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The state of electric vehicles in Australia



The report is written by ClimateWorks Australia on behalf of the Electric Vehicle Council, the national body representing the electric vehicle industry in Australia. The Electric Vehicle Council represents members involved in providing, powering and supporting electric vehicles, with a mission to accelerate the electrification of road transport for a more sustainable and prosperous Australia. ClimateWorks Australia is an expert, independent adviser, committed to helping Australia transition to net zero emissions by 2050. It was co-founded through a partnership between Monash University and The Myer Foundation and works within the Monash Sustainable Development Institute. This activity received funding from ARENA as part of ARENA's Emerging Renewables Program.

Disclaimer: This report represents the views of the Electric Vehicle Council, however it may not necessarily represent the views of individual Council members.

Electric vehicles are a proven technology with strong environmental, economic and social benefits.

Electric vehicles can be powered by renewable energy, and could reduce emissions in the transport sector to help Australia meet its Paris Agreement emissions reduction goals at a lower cost. They also offer benefits to public health, through reducing air pollution in cities, and could generate Australian jobs in sales, charging infrastructure deployment, and potentially the manufacture of batteries and electric vehicle components.

Despite these benefits, Australia is falling behind on electric vehicle uptake. While there are two million electric vehicles on the road globally, just 1369 electric vehicles were sold in Australia in 2016, representing 0.1 per cent of the market.¹ International evidence suggests a strong correlation between cumulative electric vehicle sales and the number of vehicle models being offered. An anticipated improvement in the number of lower cost models available in Australia is likely to increase sales.

Australia's relatively slow rate of electric vehicle uptake stands in contrast to positive consumer attitudes. Our survey of 504 Victorians found that 50.2 per cent of respondents would be willing to consider purchasing an electric vehicle, and that 19 per cent had researched the options for purchasing an electric vehicle. However, purchase cost and the distance able to be travelled on a charge remain key concerns.

Strong government policy on electric vehicles can address these barriers to uptake. International experience has demonstrated that coordinated government policy is essential to supporting electric vehicle uptake. In Australia, the adoption of light vehicle CO₂ emissions standards could provide an overarching incentive to support electric vehicle uptake, provide a signal to industry to support greater investment, and could help to lower electric vehicle costs over time. This policy is currently being considered by the Commonwealth Government. Governments across all jurisdictions also have the opportunity to support electric vehicle uptake through the incorporation of electric vehicles into government fleets, and through support for the installation of a charging network.

¹The commonly reported number for electric and plug-in hybrid electric vehicles in 2016 is 219, however further investigation revealed an additional 12 models with an electric or plug-in hybrid electric vehicle variant.

Introduction

The State of Electric Vehicles report provides an up-to-date assessment of the state of Australia's electric vehicles industry. Through annual updates, the report will track Australia's progress towards a lower emissions, more cost-effective light vehicle fleet.

The report is structured into four sections, and provides key data against a range of barriers to electric vehicle uptake:

- 1. Electric vehicle uptake** in Australia, including electric vehicle sales numbers over a six year period, both by jurisdiction and market segment. This section also provides an overview of historical, current and future model availability in Australia;
- 2. Charging infrastructure**, reviewing the roll out of electric vehicle charging infrastructure across Australia by state and location;



The launch of the Electric Vehicle Council, Australian Parliament House, 22 May 2017.

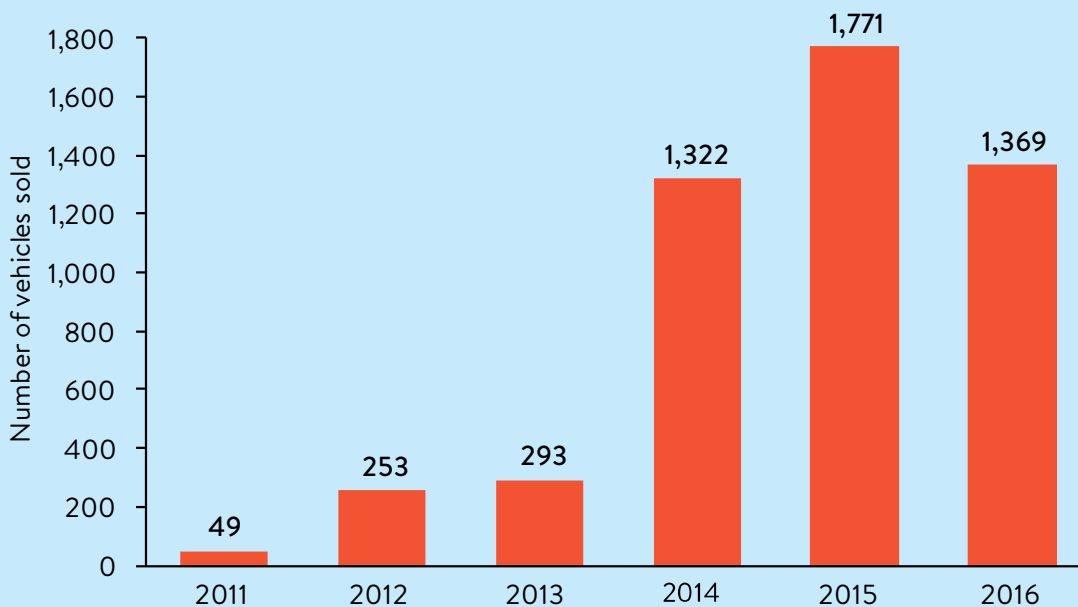
- 3. Consumer attitudes**, presenting the results of an online survey carried out by the Royal Automotive Club of Victoria (RACV) which asked 504 Victorians about their perceptions of electric vehicles. The results of this survey are consistent with similar consumer attitudes surveys conducted in other areas of Australia and internationally; and
- 4. Electric vehicle policy** in Australia, reviewing implemented policy across federal, state and territory jurisdictions. While local governments also play an important role in supporting electric vehicle uptake, an assessment of local government policy was not within the scope of this report.

1. Electric vehicle uptake in Australia

Globally, the number of electric vehicles sold each year is growing rapidly, with a 40 per cent increase from 2015 to 2016, to reach sales volumes of over 750,000 in 2016. There are now more than two million electric vehicles on the road.² In contrast, Australian electric vehicle sales fell 23 per cent from 2015 to 2016. Australians purchased 701 plug-in hybrid electric vehicles, and 668 fully electric vehicles in 2016, making up 0.1 per cent of the Australian market.³ The decline in electric vehicle sales may be linked in part to the limited number of lower priced models available in 2016 (see Model Availability section below).

Australia's states and territories differ in their rate of electric vehicle uptake (Figure 1). In the last six years, Victorians have purchased the highest number of electric vehicles, with 1,017 vehicles purchased between 2011 and 2016 (excluding Tesla vehicle numbers). However, taking into account market size, the ACT is outperforming other jurisdictions: in 2016, ACT residents purchased 18 electric vehicles for every 10,000 vehicles sold (Figure 2).

Figure 1. Electric vehicle sales in Australia, 2011-2016.
Source: V-Facts (2017); Numbers include estimated Tesla sales (see Footnote 3).



² International Energy Agency (2017)

³ V-Facts (2017); Electric Vehicle Council industry engagement.

Note: Tesla does not publicly release its sales figures and has not supplied these figures. As the Electric Vehicle Council's Tesla sales estimate is not disaggregated by state or buyer type, some analyses in this report do not include Teslas and this is noted where applicable.

Business is the largest buyer of electric vehicles at 64 per cent of total sales in 2016 (excluding Teslas; Figure 3). In its recent report on the emissions intensity of Australia's new vehicle fleet, the National Transport Commission presented detailed sales data for a selection of electric vehicle models. This data indicates that over the period of 2011 to 2016, the majority of sales were from manufacturer fleets and dealer demonstrators (62 per cent of total sales)⁴. In Australia's developing electric vehicle market, vehicle manufacturers use their own fleet and demonstrator vehicles for promotion and education. These vehicles are then sold as ex-demonstrator or ex-executive vehicles. As the market matures, the proportion of vehicles in this category is likely to decrease: for the overall vehicle market in Australia, manufacturer fleets and dealer demonstrators make up only 20 per cent of total sales⁵.

Private buyers also make up a substantial portion of the market, at 34 per cent of total sales. In contrast, government fleets make up only 2 per cent of total sales. Given the greater purchasing power of fleets in comparison to individual buyers, increasing sales in this segment represents a significant opportunity for governments to lead electric vehicle uptake in Australia.

Figure 2. Sales of electric vehicles for Australia's states and territories (excluding Teslas). Chart shows electric vehicles purchased per 10,000 vehicle sales in 2016 and total sales for 2011 - 2016. Source: V-Facts (2017), ACA research (2017)

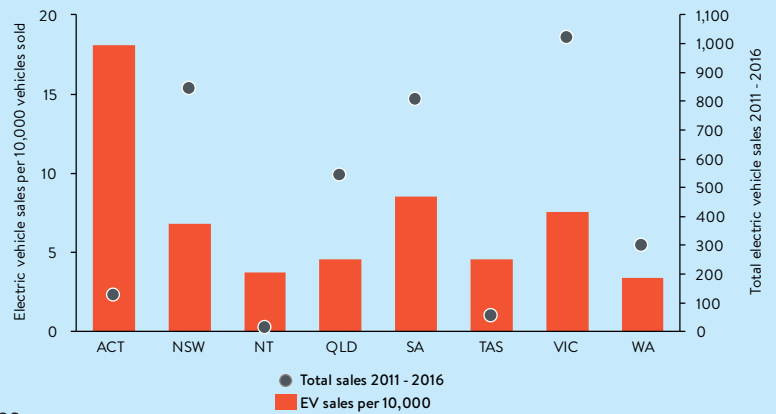
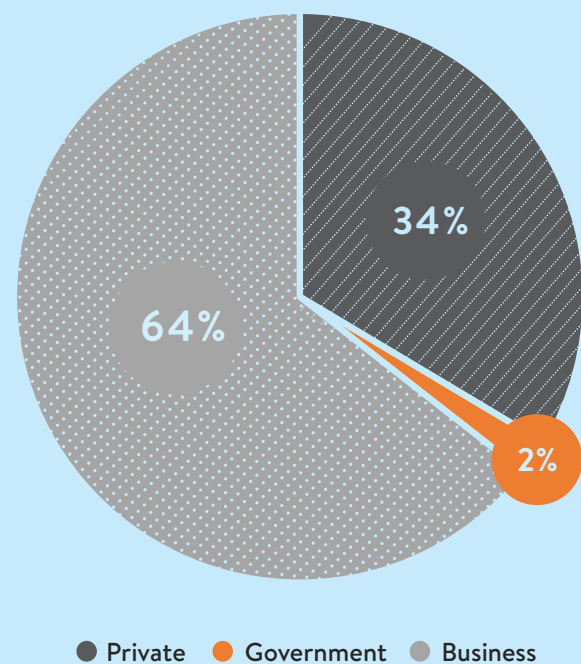


Figure 3. Proportion of electric vehicle sales by buyer type, 2016 (excluding Teslas). Source: V-facts (2017)



⁴ National Transport Commission (2017)

⁵ National Transport Commission (2017)

Australian electric vehicle uptake is expected to increase substantially in the future. Once electric vehicles become economically viable there is no real upper limit on their adoption except the rate of turnover of the vehicle stock. CSIRO’s Future Grid Forum found that forecasts of electric vehicle uptake are uncertain, and that the higher end projections are feasible given the potential appeal of the technology, and the significant advances in battery technology.⁶ Australia’s commitment to meeting the emissions reduction targets of the Paris Agreement is also likely to incentivise faster rates of electric vehicle uptake. The ClimateWorks scenario presented in Table 1 is reflective of a pathway to net zero emissions for Australia in 2050 in line with the Climate Change Authority’s 2 degrees carbon budget, and highlights the important role that electric vehicles can play in helping Australia get to net zero emissions by 2050.⁷

Table 1. Projected electric vehicle uptake rates from a variety of studies. Sources: ENA and CSIRO (2015); ClimateWorks Australia (2014); Beyond Zero Emissions (2016); Department of the Environment and Energy (2016); AEMO (2016); International Energy Agency (2016); Bloomberg New Energy Finance (2016)

	Study	Year	Uptake rate
Australian projections	Network Transformation Roadmap (ENA and CSIRO, 2016)	2035	20% of light vehicle fleet
	Pathways to Deep Decarbonisation in 2050 (ClimateWorks Australia and ANU, 2014)	2030	45% of light vehicle fleet
	Zero Carbon Australia, Electric Vehicles (Beyond Zero Emissions, 2016)	2030	100% of passenger car fleet
	Australia’s emission projections 2016, (Department of the Environment and Energy, 2016)	2030	15% of new light vehicle purchases
	Projections for the National Electricity Market (AEMO, 2016)	2025	6.5 to 27% of new light vehicle purchases
2036		16 to 45% of new light vehicle purchases	
Global projections	Global EV Outlook 2016 (International Energy Agency 2016)	2030	10% of light vehicle fleet
	Bloomberg New Energy Finance, 2016	2040	25% of light vehicle fleet

⁶ Energy Networks Association and CSIRO (2015)

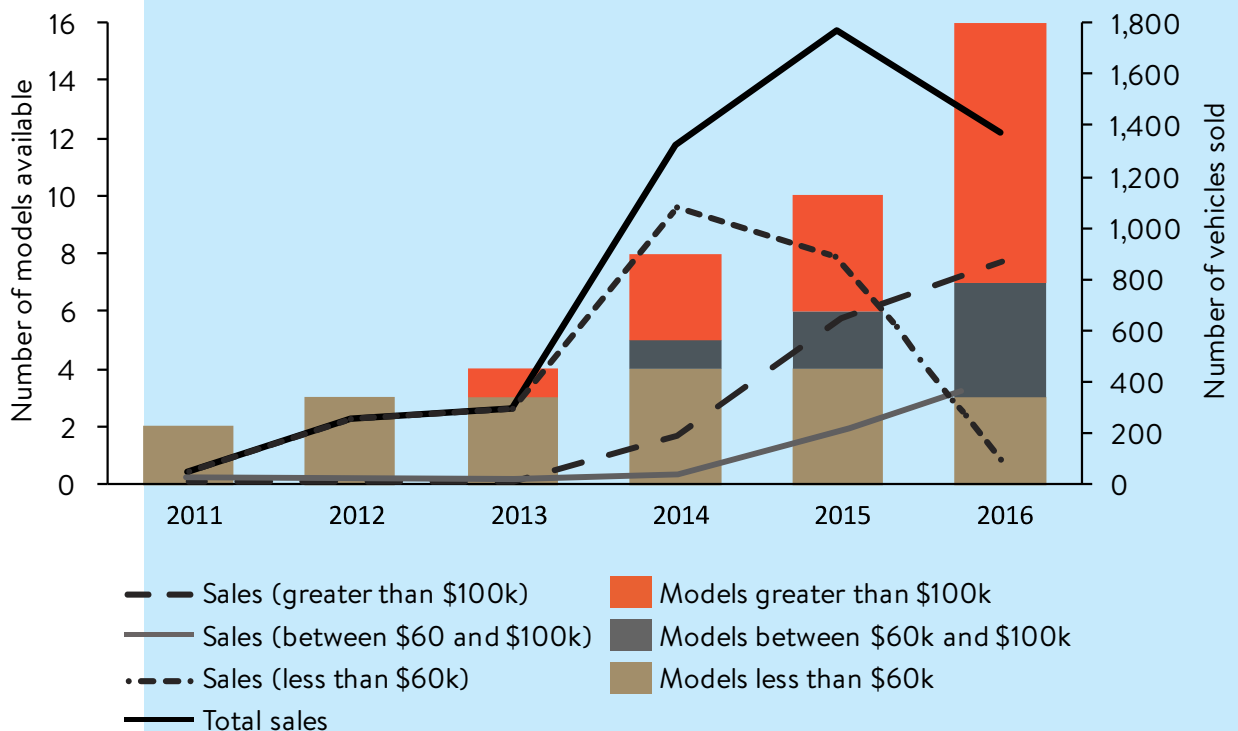
⁷ ClimateWorks (2014)

Model availability

International evidence suggests a strong correlation between cumulative electric vehicle sales and the number of vehicle models being offered. A greater number of models available across a range of market segments can increase consumer choice and sales.

The number of electric vehicle models in Australia has steadily increased over the last six years, with 16 models available for sale in 2016. The majority of the growth has been in the more expensive models, with 13 of the 16 models available priced at more than \$60,000 (Figure 5).

Figure 5. Number of electric vehicle models available in Australia (including Teslas). Source: Sales: V-Facts (2017), Tesla does not publicly release its sales figures and has not supplied these figures. Model availability: based on information published on Car Advice and Motoring.com.au



The decline in electric vehicle sales in 2016 (see Electric Vehicle Uptake section above) may be partially attributable to the low number of models available at less than \$60,000. While sales have generally been strong for electric vehicles in this price range, sales dropped in 2016 (Figure 6). In 2016 there were three models available for less than \$60,000: the Nissan Leaf, the Mitsubishi Outlander and the Renault Kangoo ZE. However, the Nissan Leaf was only available early in the year, the Mitsubishi Outlander sold out mid-year and the Renault Kangoo ZE is a van that is only available through special arrangement with Renault.

Model availability in Australia is expected to increase in the near future. Seven new electric vehicle models and model updates are expected to be introduced into the Australian market in the next 18 months, with three of these expected to be priced at \$60,000 or less⁸.

⁸ GoAuto.com.au (2017); Car Advice (2016a); Car Advice (2017a); Car Advice (2017b); Motoring.com.au (2017); Car Advice (2017c); Car Advice (2016b)

2. Charging infrastructure

Perceptions around the availability of public charging infrastructure can be crucial to electric vehicle uptake. While research shows that most electric vehicle charging will occur at home or in the workplace⁹, widespread public infrastructure is needed to mitigate range anxiety on the part of prospective purchasers.

There are currently 476 dedicated electric vehicle public charging stations in Australia. While Victoria has the highest number of charging stations, the Australian Capital Territory is leading on a per capita basis with 3.5 chargers per 100,000 residents. Charging stations are currently concentrated in capital cities, however, there is an expanding regional network as regional towns and cities are capitalising on the potential tourism benefits of providing electric vehicle charging infrastructure. In addition, governments, membership organisations and vehicle manufacturers are installing electric vehicle fast charging highways, with fast

charging available at regular intervals along high-use regional routes. For example, the Royal Automobile Club (RAC) in Western Australia has installed 11 fast charging stations in south west WA¹⁰, while Tesla has installed Tesla Superchargers to allow travel between Melbourne and Brisbane, with plans to connect to Adelaide and common holiday destinations¹¹.

Charging infrastructure comes in a variety of forms. Currently, the majority of chargers available in Australia are AC chargers. AC charging is used primarily for locations where an electric vehicle will be parked for more than an hour. AC Charging power levels range from 2.4kW to 22kW, with an average installation of 11kW charging a vehicle at approximately 50km of range per hour. In contrast DC chargers provide much faster charging, and are thus more useful for travelling long distance between cities. There are currently 40 DC charging stations available in Australia.

Table 2. Public charging infrastructure in Australia. Source: PlugShare (2017) and Australian Bureau of Statistics (2017)

		ACT	NSW	NT	QLD	SA	TAS	VIC	WA
Total number of charging stations		14	130	2	75	42	16	134	63
Charging stations per 100,000 residents		3.5	1.7	0.8	1.5	2.5	3.1	2.2	2.4
Total #	AC	11	119	1	70	41	16	127	51
	DC	3	11	1	5	1	0	7	12
Total #	Capital city	14	60	2	28	17	4	78	34
	Regional	0	70	0	47	25	12	56	29

⁹ Idaho National Laboratory (2015)

¹⁰ RAC WA (2017)

¹¹ Tesla (2017)

3. Consumer attitudes

Consumer attitudes are vital to understanding purchasing decisions and the motivations behind electric vehicle uptake in Australia. Through an online survey carried out by RACV on behalf of the Electric Vehicle Council, 504 Victorians were asked about their perceptions of electric vehicles. In reviewing the responses, there was a relatively even response rate based on gender (53 per cent female and 47 per cent male) and across age demographics (approximately 5-10 per cent across 12 age categories).

The results of the survey demonstrated that while many people are willing to consider purchasing an electric vehicle, purchase cost and access to charging infrastructure remain key barriers to uptake.

Figure 7. Victorian consumer attitudes towards electric vehicle purchase. Chart shows responses to the question “Which of the following statements best applies to you when thinking about electric vehicles?” as a percentage.

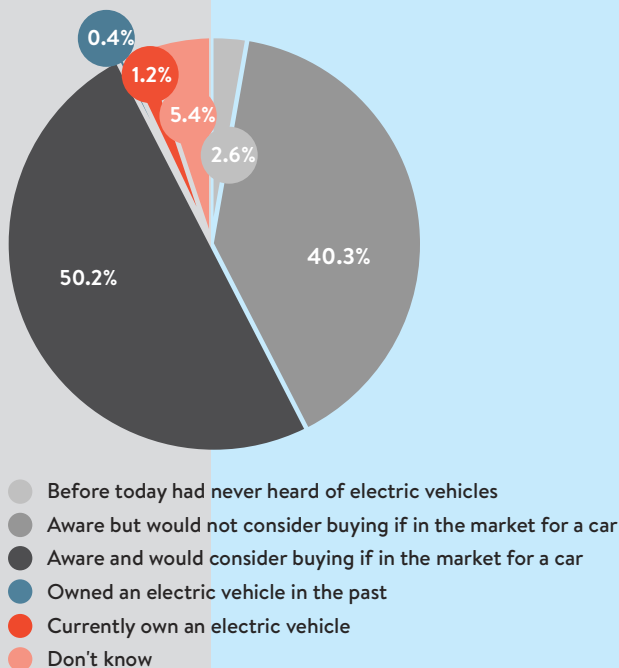
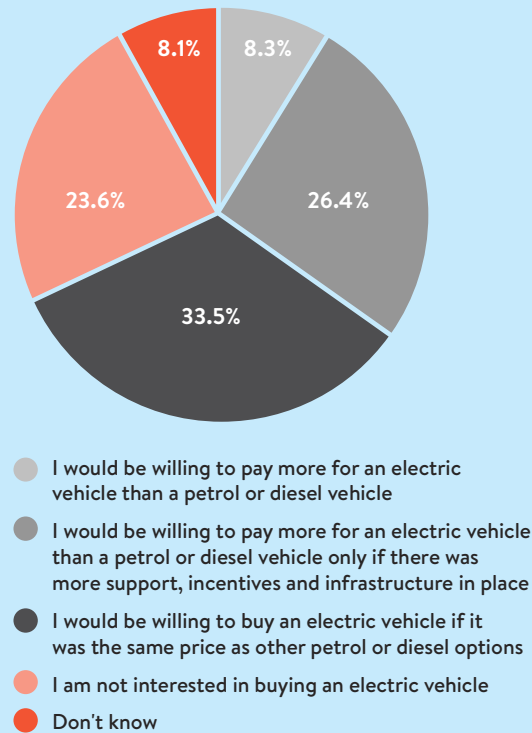


Figure 8. Victorian consumer attitudes towards electric vehicle prices. Chart shows responses to the question ‘Which of the following statements best describes your attitude towards electric vehicles?’ as a percentage.



Of the respondents, 50 per cent said that they would consider buying an electric vehicle (Figure 7) and 19 per cent of respondents had spent time researching the options for buying an electric vehicle. Key selling points were the environmental friendliness of the vehicles and cost savings on fuel and maintenance. Conversely, 40 per cent of respondents said they would not consider buying an electric vehicle with range and access to charging infrastructure issues common concerns.

The price of electric vehicles is also a key issue. While 35 per cent of respondents would be willing to pay more for an electric vehicle than a petrol or diesel vehicle, most would only do so if there were more support, incentives and infrastructure in place (Figure 8). An additional 34 per cent would be willing to buy an electric vehicle if it were at price parity with similar petrol or diesel options.

The survey results demonstrate that government policies can encourage the uptake of electric vehicles. Subsidies to reduce the purchase cost of electric vehicles, subsidies for the installation of home charging infrastructure and provision of public charging infrastructure were nominated as particularly important policies from the consumer perspective (Figure 9).

Figure 9. Victorian consumer perceptions of government policies on electric vehicle uptake. Chart shows percentage of respondents nominating each policy as a response to the question ‘What policies do you think the government could implement that would encourage you to purchase an electric vehicle? (please nominate your top three)’

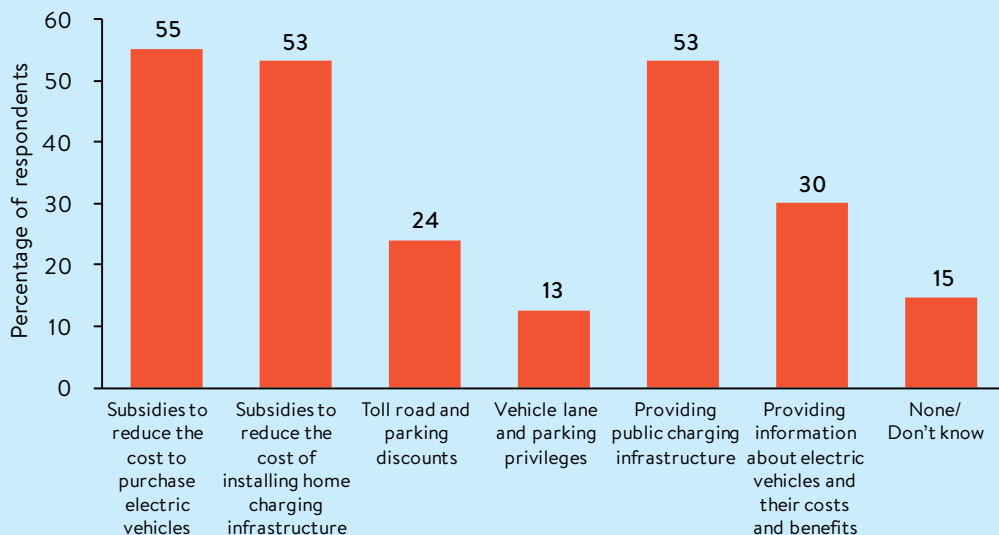
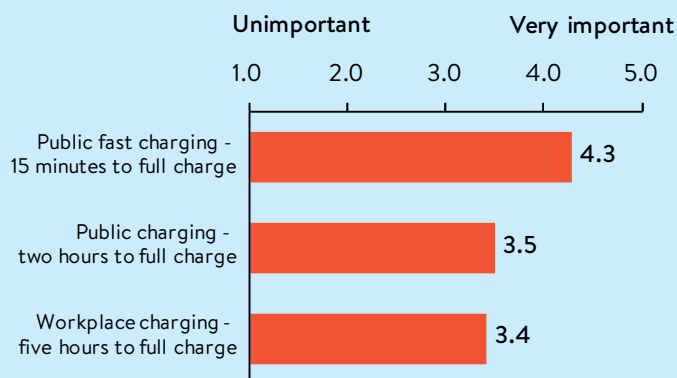


Figure 10. Victorian consumer perceptions of public charging types. Chart shows average response to the question ‘How important is the availability of different types of charging infrastructure to your decision to buy/own an electric vehicle? Please rate on a scale of 1 (not important) to 5 (very important)’



In considering different charging infrastructure options, respondents considered public fast charging the most important to their decision to purchase an electric vehicle (Figure 10).

The results presented here are consistent with similar consumer attitudes surveys conducted in other areas of Australia and internationally.

The Queensland Householder Energy Survey conducted in 2016 found that half of all Queenslanders in the market for a new car would be open to considering an electric or hybrid vehicle.¹² A survey conducted by the UK Department of Transport in 2016 found that consumers identified similar deterrents when considering the purchase of an electric vehicle, with recharging (45 per cent) the distance travelled on a battery (39 per cent), cost (28 per cent) and lack of knowledge (13 per cent) the primary concerns.¹³

¹² Colmar Brunton (2017)

¹³ UK Department of Transport (2016)

4. Electric Vehicle Policy in Australia

International experience has demonstrated that policy can be critical in encouraging the uptake of electric vehicles. In comparison to our global peers, policy support for electric vehicles in Australia remains in its early stages. Australia does not currently have an overarching electric vehicle policy framework, which limits the capacity for a coordinated national approach (Table 3, Appendix 1). For example, the Commonwealth Government provides a discount on the luxury car tax, and a number of states and territories provide varying discounts on stamp duty and registration for electric vehicles (Table 4). A number of state and territory governments also provide information and education for the public and business.

Table 3. Overview of federal, state and territory government policy.

		ACT	NSW	NT	QLD	SA	TAS	VIC	WA	FED
Uptake	EV purchases 2011 - 2016	125	843	12	541	805	56	1017	298	3697
	EV sales per 10,00 vehicles (2016)	18	7	4	5	9	5	8	3	7
Regulation	Vehicle CO ₂ emissions standards									o
Financial incentives	Stamp duty, registration and tax discounts	✓	✓	✓	✓		o	✓		✓
	Direct vehicle subsidy						o			
	Fleet incentive						o			✓
	Charging infrastructure support	✓		o	✓	✓	✓*			
Non-financial incentives	Vehicle lane and parking privileges	✓					o			
	Electric vehicle public transport trials			✓		✓				
	Government fleet initiatives	✓	✓			✓	✓			
	Information and education programs	✓			✓*	✓	✓			✓

Table notes: Policies that are in place are marked ✓, policies that are planned but not implemented are marked ✓* policies under consideration are marked o. This table was compiled through a survey of Australia's state, territory and federal governments on their electric vehicle policies. The Commonwealth Government, the Australian Capital Territory, New South Wales, the Northern Territory, Queensland, South Australia, Tasmania and Victoria provided input. For Western Australia we undertook a desktop research study. Vehicle purchase numbers do not include Teslas.

Some state and territory governments have begun to recognise the need for greater investment in electric vehicles. These governments have developed policies to support the deployment of charging infrastructure and to encourage the uptake of electric vehicles in their own fleets. For example, the Queensland Government is working with Energy Queensland to roll out a network of fast chargers that will allow electric vehicle drivers to travel the 1,800 km between Cairns and the Gold Coast¹⁴ (Box 1). The Australian Capital Territory Government requires government fleet managers to consider a car's environmental impact in addition to functionality and lease cost, and also provides the largest stamp duty and registration discount. These policies could be contributing to the relatively high rate of electric vehicle uptake in the ACT, which has the highest electric vehicle market share of any state or territory.

One broad and comprehensive policy that could encourage the uptake of electric vehicles is the introduction of light vehicle CO₂ emissions standards. Australia is one of the few remaining developed countries without light vehicle CO₂ emissions standards in place, with standards covering over 80 per cent of the global automotive market.¹⁵ The Commonwealth Government is currently considering the implementation of standards through the Ministerial Forum on Vehicle Emissions.

Table 4. Comparison of estimated discounts on stamp duty and registration for a \$60,000 electric vehicle

	ACT	NSW	NT	QLD	VIC
Discount	\$2110	<\$250	\$40 to \$80	\$660	\$100

Table notes: Estimated discounts are for a \$60,000 electric vehicle in comparison to a \$60,000 medium sized petrol or diesel vehicle with a two to three litre engine and emissions of 182g/km. Sources: State and territory survey responses; Access Canberra (2017a, 2017b); Roads and Maritime NSW (2017); Northern Territory Government (2017); Queensland Government (2017b); Vic Roads (2017)

¹⁴ Queensland Government (2016)

¹⁵ International Council on Clean Transportation (2015)

Case Study:

The planning of the Queensland Electric Super Highway

The Queensland Government and Energy Queensland are planning and installing the Queensland Electric Super Highway, which will enable electric vehicles to travel over 1,800 km between the Gold Coast and Cairns. Charging networks play a crucial role in addressing range anxiety for consumers. The Queensland Government is planning carefully to ensure that the locations for the Queensland Electric Super Highway are attractive, safe, convenient, and cost-effective.

The Queensland Government found that there are specific considerations that are important in developing an electric vehicle fast-charging network:

- Amenities at the charging site: The current generation of 50 kW fast chargers take around 30 minutes to charge the average electric vehicle to 80 per cent, meaning that charging sites will be more attractive for drivers when co-located with amenities such as shops and bathrooms.
- Local capacity of the electricity grid: Charging stations need three phase power and sufficient capacity to supply a number of charging ports, and upgrading transformers can be a costly exercise that is best avoided if possible.

To address these requirements, the Queensland Government and Energy Queensland developed a number of broadly applicable principles for planning an electric vehicle charging network:

- Plan for a long-distance, long-term electric vehicle charging network
- Establish clear planning principles based on understanding electric vehicles
- Utilise existing assets (electricity infrastructure, road network and carparks) - starting point is network capacity
- Partner with willing public and private hosts
- Develop a supporting policy and planning context
- Integrate electric vehicle charging into planning for future road and energy networks.

Through applying these principles, the Queensland Government and Energy Queensland have successfully planned the world's longest electric vehicle highway (in a single state).

Appendix 1:

Links for state, territory and federal government electric vehicle policies

The following list contains all of the information readily accessible on the internet on state, territory and federal currently implemented electric vehicle policies.

Australian Capital Territory

Concession on stamp duty:

https://www.accesscanberra.act.gov.au/app/answers/detail/a_id/2928/~/_/duty-payable-upon-registration-or-transfer-of-a-motor-vehicle#!tabs-2

Concession on registration:

https://www.accesscanberra.act.gov.au/app/answers/detail/a_id/694#!tabs-7

Charging infrastructure provision:

<http://apps.treasury.act.gov.au/budget/budget-2016-2017/home/a-sustainable-territory>

Government fleet policy:

http://www.cmd.act.gov.au/_data/assets/pdf_file/0005/132098/non-exec_vehicle_guidelines_2010.pdf

New South Wales

Vehicle tax discount:

<http://www.rms.nsw.gov.au/roads/registration/fees/>

Government electric vehicle fleet trial:

<http://www.resourcesandenergy.nsw.gov.au/about-us/news/2017/nsw-government-unveils-electric-vehicle-fleet>

Northern Territory

Driverless electric bus trial:

<https://dipl.nt.gov.au/transport/driverless-bus>

Queensland

Discount on vehicle registration duty:

<https://www.qld.gov.au/transport/registration/fees/duty/about/>

Charging infrastructure provision:

<http://statements.qld.gov.au/Statement/2016/8/12/palaszczuk-government-welcomes-report-on-the-future-of-electric-vehicles>

South Australia

Charging infrastructure provision:

<https://www.kangarooisland.sa.gov.au/e-vehicle>

Government fleet policy:

<https://www.premier.sa.gov.au/index.php/tom-koutsantonis-news-releases/891-state-government-fleet-to-be-30-per-cent-low-emission-vehicles>

Electric vehicle public transport trial:

<http://www.abc.net.au/news/2017-03-21/driverless-car-trial-at-adelaide-airport,-flinders-university/8373006>

Tasmania

Climate Change Action Plan:

http://www.dpac.tas.gov.au/_data/assets/pdf_file/0015/332106/Climate_Action_21_Tasmanias_Climate_Action_Plan_Web_version.pdf

Government fleet policy:

http://www.dpac.tas.gov.au/divisions/climatechange/tasmanias_climate_change_action_plan_20172021/reducing_our_transport_emissions

Information and education through fleet demonstration project:

http://www.dpac.tas.gov.au/divisions/climatechange/Climate_Change_Priorities/reducing_emissions/transport

Victoria

Registration discount:

<https://www.vicroads.vic.gov.au/registration/registration-fees/concessions-and-discounts/hybrid-vehicle-registration-discount>

Federal

Luxury car tax - higher threshold for fuel efficient vehicles:

<https://www.ato.gov.au/rates/luxury-car-tax-rate-and-thresholds/>

Clean Energy Finance Corporation fleet program:

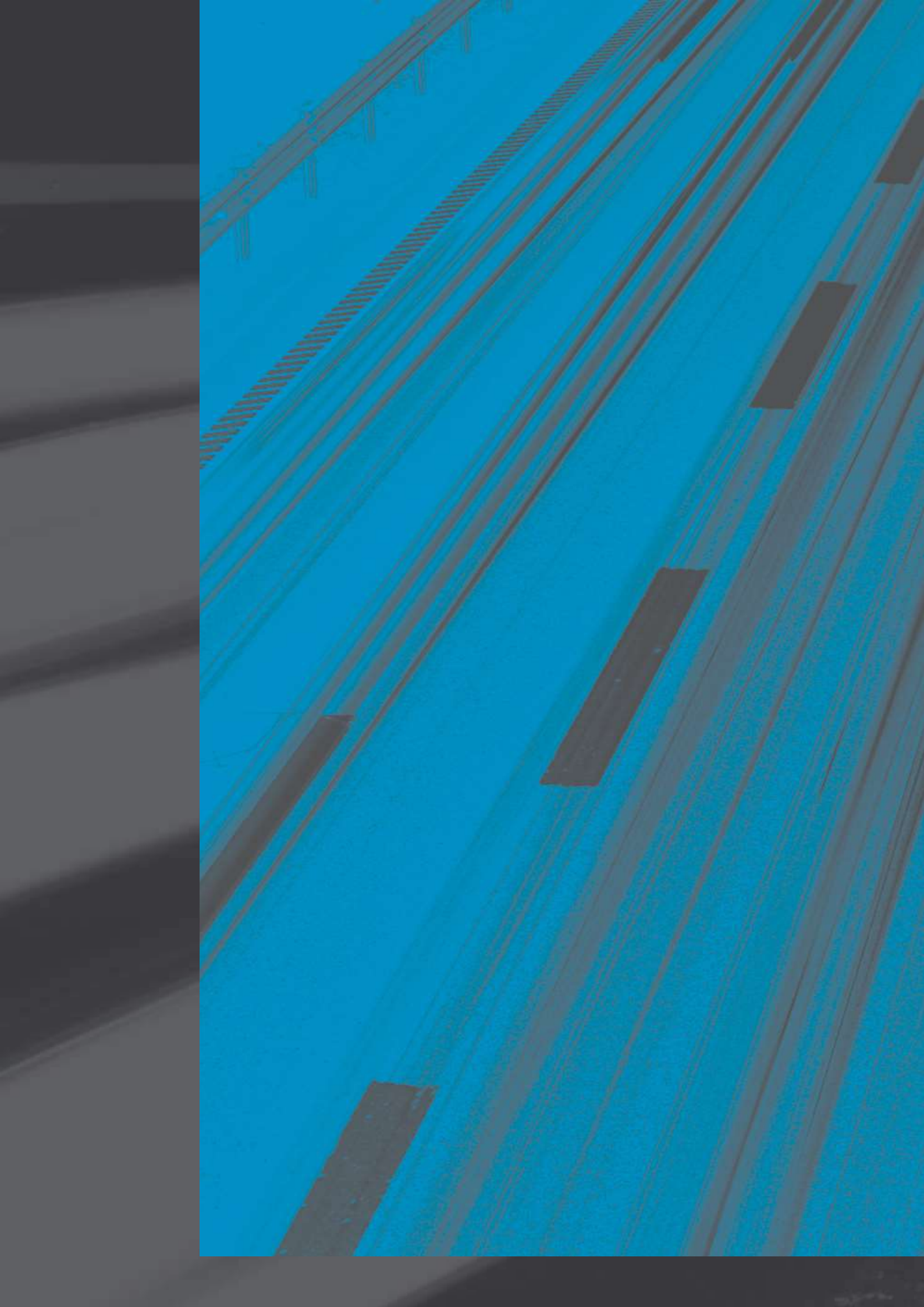
http://www.cefc.com.au/media/107564/cefc-factsheet_eclipx-lev_lr.pdf

Information and education:

<https://www.greenvehicleguide.gov.au/>

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