Appendix 08

Electric Vehicle Charging Stations

Electric vehicles and charging infrastructure

Discussion paper
April 2018

HOBSONS BAY CITY COUNCIL

Acknowledgements

Council acknowledges the peoples of the Kulin Nation as the traditional owners of these municipal lands and waterways and pays respect to Elders past and present.

Council acknowledges the legal responsibility to comply with the Charter of Human Rights and Responsibilities Act 2006 and the Equal Opportunity Act 2010. The Charter is designed to protect the fundamental rights and freedoms of citizens. It gives legal protection to 20 fundamental human rights under four key values: freedom, respect, equality and dignity.

Council acknowledges all community members, community groups, businesses, Council advisory groups, transport operators, government agencies and other stakeholders who were involved in the development of the Integrated Transport Plan 2017-30.

The work of several contractors has also been used in the development of the Integrated Transport Plan 2017-30, including Hale Consulting, Australasian Centre for the Governance and Management of Urban Transport (GAMUT), MRCagney Pty. Ltd. and John Palermo Photography.

The Integrated Transport Plan 2017-30 is consistent with the Transport Integration Act 2010 and Council's responsibilities as a road authority under the Road Management Act 2004.

For further information, or to receive a copy of this document in an alternate format, contact

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August 2017

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Executive Summary

In mid-2017, Council requested submissions from the community for projects to be considered as part of its 2017-18 budget development process. One request was a feasibility study into the provision of public charging infrastructure for electric vehicles (EVs). In response, Council identified the need to produce a discussion paper that examines EVs and associated electric vehicle charging stations (EVCSs) as emerging technologies. This paper considers trends and forecasts in relation to technologies in Australia and overseas and provides advice and recommendations on the feasibility of the adoption of EVs and EVCS in Hobsons Bay.

Electric vehicles bring opportunities such as zero emissions at the exhaust pipe compared to fossil fuel based internal combustion engine vehicles leading to better local air quality and zero overall emissions if charged with renewable energy sources. There are also economic development opportunities as recent economic modelling from Pricewaterhouse Coopers (PwC) found that a supportive approach to EV adoption would lead to electric cars becoming 57 per cent of new car sales by 2030, accounting for 20.8 per cent of vehicles on the road. This would deliver a $2.9 billion benefit for the economy and lift net employment by 13,400. Drivers would save $1,700 per annum in ownership costs by 2030 if costs are considered over the life of the vehicle as EVs are cheaper to run than conventional vehicles as they can be charged at home and have lower maintenance costs as servicing is minimal.

Internationally EV sales are surging, making up 1.7 per cent of new car sales in key markets in 2017 (1.1 million vehicles), up from 1.1 per cent in 2016 (740,000 vehicles). Future growth is forecast by Bloomberg New Energy Finance's Electric Vehicle Outlook 2017 predicting that by 2040, 54 per cent of new car sales and 33 per cent of the global car fleet will be electric. In Australia, electric vehicle sales in 2017 were about 1.2 per cent of total vehicle sales (about 2200 plug-in vehicles) which represented a 60 per cent increase on 2016 sales.

Electric vehicles and other emerging technologies are a component of Council's recently adopted *Integrated Transport Plan 2017–30*. It is Council's intent to understand, support and prepare for new and emerging transport models and technologies. Encouraging electric vehicle adoption where and when it is suitable is relevant to a number of Council strategies, namely the *Community Greenhouse Strategy 2013-30* which identified that emissions from residential travel account for 10.7 per cent of total emissions and with no action this figure is estimated to increase to 13.9 per cent by 2030. Adopting a low carbon vehicle strategy that provides information, facilitates public charging points and identifies priority parking for low carbon vehicles is mentioned as one way of addressing this. Similarly Council identified in its *Corporate Greenhouse Strategy 2013–20* that undertaking an electric vehicle trial could be a comparatively low cost per tonne option for reducing emissions while building knowledge of the technology.

Many countries have considerable incentives to support EVs and have targets in place to phase out traditional fossil-fuel vehicles. In Australia, sales are reflective of current high

purchase prices as a consequence of the lack of any government support, a much more limited range of vehicles to choose from, and a lack of familiarity with the technology. Expansion of vehicle model choice over 2018-19, especially in the sub $60,000 category, is anticipated to lead to an uptake in sales growth giving Council an opportunity to embrace EVs. While limited in some aspects the charging network is also starting to expand with support from manufacturers, state governments and others. Gaps still exist for local and regional charging for local journeys to work, shopping and tourism destinations which also provide an opportunity for Council to provide leadership and a service in this space.

Key recommendations of this discussion paper include:

That Council:

1. Develop a commercial model with strategic partners to encourage the installation of destination and workplace charging on the basis of environmental, economic and social benefits, including investigating the expansion of the Energy$mart program to provide subsidies to businesses for EVCS.

2. Continue to advocate to the Victorian and Australian Governments to support the adoption of EVCS through direct and indirect incentives as well as the promotion of the benefits of the technology.

3. Develop an EVCS policy directive in upcoming ESD policies to support the promotion of local EVCS and ensure a coordinated and consistent approach to the provision of EVCS for Council and the community.

4. Trial an electric vehicle with a view to including it in the Council car fleet and install a publically available EVCS at the Hobsons Bay Civic Centre to promote access to the community.

5. Undertake a trial of EVCS at key locations across each of the three wards in the municipality and investigate combining this with a trial of SmartPoles.

Introduction to electric vehicles

Electric vehicles describe a variety of different but related technologies using an electric drive to power, or assist in the powering of, a vehicle[1]. For the purposes of this paper, EVs will refer to cars where electric energy is stored in rechargeable batteries and sourced from an external plug-in system as these require additional associated infrastructure to operate effectively. The following technologies meet this criteria:

- battery electric vehicles (BEVs) use an electric motor and a battery pack and rely entirely on an external electricity source
- plug-in hybrid electric vehicles (PHEVs) combine both a battery pack chargeable from an external power source and electric motor with an internal combustion engine. The PHEVs feature battery packs smaller than BEVs which are generally used to only drive the wheels at low speeds or for a limited range, with the internal combustion engine powering the vehicle when the battery is depleted or when extra power is required
- extended range electric vehicles (E-REVs) combines a battery, electric drive motor and a regular combustion engine. The electric motor also drives the wheels with the ICE acting as a generator for the battery when it is depleted

Electric vehicles contrast to conventional hybrids which use electricity to help drive the wheels but do not need to be plugged into the mains and can only generate electricity through regenerative braking. Alternative fuel vehicles include hydrogen fuel cell vehicles (FCVs) that use hydrogen and oxygen, and gas vehicles that use liquid petroleum gas or compressed natural gas.

Electric vehicle batteries differ in terms of capacity, number and composition. The driving range that electric vehicles can travel before their battery is depleted is an important characteristic of electric vehicles. In the past it was a barrier to many purchasing EVs as the range of a popular model, the 2016 Nissan Leaf (30 kWh battery) was approximately 172 km. Newer models feature an increased driving range due to improvements in battery technology. For example, the 2018 Nissan Leaf features a 400km driving range. This highlights the rapid transformation that is occurring in the electric vehicle sector.

The EVs offer benefits in terms of zero emissions at the tailpipe compared to fossil fuel based internal combustion engine vehicles leading to better local air quality and zero overall emissions if charged with renewable energy sources. They are cheaper to run than conventional vehicles as servicing is minimal and fuel costs are cheaper as they can be charged at home.

EV sales and forecasts

The sale of EVs in Australia are low by international standards but are growing. In 2017 Australians purchased approximately 2184 electric vehicles (this includes an estimate for

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/3986/plug-in-vehicle-infrastructure-strategy.pdf

Tesla which does not publically release sales figures[2]) which is approximately 1.2 per cent of total vehicle sales, as shown in Figure 1. This represents a 60 per cent increase on 2016 sales when a total of 1369 EVs were sold including 701 plug-in hybrid electric vehicles and 668 battery electric vehicles[3]. The general trend of EVs sales is erratic however with 2015 beating the previous record sales year with 1771 registrations.

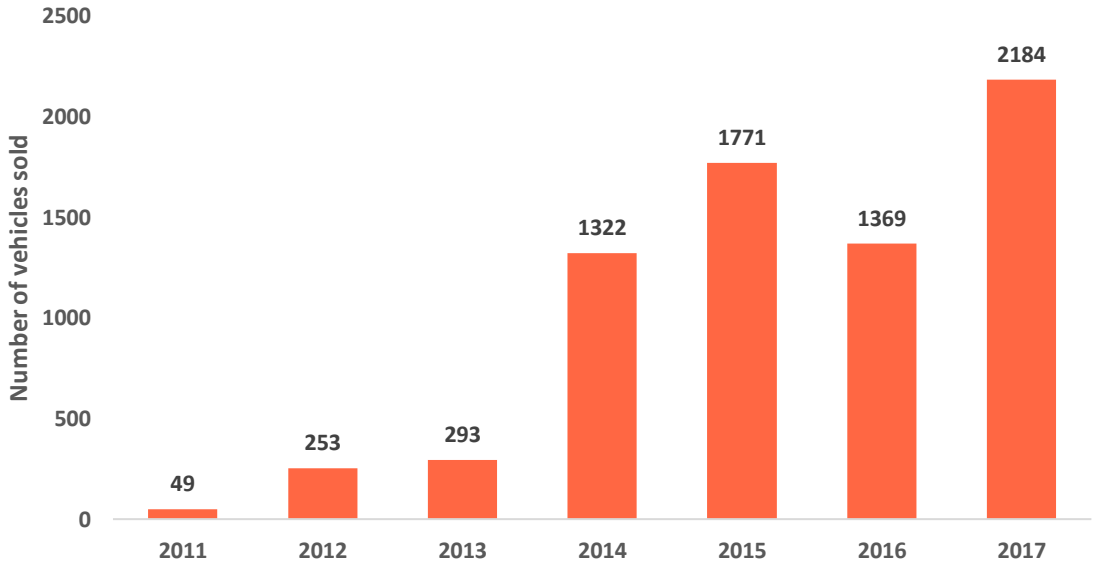

Figure 1. Electric vehicle sales in Australia, 2011-2017
Source. The State of Electric Vehicles 2017[1]. 2017 sales include numbers from Go Auto (1124 EVs)[1] plus an estimate for Tesla sales[1]

Forecasts for future EV sales in Australia vary widely. The Australian Energy Market Operator examines EV sales within the National Electricity Market (NEM) and in 2017 forecast them to reach 276,800 vehicles per annum by 2036 or 27.1 per cent of sales under the most likely scenario in the National Electricity Forecasting Report's (NEFR)[4]. As a result, total electric vehicles would reach over 2.85 million by 2036 or 17.7 per cent of vehicles by 2036. A 2018 update to this forecast now estimates that there will be 10 million EVs in Australia by 2037 representing more than half the current small car fleet of 18.8 million vehicles with an average of 500,000 sales a year between now and then[5]. A report from Energeia[6] (a research and environmental advisory specialist) estimates that by 2022, EV's will represent 7.7 per cent of the new car market, with a fleet of 2.2 million vehicles by 2030.

[2] https://www.wheelsmag.com.au/news/industry/1706/revealed-tesla%E2%80%99s-secret-sales-numbers
[3] The State of Electric vehicles in Australia, Climate Works & Electric vehicle Council, 2017: http://electricvehiclecouncil.com.au/wp-content/uploads/2015/05/State-of-EVs-in-Australia-2017.compressed.pdf
[4] https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEFR/2016/AEMO-insights_EV_24-Aug.pdf
[5] https://reneweconomy.com.au/aemo-just-doubled-forecast-ev-uptake-australia-66789/
[6] http://energeia.com.au/wp-content/uploads/2014/02/Shifting-Gears-The-Australian-Electric-Vehicle-Market-to-2030.pdf

Globally, electric vehicles sales are much stronger than in Australia and are rapidly expanding. According to Macquarie Bank[7], in 2017 in the key markets of China, the US, Europe, Japan and Canada, electric vehicles accounted for 1.7 per cent of new sales, up from 1.1 per cent in 2016. In terms of numbers, this represents 1.1 million vehicles, up from 740,000 in 2016, representing an increase of 51 per cent. Model range is much larger in these markets due to local production, government incentives and vehicle manufacturer strategies which target larger markets.

International forecasts of EV sales vary widely but are also generally more upbeat in relation to the uptake of the technology than local estimates. Bloomberg New Energy Finance's Electric Vehicle Outlook 2017[8] predicts that by 2040, 54 per cent of new car sales and 33 per cent of the global car fleet will be electric. The falling price of batteries will also bring price-competitive electric vehicles to all major passenger and light-duty vehicle segments before 2030.

Key findings

- EVs make use of an electric drive to power a vehicle and are charged from external energy sources, as such this paper does not include conventional hybrid vehicles under this definition
- EV sales of EVs in Australia are currently low with 2184 sold in 2017 (or 1.2 per cent of total vehicle sales), although this represents a 60 per cent jump over the previous year
- the total number of EVs in Australia is forecast to reach 10 million by 2037 representing more than half the current small car fleet of 18.8 million vehicles with an average of 500,000 sales a year between now and then
- international sales and forecasts are significantly higher than in Australia

Electric vehicle charging stations (EVCS)

Charging an EV requires a plug connecting the vehicle and battery to an electrical outlet and can take a number of hours to recharge, although the time taken depends on a number of factors such as the speed of the charger, the vehicles battery capacity current and the state of charge of the vehicle's battery.

The EVCSs can range from an adaptor to use a simple wall-socket to recharge at home overnight all the way to a sophisticated rapid charger located at a freeway service centres which can recharge a battery to 80 per cent in 20-30 minutes. Charger power is generally spoken about in terms of kilowatts (kW) and time to charge is rated in terms of range per hour (RPH) or the approximate number of kilometres for one hour of charge. For simplicity sake charging power and speed is also sometime referred to by levels 1 to 3. To compare charging power, speed and range per hour, Table 1 below provides a summary.

[7] https://www.businessinsider.com.au/the-rapid-growth-in-global-electric-vehicle-sales-in-4-charts-2018-1
[8] https://about.bnef.com/electric-vehicle-outlook/

Electric vehicles themselves also vary in terms of their battery capacity with larger batteries obviously taking longer to charge. The rate at which an EV can accept charge from a charger is also variable on how charged the vehicle battery already is and also hardware constraints with some vehicles not designed to take rapid charge for example. There are also a number of different types of EV connector cords which vary by manufacturer in a similar way to mobile phone charging cables.

Table 1. Electric Vehicle Charger Speeds

Level	Charger power (kW)	Charger speed (time to recharge)	Range per hour (RPH)	Info
1	2.3 kW	12+ hours	7.5-15km	Standard electrical power points suitable when long charging times are available e.g. overnight.
2	3.5 – 22 kW	3.5kW, c. 10 hours; 7kW c. 6 hours; 22kW, 2 hours	18-40km	Requires expert installation and robust equipment due to faster charging speeds and higher heat generation. Higher speeds are suited to workplace or destinations such as shopping centres or fast home charging.
3	50kW+	20-30 mins to 80% charge	70km/10 minutes	Require specific EV units and upgrades to services as chargers require more power than a house. Recommended for highways or to allow quick charges on longer trips.

Charging infrastructure operating models

The variance of charging times and speeds means that certain types of charging infrastructure is more suited to certain locations and uses. According to Economic Development Queensland's *Planning for Electric Vehicles (EVs): How Queensland is charging ahead*[9] the majority of electric vehicle charging will take place at home, with smaller amounts done at the workplace and destination chargers. Only three to five per cent of charging is likely to take place at Level 3 chargers where an 80 per cent charge can be attained in a short period. This presentation provides more information on the suitability of

[9] http://renewablecities.com.au/wordpress/wp-content/uploads/2017/06/10.00-11.15am-Day-2-Michael-Kane-EDQ-EV-Planning-Presentation.pdf

charging infrastructure to different application and a summary of the findings in are outlined in Table 2.

Table 2. Explanation of charging infrastructure categories

Where EVs are charged	Charger power	Ideal locations	Activities enabled
Inter-regional	50kW+ DC fast chargers	Convenient locations	Long distance travel
Destination	7 – 22kW chargers	Tourist destinations, shopping centres	Widespread travel and EV Tourism
Workplace	7 – 22kW chargers	Park 'n' rides, workplaces	Complete EV ecosystem
Home	2.3 – 2kW chargers	Off-street parking	Better grid utilisation

Charging at home maximises long charging times that are generally available overnight which means that only slow charging speeds are required. Overnight charging also coincides with off-peak energy prices with some retailers such as AGL offering competitive charging rates for EVs, currently $1 per day. Charging can also be done using standard power sockets and an adaptor but it is generally recommended that dedicated home and workplace charging is installed for convenience, faster speeds and other benefits. For those without access to off-street parking, charging is difficult as relying on a public charging network can be inconvenient and expensive. Dedicated residential EVCS would require overcoming legal issues of crossing a title boundary with an electrical sub circuit and tripping hazards as well as needing separate metering to enable use to be attributed to specific users which is also expensive although charging technology with in-built metering is starting to become available.

Medium-speed public charging infrastructure, or destination charging, is suited to locations where drivers will spend at least a few hours charging. This form of charging can occur in the workplace or can promote widespread travel and tourism by EV drivers as it addresses concerns of range anxiety. It is commonly used by shopping centres, tourist operators to encourage longer visits and retail to highlight their green credentials, provide a point of difference to consumers. Local governments have started to provide this type of charging infrastructure for these very reasons. Charging outlets may be owned by the site owner/occupant, or may be supplied under a service provision agreement by the EV charging service provider. This form of charging infrastructure can generally be cost recovered to an extent with some operators charging a flag fall fee and a per kilowatt hour fee.

Rapid DC charging for inter-regional transport is useful where EVs need to travel beyond their available battery range in a relatively short period of time e.g. travel between Melbourne and Adelaide. As such charging using such infrastructure is relatively uncommon accounting for only three to five per cent of charging, generally sited in locations accessible to highways such as service centres and rest areas. The high cost of installation and electricity provision generally means that such systems are focused on cost recovery and run by EV charging service providers, fuel retailers and other large commercial entities. Rapid charging can also be used economically by business operators that undertake long duty cycles such as a delivery service that requires top-ups over the course of a delivery.

EVCS infrastructure in Australia

According to a Climate Works report, *The State of Electric Vehicles*[10] there are 476 dedicated electric vehicle charging stations around Australia as at June 2017. Of these 134 were in Victoria and 78 in Melbourne; 127 were Level 1 or 2 chargers while only seven were Level 3 DC rapid chargers.

Due to a lack of overarching and consistent policy at all levels of government, current charging infrastructure is patchy and not necessarily well planned in terms of the type of infrastructure required and the demand. Various groups have installed charging infrastructure, mostly in the form of rapid charging to facilitate longer distance by EVs. Manufacturers such as Tesla have installed 358 destination chargers and 19 DC supercharger locations in and between major cities servicing their customer base. Motoring bodies such as NSW's NRMA is in the process of identifying location for a $10 million investment that will deliver at least 40 chargers. Western Australia's RAC has a network servicing Perth and the South West (owned and maintained by local governments) which provides public access through the ChargeStar network which charges a fee to access the service.

[10] The State of Electric vehicles in Australia, Climate Works & Electric vehicle Council, 2017: http://electricvehiclecouncil.com.au/wp-content/uploads/2015/05/State-of-EVs-in-Australia-2017.compressed.pdf

Figure 2 Figure 3. Current locations of charging points in Melbourne and surrounding areas
Source: Electric Vehicle Council http://electricvehiclecouncil.com.au/charger-guide/ (accessed 26/03/2018)

Case study: Moreland City Council

Moreland City Council was part in the Victorian Electric Vehicle Trial conducted by the Department of Transport in 2011 which covered the cost of installation of chargers for use by the council and the public with Council currently subsidising the costs of electricity[11]. As part of the trial they installed two Level 2 and one Level 3 fast charge station at Council offices as well as five level 2 recharge stations throughout the municipality for use by the general public (currently provided free of charge), and one private facility at Council's depot. The EVCSs are currently maintained through an agreement with ChargePoint for an annual flat rate of $1,400 per annum for seven chargers. Utilisation of EVCS was 8,800 charging events over five years from four Council owned EVs and public utilisation. Since this time their council fleet has grown to four EVs and public EV ownership and EVCS use would potentially have increased.

Case study: City of Adelaide

In late 2017 Adelaide City Council, as part of the Carbon Neutral Adelaide Partnership with the Government of South Australia and fully funded by Mitsubishi have installed 19 electric charge points free to use for two months following installation[12]. The council is also offering residents and businesses up to 50 per cent

[11] http://www.moreland.vic.gov.au/globalassets/areas/esd/esd-electric-vehicle-ev-feasibility-study-august-2014
[12] https://www.caradvice.com.au/588168/mitsubishi-rolls-out-ev-charging-stations-in-adelaide-cbd/

of the cost or $5,000 per plug / socket to install their own charging points. Include consultation info get in touch for installation, what did they do, costs, utilisation.

Case study: Queensland Government

Scheduled for completion in early 2018, the Queensland Government in partnership with Energy Queensland is rolling out a network of fast chargers which allows electric vehicle drivers to travel the 1,800 km between Cairns and the Gold Coast and from Brisbane to Toowoomba[13]. The network is being installed in convenient, safe locations close to major highways where there are existing amenities such as cafes, restaurants and shops and is free for the first 12 months. All electricity used is from green energy credits and offsets.

Key findings

- there is a variance in relation to the power, speed and range provided per hour of EVCS
- most EV drivers will charge at home, some drivers will charge at work and other destinations and fast charging will generally only be required when undertaking long-distance journeys
- the type of EVCS installed should be closely matched to the activities it is enabling and the time available to charge
- the current network of charging infrastructure is patchy due to a lack of an overarching framework or clear planning outcomes
- in the absence of good planning, a number of providers are delivering charging networks to support their own vehicle specifications
- some local councils have installed charge points while manufacturers, State Governments and motoring bodies are focused on creating longer distance charging networks

Strategic context and alignment with policy

Australian and Victorian Governments

The Australian Government does not currently have an overarching EVs policy framework. There exists a discount on the luxury car tax for EVs liable to it, however this only benefits more expensive electric vehicles and so also provides an inadequate incentive.

The Victorian Government also lacks a policy on EVs and EVCSs although since 2010 Victorians who register a hybrid or electric vehicle are eligible for discounts of $100 per year off the vehicle registration fee. The Parliament of Victoria is however currently undertaking an Inquiry into EVs which Council has provided a submission on. The focus of the inquiry is on the potential benefits to the environment of the widespread uptake of electric vehicles in Victoria; the regulatory, infrastructure, economic, employment and incentive options for

[13] https://www.qld.gov.au/transport/projects/electricvehicles/super-highway

supporting the uptake of privately owned electric vehicles; the applicability of electric vehicles in public transport bus fleets and public sector fleets; and options for supporting the manufacture and assembly of electric vehicles in Victoria, including the transition of workers and suppliers affected by the closure of vehicle manufacturing in Victoria; and the applicability of electric vehicles to the car share providers market. The findings from this inquiry have been delayed several times and was due for release in late March 2018, although this has now been pushed back until May 2018.

Other states and territories provide varying discounts on stamp duty and registration for electric vehicles but generally the amount is insignificant and does not provide a substantial incentive. The Australian Capital Territory Government, which already has the highest electric vehicle market share of any state or territory, has announced a comprehensive policy requiring the following[14][15]:

- at least 50 per cent of all newly leased fleet passenger vehicles to be zero emissions vehicles in 2019–20 where fit for purpose with this requirement increasing to 100 per cent by 2020
- all new multi-unit and mixed-use developments to install vehicle charging infrastructure
- a review of parking and traffic regulations to ensure that priorities offered to zero emission vehicles can be enforced; and provide specific zero emissions vehicle number plates for easy identification and enforcement of zero emissions vehicles related regulations (e.g. ensuring only zero emissions vehicles park and charge in allocated spaces for vehicle charging).

Council will continue to advocate to the Victorian and Australian Governments to support the adoption of EVCSs through direct and indirect incentives as well as the promotion of the benefits of the technology.

[14] http://www.environment.act.gov.au/__data/assets/pdf_file/0012/1188498/2018-21-ACTs-transition-to-zero-emissions-vehicles-Action-Plan-ACCESS.pdf

[15] https://reneweconomy.com.au/act-takes-lead-on-evs-all-new-government-cars-to-be-zero-emissions-78922/

Hobsons Bay City Council

Hobsons Bay City Council has adopted a number of strategies relevant to EVs adoption and by consequence EVCSs, namely:

- *Community Greenhouse Strategy 2013-30*
- *Corporate Greenhouse Strategy 2013–20*
- *Hobsons Bay 2030 Community Vision*
- *Integrated Transport Plan 2017–30*

Council's adopted *Community Greenhouse Strategy 2013-30* identifies how Council can achieve a zero net emission community. Current figures for emissions from residential travel account for 10.7 per cent of the community's total emissions and with no action this figure is estimated to increase up to 13.9 per cent of the total by 2030. Adopting a low carbon vehicle strategy (Program 3.3.9) is mentioned in the strategy as one way of addressing this 'by providing information, facilitating public charging points and priority parking for low carbon vehicles.'

Promoting EVs adoption is in accordance with the *Hobsons Bay 2030 Community Vision.* Promoting the installation of EVs charging infrastructure demonstrates that Council is activating sustainable practices in accordance with Priority 5 by showing leadership in the area and demonstrating the positive impact the technology will have on delivering a range of outcomes. A priority outcome of the consultation for this vision was the provision of a cleaner and less polluted Hobsons Bay which would be aided by fewer local vehicle emissions and the associated health impacts.

The *Corporate Greenhouse Strategy 2013-20* outlines a pathway for Council's goal of achieving zero net greenhouse gas emissions by 2020 target. An electric vehicle trial is discussed as an abatement strategy which would reduce Council's fleet emissions at a cost of $137 per tonne, emissions reduction potential of 27 tCO_2-e/year at a capital cost of $417,236 or $52,154 per year. Installation of EVCS would be required as part of this trial enable efficient use of the fleet by providing the opportunity to recharge overnight and when not in use.

The recently adopted *Integrated Transport Plan* 2017–30 also supports action on EVs and EVCS. The regional goal: 'Convenient, safe and sustainable connections between neighbourhoods and to regional destinations will generate more efficient movement of people and goods, attracting and providing links to jobs, services, industry and recreational activities' includes strategic direction 4 which commits Council to understand, support and prepare for new and emerging transport models and technologies (this includes car share, electric bikes, electric vehicles).

Key findings

- in the absence of a consistent or overarching strategy in relation to EVs or EVCS, different jurisdictions within Australia are progressing with a range of strategies and are having some success

- adopting and promoting EVs and facilitating public charging points is in line with a number of Council policies that provide sustainability, transport and health outcomes. These include:
    - *Community Greenhouse Strategy 2013-30*
    - *Corporate Greenhouse Strategy 2013–20*
    - *Hobsons Bay 2030 Community Vision*
    - *Integrated Transport Plan 2017–30*

Discussion - Electric vehicles

Model availability and cost and consumer preference

Model availability and cost is an important factor and is something that will improve in the future. While the number of electric vehicle models in Australia has steadily increased over the last six years, the majority of the growth has been in the more expensive models, with 13 of the 16 models available in 2016 priced at more than $60,000. By 2019 there should be eight EVs priced below $50,000. These include; the Mitsubishi Outlander, Renault Zoe and e-NV200, Hyundai Ioniq Electric and Plug-in Hybrid, Hyundai Kona, Nissan Leaf and the Tesla Model 3. The premium market segment will also grow with new entrants such as the Jaguar I-Pace SUV and models from Range Rover and Volvo.

Consumer preference is also a potential issue for increased EVs uptake, with Australians showing preference for Sport Utility Vehicles (SUVs) and other utility vehicles such as 'utes'. While there are no electric utility vehicles currently on the market, a number of electric SUVs are scheduled to be released in the short term including the affordable Hyundai Kona. Vehicle preferences aside there is still a large portion of the market that can be electrified in the compact and mid-sized market.

Government incentives and tax breaks have been very important in driving EVs uptake overseas. In the UK there is strong support for reducing the purchase price of EVs with grants of up to 35 per cent of the purchase price, up to a maximum of £4,500. Norway has an ambitious CO_2 emissions target for new vehicles; 85 g/km by 2020 compared to the EU-wide target of 95 g/km by 2020 and Australia where the average new internal combustion engine vehicle emits ~ 185g CO_2/Km. Norway exempts electric vehicles from levied taxes, road tolls, parking costs and provides free charging at public charging stations and access to special lanes to optimise journey times. As a result, the cost of purchasing an EV for private use in Norway is lower than a comparable conventional car and the indirect incentives such as special lane access is estimated at approximately $3,400 (~16,000 kroner) per year for an electric vehicle owner.

Many vehicle manufacturers are strongly advocating in support of an electric vehicle future. Volvo announced that every one of its cars launched from 2019 would have an electric motor, marking an end to reliance on the internal combustion engine. Similarly, Jaguar Land Rover has pledged that every new model will be electric from 2020. The Volkswagen Group,

Daimler Group and BMW Group have committed investments in excess of $75 billion to develop electric cars. Volkswagen, the world's largest car maker, declared that it intends on being the largest electric vehicle maker by 2025. General Motors intends to launch at least 20 new all-electric models by 2023. Ford Motor Co. announced it would invest $4.5 billion into electric vehicle manufacturing, and introduce 13 new models over the next five years. With Australia no longer involved with commercial vehicle manufacturing, we are fully reliant on importing vehicles and also to international trends. With such a significant emphasis on electrification worldwide, it is important that we plan and prepare for an expanded electric vehicle fleet in Australia.

Technology

Electric vehicle technology is rapidly evolving and so obsolescence of technology is a relevant consideration. For example, the first mass market EVs on sale in Australia, the Mitsubishi i-MiEV, had a 16 kWh battery delivering a 100 km range on the US EPA cycle (which represents real-world rather than lab-testing range). Compare this to the Tesla Model 3 that will soon reach the Australian market. Whilst at a similar price point, the specifications for the new Tesla are a much improved 350 km from a 50 kWh battery.

Fuel Cell Vehicles (FCVs) are also being promoted as an alternative to conventional fossil-fuel vehicles and use hydrogen, LNG or CNG as fuel. FCVs could be seen as competition to EVs but are less mature as a technology, and not widely manufactured or sold. Refuelling for FCVs ranges from three to five minutes with a full tank of fuel giving a range of up to 550km. Risks for FCVs are similar to EVs such as: higher purchase costs compared to ICEVs; lack of infrastructure; and little or no policy framework. For heavy vehicles, including buses and trucks, FCV is a well proven technology and is well suited for longer range applications.

Economic development

Recent economic modelling from Pricewaterhouse Coopers produced with support from Electric Vehicle Council, NRMA, St Baker Energy Innovation Fund titles *Recharging the economy*[16] has found that adopting the Norwegian approach to supporting EV adoption, as outlined in the earlier section, would have a number of benefits. This approach would enable 57 per cent of new car sales to be electric by 2030, accounting for 20.8 per cent of vehicles on the road. The report found that it would deliver a $2.9 billion benefit for the economy by 2030 and lift net employment by 13,400. Drivers would save $1,700 per annum in ownership costs by 2030 if costs are considered over the life of the vehicle through lower maintenance and reduced fuel costs.

Electric vehicles, their owners and EVCSs can also be thought about in terms of their ability to add to the local economy. EVCSs can act as a tourist and retail attractors and due to the profile of initial EVs owners, this could mean higher local spending. Rorke and Inbakaran (2009)[17] identified those most likely to be early adopters based on international experience

[16] http://electricvehiclecouncil.com.au/wp-content/uploads/2015/05/Recharging-the-economy.pdf
[17] http://atrf.info/papers/2009/2009_Rorke_Inbakaran.pdf

were people with higher weekly incomes, ownership of two or more vehicles, broadband internet connection and bachelor degree or higher. Strategically located destination charging can be used to support existing tourist and retail destinations, encourage longer visits as vehicles charge and also act as a point of difference to competitors.

Clean air and reduced emissions

Australia's transport sector represents the third highest source of emissions, contributing to 17 per cent of total emissions in 2017 according to data from the Department of the Environment and Energy[18]. Transport emissions are projected to rise by five per cent to 2020 despite overall emission falling. The zero exhaust emissions of EVs at the tailpipe represents one way to reduce these emissions if charged using renewable energy sources. This is especially important as a large proportion of Victoria's electricity is generated from brown coal. EVs can also preferentially charge at times of high levels of renewables and so can assist in balancing the grid[19].

Internationally, some countries are strongly encouraging a shift away from fossil fuel-based cars due to air quality and emission concerns. Seven countries have already committed to banning such vehicles by 2040 including The Netherland, Norway (by 2025), India, China, France, Germany and the UK. These countries are also among the strongest in terms of providing incentives to encourage the take up of EVs which have proven to be very successful in some cases.

EVs also represent a great opportunity to improve local air quality, which is of increasing concern overseas. Within Hobsons Bay this should also be considered due to the large number of diesel heavy vehicles associated with freight movements and heavy industry, those most associated with poor air quality, within the council area. Additionally the City of Maribyrnong's incoming truck ban and the West Gate Tunnel project will result in poorer air quality. The combination of these two projects combined with population increases and the high level of car dependency within Hobsons Bay support the need to enhance the adoption of electric vehicles, given their potential for zero emissions at the tail pipe.

Driver behaviour

Electric Vehicles represent a significant behavioural shift for drivers. Drivers will need to become familiar with plugging in a vehicle to charge at home as required and may have concerns about running out of charge and not being able to undertake long distance trips (a phenomenon known as range anxiety). Many of these concerns may prove to be unfounded as the Australian Bureau of Statistics data for the 12 months prior to 30 June 2016 show that the average Victorian only travels 40km per day. A similar study in Sydney found fewer than 10 per cent of cars travel more than 100 km per day[20]. As almost all Australians live in cities, and our cars travel short distances in traffic this would mean that most households

[18] https://www.environment.gov.au/system/files/resources/eb62f30f-3e0f-4bfa-bb7a-c87818160fcf/files/australia-emissions-projections-2017.pdf
[19] https://theconversation.com/how-electric-cars-can-help-save-the-grid-73914
[20] http://theconversation.com/dont-wait-for-electric-vehicle-infrastructure-you-probably-dont-need-it-9958

would easily be able to undertake daily travel with an average EV and would only need to recharge their EV once a week even with a buffer included. Charging at home overnight is also a way of addressing this in a convenient way and taking advantage of off-peak electricity tariffs. Early experience in the UK and Japan has shown that while EV owners value public charging infrastructure, most charging is done overnight at home. The reality is while rapid charging plays a vital role in facilitating longer distance travel i.e. between cities, the vast majority of Australians will rarely need them.

The PHEVs can enhance fuel economy in relation to combustion engine vehicles if they are regularly charged to maximise the benefit of the small batteries that are included. However they can also be driven without ever charging the battery, something that will return below average fuel economy but which may happen if charge point access is an issue.

Key findings:

- there are a number of barriers to the uptake of EVs in Australia including; model availability, high cost of the vehicles, consumer preference and lack of awareness, and lack of public charging infrastructure
- many countries have announced future bans for fossil-fuel fuelled vehicles to address air quality concerns. These countries are also actively supporting EVs as an alternative. Most vehicle manufacturers have committed to expanding their offering of electric vehicles
- sales are anticipated to rise as more affordable vehicles reach the Australian market with eight models priced below $50,000 expected to be available by the end of 2019
- EVs produce zero emissions at the exhaust pipe and the lack of combustion engine also means better local air quality
- economic development opportunities from ramping up support for EVs could lead to electric cars being 57 per cent of new car sales by 2030, accounting for 20.8 per cent of vehicles on the road and delivering a $2.9 billion benefit for the economy and lifting net employment by 13,400. Drivers would save $1,700 per annum in ownership costs by 2030 as fuel is cheaper and servicing is minimal
- while EVs will require some behavioural change to make charging a regular behaviour, data indicates that the average driver will only have to charge every few days or only on longer trips
- technology is rapidly evolving but vehicles now come with much longer driving ranges making them more useful for more applications

Discussion - Electric vehicle charging stations

Cost of installation

The cost of installing EVCS is highly variable due to the many factors at play in terms of hardware and site selection. As such it makes it difficult to provide an estimate of costs. Many existing installations in Australia have been supported by commercial partners or through government support.

The Victorian Electric Vehicle Trial Mid-term Report[21] found that establishment costs for brownfield sites often greatly exceed that of the charger unit itself. Costs estimates were found to be at least $23,750 where the distance between the charger and the electrical supply is about 50 metres and electrical supply upgrades are not required, with a summary in Table 3. This highlights the need for thorough site works being undertaken in advance to reduce costs and undertaking installation when other upgrades are being undertaken. Electricity network configuration can lead to increased installation costs if there is a need for an upgrade to the local network to cover increased loads. Close collaboration with electricity network operators in the early stages can lower risk of delays, extra costs and poor project outcomes. Suppliers have indicated that EVCSs have lifespans of up to five years which should be factored into cost and replacement plans.

Table 3 EVCS establishment costs

Item	Minimum Cost (AUD$)
Site preparation	$2,000
Trenching	$10,000
Pipe, pits, conduit	$1,000
Cabling and pull-through	$250
Distribution board	$1,500
Slab, mounting and installation	$5,000
Termination and commissioning	$1,000
Total	$23,750

[21] http://pandora.nla.gov.au/pan/141186/20130618-1013/www.transport.vic.gov.au/__data/assets/pdf_file/0011/92666/Electric-Vehicle-trial-mid-term-report.pdf

Chargers themselves are relatively inexpensive and have drastically reduced in price. Research on previous councils that have installed EVCS as well as a scan of EVCS installers provides the following indicative costs.

Example 1:

Mornington Peninsula Shire was involved with a previous Victorian EV Trial and chose to upgrade an existing EVCS to ensure compatibility with newer models. The cost of doing so was $4,300 for the charging Garo unit (2x 16A sockets) and limited site works and installation. Costs were low as trenching and cabling was pre-existing due to a previous installation.

Example 2:

E-station is a provider of low cost charge points. Their eBasic wall mounted type 2 charging station for indoor or outdoor use is $850 wired up to either single phase power (7kw) or three phase power (22 kW) speeds. Their eVOLVE Smart Bollard mounted charging station with two sockets which would provide an indicative costs for the specification of charger that council might consider is $4,990 offering the same charging speeds but with more advanced features such as in-built communication to allow billing, error diagnostics and user management.

Example 3:

Rapid DC chargers meanwhile range in price from $40,000 – $100,000 per station plus highly variable installation costs ranging from $15,000 depending on specific projects. However, this type of EVCS provides speed well in excess of what Council might consider for fleet or public use.

Operating models

Additional costs to council after installation of EVCS is dependent upon the delivery and operational model chosen such as whether council chooses to engage a third party to manage EVCS or charge for access to EVCS and electricity. Ongoing monitoring (for maintenance) and user management (billing and utilisation) of EVCSs can be contracted out and is a valuable service to identify levels of usage and provide quick feedback on faults so they can repaired. Moreland City Council has an agreement with ChargePoint for the maintenance of their six EVCSs for an annual flat rate of $1,400 per annum. Based on overseas experience, ownership of the EVCSs and responsibility for fixing faults would remain with council.

In terms of cost to access EVCSs and electricity there are arguments for and against. Providers such as the City of Adelaide and City of Geelong offer free charging for the first hour and then a charge per kWh, depending on whether it's a peak or non-peak rates. Others such as Moreland City Council provide free charging and view the provision of EVCSs as providing a public service and sustainable leadership to promote the technology.

Cost to Council for providing EVCs and ongoing management could be lowered and de-risked by partnering with commercial entities such as a shopping centre of tourism destination that would have an interest in destination charging. Altona Gate Shopping Centre has been approached about sustainability initiatives and is considering EVCSs as part of their future planning. Likewise Victoria Museum's Scienceworks would also be a potential partner due to its profile and visitation levels. Council currently provides support to businesses in the form of access to trusted suppliers and subsidies of up to $5,000 to install energy efficient lighting, solar panels and batteries as part of the Energy$mart program. There is scope to expand this program to cover subsidies for EVCSs where there would also be public benefit or where it would facilitate EVCSs by multiple business users.

Based on the above costs to install and operate, provision of dedicated residential charging would be prohibitive. Additionally there are no existing examples in Australia of providing such a service and whilst there are some examples overseas this is using new technology[22] and has been with financial support from higher levels of government.

Technology

Charge station obsolescence is a possibility as new technologies emerge that supersede or become incompatible with older EV models. Similar to EVs themselves, charging technology has rapidly progressed with maximum speed increasing from an average of around 50kW to 350kW. In California, USA a rapid rollout of first generation chargers around the year 2000 has recently been upgraded to today's standard at a cost of $1.9 million USD. Looking forward there is continuing research into wireless charging technology for EVs however this remains in its early stages and is still overcoming issues of price, speed and energy efficiency. Additionally it is not currently a standard feature and it is likely to be a number of years before this technology develops into a significant portion of the market.

Case study: Smart poles

Smart poles are emerging as a key infrastructure feature in urban areas. Smart poles are multifunctional units that can include: energy-efficient, automated LED lighting technology, wi-fi (to a range of about 100m), CCTV, audio speakers for public announcements, projection, banner arms and electric vehicle charging stations[23]. Smart poles have been installed at locations around Australia including: The University of Wollongong, Darling Harbour in Sydney and Robina Shopping Centre, Gold Coast.

Blacktown City Council, has finalised an agreement with infrastructure group ENE-HUB to install 10 smart poles with charging points on local streets as well as in car parks and shopping centres[24]. EV drivers will be able to charge their cars for free at

[22] https://www.ubitricity.com/en/charging-solutiona/b2b-smart-cities/
[23] http://ene-hub.com/ene-hub-smart-city
[24] http://www.afr.com/business/infrastructure/roads/sydneys-blacktown-leads-with-smart-poles-to-charge-electric-cars-20170817-gxyi8l

the poles which will also provide Wi-Fi and LED street lighting for three years, but will then be asked to pay. The council is paying a one-off contribution of $30,000 to the project and enter into a 15-year licence agreement with ENE-HUB.

Smart poles provide a potential option for Council providing EVCS at strategic locations when undertaking renewal works. Council has recently advocated to the Victorian Government to financially support the installation of Smart Poles in collaboration with local governments. As Smart Poles include other functionality it is likely that any EVCS would be located in high traffic areas such as Pier Street, Altona or Williamstown.

To ensure maximum benefits the following should be considered before committing to this technology and deciding upon locations:

- Smart Poles featuring EVCS are located in areas of high traffic where there is demand
- EVCS are clearly signposted and there are suitable parking restriction to ensure high levels of utilisation
- EVCS are easily accessible while unlikely to be a tripping hazard once connected to an EV
- charging socket type and speed are of the right specification for the majority of users

Energy demand

Charging electric vehicles requires a considerable amount of energy although it is important to contextualise this energy use. According to US DOE's Office of Energy Efficiency & Renewable Energy[25], annual energy consumption for charging a Nissan Leaf to cover a typical household average driving habits and consumption rates would consume 2,800 kW-hrs. This is just over twice as much as a refrigerator but much less than electric home heating (11,300 kW-hrs) and water heating (4,700 kW-hrs).

At the national level Australian Energy Market Operator (AEMO) Insights Paper: Electric Vehicles[26] found that the 20-year impact of electric vehicles on energy consumption is projected to be small, adding almost four per cent to 2035–36 projections for electricity use in Australia. This would not significantly add to the total energy consumption as the increasing installation of solar PV and energy efficiencies are already leading to reductions. The demand for energy from an EVCS can be reduced through increased energy efficiencies, smart-grid networks and distributed electricity generation which are not considered as part of this paper but are part of Council's total energy reduction strategies.

[25] https://energy.gov/eere/vehicles/articles/fact-994-september-11-2017-electric-vehicle-charging-consumes-less-energy

[26] https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEFR/2016/AEMO-insights_EV_24-Aug.pdf

International examples

In the UK there is strong support for reducing the purchase price of EVs with grants of up to 35 per cent of the purchase price, up to a maximum of £4,500. There is also strong support to ensure there is an adequate charging network with grants available through the UK's Office for Low Emission (OLEV), a national funding body, to assist with the cost of installing charge points at home, at work and to local government to provide on-street residential charging to constituents who do not have off-street parking. On-street residential charging for residents is facilitated by local governments who are able to apply for matched funding from OLEV to install on-street chargers. Local governments can choose how they fund and operate these chargers but many opt to partner with an EV charging service provider that can maintain a charge point, manage customers and advertise it as part of their network. Due to these initiatives, the UK has a well-developed charging network with public charging points in 5,495 locations, with 15,798 connectors available within these devices. Of these, 1,001 locations have a rapid public charging point installed with 3,289 connectors available.

Key findings

- the cost of installing EVCS is highly variable due to the many factors at play in terms of hardware and site selection although costs are rapidly reducing with the EVCS itself often a minor component of the total cost once expenses such as trenching are considered. Comprehensive site works and installation when other works are being undertaken can reduce costs
- it is not advised that council provide rapid EVCS or dedicated EVCS due to cost considerations or provision by other market providers
- technology change is a worthwhile consideration due to rapid changes in the field. There are opportunities and examples of retrofitting and updating technology as it advances meaning that this risk shouldn't necessarily discourage installation.
- charging of electric vehicles will increase energy demand however the Australian Energy Market Operator estimates that in 2035–36 it will only increase total usage by four per cent

Council policy

Whilst electric vehicles and associated charging infrastructure is strategically aligned with current Council policy it is highly relevant to future policies currently under development including:

- Environmentally Sustainable Design Policy for Council Buildings and Infrastructure
- ESD Policy
- Climate Change Adaptation Plan Refresh

Environmentally Sustainable Design (ESD) Policy for Council Buildings and Infrastructure

Currently under development this policy will outline Council's position on the ESD requirements to be achieved in the planning, design, construction, operation and

management of Council buildings and surrounding assets. Consideration should be given to sustainable transport and in particular to encourage the use of low and zero-emission transport including innovative parking solutions that facilitate their use and consider future needs and new transport trends and technologies. In terms of design charging points for electric vehicles and bicycles should be considered, with energy to be provided from renewable sources either on council assets or externally supplied.

ESD Policy

Currently under development this policy will provide guidance on how sustainable transport is considered and facilitated in Council and local planning provisions. Consideration should be given to inclusion of the following:

- provision of suitable EVCS at service station developments
- provision of EVCS in the workplace charging in new developments
- provision of EVCS in new urban developments, especially where there are shared parking areas where provision by the resident would be problematic. This could take the form of minimum provision requirements in shared and guest parking in multi-unit developments, dwellings with no off-street parking and those with car stackers
- provision of adequate excess capacity in electrical infrastructure in new developments to allow expansion of EVCS in the future

EVCS Policy Directive

A new policy directive to existing policies with regards to EVCS should be considered to ensure there is a coordinated and consistent approach to EVCS provision across Council. This should borrow from The ACT's Transition to Zero Emissions Vehicles Action Plan 2018–21[27]. The selection of EVCS sites and design is of critical importance to the effectiveness of the infrastructure. For example the Ausgrid Smart Grid Smart City[28] initiative suggested basic criteria for charge point sites including; 24/7 accessible, dedicated parking bays and adequate lighting and surveillance. Appropriate signage and compliance to ensure that designated parking spots for EV charging are used for the purpose of EV charging has also been highlighted in local studies[29].

Consideration should be given to the following:

- guidelines for appropriate site selection including technical feasibility, anticipated usage
- Council position on providing on-street parking for residents and if so under what circumstances.

[27] http://www.environment.act.gov.au/__data/assets/pdf_file/0012/1188498/2018-21-ACTs-transition-to-zero-emissions-vehicles-Action-Plan-ACCESS.pdf
[28] https://www.aemc.gov.au/sites/default/files/content/f3e5478e-b08a-4215-817a-fda9ff29ded1/Ausgrid-Attachment-nbsp%3B-received-8-November-2011.pdf
[29] https://www.tweed.nsw.gov.au/Controls/Meetings/Documents/21%20Attach%202%20[CNR-CM]%20Power%20up%20-%20Northern%20Rivers%20Electric%20Vehicle%20Strategy.pdf

- design guidelines to ensure consideration of accessibility, compliance, signage, compatibility with vehicle charging hardware, lighting and surveillance
- cost profile of preferred designs and hardware and contracting of user charging, payment and reporting to third party EVCS operators
- guidelines of operating and cost-sharing models with partners and cost and charging structure
- maintenance requirements
- energy sourcing requirements e.g. renewal energy and on-site generation where possible

Development of this policy consideration should also keep track of the Inquiry into EVs that the Parliament of Victoria currently being undertaken, to ensure alignment with recommendations.

Council EVCS and SmartPole Trial

The electric vehicle market is growing and there exists a gap in the provision of EVCS in the Hobsons Bay area which Council could be involved with managing through a trial combined with evaluation. Based on research within this paper it is recommended that Council could be involved with providing level 2 destination charging at strategic locations and facilitate other partners in providing similar infrastructure.

To provide leadership in sustainability and respond to Council's target of zero net emissions by 2020, the installation of an EVCS at the Hobsons Bay Civic Centre would provide an opportunity to trial an electric vehicle as part of Council's fleet with a view to increase the adoption of electric vehicles. This supports the upcoming behavioural change work that is being undertaken as part of the Corporate Greenhouse Strategy 2013-2020 and the Target 2265 emissions reduction plan that focusses on the management and use of Council's fleet.

Council is also currently examining SmartPole technology with a view to installing some of the technology as a trial and should investigate installing EVCS as part of this to reduce separate site works and costs which are the most expensive component of EVCS installation. As SmartPoles can include other functionality such as lighting, CCTC and wi-fi, discussion with relevant partners within Council and externally such as Victoria Police and VicRoads would need to take place. Such discussions would also be important to the siting of SmartPoles and the signposting and parking restriction for efficient EVCS use.

It is proposed that a three year trial could be undertaken, combined with that of the SmartPole trial with an associated promotion and advocacy campaign and yearly evaluation of use and feedback. Specific locations could be adjacent to Hobsons Bay Visitor Centre in Williamstown which receives almost 42,000 visits annually and is located near to a number of other attractions such as Seaworks Maritime Precinct which attracts more than 100,000 visitors a year, Williamstown Historical Museum, Melbourne Seaplanes, The Enterprize and HMAS Castlemaine. An EVCS in the vicinity would be highly visible, promote EV tourism and

encourage visitors to these attractions to stay for longer periods while their vehicle charges. A SmartPole EVCS near Altona Beach would leverage its position as one of the few accessible beaches in Melbourne's west serving a catchment approaching 900,000 and located near to a popular local shopping strip. The upcoming Aviation Road level crossing removal provides a significant opportunity to install an EVCS, potentially in conjunction with a SmartPole as the highest cost associated with EVCS installation is the construction works associated with trenching.

Council can also play a lead role in facilitating others to install EVCS, potentially through the Energy$mart program. Altona Gate Shopping Centre, a subregional shopping centre with 109,914 residents in the Total Trade Area has recently expressed interest in installing an EVCS. The centre is strategically located to service the community of Hobsons Bay and the traffic from the M1 Freeway and competitors to this centre such as Stockland's Point Cook have already installed EVCSs. Victoria Museum's Scienceworks is another potential partner where EVCS installation would be in alignment. The museum currently attracts 500,000 visitors a year and an EVCS could act as an educational tool and exhibit, encourage visitation by a broader demographic and facilitate electrification of their fleet.

A core component of EVCS installation should include an annual evaluation process to determine:

- usage, issues (such as maintenance, access to the station) and feedback on location, design
- requirement for installation or removal of more EVCSs
- cost and convenience to determine whether or not the service attracts or deters usage

Conclusion

The EV and associated EVCS market in Australia remains in its early stages but is poised for rapid growth. By 2019 there should be eight EVs available in Australia from a range of established manufacturers priced below $50,000 which is considered the point at which they will be affordable to a wider demographic. Internationally in 2017 in the key markets of China, the US, Europe, Japan and Canada, electric vehicles accounted for 1.7 per cent of new sales, up from 1.1 per cent in 2016. In terms of numbers of vehicles, this represents 1.1 million vehicles, up from 740,000 in 2016, representing an increase of 51 per cent. Many vehicle manufacturers are also strongly advocating in support of an electric vehicle future with some such as Volvo announcing that every one of its cars launched from 2019 would have an electric motor. Against this background the AEMO is forecasting 10 million EVs in Australia by 2037 representing more than half the current small car fleet of 18.8 million vehicles.

Electric vehicles would bring with them well documented environmental benefits through reduced greenhouse gas emission and air pollutants. In addition recent modelling by PwC found a more supportive government policy and infrastructure environment to EVs could

deliver a $2.9 billion benefit for the economy by 2030 and lift net employment by 13,400 with drivers saving $1,700 per annum in ownership costs through lower maintenance and fuel costs. EVs are also strategically aligned with a number of Council policies that provide sustainability, transport and health outcomes including:

- Community Greenhouse Strategy 2013-30
- Corporate Greenhouse Strategy 2013–20
- Hobsons Bay 2030 Community Vision
- Integrated Transport Plan 2017–30

The current EVCS network remains underdeveloped to deal with increased EV numbers and to act as an enabler rather than a barrier to EV adoption. Hobson Bay is no exception with not a single public EVCS in the municipality. A current a lack of legislative and funding support by State and federal Government has made strong commitments by local governments difficult but many stakeholders are now taking the challenge into their own hands. Manufacturers such as Tesla have installed hundreds of EVCS providing links between capital cities while the Queensland Government and motoring bodies such as NSW's NRMA and WA's RAC are doing the same.

Hobsons Bay City Council should position itself as a proponent of electric vehicles and a facilitator of EVCS. Overseas precedents suggest that local government can have a role in residential and destination charging but that rapid charging is best left to commercial operators who can bear the high installation costs and achieve full cost recovery. Well placed destination EVCS can be viewed as an economic attractor to wealthier EV owners and to encourage them to stay longer while charging. Local provision of EVCS can also be seen to promote sustainable practices and achieve strategic council strategies to cut greenhouse gas emissions. Providing charging options to resident's on-street is in its early stages even in more established markets and lessons are still being learnt about the best approach.

Immediate actions include producing future Council policy with EVs and EVCSs in mind. The upcoming trial installation of SmartPoles also provides an opportunity to test the market for EVCS which can be included and to evaluate the current need for the technology. Leveraging private sector partners such as Altona Gate Shopping Centre could also provide a low cost and low risk approach to trialling the technology and testing the market whilst also showing leadership.

Recommendations

Electric vehicles and associated charging infrastructure is an emerging area that will grow in importance over the coming years. While the number of vehicles in Hobsons Bay and Australia more generally is currently low, there is evidence that numbers will grow. The Federal and Victorian governments are yet to provide incentives for EVs and charging infrastructure, however manufacturers, motoring associations, retail and tourism providers as well as other state and local governments are committed to growing the charging

network. Hobsons Bay City Council should prepare for EVs both internally, in terms of gaining familiarity with the technology, and externally in providing infrastructure to residents and facilitating the private sector to play a key role.

The following recommendations are made to support Council's transition to the electrification of vehicles by adopting a positive but balanced approach in the following way:

1. Develop a commercial model with strategic partners to encourage the installation of destination and workplace charging on the basis of environmental, economic and social benefit, including investigating expansion of the Energy$mart program to provide subsidies to businesses for EVCS The following are potential partners and EVCS locations:
    - Victoria Museum Scienceworks
    - Altona Gate Shopping Centre
2. Advocate to the Victorian and Australian Government to support the adoption of EVS through direct and indirect incentives as well as the promotion of the benefits of the technology
3. Develop an EVCS policy directive in upcoming ESD policies to support the promotion of local EVCS and ensure a coordinated and consistent approach to the provision of EVCS for Council and the Community. The two upcoming policies are:
    - ESD Policy
    - Environmentally Sustainable Design (ESD) Policy for Council Buildings and Infrastructure

    That these policies consider the outcomes of the Victorian Parliamentary Inquiry into EVs and the subsequent response from the Victorian Government.
4. Trial an electric vehicle with a view to including it in the Council car fleet. To support the vehicle, install a publically available EVCS at the Hobsons Bay Civic Centre and promoted access to the community.
5. Undertake a trial of EVCS at three key locations across the three wards in the municipality. Investigate combining this with the SmartPoles trial so that the co-location reduces site works and costs. The following locations are areas of high use to maximise utilisation and economic benefits.
    1. Nelson Place, Williamstown
    2. Pier Street, Altona
    3. Aviation Station (as part of the level crossing removal process)

    A trial period of three years is proposed with an annual evaluation that outlines usage, issues and recommendations for the future. An advocacy and promotion strategy would also form a component.