08_19_COPY_02&utm_medium=email&utm_term=0_25617522fe-6784435dbf-1209014241

McKinsey & Company (2019). *Global Energy Perspective 2019.* Accessed on 29 July 2019: https://www.mckinsey.com/industries/oil-and-gas/our-insights/global-energy-perspective-2019?

Minister for Industry, Science and Technology (2019). *$25M turbo charges battery development.* Accessed on 1 August 2019: https://www.minister.industry.gov.au/ministers/karenandrews/media-releases/25m-turbo-charges-battery-development

MRI e-cycle solutions (2019). *Battery recycling.* Accessed on 29 July 2019: https://mri.com.au/recycling/battery-recycling/

New South Wales Health (2013). *Who is affected by air pollution?* Accessed on 29 July 2019: https://www.health.nsw.gov.au/environment/air/Pages/who-is-affected.aspx

Organisation for Economic Co-operation and Development (2014). *The Cost of Air Pollution.* p. 63. Accessed on 29 July 2019: https://www.oecd-ilibrary.org/environment/the-cost-of-air-pollution_9789264210448-en

Parliament of Australia Senate Inquiry (2019). *Senate Select Committee on Electric Vehicles.* P.2. Accessed on 29 July 2019: https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Electric_Vehicles

Podias, Pfrang, Di Persio,; Kriston, Bobba, Mathieux, Messagie, Boon-Brett, (2018). *Sustainability Assessment of Second Use Applications of Automotive Batteries: Ageing of Li-Ion Battery Cells in Automotive and Grid-Scale Applications.* Accessed on 29 July 2019: https://www.mdpi.com/2032-6653/9/2/24

Queensland Government (2018). *Queensland charges ahead with Townsville battery project.* Accessed on 1 August 2019: http://statements.qld.gov.au/Statement/2018/8/23/queensland-charges-ahead-with-townsville-battery-project

Queensland Government (2019). *Compare electric vehicle costs.* Accessed on 29 July 2019: https://www.qld.gov.au/transport/projects/electricvehicles/about/compare

Regional Development Australia (2018). *Lithium Valley: Establishing the Case for Energy Metals and Battery Manufacturing in Western Australia.* P. 14Accessed on 29 July 2019: https://www.rdaperth.org/rda-projects/lithium-valley/

Reuters (2019). *Reuters Analysis.* Accessed on 29 July 2019: https://graphics.reuters.com/AUTOS-INVESTMENT-ELECTRIC/010081ZB3HD/index.html

Schofield, Walter, Silver, Brear, Rayner, & Bush (2017). *The Clean Air and Urban Landscapres Hub's Submission on the "Better fuel for cleaner air" discussion paper.* Accessed on 29 July 2019: https://nespurban.edu.au/wp-content/uploads/2018/11/CAULRR06_

Sierzchula, Bakker, Maat, van Wee (2014). *The influence of financial incentives and other socio-economic factors on electric vehicle adoption.* Accessed on 29 July 2019: https://www.sciencedirect.com/science/article/pii/S0301421514000822

Small Caps (2019). *Lithium Australia surges into lithium-ion battery recycling with Envirostream partnership.* Accessed on 29 July 2019: https://smallcaps.com.au/lithium-australia-lithium-ion-battery-recycling-envirostream-partnership/

Sustainability Victoria (2018). *Australia's first lithium battery recycling plant opens.* Accessed on 29 July 2019: https://www.sustainability.vic.gov.au/About-us/Latest-news/2018/04/26/04/57/Australias-first-lithium-battery-recycling-plant-opens

Tawaki (2018). *China will launch a pilot electric vehicle battery recycling scheme.* Accessed on 29 July 2019: http://www.tawaki-battery.com/china-electric-vehicle-battery-recycling-scheme/

The Australia Institute (2019). *Poll: One in Two Voters Support New Car Sales 100% EV by 2025.* Accessed on 29 July 2019: http://www.tai.org.au/content/poll-one-two-voters-support-new-car-sales-100-ev-2025

The Driven (2019). *Chinese giant BYD inks deal with Australian firm to build EVs in Adelaide.* Accessed on 29 July 2019: https://thedriven.io/2019/05/16/australian-ev-firm-inks-landmark-mou-with-byd/

The European Association of Electrical Contractors (2018). *Powering a new value chain in the automotive sector: the job potential of transport electrification.* Accessed on 30 July 2019: https://download.dalicloud.com/fis/download/66a8abe211271fa0ec3e2b07/c572c686-f52f-4c0d-88fc-51f9061126c5/Powering_a_new_value_chain_in_the_automotive_sector_-_the_job_potential_of_transport_electrification.pdf

The International Council on Clean Transportation (2016). *Principles for effective electric vehicle incentive design.* Accessed on 29 July 2019: https://theicct.org/publications/principles-effective-electric-vehicle-incentive-design

The International Council on Clean Transportation (2018). *Power Play: how governments are spurring the electric vehicle industry.* Accessed on 29 July 2019: https://www.theicct.org/sites/default/files/publications/EV_Government_WhitePaper_20180514.pdf p. 8

The International Council on Clean Transportation (2019). *Update on electric vehicle costs in the United States through 2030.* Accessed on 29 July 2019: https://theicct.org/sites/default/files/publications/EV_cost_2020_2030_20190401.pdf

The New Daily (2019). *The sales statistics that show the electric car surge is underway in Australia.* Accessed on 29 July 2019: https://thenewdaily.com.au/life/auto/2019/07/05/electric-cars-australia/

The National Transport Commission (2016). *Carbon Dioxide Emissions Intensity for New Australian Light Vehicles 2016.* Accessed on 31 July 2019: https://www.ntc.gov.au/Media/Reports/(35220AEE-C4EA-9AC6-1BB6-88D8C66D80F5).pdf

Transport and Environment (2018). *Rollout of public EV charging infrastructure in the EU.* Accessed on 29 July 2019: https://www.transportenvironment.org/publications/roll-out-public-ev-charging-infrastructure-eu

Victorian Environment Protection Agency (2013). *EPA Regulatory Impact Statement.* Accessed on 29 July 2019: https://www.epa.vic.gov.au/~/media/Publications/1543.pdf

Victorian Minister for Jobs, Innovation and Trade (2019). *Melbourne Nod for Nissan HQ and Electric Car Centre.* Accessed on 29 July 2019: https://www.premier.vic.gov.au/melbourne-nod-for-nissan-hq-and-electric-car-centre/

World Health Organisation Regional Office for Europe (2017). *WHO's commitment to air quality: from the 1950s to today.* Accessed on 29 July 2019: http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/news/news/2017/02/whoscommitment-to-air-quality-from-the-1950s-to-today.3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