



Preparing the Northern Territory
for Electric Vehicles

DISCUSSION PAPER 2019

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Introduction

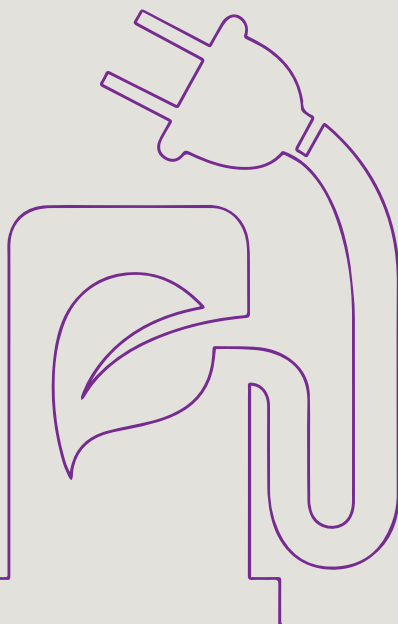
What is an electric vehicle?

An electric vehicle (EV) is any vehicle that is fully or partially driven by an electric motor. There are two main types of EVs, those that can be plugged in to charge and those that are not plugged in. There are two types of plug in EVs: battery EVs (BEVs) and plug-in hybrid EVs (PHEVs). BEVs are powered only by an electric motor and a battery. PHEVs are powered by electric motors in conjunction with an internal combustion engine (using petrol, diesel or biofuel) however, they can still be plugged in to charge. EVs include electric cars, buses, heavy vehicles, motorbikes and bicycles.

The driving range of BEVs currently varies from around 250km for lower priced vehicles to 500km for premium vehicles, which is similar to the range of conventionally powered vehicles. PHEVs typically have a smaller battery and an all-electric driving range of around 60 km, but a maximum range similar to a conventional car.

BEVs and PHEVs can be charged using a charging unit or any standard power point. On average, an overnight charge using a household power point will provide a 200km range. A dedicated Alternating Current (AC) charger increases the recharge speed. For quicker charging times, EVs can be charged at fast charging stations where recharging time can range from 10 to 40 minutes depending on the size of the battery and the type of charger.

Other types of EVs which are not plugged in to re-charge include hybrid vehicles which have a much smaller battery which is recharged while driving. Fuel cell vehicles generate electricity on-board from fuel such as hydrogen. They are re-fuelled in a similar way to petrol vehicles.



Purpose and scope of this Discussion Paper

The Northern Territory Government is preparing an EV Strategy and Implementation Plan and this Discussion Paper is the first step in developing the Strategy.

There is growing interest nationally and at the Territory level in the development of EV policy, programs and infrastructure. Purchase price is currently a major disincentive to EV uptake in Australia, with the majority of EV models available in Australia costing over \$60 000. However, several new EV models, including lower cost models, are arriving, or are scheduled for release in Australia. With the introduction of lower cost EVs into Australia over the next few years, there is likely to be increased use of EVs and greater demand for supporting infrastructure.

However, the potential for supporting or encouraging the up-take of EVs in the Northern Territory requires careful consideration. The Northern Territory covers a large land area and has a small, widely dispersed population, with many remote and very remote communities. In addition, the Northern Territory's major urban centres are geographically isolated from the

rest of Australia and experience extreme climatic conditions. These unique characteristics will present challenges for the increasing use of EVs across the Northern Territory.

The costs and benefits of EVs in the Northern Territory context and the potential opportunities and barriers need to be considered in developing EV policy and infrastructure. This Paper aims to investigate these issues and seek feedback from stakeholders and the community to assist in developing an EV Strategy and Implementation Plan.

This Paper will focus on battery EVs and PHEVs as they are likely to represent the most significant change in Australia's vehicle fleet in the short to medium term. The Paper will also focus on passenger and light commercial vehicles as these are likely to be where the greatest area of growth will occur in the near future and where government involvement will be most relevant in the short term.

Hybrid vehicles are not included within the scope of this Paper as they do not represent a significant shift from conventional vehicles and don't have the potential to operate as zero emission vehicles.

While fuel cell vehicles operate as zero emission vehicles, refuelling infrastructure and hydrogen supply are very limited at present and fuel cell vehicle technology is at an earlier stage of development than EVs. In at least the short term, hydrogen fuel cell vehicles are likely to be restricted to more densely populated areas in large cities or commercial heavy vehicle and bus fleets which return regularly to refuelling hubs. The potential for fuel cell vehicles is being considered in zero emission vehicle policy development at the national level.

Autonomous Vehicles (AVs) are capable of driving without the involvement of a human driver and are often also EVs. However, the policy issues associated with the introduction of AVs are significantly different from the issues specific to non-autonomous EVs. There is also high level, national coordination of AV research, policies and guidelines and therefore, this Paper will not focus on issues specifically related to AVs.



Have your say: "What are your views on encouraging EVs in the Northern Territory? Is this the right time for the Northern Territory Government to encourage EVs?"



Have your say

The Northern Territory Government is seeking contributions from the community and stakeholders in the development of an EV Strategy and Implementation Plan. Key questions are included throughout this Discussion Paper and responses to these questions are welcomed or additional issues can be raised for consideration.

Submissions can be made online at haveyoursay.nt.gov.au / via email to policy.transport@nt.gov.au or by post to Electric Vehicle Discussion Paper, GPO Box 2520, Darwin, NT 0801.



The EV fleet

Globally, more than 2.1 million new EVs were sold in 2018, a growth of 64 per cent from 2017¹.

The majority of the EV fleet is concentrated in China, Europe and the USA where governments have actively supported improvements in vehicle fuel efficiency and carbon emission standards. EVs represent 29 per cent of new vehicle sales in Norway, 9.7 per cent in the Netherlands, 1.1 per cent in the UK, 0.9 per cent in China and 0.7 per cent in the USA³.

There are more than 30 EV vehicle manufacturers globally which includes 13 of the top 14 vehicle manufacturers, producing over 60 different EV models³. Volvo has indicated that the company will only build hybrid and EV vehicles from 2019, General Motors has announced 20 new electric models are under design, Jaguar and Land Rover have indicated that all new model lines from 2020 will be electric or part electric and Volkswagen (the world's biggest vehicle manufacturer) is targeting three million EV sales per year by 2025 and producing EVs only by 2030. However, the majority of EV models are not currently available in Australia and this absence of consumer choice is reflected in the proportion of EV sales.

In 2018, Australians' purchased 2216 EVs, a drop of 3 per cent from 2017, however this reflects a drop in all new vehicle sales. In the first half of 2019, 1277 EVs were sold in comparison to 670 EVs in the first half of 2018, a 90 per cent increase¹.

The National Transport Commission estimates there were around 9 000 EVs in the Australian vehicle fleet at the end of 2018¹⁷.

In August 2019, there were 22 EV models available in Australia. By the end of 2020 there are expected to be 31 models available. Business was the largest buyer of EVs in 2018 at 63 per cent of total sales, followed by 33 per cent private buyers and government four per cent of total sales¹.

In February 2019, there were 35 EVs registered in the Northern Territory, including 33 light and two heavy vehicles, representing 0.02 per cent of the total Northern Territory vehicle fleet.

Currently there are 10 EVs in the Northern Territory Government fleet including five small electric trucks at the Darwin Correctional Centre, a 14 seat vehicle at the Desert Wildlife Park in Alice Springs and four golf carts used at hospital sites. None of these vehicles are currently registered for road use. A Mitsubishi iMiev was trialled by several Northern Territory Government agencies in 2012 with a mixed response reported by users.

The Northern Territory Government is currently procuring new vehicle purchase contracts and the documents note that within the life of the contract, supply of BEVs and PHEVs will be required.

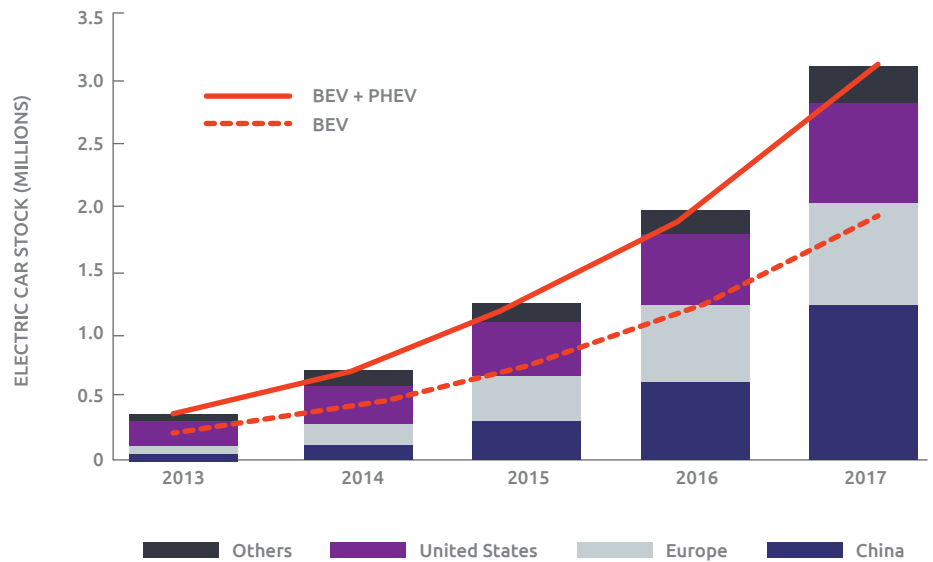
In 2017 the Northern Territory Government trialled an electric autonomous vehicle. This was the first trial of an EasyMile EZ10 autonomous vehicle in Australia.

During the trial nearly 6 000 passengers travelled on the vehicle and a total of 1646km were travelled. The vehicle was charged overnight using a standard domestic power supply.

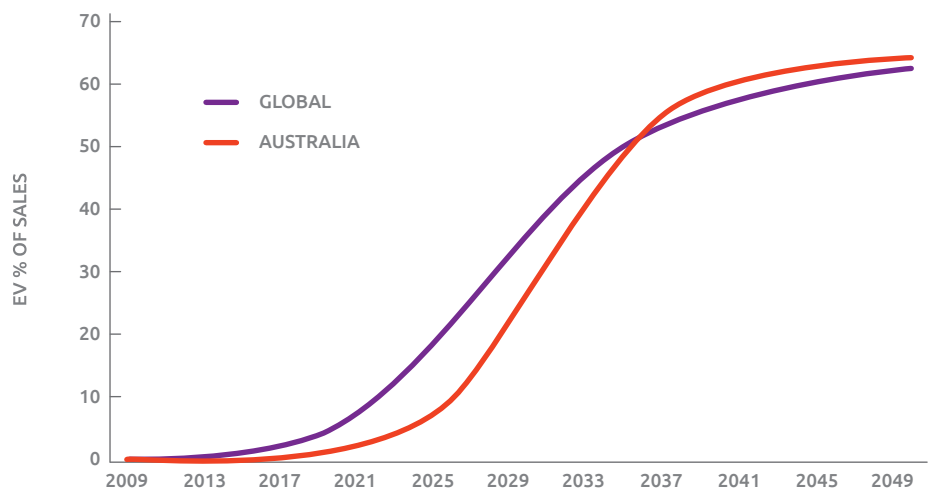
In 2013 Charles Darwin University installed a solar EV charging station, which is available to the public for recharging EVs free of charge. The solar charge station has six bays with six 15 amp charge outlets. There are also two 30 amp, 5 pin outlets that can be used to charge a vehicle to 80 per cent in two hours. A DC fast charger (which provided 80 per cent charge in one hour) was initially installed. However, the charger was severely affected by Darwin's climate and, with limited use, it became unviable to continually repair the fast charger. The University vehicle fleet currently includes a Nissan LEAF which was acquired in 2013.

The City of Darwin and Alice Springs Town Council have both previously investigated the potential for using EVs within their vehicle fleets, but neither Council has acquired an EV at this stage. However, Alice Springs Town Council has installed a publicly accessible EV charging point and the City of Darwin is investigating locations for charge points throughout the municipality.

Global EV growth⁴



Global and Australian predicted EV sales as a percentage of annual new passenger vehicle sales¹⁶



Top left: One of five electric trucks in operation at the Darwin Correctional Centre; bottom left: EasyMile EZ10 Driverless Bus Trial, Darwin; right: Charles Darwin University EV Charging Station

The policy context

Globally and within Australia, governments are introducing policies and programs to support the introduction of EVs. France and the United Kingdom have announced that they will end the sale of new diesel and petrol cars by 2040 and Norway and the Netherlands aim to do so by 2025.

In Australia, the Australian Government announced the development of a National EV Strategy in February 2019. A Low and Zero Emission Vehicle Working Group involving all jurisdictions has also been established through the Transport and Infrastructure Ministerial Council to develop an EV work program.

The Australian Government provides a discount on the luxury car tax threshold for low emission vehicles and is investigating the introduction of light vehicle CO₂ emission standards which could have implications for the uptake of EVs in Australia. Austroads, the peak organisation of Australasian road transport and traffic agencies, is proposing to coordinate guidance on EVs and charging facilities in relation to corridor management

and network operations and liaise with Standards Australia. The Clean Energy Finance Corporation is encouraging business, government and not-for-profit fleet buyers to choose low emissions vehicles through low interest loans.

National legislation planned for introduction will include new concessional import arrangements for vehicles meeting certain environmental criteria. With the replacement of the current *Motor Vehicle Standards Act 1989* with a new *Road Vehicle Standards Act*, import of new or near new electric vehicles not otherwise available in Australia will be allowed if the requirements of the Act are met. This will provide an alternative pathway for increased uptake of EVs.

At the state level, some jurisdictions have introduced specific policies to support the introduction of EVs including financial incentives, fleet initiatives and charging infrastructure programs. Queensland and the Australian Capital Territory have released EV Action Plans and South Australia has implemented a Low Emission Vehicle Strategy which includes EVs.

The New South Wales Government is trialling EVs in the State fleet and has released an Electric and Hybrid Vehicle Plan. As part of a Climate Change Action Plan the Tasmanian Government is establishing an EV working group and installing charging stations. Several jurisdictions, local councils and non-government organisations have signed a Memorandum of Understanding (MoU) for sub-national collaboration on EVs. The MoU aims to promote and accelerate the transition to EVs in Australia through coordination, information sharing and policy development.

The Northern Territory Government is committed to supporting EV uptake and this Discussion Paper is the first step in developing a framework for EV policy in the Northern Territory. EV policy development will need to align with other relevant Northern Territory policies and programs, both existing and in development, including the Roadmap to Renewables, development of a climate change strategy and the Digital Territory Strategy.



Left: Tesla charging station at Darwin Waterfront; Above: Solar panels at Naiyuu (Daly River) NT

Case Study: International EV Policy

Norway is a world leader in supporting EV uptake and has successfully introduced a range of EV policies and incentives which have resulted in 29 per cent of all new vehicle sales being EVs and three per cent of the total vehicle fleet³. In Norway, EVs are exempt from import and sales tax, registration, public parking and road toll fees and EVs can use bus lanes and vehicle ferries without charge. These financial incentives result in the cost of EVs being comparable to conventional vehicles. The Norwegian Government has also supported the installation of EV charging infrastructure with 7 500 charging points publicly available, including over 500 fast chargers⁵.



EV charging station on the streets of Norway (Photo: Knut Opeide, Norwegian Public Roads Administration)

Benefits of EVs



Have your say: "What elements do you think should be included in an EV Strategy for the Northern Territory?"

Reducing greenhouse gas emissions

Transport is responsible for 19 per cent of Australia's total greenhouse gas emissions and eight per cent of Northern Territory emissions⁶. The use of locally produced renewable energy for recharging EVs has significant potential to reduce transport greenhouse gas emissions. Although the manufacturing of EVs currently produces 15 per cent more emissions than that of fossil fuel vehicles, EVs potentially produce less emissions over the lifetime of the vehicle³. Research in Queensland has indicated that when charging an EV using Queensland's existing electricity grid mix, the operation of an average EV is responsible for approximately 25 per cent less emissions than an average fossil fuel vehicle³.

The electricity source used to charge EVs significantly impacts the emissions produced. In Australia, emissions per kilometre from EVs are the lowest in

Tasmania, where the majority of electricity is generated from renewable resources.

Analysis across all states and territories in Australia has indicated that an average EV charged from the grid in 2016 emitted less CO₂ than an average internal combustion engine vehicle in all states and territories except Victoria (where emissions were slightly higher from EVs due to fuel used to produce electricity)². Emissions from EVs charged completely from renewable sources are zero and implementation of the Northern Territory Government's Roadmap to Renewables and progression towards the 50 per cent renewables target potentially increases the environmental benefits of EVs in the Northern Territory.

Supporting renewable energy and electricity demand management

EVs can potentially assist in implementing the Northern

Territory's renewable energy target and managing electricity demand by charging vehicles at peak solar energy production during the day and lower energy demand periods during the middle of the day and at night.

Lower transport costs

Although purchase costs for new EVs are higher than conventional vehicles at present, this difference in price is expected to decrease rapidly with comparative prices predicted around 2025. Running costs of EVs are around 60 per cent to 90 per cent cheaper than fuel costs for a fossil fuel vehicle³ and with fewer moving parts, maintenance and servicing costs are lower. Electric commercial and freight vehicles could also reduce freight costs in urban areas.



Have your say: "What do you consider to be the benefits of EVs?"

Barriers to the uptake of EVs

Range anxiety

In the Northern Territory, distances between urban communities and regional centres are vast and 'range anxiety' is likely to be perceived as a major barrier to EV uptake. However, the range of EVs is rapidly increasing and will eventually be comparable to conventional vehicles. Northern Territorians drive on average 36 km a day⁷, which is easily within the range of current EVs. However, longer trips between major centres will require further investment in charging infrastructure. PHEVs which have a petrol or diesel tank to extend vehicle range for long trips may be an option for some Northern Territorians. Due to the lower costs of charging compared to refuelling, it is likely that PHEVs will mostly run on electricity for the majority of trips. Improving consumer knowledge and awareness will also assist in addressing concerns regarding range anxiety.

Charging infrastructure

There are three levels of EV chargers⁸:

Level 1 Any existing power point (10 amp) no specialised installation required.

Level 2 A 15 amp power point which will allow most electric cars to be fully recharged overnight and requires installation by an electrician. Typically installed in homes and at long stay destinations such as workplaces and shopping centres.

Level 3 A 55 amp power point which can provide approximately 80 per cent charge in 30 minutes and requires specialist installation.

The availability of public charging infrastructure is critical to EV uptake. International experience has demonstrated that the majority of EV charging occurs at home or the workplace where charging is

slow, but relatively easy to install³. However, user concerns about the availability of charging infrastructure away from home and for longer trips is a barrier to EV uptake. Although Norway has the highest proportion of rechargers, Estonia is credited as the first nation to build a country-wide network, with a recharging station every 50km on major roads, and a recharging facility in every town with a population of at least 5 000. Internationally, successful adoption of EVs has been dependant on the provision of an effective charging network.

Public charging infrastructure can include both slow and fast options. Slower public charging infrastructure is suitable for longer stay locations, where users may stay for a number of hours such as tourist destinations, public facilities or public transport hubs. Fast public charging infrastructure is required for longer distance trips between



EV Charging station at Darwin airport

cities and regional centres and easily accessible public charging infrastructure is essential to encouraging consumer confidence.

Considerations for public recharge stations include the need for standardised fittings, convenient payment options, minimal delay and prompt maintenance of faults. There have been issues internationally with subscriber only recharge networks and California has legislated to ensure that EV users are not forced to join a network.

Some countries have invested heavily in EV charging infrastructure, Japan now has 40 000 charge points which is more than the number of traditional service stations (less than 35 000)⁹. Charging infrastructure has been developed by both government and industry. In the UK, Shell has commenced installation of fast chargers at selected service stations and BP is also planning to provide EV chargers.

Car manufacturer, Tesla has installed an expanding network of fast chargers globally and in Australia.

The number of charging stations in Australia has substantially increased in the past year, with a 143 per cent increase between June 2018 and July 2019. As of July 2019 the total number of charging stations in Australia was 1930¹.

Queensland has invested in an 'Electric Super Highway', currently the longest electric fast charging highway in the world (in a single state) which connects the Gold Coast to Cairns and west from Brisbane to Toowoomba. In Western Australia, the Royal Automobile Club has installed 11 fast charging stations in the south-west and in New South Wales the NRMA is constructing 40 fast charging stations.

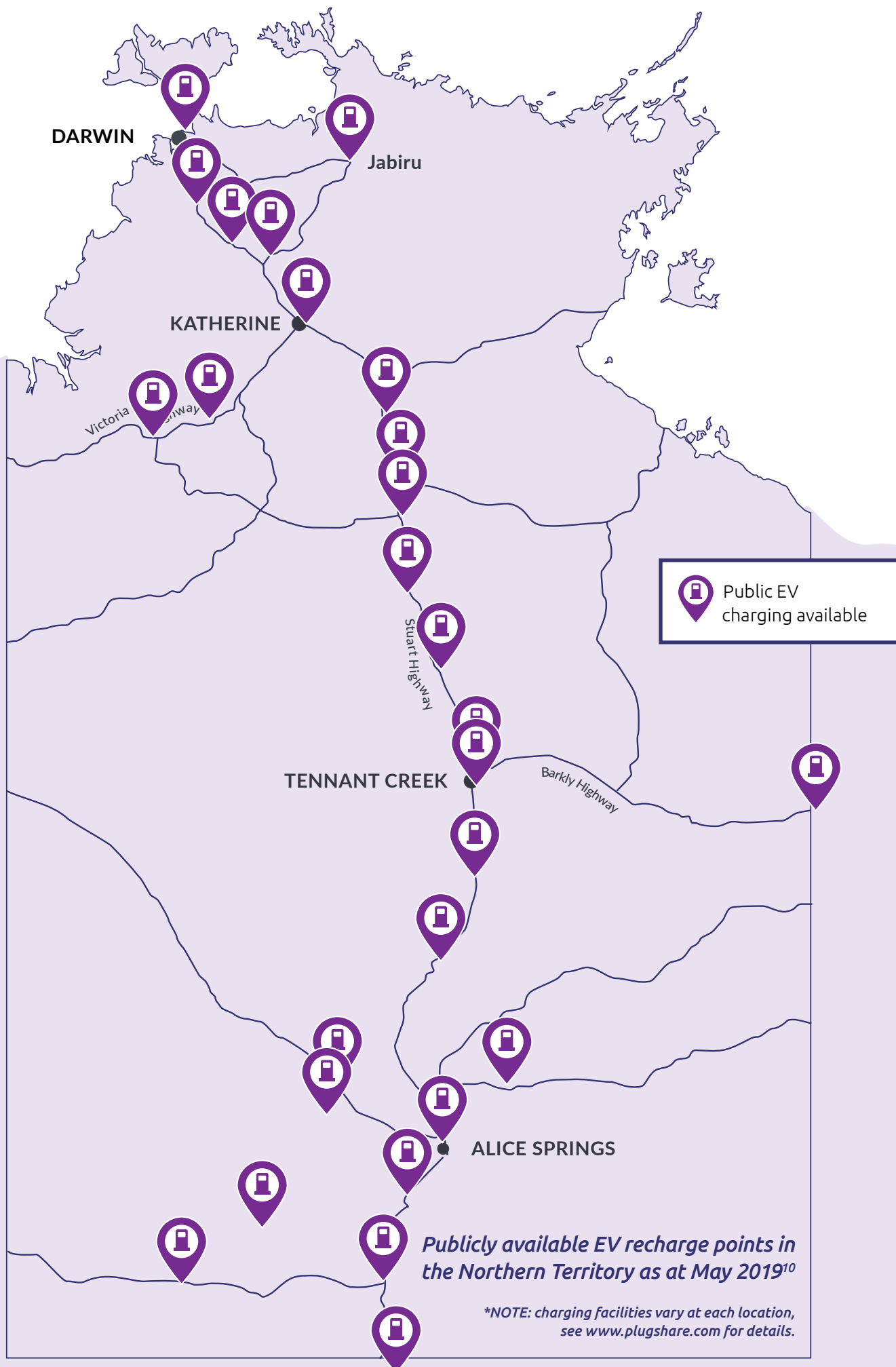
The Australian Renewable Energy Agency (ARENA) is financially

contributing to a project which will build an ultra-rapid charging network in south-eastern Australia and to the north and south of Perth. The network will be powered by purchased renewable energy, and at least one site in northern Victoria will trial an on-site solar and battery powered system. Charging sites will be public and compatible with all models of electric vehicles currently sold in Australia, with distances between chargers planned to be no greater than 200 kms.

Across the Northern Territory, the number of public charging points is increasing, with charging infrastructure being installed or made accessible by local businesses in regional centres and at tourist destinations. Most of these are slower public charging facilities and are suited to overnight stops for longer distance journeys.



EV Charging station in Queensland (Photos: Queensland Transport and Main Roads)



Publicly available charging points across the Northern Territory vary in capacity, sophistication and availability. Many of the charging points use existing power supplies located at tourist businesses such as caravan parks and roadhouses. Some businesses have installed recharging infrastructure specifically for EV charging. For example, Alice Springs Airport has recently installed solar powered EV charging facilities in the long stay car park.

EV charging at Mataranka



EV charging at Katherine





Case Study: EV-ready buildings and infrastructure

While the demand for EV recharging facilities is currently low in Darwin, the Northern Territory Government is planning ahead for future demand. The new underground State Square car park in Darwin will include EV charging stations as will the Manunda Place building on the corner of Knuckey and Cavenagh Streets.

In Australia and internationally, share charging systems are developing which provide a platform for private EV charging infrastructure to be booked and used by EV users for a fee (similar to the 'Airbnb' model)¹¹. These publicly accessible private charging locations will supplement the publicly available charging network.

Alice Springs Town Council has installed a publicly accessible solar charged EV charging point in the Council's staff car park and the City of Darwin is considering the installation of public EV charging points.

Tesla charging points are available at several locations across the Northern Territory, however they can only be used by Tesla vehicles.

Have your say: "Should the Northern Territory Government invest in public charging infrastructure, or should this be left to private industry to provide?"



Alice Springs Town Council EV charging station¹¹ (image ©Alice Springs Town Council)

EV charging costs

For domestic charging, a level 2 charging station provides increased charging speeds and enhanced safety features and can be connected to home smart or solar systems. The cost of a home charging station is around \$1 000 to \$2 500¹².

Single-port public EV charging station hardware costs range from \$2 000 to \$3 000 depending on the features and brand of the charger. Type 2 Socket systems are preferred for public charging as this allows open access to all EVs. Installation is the major component of public EV charger cost (60–80 per cent of the total). Car park and garage installations are simpler and more economic options for public EV chargers and cost around \$6 000. Kerbside and pedestal mounted stations can be more expensive to install than a car park EV charger due to additional trenching or boring costs. Connectivity for management and billing purposes add additional costs.

Level 3 or DC fast EV charging provides rapid recharge of EVs to around 80 per cent in 30 minutes. Hardware costs for a public DC EV charging station range between

\$40 000 to \$100 000 per charging station¹³. In addition to hardware, installation costs can also be high due to electrical supply upgrades and labour costs. Installation costs may range from between \$15 000 and \$60 000 depending on the specific nature of the project.

AS/NZS 3000:2007 Wiring Rules applies to the installation of multiple electric charging stations and a new standard AS/NZS 3000:2018 Section 7.9 Supplies for Electric Vehicles (currently NZ only) could be applied to the Northern Territory if required. Although there is currently no standard for the provision of charging infrastructure in Australia, there is industry led commitment to harmonise national EV charging standards. National guidelines for charging infrastructure are also in development.

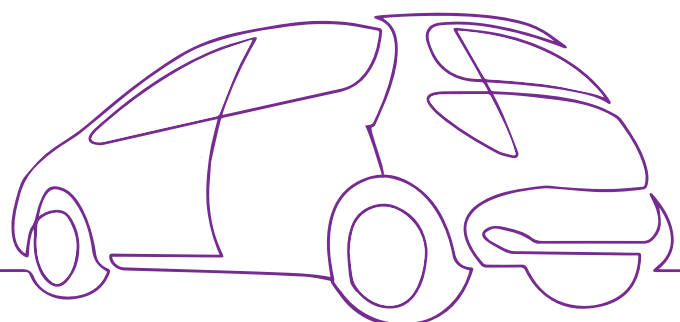
The scale of Queensland's investment in the Electric Super Highway has provided an opportunity to influence the standardisation of EV charging infrastructure. The charging stations

installed adopt the European Mennekes Type 2 connector for single and three phase AC charging, and a dual approach of European Combined Charging System (CCS) Type 2 and Japanese CHAdeMO connectors for fast DC charging.

Looking to the future, wireless EV charging technology is likely to increase charging efficiency, with conversion kits already commercially available. Publicly available wireless charging will become an option as wireless charging becomes a standard in EVs. Sweden has recently opened the world's first electrified road which recharges EVs as they drive on the road. About 2km of electric rail has been embedded in a public road near Stockholm with the electrified road divided into 50m sections and an individual section powered only when a vehicle is above it. A Perth based company is exploring how electrically conductive concrete could potentially enable wireless charging of EVs when parked or in motion.



Have your say: "Should the Northern Territory Government support EV uptake by providing grants for home and workplace charging infrastructure?"



Battery life

EV manufacturers generally provide a battery warranty for up to 10 years and it is expected that the current generation of batteries will maintain acceptable driving range for 10 plus years. When EV batteries have passed their useful EV life, battery cells can be removed and reused as home batteries or commercial stationary storage. These repurposed batteries can have another 10–15 years of life. Once battery cells can no longer be used for stationary energy storage, battery materials can be recycled to create new battery cells.

Vehicle costs

The high upfront cost of EVs is driven by the battery cost (up to one-third of the total cost of manufacturing an EV) and smaller manufacturing volumes³. However, the cost of EV batteries is continually reducing which is lowering the purchase price of EVs. In Australia, EVs are now available for around \$45 000. The cost of EVs is expected to continue to decrease with advances in battery technology and convergence on price between EVs and conventional vehicles is anticipated in Australia by 2025. Scale of production of EVs is also a barrier to EV cost reduction, however, as efficient scale of EV production is achieved in the 2020's, this is also expected to reduce the upfront cost of EVs.

Although initial EV purchase costs are currently high compared to conventional vehicles, running costs are potentially lower. The cost of charging an EV can vary depending on battery capacity, the cost of electricity at the time of charging

and the type of charging station used. However, as an indication, the average price for electricity in Australia is approximately \$0.25 per kWh, and it takes approximately 18kWh to travel 100km. Therefore to travel 100km the cost is approximately \$4.50. In comparison, the average petrol car in Australia uses 10.6 litres of fuel per 100km. At an average fuel cost of \$1.295 per litre of unleaded petrol, the cost to travel 100km is \$13.72¹³. While there are fuel savings for the consumer, there will be revenue implications for Government through reduced Commonwealth fuel excise, as the uptake of EVs increases. Given that fuel excise is the major revenue source for Commonwealth road funding, options for how EVs will be charged fairly for their use of the road network will need to be considered.

With far fewer moving parts, the costs of maintaining and servicing EVs are considerably less than conventional vehicles. However, as indicated in the graph on page 15, the resale value of EVs is lower compared to conventional vehicles. Rapid changes in technology and limited demand have resulted in EVs depreciating much faster than petrol, diesel and hybrid cars.

Consumer knowledge and awareness

A consumer survey of attitudes towards EV ownership carried out on behalf of the Electric Vehicle Council in 2019 provided responses

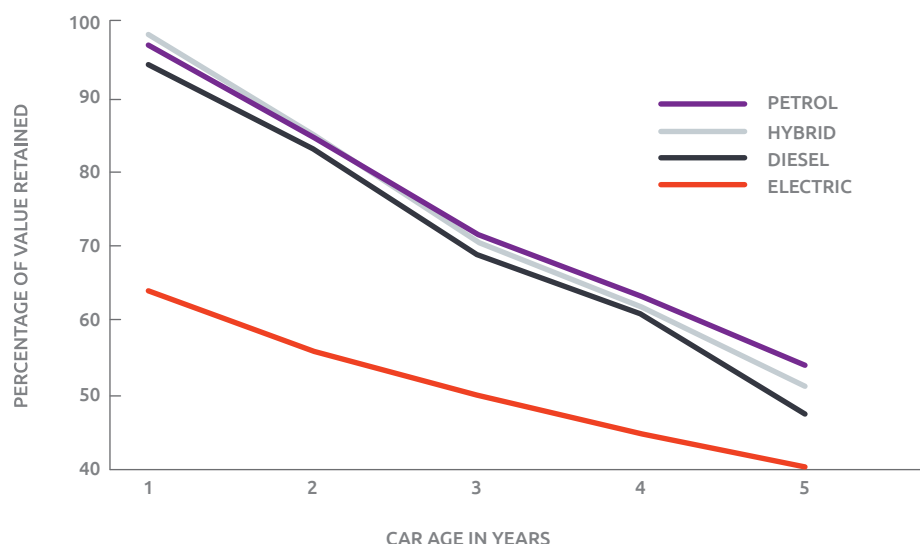
from 1939 people in New South Wales, Victoria and Queensland. The survey found that¹:

- 45 per cent of respondents indicated that they would consider buying an EV;
- 40 per cent of respondents said they would be willing to pay more for an EV, although 33 per cent of these indicated that they would only be willing to do so if there was more support, incentives and infrastructure in place;
- The primary concerns for consumers regarding EVs are range anxiety and purchase price with 73 per cent of respondents nominating concern about the distance travelled per charge and 71 per cent nominating the price of an EV compared to a petrol or diesel vehicle as a concern;
- When asked about the features which would most encourage them to buy an EV, 72 per cent indicated convenience of charging, 67 per cent indicated lower running and maintenance costs and 49 per cent indicated environmental benefits; and
- Provision of charging infrastructure, reducing the cost of EV purchase and reducing the cost of installing home charging were the top three government policies nominated by respondents to encourage the purchase of EVs.

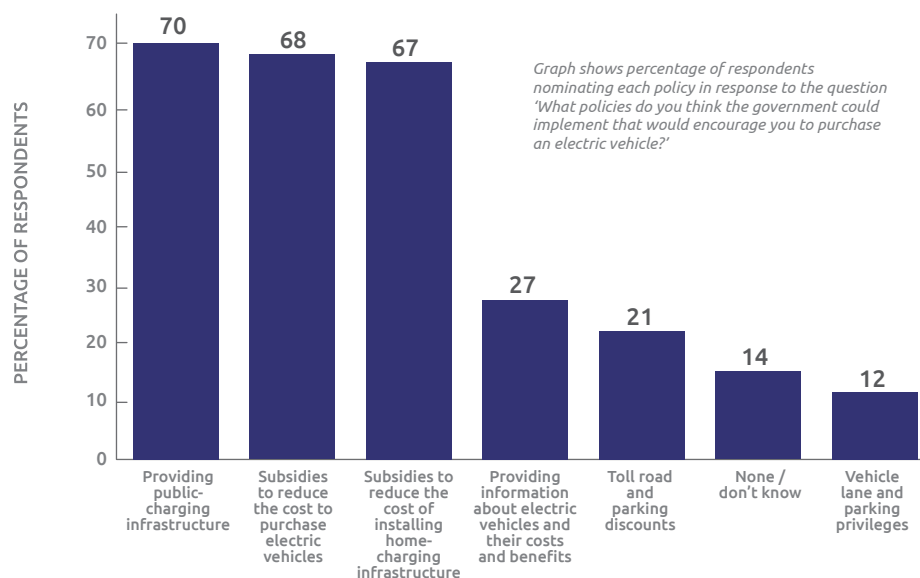


Have your say: "Do you have any comments on major barriers to EV uptake and how these can be overcome?"

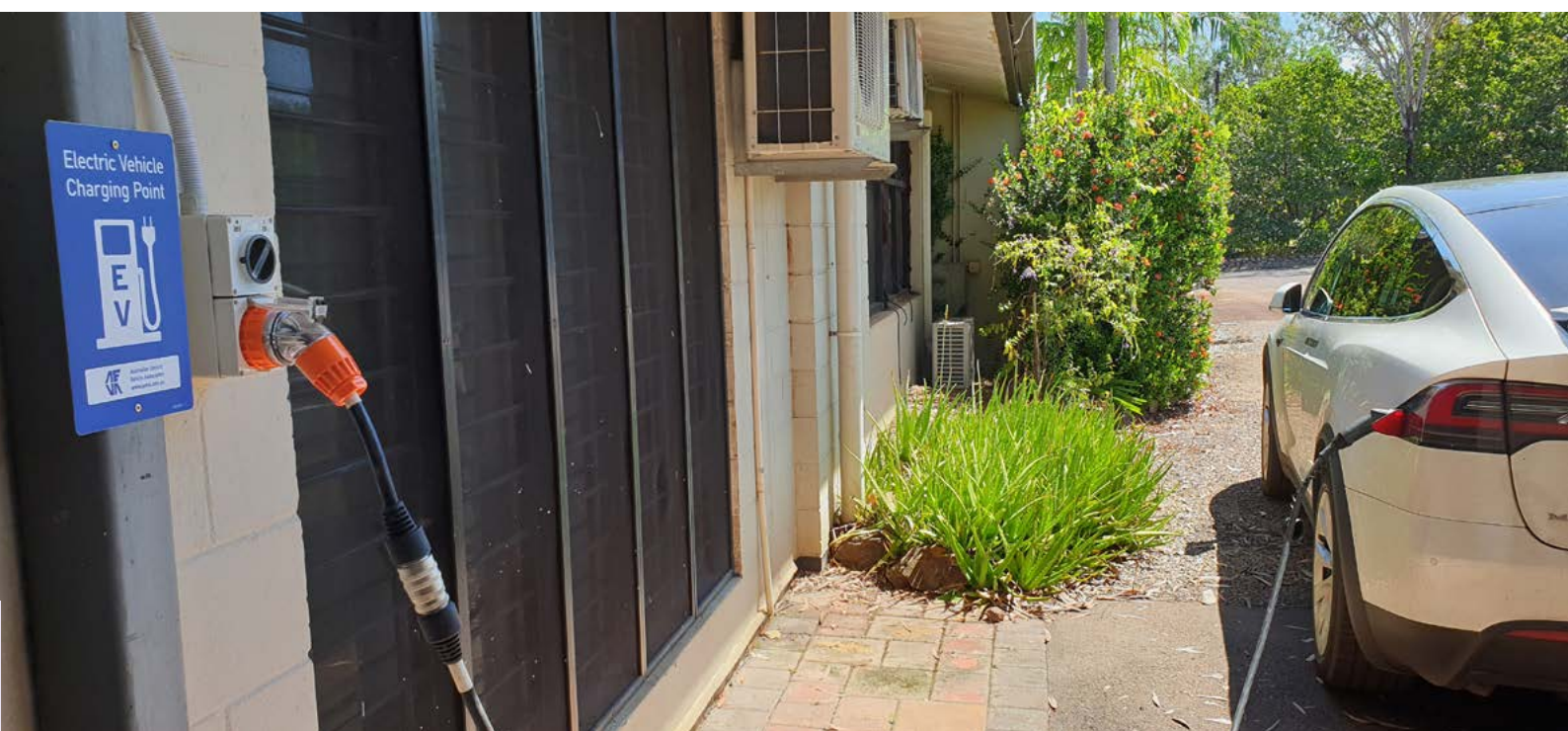
Percentage of value retained over first five years of a car's ownership (based on a car bought in 2012)¹⁴



Consumer perceptions of government policies to encourage the uptake of EVs¹.



EV Charging station at Emerald Springs



EV opportunities and issues for the Northern Territory

Small population

The Northern Territory is a small jurisdiction with a low population. As a result, in many policy areas, the Northern Territory is not in a position to lead change and be the first to adopt alternative technologies.

Australia represents only one per cent of the global car market and the Northern Territory, with only one per cent of Australia's population, has very limited capacity to influence the Australian car market. Any policies or programs implemented by the Northern Territory Government to encourage the uptake of EVs will have very limited impact in terms of the national fleet.

However, it could be easier for the Northern Territory's small urban populations to be serviced by a lower number of public charging facilities for example, providing an opportunity for the early uptake of EVs. Also, with a high mode share of private vehicles for the journey to work in Darwin and Alice Springs (in comparison to public transport for example), there could be potential for rapid uptake of EVs in urban areas and a significant change in the urban vehicle fleets in the Northern Territory.

Low demand for infrastructure

Given the Northern Territory's low population and other potential barriers to EV uptake, it is likely that there will be low demand for public EV charging infrastructure, at least initially.

Fuel costs

Urban populations may benefit from lower operational costs associated with EVs. However, EVs may not be an option for everyone or for longer trips in regional and remote communities. With potentially reduced demand for fuel due to EV uptake in urban areas, there could possibly be an increase in fuel costs for conventional vehicles in the longer term.

Climatic conditions

Extreme temperature ranges in Central Australia and high humidity and intensive rainfall in the tropics present unique challenges for EVs and charging infrastructure in the Northern Territory. Research into the impact of climate on EVs has indicated that although heat improves battery efficiency, high temperatures can degrade overall battery life span and output. Cold temperatures can also impact on battery performance. Temperature extremes require longer EV charging times and reduced efficiency and use of air conditioning has the potential to affect EV range.

However, there is potential for local innovation in this area. There has been initial private sector interest in establishing lithium-ion battery manufacturing facilities in Darwin, producing semi solid

state lithium-ion batteries uniquely optimised for warm climates.

In the same way that Central Australia is recognised as a unique road test environment for vehicle manufacturers, there is potential to position the Northern Territory as a specialised test environment for EVs and related technology.

In 2018, the first all-electric vehicle competed in the challenging Northern Territory Finke Desert Race. The vehicle was the first electric car to finish the Dakar Rally in 2017 and was fuelled by eight fast charging lithium battery modules and a 100W solar panel that powered the electric motor.

Local availability of expertise

With a limited market in the Northern Territory for EVs and highly specialised servicing and maintenance requirements, there is concern regarding the ability of local providers to service and maintain EVs and EV recharging facilities. However, local skills are likely to grow in response to demand and some servicing requirements can be undertaken remotely. There may be a need for training and/or licencing in the service and repair of EVs and the Northern Territory will need to liaise with other jurisdictions regarding this issue.



Have your say: "Are there other EV issues and opportunities for the Northern Territory?"

Case Study: Northern Territory Driverless Bus Trial – EV challenges in a hot and humid climate

During the 2017 Driverless Bus trial in Darwin, the air conditioning system in the EasyMile EZ10 bus placed a significant demand on the vehicle's battery, reducing vehicle operation time and increasing recharge times. The capacity of the air conditioning system was challenging during Darwin's wet season and although this issue can be addressed in the vehicle's design, any increase in air conditioning capacity results in increased demand on the battery. An evaluation of the project found that charging facilities need to be provided as close as possible to the vehicle's area of operation to maximise range and battery life. EasyMile gained a significant amount of learnings from the trial which have been incorporated into the design of a next generation vehicle. The Generation 2 vehicle has been equipped with an upgraded battery and air conditioning system which has been tested in comparative climates¹⁵.



Safety issues

There has been some recent media coverage of crashes involving EVs and the need for emergency services to be trained in accessing vehicles and dealing with potential battery fires, both on road and at charging sites. As new vehicles are introduced to the market, training material is made available by vehicle manufacturers for first responders and ongoing training will be required.

There have also been concerns raised about the low noise levels of EVs, particularly at speeds less than 25Km/h and potential impacts on pedestrian safety. The USA and EU are addressing these concerns by requiring all new EVs to emit noise at low speeds to improve pedestrian safety.

Power supply issues

Increased EV use will also increase demands on electricity supply. International experience from countries with relatively high levels of EV use has demonstrated that this has not been an issue at the large scale grid level. The key challenges have been at the local grid level, where infrastructure is not designed to accommodate sudden increases in power demand. However, issues with peak demand could be managed through pricing to encourage off

peak EV charging. EVs also have the potential to operate in a discharge mode, providing power back to the grid, effectively acting as battery storage and can assist in stabilising the grid in periods of peak demand. Power and Water Corporation is developing network strategies in response to developments in grid connected technology, power use and other emerging technologies, such as EVs, to accommodate future energy demand.



Have your say: "What are some of the short, medium and long term actions for government to explore to support the introduction of EVs in the Northern Territory?"

Renewable energy

The Northern Territory has considerable knowledge, capability and expertise in renewable energy technology, particularly within the Alice Springs region. Alice Springs has a national and international reputation for solar energy adoption and integration. As part of the Roadmap to Renewables, the Northern Territory Government has committed \$5 million in funding over three years for the Intyalheme Centre for Future Energy within Desert Knowledge Australia. The Centre provides opportunities to explore potential partnerships between EV and renewable energy technologies.

The Northern Territory Government vehicle fleet and public transport

NT Fleet is responsible for the management of the light and heavy vehicle fleet for the Northern Territory Government (with the

exception of the Northern Territory Police, Fire and Emergency Services). Although there have been earlier trials of EVs, there are currently no on-road EVs in the Northern Territory Government fleet. Several jurisdictions have implemented targets and/or trials of EVs within their fleets as a way of increasing awareness and encouraging the uptake of EVs. At present, the potential for EVs in government fleets is limited by the availability of EV models in Australia. However, new EV models are expected to be increasingly available. Policies to incorporate EVs into the Northern Territory Government fleet would also need to include installation of charging infrastructure at workplaces and consideration of PHEVs for regional areas where an extended vehicle range is required.

Several jurisdictions have implemented electric bus trials to reduce emissions from public transport fleets and increase awareness of EV technology.

Public bus services in the Northern Territory are provided by commercial operators, which includes the bus fleet. Currently all public buses in the Northern Territory are diesel and a move to electric buses could significantly reduce the emissions and noise generated by public buses. Although, the purchase cost of electric buses is currently significantly higher than diesel buses, vehicle running and maintenance costs are likely to be lower. Appropriate recharging infrastructure would also be required. The feasibility of including electric buses in the Northern Territory urban bus fleet could be investigated in preparation for future contracts with private operators. In the short term, there could be an option to trial the use of electric buses for special purposes, such as for tourist or other shorter trips.



Have your say: "Should the Northern Territory Government have an EV target for its vehicle fleet?"



Charging stations at Devils Marbles Hotel (left) and Alice Springs (above)

Registration and stamp duty

As with any new vehicle, there are a range of taxes and charges which add to the initial purchase costs of an EV. Import tax, GST, stamp duty and registration fees can contribute around \$10 000 to the cost of a \$40 000 vehicle. Some states and territories have reduced stamp duty and registration costs to encourage EV uptake with estimated savings on a \$60 000 EV ranging from \$660 in Queensland to \$2 110 in the Australian Capital Territory.

Registration fees

Whilst the Northern Territory does have a vehicle registration category specifically for EVs, it is similar to the registration fee for a small car with an engine size of 501-1000cc. Although the total annual registration fee is \$648.30, the registration component of this fee is only \$84.00 and the major cost is a contribution to the Motor Accidents Compensation Scheme (compulsory third party insurance). Policy options to reduce or remove the registration fees for EVs would therefore only have a limited impact on the total vehicle registration cost (refer to table below).

Stamp duty

In the Northern Territory, stamp duty is payable on the issue and transfer of a motor vehicle certificate of registration. Stamp duty is calculated at the rate of \$3 per \$100 of the purchase price or market value of the vehicle, so stamp duty on a vehicle costing \$40 000 would be \$1200. Proposals to reduce or remove stamp duty on EVs could represent a significant saving to consumers and encourage EV uptake. However, there would be a corresponding reduction in revenue for the Northern Territory Government.

EV tourism

Tourism is a cornerstone of the Northern Territory economy and the touring market is particularly important to the Northern Territory's regional centres. EV tourism is a potential growth area and several states have implemented charging

infrastructure in touring regions to support the growth of EV tourism. A recent study commissioned by the Queensland Government, found that EV based domestic tourism in Queensland could be worth up to \$234 million over the next decade (excluding international visitors)³.

In the Northern Territory, there have been proposals to install EV fast charging stations on the Stuart Highway to support EV tourism and there is evidence that local businesses are already responding to potential demand by installing publicly available charging stations. There could be potential to develop a signature EV drive, supported by charging infrastructure, on a key tourist route in the Northern Territory such as the Stuart Highway or the Arnhem Highway to Jabiru and Kakadu National Park. Infrastructure maintenance and unrestricted access to charging stations are key issues for consideration in developing charging networks.



Have your say: "Should the Northern Territory Government support the uptake of EVs through reduced stamp duty and vehicle registration costs?"



Have your say: "Do you think the Northern Territory Government should encourage EV tourism through public charging infrastructure or other initiatives? If so, where?"

EV registration cost breakdown

Registration	\$84.00
Motor Accidents Compensation (MAC)	\$552.30
Administration	\$12.00
Total	\$648.30

Breakdown of Northern Territory annual EV registration fees



Queensland EV Super Highway Network³



Above and left: EV charging station in Queensland (Photos: Queensland Transport and Main Roads)

Case Study: Queensland Electric Super Highway

The Queensland Electric Super Highway (QESH) is the showpiece action under The Future is Electric: Queensland's Electric Vehicle Strategy. The first phase of the QESH consisted of 17 fast-charging stations spanning from Coolangatta to Cairns and west from Brisbane to Toowoomba. The QESH was built in partnership with Yurika, an Energy Queensland business, local councils and other partners and is the world's longest EV super highway within a single state.

All energy used at the QESH is green energy, providing a carbon-neutral and pollutant free transport option. By the end of May 2019, use of the QESH had saved between 71 to 83 tonnes of CO₂ that would have been emitted if a vehicle had refuelled with either petrol or diesel fuel.

The establishment of the QESH network was an opportunity to not only reduce range anxiety by providing recharging infrastructure but to increase regional tourism by promoting low emission road-touring to many of Queensland's iconic tourist destinations.

The Queensland Government, through Future Proofing the Bruce, has committed a further \$2.5 million to build additional charging stations along the QESH. Planning for phase 2 is currently underway and it is expected that construction on the new sites will commence this year and be finalised by mid-2020.

How can the Northern Territory Government support and encourage the uptake of EVs?

There are a range of actions which the Northern Territory Government can consider to encourage EV uptake. These actions might focus on:

- planning and investigation
- vehicle costs
- range anxiety, charging and power supply
- skills and innovation; and
- consumer knowledge and awareness.

Have your say

The Northern Territory Government is developing an EV Strategy and Implementation Plan. This Discussion Paper has presented the benefits, barriers and opportunities for EVs in the Northern Territory. The Paper and associated consultation process are the first steps in the development of an EV Strategy.

Key questions are included throughout this Discussion Paper and responses to these questions are welcomed or additional issues can be raised for consideration. Submissions can be made online at haveyoursay.nt.gov.au/ via email to policy.transport@nt.gov.au or by post to Electric Vehicle Discussion Paper, GPO Box 2520, Darwin, NT 0801. Alternatively, if you would like to meet with us and share your views on any issues raised in this Discussion Paper or other issues regarding EVs, please contact us at policy.transport@nt.gov.au or (08) 8924 7965.

Next steps

- EV Discussion Paper released and consultation
- Review of feedback and development of draft EV Strategy and Implementation Plan for Northern Territory Government consideration
- Final EV Strategy and Implementation Plan released

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Published by the Department of Infrastructure, Planning and Logistics

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