



Electric Vehicle Feasibility Study and Business Case

Business Case Report

April 2018



Executive summary

Introduction

The Goulburn Broken Greenhouse Alliance (GBGA) engaged Ndevr Environmental to deliver the Victorian Government's Collaborative Council – Sustainability Fund Partnership funded 'Electric Vehicle (EV) Feasibility Study and Business Case' project. The project aims to determine *the viability and business case for the uptake of electric vehicles by 11 regional councils and support efficient and viable collaborative procurement of this technology*. The study was conducted in two phases:

- » **Feasibility Assessment** which investigated the strategic drivers for considering EVs, barriers to their adoption, current council fleet operations and policy context, and the current EV market and how this could impact GBGA councils.
- » **Business Case** which investigated the financial considerations in more detail by: (a) collating financial information on available and soon to be available EVs; (b) construction of an alterable model to enable comparison of whole of life costs including both direct costs (i.e. vehicle capital and operational costs) and indirect costs (i.e. ancillary equipment required, and environmental and health costs incurred); (c) interpretation of the results for GBGA councils; and (d) articulating the business case value proposition and recommendations for next steps.

Method

The Business Case has been developed through the following process:

- » An assessment of participating GBGA council's current fleet operations, including vehicle usage, fuel costs, and associated emissions.
- » Internal stakeholder engagement through an online survey and workshops.
- » Collating financial information on available and soon to be available low emission vehicles (EVs, PHEVs and hybrids) into an interactive model to enable further consideration by councils.
- » Comparing the indicative whole of life costs between typical conventional vehicles and EVs including both direct (i.e. vehicle capital and operational costs) and indirect costs (i.e. ancillary equipment required, and environmental and health costs incurred).
- » Identifying implementation requirements (e.g., funding, infrastructure, driver training, change management).

The assessment culminated in the articulation of the business case value proposition and providing recommendations for next steps.

Key Findings

During the 2017 financial year, the 11 participating councils operated a light vehicle fleet of 706 vehicles (51% passenger, 49% light commercial vehicles). Overall, vehicles travelled a total of 17,298, 291km costing councils \$1,989,941 and emitting in the order of 4,000tCO₂e (50.2% passenger vehicles, 49.8% LCVs).

The recorded average vehicle intensity of the participating Councils (238gCO₂/km) is significantly higher than the Australian average (182 gCO₂/km) and the proposed future target (105 gCO₂/km), highlighting that there is room for improving the combined fleet composition.

Twenty percent of vehicles were reported to be travelling less than 10,000km, indicating that a portion of the fleet is under-utilised; and at least 25% of vehicles are home garaged, and likely to incur FBT liability.

The average daily kilometres travelled by each Council were less than the range available in current EV technologies.

Electric vehicles

EVs present an opportunity to reduce fleet greenhouse gas (GHG) emissions and operating costs due to the higher efficiency of the electric motor, less moving parts and the absence of tailpipe emissions. Further, the absence of tailpipe emissions has public health and broader environmental benefits. While non-plug in hybrids are prevalent in the Australian market, the range of full electric and plug-in hybrid variants currently available is limited, and no fuel cell vehicles are yet available.

A barrier to the uptake of EVs and PHEVs is the price premium at point of purchase. This project therefore considered the whole of life costs for a range of vehicles, finding that - from the selection assessed - currently, the smaller non-plug-in hybrids (Yaris and Prius C) were the lowest cost of ownership from a financial and environmental perspective.

Value Proposition

The *Local Government Act 1989* requires local governments to endeavour to achieve the best outcomes for their local community, which includes ensuring that resources are used effectively and efficiently. Local councils must regard the long-term and cumulative effects of decisions such as “the environmental viability and sustainability of their municipal district.”

The introduction of EVs into Council fleets aims to ensure Councils are prepared for the future in meeting their environmental, social, and financial obligations. EVs have the environmental benefit of less to zero greenhouse gas emissions; the social benefit of improved public health from the absence of tailpipe emissions, and the reduced operating costs from the higher efficiency motor and reduced maintenance requirements. It also demonstrates leadership to the community and other levels of government.

Conclusion & Recommendations

Councils of the Goulburn Broken Greenhouse Alliance have a demonstrated commitment to climate action and reducing fleet emissions. Stakeholders are engaged and wanting to demonstrate leadership to the community in reducing transport emissions in the most sustainable manner.

The comparison between different vehicles on the total cost of ownership highlighted that the full EV technology still incurs a price premium. However, EVs are competitive in certain circumstances. When comparing larger vehicles, the EVs were competitive with the commensurate conventional vehicles; while a comparison of smaller vehicles found that the non-plug-in hybrid (more established) vehicles have the lowest total cost of ownership. Additionally, given these initiatives will result in emissions reductions Councils should consider the cost of abatement in comparison to other non-fleet initiatives as this will likely further enhance the business case. As the market continues to grow, the purely financial business case will continue to improve and councils in a leadership role are wise to ensure the respective communities are prepared.

The *C40 Cities' Best Practice Guide for Low Emission Vehicles* reports that the best way to encourage uptake of lower emission vehicles in communities is to focus on council fleets first to demonstrate and market the benefits. Vehicles potentially suitable for replacement with EVs were identified within each council. It is expected that some councils can incorporate EVs (or trial them) in the short term, while others may require a step change transition to non-plug-in and plug-in hybrids while change management initiatives and charging infrastructure is put in place.

The following recommendations arise from the Business Case Report and Feasibility Assessment.

1. Councils without existing data management systems should consider investing in such systems as the only way to improve performance is to have access to data to monitor it.
2. Councils should monitor fleet utilisation and consider generating funds for EV investment by removing under-utilised vehicles and implementing measures to reduce FBT liability.
3. Establish internal Fleet Committees. Through this project, Councils have been co-operating across departments, and continuing this momentum through a formal collaboration between fleet, environment, finance and HR will facilitate future fleet improvements.
4. Ensure Fleet Policies are up to date and reflect council objectives, including preferences for lower emission vehicles (EV or otherwise). Councils should ensure that all vehicles are fit for purpose. Each council should consider what tasks are required to be completed by vehicles, and then identify the lowest emission vehicles to deliver these.
5. Councils should ensure that emissions reduction targets incorporate fleet emissions reduction targets to provide a strategic overlay to improvement actions.
6. Councils consider and validate the vehicles identified as suitable for replacement with EVs and establish an Expression of Interest process as a group for manufacturers to quote to fill the demand, incorporating group purchasing discounts (charging stations and vehicles).
7. Trial incorporating EVs, capitalise on branding to ensure maximum impact.
8. Communicate Council's commitments and progress. Ensure continual ongoing communication with employees around changes and reasoning.
9. Councils should ensure that the fleet pool includes non-plug in hybrid vehicles that are suitable for travelling longer distances (e.g. Melbourne-return) while the fleet vehicle composition transitions to EVs and PHEVs that have a more limited driving range.
10. Ensure all future Council developments (e.g. new facilities) include EV Charging infrastructure or include the necessary electrical requirements needed for future implementation of charging infrastructure on the premise.
11. While vehicle manufactures have indicated limited ability to provide discounts, Councils should still consider bulk purchasing of EVs and charging infrastructure from suppliers in order to maximise potential discounts. This will give Councils an additional financial incentive to combine their purchasing power. There are additional councils outside of GBGA interested in partnering (i.e. Northern Alliance for Greenhouse Action).

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Contact Person	
BUSINESS NAME:	Ndevr Environmental
ADDRESS:	L2, 27-31 King Street Melbourne VIC 3000
CONTACT PERSON:	Hannah Meade
TELEPHONE NO:	+613 9865 1413
MOBILE NO:	+61434 479 544
EMAIL:	hannah.meade@ndevr.com.au

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1 Introduction

1.1 Project Overview

The Goulburn Broken Greenhouse Alliance (GBGA) engaged Ndevr Environmental to deliver the Victorian Government’s Collaborative Council – Sustainability Fund Partnership funded ‘Electric Vehicle (EV) Feasibility Study and Business Case’ project. The project aims to *determine the viability and business case for the uptake of electric vehicles by 11 regional councils and support efficient and viable collaborative procurement of this technology.*



Figure 1: GBGA Councils (Source: GBGA 2016)

The study was conducted in two phases:

- » **Feasibility Assessment** which investigated the strategic drivers for considering EVs, barriers to their adoption, current council fleet operations and policy context, and the current EV market and how this could impact GBGA councils.
- » **Business Case Report.** The purpose of this stage was to investigate the financial considerations in more detail and draw conclusions from the findings of this and the Feasibility Assessment. This is delivered by: (a) a collation of available financial information on available and soon to be available EVs; (b) construction of an alterable model to enable comparison of whole of life costs including both direct costs (i.e. vehicle capital and operational costs) and indirect costs (i.e. ancillary equipment required, and environmental and health costs incurred); (c) interpretation of the results for GBGA councils; and (d) articulating the business case value proposition and recommendations for next steps.

An overview of the delivery approach is provided in Figure 2 below. The participating Councils agreed to move to the Business Case Assessment at the conclusion of the feasibility workshop.

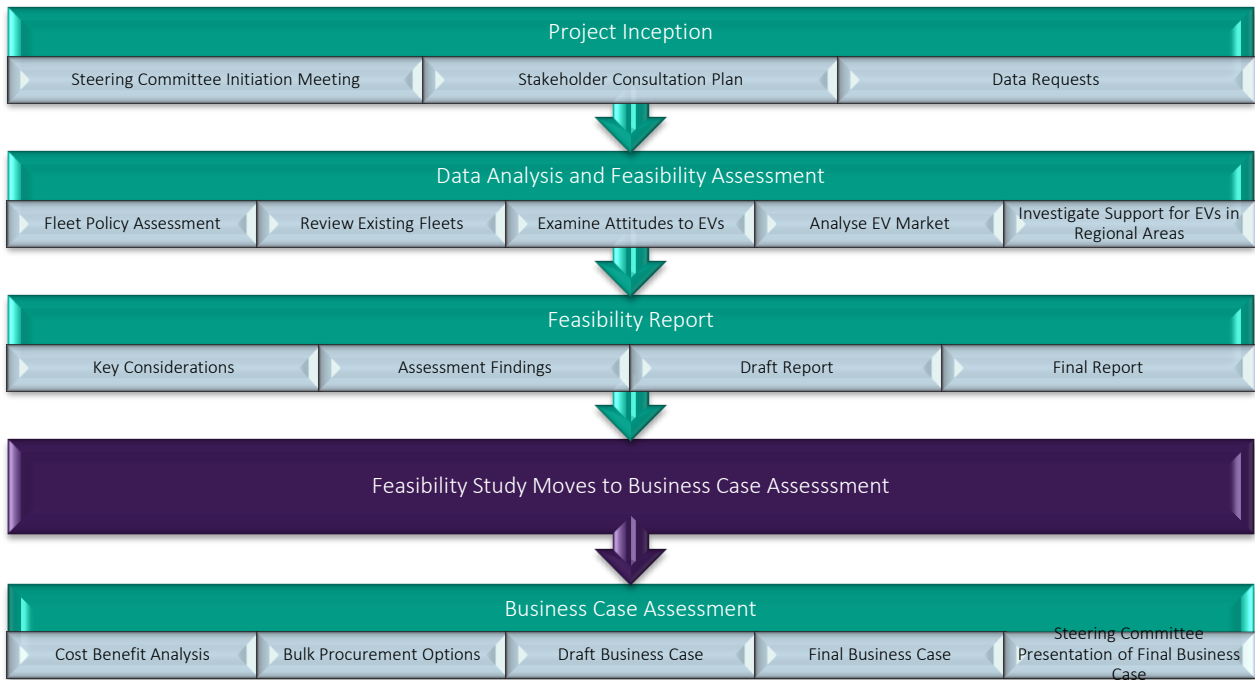


Figure 2: Project Methodology

1.2 Report Outline

This Business Case Report is structured as follows:

- » **Section 1** provides an overview of the feasibility findings
- » **Section 2** details the approach undertaken in assessing the business case.
- » **Section 3** investigates the cost benefit analysis of EVs compared to existing and future conventional fleet vehicles.
- » **Section 4** surmises the value proposition and business case based on all the information collated through this study.
- » **Section 5** provides the conclusion of the business case.
- » **Section 6** offers recommendations for the uptake of EVs (or otherwise low emission vehicles) in council fleets.

This Report also includes several attachments for further detail, including information provided by suppliers, and an interactive model for vehicle cost benefit comparisons.

1.3 Feasibility Findings

Fleet Overview

Eleven different Councils, with 11 separately managed and operated fleets, participated in this study. Available data varied and was revised from the Feasibility Assessment phase upon receipt of additional fleet data. Altogether, there are in the order of 706 light vehicles (51% of which are passenger vehicles). Sixty-one percent of vehicles are owned (and 39% leased); and at least 25% are garaged at employee residences. The average age of the vehicles is approximately 3 years.

It was estimated that the combined fleet generates over 4,000tCO₂e p.a [an estimate was required as not all Councils were able to provide actual fuel data]. Table 1: Overview of Individual Council Fleets (next page) provides an overview of each of the participating council fleets, providing information on council size, fleet size, average distance travelled by the light vehicle fleet, total emissions, average emissions intensity, and total fuel costs.

Figure 3 below illustrates the total emissions from each participating Councils in addition to the emissions intensity compared to the new vehicle average and proposed target. As shown, all except one Council exceed the new vehicle average.

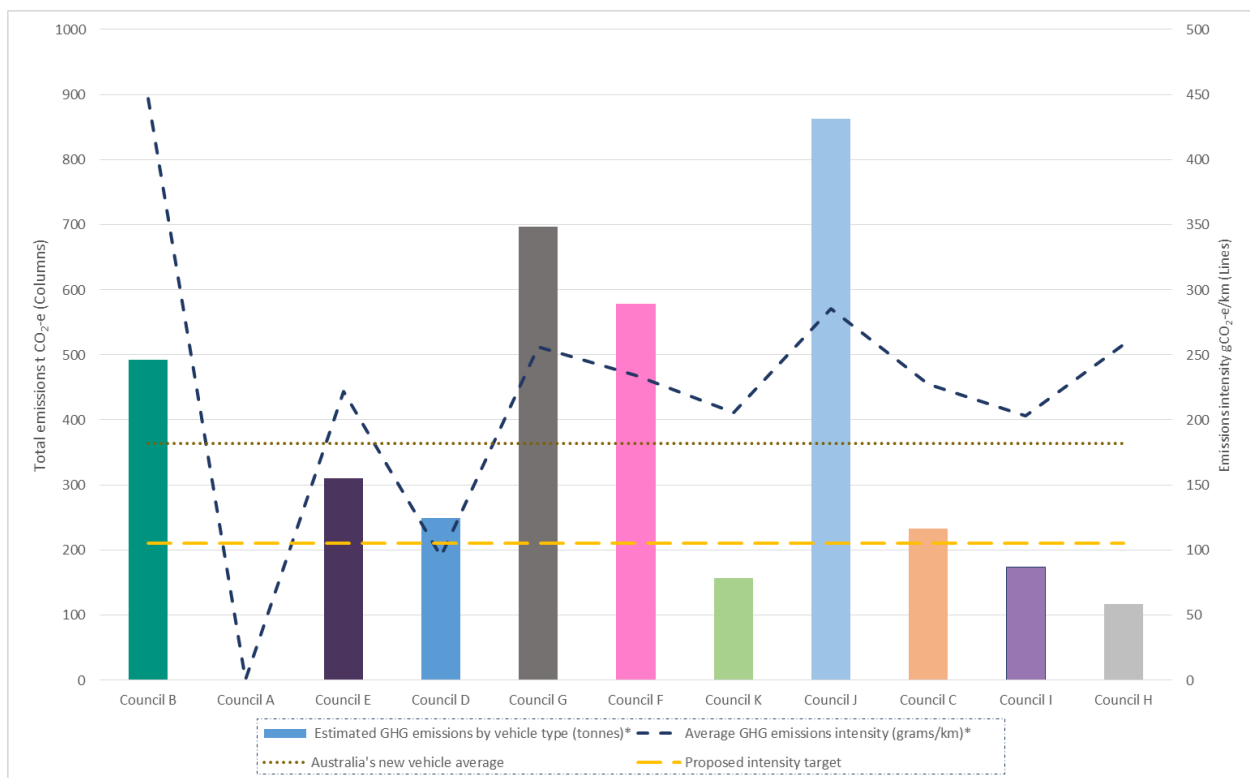


Figure 3: GBGA Council emissions and emission intensity compared to average new vehicle emission intensity

Table 1: Overview of Individual Council Fleets

Council	Council Size	Council Maintained Road Network	Total number of vehicles	Average annual kilometres	Total emissions (tCO ₂ e)	Av. emissions intensity (gCO ₂ /km)	Total fuel cost (\$)
Council A	Regional City	416km (sealed)	58	15,172	~214	n.p	~\$114,400
Council B	Regional City	691km (sealed) 1288km (unsealed)	63	5,815.	492	446.9	\$237,693
Council C	Small Shire		26	44,338	233	227.4	\$104,999
Council D	Regional City	1,163km (sealed) 1,123km (unsealed)	137	19,066	248	95.1	\$125,059
Council E	Small Shire	474km (sealed) 668km (unsealed)	37	37,853	311	221.8	\$157,048
Council F	Large Shire	4,000km (sealed and unsealed)	74	33,385	579	234.3	\$239,830
Council G	Large Shire	668km (sealed) 715km (unsealed)	107	25,471	697	255.8	\$329,874
Council H	Small Shire	244km (sealed) 581km (unsealed)	13	25,212	116	258.1	\$55,904
Council I	Small Shire	436km (sealed) 1,027km (unsealed)	37	23,682	173	203.3	\$87,006
Council J	Large Shire	1150km (sealed) 2100km (unsealed)	4	34,750	862	285.6	\$476,700
Council K	Small Shire	615km (sealed) 732km (unsealed)	37	20,659	157	205.4	\$61,428

Considerations and Findings

The Feasibility Assessment identified key areas for consideration both in terms of practical requirements for EV implementation, and areas of stakeholder concern. A summary of these and the respective findings is shown in Table 2, and the complete Feasibility Report is attached as Appendix B.

Table 2: Overview of Feasibility Study Findings

Considerations	Findings
<p>Availability of EVs</p> <p>For EVs to be a feasible option they need to be available for purchase.</p>	<p>The majority of EVs currently available are in the luxury vehicle bracket although some non-luxury vehicles are available.</p> <p>Currently available non-luxury EVs include: Mitsubishi Outlander PHEV, Renault Zoe, Renault Kangoo, Tesla Model 3.</p> <p>The Hyundai Ioniq non-plug-in hybrid is available for a 9-12month trial program, and the plug-in hybrid and full EV Ioniq variants will soon become available as well.</p>
<p>Suitability of EVs</p> <p>Available EVs also need to be suitable for Council applications. Stakeholders indicated range anxiety and off-road driving as barriers to EV adoption.</p>	<p>The data provided indicated that the average daily kilometres travelled was 84km/day, which would not require a recharge during the day.</p> <p>Hybrid electric variants provide an option with improved environmental performance but with the backing of the conventional engine for additional power that could be required for off-road driving.</p> <p>It should be noted that at this stage it is not recommended that any whole fleet be swapped for EVs – and that all vehicles are fit for purpose. There are EVs currently on the market that could meet the needs of Councils.</p>
<p>Local Sourcing</p> <p>Councils’ procurement practices preference support for local industry. Stakeholders indicated concern that local dealerships may be disadvantaged by a Council preference for EVs.</p>	<p>It was found that there were local dealerships in the region for the manufacturers scheduled to provide EVs. While the individual local dealerships may not currently stock EVs a demand for them would facilitate supply.</p> <p>There is further opportunity to support local industry by the need for new skills in the area associated with EVs and charging infrastructure.</p>
<p>Charging Infrastructure</p> <p>To incorporate EVs into the GBGA Council fleets, sufficient charging infrastructure must be in place to</p>	<p>A level 2 station at Council depots would enable overnight charging for Council fleet vehicles; and public charging (level 2 and 3) stations would both raise community awareness and appease community range anxiety concerns</p>

Considerations	Findings
<p>support their use.</p>	<p>to facilitate uptake.</p> <p>It was found that the largest cost associated with charging infrastructure is the installation, and accordingly any installations should allow for future stations to be added on.</p>
<p>Whole of life environmental benefit</p> <p>The driver for considering EVs is for the environmental benefit, and stakeholders wanted to ensure that implementation of EVs would have a whole of life environmental benefit.</p>	<p>The absence (for full EVs) or reduction (for hybrid variants) of tailpipe emissions results in improved air quality and removal of greenhouse gas emissions.</p> <p>It was found that even charging with Victorian grid electricity (i.e. not 100% carbon neutral) produces less emissions than a conventional engine vehicle.</p> <p>The additional benefit of using electricity is that there is the future option to charge from renewable power and to benefit from the Victorian renewable energy target and the resultant improvement in grid electricity.</p> <p>Further, energy intensity associated with batteries is expected to decline, with manufacturers reportedly having processes in place to re-use and recycle batteries.</p>
<p>Whole of life costs</p> <p>The price premium of EVs was identified as a barrier to implementation, while the reduced operating costs was identified as an opportunity. Councils therefore sought to understand the whole of life cost comparison.</p>	<p>Previous research found that the reduced operational costs associated with EVs was enough to compensate for the purchase price premium. These cases were for the Nissan Leaf which is no longer available.</p> <p>This business case assessment will consider whole of life costs for currently available vehicles.</p>
<p>Community stewardship</p> <p>The <i>Local Government Act</i> requires Councils to act in the best interests of their respective communities, and leadership was identified as one of the key drivers for considering EVs.</p>	<p>Research found that the Community is likely to become more receptive to EVs the more they are seen around the region. Any council EV should be adequately signed for maximum community impact.</p>

2 Business Case Approach

The Business Case has been developed through the following process:

- » An assessment of participating Councils' current fleet operations, including vehicle usage, fuel costs, and associated emissions.
- » Internal stakeholder engagement through an online survey and workshops (participating stakeholders are listed in Section 2.3).
- » Collating financial information on available and soon to be available low emission vehicles (EVs, PHEVs and hybrids) into an interactive model to enable further consideration by Councils (further explained below).
- » Comparing the indicative whole of life costs between typical Council conventional vehicles and EVs including both direct (i.e. vehicle capital and operational costs) and indirect costs (i.e. ancillary equipment required, and environmental and health costs incurred).
- » Identifying implementation requirements (e.g., funding, infrastructure, driver training, change management).
- » Articulating the business case value proposition and making recommendations for next steps.

2.1 Interactive Model

Cost Comparison

The attached model allows the user to compare the indicative whole of life costs of different vehicles taking into consideration the purchase price, residual value, operating costs (fuel, maintenance, insurance and registration) and environmental impact (air quality and greenhouse gas).

As shown in Figure 4, the user can select up to 6 different vehicles to compare and can alter the assumptions built into the model (described in detail in section 3.1), generating different cost comparison charts as shown in Figure 3.

The intention of the model is to allow Councils to compare different vehicles – rather than provide an accurate total cost of ownership. The model contains a database of collated information that can be added to and altered as more information becomes available, and which individual councils can alter to suit Council-specific circumstances.

Comparisons

This sheet allows for the comparison of different vehicles
This should be used as guidance only.

It is based on the following assumptions:
(select from the dropdown menus)

Purchase Year:	2018
Depreciation:	diminishing value
annual Kilometres:	20,000 km/ p.a
years of ownership	4 years
Price of Petrol	1.2 \$/l
Price of Diesel	1.2 \$/l
Price of LPG	0.91 \$/l
Price of Electricity	0.16 \$/kWh
Price of carbon	\$10 \$/t
source of electricity	Victoria - grid
annual insurance cost	\$ 800.00
vehicle location	rural

Select which vehicles to compare from the drop down menus:

Vehicles to Graph		
Vehicle 1	Ford Ranger XL Diesel	own
Vehicle 2	Ford Ranger XL ULP	own
Vehicle 3	Mitsubishi Outlander PHEV LS	own
Vehicle 4	Renault Zoe	own
Vehicle 5	BMW i3	own
Vehicle 6	Renault Kangoo ZE (2 Seat)	own

WARNING: lease pricing for vehicles other than outlander PHEV & Ioniq hybrid 12mth trial are estimates.

From these vehicles the Renault Zoe has the lowest whole of life costs (using ATO calculation for the residual)
Ford Ranger XL ULP has the lowest whole of life costs (using the NZ adjusted calculation for the residual)
Renault Zoe has the lowest whole of life costs (excluding residual) *(does not include leased options as NA)*

From these vehicles when including a portion of the charging infrastructure costs the
Renault Zoe has the lowest whole of life costs (using ATO calculation for the residual)
Ford Ranger XL ULP has the lowest whole of life costs (using the NZ adjusted calculation for the residual)
Renault Zoe has the lowest whole of life costs (excluding residual) *(does not include leased options as NA)*

I wish to add a new vehicle and detail to the data base for comparison

Add Vehicle

Vehicle Capital and Operating Cost Comparison

Graph 1

Vehicle Capital, Operating & Environmental Cost Comparison

Graph 2

Whole of Life Costs (inc. ATO calc residual)

Graph 3

Whole of Life Costs (inc. NZ calc residual)

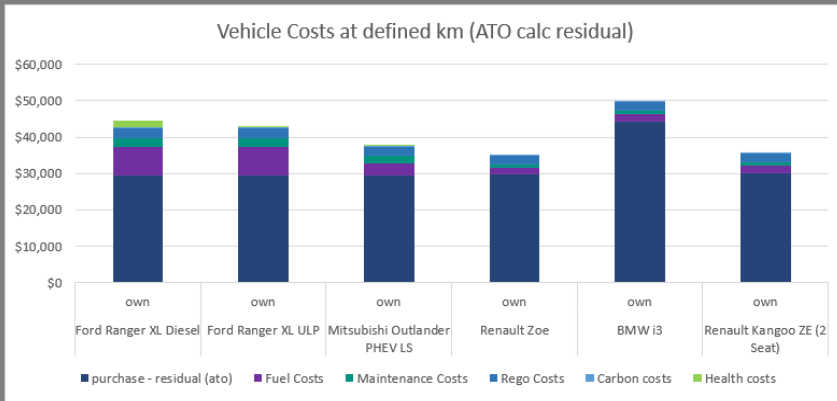
Graph 4

Whole of Life Costs (inc. charging inf. Portion)

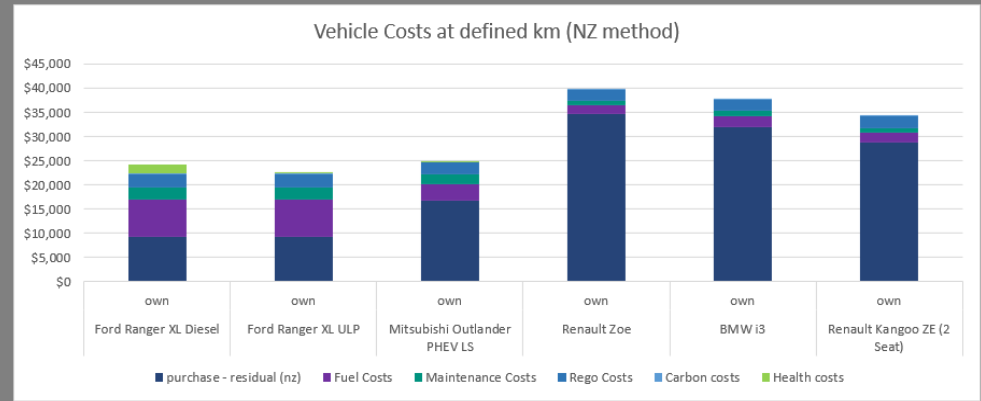
Graph 5 & 6

Figure 4: User Interface of Costs Comparison Sheet

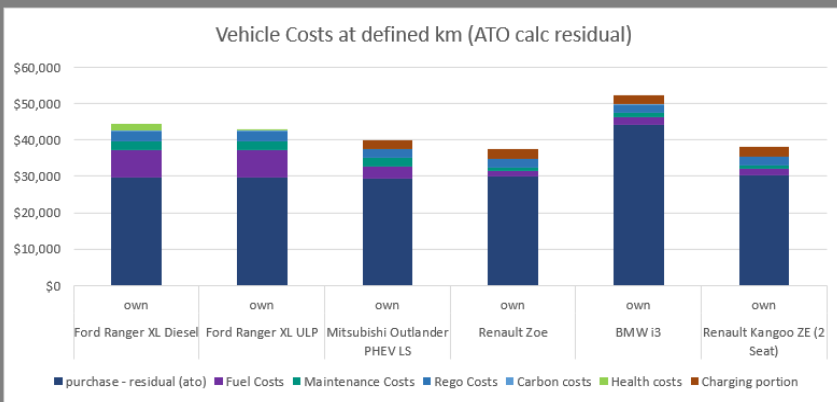
Graph 3 - Vehicle Costs including Environmental and Residual (ATO dep calc)



Graph 4 - Vehicle Costs including Environmental and Residual (NZ calc method)



Graph 5 - Vehicle Costs including Environmental, Residual & Charging Infrastructure portion (ATO dep calc)



Graph 6 - Vehicle Costs including Environmental, Residual & Charging Infrastructure portion (NZ method)

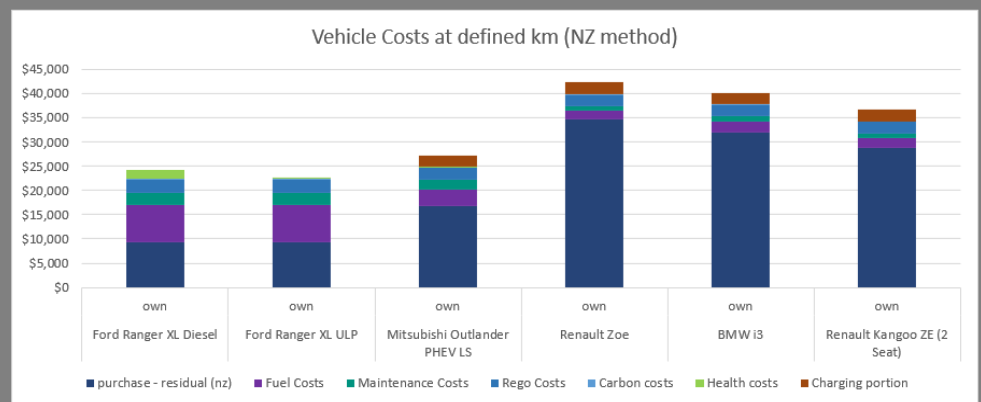


Figure 5: Example of Cost Comparison Charts

Scenario Modelling

The second component of the tool utilises the fleet data provided by GBGA Councils to identify vehicles potentially suitable for switching to EVs, and to estimate the baseline for potential benefits of changes.

2.2 Information Sources

In addition to available online information, discussions were held with the following entities, and the following additional resources were consulted, to gather up to date EV intel for consideration in determining the business case:

- » Vehicle Manufacturers including Mitsubishi, Renault, and Hyundai
- » Charging Infrastructure Providers including Jet Charge, ChargePoint and Tritium
- » Electric Vehicle Council
- » Australian Government Agencies
- » New Zealand Government resources (given they are further advanced with EVs) including the New Zealand Government’s Energy Efficiency and Conservation Authority’s (EECA) ‘Vehicle Total Cost of Ownership Tool’ designed “to assist consumers to easily compare the cost of buying, running and on-selling new vehicles constructed on data sourced from Optifleet. (EECA Business 2017b)
- » GBGA Council websites



Figure 6 Vehicle total cost of ownership tool icon (source: EECA 2017)

2.3 Council Stakeholders

The following Council stakeholders were involved in the development of this Business Case through responding to surveys, attendance at workshops, provisions of data and policies:

Table 3: Stakeholders from participating councils over the course of the project.

Council/ Organisation	Workshop 1 (Inception)	Workshop 2	Survey Respondents
GBGA	Project Officer – Regional Electric Vehicle Study	Project Officer – Regional Electric Vehicle Study	NA
Benalla	Environmental Sustainability Coordinator	Environmental Sustainability Coordinator	Procurement, Environment/Sustainability
Campaspe	Conservation Officer	Conservation Officer	Senior Management, Customer Service, Administration, Customer outreach, Fleet/Infrastructure, Projects, Aged & Disability Services, Health, Environment/Sustainability, Aquatics & Recreation, Development Engineering, Finance, Road Services, Economic Development/Tourism, Planning, Records, Human Resources, Corporate Services, Emergency Management, Procurement, ICT, Governance,

Council/ Organisation	Workshop 1 (Inception)	Workshop 2	Survey Respondents
			Immunisation
Indigo	Coordinator Natural Resources Management	Environmental Projects Officer	Fleet / Infrastructure, Environment/Sustainability
Mansfield	NA	Environment Officer	Environment/Sustainability
Mitchell	NA	NA	Environment/Sustainability, Fleet/Infrastructure, Building, Planning, Senior Management, Finance
Moira	Environmental Sustainability Officer	Environmental Sustainability Officer	Senior Management, Economic Development / Tourism, Information Services, Records, Information Technology, Procurement, Information Management, Technology, Human Resources, Finance, Environment/Sustainability
Murrindindi	NA	Coordinator Environment	Capital Works, Planning, Fleet/Infrastructure, Senior Management, Building, Environment/Sustainability, Waste, Finance, Local Laws
Shepparton	Team Leader Building Maintenance Facilities Management	Team Leader Building Maintenance Facilities Management; Team Leader Sustainability and Environment; Coordinator Plant, Fleet and Store	Fleet/Infrastructure, CEO, Environment/Sustainability, Health, Corporate Services, Economic Development/Tourism, Projects, Human Resources, Community Services, Support Officer, Aquatics & Recreation, Property, Engineering, Finance, Design Engineer, Senior Management, Planning
Strathbogie	NA	Waste Management Engineer; Team Leader Environment and Economic Development	NA
Wangaratta	Sustainability Education Officer	Sustainability Education Officer	Environment/Sustainability
Wodonga	Sustainability Coordinator	Team Leader Plant, Fleet and Building Maintenance	Environment/Sustainability

3 Cost Benefit Analysis

This section details the assumptions included in the model and the cost benefit analysis undertaken to compare different vehicles within the GBGA fleets.

3.1 Assumptions

The following assumptions were made in the construction of the model and in undertaking the cost benefit analysis.

3.1.1 Financial Benefits

The use of a vehicle has no fiscal benefit other than the ability to undertake council operations. Accordingly, it has been assumed for the purposes of comparisons that all vehicles are utilised equally and provide the same financial 'benefit'. Environmental costs are treated separately.

3.1.2 Annual Kilometres

The default annual kilometres are set to 20,000km, which is the annual amount generally set by leasing companies in providing their estimates. Note this is just less than the current combined fleet average of 25,000km/pa. The model user can, however, alter the average annual kilometres and the total years the vehicle is kept within the fleet, which will impact on the whole of life costs.

3.1.3 Vehicle Purchase Price and Discount

Current vehicle purchase prices were sought from manufacturer websites, or through direct correspondence with manufacturers. Basic model prices were used and a government discount of 6% was applied to all vehicles to reflect government pricing.

The user can update the discount applied and the purchase prices if more specific information is available to the user.

Further, please note that while the model enables comparison of leased vehicles, aside from the Mitsubishi Outlander PHEV and Hyundai Ioniq hybrid trial, lease prices are estimates based on purchase price. These figures can be updated in the model for Councils with access to actual lease prices who wish to undertake comparisons. Otherwise, comparison between 'owned' vehicles will provide a similar indication.

Lease prices are typically a combination of the vehicle depreciation plus interest plus tax plus leasing company margins, and therefore in addition to varying between companies can be commercially sensitive and subject to negotiation.

3.1.4 Vehicle residual value

A vehicle's residual value is the amount it can be sold for in the second-hand vehicle market.

Two methods for the estimation of the vehicle residual value have been included in the model:

- » **Australian Taxation Office (ATO) guidelines for depreciating vehicle assets**, which for taxation purposes are assumed to equal zero after eight years. The model allows the user the option to use the straight-line or diminishing value depreciation calculation method to align with internal accounting practices. The limitation of this approach is that it does not take into consideration second-hand vehicle demand for the specific vehicle and, therefore, the market value. However, the benefit of this approach is that it is equal for all vehicles and reflects internal book-keeping and the value of the asset for taxation purposes. (ATO 2017b)
- » **New Zealand's Vehicle Total Cost of Ownership Tool residual price estimate**, as described in Section 2, the tool provides an estimated residual based on a wholesale position of the specific vehicle and its age and distance travelled. The percentage of the purchase price has been incorporated into the model. The limitation of this approach is that while it has been adjusted to Australian prices it is based on the New Zealand market and currently annual kilometres travelled are locked in at 20,000km. For more information, visit: <https://www.ecabusiness.govt.nz/tools/vehicle-total-cost-of-ownership-tool/>.

In the calculation of the whole of life costs the model subtracts the residual from the purchase price as an estimate of the total capital cost of ownership.

Given the subjectiveness of residual calculation, the model also presents a comparison excluding the residual component.

3.1.5 Annual registration costs

The model includes the VicRoads offer of a \$100 discount on registration for hybrid and electric vehicles.

Leased vehicles will generally include the price of registration in their monthly fee and an additional registration cost has therefore not been applied to leased vehicles. (VIC Roads 2017)

3.1.6 Fuel and Electricity Consumption

The Green Vehicle Guide ratings for individual vehicles have been used assuming a combination drive cycle.

While it is acknowledged that consumption rates will vary in real-life based on duty-cycle and driver behaviour these rates allow for a fair comparison between vehicles. (Green Vehicle Guide 2018)

3.1.7 Fuel and Electricity Pricing

The model allows the user to enter the assumed price per litre of fuel and kWh of electricity to reflect individual purchasing arrangements.

These rates are used to calculate whole of life operating costs.

3.1.8 Maintenance Costs

Annual maintenance cost estimates have been sourced from manufacturers, and in the absence of information, the New Zealand Total Cost of Ownership Tool has been used and adjusted to Australian dollars.

3.1.9 Carbon Footprint Costs

The carbon costs are estimated based on the GHG emissions generated by the vehicle usage over its life.

GHG emissions are calculated using the National Greenhouse Account Factors (July 2017 update) applied to the estimated fuel or electricity consumed. Electricity has been assumed to be sourced from the Victorian grid. However, this can be altered to renewable sources.

The user can enter the price per tonne of carbon to reflect the price that may be currently paid for offsets.

A default of \$10/tonne has been set in the model based on the average price at the recent Emissions Reduction Fund auction. The user may wish to include a higher price (i.e. \$23/tonne), which was the rate set when Australia had a carbon price.

3.1.10 Health Associated Costs

The estimated human health cost per unit of health pollutant produced is derived from an assessment of human morbidity and mortality impacts from exposure to the pollutants and the monetary costs associated with addressing those impacts (DTR 2009). The figure is an economic exposure measure and is therefore higher in areas of high human population exposure and lower in less densely populated areas. Given the GBGA Councils are in regional areas the exposure risk is less than in heavily populated capital cities.

3.1.11 Discount Rates

The real (i.e. inflation adjusted) interest rate on borrowings represents a 'benchmark' for the discount rate applied in a cost benefit analysis. This can vary according to the size and security of the borrower, and the state of capital markets.

Given that the purpose of this exercise was an indicative comparison between vehicles, no discount rate has been applied.

3.1.12 Life Cycle Manufacturing Impact

The largest environmental impact from cars (85-90%) is attributable to its operating phase (Green Vehicle Guide 2018). Accordingly, the impact from manufacturing has been ignored from comparisons as it has been assumed equal across all manufacturers.

(It is noted that this is not always the case. For example, BMW's selling point for their i3 is that all components are recyclable and sustainably sourced.)

3.1.13 Vehicles per charger

While there is no set rule for how many chargers are required per vehicle, the U.S. Department of Energy (2012) recommends one level 2 charging unit (or charging port) per vehicle – to allow for overnight charging - and a level 3 charging station for fleets that travel over 160kms per day.

The model currently assumes a dual port wall mount level 2 charge station for every two EVs. The number of years over which the asset is depreciated is assumed to be 20, and the cost of the charger is apportioned to the number of years that the vehicle would be using it. These numbers can be altered in the model.

3.2 Whole of Life Cost Comparisons

3.2.1 Vehicles Considered

The following conventional (non-EV) vehicles were noted as the most prevalent in the GBGA fleets and built into the vehicle data base for comparison*:

- » Toyota Camry Ascent Sedan
- » Holden Colorado LT Crew Cab
- » Ford Ranger XL
- » Mitsubishi Triton GLX
- » Nissan Pathfinder ST
- » Subaru Forester 2.0
- » Mitsubishi Outlander Exceed

The following available EVs (hybrid and BEV) have been built into the model:

- » Toyota Corolla Hatch (hybrid)
- » Nissan Pathfinder ST (hybrid)
- » Toyota Camry Ascent Sedan (hybrid)
- » Toyota Prius
- » Mitsubishi Outlander PHEV
- » Renault Zoe BEV
- » Renault Kangoo Z.E BEV

In addition, the following EVs that are not yet available, but will be soon, have been included in the vehicle database:

- » Hyundai Ioniq BEV
- » Hyundai Ioniq PHEV
- » Nissan Leaf 2

*Noting that vehicle inclusion in the comparisons may not necessarily reflect suitability for replacement.

3.2.2 Comparisons

Table 4 below details the estimated cost components associated with the purchase and operation of the above listed vehicles. Indicative GHG emissions for vehicle operations have been include (assuming Victorian grid electricity).

Table 4: Indicative Vehicle Costs (assuming 4 years, 20,000km pa)

Vehicle	Capital Cost (inc 6%- government discount)	Residual Value		Operating Costs		tCO ₂ e
		ATO	NZ ref	Fuel (ULP, diesel, electricity)	Maintenance	
Toyota Camry Ascent Sedan (ULP)	\$29,810	\$9,432	\$18,495	\$7,584	\$1,660	15.04
Toyota Camry Ascent Sedan (hybrid)	\$31,972	\$10,116	\$19,836	\$4,320	\$1,751	8.57
Mitsubishi Triton GLX	\$31,011	\$9,811	\$24,053	\$10,464	\$2,175	23.72
Toyota Hilux	\$50,327	\$15,924	\$32,879	\$11,520	\$2,274	22.85
Holden Colorado Crew Cab	\$45,520	\$14,403	\$30,411	\$8,352	\$1,627	18.93
Nissan Pathfinder ST	\$43,257	\$13,687	\$24,914	\$9,792	\$2,493	19.42
Nissan Pathfinder ST Hybrid	\$46,121	\$14,593	\$26,564	\$8,256	\$2,825	16.37
Subaru Forester 2.0 XTSTI (ULP)	\$46,252	\$13,756	\$18,653	\$8,928	\$1,843	17.71
Ford Ranger (ULP)	\$45,990	\$13,678	\$33,894	\$7,680	\$2,502	15.23
Ford Ranger (diesel)	\$45,990	\$13,678	\$33,894	\$7,680	\$2,502	17.41
Mitsubishi Outlander (conventional)	\$38,530	\$12,191	\$23,684	\$5,952	\$2,002	11.8
Mitsubishi Outlander (PHEV)	\$43,146	\$13,651	\$26,429	\$3,347	\$2,193.	14.8 (or 3.2)

Vehicle	Capital Cost (inc 6%-government discount)	Residual Value		Operating Costs		tCO2e
		ATO	NZ ref	Fuel (ULP, diesel, electricity)	Maintenance	
Nissan Leaf	\$35,551	\$11,248	\$18,142	\$1,702	\$1,301	16.16 (or 0)
Toyota Corolla	\$26,638	\$8,428	\$15,974	\$3,393	\$1,501	7.81
Toyota Prius C	\$26,143	\$8,272	\$15,360	\$3,283	\$1,638	6.47
Renault Zoe BEV	\$43,729	\$13,836	\$8,997	\$1,702	\$1,081	11.49 (or 0)
Renault Kangoo Z.E BEV	\$44,171	\$13,976	\$15,328	\$1,984	\$900	13.39 (or 0)
Hyundai IONIQ Hybrid	\$42,300*	\$13,384	\$22,954	\$2,876	\$905	5.71

* Noting the Hyundai IONIQ has not yet been priced for the Australian market - the above is an estimate.

Figure 7 to Figure 10 illustrate the comparison including health, environment, and other operating costs.

Note also, that these comparisons do not include potential FBT liability that could be applicable to vehicles less than one tonne available for personal use. FBT can add considerable costs to the ownership of a vehicle. As an indication, a Toyota Prius purchased for \$26,143 could incur a FBT liability in the order of \$6,000 per annum, and a Camry hybrid purchased for \$31,972 could have a FBT liability of over \$7,000 per annum. This can quickly double the total cost of ownership to Council. (ATO 2017a)

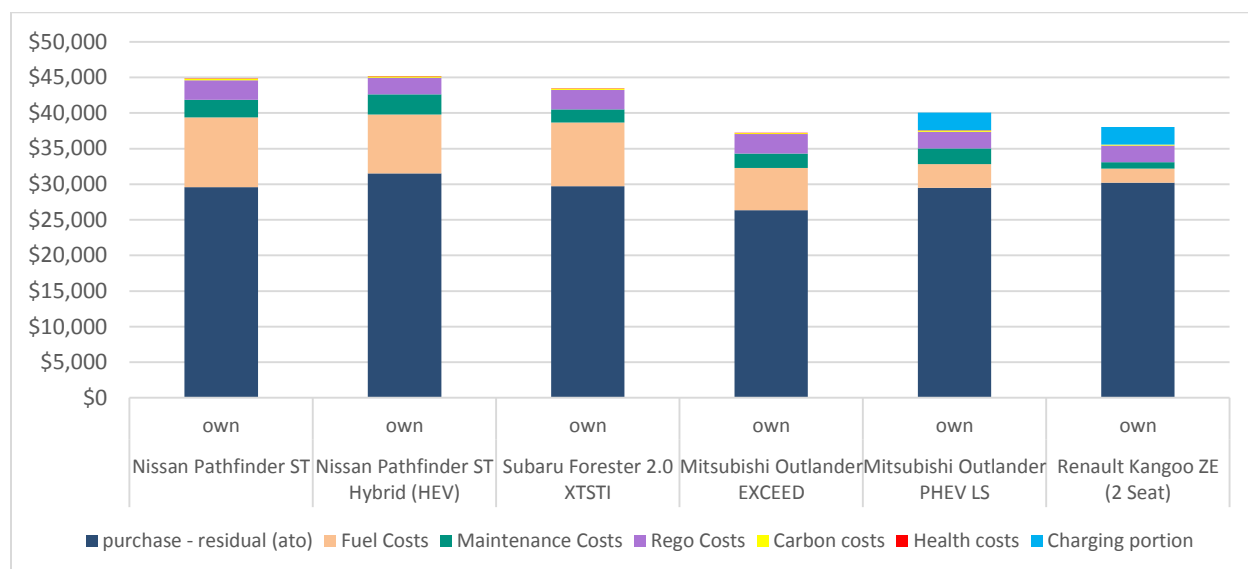


Figure 7: Total Cost of Ownership Comparisons (based on 20,000km p.a.; 4-year ownership; ATO based residual estimate)

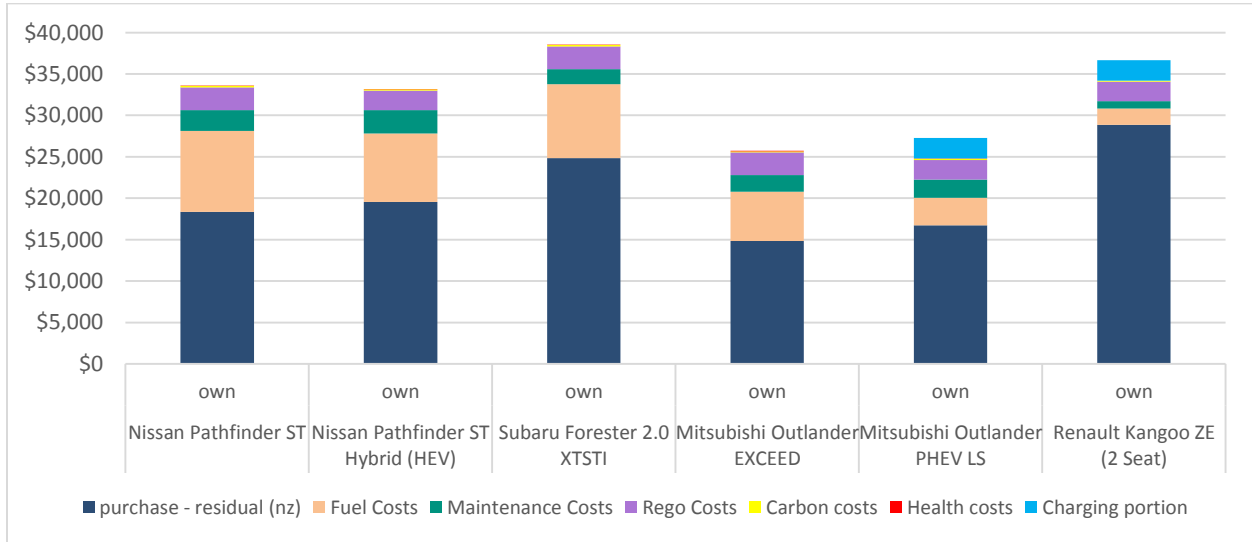


Figure 8: Total Cost of Ownership Comparisons (based on 20,000km and 4-year ownership) and NZ calculated residual

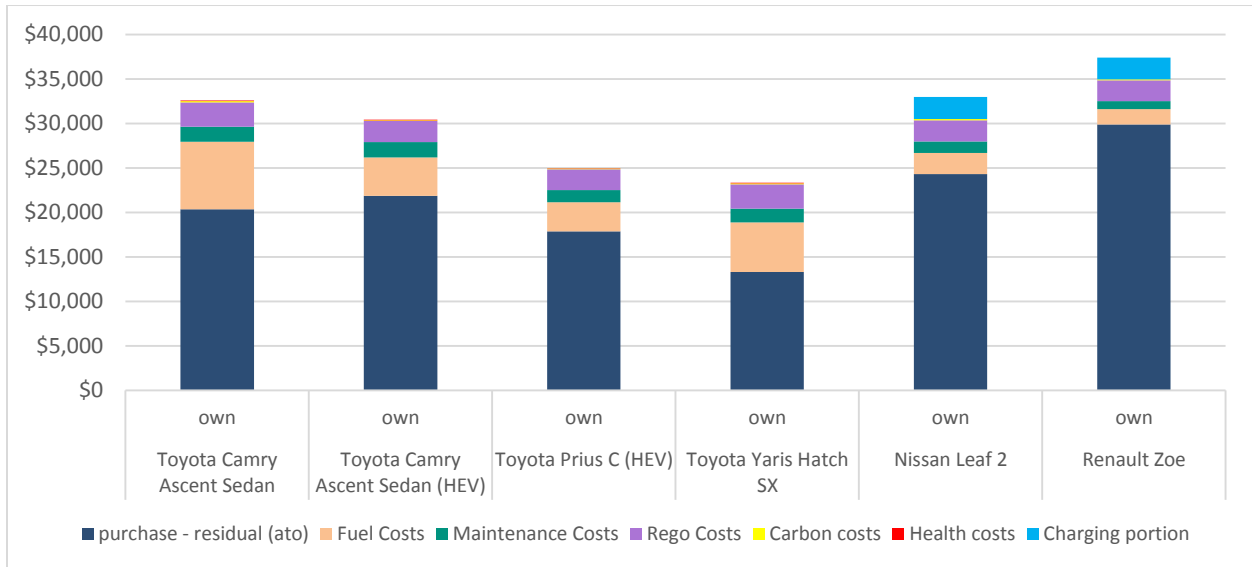


Figure 9: Total Cost of Ownership Comparisons (based on 20,000km p.a.; 4-year ownership; ATO based residual estimate)

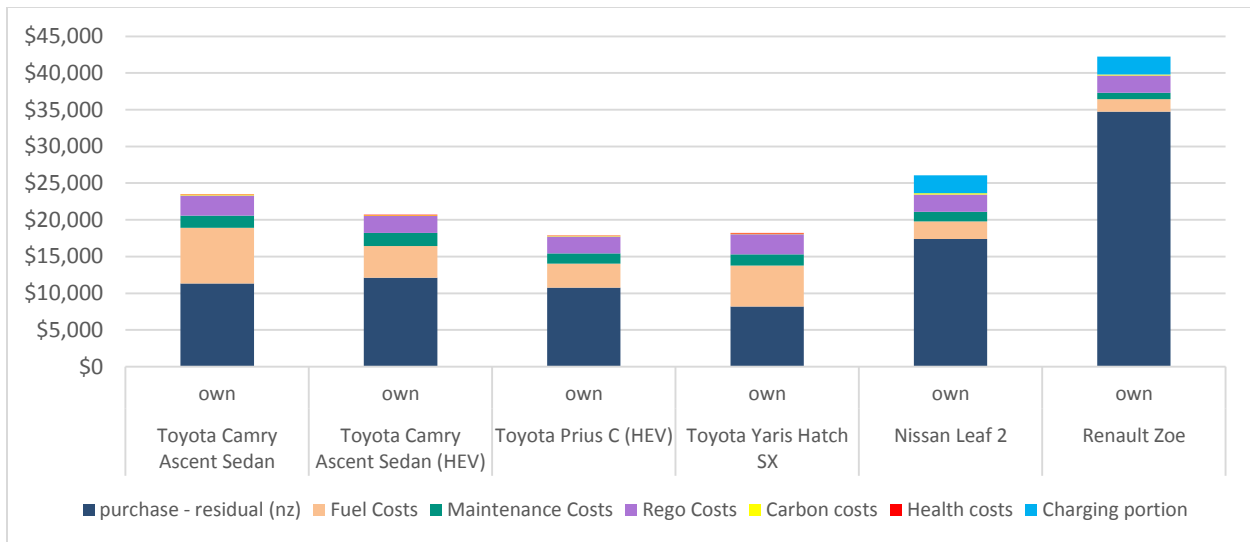


Figure 10: Total Cost of Ownership Comparisons (based on 20,000km and 4-year ownership) and NZ calculated residual

The above charts indicate the following:

- » In the larger light vehicle charts, the Mitsubishi Outlander PHEV and the Renault Kangoo are price competitive.
- » In the smaller passenger vehicle charts, the small non-plug in hybrids (Yaris and the Prius) were the lower cost vehicles.
- » While lower emission vehicles can have a higher purchase price, and less certainty with residual prices – in some instances the reduced operating costs compensate for this.
- » The price premium of newer technology (i.e. purely EVs) is still a cost barrier.

Greater Wellington Regional City Council opted to exclude the expected residual when comparing vehicles for inclusion in its fleet. Figure 11 and Figure 12 illustrate the above charts without considering a residual value.

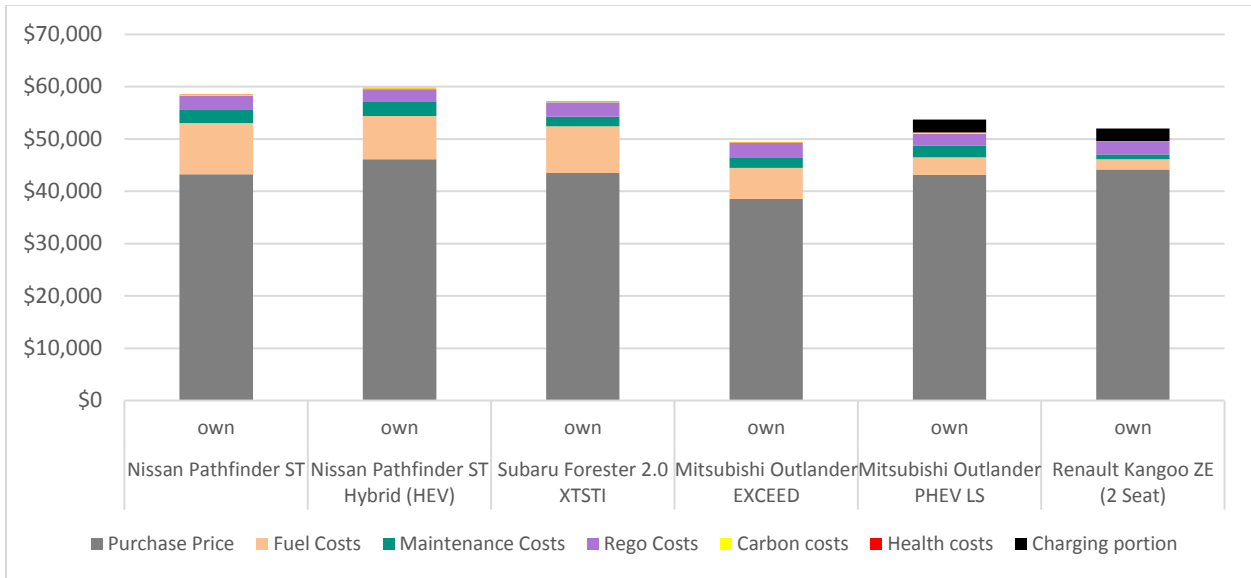


Figure 11: Total Cost of Ownership Comparisons (based on 20,000km and 4-year ownership) excluding residual

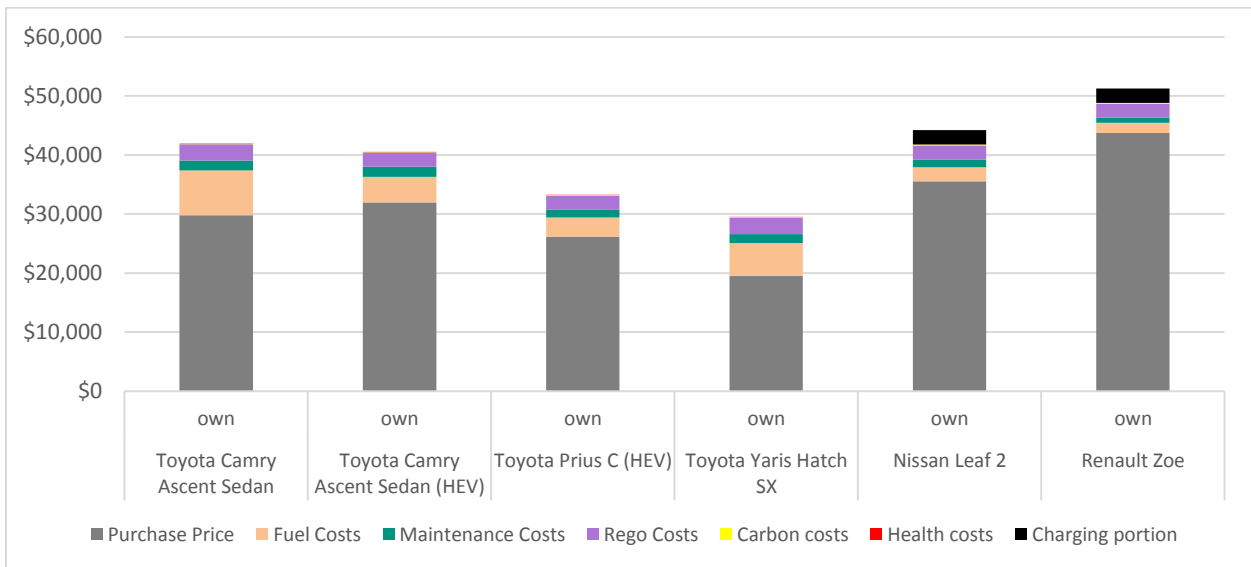


Figure 12: Total Cost of Ownership Comparisons (based on 20,000km and 4-year ownership) excluding residual

3.3 Finance & Procurement Options

Given that the incorporation of EVs may require additional upfront capital, the finance and procurement options set out below could be considered if Council has a cashflow concern.

However, the ideal solution is that fleet sizes are first optimised, and money saved from operating less vehicles is invested in more efficient technology. While investigating utilisation was not a component of this project, it was observed that portions of the Council fleets travelled less than 10,000km p.a. While, some of this could be attributable to vehicle turnover, the high portion of potentially underutilised vehicles indicate significant opportunity to consolidate fleet sizes. Every vehicle within a fleet is a cost to the Council and under-utilised vehicles are likely incurring unnecessary ownership expenses (i.e. insurances, registration, maintenances).

Further, many vehicles were reported as home garaged and are therefore potentially incurring a FBT liability to the respective Council. The numbers shown below are likely conservative as not all Councils provided garaging details. As discussed in the previous section, FBT liability, depending on employee contribution, can double the total cost of vehicle ownership to Council.

Table 5: Additional Council Fleet Information (utilisation and garage location)

Participating Council	Fleet Size	%vehicles travelling <10,000km p.a	% fleet home garaged
Council A	58	52%	0%
Council B	63	54%	0%
Council C	27	4%	74%
Council D	137	26%	0%
Council E	37	0%	73%
Council F	74	7%	69%
Council G	107	25%	0%
Council H	18	6%	50%
Council I	37	22%	30%
Council J	105	1%	56%
Council K	43	16%	0%

3.3.1 Leasing

Leasing fleet vehicles can remove the risk associated with the unknown residual values, as the risk can be taken by the leasing company (or shared). Other advantages include an improvement in cashflow, fixed monthly costs, inclusion of procurement and disposal costs, automated toll management. Different types of leases are available:

- » **Operating Lease.** Used to acquire equipment on a short-term basis in comparison to the useful life of the vehicle asset. An operating lease for fleet vehicles is commonly between three and five years.
- » **Chattel Mortgage.** Under a Chattel Mortgage, a vehicle is a piece of personal movable property that serves as the security for the loan.
- » **Novated lease.** Under a novated lease arrangement, the employer agrees to take on the obligations of making the lease payments, while the employee leases the motor vehicle. This method is commonly used in salary packaged vehicles.

For Councils with limited resources leasing can be an option to outsource fleet administration and enable the fleet manager more time to focus on key strategic issues and risks. Current practice amongst the Councils was varied, where the total was 61% vehicles owned and 39% leased.

3.3.2 Shared Services

At the feasibility workshop, the option of Shared Services was raised by Councils.

In 2014, an audit conducted by the Victorian Auditor General's office discovered that 91% of the 58 surveyed Victorian councils were then involved in shared services. According to the audit, there are 34 shared services that primarily relate to the use of local council transport fleets. 23 of these services directly relate to waste management, while the others include senior citizen support and emergency services. The audit found that sharing services improved the fleet efficiency, as fuel and maintenance costs were reduced following the implementation of the sharing schemes.

The following bodies were considered to facilitate shared fleet services:

- » **Procurement Australia.** The organisation that assists Government entities and Australian business with procurement and fleet services through aggregating buying power from its 700 + member associations.
- » **Municipal Association Victoria.** The primary body for local government that provides services such as insurance protection, recruitment advice, governance support and group procurement.

3.3.3 Bulk Procurement

Bulk procurement could also be explored as an option to obtain discounts from manufacturers or to entice manufacturers to make EVs that are not yet available in Australia available. Manufacturers have indicated in this regard, that there would need to be a demand of over 500 vehicles. A demand of this size exceeds the entire fleet of all the participating councils and the project team therefore investigated other parties as possible bulk procurement partners. These include:

- » The ACT, South Australia, City of Adelaide, City of Hobart and the Electric Vehicle Council of Australia have signed a Memorandum of Understanding (MoU) to work together to increase the share of EVs in government fleets, support the uptake of EVs in the community, and take a coordinated approach to planning and constructing infrastructure to support the use of EVs (ACT Government 2017). The Electric Vehicle Council advised that the objective of the MoU is to generate demand for

manufacturers to bring sufficient vehicle numbers to Australia. The collaboration between the State and Federal governments will not extend to a single bulk buy purchase as such, due to the different budgets and structures, nor will it necessarily involve any discount from manufacturers. Should Councils wish to participate in the MoU it would further facilitate demand to manufacturers to supply vehicles and increase competition/ provide options (rather than a specific group purchase discount).

- » The Northern Alliance for Greenhouse Action (NAGA) is undertaking a low emission vehicle study (to be completed March 2018) similar to GBGA and there is a possibility to combine any demand for EVs and infrastructure. Further, NAGA have indicated additional that additional councils have expressed interest in adding demand to any bulk procurement. NAGA Councils have accepted the business case to introduce low emission vehicles into its respective fleets and is looking to partner with other interested parties in investigating next steps.

3.3.4 Manufacturer Packages

Manufacturers that have EVs available in Australia have indicated that while the option for further discounts on the vehicles themselves may be limited (i.e. in addition to existing government discounts), they can offer packages that include complimentary charging stations. (e.g. Mitsubishi said that if each council was to sign on for two EVs they would include a basic level 2 charging station unit for each council). Additionally, Jetcharge indicated that they would provide bulk purchasing discounts (amount depending on the demand). Similarly, ChargePoint, whose business model includes the management and maintenance of stations, indicated that bulk purchasing discounts would be available (depending on demand).

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4 The Business Case

4.1 Value Proposition

The introduction of EVs into Councils' fleet aims to ensure Councils are prepared for the future in meeting their environmental, social, and financial obligations. EVs have the environmental benefit of less to zero GHG emissions; the social benefit of improved public health from the absence of tailpipe emissions, and the reduced operating costs from the higher efficiency motor and reduced maintenance requirements.

Implementation will require some up-front investment for the vehicles that incur a premium price or require charging infrastructure.

The value proposition is further elaborated below.

4.1.1 Role of Local Government

The *Local Government Act 1989* requires local governments to endeavour to achieve the best outcomes for their local community, which includes ensuring that resources are used effectively and efficiently. Local councils must regard the long-term and cumulative effects of decisions such as “the environmental viability and sustainability of their municipal district.”

Local government entities, as representatives of the local community, have a legislative and electoral mandate to manage local issues and address the needs of the community by enhancing community safety, peace and order, public health, environment and amenity (MAV 2017).

As the world progresses towards a low-emission society, ensuring local communities remain sustainable will be an ever-evolving challenge. Early adoption of new technologies will ensure that councils remain environmentally viable and reduces the risks to their communities. EVs can aid Council in achieving these commitments, as outlined in the sub-section below.

4.1.2 Environmental Commitment

As detailed in the Feasibility Report, transport has been identified as a key sector requiring attention in meeting set climate change targets in Australia and globally. The *Victorian Climate Change Act 2017* envisages that to achieve the long-term emissions reduction target of net zero greenhouse gas emissions by 2050 the State will need to move towards clean energy options for transport.

EVs, in addition to the higher efficiency of the electric motor, can be powered by renewable sources reducing emissions associated with vehicle use to zero. EVs powered by the grid will have an environmental footprint associated with the electricity usage, however the grid is continuing to improve in line with renewable energy targets (25% by 2020 and 40% by 2025), which will further improve the environmental business case for EVs even when not utilising renewables.

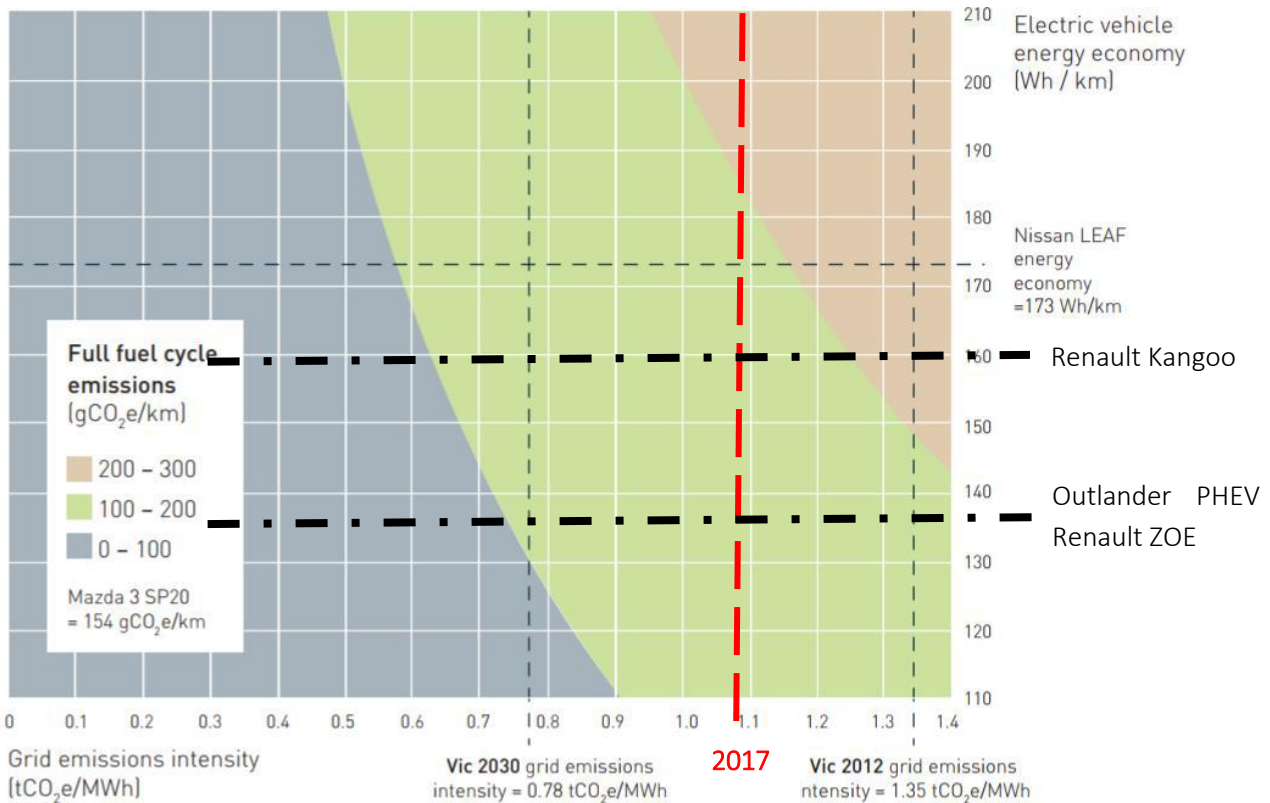


Figure 13: Figure 52. Chart depicting the interrelationship between EV energy economy and the electricity grid emissions intensity in determining full fuel cycle GHG emissions, including some pertinent figures for comparison (DIT 2012, DCCEE 2012b, personal communications). (source: State Government of Victoria 2013, *Creating a Market*, Victorian Electric Vehicle Trial Mid-Term Report).

In addition, the energy intensity associated with battery assembly will continue to decline as production continues to increase. Additionally, EV batteries can both be recycled (materials taken for use in new batteries); and re-used for other battery demands (Dunn et al 2015). For example, a Melbourne based company, Re-electrify, has been established with ARENA funding to re-use EV batteries to power cooling systems.

4.1.3 Public Health Considerations

The motor vehicle fleet is a significant contributor to air pollution; particularly, through the emission of carbon monoxide, nitrous oxides and particulate matter. The detrimental effects on health are exacerbated in comparison to other sources due to the proximity and exposure of the population (i.e. ground level and in populated areas, in comparison to industrial emissions from stacks that are diluted prior to reaching the population). In Australia, it has been suggested that vehicle emission caused 40% more deaths than the road toll; and there is increasing evidence suggesting links between the level of air pollution and serious health consequences (Schofield, Walter, Silver, Brear, Rayner and Bush 2017).

Recent studies (which included Australia) also reveal the severity of the global human health impact from diesel emissions; in 2015 about 38,000 premature deaths (heart disease, lung disease and strokes) were attributed to the fact that most diesel cars produce more toxic nitrogen oxides (NOx) than regulations allow (Anenberg et al 2017). In Australia, it was estimated in 2015 that the cost to the economy of

premature deaths caused by air pollution was \$17.8 billion, with a further \$4.5 billion in welfare losses and foregone labour. NOx emissions are known to cause smog and acid rain; and have a detrimental health impact by causing inflammation of airways, decreased lung function and increased risk of respiratory conditions and allergies.

Given that the environmental and health implications of vehicle tail-pipe emissions are well understood, it is part of Council's corporate social responsibility to be conscious of the vehicles it purchases and their usage in the community.

4.1.4 Safety

Further to public health, EVs have been acknowledged by Bloomberg New Energy Finance (2016) as starting to transform the safety and experience of the travelling public. The driver support software accompanying electrified vehicles (i.e. collisions avoidance, lane maintenance, tiredness alerts, driverless parking) is set to reduce the number of collisions.

4.1.5 Cost Considerations

Council budgets are subject to public scrutiny and, like all organisations, councils are required to ensure best use of funds to ensure financial sustainability. Fleet expenditure is typically an accepted cost of running a business. However, it can be a large financial impost for little return: fleet assets commence depreciation straight away, operating costs while often small in the context of an organisation's total budget, can be substantial particularly if vehicles are under-utilised and not providing an economic benefit to the organisation. EVs have reduced operating costs due to the higher fuel efficiency, and lower maintenance costs associated with less moving parts.

Further, in line with the Victorian Government's target for net zero emissions by 2050, it is assumed that most councils will be required to follow suit, and such a commitment will most likely require the purchase of offsets and implementation of emission reduction activities.

Key considerations here are that (a) fleet emission reductions present a lower cost of abatement option in comparison to other initiatives implemented by Council (e.g. street lighting upgrades discussed in the workshop); (b) the purchase price of offsets will provide additional financial incentive to the business case for reducing fleet emissions.)

4.1.6 Leadership

As the world progresses towards a low-emission society, ensuring local communities remain sustainable will be an ever-evolving challenge. Councils have an opportunity to show leadership to their community, peers and industry, and are well placed and capable of leading change (Dierwechter & Coffey 2010). The choices in vehicles selected by government and corporate fleets feed the choice of vehicles available to the community to purchase, with fleet vehicles populating 80% of the second-hand vehicle market. Councils, as stewards for the community, have a corporate responsibility to ensure that low emission vehicles are entering the second-hand vehicle market and available as a choice for that consumer base.

Further, given the turnover rate and buying power of government agencies, it will provide a demand to manufacturers and stimulate growth in the Australian market for low emission vehicles.

4.1.7 Participating Council Specific Drivers

The GBGA Councils have strong environmental drivers, as illustrated by membership in the Alliance. Additionally, GBGA Councils have strategic commitments in place that align with the transition to EVs – as provided in report to GBGA.

Further, there is strong support for the introduction of EVs into Councils' fleets with 82% of survey respondents conveying positive attitudes towards EVs in the region and wishing to see more EVs in their respective Council's fleets.

4.2 Implementation Considerations

4.2.1 Low Emission Vehicles

4.2.1.1 Availability

A current barrier to broader uptake of EVs in Australia is the limited availability of non-luxury EVs. The Feasibility Assessment presented different EVs that are available (or will soon be available) for purchase in Australia.

At the workshop there was interest in the Mitsubishi Outlander PHEV, and there were no other suitably available EVs on the market. Since the workshop the following advancements have taken place:

- » The Renault Zoe and Renault Kangoo are now available for purchase in Australia
- » Nissan has announced that the Nissan Leaf 2 will be available for purchase in Australia in the next financial year (i.e. between July 2018 – June 2019).
- » Hyundai has commenced trialling the non-plug in hybrid Ioniq variant organisations (including NAGA Councils).

The EV Council is working with State and Federal governments to create demand for electric vehicles within government fleets; and it is anticipated that following this and similar initiatives, the number of vehicles available in Australia will continue to increase.

4.2.1.2 Suitability

GBGA vehicles identified for consideration to be replaced by an EV include:

- » Vehicles housed at Council for ease of charging
- » Vehicles travelling less than 120km/day to appease range anxiety in the short-term
- » Passenger vehicles with limited to no towing requirements

Based on the above criterion and Council fleet data provided, all Councils had potentially suitable vehicles that could be replaced with EVs.

When examining vehicle suitability, consideration should also be given to the following:

- » Are all vehicles currently operating in Council fleets required?
- » Can under-utilised vehicles be removed or consolidated into pool vehicles?
- » Are all vehicles within Council's fleet fit for purpose?
- » Is it a business need that vehicles are home garaged?

Addressing these questions can result in financial savings and additionally suitable vehicles.

4.2.2 Charging Stations

The incorporation of fully electric or plug-in hybrid electric vehicles will require on-site charging infrastructure and, as discussed in the Feasibility Assessment, there are different levels of charging stations and different plug types available.

The price of charging stations varies depending on the unit, and the installation required. Installation costs can fluctuate depending on the capacity at the distribution board, and length of conduit and cabling required to the installation site. The estimated installation price range for a level 2 unit is between \$850 and \$3,000; and between \$4,000 and \$50,000 for a level 3.

Additional costs associated with charging infrastructure are network charges, maintenance, and/ or some providers have a business model based on annual service plans that include 24hr assistance.

There is currently limited public charging infrastructure in the region. However, as the EV market continues to grow, investment in infrastructure from private industry will also grow, which will see additional public charging stations coming online in the area in the future.

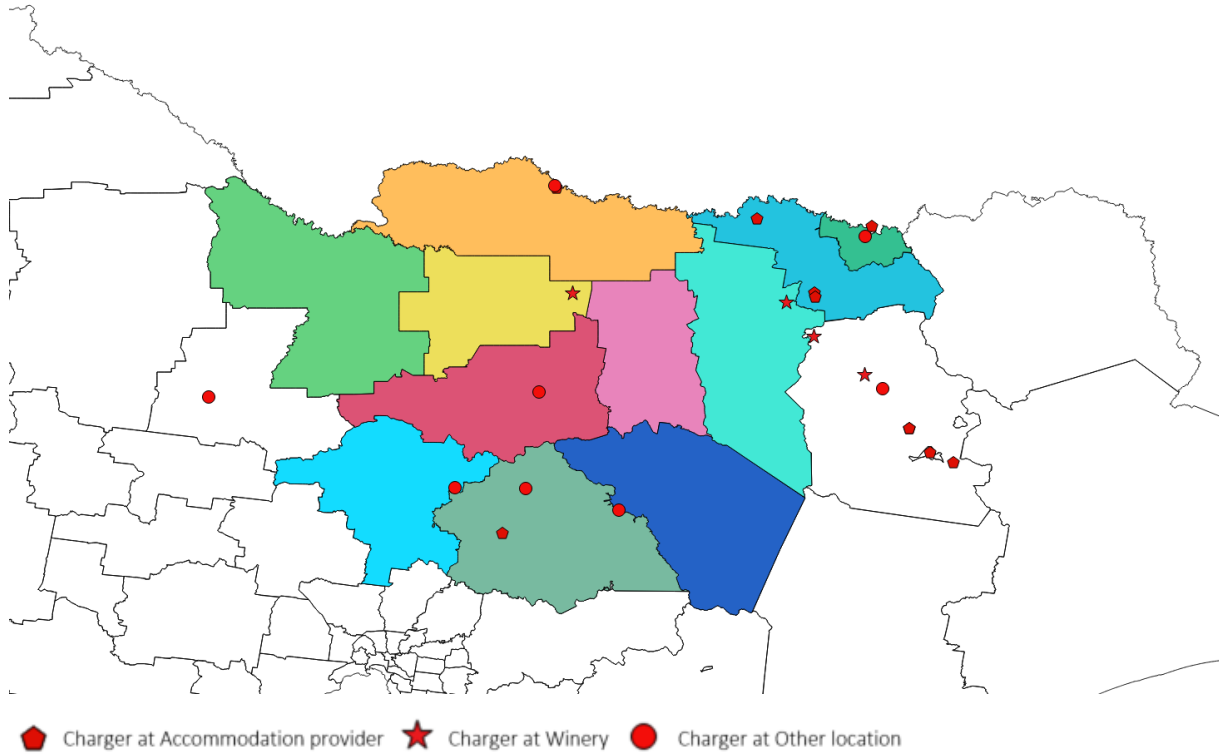


Figure 14: Current Charging Stations

It is recommended that councils focus on council fleets and on-site charging stations available to the public in the first instance, rather than public charging infrastructure because of the rapidly growing EV market, which may spark public infrastructure development from elsewhere.

Focussing on Council fleets first is listed as one of the key points in C40 Cities' *Best Practice Guide for Low Emission Vehicles* (2016). Private providers will invest in public charging stations on council land if there is space and demand.

Additionally, on-site charging stations will be sufficient to accommodate EVs in the fleet. It is not commercially attractive for employees to be required to recharge during a journey and most vehicles travel less than the new EV ranges (Figure 15). Additionally, as set out elsewhere in this Report, it is recommended that as a first measure Councils replace vehicles that travel relatively small distances to appease any range anxiety on the part of employees.

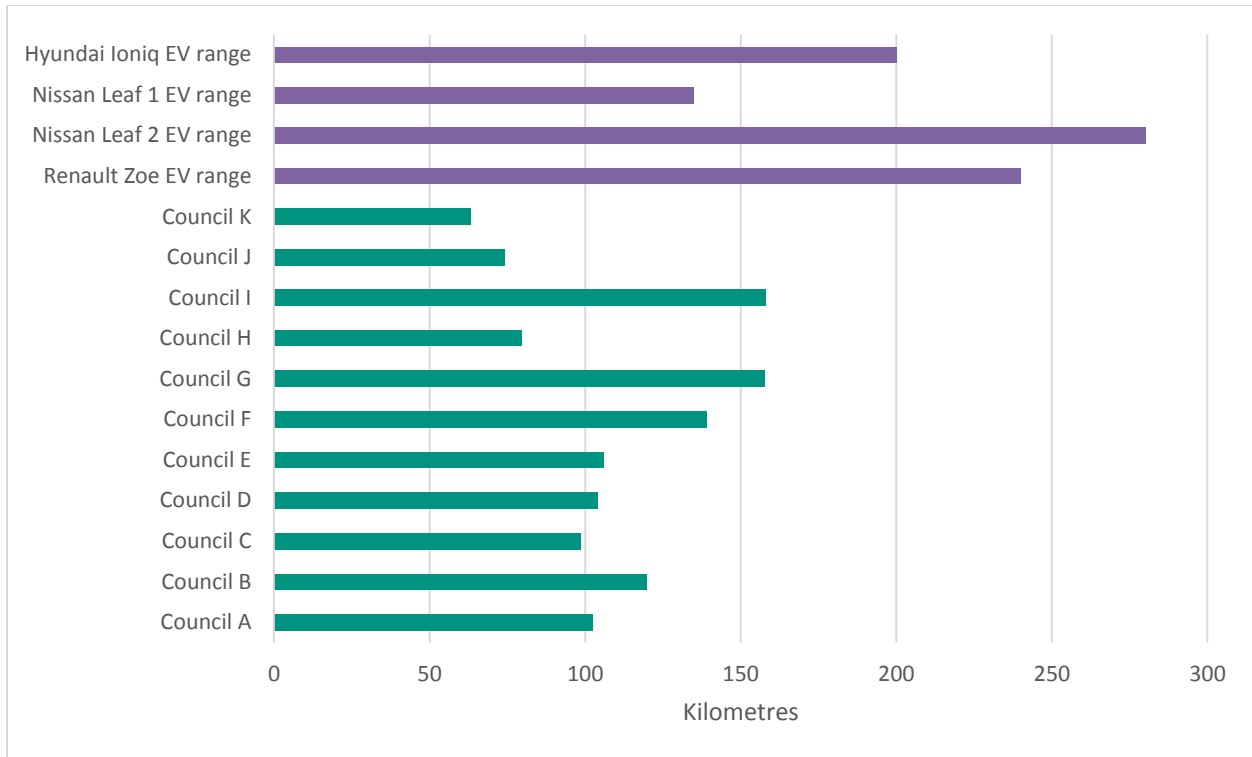


Figure 15: Average Daily kilometres per Council compared to new EV ranges

Renewable energy sources for on-site charging stations could be considered in addition to, or in conjunction with, plans for council building renewable sources (i.e. solar panels). An example of a metropolitan council on-site charging station prepared for renewable energy can be seen below.



Figure 16: Example of Carpark Solar Panels that can be used for charging infrastructure. Charging EVs with solar generated electricity can result in zero net carbon emissions

4.2.2.1 Planning Conditions for New Developments

To ensure that Councils are appropriately equipped for future EV uptake in the community, it is important that charging infrastructure be properly planned and executed. New developments and projects could be mandated to be EV-ready, where decisions are made at design stage for the allowance of charging infrastructure – providing access to power and space for a charging station, even potential connection to

renewable energy sources (i.e. connected to solar grid if project is including it anyway). This allowance at construction is a more cost-effective approach than retrofitting. Installation costs can be the largest component of installing a charging station.

Councils can create specific planning conditions for their own capital works projects in their internal Environmentally Sustainable Development (ESD) policies, as well as consider updating the Local Planning Scheme and Regulations to ensure private developments within the council appropriately set up to cater for future EV needs.

Some Victorian Metropolitan councils are placing performance requirements around EVs. These councils have established a Local Planning Policy Framework under the Planning Scheme for ESD. Transport is listed under the objectives for which developments are to achieve best practice in environmentally sustainable development. One of the ESD outcomes under this objective is to promote the use of low emissions vehicle technologies and supporting infrastructure.

4.2.3 Change Management

Transitioning Councils’ fleet toward EVs requires cultural and behavioural change. Therefore, when implementing the recommended actions, they should be accompanied by change management strategies to ensure successful and effective adoption of the desired behaviour. To ensure the success of the change management strategies, it is imperative that all stakeholders (council and community) are brought along the change journey from the beginning; inclusion is key.

This is evident in the elements prescribed in the change management process (Figure 17).

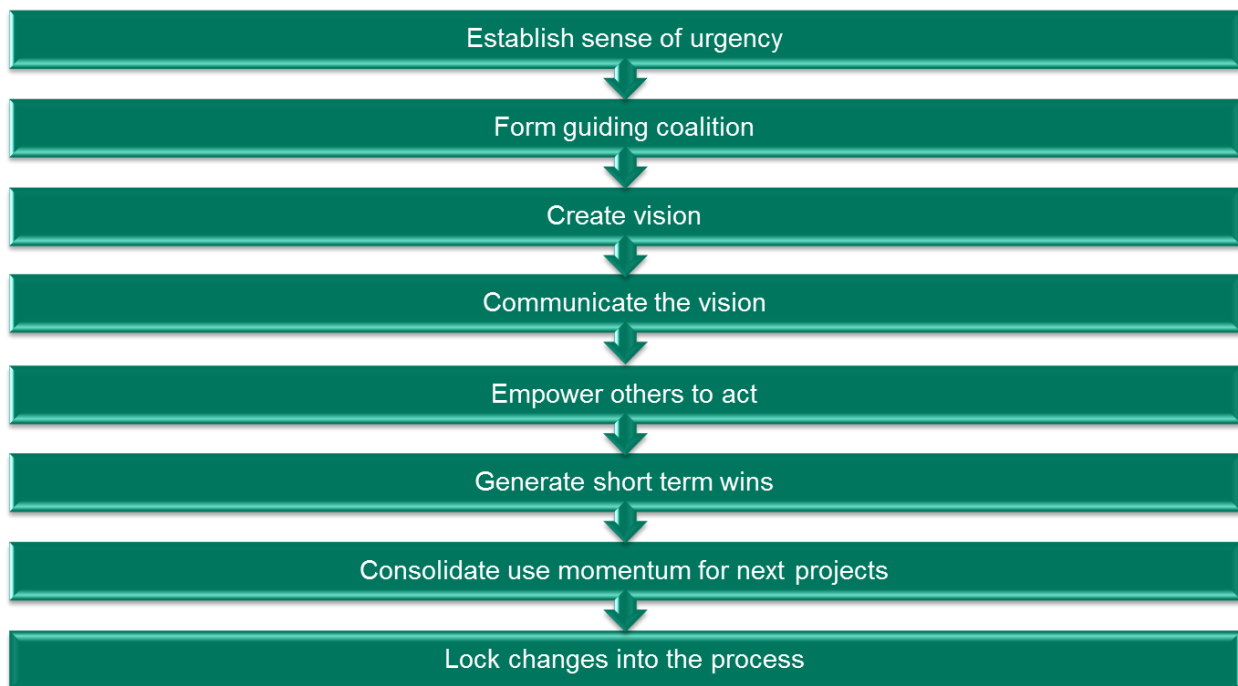


Figure 17: Change management process (Kotter et al 1995).

5 Conclusion

Councils of the Goulburn Broken Greenhouse Alliance have a demonstrated commitment to climate action and reducing fleet emissions. The electric motor presents a cleaner alternative to the internal combustion engine through the absence of waste energy (i.e. tailpipe emissions), and the ability to improve the supply fuel (i.e. use of renewables). The incorporation of EVs into council fleets is therefore an opportunity for councils to achieve combined and individual strategic climate action commitments, and to demonstrate leadership to the community.

The EV market in Australia, despite lagging compared to the rest of the world, is currently in a growth phase. Through the course of this project suitable vehicles were identified as available or soon to be available, with increasing commitments from manufacturers to invest in the technology.

The comparison between different vehicles on the total cost of ownership highlighted that the full EV technology still incurs a price premium. However, EVs are competitive in certain circumstances. When comparing larger vehicles, the EVs were competitive with the commensurate conventional vehicles; while a comparison of smaller vehicles found that the non-plug-in hybrid (more established) vehicles have the lowest total cost of ownership. As the market continues to grow, the purely financial business case will continue to improve.

Further, it was identified that most Councils have an opportunity to reduce current fleet costs, which could in turn be utilised to invest in EV technology. These opportunities include: consolidation of fleets (i.e. removal or pooling of under-utilised vehicles) and investigating and reducing FBT liability (i.e. reducing availability of vehicles for personal use). Noting, the latter will require senior management and HR involvement. Additionally, given these initiatives will result in emissions reductions Councils should consider the cost of abatement in comparison to other non-fleet initiatives as this will likely further enhance the business case.

This project has identified that each Council has room for improvement within its fleet; either through improved utilisation of existing vehicles within fleets, and/or improved performance. The recorded average vehicle intensity of the participating Councils (238gCO₂/km) is significantly higher than the Australian average (182 gCO₂/km) and the proposed future target (105 gCO₂/km), highlighting that there is room for improving the combined fleet composition. This can be achieved by a combination of improvement strategies including a transition to EVs when fit for purpose.

All GBGA Councils were found to be engaged in the process of investigating a transition towards EVs. For some Councils the incorporation of EVs, or trial of, can commence in the short-term; for others a step change via non-plug-in and plug-in hybrids will be more appropriate as change management and charging infrastructure is put in place.

The incorporation of EVs into GBGA Council fleets will ensure Council is demonstrating leadership to both its community, and to the higher, less agile levels of government.

6 Recommendations

The following recommendations arise from the Business Case Report and Feasibility Assessment.

- » Councils without existing data management systems should consider investing in such systems as the only way to improve performance is to have access to data to monitor it. This can be formally with purchased telematics or informally through a more structured approach to data collection and collation.
- » Councils should monitor fleet utilisation, and consider generating funds for EV investment by removing under-utilised vehicles, and implementing measures to reduce FBT liability
- » Establish internal Fleet Committees. Through this project Councils have been co-operating across departments, and continuing this momentum through a formal collaboration between fleet, environment, finance and HR will facilitate future fleet improvements.
- » Ensure Fleet Policies are up to date and reflect Council objectives, including preferences for lower emission vehicles (EV or otherwise). Councils should ensure that all vehicles are fit for purpose. Each Council should consider what tasks are required to be completed by vehicles, and then identify the lowest emission vehicles to deliver these.
- » Councils should ensure that emissions reduction targets incorporate fleet emissions reduction targets to provide a strategic overlay to improvement actions.
- » Councils should consider and validate the vehicles identified as suitable for replacement with EVs and establish an Expression of Interest process as a group for manufacturers to quote to fill the demand, incorporating group purchasing discounts (charging stations and vehicles).
- » Trial incorporating EVs and capitalise on branding to ensure maximum impact.
- » Communicate Council's commitments and progress. Ensure ongoing communication with employees around changes and reasoning.
- » Councils should ensure that the fleet pool includes non-plug in hybrid vehicles that are suitable for travelling longer distances (e.g. Melbourne-return) while the fleet vehicle composition transitions to EVs and PHEVs that have a more limited driving range.
- » Ensure all future Council developments (e.g. new facilities) include EV Charging infrastructure or include the necessary electrical requirements needed for future implementation of charging infrastructure on the premise.
- » While vehicle manufactures have indicated limited ability to provide discounts, Councils should still consider bulk purchasing of EVs and charging infrastructure from suppliers in order to maximise potential discounts. This will give Councils an additional financial incentive to combine their purchasing power. There are additional councils outside of GBGA interested in partnering (i.e. Northern Alliance for Greenhouse Action).

7 References

ACT Government 2017, 'Driving climate action through electric vehicle MOU' [Media Release], viewed 8 December 2017 from <https://www.cmtedd.act.gov.au/open_government/inform/act_government_media_releases/rattenbury/2017/driving-climate-action-through-electric-vehicle-mou>

Anenberg, S. C., Miller, J., Minjares, R., Du, L., Henze, D. K., Lacey, F., Malley, C. S., Emberson, L., Franco, V., Kilmont, Z., Heyes, C., 2017, 'Impacts and mitigation of excess diesel-related NOx emissions in 11 major vehicle markets', *Nature* 2017 May 25, 545(7655):467-471

ATO 2017a, 'Fringe Benefit Tax (FBT)' viewed on 10 November 2017 from <[https://www.ato.gov.au/General/Fringe-benefits-tax-\(FBT\)/>](https://www.ato.gov.au/General/Fringe-benefits-tax-(FBT)/>)

ATO 2017b, 'Guide to Depreciating Assets 2017', viewed on 10 November 2017 from <https://www.ato.gov.au/uploadedFiles/Content/IND/downloads/Guide-to-depreciating-assets_2017.pdf>

BNEF 2016, 'Liebreich and McCrone: Electric vehicles – It's not just about the car', viewed on 10 November 2017 from <<https://about.bnef.com/blog/liebreich-mccrone-electric-vehicles-not-just-car/>>

C40 Cities 2016, 'Good Practice Guide Low Emission Vehicles', C40 Cities Climate Leadership Group

Dierwechter, Y. and Coffey, B 2010, 'Assessing the effects of neighbourhood councils on urban policy and development: The example of Tacoma, Washington' *The Social Science Journal*, 47, pp. 471-491; Jun, KN 2012, 'Escaping the local trap? The role of community-representing organisations in urban governance', *Journal of Urban Affairs*, vol. 35, no. 3, pp. 343-363.

Dunn, JB, Gaines, L, Kelly, JC, James, C and Gallagher, KG (2015) 'The significance of Li-ion batteries in electric vehicle life-cycle energy and emissions and recycling's role in its reduction', *Energy and Environmental Science*, 8, 11, 158-168)

ECCA Business 2017a, 'Electric vehicle battery life', viewed on 10 November 2017 from <<https://www.eecabusiness.govt.nz/technologies/electric-vehicles/electric-vehicle-battery-life/>>

ECCA Business 2017b, 'Vehicle total cost of ownership tool', viewed on 10 November 2017 from <<https://www.eecabusiness.govt.nz/tools/vehicle-total-cost-of-ownership-tool/>>

Electric Vehicle Transportation Centre (2016), 'Cost Analysis of Workplace Charging for Electric Vehicles', viewed on 10 November 2017 from <<http://fsec.ucf.edu/en/publications/pdf/FSEC-CR-2030-16.pdf>>

EVSE 2017, 'How much does it cost to set up an EV Charging Station?', viewed on 10 November 2017 from <<https://www.evse.com.au/blog/evchargercost/>>

GBGA 2016, 'The Goulburn Broken Region', viewed on 10 November 2017 from <<http://www.gbga.com.au/goulburn-broken-region.html>>

Green Vehicle Guide 2018, 'Green Vehicle Guide', viewed on 10 November 2017 from <<https://www.greenvehicleguide.gov.au/>>

Kotter, J.P. 1995, 'Leading Change: Why Transformation Efforts Fail', *Harvard Business Review*, March-April, pp. 59-67.

MAV 2017, 'About Local Government', viewed on 10 November 2017 from <www.mav.asn.au/about-local-government/Pages/default.aspx>

Parliament of Victoria 2018, 'Inquiry Into Electric Vehicles', viewed on 10 November 2017 from <<https://www.parliament.vic.gov.au/eic/inquiries/inquiry/909>>

Pelletier, L.G. and Sharp, E. 2008, 'Persuasive communication and pro-environmental behaviours: How message tailoring and message framing can improve the integration of behaviours through self-determined motivation', *Canadian Psychology*, 49(3), p.210; Kotter, J.P. 1995, 'Leading change: Why transformation efforts fail', *Harvard Business Review*, 59-67.

Schofield, R., Walter, C., Silver, J., Brear, M., Rayner P., and Bush, M. 2017, 'Submission on the "Better fuel for cleaner air" discussion paper', viewed on 6 September 2017 from <http://www.nespurban.edu.au/publications-resources/research-reports/CAULRR06_SubmissionFuelQualityStandardsAct2000_Mar2017.pdf>

U.S. Department of Energy 2012, 'Plug-In Electric Vehicle Handbook for Fleet Managers', viewed on 10 November 2017 from <https://www.afdc.energy.gov/pdfs/pev_handbook.pdf>

VAGO 2014, 'Shared Services in Local Government', viewed on 10 November 2017 from <<https://www.audit.vic.gov.au/report/shared-services-local-government>>

VIC Roads 2017, 'Vehicle Fees' viewed on 10 November 2017 from <<https://www.vicroads.vic.gov.au/registration/registration-fees/vehicle-registration-fees>>