How Greater Wellington Regional Council is electrifying its vehicle fleet.

An information paper for vehicle fleet managers about electric vehicles, charging infrastructure, and practical ideas on how to transition a fleet to electric.

October 2016

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greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

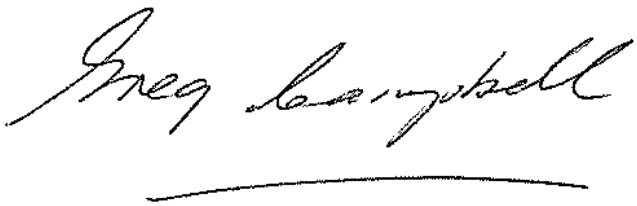
We support Electric Vehicles
Drive the Future

Introduction

The Greater Wellington Regional Council (GWRC) is delivering a number of significant initiatives which impact on both our natural environment and our resilience as a region. We engage with diverse communities and receive a clear message about the activities they believe the regional council should be focused on over the next 10 years. Communities say they want reassurance that our infrastructure is resilient and the quality of our environment is protected.

We strive to set a positive example for business and community in the region. Throughout Wellington, Porirua, the Kapiti Coast, and the Hutt Valley, the leading contributor to climate change is road transport emissions. New Zealand's electricity generation is some of the cleanest in the world and offers a sustainable alternative to fuel. We therefore are working to be the first region in New Zealand to have an electric bus fleet, and encourage others to adopt electric vehicles, big and small. Looking inwardly, an annual review of our corporate carbon footprint showed our light vehicle fleet to be our leading source of our emissions. As a result, I agreed on a strong yet pragmatic approach to transitioning our light fleet to electric. We are now the first in the local government sector to adopt an 'electric first' vehicle policy.

The government has set a clear target for 64,000 electric vehicles by 2021, and is setting progressively stronger international agreements on climate change. We look forward to the rest of our sector working alongside us in delivering meaningful contributions on both accounts. Electric vehicles are an important and actionable change we can all make to protect our environment and resources.



Greg Campbell
Chief Executive

Summary of key points in this document

- **Over 50%** of our corporate emissions relate to the light vehicle fleet and staff commuting.
- Driving an electric vehicle (EV) **reduces emissions by 80%** versus a petrol and diesel equivalent.
- Short range EVs suit 70% of our daily trips. Long distance EVs exist and will become affordable in time.
- Plug-in hybrid EVs can drive long distance and offer **an interim solution to long range and low emission.**
- EVs cost more to purchase but are very cheap to run. Drive the vehicles far enough and they cost less overall.
- We organised **staff test drives** early in the process to raise awareness, interest, and get feedback.
- We are **buying vehicles iteratively,** as they come up for replacement.
- Prices and diversity of electric vehicles is rapidly improving; **44 new models are expected here by 2020.**
- We're installing low-cost **electric charging stations at our offices,** including some visibly for visitor use.
- Staff now must **first evaluate an electric vehicle when making a purchase.** A fuel vehicle can be purchased only with approval by management, subject to it being necessary for work purpose.

About this document

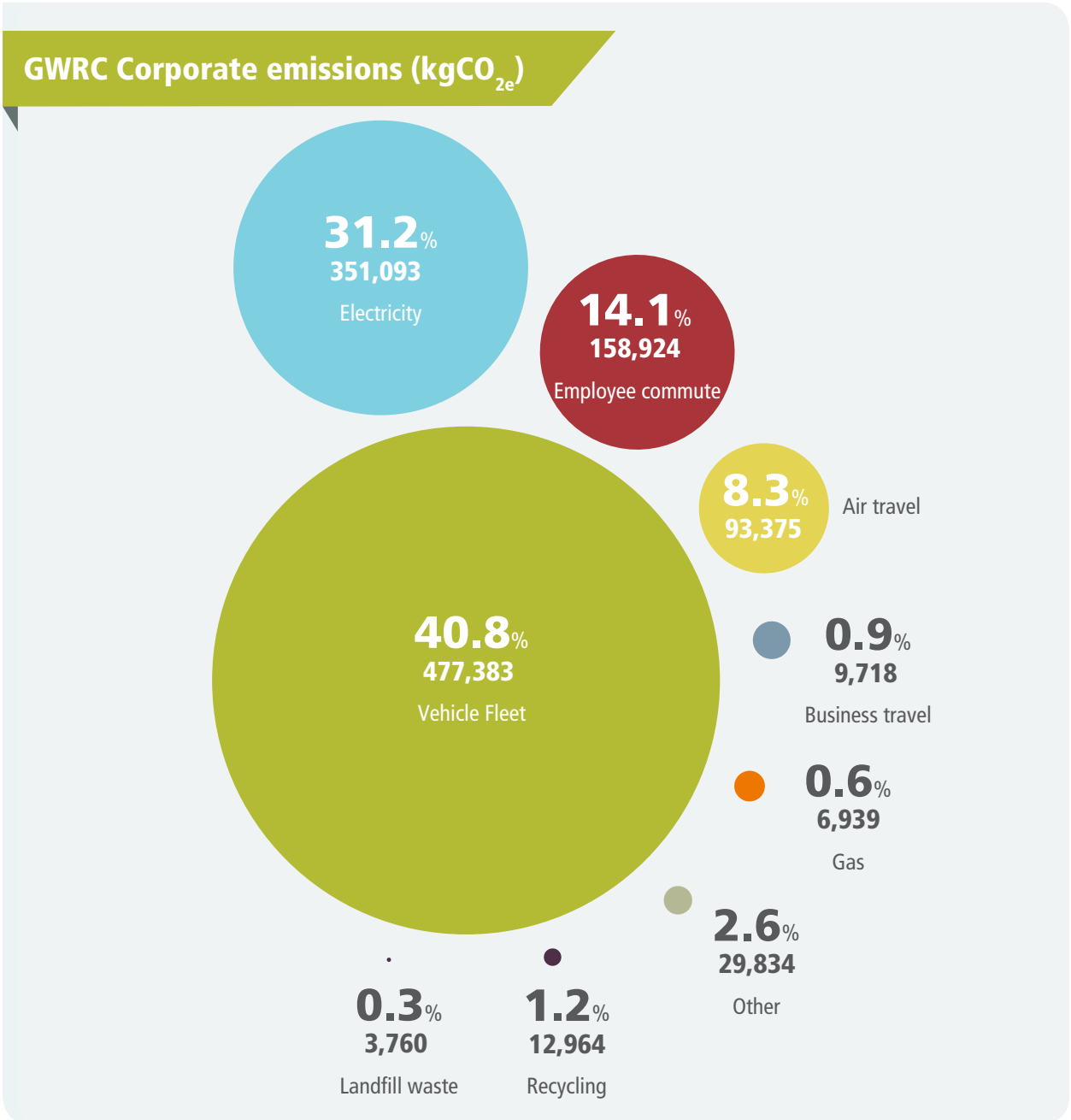
This information paper provides public details on GWRC's 'electric first' vehicle policy, background on the policy and how it developed, and important lessons learnt. The document is aimed at the senior leadership, senior managers, sustainability officers and vehicle fleet managers within local government. A further update to this document would be appropriate in time once GWRC's vehicles have been bedded in, further chargers have been rolled out, staff experiences better understood, and further learnings are available to share.

A 2016 survey undertaken by GWRC showed local government considered the high upfront cost, lack of specialist vehicles, few charging stations, and lack of driving range as significant barriers to electric vehicle uptake. Our motivation in releasing this document is to build awareness of how to overcome such concerns.

Why look at vehicles?

Greater Wellington Regional Council is a local government agency with about 500 staff. It has a range of statutory responsibilities, including environmental and public transport functions for the 500,000 residents in the capital city region of New Zealand. Our purpose is to enrich life in the Wellington Region by building resilient, connected and prosperous communities, protecting and enhancing our natural assets, and inspiring pride in what makes us unique.

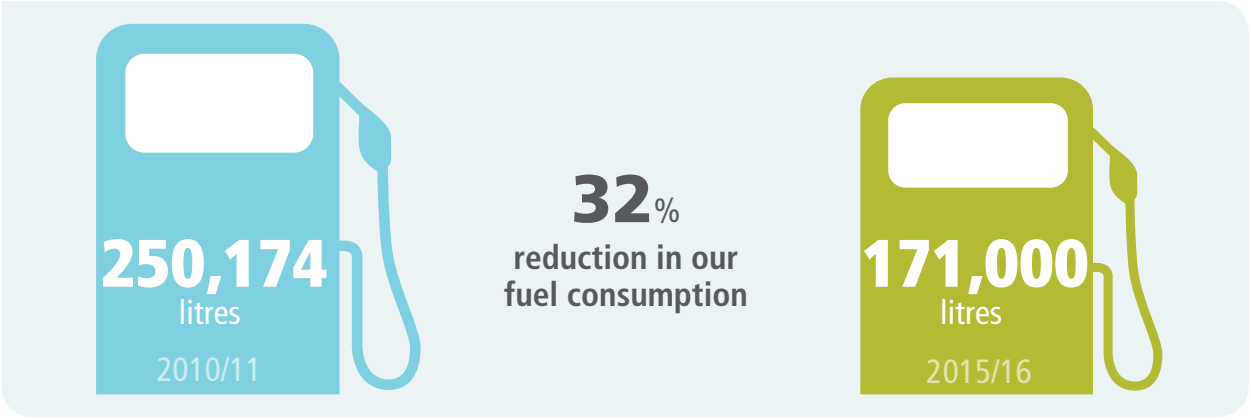
The council has a Climate Change Strategy and Sustainability Action Plan focused on its own corporate processes and activities. These trigger an annual audit of the carbon emissions across our organisation, which recently highlighted that our single largest emissions source is our vehicle fleet comprising approximately 150 cars, SUVs and utility vehicles.[1] This made vehicles an obvious area of focus.



1 Graphic and statistics from GWRC Corporate Sustainability Report. Relates to 12 months ending June 2016.

Many strategies already in place

Significant improvements had already been made in recent years around vehicle emissions, reducing tonnes of CO_{2e} from 658 in 2011/12 to 471 in 2015/16, primarily due to reduced fuel consumption across our light vehicle fleet:



This progress had been achieved by:

- Installing and monitoring vehicle travel using GPS systems. This was introduced in 2014 and yielded a 5% improvement based on improved driving behaviour by staff. The vehicle movement data is integrated with fuel purchase information and also allows us to accurately determine the real-world fuel economy and emissions profile for each vehicle and our fleet as a whole.
- Introduction of fuel efficiency targets in our vehicle purchasing policy.
- Offering alternatives to motorised travel. Video Conferencing (VC) facilities were installed in early 2014 at four key offices. Six bicycles and four push scooters were purchased and are bookable by staff for work-related local travel, and cycle-skills training is available to staff and promoted across the organisation.

While our employee commute to and from work is our third largest emissions source, we have:

- High numbers of staff walking, cycling and taking public transport when commuting (47% as at August 2016). Our office is in walking distance to the city's major bus hub and train station.
- High numbers of car-pooling (20%). Teams of three or more (minimum two staff and one other passenger) who commute together can enter a monthly draw to win a month's free parking.
- Only 31% of staff drive alone to work in a car but this disproportionally represents most of our commuting emissions (64%, 102 tonnes). A typical organisation has between 40–70% of employees driving alone to work.

Work-related travel is essential for many of our roles. Fifty one percent of us travel at least once a week during work hours, and 17% of us travel most days during work hours. Fifty five percent of work travel is in our fleet vehicles, followed by walking (18%).

Despite these initiatives and our progress, our vehicle fleet emissions still account for the highest proportion of our carbon footprint, and so we needed to look for more dramatic ways to make subsequent improvements.

Change is in the wind

New Zealand's transport emissions have almost doubled since 1990 and now make up 17% of our national carbon footprint. Under the United Nations Framework Convention on Climate Change, New Zealand has adopted an unconditional target to reach 5% below 1990 levels by the year 2020. Reducing transport emissions is a major way for the country to deliver on immediate and future climate change targets.

Separate to climate change, we also saw the case against fuelled vehicles stacking up. In our role of monitoring air quality, we are well aware of the problems that vehicle exhaust emissions make to our local air quality and their contribution to respiratory illness and premature deaths. The World Health Organisation now classifies exposure to diesel emissions in its highest category of carcinogens. Reducing vehicle emissions therefore presented both an opportunity to settle our concerns and to promote environmental leadership.

ACTION: Create a trigger for change by identifying how much of your organisation's carbon footprint is from your vehicle fleet and staff commute, and build up a detailed picture about vehicle use. Give a mandate to an internal champion to deliver meaningful transport emission reductions on an annual basis.

Electric vehicles an obvious solution

Electric vehicles are propelled by an electric motor powered by an on-board storage of electricity such as a battery.

They have several advantages:

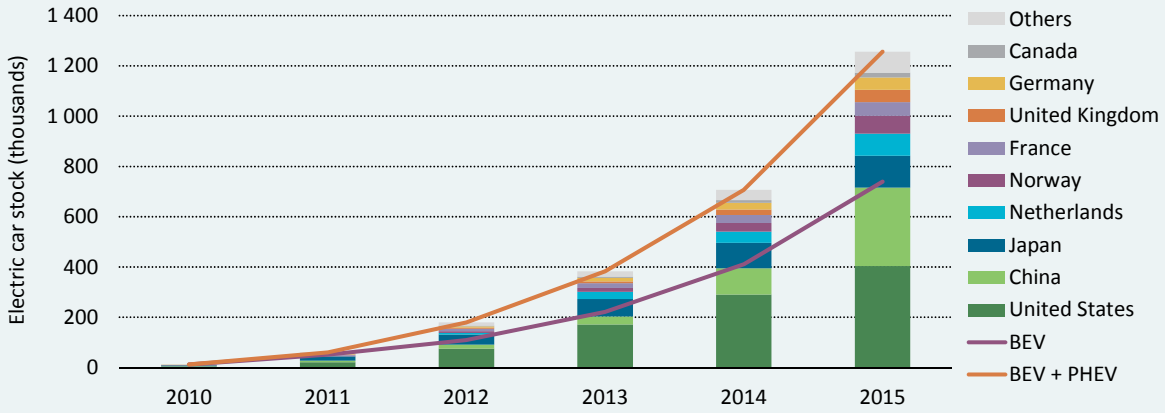
- **80% reduction in CO_2 emissions in New Zealand.** This significant reduction in emissions is because 80% of New Zealand's electricity is generated from renewable sources. This CO_2 reduction will further improve as the electricity sector delivers on a 2025 goal to lift renewable electricity generation even higher. There are also many other advantages to using this home-grown energy compared with using imported fossil fuels.
- **No tailpipe emissions.** This improves local air quality, supporting the health of people living in our region.
- **Fewer lifecycle emissions.** Even when you take into account raw material extraction, battery manufacture, vehicle manufacture and shipping, the Energy Efficiency and Conservation Authority (EECA) found pure electric vehicles emit 60% fewer climate change emissions over the full life cycle than for petrol vehicles. Their analysis found that there was no significant difference in the depletion of rare earth metals between EVs and petrol or diesel vehicles. Further, the lithium used in lithium-ion batteries for EVs, actually present in the form of salts, is neither a rare-earth nor even a precious metal.[2]
- **We have enough power.** If all of the three million light vehicles in our country were to go electric tomorrow, the required extra electricity (around 10%) could be met by new renewable generation that already has consents for construction.

2 https://www.eeca.govt.nz/news-and-events/media-releases/research-confirms-environmental-benefits-of-electric-vehicles/

The future is here

The environmental advantages are clear. But is the technology ready? We took confidence from the exponential growth in global sales, and in the news that most major car manufacturers are now selling electric vehicles or had short term intentions to begin. However, we still needed to be assured of performance and cost.

Global electric vehicle fleet[3]

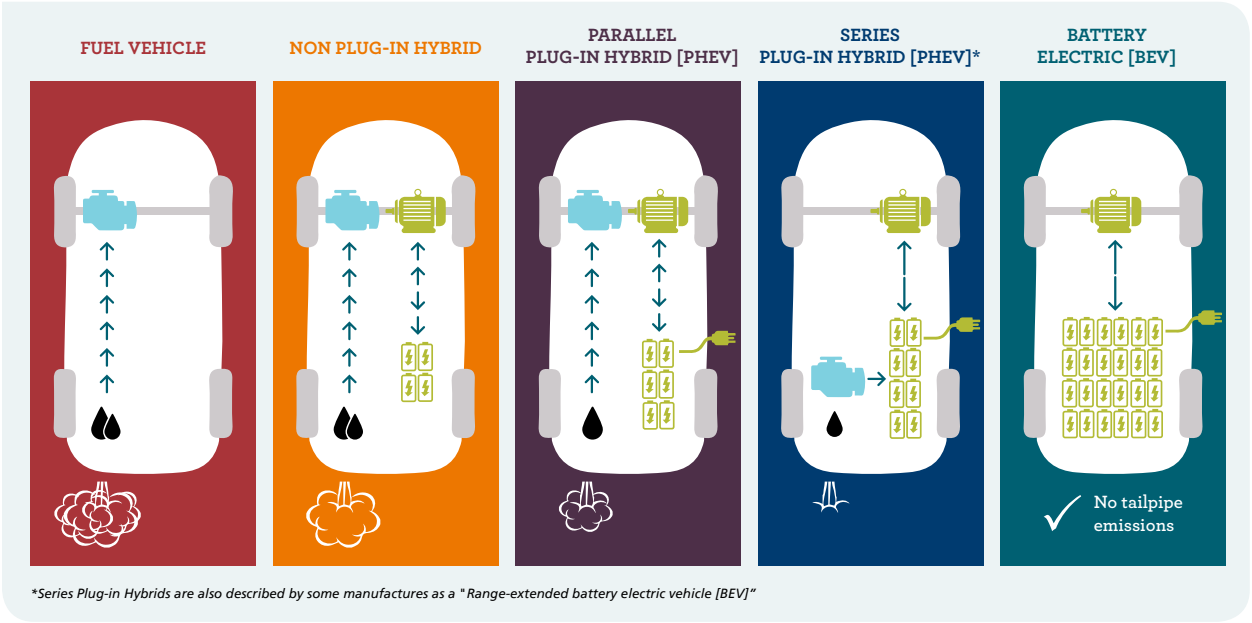


The Tesla Model S, pictured here at the Brooklyn Turbine in Wellington, is a highly coveted, ultra-high performance fully electric car

3 Graph source: iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf

Vehicle types

There are three types of electric vehicles, all of which are different to the 'hybrids' we are familiar with.



**Series Plug-in Hybrids are also described by some manufactures as a "Range-extended battery electric vehicle [BEV]"*

Range of body types	Broad	Moderate	Poor but improving	Poor but improving	Poor but improving
Purchase Price	Low	Medium	High but falling	High but falling	High but falling
Running Costs	High	Medium	Low	Low	Very Low
Emissions	High	Medium	Low	Very Low	Zero

The pricing, capability and selection of electric vehicles is rapidly evolving and maturing in New Zealand. While large international markets have dozens of brands and models to choose from, the selection is much reduced locally. However, in 2016 the Motor Industry Association has published that it expects at least 44 new models of plug-in hybrid and full electric vehicles will enter the New Zealand market by the end of 2020, as indicated in a mid 2016 survey:

MIA Plugin Vehicle Survey - Planned dates of introduction into the NZ Market

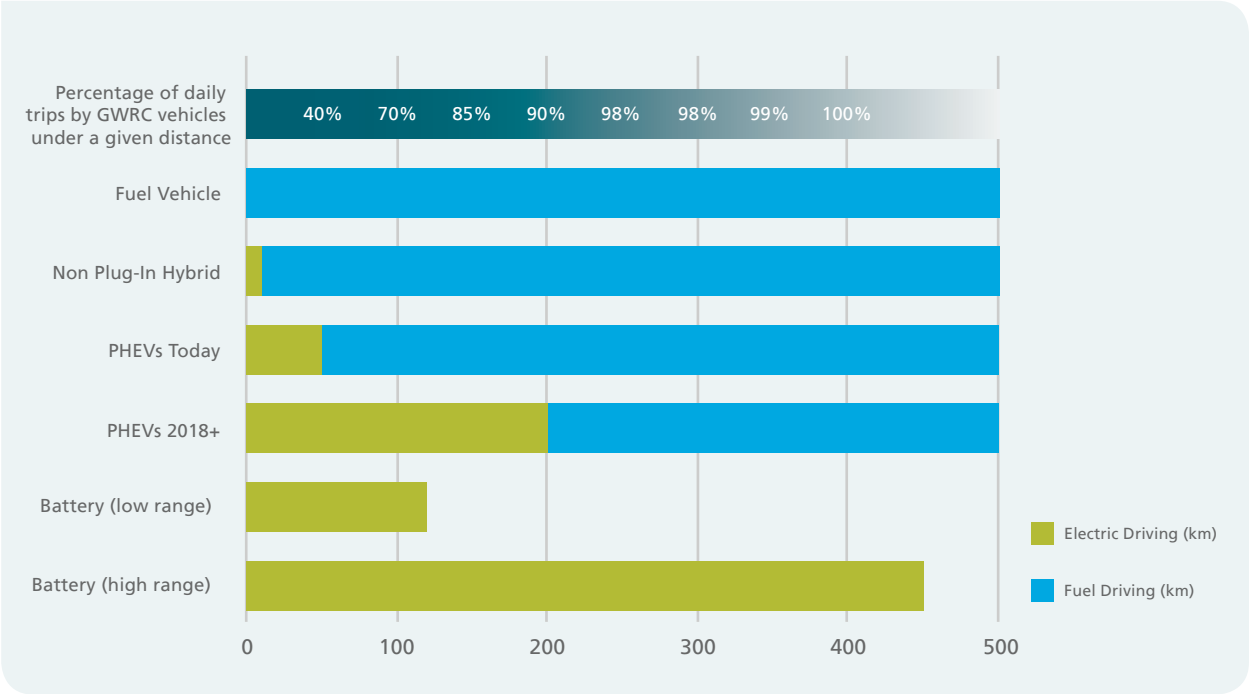
VEHICLE SEGMENT	2016		2017		2018		2019		2020		TOTAL
	BEV	PHEV	BEV	PHEV	BEV	PHEV	BEV	PHEV	BEV	PHEV	
Passenger - Micro/Light/Small	1		2		1		1	1	2	1	9
Passenger - Medium/Large/ Upper Large	1	2	2	2		1		2	2		12
People Movers											0
Passenger - Sports		1		1						1	3
SUV - Compact/Medium		1		1		3	1	2	1	2	11
SUV - Large/Luxury		1		1		2	1	1		1	7
Light Commercial Vehicles	1			1							2
TOTAL NEW MODELS	3	5	4	6	1	6	3	6	5	5	44
TOTAL BEV	3		4		1		3		5		16
TOTAL PHEV		5		6		6		6		5	28

Driving range

There is a temporary concern about how far an electric vehicle can drive before needing to recharge, giving rise to the term range anxiety. However, this issue is temporary:

- Most fully electric vehicles manufactured 2011-2016 can only drive 100-200km between charges, but
- Luxury fully electric vehicles since 2014 already can drive over 450km, a similar driving distance to conventional fuel vehicles, and it is expected that from 2018 we will see a dramatic shift of lower priced EVs closing in on such distances. This is due to increasing scale and reducing cost of battery production.
- Plug-in hybrids come with a vast spectrum of what distance they can drive electrically. They however present no challenges in terms of long distance driving. The distance they can drive on electricity will quickly grow over the years ahead. Such vehicles are already an answer where range is a concern.
- Staff can learn to use vehicles within their capability.

Comparison of how far different vehicles can drive before recharging or refueling:



Our GPS data showed 70% of any daily trip taken by one of our fleet vehicles was 100km or less. That is easily accommodated by affordable electric vehicles already in the market. Data then showed that when vehicles are capable of travelling 250km on a charge, they would be accommodate practically all (98%) journeys, and arguably the remaining 2% of trips could then still be feasible by charging at some point along the way.

In the meantime, a percentage of our fleet will need to be plug-in hybrid vehicle in order to drive long distance, either as a dedicated vehicle for a person who regularly travels long distance, or as a vehicle booked on occasion by someone typically using a short range electric.

We then wanted to quantify what sort of emissions savings a plug-in hybrid had so that we could justify their use, and either way, whether the total cost of ownership of such vehicles were less than a conventional vehicle. At the time of evaluation (mid 2016), the fully electric Nissan Leaf (imported) and the plug-in hybrid Mitsubishi Outlander (new) were the two products that were available and in attractive price bands.

ACTION: Find out how many of your vehicles and days a year that your vehicles drive under 100km daily to identify the proportion can than already go full-electric today. Where an existing vehicle is only occasionally driven long distance, it may well be replaced by a full electric, with the driver booking a shared pool plug-in hybrid for long trips.

Rugged vehicle capabilities

Many of our vehicles are "work horses" that drive off-road and tow significant loads.

Some of our vehicles travel demanding terrain.

This presents a challenge in that most electric vehicles today are targeted at on-road driving and do not have an open tray to carry cargo.

This is expected to change. Today, the Mitsubishi Outlander plug-in hybrid SUV is a 4WD vehicle with some off-road capability, and has a New Zealand tow-rating of 750KG (braked). This means that an existing electric vehicle can be used for some of our off-road and towing requirements.

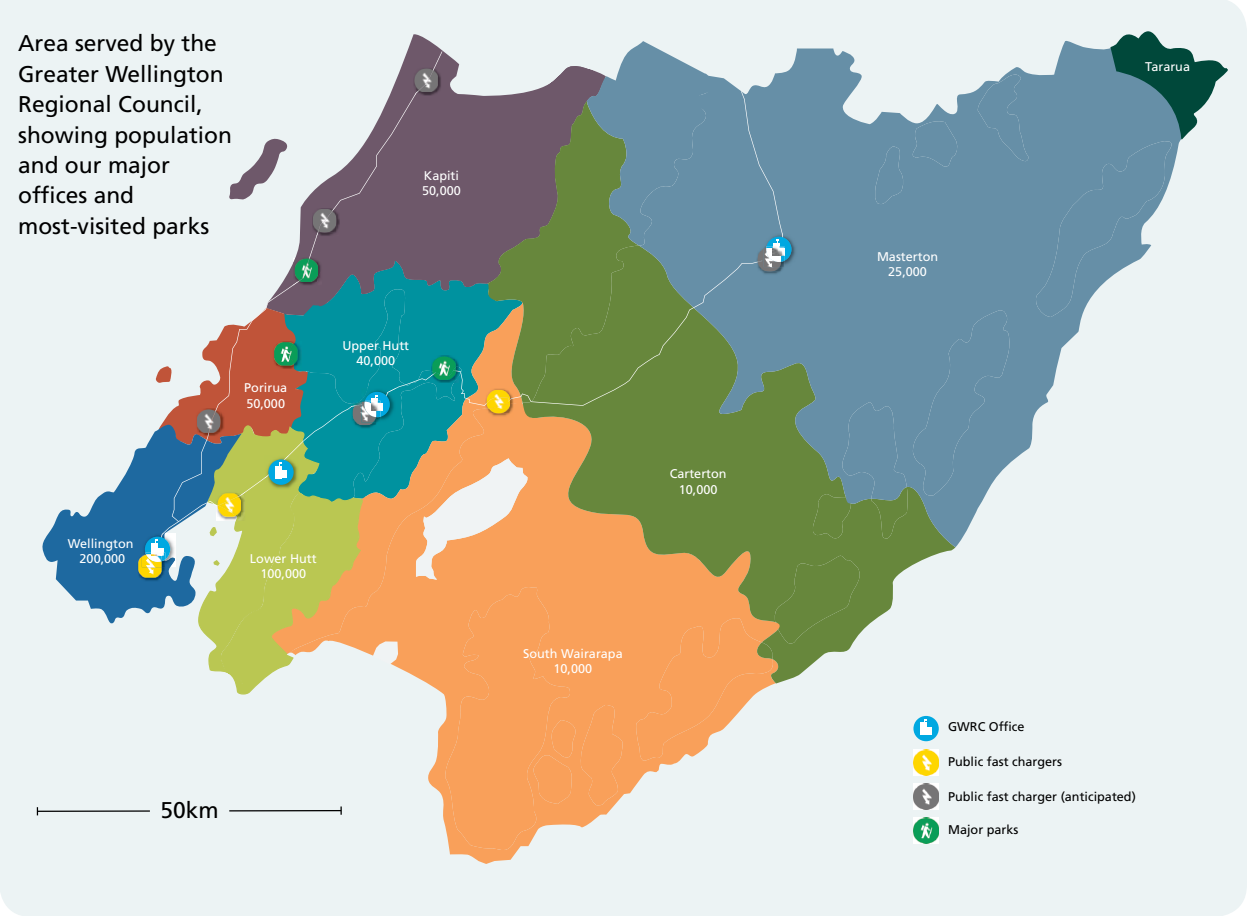
The (admittedly very expensive) Tesla Model X fully electric SUV has a tow-rating of 2200KG, and has a motor performance that exceeds almost all "workhorse" diesel utes, proving that electric vehicles have more than enough performance. Tesla has announced it will release a "pick up truck" in 2017, which should encourage others to introduce the same. The only heavy duty utility vehicles we identified today were those made by VIAMotors in the USA. While they are planning to produce right hand drive vehicles, their purchase price is 3 to 4 times higher than what we would tend to pay today – too high for us to accommodate.

While we wait for cost effective heavy duty electric vehicles and those with trays to eventuate, we will continue to need to purchase conventional vehicles.

ACTION: Identify specialised vehicle requirements beyond passenger capacity (e.g. open trays, 2000 KG towing capacity) and minimise the use of fuel vehicles through providing only enough such vehicles to meet actual demand. Bookable 'heavy duty' vehicles in a pool may help.

Charging an electric car

Buying a petrol car doesn't require any thinking on where to refuel. With an electric, there is both a need to install car chargers at offices or even common destinations, and to be aware of the location of available charging infrastructure.



Example low-cost "slow" charging station:

This equipment can recharge a 100-140km range car in four to six hours depending upon the charge rate of the unit. Vehicles with larger batteries tend to be capable of faster charge rates, up to 100km per hour. We're installing such equipment outside our offices. Indicative costs:

- Electrical cabling (10 meters) & labour: $5000
  (Varies considerably with cable-run distance)
- 3-phase 22kW AC chargers: $2000 each
- Posts and signs: $1500 each
- Ground painting: under $500 for several parks

Our Nissan Leaf recharging at a public fast charger:

This equipment recharges a 100-140km range car in about 20 minutes. Some vehicles do not come with fast charging compatibility.

The cost of this fast charging equipment is currently too high for us to consider purchasing and installing ourselves ($50,000+ for 50kW), however a nationwide network of fast chargers is developing. We anticipate that "medium speed" 25kW DC chargers (e.g. an hour to fully recharge) may soon become sufficiently affordable to purchase.

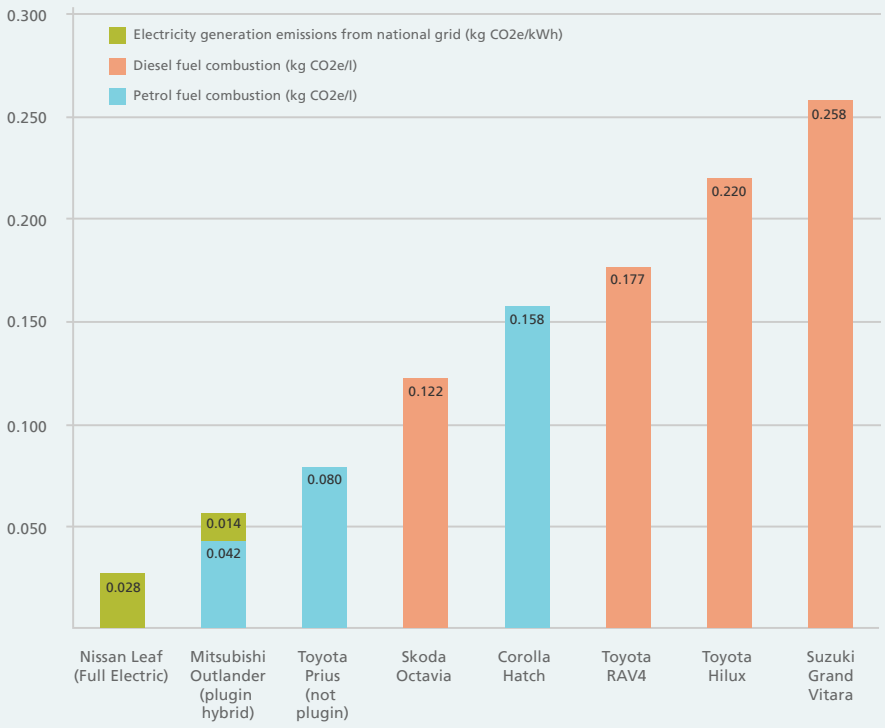
Electrical recharging takes longer than liquid refueling. This can risk a staff member wanting to drive away, only to find it will be some time before the car has enough charge to make a trip. Moderate to high speed chargers at your office and in your region are a short term solution for staff in a hurry.

ACTION: Install chargers at your offices. Proactively encourage the implementation of public chargers in your region through conversation and partnership. Note the benefit of providing chargers at offices for staff and visitors, and provide these if possible; this promotes electric vehicle adoption and offers an environmental marketing opportunity.

Environmental analysis of vehicles

We modelled common vehicles in our fleet against electric vehicles we could buy:

Emissions (lower is better). kg CO_{2e} per km driven



Small vehicles and full electrics: The Nissan Leaf, Toyota Corolla Hatch, Toyota Prius, and Skoda Octavia are all roughly similarly sized 5-door hatchbacks. The modelling shows that a full electric vehicle is multiple times better in terms of emissions. The blue component in the graph for electric vehicles shows emissions from New Zealand's specific profile of coal, gas, and geothermal power stations that do release carbon dioxide and other gases. In other words, these are not emissions from the vehicle, but are emissions produced elsewhere in the country used to power the vehicle. This was added to produce a fairer comparison (although, it should be noted, we could have likewise added more emissions of petrol and diesel to account for the production and transportation of fuel, which would have shown fuel vehicles in a poorer light). The blue electrical component will drop over time, as New Zealand's electricity power grid removes coal and gas-fired generation.

What about plugin hybrids? While the environmental gains for pure electric vehicles were very clear, we initially questioned whether plug-in hybrids provided substantial emissions savings. Our GPS data showed us that a 100km trip between charges is a fair average representation on which to calculate emissions. For the Mitsubishi Outlander this means approximately half of its travel is electric and half is petrol. In practice, such vehicles would likely drive electric for many days running on electricity where they perform short distances (40% of daily trips are under 50km), offset by occasional long journeys where they drive several hundred kilometres before plugging in that night. Surprisingly, the modelling showed us that the environmental gains were very clear: the vehicle outperforms and produces fewer emissions than vehicles such as the Toyota Prius. Despite its large size, it would make more sense to drive this large SUV from Wellington to Masterton, plug in, and return back in the same way, than it would to drive a 'best in class' fuel efficient hybrid. The emissions improvement over other SUVs in the market was remarkable.[4]

4 Caution must be applied in looking at raw numbers for emissions. More confidence can be placed in relative figures comparing one vehicle to another: the raw numbers will reflect driving style and the route driven.

As a consequence, it made sense for us to prefer an electric or plug-in hybrid when buying any vehicle, unless it lacked specific features (e.g. an open tray ute), supposing we could resolve the final part of evaluation puzzle - price.

Banking on electric vehicles

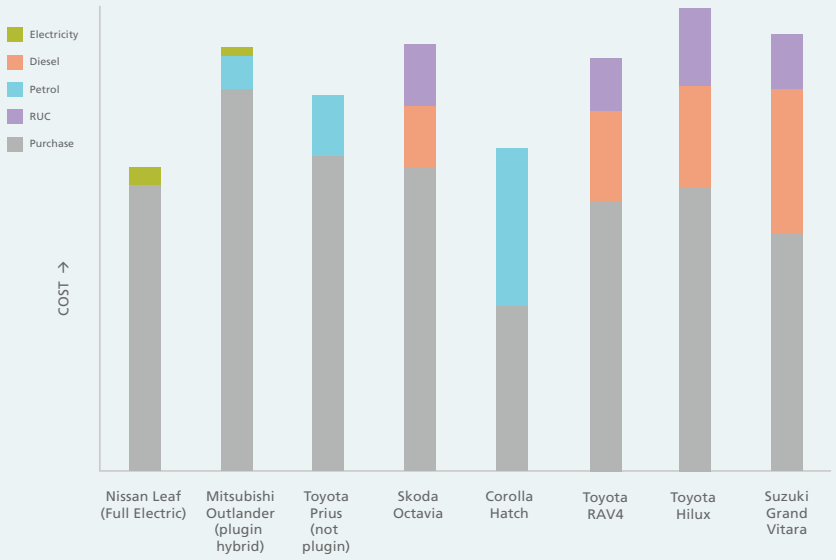
Our emissions modelling, and our own existing vehicle records made it easy to evaluate the electricity and fuel costs for the vehicles.

There was no specific budget or plan to bulk buy a fleet of electric vehicles, but rather, the assumption was that at a point when a given vehicle was up for replacement due to age, that we would replace it with an electric vehicle supposing this could be afforded. This would be a challenge and blocked if this carried a price premium.

We compared the same vehicles on a pricing model.

The findings were that fuel (including road user charges in the case of diesel vehicles) easily cost $15,000 over the life of a given vehicle (typically five years or more). The associated electricity costs for driving the same range were negligible - merely $2000 for a full electric. Therefore if the upfront cost of an electric vehicle was no more than $10,000 to $15,000 than the alternative conventional vehicle, then an electric vehicle would be the same price, or cheaper.

Total cost of vehicle at 120,000km (Lower is better)



Prices exclude residual value, and are new from AoG catalogue except for Nissan Leaf which is used.

This could be achieved supposing:

- In the case of a Nissan Leaf, it was bought used. This presented an exception as we only bought new vehicles. However, we would rather buy used, than buy nothing, or buy a much more expensive new electric vehicle. The Nissan Leaf was originally supplied by Nissan New Zealand, however, dealers have begun to buy vehicles new or used out of the UK and Japan. At the time of writing, there is approximately 200 such vehicles available for sale in this manner, in a broad price from about $15,000 to $45,000; we modelled it on a price of $31,000.)
- In the case of a Mitsubishi Outlander, it was bought from the All-of-Government contract.

This showed that we could buy an electric vehicle for no cost premium, when measured in total cost of ownership terms. We would have to explain to departments that they may have to pay more up front, but that they would see savings over the years following.

If an organisation finds the jump in price to buy and own an electric vehicle is higher than in our case (e.g. by avoiding the used market), then you could examine whether reducing the fleet size whilst keeping the overall transport budget unchanged allows enough of a budget increase on a per-vehicle basis.

Costs down the road?

Evidence shows the maintenance of an electric vehicle is lower. There are fewer moving parts in a fully electric vehicle, so there are fewer parts to break and service. A plug-in hybrid still has many moving parts, however, it is expected they would wear more slowly owing to less strain; this is particularly the case for series plug-in hybrid (aka range-extended battery) electrics because a generator is a much simpler transmission.

There is the potential to replace a battery, which is a very high cost part (many thousands of dollars). Batteries can either:

- fail outright (exceedingly rare, from our research); or
- slowly degrade (which is normal, and the only issue is if they degrade faster than expected. For example, at eight years of age, by which stage we would have expected to have sold the vehicle, the battery health should still be around 70%).

Fortunately there is an accurate predictor for battery failure on a used vehicle which is to perform a battery health check. This is a simple process of reading figures from the dashboard or conducted in a more detailed fashion using a smartphone (most dealers can show this information before a sale), and is therefore practical and sensible to perform. We could find no international evidence that lithium-ion batteries failed frequently, and that worst case, if we did have to buy a new battery for one of our many electric vehicles, it would dip into some of our fleet cost savings rather than present an overall increase to our wider fleet budget. Battery warranties on used vehicles are beginning to emerge in the market and will reduce the risk to buyers

Some logistics such as access to chargers, the timing of charging, and whether charging to full is necessary will require some development during our deployment stage.

The final area of pricing to examine is the resale value. If the price we got from selling an electric vehicle was lower than what we might get from a petrol vehicle of the same age, we would need to factor that into our decision making. Our research found we could sell an EV for a fair price, potentially higher than a similarly aged fuel vehicle. EECA's *Vehicle total cost of ownership tool* offers an estimate of vehicle resale value based on third party data from a variety of sources (e.g. auction houses).

Of course, time will tell what the resale pricing comes to be. Eventually we would expect to see instability on the resale of fuel vehicles, when consumers begin to stigmatise them.

ACTION: Perform a fleet analysis and identify the mileage or age needed for electric vehicles to cost the same as fuel vehicles. Consider extending your vehicle age replacement criteria if necessary. Contact us for a copy of our Vehicle cost and emissions analysis spreadsheet to simplify your evaluation.

Driving culture change

First-hand experience and international research shows the best way to get people to be confident in driving or buying an electric car is to **get them behind the wheel.**

Most New Zealanders are unfamiliar with the performance and driving characteristics of EVs, and how charging works. It is very important to give staff the chance to go for a drive and see how charging works. Almost everyone who does will enjoy the experience and gain confidence that electric vehicles are very real and very competitive. Importantly, they will engage in asking a large number of questions as they run through the limitations or issues that they see. For example, they will identify that electric vehicles have much better acceleration and hill-climbing ability than they initially expect, and that they recharge the battery when slowing or travelling down hills.

We organised local dealerships to loan two different vehicles to us for a week, and posted via email and the intranet and printed posters that staff could trial an electric vehicle. Staff were able to drive around the block or go on longer journeys as they saw fit. An internal champion ensured that staff were given a brief about the vehicle. It was important to include both the leadership and operational staff in the trial experience so that decision makers and those impacted by decisions were both confident about the technology.

Staff feedback on a fully electric car:

- All staff who gave feedback indicated that the Leaf met all their work-related travel requirements and that they would be very supportive of a Nissan Leaf joining our pool fleet.
- Roomier and drove better than expected
- Catalysed one staff member to purchase their own Nissan Leaf.

Staff feedback on a Mitsubishi Outlander PHEV:

- Very good and suitable for SUV replacement
- Liked the economy and extremely low emissions
- Not sure they suit rugged field work
- Very nice to drive and extremely quiet
- Be good for general managers to show advocacy
- Lack of ground clearance - what happens if the batteries on the underside hit the ground?
- People will forget to plug in
- Wouldn't cope with crossing the Kapiti river
- Needs open tray as we are carrying toxins and traps and dead animal carcasses

Similarly, we understand that the City of Sydney initially found staff were reluctant to drive an EV. After familiarisation, EVs became the preferred vehicles and were highly utilised.[5]

ACTION: Organise a selection of trial vehicles for staff. Ensure they are shown the basics and have the opportunity to drive far enough to get a good sense for the vehicles. Capture feedback.

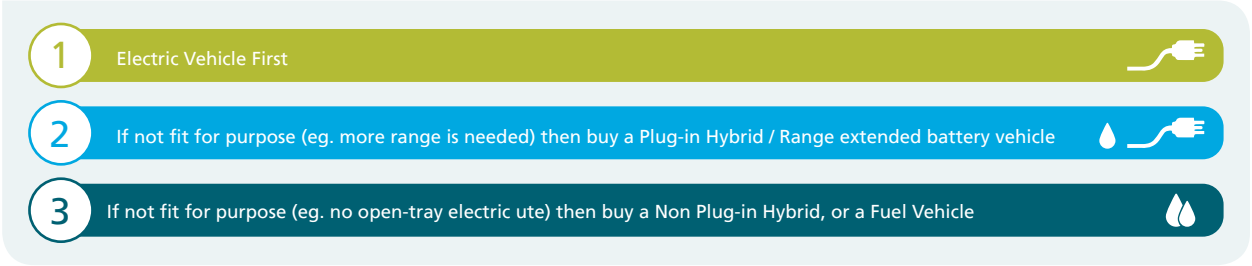
5 Source: Chris Binns, City of Sydney

Vehicle review becomes an opt-out policy

With the trial carried out, and staff largely enthusiastic and/or aware of the vehicle, updates to the vehicle policy could now be made.

Initially we looked at all vehicles and began to identify which ones could be replaced. However this put a lot of burden upfront on key people, and any decisions now would quickly be out of date as the pace of technology change was so fast.

While people were enthusiastic about the electric vehicle trial, and this was a necessary step to get people interested, we felt people would still continue to select a conventional vehicle they were used to. We would be more effective in reducing emissions if we have people look first at electric, and only have a conventional vehicle if they could justify a good reason (noting that range and cost per se were not good reasons)



The vehicle policy was thus updated to state:

1. The large negative impact that transport has on our emissions profile and our desire for electric vehicles to address this, and that vehicle purchases be electric by default, as follows:
   GWRC recognises that transport accounts for a large percentage of greenhouse gases and local pollutants which have negative effects in terms of climate change and air quality in our region and globally. GWRC therefore: (a) requires electric and plug-in electric vehicles are bought unless the requirements can only be reasonably met using a fuel vehicle, and (b) will fund and install electric car charging facilities at GWRC buildings as demand requires.
2. Increased the maximum upfront price allowed for an electric vehicle - noting reduced or avoided fuel purchases which result in the vehicle costing the same over the lifetime of the vehicle.
3. If a fuel vehicle is purchased, there is no preference in policy between petrol and diesel fuel types.
4. Introduced more stringent fuel economy and CO_2 emissions, which would disqualify some cars and SUVs from being repurchased. No change was made to utes because there are currently no efficient vehicles in this case.
   (Utes remain at 8.5L fuel /230g CO_{2e} per 100km; while all other vehicles dropped from 7.6L to 6L)
5. Allowing an exception for vehicles to be purchased used and/or off the All of Government list where this offers better value for money (an example is given in policy specifically around buying a used electric vehicle).
6. An opt-out process (see appendix for wording)
7. A provision allowing early replacement of a fuel vehicle with electric if authorised by CFO and CEO.

The process for buying a vehicle already carried a concept of whether a vehicle was even needed.

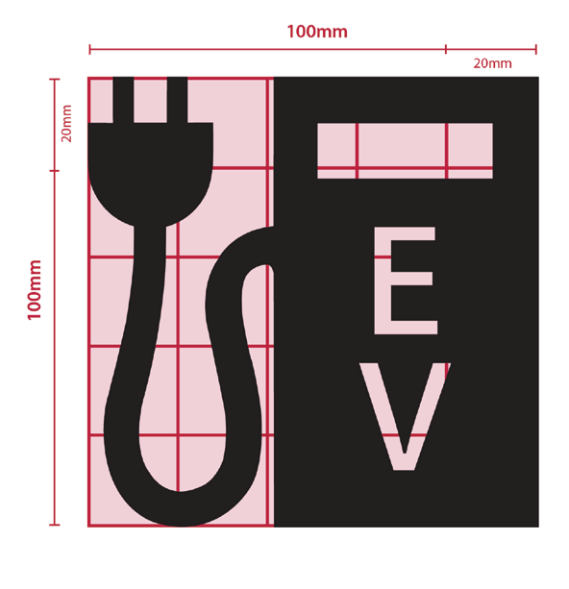
ACTION: Update your vehicle purchasing policy to give preference to electric vehicles. Use the text found later as inspiration. While numerical and written explanations are clearly necessary, be sure to lead with staff driving trials to encourage support.

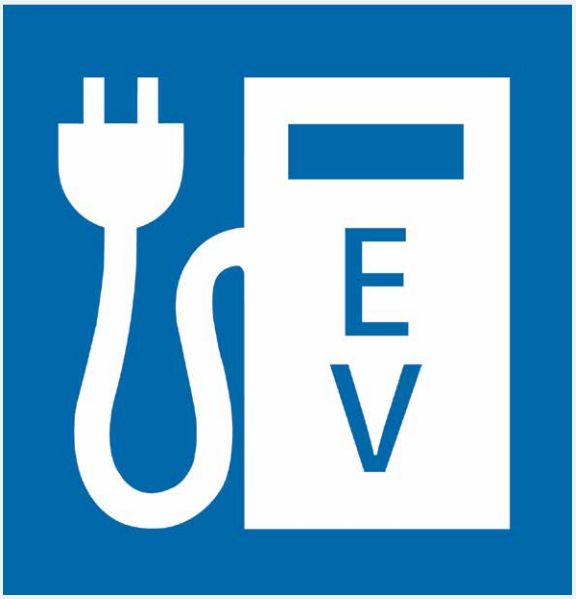
Gaining agreement and launching the policy

The policy and a detailed supporting paper were taken to our executive leadership team in June 2016 and was approved with minor feedback. The policy was then launched with staff:

- An initial used electric Nissan Leaf was purchased and added to vehicle pool for any staff to book.
- We developed prominent branding for our electric vehicles to build public awareness when driven about.
- Initial charging stations installed out the front of our main office. We used the official NZTA electric vehicle charging sign to support broader familiarity of new this symbol.
- A 'users guide' was formulated introducing both the use of the vehicle and with details specific to our region, e.g. where to find charging stations.
- An informative email came from the leadership explaining what was going on.
- An "RFID" tag was purchased so that the vehicle could use fast chargers
- Q+A sessions were held at key offices for staff to ask questions
- The fleet manager and administrator spent time developing a good body of knowledge about electric vehicles.

The NZTA has released the below electric vehicle charging symbol. For consistency across the nation, this gazetted symbol should be incorporated into wall and ground signage.





ACTION: Proudly purchase electric vehicles. Sign-write cars and charging stations, and publish information about EVs to your website, social media, and in community and customer publications. Bring your EVs out to events.

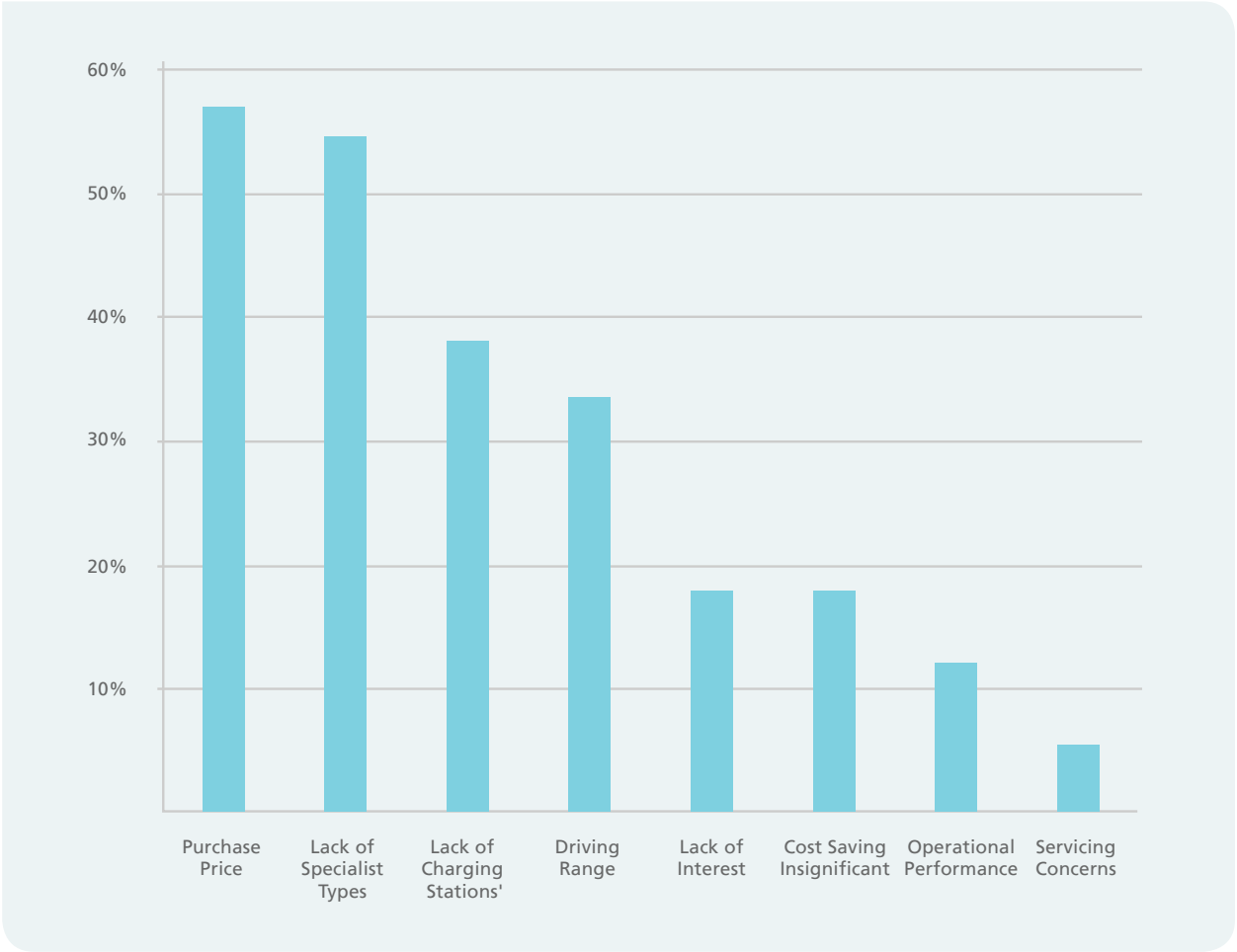
Where does this place us in the local government sector?

We ran a survey across local government in June 2016 which showed:

- Local government in New Zealand has over 4000 light vehicles. Our fleet size (150) is one of the larger.
- Only 20 vehicles in local government are currently fully electric or plug-in hybrids.
- Most councils stated no intention of buying an electric or plug-in hybrid vehicle in the coming 12 months. The key barriers described (cost, range anxiety, absence of available specialist vehicles) were issues we have resolved, and this experience fed a desire to write up a case study to help the sector understand that electric vehicles are ready to be adopted today.
- 19 councils intend to buy an electric vehicle in the coming year, and three stated they have plans to buy more than two (Dunedin City, Northland Regional, and us). There is considerably higher levels of potential uptake of electric vehicles than what is currently planned.

We hope that the rest of the sector can adopt and adapt our vehicle policy to drive uptake. This will thereby directly contribute to the government's stated goal of 64,000 electric vehicles by 2021, encourage families and businesses in our communities to follow suit, and deliver economic and environmental benefits to our country.

Identified Barriers from respondents



What are we looking at next?

- We will continue to buy electric vehicles and add charging stations to our property, and encourage organisations in our region to do the same.
- We will track actual financial and emissions savings due to our electric vehicles versus our modelling.
- International research shows employers who offer car charging to staff are 5 times more likely to buy an electric vehicle in their private lives. Staff vehicle commuting is the council's third largest contributor to emissions (at 14%), and so deserves attention. (A very low number of people commute to work in a car versus the national average, as we have high levels of public transport, car-pooling, walking, and bicycle use.)
- We keenly await the ongoing improvements to price, electric range, and product diversity. This will help shift long-distance vehicles to full-electric, and shift heavier duty vehicles to plug-in hybrid and to full-electric in the fullness of time.
- Adopting electric vehicles means our electricity demand, and thus electricity-source emissions, will rise. We need to encourage much night-time charging (when electricity generation emissions are lower) and evaluate whether adding solar power at offices is practical and would reduce emissions materially.
- We will happily share our challenges and successes with others interested to know about our ongoing journey.

For more information contact Sigurd Magnusson at sustainability@gw.govt.nz at Greater Wellington Regional Council.

ACTION: Annually monitor your progress annually and adapt your policies to complete the transition of all vehicles to electric.

Chair Chris Laidlaw holds a portable charging cable

Appendix: vehicle policy text

The following text forms part of the GWRC's vehicle policy. Our wider vehicle policy covers many additional topics, including safety requirements (minimum ANCAP 4 star). We share the following text to encourage other organisations to adapt and embed it into their vehicle policy documents.

1. Reducing transport emissions

GWRC recognises that transport accounts for a large percentage of greenhouse gases and local air quality pollutants which have negative effects in terms of climate change and air quality in our region and globally.

GWRC therefore:

1. Requires electric and plug-in electric vehicles are bought unless the requirements can only be reasonably met using a fuelled vehicle.
2. Will fund and install electric car charging facilities at GWRC buildings as demand requires.

2. Purchasing of vehicles

1. New vehicle purchase and disposal

i. Purchasing

All vehicles are to be purchased through the People and Customer Group. An Asset Purchase Form is to be completed and provided to this group.

A vehicle purchase must comply with the "Vehicle Purchasing Parameters" as specified in Appendix 1 to this policy. The Vehicle Purchasing Parameters are reviewed and updated annually.

Managers are asked to clearly identify the real task a vehicle is required to do and then choose the most fuel efficient vehicle that will get the job done (ie. is 'fit for purpose'). This will involve discussions with staff about their needs. Questions to ask include:

- How far does the vehicle travel per day?
- What is carried in the vehicle? How much storage space is needed?
- Is four-wheel drive capability necessary, or could the vehicle be replaced by a two-wheel drive with equal ground clearance and load carrying capacity?
- Can rarely needed requirements be met by using another heavier duty vehicle?

Additional manufacturer's specification and performance information (e.g. load and towing capacities) can be obtained from the Fleet Administrator.

ii. Selecting an Electric, Plugin Hybrid or Fuel vehicle

Managers must:

1. First evaluate a Fully Electric Vehicle based on "fit for purpose".
   Such cars have a limit to the distance they can drive between recharging. It may be that it is sufficient for almost all travel, and that a different car in the Fleet could be used for long trips.
2. If a Fully Electric Vehicle is not fit for purpose, a Plug-in Hybrid Electric Vehicle (PHEV) must be evaluated.
   Such vehicles have no range limitation, and have substantially lower emissions than a typical hybrid or fuel vehicle, and will cost the same over its lifetime.

3. If neither a Fully Electric nor a Plugin-Hybrid Electric Vehicle are fit for purpose, a checklist must be completed to justify purchasing a fuelled vehicle or (non plugin) hybrid. The form of this is found in Appendix 3, and asks:
    - Typical use of the vehicle
    - What aspect of passenger or cargo or towing capacity or other requirement is required so that a fuel vehicle is justified.
    - Why can't an electric or plugin-hybrid as a primary vehicle be purchased but use a fuel vehicle when required (either from elsewhere in the pool, or elsewhere in the organisation.
    - The most fuel-efficient vehicle that meets the requirements of its use, and whether this meets fuel and emission requirements.

The checklist will accompany the Asset Purchase form to the Finance, Corporate Services Group. If a fuel vehicle purchase is approved the driver is encouraged where practical to book and use an electric or plugin hybrid vehicle from the pool or other department vehicles for specific trips, such as when driving on the road without large loads. This reduces the higher fuel bills and emissions produced by a fuel vehicle.

Note that Appendix 1 provides more information on specific vehicles for the types above, and budgets for vehicles. Electric and Plug-In Electric Vehicles are permitted to have higher upfront costs due to lower running costs making them the same cost overall.

Example: Buying electric when all needs are not met.

A department is replacing a medium-sized vehicle. The manager identifies an electric car would serve the majority of all trips, however on one or two days a month the vehicle's primary driver travels into rural areas, and could potentially need to tow a load. The manager identifies there are other fuel vehicles in their pool, as well as a number of outside the pool.

The manager purchases an electric vehicle, and the driver books a different vehicle for the small number of specific journeys with higher demands.

The electric car has a higher upfront cost but is cheaper overall when the lifetime of the running costs are factored.

This approach furthers GWRC's goals around lower transport emissions and financial costs, without putting drivers and their operations at risk.

iii. Use of AoG contract and Best Value

It is preferred but not required that vehicles are bought, new, and on the AoG contract. However, where better Value for Money can be found by purchasing a used vehicle, or procuring off the AoG list, this is permitted, but this must be noted in the asset purchase form.

Example: Used vehicle:

A passenger vehicle is being replaced. An electric car would be ideal however the preferred model is not found under an AoG contract. A used electric vehicle with under 10,000km mileage is purchased from an importer because this provides a discount much like that experienced via the AoG contract.

iv. Vehicle Replacement Criteria

Vehicles are replaced when they reach the following criteria:

- Manager's remuneration vehicles – 4 years and 100,000km, or 5 years
- Operational vehicles petrol or electric – 5 years and 120,000km, or 6 years
- Operational vehicles diesel – 6 years and 150,000kms, or 7 years
- Chair – Following triennial election.

A fuel vehicle (including hybrid that cannot plug in) even where in good working order can be replaced with an electric or plug-in hybrid prior to replacement criteria if agreed by CFO and CEO.

As a general rule:

- Operational vehicles should be purchased before December as this allows GWRC to hold a larger fleet over the busy summer period without a year round increase in fleet size.
- Any new vehicles should have improved fuel consumption and lower CO_2 emissions when compared with the vehicle it is replacing.

If a vehicle is not performing to an acceptable level or is no longer fit for purpose, it may be replaced or transferred sooner than these criteria. In these circumstances, the Chief Financial Officer must approve the early replacement of a vehicle.

v. Special provisions of Remuneration vehicles

Replacement and use of remuneration vehicles is subject to conditions in the employment agreement of the individual receiving the vehicle, and additionally for the Chair any rules set by the remuneration authority. Those with Remuneration Vehicles are encouraged but are not required to replace vehicles with an electric or plug-in electric vehicle.

vi. Minimum Approval

Approval on a vehicle purchase/replacement must include at a minimum:

- General Manager, unless the vehicle is designated to a General Manager or higher.
- CFO

If any aspect of the vehicle purchase falls outside the criteria in this policy, the Chief Executive must also give approval.

Vehicle policy continued – Appendix a:

Vehicle Purchase Price and Emissions Requirements

Type of vehicle	Maximum price (ex GST) (Diesel or Petrol Fuel)	Maximum Price (ex GST) (Electric or Plugin Hybrid)
Operational Vehicles (Utes, work-specific 4WDs)	$45,000	$55,000
Operational Vehicles (Passenger pool vehicles)	$30,000	$42,000

Notes:

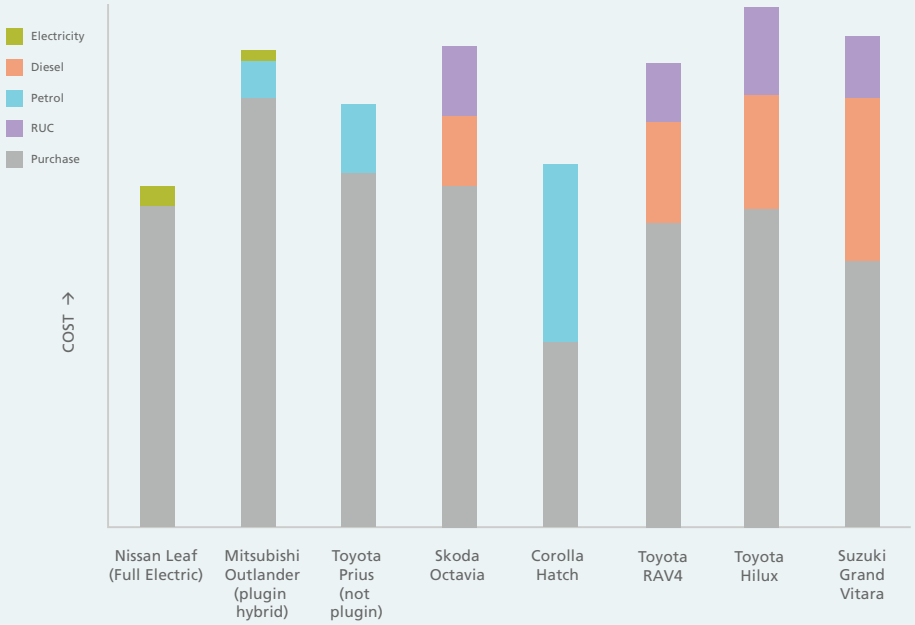
1. The maximum upfront price for an electric vehicle is higher because of reduced or avoided fuel purchases which result in the vehicle costing the same over the lifetime of the vehicle.
2. If a fuel vehicle is purchased, there is no preference between petrol and diesel fuel types. Prior to 2016 preference had been given to diesel.
3. Budget for additional charging facilities at GWRC offices, parks, and other buildings is not deemed part of the vehicle purchase and is budgetted as a property expense, and will be provided on a reasonable basis.

The following two graphs indicate pricing and environmental insights, including:

1. A fully electric (Nissan Leaf) is cheaper over its lifetime than a vehicle than a petrol vehicle even if the petrol vehicle is over $10,000 cheaper upfront (Toyota Corolla),
2. A plug-in hybrid (Mitsubishi Outlander, which drives 50km before resorting to petrol) is about the same price over its lifetime despite costing much more upfront than its peers.
3. A fully electric (Nissan Leaf) has almost no emissions (those shown are due to a small percentage of greenhouse gases produced in New Zealand's electricity generation),
4. Counter-intuitively, the plug-in hybrid (Mitsubishi Outlander) has lower emissions than a best-in-class fuel vehicle (Toyota Prius), making it a suitable car/wagon replacement.
5. The Nissan Leaf's emissions are 0 however graph has factored in 2016 levels of CO_2 produced by electricity generation (Huntly Coal Station et al), to produce a fairer assessment. The Outlander PHEV also has electricity emissions accounted.

Emissions (lower is better). kg CO_{2e} per km driven

Total cost of vehicle at 120,000km (Lower is better)



Prices exclude residual value, and are new from AoG catalogue except for Nissan Leaf which is used.

Emissions Requirements:

New vehicles using fuel will be subject to the following maximum CO_2 emissions and fuel economy ratings:

Utes: 0.230kg/km CO_2 and 8.5L fuel/100km

Others: Petrol: 0.140kg/km CO_2 and 6L fuel/100km;
Diesel: 0.160kg/km CO_2 and 6L fuel/100km

Opting out

The following form is provided to staff if they wish to opt out of buying an electric vehicle. The idea is not to be punitive; if a staff member has good reason to buy a fuel vehicle this should be supported and streamlined. The idea is also to be durable, i.e. when new and more capable electric vehicles arise, the form should remain relevant; it is therefore up to those approving the form to be aware of, for example, tow ratings of vehicles. Finally, the form asks that staff consider sharing vehicles to avoid a petrol vehicle being used on the off-chance or the rare occasion that it needs to perform heavy work.

Vehicle Policy Continued - Checklist - request for a non-plugin vehicle

This is to be accompanied with the Asset Purchase Form when a vehicle is sought that can only be refueled. Any vehicle that does not have a plug needs to use this form.

1. What is the vehicle typically used for? Note geography and type of load. (1-2 sentences).

e.g. Travels on-road between office A and office B; Or e.g. regularly used by park-ranger and towing 2000 KG frequently.

2. A fuel vehicle is sought because it is the only practical means to gain: (tick and explain).

   ☐ Open Tray
   ☐ 4WD and/or high ground clearance to cross rivers
   ☐ High tow rating (how many KG need to be supported? _____ KG)
   ☐ Spare wheel or specialised equipment (explain below)

e.g. "An open tray is essential for the role of this vehicle and no plug-in vehicle has this feature".

3. Why can you not purchase an electric or plugin-hybrid as a primary vehicle but use an existing fuel vehicle when required (either from elsewhere in the pool, or elsewhere in the organisation).

4. The most fuel-efficient vehicle that is fit for purpose, and which is being sought for purchase, is:

(Make & Model)

5. Does this vehicle meet the fuel consumption and CO_{2e} emissions targets currently stated in Appendix 1 of this vehicle policy?

   ☐ Yes
   ☐ No

Nissan Leaf full electric left, Mitsubishi Outlander plug-in hybrid right

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

We support
Electric Vehicles
Drive the Future