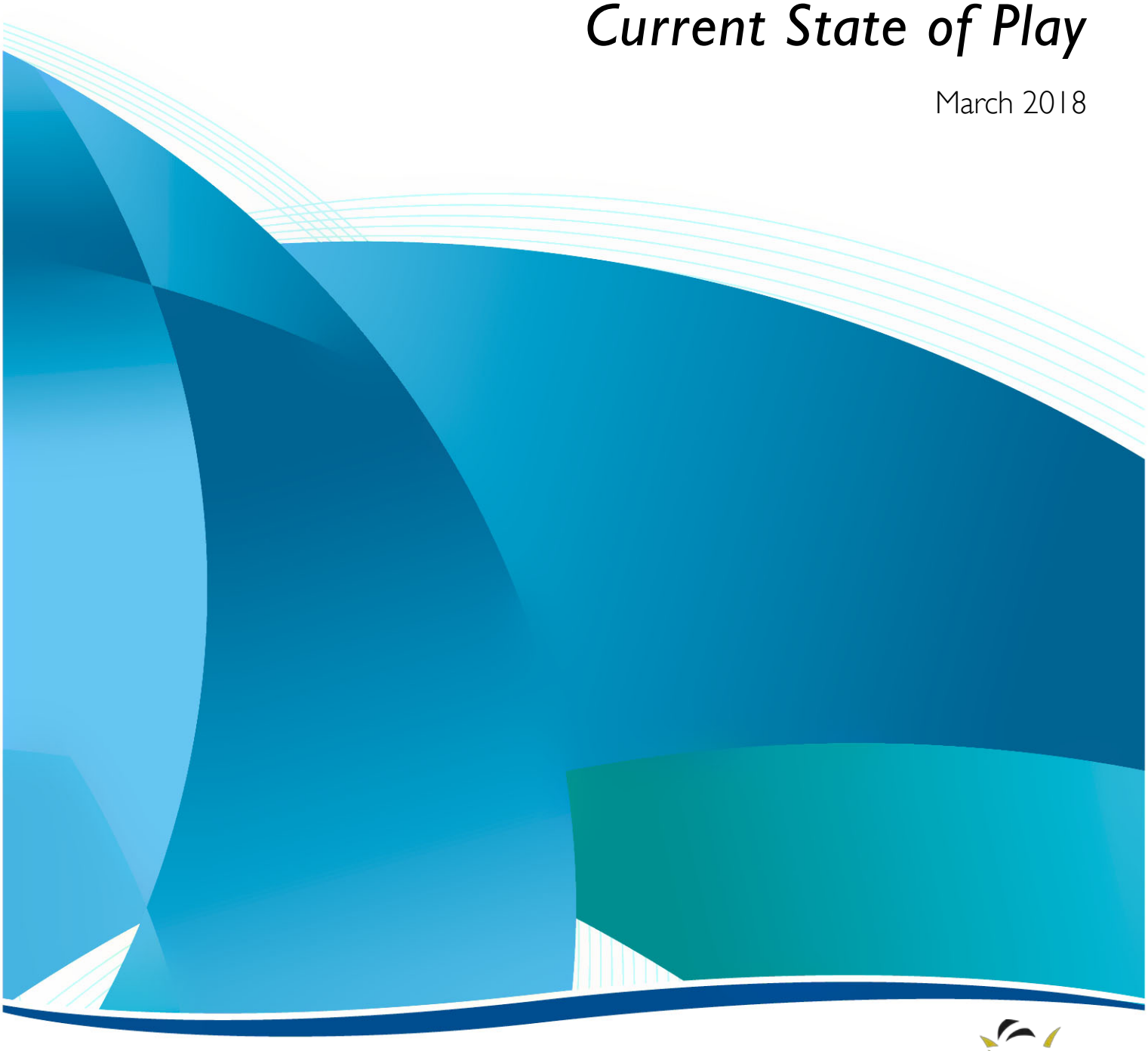
Electric Vehicles in Tasmania

Current State of Play

March 2018



Tasmanian Climate Change Office
Department of Premier and Cabinet

Tasmanian Government

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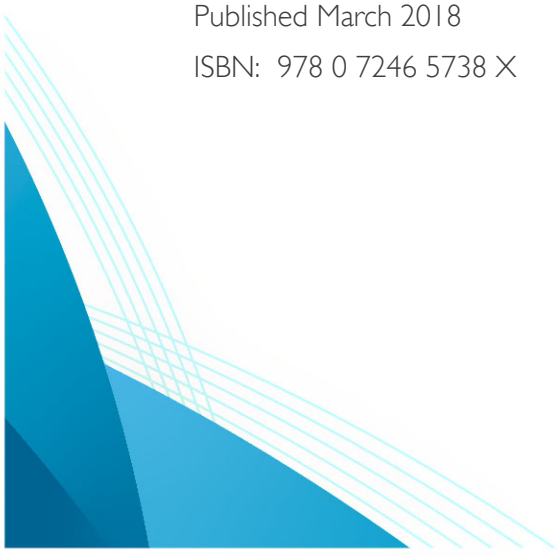

CONTENTS

INTRODUCTION

Tasmanian Government's commitment to support the uptake of electric vehicles

Climate Action 21: Tasmania's Climate Change Action Plan 2017-2021[1] (Climate Action 21) sets the Tasmanian Government's agenda for action on climate change through to 2021.

Under Climate Action 21, the Tasmanian Government is committed to working with key partners to develop a coordinated approach to support the uptake of electric vehicles[2] in Tasmania. This includes supporting the rollout of a statewide electric vehicle charging network consistent with market trends. The Tasmanian Government has committed $250,000 to support this work.

The overarching purpose of the Tasmanian Government's work in this space is to ensure the State is best placed to capture the benefits electric vehicles will bring, and ensure Tasmania is a genuine leader in the response to climate change.

Tasmania's transport sector has the highest emissions out of all the sectors of the State's economy and vehicle fleet costs are a significant expense for the Tasmanian Government, local government, private sector fleets and the community. This highlights the need to put in place strategies to support a more sustainable transport system. Electric vehicles, powered by Tasmania's renewable energy, could reduce emissions in the transport sector, reduce transport costs and help to improve the State's energy security (ClimateWorks 2017).

In addition to supporting the uptake of electric vehicles, the Government is committed to reducing the State's fuel costs and transport emissions by supporting the uptake of other forms of transport, such as public transport, and taking action to improve Tasmania's vehicle fleet efficiency.

Tasmanian Government's Electric Vehicle Working Group

The Tasmanian Government has established the Electric Vehicle Working Group to provide advice on the development of an integrated approach to support the uptake of electric vehicles in a way that maximises benefits to the State. The Working Group will play an active role in:

- identifying and exploring barriers to electric vehicle uptake;
- reviewing relevant policy and regulatory settings relating to each barrier;
- identifying priority areas of action to support electric vehicle uptake;
- understanding the impact of electric vehicle uptake on Tasmania's electricity sector;
- assessing approaches to support the rollout of electric vehicle charging infrastructure in Tasmania; and
- investigating ways to improve electric vehicle data collection.

[1] *Climate Action 21: Tasmania's Climate Change Action Plan 2017-2021* is available at http://www.dpac.tas.gov.au/divisions/climatechange/tasmanias_climate_change_action_plan_20172021.

[2] For the purpose of this paper, the term 'electric vehicle' refers to plug-in hybrids and battery electric vehicles, unless otherwise specified (see Attachment 1 for definitions). Hybrids are not included in this definition as their batteries cannot be charged from an external electricity source.

The Working Group will explore the social, environmental and economic benefits of electric vehicles, and consider the impact of increased uptake on Tasmania (eg existing industry sectors, government and the community).

The Working Group reports to the Department of Premier and Cabinet's Tasmanian Climate Change Office and comprises representatives from the following organisations:

- Australian Electric Vehicle Association;
- Aurora Energy;
- Hydro Tasmania;
- Local Government Association of Tasmania;
- Royal Automobile Club of Tasmania;
- Sustainable Living Tasmania;
- TasNetworks;
- Tasmanian Government (Department of Health and Human Services; Department of State Growth; Department of Treasury and Finance; Department of Justice);
- Tourism Industry Council Tasmania; and
- University of Tasmania.

Electric vehicles in Tasmania – Current State of Play

This paper examines the current state of play regarding electric vehicles in Australia and explores key considerations for supporting the uptake of the technology in Tasmania. The paper is designed to inform the Electric Vehicle Working Group and start the conversation regarding the Tasmanian Government's role in supporting electric vehicle uptake.

CURRENT STATE OF PLAY

Uptake of electric vehicles

For the purpose of this paper, the term 'electric vehicle' refers to plug-in hybrids and battery electric vehicles, unless otherwise specified (see Attachment 1 for definitions). Hybrids are not included in this definition as their batteries cannot be charged from an external electricity source. Electric vehicles include cars, buses, trucks, trains, aeroplanes, boats, bicycles (e-bikes[3]), motorcycles and scooters.

Australians purchased 1,369 electric vehicles (cars) in 2016, representing 0.1 per cent of the national passenger vehicle market (ClimateWorks 2017). In Tasmania, approximately 56 electric vehicles (cars) were purchased between 2011 and 2016, representing 0.02 per cent of the Tasmanian passenger vehicle market[4].

Electric vehicles account for approximately 0.2 per cent of the global fleet (OECD / IEA 2017). Norway has the highest electric vehicle uptake representing 39 per cent of its new vehicle sales, which equates to over 3 per cent of its vehicle fleet (OECD/IEA 2017), followed by the Netherlands (6.4 per cent of vehicle fleet) and Sweden (3.4 per cent of vehicle fleet) (OECD/IEA 2017). An overview of the policies and programs that have been introduced in Norway to encourage electric vehicle uptake is provided at Attachment 2.

The international uptake of electric vehicles is continuing to rise. In 2010, the global sale of electric vehicles amounted to a few hundred. By January 2017 cumulative global sales reached two million (Lutsey 2017).

Uptake of e-bikes is expected to grow in the future as awareness of the technology and commercial availability of models increases (RAC 2017). In the United Kingdom, e-bike sales rose from 5 per cent of the bicycle market in 2015 to 12 per cent in 2016 (The Guardian 2017). In Australia, cycling is one of the fastest growing modes of transport, and the overall number of bicycle sales has substantially increased over the past 15 years, including increasing demand for e-bikes (EV Talk 2017).

What Tasmania has done so far

Tasmanian Government

In 2013, the Department of Premier and Cabinet's Tasmanian Climate Change Office (TCCO) undertook a project to investigate the potential benefits of electric vehicles in Tasmania. The benefits identified included:

- reduced transport-related air pollution;
- improved energy security due to reduced reliance on imported fossil fuels; and
- significant emissions reduction opportunities due to Tasmania's renewable energy profile (Joule Logic 2014).

[3] An electric bike (e-bike) is a bike that can be powered by electricity (battery and electric motor) as well as propelled by pedals.

[4] The market percentage was calculated based on the number of registered passenger vehicles in Tasmania in 2017 according to the Australian Bureau of Statistics Motor Vehicle Census, available at http://www.abs.gov.au/ausstats/abs@.nsf/mf/9309.0. The market percentage is approximate due to limitations and variations associated with State and territory reporting of electric vehicle data, including electric vehicle definitions and categories.

In 2015, TCCO delivered the Electric Vehicles Demonstration Project, in partnership with Hydro Tasmania and TasNetworks. Through the Project, 19 electric vehicles were deployed across a range of vehicle fleets from Tasmanian Government agencies, TasNetworks, Hydro Tasmania, local government and the education sector. The trial identified a number of barriers to electric vehicle uptake in Tasmania, including concerns regarding the driving range of electric vehicles caused by the current lack of public charging infrastructure (Tasmanian Government 2017a). The University of Tasmania participated in the Demonstration Project by sharing its knowledge and experience of integrating electric vehicles into its fleet.

City of Hobart

The City of Hobart has installed electric vehicle charging stations in city-owned carparks. Additionally, the City of Hobart is developing a transport strategy to plan for the future transport needs of its community, including environmental impact reduction and increasing the use of sustainable transport modes.

City of Launceston

The City of Launceston is developing a transport strategy to plan for the future transport needs of its northern community, including environmental impact reduction and increasing the use of sustainable transport modes.

University of Tasmania

The University of Tasmania demonstrates leadership in sustainable transport through its Sustainable Transport Strategy[5] and the implementation of sustainable transport practices. The organisation has had three return-to-base all-electric Nissan Leafs in its vehicle fleet since 2012 with purpose built charging stations for these vehicles. The University has also been installing electric bike charging stations for both public use at bike hubs and in individual bike lockers since 2011 and includes requirements for provision of 10 per cent of bike parking spaces in bike hubs to have power points available. In addition, the University has installed charging power points and identified electric vehicle parking spaces in new developments in Hobart and Launceston at levels meeting Green Building Council of Australia requirements.

Australian Electric Vehicle Association (AEVA)

AEVA is a not-for-profit organisation dedicated to promoting and facilitating the uptake of electric vehicles.

AEVA creates greater awareness of electric vehicles and encourages their use to foster further research and development in electric technology and to be an official source of information on electric vehicles in Australia (AEVA 2017). The organisation also provides a forum for social and technical communication in the electric vehicle field.

The Tasmanian branch of AEVA created an Electric Highway Working Group in 2015 which focused on the issue of electric vehicle charging infrastructure in Tasmania and included representatives from TasNetworks, Hydro Tasmania and several Tasmanian Regional Development Authorities.

[5] Further information on the University of Tasmania's Sustainable Transport Strategy is available at: http://www.utas.edu.au/__data/assets/pdf_file/0011/979472/Sustainable-Transport-Strategy-2017-2021.pdf.

Benefits of electric vehicles to Tasmania

Tasmania is ideally situated, and uniquely placed, to benefit from a growing electric vehicle market due to the State's:

- growing visitor economy (popular fly/ferry-drive holiday destination);
- compact geography;
- clean and green image;
- high percentage of renewable energy generation;
- shorter average car commuting distances;
- significant reliance on imported fossil liquid fuels; and
- high-emitting transport subsector, which offers a significant opportunity for emissions reduction.

The environmental, social and economic benefits of electric vehicles are outlined below.

Reducing emissions

Electric vehicles, powered by Tasmania's locally produced renewable energy have the potential to contribute significantly to reducing emissions in the transport sector.

Energy security and improved utilisation of electricity network

Tasmania has a reliance on imported fossil liquid fuels for non-stationary and transport energy use.

The Tasmanian Energy Security Taskforce found that electric vehicles may assist in reducing Tasmania's dependence on liquid fuels in the non-stationary energy sector in the longer term and provide other benefits to the State (Tasmanian Government 2017b).

Electric vehicles have a natural synergy with locally-produced renewable energy. They can boost demand for energy from the grid and improve the utilisation of the existing electricity network (Tasmanian Government 2017b).

Reduced transport costs

Not only are electric vehicles smoother and quieter to drive, they also have significantly lower service requirements and running costs (electrical recharging is significantly less expensive than refuelling Internal Combustion Engine (ICE) vehicles) (AFDC 2017).

The operating cost savings of electric vehicles means that businesses and households will benefit from reduced transport costs, particularly as electric vehicles and ICE vehicles hit price parity.

Reduced transport costs has flow-on effects to the Tasmanian economy by increasing demand for locally produced electricity (rather than imported fossil fuels).

Some studies also suggest the future electrification of transport out to 2050 could also result in lower residential electricity bills, particularly if fast charging stations are introduced to enhance capacity utilisation of the electricity network (Tasmanian Government 2017a).

Improved public health

Electric vehicles offer benefits to public health; for example reduced traffic noise, and air quality improvements because there is no tailpipe air pollution.

Tourism

Tasmania is a popular fly/ferry-drive holiday destination and its visitor economy is growing.

With increasing popularity of electric vehicles there is an opportunity to diversify Tasmania's visitor tourism industry by including a new electric vehicle market segment.

Jobs

Electric vehicles can generate local job opportunities in sales and charging infrastructure deployment, and diversify economies with new products and services.

Building climate resilience

Wide-scale electric vehicle uptake also has the potential to build climate resilience by mobilising electricity during emergency (extreme weather) events, or periods of sustained power loss. In such events, the energy stored in the batteries of electric vehicles could be used to run lighting and power essential appliances in homes, businesses or evacuation centres.

Benefits of e-bikes

E-bikes have wide-ranging benefits including reducing emissions, enhancing mobility access, reducing traffic congestion and providing a cheaper and more manageable commute (and other shorter trip) option (The Guardian 2017). Australian trials of e-bikes show that once on an e-bike, most people like them (RAC 2017). The University of Tasmania has data that shows an increasing uptake of electric bikes from staff and students at all campuses with the first bikes appearing in 2011.

Potential future benefits of autonomous electric vehicles

In the future, autonomous[6] electric vehicles may also offer additional benefits, including:

- mobility services for people that are unable to drive;
- improved traffic safety;
- reduced traffic congestion;
- improved access to vehicles through car/ride-sharing;
- increased availability of urban space (through the reduced need for car parking spaces); and
- improved electricity grid performance through vehicle-to-grid[7] technology (Driverless car market watch 2017).

[6] An autonomous vehicle (also known as a driverless vehicle) is capable of driving itself without any human input. From a technology perspective, autonomous and electric vehicles are inextricably linked.

[7] Vehicle-to-grid is a term used to describe the connection of electric vehicles onto the interconnected power network with facility for the transfer of energy between vehicle and grid.

Electric vehicle policy in Australia

Around the world, governments are recognising the benefits of wide-scale electric vehicle use and are supporting their uptake through policy (The Australia Institute 2017). Government policy has the potential to enable the right conditions to encourage the uptake of electric vehicles.

In Australia, a number of state and territory governments have implemented policies to support electric vehicle uptake (summary provided in Table 1 below).

The ACT Government encourages the purchase of low emission vehicles through reduced stamp duty and reduced registration costs. The ACT Government has also provided electric vehicle charging infrastructure support and has fleet initiatives in place to increase the number of low emission vehicles within Government (ACT Government 2017b). From a broad policy perspective, the ACT Government considers reducing transport emissions (currently producing 60 per cent of the Territory's greenhouse gas emissions) as a key component to achieving its target of net zero emissions by 2050 (ACT Government 2017b).

The Queensland Government has released a whole-of-government electric vehicle strategy (The Future is Electric[8]) to support the uptake of electric vehicles. Under this strategy, the Government is providing discounts on electric vehicle registration, supporting the planning and building of an electric vehicle charging super-highway, and developing a destination charging strategy (Queensland Government 2017).

The Government of South Australia has developed a Low Emission Vehicle Strategy[9] to increase the proportion of these vehicles on the state's roads (Government of South Australia 2017b). The strategy identifies ways to remove or reduce barriers to these vehicles and accelerate their uptake by South Australians. Initiatives include supporting electric vehicle charging infrastructure, purchasing electric vehicles to use in the Government fleet, promoting community awareness of electric vehicles (demonstration projects, pilots etc), and investigating the impact of electric vehicles on electricity suppliers.

In December 2017, the ACT Government, the Government of South Australia, City of Adelaide, City of Hobart and the Electric Vehicle Council of Australia signed a memorandum of understanding to collaborate to support the greater use of electric vehicles (ACT Government 2017a).

Table 1: Overview of government electric vehicle policy in Australia (Source: ClimateWorks 2017)

Electric Vehicle Policy	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	AUS GOV
Uptake									
EV purchases 2011-16	125	843	12	541	805	56	1,017	298	3,697
EV sales per 10,000 vehicles (2016)	18	7	4	5	9	5	8	3	7
Regulation									
Vehicle CO_2 emissions standards									
Financial Incentives									
Stamp duty, registration and tax discounts	✓	✓	✓	✓			✓		✓

[8] Further information on the Queensland Government's electric vehicle strategy (The Future is Electric) is available at: https://publications.qld.gov.au/dataset/the-future-is-electric-queensland-s-electric-vehicle-strategy/resource/7e352dc9-9afa-47ed-acce-2052cecfec8a.

[9] Further information on the Government of South Australia's Low Emission Vehicle Strategy vehicle strategy is available at: https://www.sa.gov.au/topics/driving-and-transport/vehicles/vehicle-types-and-specifications/about-low-emission-vehicles.

Electric Vehicle Policy	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	AUS GOV
Direct vehicle subsidy									
Fleet incentive									✓
Charging infrastructure support	✓			✓	✓	✓			
Non-financial incentives									
Vehicle lane and parking privileges	✓								
Electric vehicle public transport trials			✓		✓				
Government fleet initiatives	✓	✓			✓	✓			
Information and education programs	✓			✓	✓	✓			✓

Electric vehicle model availability and cost in Australia

According to ClimateWorks (2017), the number of electric vehicle models available in Australia has steadily risen over the past six years, with 16 models available in 2016. The vast majority of electric vehicle models currently available in Australia are priced at more than $60,000.

In 2016, there were only three electric vehicle models available for less than $60,000 (Nissan Leaf, Mitsubishi Outlander and Renault Kangoo ZE). The Nissan Leaf is no longer available in Australia and the Renault Kangoo is a van that is only available through special arrangement with Renault. By comparison, there are over 20 electric vehicle models available in the sub-$60,000 price range in Scandinavian countries (The Financial Review 2017).

Electric vehicle model availability in Australia is expected to increase in the near future with seven new electric vehicle models anticipated to be introduced into the Australian market in the next 18 months. Three of these models are likely to be priced at $60,000 or less.

From a global perspective, electric vehicle model availability is expected to grow in the coming years as prices come down, more efficient batteries become available and tighter emissions reduction regulations for the car industry take effect, particularly in the European Union (JATO Dynamics 2015).

KEY CONSIDERATIONS FOR TASMANIA

The key barriers to electric vehicle uptake are their purchase price, limited selection and range of models available, lack of public charging infrastructure limiting journey length, and lack of consumer awareness. Understanding and addressing these barriers can contribute to supporting electric vehicle uptake.

Policies and programs that may address these barriers include:

- incorporating electric vehicles into fleets to stimulate demand, raise awareness through exposure and contribute to the second-hand electric vehicle market;
- introducing stamp duty and registration discounts to reduce the upfront cost of electric vehicles;
- a coordinated rollout of public electric vehicle charging infrastructure to permit movement throughout the State; and
- awareness initiatives to increase community exposure to, and understanding of, electric vehicles.

Electric vehicle charging infrastructure

One key barrier to electric vehicle uptake is the lack of public charging infrastrtucture to support longer distance drives, for electric vehicles with limited range.

While the primary charging site for most electric vehicle owners is at home, public charging is needed to support extended journeys, including to facilitate electric vehicle tourism.

There are currently 476 dedicated electric vehicle public charging stations in Australia, of which 16 are located in Tasmania (ClimateWorks 2017). According to the Plugshare database, there are currently 74[10] electric vehicle charging stations available in Tasmania. Some of these chargers have limited availability/accessibility to the public (eg only available to business patrons). Presently, most of the chargers available in Australia are AC chargers. AC charging is generally considerably slower than DC charging, and is suitable for locations where drivers stop for longer periods, such as home, work or tourist destinations (particularly overnight accommodation).

DC charging allows most electric vehicles to charge more quickly (depending on the model and charger capacity), with a full charge typically taking 30 to 90 minutes. Many electric vehicle drivers will only need a five to fifteen minute top-up charge to reach their destination, so relatively short charging times are most common where DC chargers are widely available. There are currently 47 DC charging stations available in Australia, with none available in Tasmania (NRMA 2017). Table 2 below summarises the electric vehicle public charging infrastructure currently available in Australia.

A coordinated approach to the rollout of electric vehicle charging infrastructure ensures charging stations are strategically placed to fulfil the charging needs of the Tasmanian community and the tourism industry.

Because there is currently no standardised uniform electric vehicle charging type, manufacturers use different charging technologies (The Australia Institute 2017). It is important that governments support a

[10] Number of electric vehicle charging stations in Tasmania according to PlugShare on 20 December 2017.

charging network that is consistent with market trends, or specify standards. It is also important that charging infrastructure complies with the standard of electrical work. In Tasmania, relevant legislation includes the *Occupational Licencing Act 2005* and the *Occupational Licensing (Standards of Electrical Work) Code of Practice 2017*.

Policies to support the installation of home and workplace electric vehicle charging infrastructure (eg potential financial incentives) combined with education programs, can also help to address electric vehicle charging concerns.

TasNetworks has introduced an Electric Vehicle Fast Charger Support Scheme[11] to act as an incentive for the installation of public DC chargers. The scheme provides both technical advice and cost rebate components.

With regards to e-bikes, encouraging employers to provide charging opportunities for commuters can encourage their use (EV Talk 2017). Use of e-bikes can also be encouraged through initiatives that support bicycle use in general including safe lanes and routes, and parking facilities (EV Talk 2017).

Electric vehicle charging infrastructure in Tasmania

PlugShare is a free software application that allows users to find and review electric vehicle charging stations worldwide, and connect with other electric vehicle owners.

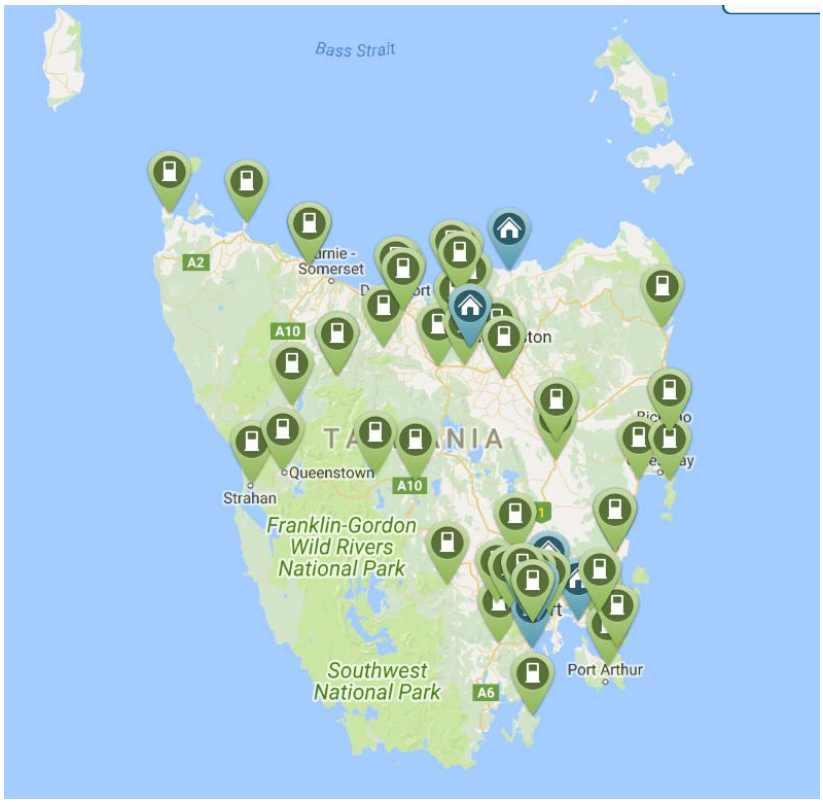

Figure 1: Electric vehicle charging infrastructure in Tasmania (Source: PlugShare 2017)

[11] Further information on the Electric Vehicle Fast Charger Support Scheme is available on the TasNetworks website at: https://www.tasnetworks.com.au/industry-and-development/electric-vehicle-fast-charger-scheme/.

Table 2: Public electric vehicle charging infrastructure in Australia (Source: ClimateWorks 2017)

Public electric vehicle charging infrastructure	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
Total # DC	3	11	1	5	1	0	7	12
Total # Capital city	14	60	2	28	17	4	78	34
Total # Regional	0	70	0	47	25	12	56	29

Community awareness of electric vehicles

While many people are willing to consider purchasing an electric vehicle, studies have shown that lack of consumer knowledge and awareness of electric vehicles is a key barrier to the adoption of the technology (Climate Works 2016). Key concerns held by prospective purchasers include uncertainty about the total cost of ownership, the expectancy of battery life and constraints of limited driving range compared to ICE vehicles. Raising community awareness and understanding of electric vehicles can help prospective purchasers to realise the benefits of uptake more quickly. Exposure to new technology is known to improve the likelihood of adoption (ClimateWorks 2016).

Awareness initiatives can include demonstration and/or trial initiatives to increase community exposure to electric vehicles, including encouraging first driving experiences, and raising community awareness of the benefits of ownership.

Widespread introduction of electric vehicles into fleets (eg government, business and public transit network) can also act to raise community awareness of electric vehicles through exposure. Vehicle fleet purchasing policy, including supporting the purchase of electric and alternative fuel vehicles, was identified as a potential measure to improve fleet efficiency in the Australian Government's Vehicle Emissions Discussion Paper (2016). The Discussion Paper also highlighted the importance of measures that provide information and education on the efficiency and environmental performance of vehicles (Australian Government 2016).

As part of its broader electric vehicle strategy, the Queensland Government has committed to establishing a Fleet Transition Working Group to investigate opportunities for transitioning its Government fleets to include a greater number of electric vehicles (Queensland Government 2017). Additionally, the New South Wales Government is running a Government electric vehicle fleet trial to take the first step towards increasing the number of low emission vehicles in the Government fleet (New South Wales Government 2017).

A number of states are undertaking electric bus trials which are an effective way to increase community awareness of electric vehicles. Tasmania's largest transport provider, Metro Tasmania, has 100 new buses being delivered over the next two years (from 2017-18), which are designed for conversion from ICE to electric.

Tasmania maintains a flexible whole-of-government vehicle contract, which allows contracted manufacturers to submit models for consideration at any time. Subject to whole-of-life costs and likely demand reviews, vehicles are placed on contract and subsequently made available for agencies to select. Historically, the Tasmanian Government has been open to the inclusion of electric vehicles on its whole-of-government

common-use contract (ie Nissan Leaf, Holden Volt and Mitsubishi Outlander PHEV have all been available to agencies through the Tasmanian Government's vehicle contract)[12].

Raising community awareness of available electric vehicle public charging infrastructure can promote uptake of the technology by alleviating concerns regarding limited driving range. The introduction of consistent labelling of electric vehicles (eg distinguishable licence plates) and charging infrastructure signage can also help to raise awareness by increasing visibility of the technology within the community.

Another way to promote community awareness of electric vehicles is at the vehicle dealership level. Increasing understanding and awareness of electric vehicle model availability at dealerships can raise awareness of prospective vehicle purchasers.

Resources

Electric Vehicle Council website

The Electric Vehicle Council's website allows potential purchasers to browse electric vehicle models currently available in Australia, easily compare the running costs of electric vehicles with ICE vehicles and search for locations of charging points around the country (Electric Vehicle Council 2017).

Australian Electric Vehicle Association (AEVA)

AEVA is a not-for-profit organisation dedicated to promoting and facilitating the uptake of electric vehicles.

AEVA provides a forum for social and technical communication in the electric vehicle field. The organisation creates greater awareness of electric vehicles and encourages their use to foster further research and development in EV technology and to be an official source of information on EVs in Australia (AEVA 2017).

Case Study: Electric bus trials in SA, ACT, QLD and NSW

South Australia – The South Australian Government has commissioned the design and building of two Australian made electric buses. The buses will be trialled to provide the Government with data on how electric and low-carbon buses could be used in Adelaide's public transit network. The Government is also planning to trial six hydrogen fuel cell electric buses in the Adelaide Metro system within the next two years. The buses will be refuelled by hydrogen produced by 100 per cent renewable energy (Bustech 2017) (Government of South Australia 2017a).

Australian Capital Territory – The Australian Capital Territory Government is trialling three leased electric buses on public transport routes in Canberra (one hybrid diesel fuel electric and two pure electric). The purpose of the trial is for the Government to assess the viability of using electric buses within the bus network to see if it can progressively replace the existing fleet (Transport Canberra 2017).

Queensland and New South Wales – Electric buses (BYD pure electric) have been added to the transport fleet at Brisbane airport (11 buses) and Sydney airport (6 buses) (Electric Vehicle News 2017) (Electric Cars Report 2017).

Case Study: Three-wheeled electric vehicle trial - Tasmania

Australia Post – Australia Post is trialling three-wheeled electric vehicles in Hobart, which are being used for letter and parcel delivery. The benefits of the e-bikes include increased safety protection for postal service

[12] Information provided by the Tasmanian Government Department of Treasury and Finance in November 2017.

employees, supporting the ageing postal service workforce to stay in the job longer, and business efficiency improvements. Australia Post is running similar pilot programs in Victoria, New South Wales, Queensland, South Australia and Western Australia. Following the trials, Australia Post will consider rolling out the e-bikes nationally (ABC News 2017) (Australia Post 2017).

International Case Study: Electric vehicle awareness campaign in San Francisco

- San Francisco Bay's 'Experience Electric – The Better Ride awareness' raised awareness of the many benefits of, and incentives for, the purchase of electric vehicles through test drives and the use of #TheBetterRide on social media.
- The campaign provided around 5,000 electric vehicle test drives for members of the public at events throughout the nine San Francisco Bay Area counties (Source: Centre for Sustainable Energy, 2017).

International Case Study: Electric vehicle targets for state agencies in California

- The State of California has set a target for 50 per cent of light-vehicles purchases by state agencies to be electric by 2025, and 15 per cent of medium-heavy vehicle purchases by state agencies to be electric by 2025 (increasing to 30 per cent in 2030) (Government Fleet, 2017).

Upfront cost of electric vehicles

Globally, electric vehicles are currently more expensive compared to their ICE vehicle equivalents, primarily due to the high cost of batteries (Climate Council 2015). Despite the lower operating cost of electric vehicles, the upfront cost difference is a major barrier to consumers.

Due to higher demand for batteries, competition among battery suppliers and increased production rates, it is predicted that cost parity with ICE vehicles will occur by 2025 (Bloomberg 2016).

In Australia, the price of electric vehicles is further inflated due to shipping costs and expenses associated with market introduction and low sales volumes (ClimateWorks 2016). Greater uptake of electric vehicles would ultimately lower these costs by spreading them across a higher volume of sales.

Policy incentives, such as upfront purchase subsidies, or stamp duty and registration discounts, have been shown to stimulate short-term demand and encourage the purchase of electric vehicles (ClimateWorks 2017).

An example of such an incentive could be a stamp duty regime for new light vehicles[13] that establishes differential charges linked to environmental performance. Charges would be based on the environmental ratings published on the Australian Government's Green Vehicle Guide [14]. A number of states and territories provide discounts on stamp duty and registration for electric vehicles, as outlined in Table 3 below.

Table 3: Comparison of estimated discounts on stamp duty and registration for a $60,000 electric vehicle (Source: ClimateWorks 2017) [15]

[13] Gross vehicle mass of less than or equal to 4.5 tonnes.

[14] Further information regarding the Australian Government's *Green Vehicle Guide* is available at http://www.greenvehicleguide.gov.au.

[15] Estimated discounts are for a $60,000 electric vehicle in comparison to a $60,000 medium-sized petrol or diesel vehicle with a two or three litre engine and emissions of 182 grams per kilometre.

Discount comparison across Australia	ACT	NSW	NT	QLD	VIC
Discount amount	$2,110	< $250	$40 to $80	$60	$100

Case Study: Stamp duty reduction for electric vehicles in Australian Capital Territory

The Australian Capital Territory Government's Vehicle Emission Reduction Scheme provides a differential stamp duty system for new light vehicles, incentivising the purchase of low emission vehicles, such as electric vehicles. Under the Scheme, vehicles have a performance rating based on their carbon dioxide (CO_2) emissions, consistent with the Australian Government's Green Vehicle Guide. In effect, purchasers can avoid paying duty, or reduce the duty they pay, by choosing higher rating vehicles (eg new vehicles that emit below 130g of CO_2 per kilometre pay no duty) (ACT Government 2017a).

Electric vehicle model availability

The experience of a number of international jurisdictions suggests a strong correlation between electric vehicle sales and the number of models available for purchase (ClimateWorks 2016).

The current lack of choice of electric vehicle models in Australia makes it difficult for consumers to find electric vehicles that meet their price and diverse transport needs. The current low demand for electric vehicles in Australia means that many electric vehicle manufacturers do not introduce their models to the Australian market.

Bulk purchasing of electric vehicles, through the combined purchasing power of fleets, can act to stimulate demand and lead to increased model availability. Increasing the number of electric vehicles in fleets also stimulates the second-hand electric vehicle market and exposes the community to the technology.

Another way to increase model availability is through mandatory emissions reductions targets for new cars, and setting targets for increased number of electric vehicles in fleets, or aspirational targets to end the sale of internal combustion engines.

An international perspective on electric vehicle model availability

Europe currently offers the most consumer choice of electric vehicle models, while domestic manufacturers in the United States and China are starting to gain momentum (JATO Dynamics 2015).

The main driver for growth in electric vehicle model availability in Europe is the European Union's mandatory emissions reduction targets for new cars. By 2021, the average emissions of all new cars sold must be 40 per cent less than emissions from today's average car. This goal can only be met by the rapid, large-scale adoption of electric vehicles (Yale University 2017).

Some jurisdictions are now setting ambitious targets to end sales of internal combustion engines, including India (by 2030), China (considering timeframe), United Kingdom (by 2040), France (by 2040), Netherlands (2025) and Norway (by 2025) (CNN 2017).

International Case Study: Bulk purchasing of electric vehicles in Sweden

- As a smaller market, Sweden looked to bulk procurement to demonstrate purchasing potential to electric vehicle manufacturers and incentivise the introduction of electric vehicle models to address local supply constraints.

- A joint electric vehicle procurement project was initiated by 296 organisations. The Swedish Government provided a grant of AUD $9.1 million to assist in reducing the purchase price by up to 25 per cent for the first 1,050 vehicles purchased through the procurement project.
- In total, more than 900 vehicles were ordered through the procurement project (as of November 2014) which made a significant contribution to increasing the number of models in the Swedish market (Kuiper 2016) (Swedish Energy Agency 2015).

ATTACHMENT 1

Types of electric vehicles

Hybrid electric vehicles

Hybrids (HEVs) use a battery-powered electric motor to supplement an Internal Combustion Engine (ICE). The electric motor is powered via a small battery, which is charged through regenerative braking and/or using excess engine capacity. The electric motor eliminates idling emissions and enables the vehicle to operate with zero emissions at low speeds. At higher speeds, the vehicle switches to the combustion engine (United States Department of Energy 2016). Examples include the Toyota Prius, Toyota Camry Hybrid, the Honda Civic Hybrid and the Lexus Hybrid.

Plug-in hybrid electric vehicles

Plug-in hybrids (PHEVs) are similar to HEVs in that they combine an electric motor with an ICE. However, PHEVs utilise a larger battery that can be recharged through regenerative braking or from the engine, and can also be plugged into an external charging outlet (United States Department of Energy 2016). When the battery is low or when more power is required, the combustion engine replaces the electric drive (Climate Council 2015). Examples include the Mitsubishi Outlander PHEV, BMW i8 and Holden Volt.

Plug-in battery electric vehicles

Unlike HEVs and PHEVs, battery electric vehicles (BEVs) are fully electric and rely solely on a rechargeable battery to store energy for the electric motor (Climate Council 2015). They do not have an internal combustion engine, fuel tank or exhaust pipe, so they do not produce exhaust emissions. Similar to HEVs and PHEVs, BEVs can also recharge their batteries through regenerative braking. Examples include the Tesla Model S, BMW i3, Mitsubishi i-MIEV and the Nissan Leaf.

Fuel-cell electric vehicles

A relatively new concept, fuel-cell electric vehicles (FCEVs) generate electricity using compressed hydrogen, instead of storing and releasing energy like a battery. This generated electricity then charges the on-board battery pack and/or powers the vehicle's electric motor. This whole process emits only water vapour. However, extracting hydrogen from a water molecule (eg natural gas) can be an energy-intensive process that generates greenhouse gas emissions if renewable sources of energy are not used. The Hyundai ix35 Fuel Cell is the first FCEV to be permanently imported into Australia (Hyundai 2016). In addition, three Toyota Mirai FCEVs have been delivered to Australia as promotional vehicles (Toyota Australia 2016).

ATTACHMENT 2

Policies and programs introduced in Norway to promote electric vehicle uptake

Norway is leading the world's electric vehicle market. The following is an outline of the policies and programs that have been introduced in Norway since 1990 to encourage electric vehicle uptake.

Financial and non-financial incentives for electric vehicles

- No purchase/import taxes (1990).
- No registration costs (1990).
- Exemption from 25 per cent Value Added Tax (2001).
- Low annual road tax (1996).
- No charges on toll roads or ferries (1997 and 2009).
- Free municipal parking (1999).
- Access to bus lanes (2005).
- Reduction on company car tax by 50 per cent (2000).
- Exemption from 20 per cent Value Added Tax on leasing (2015).

Charging infrastructure

- Since 2009, the Norwegian Government has maintained a program of large-scale investment in public electric vehicle charging infrastructure. The Norwegian Government launched a program to finance the establishment of at least two multi-standard fast charging stations every 50 km on all main roads in Norway by 2017.
- There is also strong support from cities and towns for charging infrastructure.

Community awareness

- The Norwegian Government has funded communication campaigns, including an electric vehicle website which communicated information on electric vehicles to the public, including incentives and available charge points.

Targets

- The Norwegian Government has set an ambitious target to end the sale of internal combustion engines by 2025.

Source: (EV Norway 2017) (Filho and Kotter 2015) (CNN 2017)

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