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Electric Vehicles within the City of Ryde **Commercial-in-Confidence**
City of Ryde Council
11 December 2012

Electric Vehicles within the City of Ryde

Recommendations for Council



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Electric Vehicles within the City of Ryde
Electric Vehicles within the City of Ryde - Recommendations for Council

Electric Vehicles within the City of Ryde

Recommendations for Council

Prepared for
City of Ryde Council

Prepared by
AECOM Australia Pty Ltd
Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com
ABN 20 093 846 925

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Quality Information

Document Electric Vehicles within the City of Ryde



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Date 11 December 2012

Prepared by Jenny Riesz and Atsushi Yamamoto

Reviewed by Jennifer McAllister

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Executive Summary

This report was commissioned by the City of Ryde to investigate, analyse and provide a framework for the City's electric and low emissions vehicle policy response. Low emission vehicles are likely to comprise an increasingly large proportion of the Australian motor vehicle fleet. Their increasing market share is underpinned by a number of drivers including increased community awareness and government action on reducing greenhouse gas emissions, increased evidence on the link between tailpipe emissions and health, and government and community desire to reduce dependence on oil. These issues are driving a global movement for low emission vehicles, with automotive manufacturers gradually introducing more and more low emission vehicles to the market.

This report reviews the policy, market and technological environment in which the City of Ryde will make its decisions:

- **Policy review** – For the most part, Australian, state and territory governments consider that this technology will be driven by the market and consumer choice, with policy effort focussed on removing regulatory barriers to entry, and identifying the likely impacts of EVs on the transport and energy markets to assist planning.
- **Environmental performance** – EVs are generally environmentally superior to average internal combustion engine (ICE) vehicles, particularly where they are charged with 100% GreenPower. Furthermore, the emissions intensity of average grid electricity is likely to decrease over time as more renewable generation is installed (supported by the 20% by 2020 Renewable Energy Target and the carbon price). However, EVs do not offer all the benefits of public transport, walking and cycling, such as reduced traffic congestion, improved health impacts and reduced parking requirements.
- **Impacts on the grid** – The impact of EVs on the grid will depend heavily upon the manner in which peak-period charging is managed. Impacts could range from minimal to very significant. This is the subject of a significant review by the Australian Energy Market Commission at present. Should peak pricing be introduced, it would incentivise charging outside of peak periods, thus minimising requirements for costly grid augmentations.
- **Timing of EV rollout** - A shift to EVs over the coming decades is inevitable. Within 10 to 15 years, plug-in hybrid vehicles (PHEVs) and battery electric vehicles (BEVs) could have a significant presence in the Australian market. PHEV and BEV sales are expected to be around 20 per cent of sales by 2020 rising to around 45 per cent of sales by 2030. Anticipated uptake levels for each vehicle type are illustrated in Figure 1. Since uptake is expected to be gradual over the coming decades, policy makers have time to implement measures to manage this transition.

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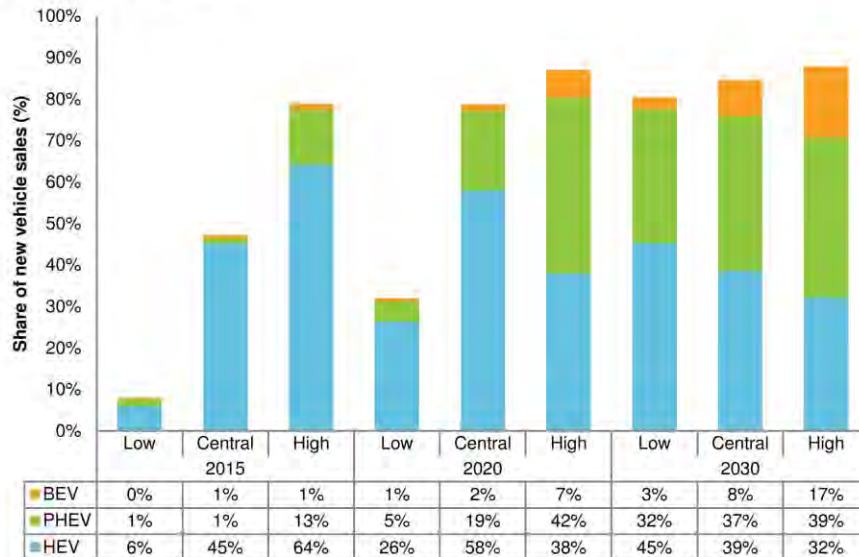
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Figure 1: Estimated take up of EVs



Source: AECOM

- **Ryde demographics** – City of Ryde has a slightly higher proportion of high income and higher education level residents than Greater Sydney; people with these characteristics are more likely to be early adopters of new technology. This could mean that City of Ryde has a slightly higher EV take-up rate than other Councils in the Greater Sydney area.
- **EV charging infrastructure requirements** – EVs can be charged at a standard power point, although faster charging is possible with more sophisticated equipment. Since the majority of vehicle travel is well within the range of typical EVs, it is anticipated that the majority of charging will take place at home due to the convenience and relatively low cost of this option. Once consumers become familiar with the range capabilities of their vehicles and feel confident that they can undertake the majority of journeys required without charging outside of the home, they are unlikely to frequently utilise more expensive charging options such as rapid charging facilities and paid on-street charging if less expensive home charging is available. Accordingly, in the near term, extensive public EV charging infrastructure (including on-street charging and rapid charging facilities) is unlikely to be required. However, eventually it is anticipated that EV charging facilities will be provided at the majority of locations where vehicles are parked for extended periods of time, driven by customer preferences and private market response.
- **Retrofitting** – It is estimated that the provision of basic EV charging infrastructure at a greenfield residential property costs \$200 to \$300 (for parts and labour). By contrast, retrofit of an existing building to install the same basic charging infrastructure costs around \$2,000, or up to \$10,000 where digging is required. Given the inevitability of EV take up, this suggests an argument in favour of including basic EV charging infrastructure in buildings, even where it will not be used in the immediate future. Buildings under development now will still be in use when EVs become pervasive, suggesting that requiring building developers to include basic EV "readiness" in their design is justified. This can be implemented by requiring the provision of suitable ducting ('pipes and pits'), which does not add significant cost to the initial development, but substantially reduces the costs of later retrofit.
- **EV charge providers** – There are two significant EV charging point providers in the Australian market at present: Better Place and ChargePoint. Both offer services installing commercial charging points.

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A decision framework for policy development with regards to EVs is outlined in section 4.0 of this report. Following from this framework, the following objective is recommended for the City of Ryde's approach to low emissions vehicles:

To provide the right policy and infrastructure framework to prepare for a change in private vehicle choices, and address market failures which hinder the substitution of low emission vehicles for ICEs.

This objective does not assume that EV technology should be adopted within the City at all costs. Rather it acknowledges that all private vehicle choices ought to receive similar levels of support from government, and looks to ensure that legacy approaches in regulating and supporting conventional motor vehicles do not inadvertently discriminate against the new technology. It also seeks to acknowledge the potential environmental benefits from electric vehicles when compared to conventional vehicles, and seeks to actively address market failures which currently prevent environmental benefits and costs from being passed on to vehicle users.

The range of roles the City potentially could play in the EV market are listed in Table 1, each with different risks and benefits associated. This recommended objective would place City of Ryde in between "creating a neutral policy environment" and "favouring new technologies with environmental benefits".

Table 1: Spectrum of actions available to City of Ryde

Actions	Implementation costs	Benefits	Risks
Do nothing	None	Avoid risk of investing in the wrong technologies	Slow take up of EVs and loss of environmental benefits. Residents may feel the city is not supporting their choices to use EVs. City may be unprepared for the mass adoption of EVs
Create a neutral policy environment	Low	Addresses policy failures that make it difficult for a new technology to enter the market.	Does not maximise environmental benefits associated with EVs.
Favour new technologies with environmental benefits	Moderate	Allows access to environmental benefits associated with EVs.	If implemented poorly can risk investment in the wrong technologies.
Favour new technologies at any cost	High	Maximise benefits associated with EVs.	If implemented poorly can risk investment in the wrong technologies.

The analysis of market and policy failures contained within this report suggests there are several key areas where intervention may be warranted to overcome existing market and policy failures and prevent new ones arising. The results from this "first principles" review is also supported by an empirical review of the literature, which suggests that other Councils have taken a similar approach. The recommended activities for Council fall into four broad categories:

- Building community confidence in the technology
- Ensuring access to charging infrastructure
- Removal of policy barriers to new technology
- Monitoring the market

Table 2 relates these objectives to a series of possible measures for implementation by the City of Ryde, with a more comprehensive description of recommended measures provided in Table 3. The measures have been developed following a review of the literature as well as data analysing specific characteristics of the City of Ryde. Detailed recommendations are included in the body of this report in section 7.0 to section 10.0.

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Table 2: One-page summary of recommended measures for City of Ryde

Action	Motivation	
Building community confidence in the technology	Public relations campaign around EVs	Address market failure (information and uncertainty) by addressing range anxiety and other uptake concerns of local residents.
	Trial a small number of EVs in the council fleet	Address market failure (information and uncertainty), by providing data and demonstration of EVs
	Collaborate with other jurisdictions	Amplify the benefits of other initiatives to promote consumer awareness (address information and uncertainty market failure)
	Encourage car share schemes to include EVs	Provide access to EVs for residents in areas with minimal off-street parking. Increase public exposure to EVs, alleviating range anxiety and increasing technology awareness.
	Provide charge infrastructure maps	Address market failure (information and uncertainty)
Ensuring public access to charging infrastructure	Remove policy barriers for provision of on-street charging infrastructure	Ensure existing government policy framework for private vehicles does not form a barrier to new technology. Reduce uncertainty around the planning approvals process for potential charge station investors.
	Provide information to private car park owners	Reduce uncertainty for potential charge point providers.
	Introduce requirements for consideration of EV charge infrastructure in new developments	Encourage developers to provide access to home charging facilities to make EVs a viable option for residents.
Clarifying Council position	Clarifying relative priorities around EVs and other transport modes	Reduce uncertainty for potential EV charge station investors and residents.
	Clarify policy around Council owned EVs	Ensure existing government policy framework for private vehicles is technology neutral.
Monitoring the market	Monitor the market	Manage risks associated with timing uncertainty and ensure Council's response remains optimal and timely

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Table 3: Detailed summary of recommended measures for City of Ryde

Action	Details	Costs		Timeframe	Responsibility
		Type	Estimate ¹		
Public relations campaign around EVs	<ul style="list-style-type: none"> - Integrate practical information about the features of EVs into market stalls, newsletters, social media and free media. - Conduct in conjunction with other community outreach activities - Focus on information on EV technology, particularly alleviating range concerns. - Use vehicles in Council EV fleet trial for engagement, and as a source of data to share with the public. 	<ul style="list-style-type: none"> Staff time Development of website and other marketing materials 	<ul style="list-style-type: none"> Recurrent budget approximately 35 hours per year. \$5000 	Start when practical, taking advantage of opportunities to integrate with existing initiatives	Senior Sustainability Coordinator – Transport and Environment, in collaboration with Community Engagement team
Trial a small number of EVs in the council fleet	<ul style="list-style-type: none"> - Carefully monitor extensive information around usage and charging, maintenance costs, insurance costs, charging infrastructure, driver impressions (via survey before and after utilisation). - Use information collected and vehicles as inputs to the public engagement program. - Apply bra - nding on vehicles to maximise demonstration and awareness benefits. - Charge with 100% GreenPower to ensure integration with overall GHG reduction targets and demonstrate costs and benefits to City residents and businesses. Ensure that this is publicised. - Utilise information collected on the trial to facilitate informed decision making on leaseback/package vehicles and future fleet vehicle purchases. - Share data collected and related resources for public engagement with other jurisdictions 	<ul style="list-style-type: none"> Vehicle Charging infrastructure Staff time 	<ul style="list-style-type: none"> \$30,000 - \$70,000, depending upon vehicle selected \$200 to \$10,000, depending upon local circumstances and speed of charging required 	Start as soon as practical, to provide maximum value	Section Manager – Plant & Fleet, in conjunction with Senior Sustainability Coordinator – Transport and Environment.
Collaboration with	Collaborate with other Councils	Staff time	Recurrent budget approximately 35	Start as soon as practical, to	Senior Sustainability Coordinator – Transport

¹ Staff time and marketing cost estimates have been provided by the City of Ryde.

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Action	Details	Costs		Timeframe	Responsibility
		Type	Estimate ¹		
other jurisdictions	<ul style="list-style-type: none"> - Share data on trial programs - Promote adoption of appropriate standards and regulations at a federal and state level - Combine resources to monitor the market 		hours per year.	provide maximum value	and Environment
Car share	Negotiate with car share providers to include a minimum proportion of car share spaces for EVs (with associated charging infrastructure) <ul style="list-style-type: none"> - Negotiate on a case-by-case basis for number of EVs that is appropriate at the time, based upon the cost of vehicles and charging infrastructure - EVs should be located in a prominent location to maximise value. 	Staff time	Recurrent budget approximately 70 hours once off.	When approached by car share providers	Senior Sustainability Coordinator – Transport and Environment
Provision of charge infrastructure maps	Provide information to consumers on locations of charging infrastructure in Ryde. To maximise benefit should be done in collaboration with other jurisdictions.	Staff time Website development	Recurrent budget approximately 21 hours once off. \$5000	When publicly accessible charging infrastructure becomes available	Senior Sustainability Coordinator – Transport and Environment in collaboration with Community Engagement team

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Action	Details	Costs		Timeframe	Responsibility
		Type	Estimate ¹		
Removing policy barriers for private charging infrastructure providers	Clarify planning processes for EV-related infrastructure <ul style="list-style-type: none"> - Request amendment to Standard Instrument to include a standard definition for 'on-street' and 'off-street' recharge facilities. Conduct in partnership with other Councils if possible. - Amend LEP (once Standard Instrument has been updated) - Amend DCP to include guidelines regarding the impacts of on-street charging infrastructure development and the acceptable forms such development may take - RMS approvals and standardised systems and signage – collaborate with industry groups to obtain RMS approvals for standard Pay Parking Systems (the technology), Pay Parking Schemes and associated standardised signage. 	Staff time	Recurrent budget approximately 140 hours once off	Align with any forthcoming reviews, noting that the market is likely to require guidance fairly rapidly and a more comprehensive approach will produce more orderly results (i.e. by 2016).	Senior Sustainability Coordinator – Transport and Environment
Information for private car park owners	Encouraging installation of EV infrastructure in privately owned car parks via provision of information and clarity of planning requirements.	Staff time Marketing materials	Recurrent budget approximately 35 hours once off. \$5000	Preferably commence following commencement of EV trial, to utilise data collected.	Senior Sustainability Coordinator – Transport and Environment with Community Engagement team
Introduce requirements for consideration of EV charge infrastructure in new developments	Specify a minimum requirement for EV charge infrastructure in new developments (particularly high density residential). Council can select how ambitious this should be, ranging from a requirement that developers "consider" the inclusion of EV charge infrastructure, to providing ducting (preventing necessity for digging in a later retrofit), to providing ready charge points at a proportion of spaces. This report recommends that a minimum requirement of provision of ducting to all parking spaces in new	Staff time	Recurrent budget approximately 70 hours once off	Align with forthcoming reviews. Given the long-lived nature of buildings being constructed now it is recommended that this is implemented in the version of the DCP currently under review.	Senior Sustainability Coordinator – Transport and Environment

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Action	Details	Costs		Timeframe	Responsibility
		Type	Estimate ¹		
	developments is specified. This can be provided by developers at negligible cost and substantially reduces the costs of later retrofit to include EV charging infrastructure of the appropriate type, when it is eventually demanded by consumers. This would be implemented via changes to the DCP Parking Controls.				
Clarifying relative priorities around EVs and other transport modes	Clarify priorities around EVs, public transport, walking and cycling. This appears to be most appropriately implemented in the LEP and DCP.	Staff time	Recurrent budget as per earlier action	Align with forthcoming reviews.	Senior Sustainability Coordinator – Transport and Environment
Clarify policy around Council owned EVs	<i>Sustainable Plant & Fleet Replacement & Hire Policy</i> <ul style="list-style-type: none"> - Include consideration of EVs <i>Motor Vehicle Policy</i> <ul style="list-style-type: none"> - Clarify priorities around Australian-assembled vs EVs - Include additional factors for consideration around vehicle usage in vehicle selection - Review purpose and use of council vehicles and consider charge point installation 	Staff time	Recurrent budget approximately 35 hours once off.	Implement when practical, from February 2013.	Senior Sustainability Coordinator – Transport and Environment with Section Manager – Plant & Fleet
Monitor the market	Periodically monitor the market to ensure awareness of any rapid market shifts that may create a step-change in uptake	Staff time	Recurrent budget approximately 21 hours annually.	Implement when practical, from February 2013 and ongoing annually.	Senior Sustainability Coordinator – Transport and Environment

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1.0 Introduction

Low emission vehicles are likely to comprise an increasingly large proportion of the Australian motor vehicle fleet. Their increasing market share is underpinned by a number of drivers including:

- Increased community awareness and government action on reducing greenhouse gas emissions
- Increased evidence on the link between tailpipe emissions and health
- Government and community desire to reduce dependence on oil

These issues are driving a global movement for low emission vehicles, with automotive manufacturers gradually introducing more and more low emission vehicles to the market.

This report was commissioned by the City of Ryde to investigate, analyse and provide a framework for the City's electric and low emissions vehicle policy response. Key components of this report include:

- a) An **Analysis** of key information to establish the evidence base upon which a credible strategy can be built.
- b) A **Framework** for understanding the role of Council in supporting the deployment of cost effective electric and low emission vehicles.
- c) A **Draft Strategy**, which builds on the framework and analysis to generate objectives and a preliminary list of actions to meet those objectives which can be considered by Council.

The remainder of this introductory chapter sets out analysis of the available data about electric vehicles in the Australian vehicle market.

Low emission vehicles is a general term that encompasses various vehicle technologies and fuels, such as electric vehicles, hydrogen fuel vehicles and natural gas vehicles, where the emissions generated are less than the emissions generated by conventional internal combustion engine (ICE) vehicles. This strategy focuses on electric vehicles (EVs), including hybrids (HEVs), plugin hybrids (PHEVs) and battery electric vehicles (BEVs).

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2.0 Current state of electric vehicles market

2.1 Overview of EV technology

2.1.1 Electric Vehicles available in Australia

There are a large number of EVs now available (or planned to be imminently available), but only a small selection of these are bound for the Australian market. This limits consumer choice in EVs Australia. Furthermore, EVs remain significantly more expensive than comparable ICE vehicles. This limits uptake of EVs at present in Australia. As vehicle costs fall, uptake is likely to increase (as discussed further in section 2.6.1). A list of electric vehicles (excluding hybrids) presently available in Australia is provided in Table 4, although it should be noted that this list is expanding rapidly.

Table 4: Electric Vehicles available in Australia

Manufacturer	Model	Category	Range	Status	Cost
Blade	Electron	BEV	100km	Available now	\$48,000
Chevrolet (Holden)	Volt	PHEV	60km	Planned	\$30,000 - \$40,000
Energetique	evMe	BEV	200km	Concept available now	\$70,000
Mitsubishi	iMIEV	BEV	160km	Available now	\$48,000
Nissan	Leaf	BEV	160km	Available now	\$51,500
Renault	Fluence Z.E	BEV	160km	Available from Q4 2012	\$30,000 - \$40,000
Tesla	Roadster 2.5	BEV	394km	Available now	\$207,980
Ford Australia	Ford Focus Electric	BEV	160km	Investigating the market	\$40,000 - \$50,000
Skoda	Octavia Green E line	BEV	150km	Testing	To be determined

Source: CSIRO Electric Driveway Project, "Plugging in: A Technical and Institutional Assessment of Electric Vehicles and the Grid in Australia – Phase 1 Report". 2010. Supplemented with market research.

The price premium of an EV is directly related to the battery price, which in turn is directly related to the size and weight of the vehicle. Correspondingly, a large EV has a much higher premium than a small EV. Initially, this is likely to result in higher take up of small EVs, typically travelling short distances in the short term. However, over time, as the price premium falls, vehicles travelling longer distances will benefit more from the cheaper fuel.

2.2 Charging infrastructure

Different types of EVs have different charging requirements. There are a range of EVs including hybrid electric vehicles (HEVs), plug in electric vehicles (PHEVs) and battery electric vehicles (BEVs). Only PHEVs and BEVs will require access to charging infrastructure. PHEVs, which can use both petrol and electricity as fuel, will be less reliant on charging infrastructure.

Most EVs can be charged at a standard home power point, with the time for a total charge being 6-8 hours (or 2-3 hours for a top-up charge). Most users are expected to find it convenient to charge their vehicle overnight at home. If necessary, fast charge facilities can be utilised, reducing the total charge time to only 2-3 hours; these may prove appropriate for locating at shopping centres and other public areas. Rapid charge facilities are also possible; these can reduce total charging time to as low as 10-20 minutes. Dedicated premises are required for

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infrastructure of this type. Most users are expected to use rapid charge facilities only rarely. The types of charging infrastructure are summarised in Table 5.

Table 5: Types of charging infrastructure

Type of charging	Power requirements	Time to charge	Other
Level 1: Standard Charge	10A – 15A 240V AC ~3.5kW	Total: 6 – 8 hrs Top up: 2 – 3 hrs	10A: home power points 15A: air-conditioners, campervans
Level 2: Fast Charge	32A 240V AC ~7.5kW	Total: 2 – 3 hrs Top up: 30 mins	Can be installed in most Australian premises. May require strengthening of household connections to reduce the risk of overload
Level 3: Rapid Charge	125A 400-600DC 50 – 75 kW	Total: 10 – 20 mins Top up: few mins	Only installed on dedicated premises

2.2.1 Charging at home or in private premises

In general, complex new technology is not required for charging of EVs in private premises. Level 1 and 2 charge facilities are expected to suffice for the majority of applications at homes, commercial premises and public charging facilities. Minor upgrades may be required to add telecommunications infrastructure if users are seeking to participate in 'smart grid' schemes (allowing more intelligent charging behaviour). However, the infrastructure for this is also widely available and not complex.

Standard home electricity sockets are typically 10A, with the familiar three pin arrangement, as illustrated in Figure 2. These are used for most earthed domestic appliances and equipment in Australia, and can be used to charge an EV (slowly). A 15A socket is usually recommended for EV charging. This is also a standard mains plug, but featuring a slightly larger earth pin as illustrated in Figure 2. 15A plugs are typically used for home appliances with higher energy requirements, such as air conditioning, caravans and light industrial appliances and equipment. Any suitably qualified electrician will be able to install a standard 15A plug in the appropriate location for EV charging. The costs for this service will vary depending upon the complexities of the site, but are expected to be on the order of \$200-\$500 (provided no major earthworks are required).

Figure 2: Australian Mains Plug Variants - AS/NSZ 3112

Standard 10A mains plug Standard 15 A mains plug



2.2.2 Installing a second meter

It is possible to have a second meter installed at a site that is specific to the charging of the EV (and associated with a separate retail account). This would allow an EV user to accurately monitor electricity usage associated with the EV, and also to purchase 100% GreenPower. The new meter will be supplied by Ausgrid (free of charge), but the EV user would need to pay for the cost of an electrician to separate out the specific load associated with the EV and set up the switchboard appropriately. No special equipment is likely to be required, so the main cost would be the labour of the electrician. The cost will vary significantly site to site; where the switchboard is in good order and already meets all the required standards, and the EV load can be easily separated, costs will be minimal. By contrast, some existing switchboards do not meet current required standards and would involve more extensive work to comply before the new meter could be installed.

A Level 2 electrician (certified to do metering work) is required to complete the necessary re-wiring, and would work closely with Ausgrid to install the meter.

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2.2.3 Specialist providers of EV charging infrastructure for public environments

Charging in public environments is more complex, requiring greater consideration of OHS risks, as well as requiring infrastructure that can resist vandalism or more extreme wear and tear.

There are a small number of companies offering the installation of charge points specifically for EV use at present. ChargePoint Australia is the largest provider, and offers a range of products suitable for public and commercial spaces. They are not intended for domestic (in home) operation, where any suitably qualified electrician will typically be able to install the required facilities (as long as Level 1 charging suffices).

2.2.4 ChargePoint

The products offered by ChargePoint at present are listed in Table 6. As indicated, all are intended for commercial use (not domestic charging). Level 1 chargers feature a standard 15A plug (as pictured in Figure 2). Level 2 chargers feature an SAE J1772 plug, which is a standard electrical connector for EVs maintained by the Society of Automotive Engineers (based in North America). This plug features signalling capability that is compatible with the Mitsubishi i-MiEV, the Nissan Leaf, the Renault Fluence, the Tesla Roadster and others.

All the products offered by ChargePoint are available as wall, pole or bollard mounts, as pictured in Figure 3.

Table 6: ChargePoint Products

Model	Application	Level	Power	Connector	Mounting Options
CT500	Domestic/Light Commercial	Level 2	240V, 32A	SAE J1772	Wall mount
CT1500	Commercial	Level 1	240V, 15A	AS/NZS 3112 socket-outlet	All available as wall, pole or bollard mounts
CT2000	Commercial	Level 2	240V, 32A	SAE J1772	
CT2100	Commercial (Dual Output)	Level 1	240V, 15A	AS/NZS 3112 socket-outlet	
		Level 2	240V, 32A	SAE J1772	
CT2500	Commercial (Dual Output)	Level 1	240V, 15A	AS/NZS 3112 socket-outlet	
		Level 2	400V, 32A	Mennekes	

Source: <http://chargepoint.com.au/products-charging-stations.php>

Figure 3: Mounting styles available from ChargePoint



Source: <http://chargepoint.com.au/products-charging-stations.php>

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Figure 4: SAE J1772 EV charging plug



In private communications, ChargePoint provided indicative recommendations on the products required for various circumstances (indoor, outdoor, Level 1, Level 2), and indicative quotes for the purchase of these products at City of Ryde premises, as listed in Table 7. However, they emphasised that installation costs can vary substantially depending upon site-specific factors, and an individual quote for each site should be sought. These costs are for the unit only; installation of the unit is an additional cost.

Table 7: Indicative quotes provided by ChargePoint (for unit purchase only, does not include installation costs)

Location	Type	ChargePoint Product	Price per unit (single unit only)	Price per unit (2 – 24 units)
Indoor	Level 1	CT1500	\$3,000	\$2,800
	Level 2	CT500	\$3,860	\$3,550
Outdoor	Level 1	CT1500	\$3,000	\$2,800
	Level 2	CT2000	\$6,350	\$6,284

Source: Communication with ChargePoint

Installation cost estimates provided by ChargePoint are listed in Table 8. They note that installations on public land, particularly on-street, are considerably more expensive than installations on private properties. Private property installations are generally cheaper and faster to implement.

Table 8: Indicative quotes provided by ChargePoint for installation

Location	Unit type	Indicative installation cost	Notes
Domestic garage	CT500	\$600 - \$1,200	Cost will depend upon site complexities.
Commercial car park	CT2000	\$1,000 - \$2,500	Cost will depend upon site complexities. Cost per installed unit decreases as the number of units installed increases. (eg. installing 5 x CT2000 could reduce the installation cost per unit to \$800)
On-street bollard		\$10,000 +	Cost includes factoring in development approvals, permits, electrical, earthworks, pedestrian and traffic control, civil reinstatement, etc.

Source: Communication with ChargePoint

2.2.5 Better Place

Better Place offers membership packages intended for domestic EV users which include:

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- Charge Spot installed at your home (wall mounted, single outlet). They cautioned that some locations may involve additional complexities during the installation and incur additional up front costs, which are not included in the membership package.
- Standard home wiring & installation of the Charge Spot.
- 100% GreenPower upgrade
- 24/7 Member Assistance
- Full warranty on hardware
- Advanced smartphone app features
- Energy activity reports
- Weekly costs fixed for 3 years
- Proactive fault detection

Membership pricing offered by Better Place is listed in Table 9. The standard wall mounted charge point provided by Better Place with these domestic membership packages is illustrated in Figure 5, and the more robust commercial charge points are illustrated in Figure 6.

Table 9: Membership package pricing offered by Better Place

Vehicle type		Upfront costs	Weekly costs (for three years)
Holden Volt	Option 1:	\$2,999	\$0
	Option 2:	\$1,999	\$12
	Option 3:	\$0	\$25
Mitsubishi iMiEV	Option 1:	\$2,999	\$0
	Option 2:	\$999	\$15
Nissan Leaf	Option 1:	\$2,999	\$0
	Option 2:	\$999	\$15

Source: Better Place website and private communication

Better Place also offers fleet vehicle packages, which are negotiated on a case by case basis. These usually include more complex and robust charge infrastructure intended for shared use. Further information on the services provided with fleet packages is available on the Better Place website². They were reluctant to offer indicative pricing, preferring that City of Ryde contact them to obtain quotes based upon their specific site and requirements. Depending upon Council's intended use of the vehicle, a domestic style membership package may suffice.

Figure 5: Standard wall mounted charge point provided by Better Place with domestic membership packages



Source: Better Place website

² <http://www.betterplace.com.au/media/docs/Electric-fleet-structure-Nissan-Leaf-41c38860-b423-4527-b555-9a4c2137c828-0.pdf>
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Figure 6: Better Place commercial charge points



Source: Better Place website

2.3 Driving and charging EVs

The behaviour of drivers and users of EVs under future scenarios is, of course, not entirely predictable. However at this stage it seems likely that charging options and utilisation will include:

- **At Home:** It is likely that most private EV owners will charge their vehicles overnight at home. Vehicles can be charged using standard domestic electrical outlets, making this option the cheapest and most convenient means of charging when off-street parking is available. However, access to off-street parking can vary. Given most vehicles will be parked overnight a level 1 charger should be sufficient but some EV owners will wish to install a level 2 charger at their property.
- **At work:** Given most vehicles will be parked at work for 6 to 8 hours a level 1 charger should be sufficient for at work charging. However, some car parks may wish to provide a level 2 charger.
- **Other car parks (Council/private owned):** Drivers may wish to charge their vehicles at car parks (run by both private operators and Council). This could include car parks at shopping centres, supermarkets and leisure facilities (cinema, gym, pool). People typically spend from 20 minutes to a few hours in these car parks so either a standard charge (for a top up) or fast charge (for a total charge) is likely to be installed. Many of these car parks are located close to residential areas; with agreement from the owners they could be opened up overnight to allow local residents to use charging facilities.
- **On-street:** In areas where there is limited access to off-street parking, on-street chargers would be required to provide residents with access to charging facilities.
- **Dedicated charging infrastructure:** Over time it is likely that dedicated charging premises like existing petrol stations will emerge with either very quick charge or battery swap. These are likely to be used by commercial vehicles and taxis, who want to charge as quickly and conveniently as possible.

Whilst it is too early specify with precision where and how people will charge their EVs, early evidence from trials suggests the majority of charging will occur at home, in housing where vehicle parking is available. However where residents do not have access to off street parking, other options may be required.

Census data from 2011 (illustrated in Figure 7) shows that City of Ryde has a larger proportion of high density dwellings than Greater Sydney, suggesting that there could be areas where residents have limited access to off-street parking. On-street charging facilities may be required in these areas to facilitate EV uptake, but this should be balanced against priorities around reducing private vehicle usage and increasing utilisation of public transport, walking and cycling. Car share schemes (such as those offered by companies like GoGet) may offer a suitable compromise, where they provide services in those areas (this is more likely in high density areas), and where it can be negotiated for them to provide EVs as a part of their fleet. This also provides the opportunity to increase consumer awareness and exposure to EVs.

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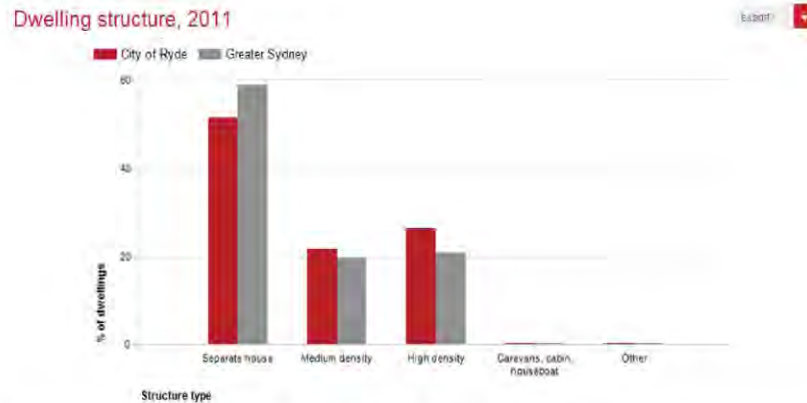
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Figure 7: Dwelling structure, 2011



Source: Australian Bureau of Statistics, Census of Population and Housing, 2011 (Enumerated data). Compiled and presented by id.

2.3.1 Vehicle range

One of the factors that limits the uptake of EVs is concern around the distance that vehicles can travel on a single charge, termed "range anxiety". This is often used as an argument for the installation of rapid charge stations. However, most EVs have a range of 80-160 kilometres (as illustrated in Figure 8), which is sufficient for the majority of trips. For example, in Greater Sydney the average trip distance is only 8.5 km³.

Evidence from real world trials suggest that range anxiety reduces once people start using EVs regularly. Research from the UK showed that prior to the trial 100% of private drivers said they would be more concerned about reaching their destination with an EV than they would with their normal car. After three months this dropped significantly, by 35%. The study concluded the drop in range anxiety is in part due to the increased understanding of vehicle capabilities, driving techniques and journey planning. Charging data also shows users gained more confidence in their journey distance over the three months, with an eight per cent increase in users allowing their batteries to drop below 50% before plugging in⁴. This suggests that the provision of information and demonstration programs will assist in reducing range anxiety.

³ NSW Household Travel Survey, 2010/11

⁴ Everett A, Walsh C, Smith K, Burgess M and Harris M, *Ultra-Low Carbon Vehicle Demonstrator Programme*, May 2011
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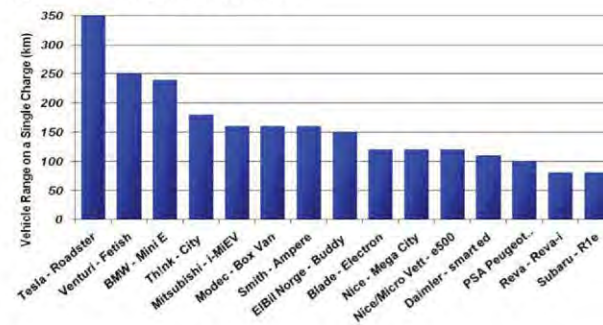
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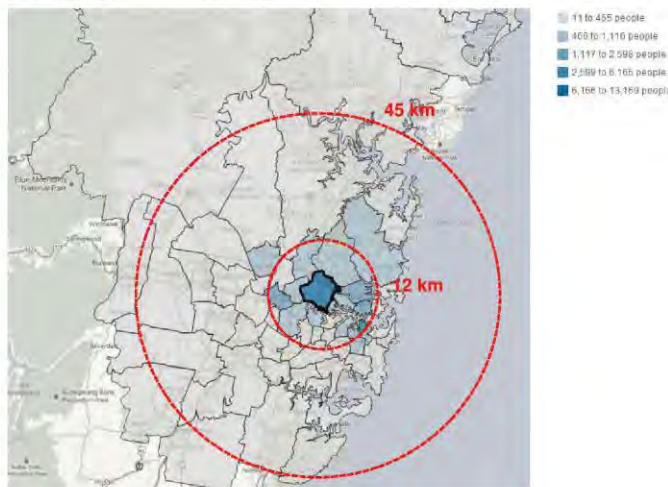
Figure 8: Vehicle range on a single charge



Source: CSIRO, Barriers to and policy solutions for EV adoption in Australia, 2011

With regards to Ryde residents, census data suggests that the majority of people living in Ryde travel less than 12km to work, as illustrated in Figure 9. This suggests that EVs offer an effective alternative to ICEs, even if charging infrastructure is not available at their place of work.

Figure 9: Journey to work for Ryde residents



Source: Australian Bureau of Statistics, Census of Population and Housing, 2011 (Enumerated data). Compiled and presented by id.

The census data from 2011 also indicates that the majority of people working in Ryde travel less than 12km to get to work. With most EVs having a range of 80-160km, this suggests that the provision of charging infrastructure at peoples' places of work within Ryde is not essential.

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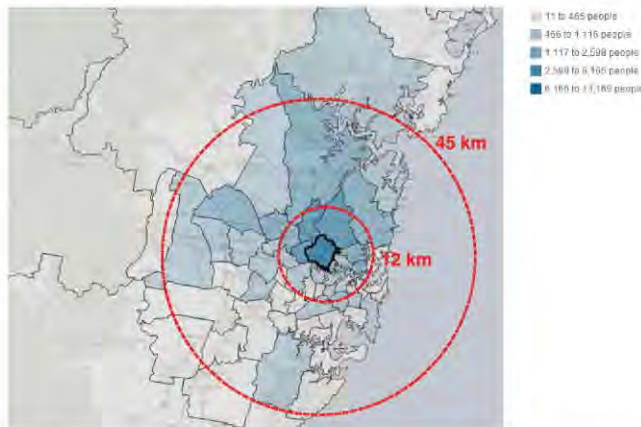
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Figure 10: Journey to work in Ryde



Source: Australian Bureau of Statistics, Census of Population and Housing, 2011 (Enumerated data). Compiled and presented by id.

2.4 Environmental impacts

2.4.1 Greenhouse gas emissions

Given that around 80% of electricity in Australia is sourced from emissions intensive coal-fired generation, it is important to determine whether a shift to electric vehicles reduces greenhouse emissions.

In general, AECOM's analysis suggests that an average ICE vehicle is more greenhouse gas intensive than an average EV (see Figure 11). However, there are a wide range of ICEs and EVs available on the market, with widely differing performance characteristics, and it is acknowledged that there is likely to be some overlap. Where a large EV is compared with a small and highly efficient ICE (or a hybrid vehicle), the ICE may prove to be less emissions intensive at present.

The relative environmental performance of EVs and ICEs is likely to change over time, in favour of EVs. Whilst ICE vehicles will become more efficient over time, the average emissions intensity of the National Electricity Market is also declining as greater amounts of renewable energy are rapidly installed under the national 20% by 2020 Renewable Energy Target. Figure 11 shows a projected comparison between ICE and EV emission profiles to 2040.

Importantly, EVs can be powered by 100% renewable energy, thereby making the greenhouse gas emissions associated with their operation equal to zero. In Australia, 100% renewable energy can be easily purchased via Greenpower at minimal cost (the tariff rate for 100% renewable energy is typically only 20-25% higher than standard electricity tariffs).

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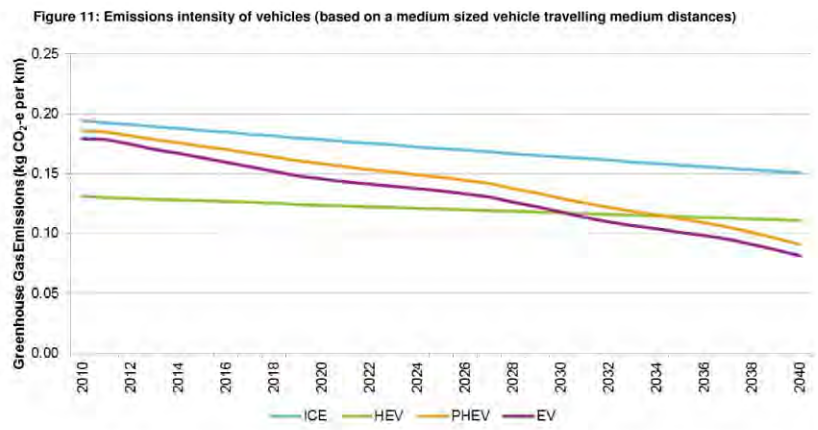
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Source: AECOM based on a number of assumptions about future fuel efficiency. Emissions intensity for petrol has been sourced from National Greenhouse Accounts Factors (DCCEE, 2011). Emissions intensity for NEM has been sourced from Treasury modelling (2011)5

2.4.2 Air pollution

Motor vehicles are generally the main source of air pollution in dense urban centres and a transition to low emission vehicles offers the potential for significant reduction in local air pollution and associated economic benefits⁵. Unlike existing internal combustion engines, EVs have no tailpipe emissions at the point of consumption. Depending on the source of electricity (coal, hydro, wind, etc.), a net emissions reduction for the transport sector could be achievable through the use of EVs. Importantly, a number of government policies, including the Clean Energy Futures package and the Renewable Energy Target, are driving a transition to cleaner electricity generation in the National Electricity Market (NEM) which will enhance these benefits.

2.4.3 Sound pollution

EVs are significantly quieter to operate than ICEs. Views differ as to the costs sound pollution (and therefore the benefits of reducing it), but regardless of quantification of its value it is certainly an additional benefit that can be attributed to the use of EVs over ICEs.

2.4.4 No beneficial impacts on traffic congestion and parking limitations

EVs offer no beneficial impacts in terms of reduced traffic congestion and parking limitations. Strategies to decrease private vehicle use via promotion of public transport, walking and cycling generally offer a superior alternative to EVs (where feasible).

2.5 Impact on energy market

The extent of environmental benefits is dependent on the source of electricity for EVs. The positive externalities will be enhanced if EVs are powered by renewable energy. However, the supply of energy is provided through the National Electricity Market and all energy consumers have the option to purchase renewable energy. The

⁵ Australian Treasury, 2011, *Strong Growth, Low Pollution - Modelling a Carbon Price*, Commonwealth of Australia, Canberra.

⁶ The economic costs of air pollution are directly related to the number of people exposed so tend to be significantly lower in regional areas where most large power generation occurs.
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potential exception to this could be charging of EVs at on-street charging stations, where Council could use its role as the guardian of public space to influence the supply of electricity.

There is also the possibility that EVs will create negative externalities in the energy market. The charging of EVs, if it occurs in peak periods, could require significant upgrades to the network. Currently the cost of additional peak demand is borne by all electricity users rather than the people who create the cost. As such, EV users do not have strong incentives to charge in off peak periods to minimise the network upgrade costs. This issue is currently being addressed by the Australian Energy Market Commission in their Electric Vehicle Review and Power of Choice Review. The charging of EVs may also create local network impacts which require strengthening of the network. Addressing these issues is the responsibility of the distribution company.

While there are substantial market failures related to energy, closer examination suggests that the role for the City in addressing these is limited. For the most part, responsibility for energy is allocated to policy makers and regulators at federal and state levels. Direct responsibility for provision of adequate supply to city consumer's lies with both the distribution company and a range of retailers operating in a regulated market. While the city may provide information to these actors from time to time there are limited options to directly impact on the outcomes.

2.6 Outlook for EV uptake

Consumers consider a number of factors when deciding which vehicle to purchase. Whilst the financial cost plays a significant role, the decision of what vehicle to purchase is influenced by consumer preferences. Previous research undertaken by AECOM⁷ identified the following key factors affecting the take up of EVs:

- **Vehicle price** (which is largely driven by battery prices) and rate at which it converges with an ICE vehicle. As technology improves and scale economies are achieved, EVs are expected to eventually have the same purchase price as ICE vehicles. Demand for EVs will rise strongly as price parity is approached.
- **Global supply constraints in the EV market.** Whilst a large number of EV models are expected to be launched in the near future, there is some uncertainty as to how many will be produced and whether this will be sufficient to meet consumer demand. Australia has traditionally not been viewed as a key market for the motor industry so there is uncertainty over the share of global EV production that is allocated to Australia. Therefore even if consumers prefer to purchase EVs there may be insufficient supply.
- **Supply of charging infrastructure.** Motorists value the ability to refuel (or recharge in the EV context) their vehicles. Research to date suggests that whilst most charging will occur at home, the provision of public infrastructure can assist in alleviating range concerns. However, it is possible that range concerns could also be addressed through comprehensive community engagement and provision of information and demonstration programs.
- **Fuel prices.** One of the major advantages of EVs over ICE vehicles is the potential cost savings from using electricity instead of petrol or diesel. Both EVs and ICE vehicles will experience efficiency improvements in fuel consumption. Similarly both EVs and ICE vehicles face rising fuel costs in terms of electricity (partly influenced by carbon pricing) and rising global crude oil prices. Overall however, EVs are relatively more cost effective to operate compared to ICE vehicles.
- **Vehicle range.** The range of EVs compared to other vehicles influences the demand for EVs since consumers value the ability to drive longer distances without having to refuel. The range of EVs will improve as battery and drive train technology improves so that the competitiveness of EVs improves in the long run.

⁷ See AECOM 2009, 2010, 2012.
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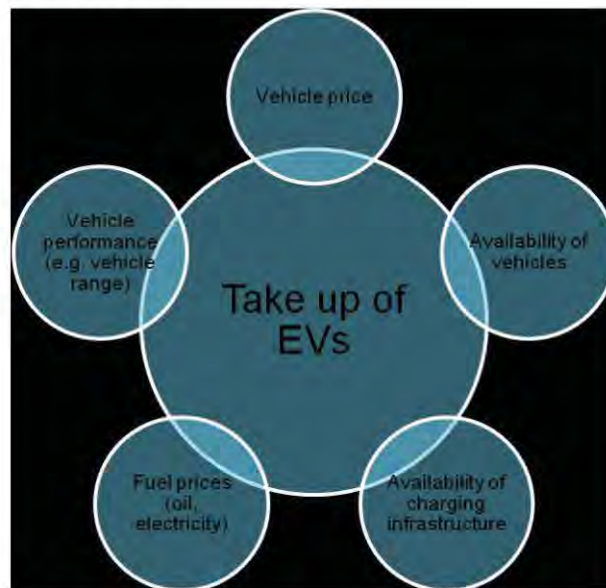
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Figure 12: Key factors affecting take up of EVs



2.6.1 Expected take up of EVs

In the next few years take up of EVs is expected to be predominantly hybrid vehicles with plug-in hybrids and battery electric vehicles only expected to account for around 1 to 2 per cent of sales by 2015. This is due to the superior range and ability to use petrol as fuel. However, over time it is expected that there will be a shift towards PHEVs and BEVs as purchase prices converge to parity with traditional vehicles, battery improvements result in increased vehicle range, more charging infrastructure is provided and oil prices continue to rise relatively more than electricity prices.

Within 10 to 15 years, PHEVs and BEVs could have a significant presence in the Australian market. PHEV and BEV sales are expected to be around 20 per cent of sales by 2020 rising to around 45 per cent of sales by 2030.

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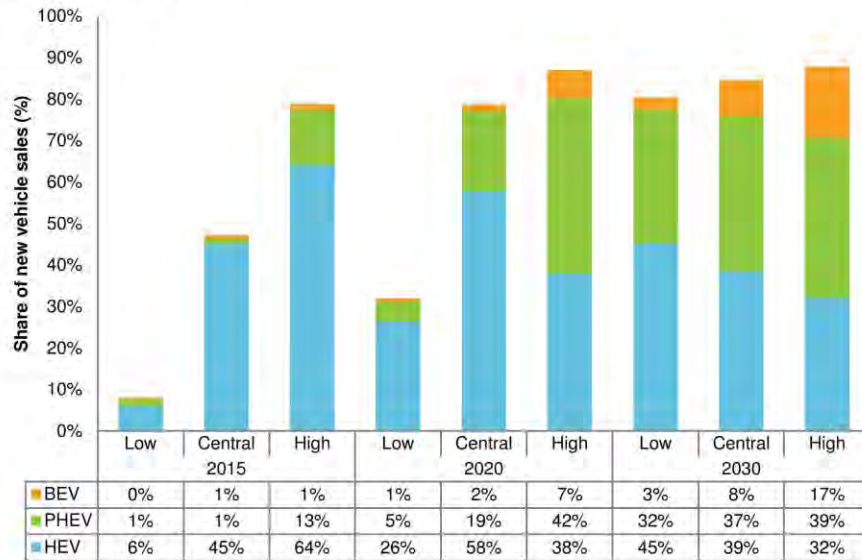
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Figure 13: Estimated take up of EVs



Source: AECOM

There are inherent uncertainties in making forward estimates, particularly in a new market. Take up of EVs could be slower if EV prices take longer to reach price parity and supply constraints remain in the Australian market. However, it is also possible that take up could be much quicker if, for example, battery prices fall much quicker than currently anticipated, Australia is instead seen as a key EV market with supply constraints easing more quickly than expected and the emergence of leasing arrangements that reduce the upfront purchase cost.

AECOM's analysis suggests there will be an inevitable transition towards EVs but there will be time for policy makers to respond. Importantly, there is much uncertainty around the key factors that are likely to affect take up of EVs so it is important that the City of Ryde continue to monitor the market and update this strategy as necessary.

2.6.2 City of Ryde residents may be early adopters

Due to the high cost of EVs, the take up of EVs is likely to be limited to early adopters rather than the mass market in the next few years. Studies on consumers of hybrid electric vehicles (HEVs) – vehicles comparable to EVs when they were first introduced to the market – have found that early adopters share a number of characteristics, such as higher average income⁸, higher levels of education⁹, above average technological skills¹⁰, increased environmental awareness and increased awareness in new technology¹¹.

City of Ryde has a high proportion of residents that are highly educated with high incomes. Figure 14 illustrates that Ryde residents have above average representation in the highest income quartile group (compared with Greater Sydney). This proportion has also increased from 2006 to 2011.

⁸ Klein 2007, Scarborough 2007, de Haan et al 2006

⁹ de Haan et al 2006

¹⁰ Scarborough 2007

¹¹ Exploring electric vehicle adoption in New York City, Plan NYC, January 2010

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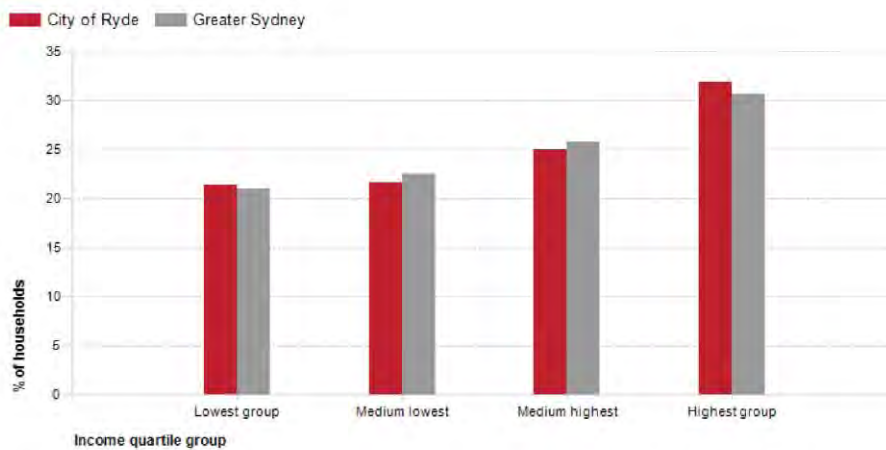
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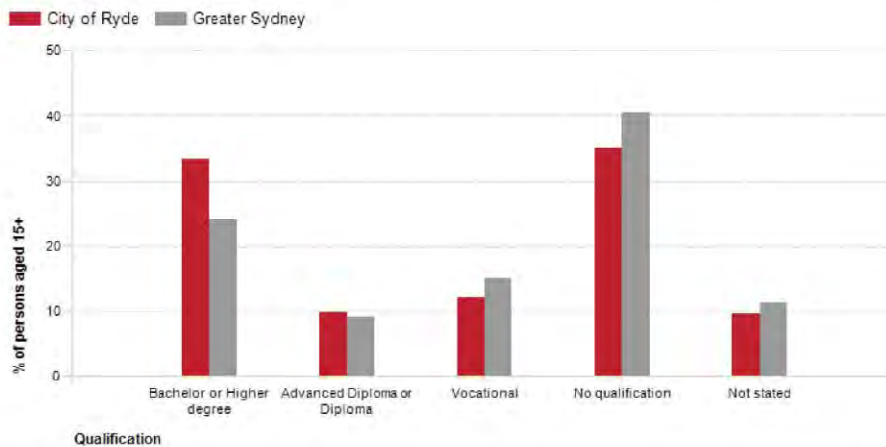
Figure 14: Household income quartiles, 2011



Source: Australian Bureau of Statistics, Census Population and Housing, 2011 (Usual residence data). Compiled and presented by .id.

Figure 15 shows that Ryde residents also have above average representation in the attainment of Bachelor or Higher degrees. This is also the fastest growing category of qualification type in City of Ryde.

Figure 15: Highest qualification achieved, 2011



Source: Australian Bureau of Statistics, Census Population and Housing, 2011 (Usual residence data). Compiled and presented by .id.

Age may also be an important factor in driving early adopter behaviour. Figure 16 indicates that City of Ryde has a higher proportion of residents in the age range 20-39, compared with Greater Sydney. People in this age bracket could be more willing to experiment with new technology.

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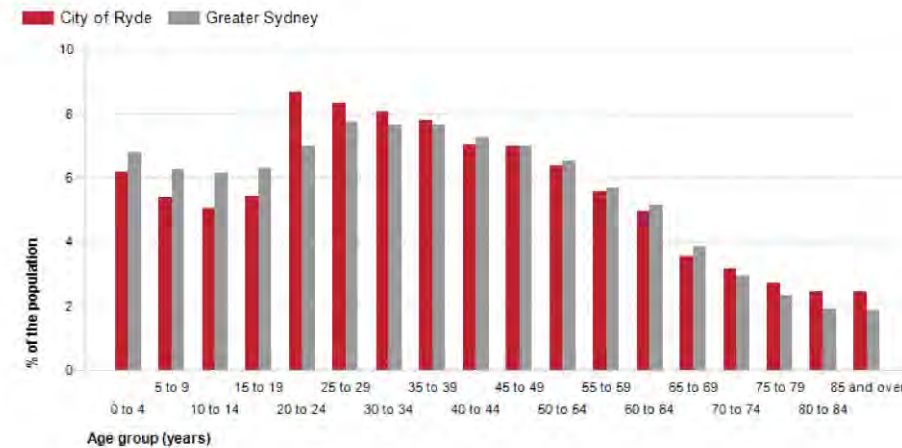
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Figure 16: Five year age structure, 2011



Source: Australian Bureau of Statistics, Census Population and Housing, 2011 (Usual residence data). Compiled and presented by .id.

The high income and concentration of individuals with high qualifications suggests that a comparatively high proportion of City of Ryde residents have the underlying characteristics of early adopters. This implies that Ryde Council may need to adopt a more proactive approach to EVs than other Councils. Establishing and utilising collaborations with other Councils who also have a high proportion of early adopters (such as the City of Sydney) can minimise the risks associated with taking a leadership role (as discussed in section 6.1).

3.0 EV policy development in other jurisdictions

As part of developing this strategy, other cities were reviewed to identify what types of policies have been implemented elsewhere. The rest of this section summarises that review.

3.1 Australian Government policy development

Details on relevant initiatives are outlined in the sections below.

3.1.1 Development of national standards

Victoria is currently taking a leadership role in the development of guidance on land-use planning for EV parking and charging, which is likely to form the basis of future standards adopted at a national level (and in other states)¹².

3.1.2 Smart Grid Smart City Electric Vehicle Trial (Sydney, Newcastle and Central Coast)

The Smart Grid Smart City (SGSC) EV Trial is a Federal Government initiative, awarded to Ausgrid (the distribution network service provider in Sydney). Commencing in 2011, this \$100 million initiative aims to study and trial Smart Grid technologies, their benefits and costs. One of the programme work streams is the Electric Vehicle project which aims to examine a range of issues surrounding the feasibility of integrating electric vehicles into the grid.

For the trial, Ausgrid has introduced 20 Mitsubishi iMiev EVs to its fleet in Sydney, Newcastle and the Central Coast. 12 are being used in a home trial in 22 households, and an additional 8 vehicles are being used in the Ausgrid fleet as pool vehicles (for business trips only). 50 slow-charge points and 6 fast-charge points have been installed in Sydney and Newcastle. Charge points have been installed at a range of sites including Ausgrid

¹² State Government of Victoria, "Guidance on Land-use Planning for Electric Vehicle Parking and Charging – The Victorian Electric Vehicle Trial", September 2012.
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depots and building car parks, shopping centres, sports grounds, TAFE colleges, Universities, private car park stations, public car parks, Officeworks, hotels and airports.

Ausgrid will use the data collected from the trial to determine the impact on the electricity grid as a result of charging of electric cars.

3.1.3 Australian Energy Market Commission

The Australian Energy Market Commission (AEMC) currently has an open review on energy market arrangements for electric and natural gas vehicles. This was initiated in September 2011, with draft advice being published in August 2012. The AEMC indicated that final advice would be published in November 2012, but as of 11th December 2012 this review remains open.

Thus far, the review has found that the energy market arrangements are sufficiently robust to accommodate the efficient uptake of EVs, but it is important to put measures in place now to facilitate efficient investment for both consumers and service providers in the long term. They consider that in general, no specific energy market arrangements should apply to EVs, and they can be treated as a form of demand side participation (DSP). Arrangements to facilitate greater uptake of DSP in general are proceeding under the AEMC's Power of Choice Review (with the final report presented to the Federal and state Ministers of the Standing Council on Energy and Resources for their consideration on 30th November 2012). They also propose that appropriate pricing signals (and particularly network pricing signals) are necessary to facilitate efficient EV charging behaviour; this is also under consideration in a more general context in the Power of Choice review. Finally, to facilitate consumer choice, they have devised new metering arrangements that enable a consumer to separate their EV consumption from their household consumption. This allows consumers to elect to purchase electricity for their EV separately from their household electricity, if they so desire. This would facilitate, for example, consumers purchasing 100% renewable energy for their car, without necessarily needing to do so for their household electricity.

3.1.4 CSIRO Electric Driveway Project

CSIRO's Electric Driveway project, is working on ways to integrate electric vehicles (EVs) into household power systems, where they can act as a distributed system for storing off-peak power from the national grid or local sources. The project will run for three years.

The project involves a number of real world field trials, mostly being implemented in Victoria in collaboration with the Victorian Government:

- In partnership with Victorian energy provider SP AusNet, CSIRO engineers converted three Toyota Prius vehicles to plug-in hybrid cars which are currently being road tested, and are providing information on driver usage patterns and residual battery capacity.
- CSIRO, in partnership with the Victoria Government, is involved in a trial involving over sixty electric vehicles deployed across Victoria. They will collect information on how these cars interact with the current electricity system, providing an insight into the barriers, impact and benefits this technology will have on Australia's future electricity network. (See further detail below about Victorian trial.)
- CSIRO in partnership with Blade Electric Vehicles are developing and testing two special-purpose EVs which will be integrated with a home energy management system, and used to partially power the homes they plug into.
- CSIRO, with members of the Australian Zero Emission House (AusZEH) consortium, designed and built a contemporary yet future ready AusZEH demonstration house with inbuilt technology supporting the integration of an electric vehicle with the home energy management systems. The demonstration house provides an example of how this EV technology can be integrated into homes.

3.2 Policies at the city level**3.2.1 Melbourne (Victoria)**

The Victorian Government Department of Transport's (VIC DoT) Electric Vehicle Trial is a state-level initiative involving the City of Melbourne, currently scheduled to run until mid-2014. The purpose of the trial is to "better understand the process, time lines and barriers for transitioning to electric vehicle technologies"¹³ and has a

¹³ Victorian Department of Transport 2012, *Electric Vehicle Trial* <http://www.tri.pps01.vic.gov.au/01531/ww/t/b> accessed on 7th of May 2012.

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multifaceted approach to understanding how EVs will evolve as a mode of transport in the short-to-medium future, and for preparing the State with adequate policy-making capabilities which cater for this new technology.

VIC DoT has raised, as the purpose of undertaking the trial, the following reasons:

- Reduction in GHG emissions:
- Energy price: electricity prices tender to be cheaper and more stable to petrol prices
- Improved air quality
- Job creation: promoting EV market uptake is expected to stimulate Victoria's automotive industry where it is currently one of only 15 places worldwide where a car can be taken from design through to the showroom.

The DoT trial includes the following initiatives:

- **Household / fleet vehicle roll-out** – 60 EVs provided by Blade EVs, EDay Life, Mitsubishi, Nissan and Toyota will be provided to public and private fleets as well as a number of households to understand how EVs will work in Victoria and to find out what EVs mean to Victorian residents. Households are selected based on a survey process and as far as possible, fleets and households will be close to each other in order to make charging infrastructure accessible to both. The purpose of the trial is to gather information related to the operation and safety of vehicles, as well as driver experiences and opinions on what it means to own and use EVs in Victoria. Data collection and management is being undertaken by CSIRO and will assist the Victorian Government understand the requirements, challenges and opportunities associated with EV uptake in Victoria.
- **Infrastructure roll-out** – The infrastructure roll-out component of the EV Trial will serve as the foundation for the Victorian EV market and guide the design and standards for the Victorian EV charging network to meet user requirements. As part of the trial, charging points will be installed in workplaces and households who are partaking in the Trial. A number of 'quick charging' points will also be established in the public space through Better Place, ECOtality and ChargePoint, while household charging infrastructure will be installed by DIUS Computing. The infrastructure trial will serve to collect information on driver behaviour and opinions of a diverse charging network, and will assist Government understand the requirements around charging infrastructure in different locations.
- **Economic impacts** – Surveys conducted on trial participants have indicated that over the trial period, 500 new jobs will be created with over \$43 million of investment to the state through infrastructure and public and private stakeholder involvement.
- **Education and awareness program** – To tackle confusion and uncertainty pertained to EVs as a transport mode, the education and awareness program is aimed at engaging and informing local communities on EV technology, and to link local designers and manufacturers into the national and international EV market. The interface for disseminating EV information will be a Department of Transport website dedicated to communicating information on EVs and how they work, as well as their environmental impacts and what kinds of vehicles are available. During the EV Trial, the site is expected to expand to subjects such as real-life driver experiences and location of charging infrastructure.
- **EV Trial participants – VIP Advisory Group** – The VIP Advisory Group has been established to provide expert advice to the Trial project team. Through the Advisory Group, stakeholders of the Advisory Group's constituents will be given a voice in the design and delivery of the trial, to ensure that the roadmap to Victoria's EV future reflects the requirements of various stakeholders.

3.2.2 Perth (Western Australia)

Launched in March 2010, the WA Electric Vehicle Trial "monitors the performance, environmental benefits, policies, infrastructure and practical implications for electric vehicle fleets."¹⁴ The goals of the trial are to:

- Demonstrate to the public the operating characteristics and environmental benefits of EVs
- Provide opportunities for local industrial development as well as gain technology transfers into WA universities

¹⁴ WA Electric Vehicle Trial 2012, homepage website available at <http://www.waevtrial.com.au>, accessed on 7th May 2012.
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- Allow trial participants to assess the suitability of EVs for their specific operational requirements
- Identify and assess the technical, regulatory, policy and planning issues with the introduction of EVs in Perth.

The initiatives under the WA EV Trial include a range of programs aimed at increasing the understanding of EV technology and requirements for mass adoption. Specifically, they include:

- Inclusion of 11 retro-fit EVs to the WA Government fleet to track and collect usage data
- Installation of 12 fast-charge bays around Perth for use by fleet participants
- Ongoing research project led by the University of Western Australia aimed at providing insights into what is required for the wider introduction of EVs.

3.2.3 Townsville (Queensland)

Ergon Energy is conducting an EFV trial in Townsville under their "Townsville: An Energy Sense Community" program, which aims to reduce the growth in capital investment projects and provide a smarter more secure network for the future.

This trial has now has entered its second stage, with the five Mitsubishi i-MiEVs cars being handed to new trial participants at Mysterton (a central location), after a successful eight-month trial at Mt Low (an outer city suburb). The new trial participants will use the cars for up to eight months, with the trial concluding in June 2013.

Customised charging equipment was installed at trial participant homes for the trial period. A solar-powered EV charge station was also installed at Townsville Airport, generating from a 4kW PV shade membrane structure covering six car parks. Further charging points have been installed at Mt Low and are planned for a shopping centre at Kirwan.

Ergon Energy is using the trial to observe possible impacts on the distribution network from charging the vehicles. They are aiming to test the vehicles in day-to-day situations to understand energy usage, frequency and timing of recharging and how they affect our network.

The trial thus far has found that households drove their EV about 360km a week, recharging took about two to three hours a night at a total cost of around \$13 in electricity a week. The trial also found that charging options need to be as flexible as possible otherwise motorists won't drive the cars.

3.2.4 General summary – Actions at the city level

Cities (and most levels of government) typically implement policies aimed at encouraging EVs for one of three reasons:

- *Addressing environmental issues* - many cities are committed to reducing GHG emissions, and to a lesser extent air pollution, and have identified mass adoption of EVs as potentially playing a major role in achieving this outcome.
- *Encouraging economic activity* - some cities explicitly state their objective of stimulating local economies through the use of EV policies.
- *Security of energy supply* - the mass adoption of EVs has been proposed by some governments as a means for reducing dependence on imported oil from foreign countries. The main source of fuel for EVs – electricity – is generally cheaper than petrol, and has less price volatility, making it a possible solution for reducing exposure to international oil markets.

Despite differences in the stated priorities for encouraging take up of EVs, many policies are replicated in cities, reflecting an emerging consensus on the tools and approaches available to legislators at the municipal level in responding to EVs. Table 10 summarises the types of policies implemented by other cities who are taking a significant range of actions (providing a broad overview of the possible scope of action). Policies are typically aimed around three key areas (outlined in further detail in the following sections):

- **Information provision or technology demonstration** - To reduce uncertainty and confusion surrounding the performance of EVs as a viable mode of transport, many council authorities have implemented initiatives aimed at building consumer confidence in the technology through marketing and educational initiatives.

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- **Consumer incentives** - Some cities are providing consumer incentives to encourage the take up of EVs. Consumer incentives are most likely to be deployed by cities that also have objectives supporting economic development and have derived economic strength from the automotive industry (like Victoria and the UK). Consumer incentives range from direct rebates to encourage the purchase of EVs through to incentives aimed at preferential treatment of EVs on the streets such as parking subsidies or use of congestion lanes.
- **Charging infrastructure** - Whilst all Cities are doing something around charging infrastructure, the extent to which Council authorities are willing to promote charge infrastructure availability varies, as well as the 'directness' of involvement in supplying it. Importantly, most cities recognise that it is not practical for the City to provide all charging infrastructure and are trying to streamline the approvals process and work with local businesses to assist them in being ready to install charging infrastructure.

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Table 10: Types of policies implemented by other cities

Type of policy	Policies	Cities				
		London	Melbourne (Victoria)	New York	Los Angeles	Perth
		<p>Objectives of EV strategy:</p> <ul style="list-style-type: none"> Promotion of innovative technology and assisting the UK automotive industry gain a competitive advantage in this industry Environmental benefits including reducing GHG emissions, improved air quality and reduction in noise Improving energy security and lower fuel costs. 	<p>Objectives of EV strategy:</p> <ul style="list-style-type: none"> Reduction in GHG emissions Improved air quality Energy price: electricity prices tender to be cheaper and more stable to petrol prices Job creation: promoting EV market uptake is expected to stimulate Victoria's automotive 	<p>Objectives of EV strategy:</p> <ul style="list-style-type: none"> Reduction in GHG emissions Reducing harmful particulate emissions 	<p>Objectives of EV strategy:</p> <ul style="list-style-type: none"> Reduction in GHG emissions Cheaper fuel Boost Los Angeles' green economy. 	<p>Objectives of EV strategy:</p> <ul style="list-style-type: none"> Environmental benefits Provide opportunities for local industrial development as well as gain technology transfers into WA universities
Information provision or technology demonstration	Demonstration programs					
	Inclusion of EVs in city fleets					
	Marketing of EV technology to public and private stakeholders					
	Collection of information through pilot programs involving public and private EV drivers					
	Collaboration across jurisdictions					
	Provision of consistent information					
	Provision of Dedicated EV car share spaces					
Consumer incentives	Parking permit subsidies					
	Use of congestion lanes					
	Tax credits					

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	High-Occupancy Vehicle (HOV) Lane Exemption						
	Rebates for home charging infrastructure						
Charging infrastructure	Direct provision of infrastructure in public places						
	Development requirements for EV infrastructure						
	Grants to building owners and car parks for the provision of charging infrastructure						
	Provision of forum for stakeholder discussions						
	Advocating for a national charging network						
	Inter-city partnerships						
	Work with building owners to provide them information on technology, regulations and timings so they are ready to implement charging infrastructure						
	Streamlining regulations for charging infrastructure						
	Assessment of impacts on local grid and network upgrades						

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3.3 Information provision and technology demonstration

To reduce uncertainty and confusion surrounding the performance of EVs as a viable mode of transport, many council authorities have implemented initiatives aimed at building consumer confidence in the technology through marketing and educational initiatives.

Many have policies aimed at **providing consistent information** to their residents.

For example, London is creating a strong and recognisable brand for the provision of information on EVs in London. As part of this they are working in partnership with other boroughs to consolidate the numerous EV related websites into a single portal for EV issues in London.

Similarly, a key part of the Victorian EV trial is an education and awareness program aimed at engaging and informing local communities on EV technology, and to link local designers and manufacturers into the national and international EV market. As part of this program there is a dedicated website aimed at providing information on EVs and how they work, as well as their environmental impacts and what kinds of vehicles are available. During the EV Trial, the site is expected to expand to subjects such as real-life driver experiences and location of charging infrastructure.¹⁵

Virtually all cities considered in the review had **inclusion of EVs in their government fleets** as one of their EV initiatives. The purpose of including EVs in City-fleets is two-fold: to reduce government's GHG emissions; and to increase exposure of EVs to the public. For example, New York has a Clean Fleet Transition Plan and approximately 25% of the city owned fleet is currently alternative fuel vehicles, including 339 EVs.¹⁶

Household trials provide the opportunity for people to test EVs as part of their daily lives but also for government to collect valuable information about the practicality of EVs in average households. Information that is collected through these trials can then be used as part of their marketing and educational initiatives.

In Melbourne, trials are currently being undertaken to gather information related to the operation and safety of vehicles, as well as driver experiences and opinions on what it means to own and use EVs in Victoria. Data collection and management is being undertaken by CSIRO and will assist the Victorian Government understand the requirements, challenges and opportunities associated with EV uptake in Victoria.

Western Australian also has an Electric Vehicle Trial that monitors the "monitors the performance, environmental benefits, policies, infrastructure and practical implications for electric vehicle fleets."¹⁷ One of the key goals of the trial is to demonstrate to the public the operating characteristics and environmental benefits of EVs.

Through demonstrator programmes, the UK Technology Strategy Board (TSB) has been involved with manufacturers, energy companies, local authorities and research organisations to inform future low carbon vehicle development to the UK market. Currently, the demonstrator programme constitutes the following:¹⁸

- *Toyota*: 20 plug-in hybrid Prius EVs in London. Of which, 10 are used in the GLAs, five within the Metropolitan Police, and five in Transport for London. The remaining 10 is used by the Government Car Dispatch Agency and private businesses
- *BMW*: 40 of BMW's Megacity car – Mini E vehicles – which are due for production in 2013, are currently being tested in the UK. The Mini E trial vehicles are being tested between London and Oxford amongst private users and within the London fleet.
- *Smart*: smart has been trialling their ED EVs for a number of years, with the latest models being updated to the newest generation of lithium-ion batteries. 60 users will be participating in a year-long trial around London and the south east, and 40 in a West Midlands trial.

¹⁵ Victorian Department of Transport 2012, *Electric Vehicle Trial* <http://www.transport.vic.gov.au/industry/e-vehicle/about-the-electric-vehicle-trial/infrastructure-roll-out> accessed on 7th May.

¹⁶ NYC 2012 *New York City Government: Citywide Administrative Services- Energy Management* <http://www.nyc.gov/html/dem/html/conservation/fleet.shtml> accessed on May 1st 2012

¹⁷ WA Electric Vehicle Trial 2012, homepage website available at <http://www.waevtrial.com.au/> accessed on 7th May 2012.

¹⁸ Source London 2012, *Technology Trials- the Technology Strategy Board trials* <https://www.source-london.net/technology-trials/> accessed on 3rd May 2012.
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- **CABLED:** the CABLED consortium began in 2009 with the Mitsubishi iMiEVs. Currently, a variety of models have become part of this trial, including 25 Tata Indica Vista EVs, 40 smart-for-two EVs, five Land Rover Range-e vehicles, and five LTI TX4 electric cabs.

All of the cities that have trials of this nature also have objectives around supporting industry.

A number of cities have taken active steps to forge **partnerships with neighbouring jurisdictions** in order to share EV-related information. For example, New York City is part of the Northeast Regional Electric Vehicle Partnership (NREVP) which started in 2010 between Philadelphia, Boston and NYC to assist early EV adopters in each city and build for the future. The partnership's initial goals include getting information to consumers and facilitating construction of EV infrastructure.¹⁹ The idea is to share information related to EV availability and local charging costs, and to educate building owners and suppliers with EV-related commercial and technical information so that building codes can be designed to accommodate EVs. The vision under the NREVP is a future where NYC residents can travel to their partner cities using EVs with confidence, knowing they can charge their cars when they arrive.

As highlighted above the City of London is working in partnership with other London boroughs to ensure consistent information is provided to consumers and is also in the process of establishing a London-wide charging network²⁰.

3.4 Provision of charging infrastructure

Whilst all Cities are doing something around charging infrastructure, the extent to which Council authorities are willing to promote charge infrastructure availability varies, as well as the 'directness' of involvement in supplying them. Typically all engaged Cities are:

- providing infrastructure at key strategic points (the extent of this varies significantly across Cities and their objectives)
- working with local businesses to assist them in installing charging infrastructure
- streamlining the approvals process.

London has set the target of delivering 25,000 charge points across the city by 2015, through collaboration with the boroughs and other partners. In *An Electric Vehicle Delivery Plan for London (2009)*, the installation of EV infrastructure has been considered for the following:

- 500 on-street, 2,000 in off-street public car parks and station car parks
- 22,500 provided in partnership with businesses. These charge points will be located in employer's car parks and retail/leisure locations.

In addition to the above, the *London Plan 2011* stipulates a requirement for all new development to provide charge points. This requirement is mandated under the City's transport policy. It is suggested that one in five spaces (both active and passive) provide an electrical charging point for the purpose of encouraging EV uptake.

In order to ensure that members of each local scheme will be able to use charge points across the country in the future, Transport for London is working with the UK Department of Transport's Office for Low Emission Vehicles (OLEV) and industry to develop standards for charging infrastructure that is coherent across the UK. London's EV infrastructure has been and continues to be developed with consideration for OLEV's infrastructure strategy as set out in *Making the Connection: the Plug-in Vehicle Infrastructure Strategy* (OLEV, 2011).

New York City is using Federal stimulus funding to install more than 200 EV chargers throughout the metropolitan area, including commercial parking lots. As part of this initiative, the City has announced to work with parking garage owners, co-op boards, consumers, and Con Edison (NYC's electricity utility provider) and provide information on technical standards and consumer needs associated with EV chargers, as well as the rules and regulations governing their installation and operation (NYC 2008). New York City is also working to simplify installation regulation to allow for home-installation of EV chargers. For example, homes with sufficient electric

¹⁹ City of New York 2010 *planYC- Exploring Electric Vehicle Adoption in New York City*, New York City.

²⁰ Mayor of London 2009 *An Electric Vehicle Delivery Plan for London*, London.

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wiring can install a charger without getting pre-approval from the city. However, homes that do not have sufficient electrical wiring from the street and grid can expect significant costs and delays. For this reason, the City is working with Con Edison and manufacturers to streamline the installation process for home chargers to achieve speed and affordability.

Los Angeles has 350 public charging sites located around the City. Other policies include:

- residential EV Home Charger Rebate Program
- becoming a member to the California EV collaborative to ensure EV drivers are able to travel smoothly across different jurisdictions
- development of an express permit system for installing home-based EV charging infrastructure which allows consumers to receive a permit for home charging infrastructure installation within 7 days. Customers are able to apply online for EV charger permitting approval, for inspections, and also for meter installations²¹.

The infrastructure roll-out component of the **Victorian EV Trial** will serve as the foundation for the Victorian EV market and guide the design and standards for the Victorian EV charging network to meet user requirements. As part of the trial, charging points will be installed in workplaces and households who are partaking in the Trial. A number of 'quick charging' points will also be established in the public space through Better Place, ECOTality and ChargePoint, while household charging infrastructure will be installed by DiUS Computing. The infrastructure trial will serve to collect information on driver behaviour and opinions of a diverse charging network, and will assist Government understand the requirements around charging infrastructure in different locations.²²

There are twelve fast charge bays around **Perth** for use by fleet participants.

²¹ Los Angeles Department of Water and Power (LADWP) 2012, *website: Drive Electric* https://www.ladwp.com/ladwp/faces/ta9Wp/res/0a7ca1/directories/fdq-drivelectric1.pdf.cfm?_afz=&afzLoop=152978170663000 accessed on 21st May 2012.

²² Victorian Department of Transport 2012, *Electric Vehicle Trial* <http://www.transport.vic.gov.au/projects/ev-trial/about-the-electric-vehicle-trial/infrastucture-roll-out> accessed on 7th May.
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4.0 Decision framework for policy development

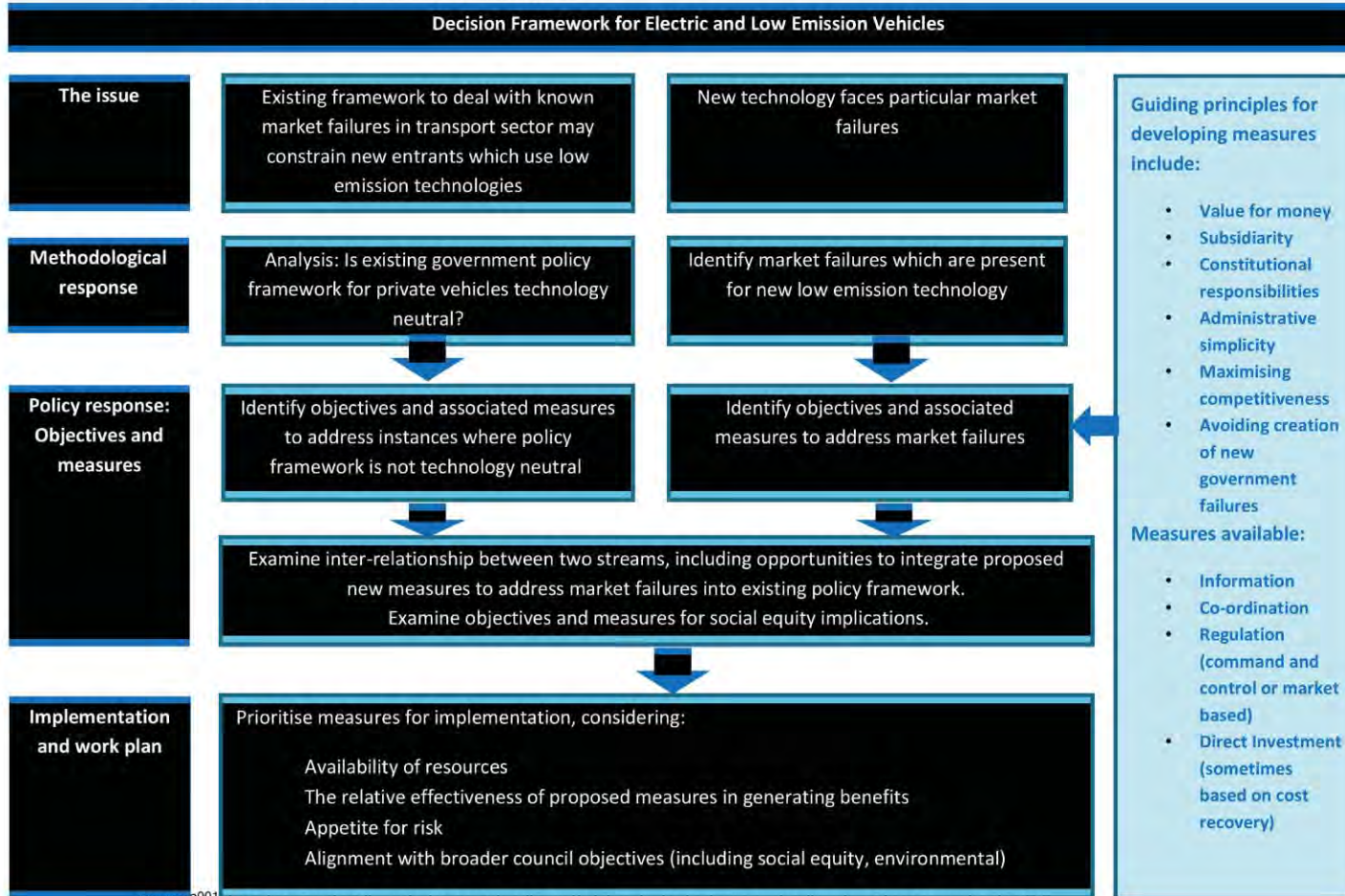
In the long term, community support for policy settings which enable EVs is likely to be strongest when the underlying logic for the City's involvement is clear, and the cost of the City's interventions is proportional to the benefits. This chapter proposes a framework for decision making for the City of Ryde in relation to electric and other low emission vehicles.

Drawing on broad principles for effective public policy, as well as the specific characteristics of the EV market and the City itself, the Decision Framework lays out key tests for any proposed policy intervention:

- first clarifying the problem which requires solving with reference to the ability (or inability) of the market to solve the issue in the first instances
- then identifying the appropriate role for the City in tackling the problem, and developing measures to meet the City's objectives
- finally prioritising issues and responses according to the City's resources and broader priorities.

A schematic which provides an overview of the Decision Framework is shown below in Figure 17.

Figure 17: Decision Framework for Electric and Low Emission Vehicle



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The Decision Framework has been applied to develop the analysis and recommendations laid out in subsequent sections of this report, as well as to have enduring value for the City in responding to subsequent circumstances or proposals in relation to electric or other low emission vehicles.

The remainder of this chapter is devoted to a discussion of each of the elements of the decision framework.

4.1 The key rationales for intervention

Good public policy is based on the premise that government only intervene where there is a strong rationale. The underlying rationale is usually founded either in market failure, policy/government failure or where there are clear government distributional objectives that need to be met. Market failure refers to where the market has not and cannot of itself be expected to deliver an efficient result (NSW Treasury Guidelines for Capital Business Cases and UK Green Book for appraisal and evaluation in central government). The Infrastructure Australia Better Infrastructure Decision-Making guidelines (Infrastructure Australia, 2008) also recognise government failure as a potential reason for government intervention. Governments may intervene to correct these market failures, to ensure socially optimal allocation of resources, provided it is clear that the costs of government intervention are less than the costs associated with the market failure.

The first phase of the decision framework requires policy makers to analyse the policy and market environment for electric and other low emission vehicles to determine whether there are grounds for government intervention. The basis of this analysis is set out below.

4.1.1 Are there any market failures that need addressing?

Market failures can occur in many different ways but they can all be classed into four generic categories: externalities, market power, imperfect information, and public goods. Table 11 provides a description of each of these market failures.

Table 11: Market failures

Generic market failure	Description
Externalities	'Externalities' result when a particular activity produces benefits or costs for other activities that are not directly priced into the market. Externalities are associated with, for example, research and development spill-overs, and environmental impacts, such as pollution. A firm might keep down its own costs by not investing in water pollution controls, but in so doing would raise the costs of those firms and individuals relying on using clean water. As a result the polluter has imposed an external cost on other users, or alternatively, a reduction in pollution confers an external benefit upon these other users.
Market Power (Barriers to Entry)	Market power can arise as a result of insufficient actual or potential competition to ensure that the market continues to operate efficiently. High start-up costs can deter entry by competitors in the first place, and therefore create market power. This situation may be exacerbated through organisations acting strategically to protect their position in the market. Examples of this are when an organisation invests in any excess capacity available in the market, or engages in a practice known as 'predatory pricing' where prices are set low (e.g. below the marginal cost of production) to drive out competitors and then raised once they have left.
Imperfect Information and uncertainty	Information is needed for a market to operate efficiently. Buyers need to know the quality of the good or service to judge the value of the benefit it can provide. Sellers, lenders and investors need to know the reliability of a buyer, borrower or entrepreneur. This information must be available fully to both sides of the market, and where it is not, market failure may result. This is known as 'asymmetry of information' and can arise in situations where, for example, sellers have information that buyers don't (or vice versa) about some aspect of product or service quality. Information asymmetry can restrict the quality of the good traded, resulting in 'adverse selection'. Another possible situation is where a contract or relationship places incentives upon one party to take (or not take) unobservable steps that are prejudicial to another party. This is known as 'moral hazard', an example of which is the tendency of people with insurance to reduce the care they take to avoid or reduce insured losses.

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Public Goods	<p>The market may have difficulty supplying and allocating certain types of products and services, such as 'public goods'. Public goods are those that are 'non-rival' or 'non-excludable' when used or consumed.</p> <ul style="list-style-type: none"> - 'Non-rival' means that the consumption of the good by one person does not prevent someone else using or consuming that good. Clean air is an example of a non-rival good. - 'Non-excludable' means that if a public good is made available to one consumer, it is effectively made available to everyone. National defence is an example of a non-excludable good. <p>Non-excludability can give rise to a problem known as 'free-riding'. This is when some consumers fail to pay for the provision of the public good because they expect others will do so. This implies that the returns to potential suppliers will be less than society as a whole would be willing to pay collectively. So a market solution would imply too little public goods being produced to be socially optimal.</p>
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Source: UK Treasury Green Book

For EVs, it is likely that market failures may relate to positive externalities associated with reduced environmental impacts from low emission vehicles, informational failures associated with consumer's limited ability to gather sufficient information of an appropriate quality to allow them to assess the costs, benefits and risks of a new technology and uncertainty to infrastructure providers about when and what charging infrastructure will be required.

4.1.2 Will the existing framework to deal with known market failures in transport sector constrain new entrants who use low emission technologies?

Ideally, government policy settings commence from an identification of market failure, and the judicious selection of a suite of tools to effectively address these issues. However governments rarely commence with a blank slate.

Invariably, most sectors of the economy are already the subject of significant intervention. Relevantly for this study, the transport sector is no exception. Consequently, when considering the policy settings in relation to a particular problem or issue, the analysis should be directed not only towards identifying market failure, but also to identifying policy failure; circumstances where existing policy settings have unintended consequences (derived from either poor design, or simply changing circumstances) which again deliver sub-optimal outcomes for society.

For example, interventions to enhance equity in transport accessibility by providing fuel rebates for one fuel source may inadvertently disadvantage new vehicle technologies powered by another fuel source.

Policy failure can be uncovered by a systematic analysis of the existing policy settings within a sector, to assess whether the policy measures individually or collectively produce unintended barriers to a new technology or service.

Once a policy failure is uncovered, options include redesign of the existing policy measure to eliminate the unintended consequence, or addition of another measure to compensate for the consequences of the initial policy settings.

4.1.3 Equity in the context of private vehicle choice

Social equity is sometimes cast as a market failure, and sometimes as a unique social and ethical consideration which need not be subject to the same tests as other policy objectives. Whatever the underlying approach, few governments are willing to disregard social equity as a foundation consideration for their policy settings, while many governments consider it the highest priority for decision making.

The pursuit of social equity in the transport sector is complex. Broadly, interventions to support public transport modes are frequently (but not exclusively) underpinned by arguments about equitable access to transport to enable economic and social participation. While some private transport interventions (investment in roads, fuel excise rebates) are similarly described in relation to social equity, for the most part private transport is not the subject of significant interventions to generate social equity; citizens' ability to pay (for fuel, for a vehicle, for tolls) appears to be generally accepted by policy makers as a reasonable basis for distribution of private transport goods and services, with broader equity considerations dealt with elsewhere, predominantly through the tax and transfer system.

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4.2 Establishing objectives and developing options

4.2.1 Importance of developing good objectives

If an intervention seems worthwhile, then the objectives of the proposed new policy, programme or project need to be stated clearly. This allows the identification of the full range of alternative options which government may adopt.²³

Having identified that there is a case for action arising from either market or policy failure, the objectives of action can be positively asserted. Following this, a hierarchy of outcomes, outputs and targets can be set out which allow the effectiveness of the proposed intervention to be assessed both prior to implementation, and during the evaluation process.

Objectives should be consistent with other policies and objectives for Council, and focussed on outcomes rather than outputs (e.g. to increase the proportion of households with access to a charging station, rather than to spend a proportion of the budget on charging stations)).

4.2.2 Developing good measures

Once a clear objective is in place, policy makers should set out a range of measures which could be deployed to meet those objectives. The broad options considered in the policy makers "toolkit" include:

- regulation (both command-and-control and market based instruments)
- information
- direct investment to provide assets, goods or services (sometimes delivered on a cost recovery basis and requiring decisions about pricing) and
- co-ordination of private players in the market.

Ideally, multiple options will be developed to allow the selection of a "value for money solution that meets the objectives of government action".²⁴

The UK treasury suggests the following actions to establish options:

- research existing reports and consult widely with practitioners and experts
- gather and analyse relevant data
- from the research identify best practice solutions
- consider the range of issues likely to affect the objective
- identify a range of policy instruments or projects that may be used to meet the objective - which may span different sorts or scales of intervention.

Whilst developing options there are some guiding principles that are generally considered good policy making:

- Measures should represent value for money with the benefits outweighing the costs.
- Measures should be designed for administrative efficiency, and to avoid the creation of new policy or market failures.
- The measures should be screened having consideration for the responsibilities and capacities of the local government. The principal consideration should be the responsibilities allocated by the constitution, or by virtue of the institutional arrangements in place where constitutional guidance is not available (as is the case for local government in Australia). In particular, existing legislation in relation to vehicles, road transport, fuel, or land use planning may provide guidance about the current scope of responsibilities.
- Policy makers may also give consideration to principles of subsidiarity: an *organizing principle* stating that matters ought to be handled by the smallest, lowest, or least centralized competent authority.

²³ UK Treasury Greenbook. P13.

²⁴ UK Treasury Greenbook p17
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4.3 Implementation and work plan

Having identified a range of options, a program of work can be identified for implementation. Ideally, measures will be evaluated to assess their costs and benefits, with the most cost effective measures selected.

Finally, Council resources are scarce. Even where measures are cost effective and aligned strongly with Council's broad objectives, council may decide that they are not a priority.

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5.0 Application of framework

5.1 Market failures

As highlighted in Section 3.0, one of the key rationales for government intervention is the existence of market failures. The following sets out some of the potential market failures in the EV market which will be discussed in more detail throughout the following sections. Importantly, some market failures may be present in the early stage of the EV market that hinder the development of the market and others may arise once the market is more established. By understanding these market failures the City will be better placed to ensure that they support the growth and development of the EV market.

5.1.1 Positive externalities

As discussed in section 2.4, the take up of electric and other low emission vehicles will provide environmental benefits (positive externalities) in terms of reduced greenhouse gas emissions and air pollution. These benefits are largely unpriced in the market at the moment leading consumers to purchase vehicles that are not socially optimal.

Because there is no price on greenhouse gas emissions from vehicle fuels, there is no incentive for consumers to choose vehicles with lower greenhouse gas emissions. The carbon price is intended to price some of the greenhouse gas externalities however private vehicles will not face a carbon price. In contrast, drivers of EVs will face the carbon price through the electricity they purchase.

5.1.2 Information and uncertainty

As EVs are such a new industry, there is limited real world experience with which potential owners and businesses can make informed decisions. In particular, there:

- remains ambiguity among consumers about the performance and safety of EVs compared to conventional vehicles
- is uncertainty around the likely evolution of the EV market which makes it hard for private businesses to plan and prepare for an EV world
- is much uncertainty about the technology, particularly the charging infrastructure and how it will be used (e.g. when charging infrastructure will be required, what charging infrastructure will be required and the process to install charging infrastructure).

For each person or business to commit resources to researching and assessing the performance of EVs and collecting information to overcome the inherent uncertainties is likely to be time consuming and costly and delay the take up EVs (which as highlighted above offer environmental benefits to society as a whole). As such, there may be a role for government to provide information and demonstrate the benefits of EVs.

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5.1.3 Competitive long term electric vehicle market

Competition is essential to an efficient market: it encourages innovation and provides consumers with more choice and cheaper prices. Market power can arise as a result of insufficient actual or potential competition. Market power can be used to drive out competitors and raise prices once they have left the market. Any action government takes to support the EV market should encourage a long term competitive market and be conscious not to inadvertently create market power for any of the early market players. For example, using one EV manufacturer for any demonstration projects may give an unfair advantage or locking in one infrastructure provider may create monopoly power which may distort the future market. Likewise, any government action should be temporary to assist the market develop and ensure government does not crowd out future private investment. For example, if government provides charging infrastructure it may prevent private investors entering the market if they believe government involvement will prevent a competitive market from evolving.

5.2 Government failures

Policy failures exist in circumstances where existing policy settings have unintended consequences (derived from either poor design, or simply changing circumstances) which deliver sub-optimal outcomes for society. Policy failure can be uncovered by a systematic analysis of the existing policy settings within a sector, to assess whether the policy measures individually or collectively produce unintended barriers to a new technology or service.

For EVs, policy failure is likely to arise in relation to one of three areas:

- vehicle policy and regulation
- road network policy and regulation (including parking policy)
- fuel policy and regulation.

While the interventions in the market to support private vehicle choice are extensive, the similarities between ICE vehicles and EVs mean that few of these interventions negatively impact on EVs.

The most significant area where existing arrangements may need to be revised to accommodate EVs are associated with the planning arrangements for road networks. Current EV technology (unlike ICEs) is dependent on recharging over long periods of time, and the most likely scenario for recharging is while vehicles are parked. The alignment of charging opportunities with parking opportunities within the road network is therefore critical to the viability of EVs, and the planning and permitting arrangements may need to be adjusted to accommodate this.

A lesser opportunity to level the playing field for EVs arises from the current practice of using maps and signs to signal refuelling opportunities. Over time, similar practices to signal recharging opportunities should be adopted.

Other areas of policy failure (some of which are outside of Council's direct control) include:

- vehicle fleet purchasing policies may not be technology neutral
- there may be additional regulation requirements such as safety and noise that need consideration
- the differential treatment of electricity and liquid fuels under the carbon price
- inadequate treatment of air pollution.

As part of their strategy Council may wish to advocate for changes to policy with other levels of Government.

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6.0 Strategies for City of Ryde

6.1 Positioning

Based on the review of the role of government (in Section 5.0) and experience from other cities (in Section 3.0) there are a range of roles the City potentially could play in the EV market, as illustrated in Figure 18.

Figure 18: Potential approaches



The City could do nothing, as the vast majority of cities are doing. The philosophy behind doing nothing is that there are no market or policy failures and the market will respond sufficiently. However, do nothing may present some risks to the City including slow take up of EVs and loss of environmental benefits, residents feeling the city is not supporting their choices to use EVs and potentially being unprepared for the mass adoption of EVs.

The City could adopt an approach that provides a neutral policy environment for EVs and other low emission vehicles. This type of approach acknowledges that there are some market and policy failures that would make it difficult for new technology to enter the market. Types of policies implemented in this approach would be around removing barriers to private investment, for example, simplifying the approvals process to install charging infrastructure. This type of approach ensures new technologies do not face barriers but does not maximise the environmental benefits that low emission vehicles provide.

Going one step further, the City could adopt an approach that favours new technology with environmental benefits. This type of approach, which has been adopted by cities like New York and Melbourne, places a high emphasis on valuing environmental externalities, making low emission vehicles more favourable than their counterparts. The types of policies included in a strategy are aimed at removing barriers to the take up of EVs and would include EVs in the city fleets to demonstrate performance and improve awareness, provision of information to address concerns about performance, working with local businesses to assist them in providing charging infrastructure and possibly the provision of some public charging infrastructure in key areas.

Alternatively, the City could adopt an approach that favours new technology at any cost. This type of approach has been adopted by cities like London and Los Angeles, whose aims include not only maximising environmental benefits but also supporting local industry and technology development. These cities also have a clear commitment to leadership. The types of policies would include consumer incentives such as parking permit subsidies, dedicated lanes for low emission vehicles and an active role in the provision of charging infrastructure. Whilst this approach has some benefits, including supporting local industry and bringing forward environmental benefits, it is also potentially a more risky approach for the City to adopt. This kind of approach would need to be developed carefully to avoid supporting the wrong technology, acting too early and distorting private investment. Further, this approach is the most expensive and ties up capital funding which could be used more effectively on other policies.

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The approach that the City of Ryde adopts will inevitably represent the view of local constituents. Technocratic approaches are an important input to decision making but ultimately elected Councillors must judge how best to meet the desires of the people of the City. Based on the framework set out in Section 3.0, a justifiable approach would be aimed at providing a neutral policy environment with some policies aimed at favouring new technology with environmental benefits.

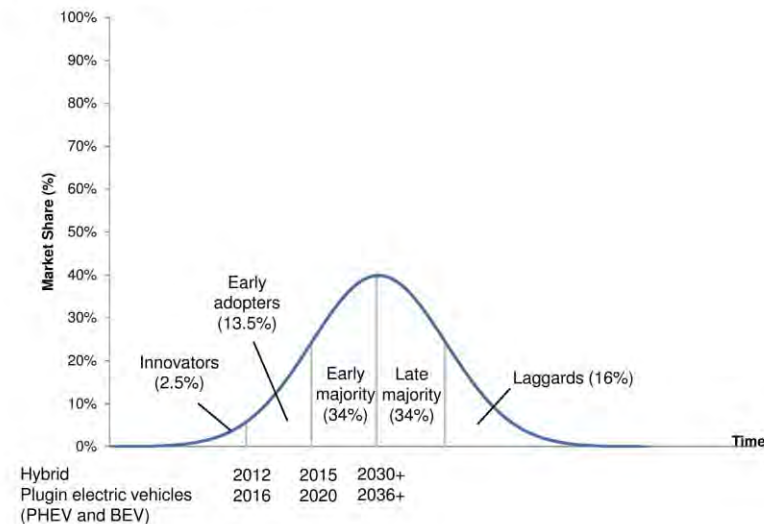
Figure 19: Suggested approach for the City's strategy



Timing of policies

When developing new policies it is important to consider the timing of any intervention and ensure there is an appropriate exit strategy for Council. New markets can typically be grouped into 5 stages: innovators, early adopters, early majority, late majority and laggards (see Figure 20). When developing the strategy consideration has been given to the appropriate timing of Council involvement using market share as indicators.

Figure 20: Technology adoption lifecycle²⁵



Source: AECOM based on Rogers, 1962

²⁵ The timings for take up are from the analysis presented in Section 2.6. These estimates reflect the current available information. However, as highlighted throughout this report there is much uncertainty around the key factors that are likely to affect take up of EVs so it is important that the City continue to monitor the market and update this strategy as necessary.

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6.2 A structured strategy

The following objective is recommended for the City of Ryde's approach to low emission vehicle strategy:

To provide the right regulatory and infrastructure framework to prepare for a change in private vehicle choices, and address market failures which hinder the substitution of low emission vehicles for ICEs.

This objective does not assume that EV technology should be adopted within the City at all costs. Rather it acknowledges that all private vehicle choices ought to receive similar levels of support from government, and looks to ensure that legacy approaches in regulating and supporting conventional motor vehicles do not inadvertently discriminate against the new technology. It also seeks to acknowledge the potential environmental benefits from electric vehicles when compared to conventional vehicles, and seeks to actively address market failures which currently prevent these benefits and costs from being passed on to vehicle users.

The analysis of market and policy failures suggest there are several key areas where intervention may be warranted to overcome existing market and policy failures and prevent new ones arising. The results from this "first principles" review is also supported by an empirical review of the literature, which suggests that other Councils have taken a similar approach.

- Building community confidence in the technology
- Ensuring access to charging infrastructure
- Removal of policy barriers to new technology
- Monitoring the market

The following outcomes hierarchy (see Figure 21) relates these objectives to a series of possible measures for implementation by the City. The measures have been developed following a review of the literature as well as data analysing specific characteristics of the City of Ryde.

The following sections discuss each objective and associated measures in detail including presenting the rationale for involvement, literature and data review which informs the recommendations for measures, appropriate timing for involvement and potential measures for success.

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Figure 21: Draft outcomes with possible measures for the City to consider

Action	Details	Motivation	
Building community confidence in the technology	Public relations campaign around EVs	Focus on information on EV technology, particularly alleviating range concerns	Address market failure (information and uncertainty)
	Trial a small number of EVs in the council fleet	Collect extensive information and use to facilitate public relations campaign, and to inform decision making in future.	Address market failure (information and uncertainty)
	Collaboration with other jurisdictions	Collaborate with other early adopter Councils <ul style="list-style-type: none"> - Share data on trial programs - Promote adoption of appropriate standards and regulations at a federal and state level - Combine resources to monitor the market 	Amplify the benefits of other initiatives to promote consumer awareness (address information and uncertainty market failure)
	Car share	Negotiate with car share providers to include a minimum proportion of car share spaces for EVs (with associated charging infrastructure)	Provide access to EVs for residents in areas with minimal off-street parking. Increase public exposure to EVs, alleviating range anxiety and increasing technology awareness.
	Provision of charge infrastructure maps	Provide information to consumers on locations of charging infrastructure in Ryde. To maximise benefit should be done in collaboration with other jurisdictions.	Address market failure (information and uncertainty)
Ensuring public access to charging infrastructure	Removing policy barriers for private charging infrastructure providers	Clarify planning processes for EV-related infrastructure.	Ensure existing government policy framework for private vehicles does not form a barrier to new technology. Reduce uncertainty around the planning approvals process for potential charge station investors.
	Provision of information for private car park owners	Encouraging installation of EV infrastructure in privately owned car parks via provision of information and clarity of planning requirements.	Reduce uncertainty for potential charge point providers.
	Introduce requirements for consideration of EV charge infrastructure in new developments	Specify a minimum requirement for EV charge infrastructure in new developments (particularly high density residential). Council can select how ambitious this should be, ranging from a requirement that developers "consider" the inclusion of EV charge infrastructure, to providing ducting (preventing necessity for digging in a later retrofit), to providing ready charge points at a proportion of spaces.	Encourage developers to provide access to home charging facilities to make EVs a viable option for residents.

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Action	Details	Motivation	
Clarifying Council Position on EVs	Clarifying relative priorities around EVs and other transport modes	In particular, clarify priorities around EVs, public transport, walking and cycling.	Reduce uncertainty for potential EV charge station investors and residents.
	Clarify policy around Council owned EVs	<p><i>Sustainable Plant & Fleet Replacement & Hire Policy</i></p> <ul style="list-style-type: none"> - Include consideration of EVs <p><i>Motor Vehicle Policy</i></p> <ul style="list-style-type: none"> - Clarify priorities around Australian-assembled vs EVs - Include additional factors for consideration around vehicle usage in vehicle selection - Review purpose and use of council vehicles and consider charge point installation 	Ensure existing government policy framework for private vehicles is technology neutral.
Monitoring the market	Monitor the market	Periodically monitor the market to ensure awareness of any rapid market shifts that may create a step-change in uptake	Manage risks associated with timing uncertainty and ensure Council's response remains optimal and timely

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7.0 Building community confidence in the technology

Objective: To provide information and technology demonstration to assist in overcoming public perceptions about the performance and safety of low emission vehicles in the early stages of market development without creating any barriers to entry for future market participants.

7.1 Rationale and Role for Council

Whilst EVs are technically viable, and offer environmental benefits to society as a whole, there remains uncertainty among consumers about the performance and safety of EVs compared to conventional vehicles. As EVs are such a new market there is limited real world experience with which potential owners can make informed decisions. There may be a role for government to provide information and demonstrate the benefits of EVs to assist consumers make informed decisions.

Any policies aimed at providing information and demonstration of EVs should only continue until there is enough information for consumers to make informed decisions. It is important to ensure there are clear exit strategies in place. Further, any measures by Council need to ensure they do not distort the future market. For example, promoting one company could result in undue market power and lead to higher prices for consumers.

Council's role in providing information and technology demonstration to assist in overcoming public perceptions about the performance and safety of low emission vehicles is justified by both first principles analysis and the experience in other cities. The following components are recommended, and outlined in future detail in the following sections:

- Public relations campaign
- Inclusion of EVs in Council fleet
- Collaboration with other jurisdictions
- Car share
- Charging infrastructure maps

Success in achieving the stated objective could be assessed by an increased community ability to respond accurately to questions about EV characteristics and performances (measured by community attitude survey). Other indicators could include hits on the EV website, and the number of EV car share users in Ryde.

7.2 Public relations campaign

7.2.1 Description

It is recommended that City of Ryde develop an EV stream integrated with existing outreach activities that considers opportunities to integrate practical information about the features of EVs into market stalls, newsletters, social media and free media. This could be conducted by Ryde's Community Engagement team in conjunction with other community outreach activities already established by City of Ryde, such as outreach activities under the Climate Change Action Plan.

It is also recommended that Ryde consider the creation of a distinct web space to provide reliable, credible information to businesses and households seeking information on EV vehicles, charging technology, environmental benefits, and GreenPower options to establish the City as a trusted provider of information. This could be integrated closely with the existing online Sustainable Living Guide.

It is reasonable, from an equity position and to enhance the environmental benefits, for the City to take a role in encouraging the use of renewable energy. Where the City has direct control, such as in council fleet vehicles, council run charging infrastructure or where the City is providing public space (e.g. on street charging infrastructure and car share) they can use this position to ensure renewable energy is used to charge EVs. Beyond this, given that consumers have a choice to purchase GreenPower (sourced from renewable supplies) for all their energy requirements, the City's role should be to ensure this choice exists when charging EVs (e.g. in private car parks) and that consumers have adequate information to make informed decisions.

Where EVs are promoted on the basis of their environmental credentials, it is important that the relatively higher benefits of walking, cycling and public transport are clearly expressed, in line with Council's priorities around reducing private vehicle use.

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There are no major barriers to the provision of level 1 and level 2 charging infrastructure for off street parking at both residential and commercial premises. In particular, there are no approvals required to install a Level 1 or Level 2 charger into an existing dwelling, a private car park or a public car park. However, the lack of barriers may be unknown and there could be a role for Council to inform individuals and commercial building owners that there are no approvals required to install EV charging infrastructure.

Thus, the campaign should focus on providing information on the following:

- Range and capabilities of EVs on the market, matched against typical household usage (alleviating range anxiety)
- Practicalities and cost of installing appropriate charging infrastructure
- Availability of public charging points (when they become available)
- Environmental credentials of EVs

7.2.2 Timing

There is no urgency regarding the delivery of this initiative. However, in order to obtain the maximum value, it is recommended that outreach activities are integrated into existing initiatives where possible from this date forwards. Engagement should continue until take up of new technologies is around 20% of sales (just transitioned from early adopters to early mass market take up). A dedicated EV website could transition to focus on availability and location of charging infrastructure as the market matures (refer to section 7.6).

7.2.3 Program of works

Action	Timeframe	Costs	Responsibility
1. Identify existing outreach activities where EV material could be incorporated	February 2013	Staff time	Senior Sustainability Coordinator – Transport and Environment, in collaboration with Community Engagement team
2. Develop EV related material to be included in outreach campaigns	March 2013 to June 2013	Staff time Website development	City of Ryde Community Engagement team
3. Implement EV material in public outreach activities	From June 2013	Marketing materials	City of Ryde Community Engagement team

7.3 Inclusion of EVs in Council fleet

7.3.1 Description

It is recommended that City of Ryde include a small number of EVs in the Council fleet. This serves a dual purpose:

- Providing a foundation for community engagement and technology demonstration
- Allowing collection of information on EV performance and utilisation

In order for this initiative to be worthwhile it is essential that the trial is carefully monitored and extensively promoted. This should include the following:

- Carefully monitor extensive information around usage and charging, maintenance costs, insurance costs, charging infrastructure, driver impressions (via survey before and after utilisation).
- Use information collected and vehicles as inputs to the public engagement program as much as possible.
- Apply branding on vehicles to maximise demonstration and awareness benefits.
- Charge with 100% GreenPower to ensure integration with overall GHG reduction targets and demonstrate costs and benefits to City residents and businesses. Ensure that this is publicised.

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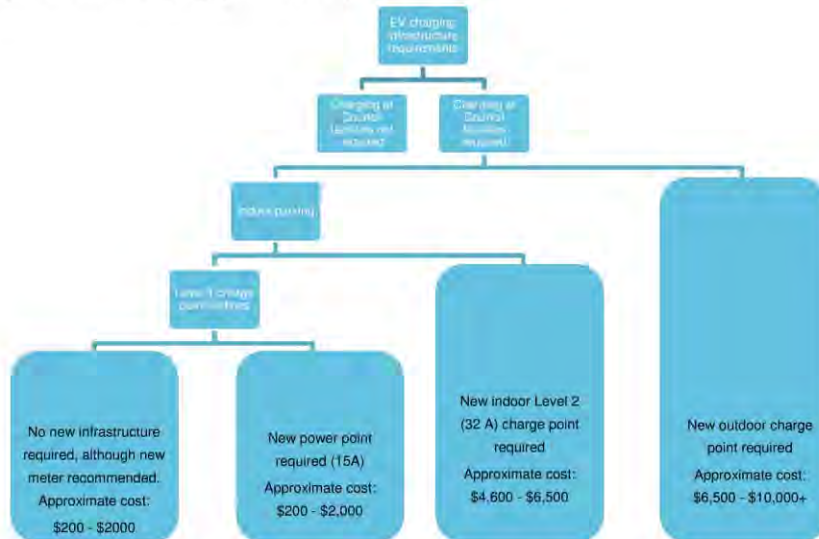
- Utilise information collected on the trial to facilitate informed decision making on leaseback/package vehicles and future fleet vehicle purchases.
- Explore potential for collaboration with Macquarie University/CSIRO/other to utilise data for further research.
- Share data collected and related resources for public engagement with other jurisdictions (refer to section 7.4).

7.3.2 Parking and charging facilities

To maximise usefulness, EVs should be parked at central locations where Council staff will have access to them. The Operations Centre and the Civic Centre are likely to be appropriate locations for the EVs to be parked.

The cost of charging infrastructure will vary depending upon a number of factors, such as whether the EV will be parked indoors or outdoors, proximity to existing charge points, and the intended usage of the vehicle, as summarised in Figure 22. For more detail on the costs of various options, refer to section 2.1.

Figure 22: Possibilities for charging infrastructure required



Usage of the vehicle will dictate whether a Level 1 charge point will suffice, or whether a Level 2 charge point may be required (as outlined in section 2.2). Level 1 charging may suffice if the vehicle is to remain parked for a reasonable duration between short trips, while Level 2 charging may be required if vehicle usage is more extensive.

If the EV is intended to be a pool vehicle, charging will be required at the Council facilities (since this is where it will remain parked for the majority of the time). Level 1 charging may suffice if usage of the vehicle during the day is low (short trips with time in between to charge). Level 2 charging would allow higher utilisation of the vehicle.

If the EV is intended to be a leaseback vehicle, a charge point may not be required at Council facilities (if the employee commute is short, and usage of the vehicle during the day is low,). Measures may need to be taken to ensure that journeys during the day are limited to ensure a sufficient charge remains at the end of the day for the commute home. If the employee commute is longer, or utilisation during the day is expected to be higher, a charge point will be required at Council facilities, under the same circumstances as a pool vehicle. In either case, charging facilities will need to be available at the home of the employee using the leaseback vehicle, in proximity to where the vehicle is to be parked overnight. Metering equipment and a new retail account would need to be set up to enable Council to pay for electricity used by the EV in an analogous manner to the petrol cards for leaseback ICE vehicles. City of Ryde have indicated that the most likely scenario is for electric vehicles to be

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trials as leaseback vehicles, and that electric Vehicles are not likely to be an option for pool vehicles at this stage.

7.3.3 Monitoring period

If Council is unsure as to the EV utilisation that might apply, a short period (several months) of maintaining log books on trips for existing Council vehicles that would be used in a comparable fashion is recommended. If the EV is to act as a leaseback vehicle this monitoring period should be associated with typical commuting patterns for the employee intended to use the EV on a regular basis.

7.3.4 Specialist charging infrastructure

There may be merit in City of Ryde trialling specialist commercial EV charging products, such as those available from ChargePoint Australia (described in section 2.2.3). This would serve to demonstrate the public charging infrastructure they provide, and could assist in engagement with private car park providers around the provision of public charging points (refer to recommendations in section 8.3). It will also include superior monitoring capability, allowing easier collection and maintenance of data on EV utilisation. On the other hand, this infrastructure is likely to be significantly more expensive, and will not be required if the vehicle will be parked in a secure private area. Also, City of Ryde may not obtain significant value from the additional monitoring functionality. Furthermore, it may assist the public engagement campaign to demonstrate that sophisticated charging equipment is not required (refer to recommendations in section 7.2). City of Ryde should consider the relative priorities around engagement with car park providers and the general public, and should obtain site-specific quotes for each (to provide further clarity around relative costs depending upon the site-specific characteristics of where the vehicle(s) will be parked).

In order to obtain a site-specific quote, recommended contacts at relevant organisations are provided below. It is also recommended that quotes are obtained from several suitably qualified electricians for the installation of standard 15A power points and appropriate metering.

Table 12: Recommended contacts at EV charge point providers

Organisation	ChargePoint Australia	Better Place
Name	Lance Douglass	Sarah Cox
Direct line	+61 2 9434 3437	+61 3 8679 0814
Mobile	+61 419 550 888	+61 402 648 666
Email	lance.douglass@chargepoint.com.au	sarah.cox@betterplace.com
Web	www.chargepoint.com.au	www.betterplace.com.au
Address	Level 2, 74 Mentmore Ave, Rosebery NSW 2018 PO Box 385, Mascot NSW 1460	114 Balmain Street, Richmond VIC 3121

7.3.5 Metering

It is recommended that City of Ryde ensure that the selected charging option is on a separate meter to general Council electricity, so that the usage of the vehicle can be accurately monitored, and 100% GreenPower can be purchased to supply the vehicle.

A separate meter would also be important to install at a homeowners property in the case of a leaseback vehicle that was to be supplied with electricity paid for by Council (in a similar arrangement to petrol cards currently in use for ICE leaseback vehicles).

As outlined in section 2.2.2, the meter is available free of charge from AusGrid and will simply need to be installed by a suitably qualified (Level 2) electrician. EnergyFix is a division within Ausgrid that provides recommendations on approved electricians, and can be contacted at 132 604. Connection services at Ausgrid can be contacted for further information at 02 9585 5980.

7.3.6 Vehicle selection

For maximum impact, the EVs selected for trial should be similar to that which an 'average' resident would select for daily vehicle use. The trial should aim to encourage the use of EVs as a daily vehicle, rather than a novelty

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option. This implies selection of a vehicle that is reasonably priced and comparable in size and appearance to a typical ICE. Obvious branding should be applied to the exterior of the vehicle to clearly identify it as an EV.

7.3.7 Employee selection for participation in the vehicle trial

Given that the City of Ryde would need to pay for an electrical meter at an employee's house and the range limitations of electric vehicles, it is likely that the preference for employees participating in the trial would be for employees based locally and ideally who own their own home. It would also be ideal to select employees who have regular Council business which results in them regularly driving around the City in order to maximise the promotional benefits. There would also be benefits in selecting employees who were prepared to act as ambassadors for the vehicles, contributing their reflections and experiences to the community outreach program.

7.3.8 Changes to Council Policies

To enable the Electric Vehicle Trial, specific exemptions/changes may be needed in employee leaseback agreements participating in the trial. For example, it may be necessary to make changes/exemptions to the leaseback policy to allow participants in the Electric Vehicle trial to swap vehicles with other employees during holiday periods (due to the range limitations of electric vehicles). Also, the additional cost of an electric vehicle above a standard ICE vehicle would need to be subsidised by Council, together with funding provided for the provision of a separate meter and GreenPower.

7.3.9 Timing

There is no urgency regarding the delivery of this initiative. However, in order to obtain the maximum benefit, it is recommended that the trial starts when the next round of funding becomes available, and continues until the take up of new technologies is around 20% of sales (just transitioned from early adopters to early mass market take up).

7.3.10 Cost

The cost of this initiative will depend upon the vehicle type selected. Indicative costs for a range of electric vehicles available in Australia are listed in section 2.1.1. The cost of charging infrastructure will also apply, as outlined in Figure 22.

At present, EVs are typically more expensive than a similar ICE vehicle. If the EV is to be used as a leaseback vehicle, this would mean that Council will need to subsidise the cost of the vehicle for that employee.

7.3.11 Program of works

Action	Timeframe	Costs	Responsibility
1. Decide intended role of trial EVs (pool, leaseback, etc). If intended for leaseback vehicle, determine which employee will use the EV.	February 2013	Staff time	Section Manager – Plant & Fleet, in conjunction with Senior Sustainability Coordinator – Transport and Environment.
2. Identify vehicles in the current fleet with usage patterns likely to be similar to the EVs. Implement a log book system to monitor usage patterns.	February 2013 to August 2013		
3. Obtain quotes for installation of charging infrastructure (and associated meter) at charging sites. Obtain quotes for both Level 1 and Level 2 charge points, and from specialist providers (such as ChargePoint) as well as standard options requiring an electrician only.	August 2013		
4. Conduct a cost-benefit analysis to determine the ideal charging infrastructure arrangement, based upon quotes obtained and the data collected on typical vehicle usage (from log books). Install the selected option.	August 2013 to October 2013		
5. Conduct market research to determine the most suitable EV for trial and obtain quotes for purchase	August 2013 to October 2013		
6. Submit funding bid for project	November		

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Action	Timeframe	Costs	Responsibility
	2013		
7. Purchase EVs and begin trial. Monitor usage and cost data, including: <ul style="list-style-type: none"> - Distances travelled - Electricity used (kWh and \$) - Other costs, such as insurance, maintenance, etc - Driver impressions and reflections 	July 2014 onwards	Vehicle - \$30,000 to \$70,000, depending upon vehicle selected Charge point - \$200 to \$10,000, depending upon local circumstances and speed of charging required	
8. Use data collected as the foundation for community awareness campaign	July 2014 onwards	Staff time	Community Engagement team

7.4 Collaboration with other jurisdictions

7.4.1 Description

It is recommended that City of Ryde collaborate with adjoining jurisdictions on a wide range of the issues outlined in this report. Intercity partnerships could be established, particularly where those jurisdictions also have areas with a higher than average proportion of early adopters. Collaboration should act to:

- Ensure that consistent information is provided to vehicle users in the Greater Sydney area.
- Combine efforts in working with State Government to update relevant state-based legislation (refer to section 8.2).
- Align policies and arrangements of parking and charging EVs with adjoining and other leading LGAs
- Ensure that vehicles traveling to Ryde from adjoining LGAs are aware of the policies and arrangements of parking and charging EVs within Ryde.
- Share information about trial programs (consumer utilisation of charging points, charging times, consumer surveys etc).
- Combine efforts in monitoring the market (refer to section 10.0).

Collaboration could be established via existing programs where appropriate. It is recommended that City of Ryde explore the potential for collaboration on EVs via organisations such as the Northern Sydney Regional Organisation of Councils (NSROC). Alternatively, intercity partnerships could be established with nearby jurisdictions where City of Ryde already has an established relationship (such as with Hunters Hill and Hornsby Councils) or with cities which have demonstrated an interest in leadership in regards to electric vehicles (such as the City of Sydney).

7.4.2 Timing

There is no urgency regarding the delivery of this initiative. However, early identification of opportunities for collaboration will maximise their value. It is recommended that City of Ryde start exploring the potential for collaboration now and continue until take up of new technologies is around 20% of sales (just transitioned from early adopters to early mass market take up). This measure may transition to focus on availability and location of charging infrastructure as the market matures (refer to section 7.6).

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7.4.3 Program of works

Action	Timeframe	Costs	Responsibility
1. Identify existing inter-jurisdictional collaboration which could be effectively extended to include EVs, and gauge potential interest from nearby jurisdictions in partnering on EV initiatives.	February 2013	Staff time	Senior Sustainability Coordinator – Transport and Environment
2. Implement initiatives collaboratively where possible.	March 2013 onwards		

7.5 Car share

7.5.1 Description

Car share providers (such as GoGet, for example) have the potential to provide access to EVs for residents. Since Council provides access to public parking spaces for car share schemes, it is reasonable to specify requirements around the use of those spaces that are in the public interest.

It is recommended that the exact requirements are negotiated on a case by case basis with car share providers interested in locating in City of Ryde. Requirements around provision of EVs should be flexible enough that they do not form a barrier to car share schemes, but still incentivise provision of a proportion of EVs to be supplied. The exact proportion that is appropriate will depend upon the cost of the vehicles and charging infrastructure at the time, and should be determined in discussion with the car share provider. Initially, it may be appropriate for only one EV to be included. This could be linked over time to the take up of the technology in the general market.

The goal should be to expose both car share participants as well as non-participants to EVs, leveraging the City's existing commitment to providing car parking space to these businesses. For maximum value, the car share spaces selected for EVs should be in a prominent location where the EVs will be visible to passing public.

7.5.2 Timing

This should be progressed when car share providers indicate interest in locating activities in the City of Ryde. Negotiated requirements should be specified until car share providers install EVs of their own accord (beyond requirements specified by Council).

7.5.3 Program of works

Action	Timeframe	Costs	Responsibility
1. Negotiate inclusion of EVs in car share fleet, in exchange for use of public land	When approached by car share providers	Staff time	Senior Sustainability Coordinator – Transport and Environment

7.6 Charging infrastructure maps

7.6.1 Description

At present, it is understood that there are no charging facilities located in Ryde. However, as charging points do become available it will be important that EV owners have easy access to information about where these are located. This will assist in reducing range anxiety amongst potential owners, encouraging further uptake of EVs.

Initially, Council should simply provide an online map of the locations of publicly accessible EV charging infrastructure on their website (this could be in a dedicated part of the website for EVs, established under the recommendation discussed in section 7.2). This should be coordinated with other jurisdictions wherever possible, taking advantage of any opportunities to supply data on public charging infrastructure to more comprehensive systems that encompass multiple jurisdictions.

Eventually, it is likely that private companies (such as Google, for example) will take over the role of providing information to owners on EV charge locations, integrated into interactive mapping software available on mobile devices. Ryde should freely provide up to date information to any and all private companies interested in

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undertaking this role. This should not be done under any sort of exclusivity agreement, since this would limit competition.

7.6.2 Timing

Provide maps when the first public charging infrastructure becomes available in City of Ryde, and continue in an ongoing fashion until adequate alternative systems are in place to ensure convenient public access to information.

7.6.3 Program of works

Action	Timeframe	Costs	Responsibility
1. Develop a map of publicly accessible charging locations	When publicly accessible charging infrastructure becomes available	Staff time Website development	Senior Sustainability Coordinator – Transport and Environment in collaboration with Community Engagement team
2. Make available on City of Ryde website (preferably associated with other EV information). Update as new sites become available.			
3. Make data freely available to private companies wishing to offer services in provision of charging locations to EV owners			

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8.0 Ensuring public access to charging infrastructure

Objective: To ensure timely access to suitable charging infrastructure that addresses the specific charging needs of the City is available whilst minimising public sector expenditure, promoting a long term competitive EV charging market and allocating the available road space fairly using transparent principles.

8.1 Rationale and Role for Council

Access to charging infrastructure is essential to the take up of EVs, since they will only be purchased if it is possible to recharge them. It is often argued in the literature that the provision of charging infrastructure is essential to alleviate range anxiety. Whilst the provision of charging infrastructure clearly has a role to play in reducing range anxiety, there are a range of other measures that are also likely to be effective. As discussed in section 2.3.1, range anxiety is predominantly driven by lack of information and uncertainty around the performance of new technology, and can be effectively addressed by consumer exposure to the technology. In this context, the direct provision of public charging infrastructure to alleviate range anxiety is likely to be an unnecessary and expensive solution to Council. The Council's role in the provision of charging infrastructure should be to ensure there are no barriers to private companies entering the market, and to encourage the inclusion of charging points in new developments. In this respect there are a number of roles for Council:

- Removing legislative/policy barriers for on-street charging infrastructure
- Providing information to address uncertainty in the private sector that may hinder the provision of charging infrastructure
- Encouraging consideration of EV charging infrastructure in new developments

Any involvement by the City should be undertaken with a view to ensuring a competitive market for EV charging. If allocating public space for charging infrastructure, it is important that the City provide the right environment to encourage a competitive market and not favour one particular business model or company over another which may inadvertently create market power in the EV charging market. Likewise, it is important that public investment in charging infrastructure does not crowd out private investment.

8.1.1 Identifying legislative/policy barriers

In the future, city residents and users are likely to seek to access to a combination of charging infrastructure, including home charging, work charging, off street car parks at key destinations such as retail and leisure facilities, on-street parking and dedicated commercial charging premises. AECOM considered each of these in turn to identify if there are any legislative/policy barriers to the provision of these charging infrastructure by the market and the potential role of Council in removing or reducing them.

This review identified that, at present, there are no approvals required to install a Level 1 or Level 2 charger into:

- Existing dwellings
- Private car parks
- Public car parks

The lack of barriers to installation of EV infrastructure into existing dwellings and private and public car parks may be unknown and there is a role for Council to inform individuals and commercial building owners that there are no approvals required to install EV charging infrastructure. This is discussed further in Section 7.2 and Section 8.3.

By contrast, the provision of on-street charging infrastructure is the area with major potential barriers. Currently, for private providers of charging infrastructure there is no clear development approvals framework and in addition there are numerous additional approvals outside the DA process that add to the uncertainty and potential costs of setting up EV charging infrastructure. Addressing this is discussed in Section 8.2.

8.2 Removing barriers for on-street charging infrastructure

The approvals process for on-street charging is complex and depends upon whether the proponent is Council or a private operator, as outlined below.

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8.2.1 Private on-street charging infrastructure

If a private operator wishes to install on-street charging infrastructure they will need development consent under Part 4 of the EPA Act 1979. However, currently the development approvals process is unclear. There is no clear definition for on-street recharge facilities within the Standard Instrument 2006, the State template for all NSW Council LEP's. The absence of a clear definition results in prohibition by default in certain 'closed' Zones of Council's existing and Draft LEP's. Closed zones are structured to specify a limited range of exempt and permissible uses, while relegating all other uses as prohibited. This, coupled with the absence of DCP objectives and design guidelines does not provide certainty to potential developers that a proposal would be able to proceed, and in what form and scale (i.e. singular or network roll-out). It also constrains Council's ability to assess the environmental impacts of a development and document the assessment such that it could be reasonably defended if it became the subject of a Class Action through the Land and Environment Court.

To address these issues it is recommended Council either:

- Seek an amendment to the State Planning Policy (Infrastructure) 2008 to include a definition for on-street charging infrastructure and relevant development standards, being provisions that designate the use in a 'permissible with consent' or 'exempt development', subject to compliance with specified development standards; or
- Amend the LEP to create an open zone (all uses permitted with consent unless expressly prohibited). This would have the effect of allowing other additional uses currently closed zones and may be contrary to the zone intent unless carefully planned; or
- Seek an amendment to Standard Instrument (State LEP Template) and update the LEP. Approach the State to request a standard definition for on-street charging infrastructure to be inserted into the Standard Instrument in the first instance, followed by an update to the Standard LEP for the City to define permissibility for recharge facilities in appropriate Zones or all Zones.

The latter is preferred, because:

- The form of on-street charging infrastructure that may be appropriate in a high density environment may be significantly different from that which might be appropriate for a suburban or rural town environment. It would be preferential if on-street charging infrastructure was managed at the local level in order to respond to unique streetscape and urban circumstances
- The blanket application of 'open' zones could have the effect of allowing other additional uses that are currently prohibited in 'closed' zones and contrary to the zone objectives, unless carefully planned.

In addition, if Council is to proceed with creating LEP provisions, Council should also update the DCP to include guidelines regarding the impacts of development and acceptable forms such development may take, following a detailed urban design analysis and risk assessment, having regard to the following (for example):

- The appropriate form for charging infrastructure (such as separated bollards, smart poles, wall plug-in points)
- The appropriate location of the charging points relative to vehicle parking spaces
- Design considerations for pedestrian safety and minimising electrical hazard
- Electrical supply considerations, including network capacity and supply point design
- "look and feel" of the infrastructure, having regard to individual street-scape character

This could be undertaken during Council's next scheduled review of the LEP/DCP within 4-10 years.

In addition, there are numerous other approvals outside the DA process that add to the uncertainty and potential costs of setting up EV charging infrastructure. These include:

- a permit for carrying out works within the road reserve under section 138 of the Roads Act 1993
- approval from RMS for the installation of non-standard traffic control (parking) signs/ the establishment of new signs for standardisation under Part 4 of the Road Transport (Safety and Traffic Management) Act 1999 and the current RMS delegations ('Guide to delegating to Councils for the purposes of Traffic Management 2009')
- if the energy fee is absorbed into a pay parking scheme fee, they will require:

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- street vendors permit issued by Council (local roads) under Section 139A of the Roads Act 1993, with the concurrence of RMS if on a classified road
- approval from RMS for a Pay Parking System (the technology) and Pay Parking Scheme under the Road Transport (Safety and Traffic Management) Act 1999 and associated Regulation and Guidelines for Pay Parking.

Council could collaborate with industry groups to obtain RMS approvals for standard Pay Parking Systems (the technology), Pay Parking Schemes and associated standardised signage. This would reduce the need to obtain approval from RMS for simple, standardised systems and repeatedly submit justification for parking allocation to EVs.

8.2.2 Public on-street charging infrastructure

If Council wishes to install on-street charging infrastructure they will need approval under Part 5 of the EPA Act 1979. It may be possible that it will be classified as an exempt development under State Planning Policy (Infrastructure) 2007 for the installation of service lines, particularly if co-located with existing street infrastructure or furniture. However, this would be subject to obtaining legal advice in relation to the circumstances and proposed design. In addition, Council would require a number of other approvals including:

- approval from RMS for the installation of non-standard traffic control (parking) signs
- if the energy fee is absorbed into a pay parking scheme fee, they will require approval from RMS for a Pay Parking System (the technology) and Pay Parking Scheme.

Council should obtain RMS approvals for standardised Council recharge infrastructure, including standard Pay Parking Systems (the technology), Pay Parking Schemes and associated standardised signage. This would reduce the need to obtain approval from RMS for the incremental installation of simple, standardised systems and repeatedly submit justification for parking allocation to EVs.

8.2.3 Dedicated charging premises (off-street charging)

Dedicated charging premises on private property will require development consent under Part 4 of the EPA Act 1979. As with private on-street charging infrastructure, there is no clear definition for dedicated vehicle recharge facilities within the Standard Instrument 2006 and Council LEP's. The definition of 'car parking' can be argued not to apply to dedicated vehicle recharge facilities because that their primary function is not for car parking, but for energy supply to vehicles. This, coupled with the application of 'closed' zones (specifying a limited range of exempt and permissible uses, while relegating all other uses as prohibited) currently results in prohibition by default in certain Zones of Council's existing and Draft Local Environmental Plans (LEP's). It also reduces certainty for both developers and Council regarding if a proposal would have acceptable impacts.

As discussed above, this can either be addressed through either:

- updating the State Planning Policy (Infrastructure) 2008 to include a definition for dedicated off-street charging premises and relevant development standards, being provisions that designate the use in a 'permissible with consent' or 'exempt development', subject to compliance with specified development standards; or
- amending the LEP to create open zones; or
- seeking an amendment to Standard Instrument (State LEP Template) to define dedicated off-street charging premises and updating the LEP to reflect this.

In terms of removing barriers to the establishment of dedicated charging premises, updating the State Policy would be the most effective option. However, considering the uncertainty around what charging infrastructure may be required and in what form of building or structure, it may be in the public interest to manage the development of this infrastructure locally under Council's LEP and DCP.

If Council is to proceed with creating LEP provisions, Council should also update the DCP to include guidelines regarding the impacts of development and acceptable forms such development may take, having regard to the following (for example):

- The appropriate form for charging infrastructure (such as separated bollards, smart poles, wall plug-in points)
- The appropriate location of the charging points relative to vehicle parking spaces

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- Design considerations for pedestrian safety and minimising electrical hazard
- Electrical supply considerations, including network capacity and supply point design

Given it is likely to be some time before electric vehicle market penetration is sufficient to support commercial operations of this kind, this could be undertaken during Council's next scheduled review of the LEP/DCP within 4-10 years.

8.2.4 Electricity retail licence

The Australian Energy Retailer (AER) recently updated their exemption guidelines, to say that the supply of electricity from a charging facility to a vehicle is a service to the transport sector, which is not regulated by the AER. As this is a deemed exemption category no application is required for exemption.

8.2.5 State planning system review

The New South Wales (NSW) Government has announced that it will prepare a new planning system for NSW. In July 2012 it released a Green Paper on a new Planning System for NSW, building on feedback from community consultation process late 2011. The two month consultation period on the Green Paper closed on 14 September 2012. The Government has commenced the next step in the process of creating a new Planning System, the preparation of a White Paper and draft legislation. The Government has announced that the White Paper will be released for public comment by the end of 2012 (however this may change to early 2013). The intent is to present new planning legislation to the NSW Parliament in early 2013.

Council will have the opportunity to submit comments on the new planning system, which could include requests for electric and other low emission vehicles to be better facilitated under the legislative framework, though the introduction of new definitions and provisions either in State-wide policy, or local plan template(s).

8.2.6 Timing

Align with any forthcoming reviews of planning instruments, noting that the market is likely to require guidance fairly rapidly and a more comprehensive approach will produce more orderly results (i.e. by 2016).

8.2.7 Program of works

Action	Timeframe	Costs	Responsibility
1. <u>Request amendment to Standard Instrument</u> Approach the State to request that a standard definition for 'on-street' and 'off-street' recharge facilities be inserted into the Standard Instrument. Conduct in partnership with other Greater Sydney Councils if possible.	Align with existing engagement processes with the State. This could form part of a submission on the White Paper on NSW's new planning system which should be released early 2013 for public comment.	Staff time	Senior Sustainability Coordinator – Transport and Environment
2. <u>Amend Local Environment Plan (LEP)</u> Update to the Standard LEP for the City to define permissibility for recharge facilities in appropriate Zones or all Zones.	Commence when Standard Instrument has been updated, or new Standard Instrument is released. Alternatively undertake in the next scheduled review of the LEP.		
3. <u>Amend Development Control Plan</u> Update the DCP to include guidelines regarding the impacts of on-street charging infrastructure development and acceptable forms such development may take.	Align with any forthcoming reviews, noting that the market is likely to require guidance fairly rapidly and a more comprehensive approach will produce more orderly results (i.e. by 2016).		
4. <u>RMS approvals for standardised</u>	Ensure in place by the time Council		

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Action	Timeframe	Costs	Responsibility
<p><u>systems and signage</u></p> <p>Collaborate with industry groups and obtain RMS approvals for standard Pay Parking Systems (the technology), Pay Parking Schemes and associated standardised signage.</p>	<p>anticipates providing or facilitating on-street charging infrastructure.</p>		

8.3 Information for private car park owners

Due to the immature nature of the EV market there is much uncertainty about when charging infrastructure will be required, what charging infrastructure will be required and the process to install charging infrastructure. For each private car park operator to collect the information required to overcome this uncertainty will be costly and may delay the installation of charging infrastructure or result in inefficient decisions being made (e.g. the installation of level 2 chargers when level 1 chargers may be sufficient). Given the Council will need to collect much of this information anyway (to implement the EV trial in the Council fleet, and for community engagement) there is a role for Council in sharing this information with private car park owners to encourage and assist them becoming ready to install charging infrastructure.

8.3.1 Description

As highlighted above, the provision of charging infrastructure in private car parks will play a crucial role in providing access to charging infrastructure for City of Ryde residents and non-residents who drive into the city for work or other purposes. However, there is currently much uncertainty about when charging infrastructure will be required, what charging infrastructure will be required and the process to install charging infrastructure. As such, it is recommended that the Council work with both private car park operators and other businesses to assist them in being ready to implement the right charging infrastructure at the right time. This will include:

- Encouraging the installation of EV charging infrastructure in existing buildings
- Providing clear guidelines on planning approvals required for charging infrastructure. At present, there are no approvals required to install a Level 1 or Level 2 charger into a private or public car park. Building operators should be made aware of this, highlighting that there are no major barriers to the provision of EV charging infrastructure at their facilities.
- Updating the business community with information on market development to assist them in being ready at the right time
- Updating the business community with information from the City's demonstration projects e.g. infrastructure installations, electricity usage patterns
- Working with shopping centre managers and leisure facility managers (e.g. cinemas) to explore opportunities to provide overnight charging in areas with high demand for charging (arising from limited off street private parking for local residents)
- Ensuring private car parking operators are well informed about the benefits and costs associated with GreenPower, and are encouraged to provide this as an option for their customers.

Better Place provides a manual for property developers that could be used as a basis for information and to facilitate engagement²⁶. This document outlines the specific technical requirements for a car park to be "EV Ready", where this implies that EV charging infrastructure could be installed later at minimal cost. The Victorian State Government "Guidance on Land-use Planning for Electric Vehicle Parking and Charging – The Victorian Electric Vehicle Trial" released in September 2012 also provides practical information for developers on planning for future provision of EV charge infrastructure. Council could recommend these as resources for developers who are seeking more information on specific technical requirements.

²⁶ Better Place, "EV wired Technical Specifications", <http://www.betterplace.com.au/Media/Docs/Better-Place-EV-wired-Technical-Specs-61847541-0x10-4011-x030-082ab7721375-0.pdf>
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8.3.2 Timing

There is no urgency about the delivery of this initiative. However, to obtain maximum value it is recommended that this initiative is implemented as soon as practical (preferably in conjunction with existing initiatives), and continues until there is sufficient charging infrastructure at private car parks, and private car park owners are well informed.

8.3.3 Program of works

Action	Timeframe	Costs	Responsibility
1. Compile information on the relevant information for installation of EV charge points in private car parking facilities (costs, planning approvals required, anticipated EV rollout, information from Council EV trial, etc).	Three months after commencement of EV trial.	Staff time	Senior Sustainability Coordinator – Transport and Environment
2. Develop an engagement program with private car park operators within Ryde, including relevant materials (eg. booklets, presentations, etc).	Following Action 1	Staff time	Community Engagement team
3. Implement engagement program	Following Action 2, ongoing	Staff time Marketing materials	Senior Sustainability Coordinator – Transport and Environment with Community Engagement team

8.4 EV charge infrastructure in new developments

8.4.1 Description

Modelling indicates that EVs will be a mainstream choice by 2020, making up a significant proportion of new vehicle sales. Furthermore, the move to EVs over the next decades is considered inevitable. It is therefore worth considering the planning guidelines around the provision of EV charging infrastructure in new building developments. Buildings are long lived assets, meaning that buildings constructed today are likely to remain in use beyond the time when electric vehicles become mainstream technology.

It is estimated that the provision of basic EV charging infrastructure at a Greenfield residential property costs \$200 to \$300 (for parts and labour). By contrast, retrofit of an existing building to install the same basic charging infrastructure costs around \$2,000, or up to \$10,000 where digging is required²⁷. Given the inevitability of EV take-up, this suggests an argument in favour of including basic EV charging infrastructure in buildings, even where it will not be used in the immediate future.

However, this must be balanced with caution around the fact that there are no clear standards for EV charging infrastructure at present, especially around the telecommunications equipment required for participation in "smart grids". Mandating minimum provision of EV charging infrastructure in new developments at present may ultimately increase costs if the wrong infrastructure is installed (due to lack of clear standards) and must be adjusted at further expense later.

A range of compromises are possible, as follows:

- **Option 1 – Requirement for building developers to 'consider' EV charging** – Eventually, availability of EV charging infrastructure will be a 'must-have' for parking locations, and the lack of this infrastructure will detrimentally affect property values. Therefore, even without a minimum requirement, developers may choose to include EV charging readiness if the cost is sufficiently low. Engagement with developers

²⁷ Victorian State Government, "Guidance on Land-use Planning for Electric Vehicle Parking and Charging – The Victorian Electric Vehicle Trial", September 2012.
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to make them aware of the inevitability of a move to EVs may assist in encouraging the installation of EV charge infrastructure. This could be conducted as a part of the planning approvals process, or through other business engagement programs. For example, it may be appropriate for Ryde's Economic Development Officer to develop a program of engagement with building developers on EVs, or for the Assessment Team to provide guidance and information during the development approvals process. If a more proactive approach is desired, the DCP could be amended to require building developers to 'consider' the inclusion of EV charging infrastructure, without any minimum requirement being specified.

- **Option 2 – Mandate minimum provision of ducting only** – Providing the "pipes and pits" from the point of supply to the likely area of charging will dramatically reduce the costs of later roll-out (by minimising the requirement for digging during the retrofit). Provision of ducting can be implemented by developers at negligible cost; it is simply a design choice that does not require the inclusion of significantly more materials. Therefore, it is recommended that suitable ducting is provided for all car spaces in the development.
- **Option 3 – Mandate minimum provision of basic charging points** – Council could choose to mandate a minimum proportion of car parks in each new development to include basic charging points (Level 1 chargers, equivalent to 10A home power points). If desired, developers could be allowed to 'cap' the circuit in readiness for later deployment, minimising issues around lack of standards for EV plugs.

To provide a point of reference, Victoria recommends that all Greenfield public parking facilities with at least 100 parking spaces designate a baseline allocation of 2% of car spaces for the installation of EV circuits²⁸. Once the number of EVs registered in Victoria reaches 5,000, the recommended percentage of car spaces shall increase to 3%, and continue to increase by 1% for each additional 5,000 EVs registered in Victoria until the percentage reaches 10%. This allocation should be considered relatively ambitious given Victoria's stated intentions around economic stimulation of their automotive industry.

This report recommends implementation of Option 2 as the most suitable at this stage. This places a minimal cost burden on developers, but will substantially reduce the inevitable retrofit costs when EVs become commonplace. Buildings under construction today are expected to remain in use for the next fifty years, which is within the time that EVs are expected to become the primary vehicle of choice.

8.4.2 Types of developments

Council will need to decide what type of buildings these mandates should apply to. Categories to consider include:

- High density residential buildings
- All residential buildings
- Commercial buildings
- Dedicated car parks

Considering that the majority of charging is anticipated to occur at home, new high density residential buildings should be considered a relatively higher priority. Other building types should be considered on their merits, balancing the costs against the potential likelihood of users seeking charging points at that location in future. It may be appropriate for this to be considered on a case by case basis through the development approvals process, as long as this does not introduce prohibitive uncertainty for developers.

8.4.3 Public sensitivity to allocation of car spaces (public or residential car parks)

If EV charge points are to be provided at public car parks, the allocation of these car spaces needs to be considered carefully. Typically, signage is included to limit usage of those spaces to EVs only (otherwise the small number of spaces provided with charge points are unlikely to be available when EVs need them). However, the public is typically highly sensitive to the allocation of car spaces, and is likely to be dissatisfied with the premature allocation of an unreasonably high number of spaces specifically for EVs. If public spaces are to be allocated to EVs, the number of spaces allocated must be adjusted over time and linked to the take up of EVs in

²⁸ Victorian State Government, "Guidance on Land-use Planning for Electric Vehicle Parking and Charging – The Victorian Electric Vehicle Trial", September 2012.
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the community. Extensive and early community engagement over this issue will assist in minimising dissatisfaction (refer to recommendations in section 7.2).

Implementation of Option 2 (provision of ducting only) will avoid this issue, since no car parks would be explicitly reserved for EVs at this point.

8.4.4 Implementation

Whichever option is selected by Council would be implemented via the Development Control Plan (DCP) in Chapter 9 (Parking Controls). Option 2, which is recommended, could be implemented in section 2.1 with the inclusion of a new provision under "General", "Controls" as follows:

- i. *Each new car parking space must include ducting ('pipes and pits') sufficient to facilitate later retrofit of electric vehicle charging infrastructure without the need for excavation within the site. This should be sufficient to support Level 2 charging facilities (32 Amps) with telecommunications capability.*

8.4.5 Timing

Given the considerable costs of retrofitting (if suitable ducting is not in place), and the minimal costs associated with making basic preparations in the near term, it is recommended that the option selected by Council is implemented in the next review of the DCP (if possible, in the version of the DCP currently being finalised).

8.4.6 Program of works

Action	Timeframe	Costs	Responsibility
1. Decide which option is preferred by City of Ryde: Option 1 – Requirement for building developers to 'consider' EV charging Option 2 – Mandate minimum provision of ducting only Option 3 – Mandate minimum provision of basic charging point	Align with forthcoming reviews	Staff time	Senior Sustainability Coordinator – Transport and Environment
2. Update the DCP, Chapter 9 (Parking Controls) to implement the selected option.			

9.0 Removing policy barriers to new technology

Objective: To ensure that Council policy does not create any barriers to the substitution of EVs for ICEs.

9.1 Rationale and Role for Council

As discussed in section 5.2, government policy can sometimes inadvertently apply barriers to emerging technologies, where they operate differently or have different requirements to existing technologies. It is important that these aspects are identified and addressed to ensure a neutral policy landscape that does not artificially prevent the entry of new technologies.

9.2 Clarifying relative priorities around EVs and other transport modes

9.2.1 Amendment of LEP

At present, Ryde's policies in the Local Environmental Plan (LEP) suggest a possible conflict related to EVs. The 'Aims' of the plan (clause 1.2 (2)) include:

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- (e) to improve access to the city, facilitate the maximum use of public transport and encourage walking and cycling.
- (f) to protect and enhance the natural environment, including areas of remnant bushland in Ryde by incorporating principles of ecologically sustainable development into land use controls.

This creates a possible conflict in interpretation, since the promotion of EVs is suggested by the clause on enhancing the natural environment (through reducing greenhouse gas emissions and local air pollution), while clause (e) suggests priorities around reducing private vehicle use.

It is recommended that City of Ryde clarify the priorities around EVs, making it clear that facilitating maximum use of public transport and encouraging walking and cycling are higher level priorities, with the promotion of the substitution of EVs for ICEs being a relatively lower priority. This could be implemented by a redrafting of clause (e) as follows:

- (e) to improve access to the city, facilitate the maximum use of public transport and encourage walking and cycling and, where it is not in conflict with these objectives, to encourage the substitution of lower emission vehicles.

Currently, Aim (e) of clause 1.2(2) specifies individual modes of transport, so it is considered appropriate to clarify Council's position in relation to low emission vehicles, which will avoid the conflict identified.

9.2.2 Amendment of DCP Parking Controls

The DCP Parking Controls currently specifies a range of objectives, including:

- 3. To minimise car dependency for commuting and recreational transport use, and to promote alternative means of transport - public transport, bicycling, and walking.

These could also be amended to explicitly define the relative priorities around low emissions vehicles, walking and cycling, as follows:

- 3. To minimise car dependency for commuting and recreational transport use, and to promote alternative means of transport - public transport, bicycling, and walking. Furthermore, where it is not in conflict with this objective, to encourage the substitution of lower emission vehicles.

9.2.3 Timing

It is recommended that this is aligned with forthcoming reviews.

9.2.4 Program of works

Action	Timeframe	Costs	Responsibility
1. Determine Council support for the proposed re-drafting	Align with forthcoming reviews	Staff time	Senior Sustainability Coordinator – Transport and Environment
2. Implement the proposed re-drafting			

9.3 Clarify policy around Council owned EVs

Policies around the vehicles owned by Council may need some review to ensure that EVs are properly considered and supported as a viable choice. This relates to the following policies, addressed in turn below:

- Motor Vehicle Policy
- Terms and Conditions for Private Use of a City of Ryde Leaseback Vehicle
- Terms and Conditions for Private Use of a City of Ryde Packaged Vehicle

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9.3.1 Motor Vehicle Policy

This document outlines City of Ryde's policies around motor vehicles owned by Council and provided to staff for the purpose of delivering Council services. Several sections may need consideration with relation to EVs.

Clause 1 states:

"These vehicles should be available in the car pool during COR's core business hours 8.30am to 4.45pm Monday to Friday unless otherwise provided an agreement with the City of Ryde"

This clause may prove problematic if EVs are provided to users on a leaseback or packaged vehicle basis, and are freely available to other users during the day. Depending upon usage during the day the EV may not retain sufficient charge for the commute home. This will be particularly problematic in the case where EV charge facilities are not available at Council premises, or where only Level 1 charging is available (and usage during the day is high) (refer to section 7.3). If EVs are to be a viable option for leaseback and packaged vehicles, this clause may need to be relaxed for EVs, or contain a caveat that EV vehicle users can manage the use of their vehicle to ensure a sufficient charge for their travel home. This could be drafted as follows:

"These vehicles should be available in the car pool during COR's core business hours 8.30am to 4.45pm Monday to Friday unless otherwise provided an agreement with the City of Ryde. With regards to electric vehicles provided on a leaseback or packaged basis, the primary user of the vehicle will be given flexibility to manage the pool usage of the vehicle to ensure that the battery is sufficiently charged as required."

Clauses 3.1 and **3.2** specify the types of vehicles that can be selected by the Mayor or General Manager and Group Managers. They specify that they "may select up to a Australian assembled 6-cylinder (luxury) vehicle". Council should be aware that the range of EVs assembled in the Australian market at present is very limited, which would restrict the availability of EVs to these users. Council should evaluate priorities between environmental sustainability (suggesting promotion of EV alternatives and a relaxation of this requirement) and contributions to the Australian economy. No changes to this clause are necessarily recommended at this stage, but it is raised for Council awareness.

Clause 4.2 specifies the principles on which vehicle selection should be made, including the following:

- Best value for CoR
- Availability in the CoR
- Fuel economy
- Environmental considerations

These clauses are likely to remain sufficient, unless City of Ryde wants to add a more specific clause explicitly prioritising the selection of EVs above ICEs. This could be justified on a similar basis to benefits in technology demonstration (refer to recommendations in section 7.3).

Clause 5.4 specifies arrangements for vehicle assignment. Council may like to add specific provisions here for the exchange of EVs between employees, as follows:

Staff members may, with mutual agreement, exchange assigned vehicles for a limited duration. In particular, staff members with electric vehicles may negotiate with other staff members to exchange vehicles during a holiday period, if the range of the electric vehicle is likely to be insufficient for intended use.

9.3.2 Terms and Conditions for Private Use of a City of Ryde Leaseback Vehicle

Similarly to the Motor Vehicle Policy, this document includes provisions specifying that the leaseback vehicle:

"is to be available at all times during City of Ryde's core business hours of 8.30 am to 4.45 pm, Monday to Friday, unless otherwise approved by the General Manager. City of Ryde's operational requirements are such that all pool vehicles must be available to be used by any other staff if required for the proper performance of City of Ryde's functions."

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As discussed above with relation to the Motor Vehicle Policy, this may create challenges for users of EVs, in ensuring that sufficient charge remains for the commute home at the end of each day. The following wording could be added:

“With regards to electric vehicles provided on a leaseback of packaged basis, the primary user of the vehicle will be given flexibility to manage the pool usage of the vehicle to ensure that the battery is sufficiently charged as required.”

Clause 8 states that:

“City of Ryde will supply a petrol card for the purchase of petrol for both City of Ryde business use and for private use subject to certain conditions. The employee is required by City of Ryde to comply with the directions given by Council’s authorised officer in connection with the use of the petrol card.

General purpose vehicle leaseback drivers may use the petrol card for the purchase of fuel for all private use within NSW & the ACT only whilst on any authorised leave in any calendar year. All fuel requirements outside NSW while on authorised leave must be purchased and paid by the employee.”

This clause needs to be reconsidered with respect to EVs (which do not operate on petrol). If Council intends to provide electricity for EVs in a similar manner to petrol for ICEs, the logistics for this will need to be outlined in this policy. If charge points are provided at Council facilities these could be metered and paid for by Council. However, for leaseback vehicles charging is primarily expected to take place at home. This therefore necessitates the installation of a new meter and associated retail account at the home of the employee. Council should consider how the costs of that installation will be covered (by the employee, or by Council).

It is recommended that all vehicle charging is performed with 100% GreenPower to maximise environmental benefits. Depending upon the retailer selected, GreenPower is typically offered at only a small increase in cost (around +25%) from standard tariffs.

This clause could be adjusted with the following additions:

“With regards to electric vehicles, City of Ryde will supply electricity for the vehicle whilst charging at Council premises, or at the staff members’ home. A separate electricity meter shall be installed at the domestic premises of the staff member for charging of the electric vehicle. The vehicle shall be charged with 100% GreenPower while charging at either of these locations.”

Clause 9 specifies that City of Ryde will carry full insurance and roadside service on all vehicles. Council should be aware that EVs may have a different cost profile for insurance and roadside services. This difference in cost will need to be considered in the price paid for the use of leaseback vehicles. No changes are recommended here at this stage, but this should be reviewed when new information regarding these costs becomes available from the trial.

9.3.3 Terms and Conditions for Private Use of a City of Ryde Packaged Vehicle

Similar issues to those identified in the Terms and Conditions for Leaseback Vehicles document apply.

9.3.4 Timing

These changes should be implemented immediately.

9.3.5 Program of works

Action	Timeframe	Costs	Responsibility
1. Determine Council preferences for dealing with the listed clauses under the Motor Vehicle Policy, and Terms and Conditions for Private Use of a City of Ryde Leaseback Vehicle or Packaged Vehicle	From February 2013	Staff time	Senior Sustainability Coordinator – Transport and Environment
2. Implement in the relevant policy documents			With Section Manager – Plant & Fleet

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10.0 Monitor the market

Objective: To regularly seek information on electric and low emission vehicles to refine their strategy.

This document reflects the best information currently available on low emission vehicles. However, as highlighted throughout this document, there is much uncertainty around future technology and the timing of take up. In particular, the technology associated with EVs and charging infrastructure will advance rapidly over the next decade. Similarly, EV owner behaviours will evolve as familiarity with this new type of vehicle grows. Consequently, the City’s strategy will need to be reviewed on an ongoing basis.

10.1.1 Recommended monitoring measures

It is recommended that the City undertake an annual review of key information around the low emission vehicle market. This should include:

- Review of available and emerging technologies (to update timing and ensure awareness of other viable low emission technologies)
- Review of sales and key factors affecting take up of EVs (price, supply, cost of electricity price, oil price) to identify if there have been any major shifts that may significantly alter estimated take up
- Review of consumer perceptions around the performance of EVs to identify effectiveness of policies aimed at building community confidence in the technology.
- Review of infrastructure technology to ensure Council has best available information for its own infrastructure and to assist businesses in installation charging infrastructure
- Local data at a precinct level to understand number and location of EVs owned by City of Ryde households (in conjunction with RMS)

This annual review should be conducted each year until the mass market starts to adopt low emissions vehicles (around 16% of market take-up).

It is also recommended that once measures are adopted for implementation, a monitoring and evaluation framework is adopted and implemented. This should be undertaken upon the adoption of each new measure, and continued throughout the duration of Council’s involvement.

As new information becomes available it is important the City update their strategy to ensure it is effective. This should be conducted bi-annually or sooner if the annual review reveals significant market changes, until there is mass market adoption of low emissions vehicles (around 50% of market).

10.1.2 Program of works

Action	Timeframe	Costs	Responsibility
1. Develop a framework for aspects to be considered in an annual market review	February 2013	Staff time	Senior Sustainability Coordinator – Transport and Environment
2. Conduct annual reviews	Ongoing annually		

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11.0 Conclusions

High level conclusions of this analysis can be summarised as follows:

- **Policy review** – For the most part, Australian, state and territory governments consider that this technology will be driven by the market and consumer choice, with policy effort focussed on removing regulatory barriers to entry, and identifying the likely impacts of EVs on the transport and energy markets to assist planning (Victoria).
- **Environmental performance** – EVs are generally environmentally superior to average internal combustion engine (ICE) vehicles, particularly where they are charged with 100% GreenPower. However, EVs do not offer all the benefits of public transport, walking and cycling, such as reduced traffic congestion and reduced parking requirements.
- **Impacts on the grid** – The impact of EVs on the grid will depend heavily upon the manner in which peak-period charging is managed. Impacts could range from minimal to very significant. This is the subject of a significant review by the Australian Energy Market Commission at present. Should peak pricing be introduced, it would incentivise charging outside of peak periods, thus minimising requirements for costly grid augmentations.
- **Timing of EV rollout** - A shift to EVs over the coming decades is inevitable. Within 10 to 15 years, plug-in hybrid vehicles (PHEVs) and battery electric vehicles (BEVs) could have a significant presence in the Australian market. PHEV and BEV sales are expected to be around 20 per cent of sales by 2020 rising to around 45 per cent of sales by 2030. Since uptake is expected to be gradual over the coming decades, policy makers have time to implement measures to manage this transition.
- **EV charging infrastructure** – EVs can be charged at a standard power point, although faster charging is possible with more sophisticated equipment. Since the majority of vehicle travel is well within the range of typical EVs, it is anticipated that the majority of charging will take place at home due to the convenience and relatively low cost of this option. Accordingly, in the near term, extensive public EV charging infrastructure is unlikely to be required. However, eventually it is anticipated that EV charging facilities will be provided at the majority of locations where vehicles are parked for extended periods of time, driven by customer preferences and private market response.
- **EV charge providers** – There are two significant EV charging point providers in the Australian market at present: Better Place and ChargePoint. Both offer services installing commercial charging points.

There are a number of roles for Council in managing the rollout of EVs in Ryde. Recognising the superior environmental performance of EVs (over ICEs) there is a role for Council in addressing market barriers to EVs in the form of consumer uncertainty. A range of initiatives to increase consumer awareness have been proposed, including a public relations campaign, the inclusion of EVs in the Council fleet (to demonstrate the technology and support community outreach activities), collaboration with other jurisdictions, promoting the deployment of EVs in car share schemes and the supply of charging infrastructure maps when public charging facilities do become available in City of Ryde.

Council also has a role to play in ensuring that residents of Ryde have access to charging infrastructure when required. Although the direct provision of public charge points by Council is likely to be expensive and not justified on a cost-benefit basis, Council can act to remove legislative barriers to private provision of public charging infrastructure, provide information to private car park operators, and mandate the consideration of "EV readiness" in new developments in Ryde (particularly residential developments).

Council can also act to streamline internal policy documents in readiness for the inclusion of EVs in the City of Ryde fleet, and as leaseback and packaged vehicles.

Finally, it is recommended that City of Ryde implement an ongoing monitoring program to assess the continuing development of the EV market. Given the large uncertainty in the development of this market, this is an important step to ensure that Council's activities remain appropriate and proportional to community needs.

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Greenhouse Gas Emissions Analysis

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Appendix A Greenhouse Gas Emissions Analysis

City of Ryde requested that AECOM provide comment on the Australian Fleet Management Association (AfMA) submission to the Department of Infrastructure and Transport regarding the proposed changes (Stage 3) to the Green Vehicle Guide (28 September 2012)²⁹. AfMA states that "there is no doubt that in certain circumstances emissions directly linked to the provision of the EV motive power can produce significantly more CO₂ than some conventionally fuelled vehicles". This is demonstrated by their comparison of the Nissan Leaf (EV) to ICEs with a range of fuel economy levels. AECOM does not dispute this analysis, but would point out that the Nissan Leaf has a significantly lower fuel economy than most other EVs currently available in the market. This means that the Nissan Leaf produces much higher than the emissions than any of the other EVs considered. The AfMA analysis does indicate that certain EVs produce more greenhouse emissions (when not using GreenPower) than certain ICEs, but does not suggest that this is true when average vehicles of each type are compared.

The AfMA data can be illustrated another way, as shown in Figure 23 and Figure 24. Figure 23 shows the greenhouse emissions associated with ICEs of varying levels of fuel economy. The dots for 2012, 2020 and 2030 show estimates of the average fuel economy of a new ICE vehicle purchased in those years. The green lines show the greenhouse emissions associated with operation of a Nissan Leaf on typical electricity from the NSW grid (not using GreenPower). The greenhouse emissions from electricity diminish over time as more renewable energy is installed in the NSW grid (shown by the lowering of the green lines in 2020 and 2030).

Due to the relatively low fuel economy of the Nissan Leaf, the greenhouse emissions from the EV (in this case) are higher than those from an average ICE purchased in each year. However, as stated above, the Nissan Leaf has considerably poorer fuel economy than other EVs. The EV with the next poorest fuel economy used in the AfMA analysis is the Audi A1 e-tron hybrid. The comparable chart for this vehicle is illustrated in Figure 24. It is clear that this EV produces less greenhouse emissions than the average ICE purchased in each of 2012, 2020 and 2030, even without the purchase of GreenPower. If the driver of the Audi purchased 100% GreenPower, the emissions associated with the operation of that vehicle would be zero.

It is also worth noting that the greenhouse emissions from an EV will automatically decrease over time as the emissions intensity of the grid diminishes. This will only be true of the comparable ICE if the owner continues to purchase new vehicles regularly (with increasing fuel economy).

²⁹ <http://www.afma.net.au/documents/item/452>
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ITEM 6 (continued)

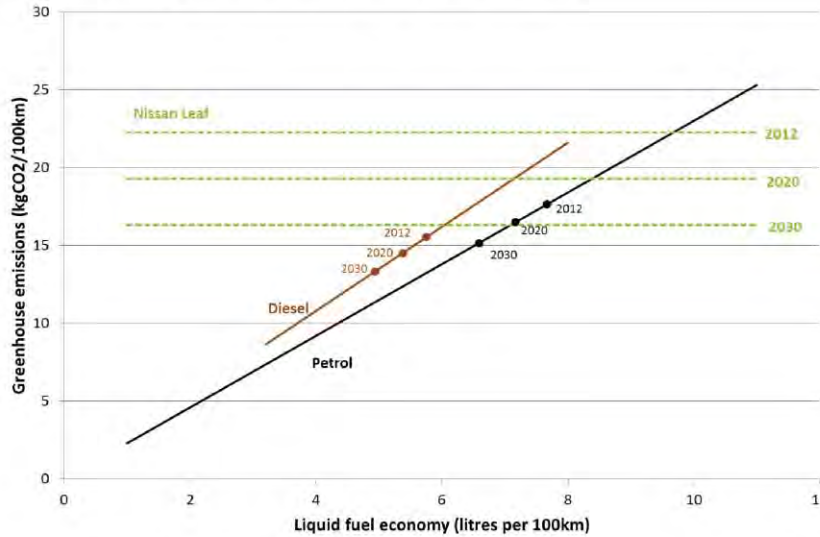
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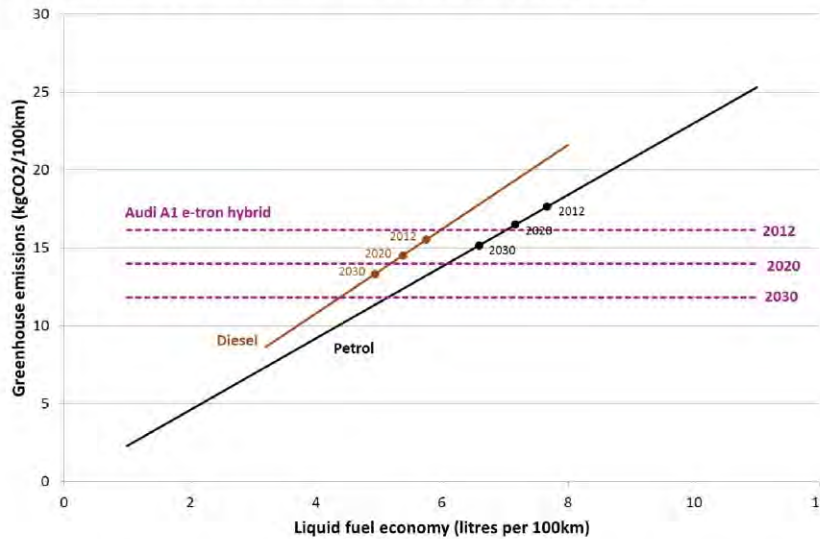
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Figure 23: Comparison of greenhouse emissions from Nissan Leaf (EV) and typical ICEs



Source: Based upon data from Australian Fleet Management Association (AFMA) submission to the Department of Infrastructure and Transport regarding the proposed changes (Stage 3) to the Green Vehicle Guide (28 September 2012).

Figure 24: Comparison of greenhouse emissions from Audi A1 e-tron hybrid (EV) and typical ICEs



Source: Based upon data from Australian Fleet Management Association (AFMA) submission to the Department of Infrastructure and Transport regarding the proposed changes (Stage 3) to the Green Vehicle Guide (28 September 2012).

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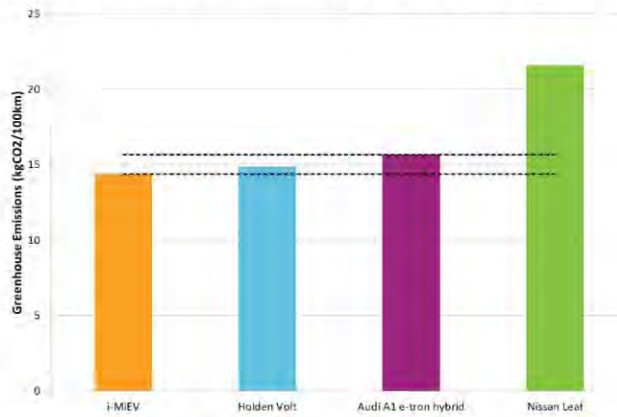
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The Nissan Leaf is somewhat of an outlier, as illustrated in Figure 25. It has a substantially lower fuel economy (leading to higher greenhouse emissions intensity) than the other EVs considered in AfMA's analysis. This means that comparison with the Nissan Leaf is not representative of the majority of EVs (although it does serve to demonstrate AfMA's point that in *some* cases EVs are more greenhouse intensive than ICEs).

Figure 25: Comparison of the emissions intensity (fuel economy) of various EVs



Source: Based upon data from Australian Fleet Management Association (AfMA) submission to the Department of Infrastructure and Transport regarding the proposed changes (Stage 3) to the Green Vehicle Guide (28 September 2012).