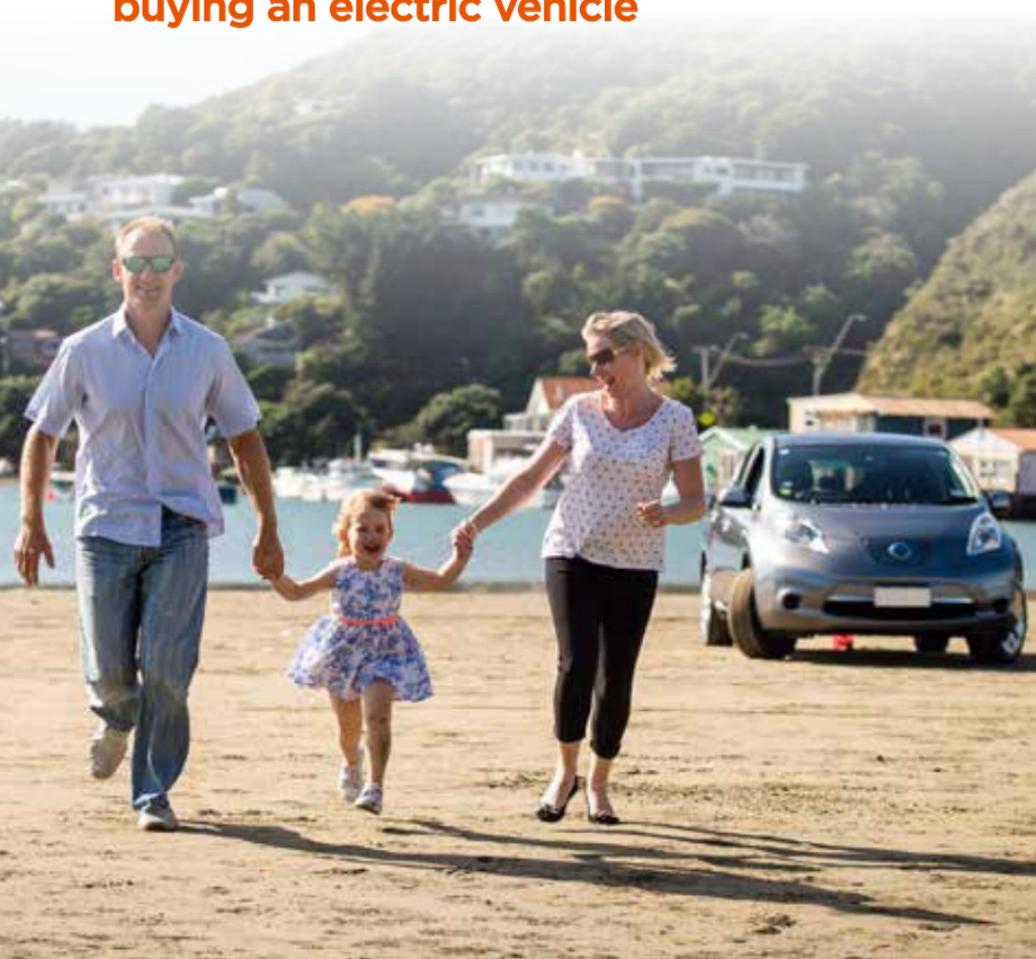


Buyer's guide to electric vehicles

**What you need to know when
buying an electric vehicle**



If you're thinking about buying an electric vehicle (EV), you're not alone – more than a quarter of New Zealanders say they would now consider buying a battery EV.

This guide answers the questions people commonly ask about this exciting technology.

It is produced by the Energy Efficiency and Conservation Authority (EECA) as part of the Government's information campaign to accelerate the uptake of EVs in New Zealand.

Every effort has been made to ensure information is accurate but you still need to exercise care and due diligence with your purchase and use of any vehicle or charging equipment.

Find out more about EVs at
www.electricvehicles.govt.nz



Energy Efficiency and
Conservation Authority
Te Tari Tiaki Pūngao

Our cars are changing

Road transport is changing at the fastest rate since the car took over from the horse and cart. Electric vehicles (EVs) are at the forefront of change around the world and in New Zealand.

EV registrations in New Zealand have swiftly grown. Demand for EVs will keep growing as battery technology further improves, charging stations spread across the country, and EVs become more price competitive with petrol and diesel cars.

The Government is committed to accelerating the uptake of EVs in New Zealand because it's one of the most effective ways we can reduce greenhouse gas emissions and meet our climate change commitments made under the 2015 Paris Agreement.

The average New Zealand petrol/diesel car emits about 2.6 tonnes of greenhouse gas per year.

How many EVs are in New Zealand today?

Find the latest statistics on the Ministry of Transport website: www.transport.govt.nz > Resources > Vehicle fleet statistics > Monthly electric and hybrid vehicle registrations.



What is an EV?

An EV is a vehicle with an electric motor that is powered by an on-board battery charged from an external power supply. There are two main types.

Battery electric vehicle (BEV)

BEVs are powered only by electrical energy stored in the battery. They are also known as 'pure electric' vehicles.

A BEV is charged by plugging the vehicle into an external electricity source. This could be a regular electrical socket, a dedicated charging unit, or one of the many public charging stations around the country.

The battery also recovers and stores energy generated when the car brakes, a system known as regenerative braking.

It has no tailpipe or tailpipe emissions.

BEVs particularly suit people who can charge overnight at home or at work, and who mostly travel within the battery range. BEV cars include BMW i3, Hyundai Ioniq, Hyundai Kona, Kia Soul, Mitsubishi i-Miev, Nissan Leaf, Renault Zoe, Tesla Model S, and VW e-Golf. Vans include Renault Kangoo, LDV V80 and Nissan eNV200.

What's to love:

- ⚡ Low running costs. Using a residential off-peak electricity rate means you can charge your EV overnight for the equivalent of 30c a litre.*
- ⚡ Low maintenance costs. A BEV motor has around 20 moving parts, compared to some 2,000 in a typical petrol or diesel car. There is no oil to change and no oil filter, air filter, gearbox, drive belts or spark plugs to worry about. The regenerative braking system saves wear on the brakes.
- ⚡ Very efficient around town. Regenerative braking recaptures and stores energy every time you slow down, and you use no energy when stopped in traffic.
- ⚡ Lowest environmental impact.

What you need to know:

- ⚡ BEVs can be more expensive to purchase than their petrol/diesel equivalents, especially brand new.
- ⚡ Charging can take 20 minutes or 8-10 hours depending on the battery and the charger you use. For long distance travel, you may need to plan where to stop and recharge (see page 11).

*Estimate based on a residential off-peak charge rate, and will vary.



Plug-in hybrid electric vehicle (PHEV)

A PHEV has two types of motors – an electric motor and battery that can be charged from an external power supply, and an internal combustion engine fuelled by petrol or diesel.

Most PHEVs start and drive in EV-only mode until most of the power stored in the battery is used, then the petrol/diesel engine automatically takes over. Regenerative braking charges the battery in both modes.

During heavy acceleration, such as driving fast up a steep hill, the petrol/diesel engine and the electric motor work together to avoid excessive draw from the battery.

Some PHEVs use a small petrol engine to generate electricity known as a range extender to power the electric motor once the battery charge decreases to a certain point.

The range of a PHEV in EV-only mode varies significantly between models. Some can only do 15-20km while some newer models can do 60km or more.

PHEVs particularly suit people who can charge overnight at home or at work, and often need to use the vehicle to travel beyond the battery range.

PHEVs include Audi A3 e-tron, BMW i3 (range extender model), Hyundai Ioniq PHEV, Mitsubishi Outlander PHEV and Toyota PlugIn Prius.

What about hybrids?

Hybrids that don't plug into an external electricity supply to recharge are not EVs.

The battery is charged by a petrol/diesel combustion engine and regenerative braking. They are more efficient than a conventional petrol/diesel vehicle and generate fewer emissions.

Hybrids include Toyota Prius and Prius C, Honda Insight and Civic IMA, and Lexus hybrid range.

What's to love:

Compared to the equivalent petrol/diesel vehicle, a PHEV has:

- € Lower running costs and lower environmental impact if you do most of your journeys in EV mode.

What you need to know:

- € PHEVs can be more expensive to purchase than their petrol/diesel equivalents.
- € As PHEVs have a petrol/diesel engine, the maintenance costs are likely to be about the same as conventional vehicles. Like a BEV, regenerative braking saves wear on the brakes.
- € Many PHEVs can't be fast charged.
- € Using the petrol/diesel engine generates emissions.



Why buy an EV?

1 / EVs are cheap to run

Battery electric vehicles are significantly cheaper to run than petrol/diesel cars. Because their motors are so simple, maintenance costs are also low.

PHEVs have lower running costs when driven in EV mode. As they have a petrol/diesel engine, maintenance costs are likely to be about the same as conventional vehicles.



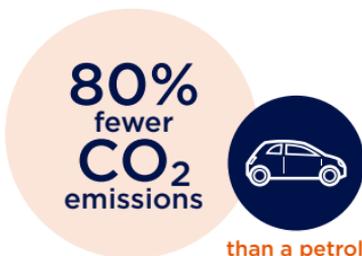
Charging an EV is the equivalent of buying petrol at 30c per litre.



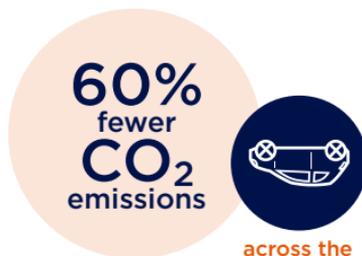
Light BEVs and PHEVs are exempt from road user charges (RUC) until the end of 2021.

2 / EVs are environmentally friendly

EVs emit 80% less CO₂ than an equivalent petrol vehicle when being driven in New Zealand, due to the fact that electricity generated here is typically at least 80% renewable (the main sources being hydro, geothermal and wind).



than a petrol vehicle when used in NZ



across the lifecycle of the vehicle

The EV experience

Driving an EV is much the same as a petrol or diesel car – but people often notice:

- ⚡ They've got great torque: EVs can accelerate quickly and smoothly from a standing start. With no gears to work through, an EV is able to apply full power as soon as you touch the accelerator pedal.
- ⚡ How quiet they are: The car stereo sounds great and conversations with passengers are much easier.
- ⚡ They handle well: The weight of the battery packs gives EVs a lower centre of gravity, so they usually enjoy superior handling and are less likely to roll.
- ⚡ The braking is different: The regenerative braking system means the car starts to slow as soon as you lift your foot off the accelerator.



Is an EV right for me?

An EV is a great solution for many Kiwis' everyday needs.

- 🔌 90% of our car travel is less than 90km.
- 🔌 Our average daily car travel is around 30km.

If your regular vehicle use looks like this, an EV will more than meet your needs. This is especially true if you are often stuck in traffic – regenerative braking recaptures and stores energy every time you slow down, and you use no energy when stationary.

And while a BEV may not be right for you if you regularly drive beyond the battery range, a PHEV may be just what you need.

Would a BEV or PHEV suit you best?



Ideal



It depends – find out more in this guide or talk to a dealer or EV expert.

Do you...	BEV	PHEV
Mostly travel within battery range?	😊	😟
Have off-street parking and access to a plug?	😊	😊
Want an economical second car?	😊	😟
Sit in traffic a lot?	😊	😊
Need the car for a mix of short and long trips?	😟	😊
Need it for regular long-distance travel?	😟	😊
Want to tow a boat or a trailer?	😟	😟
Want to reduce emissions?	😊	😊
Want low running costs?	😊	😟

How far can an EV go?

The distance you can drive on a single charge depends on the type of EV, its battery capacity, the type of roads (flat, hilly or winding) and your driving style.

A drive of 200km is within easy reach of most new EVs.

If you're driving beyond your EV's battery capacity in one go, plan a route with a public charger at regular intervals. Websites and apps help you do this by showing you the location of public charging stations, whether they're in working order, and the type of connectors they use. **See the New Zealand Transport Agency website (www.nzta.govt.nz/evroam)**, or check websites such as PlugShare, ChargeNet and Vector.

To go further on a single charge

- ☛ Fully charge your EV before you set off.
- ☛ Warm up the interior before you unplug the EV.
- ☛ Inflate tyres to the right pressure.
- ☛ Drive smoothly at a steady speed.
- ☛ Be aware that cold weather reduces an EV's range, particularly if heaters and demisters are used.
- ☛ Remove any heavy luggage or accessories (such as roof racks) you don't need.



Buying an EV

New or used?

The variety of used BEVs and PHEVs imported into New Zealand is growing all the time. Both new and used models offer fuel and maintenance savings. Used models are more affordable upfront. The advantage of buying new is that EV technology is constantly evolving and improving, so you can enjoy new features and better battery range.

EV buyer's checklist

- ⚡ Check the battery size. This is in kilowatt hours (kWh) and indicates how much electricity the battery can store when new, and therefore how far it can drive on a charge.
- ⚡ Any warranty covering the EV battery.
- ⚡ What charger inlets the vehicles has. (Be aware not all vehicles can use fast charging stations.)
- ⚡ What charging equipment is supplied, such as portable charging cables and/or supply leads.
- ⚡ Check the safety and fuel economy ratings of different cars at www.rightcar.govt.nz. You can compare the running costs with petrol or diesel cars.
- ⚡ See if the EV has the latest software updates installed.

PHEVs are more complicated...

When looking at a used PHEV, you will need to consider the same mechanical issues as you would for a used petrol or diesel vehicle.

Assessing the battery

Battery condition can be described in a number of ways including percentage of battery capacity remaining, State of Health ('SoH') and, for a Nissan Leaf, how many bars the car will charge to out of 12.

If buying a used EV, it's important to get the battery properly checked. A data reader can be plugged in and a battery health check performed – you can even have the results sent to your smartphone.

The battery's State of Health is a useful way to judge how much life a used EV's battery has left. It describes the overall condition of a battery – not its current charge. For some vehicles, on-board diagnostics can provide data that will help you determine how much longer you can expect it to last, based on how it has been used to date.

SoH can be more useful than an odometer reading. For example, an EV may have very low mileage but a reduced SoH if it has been in storage for some time, or has been excessively fast-charged. An EV with slightly higher mileage but better SoH may be a better option.

Most new EVs have battery warranties that guarantee the battery for a certain length of time (typically 5-8 years, sometimes longer) or distance (such as 100,000km).

A knowledgeable dealer will help you understand EV technology.



EV batteries

EV batteries are sophisticated pieces of equipment designed to last many years. Most new EVs have battery warranties that guarantee the battery for a certain length of time (typically 5-8 years, sometimes longer) or distance (such as 100,000km).

Over time, EV battery capacity gradually decreases the more it is used, like a mobile phone. It can also happen when a vehicle is parked up and not being used.

When an EV battery no longer provides a useful driving range – typically after many years – it can be refurbished or replaced. Sometimes it's possible to just replace the dead cells within a battery. If a full replacement is required, you may be able to improve the range of your EV by installing a new battery with more capacity.

Although a new battery is expensive, costing several thousand dollars, EVs are cost effective even when battery replacement is taken into account. Research by EECA shows that even if owners need to replace the battery, an EV

can compete with a petrol car in terms of whole of life cost.

The used battery still has value. It can be refurbished, repurposed or recycled – for example, to store electricity from solar PV panels, or raw materials reclaimed. You may even be paid for the old battery.

Members of the Motor Industry Association of New Zealand (MIA) have committed to a code of practice to have suitable systems in place for the use, capture, return, refurbishment, reuse, recycling or disposal of EV and hybrid batteries, with the aim that no batteries end up in landfills.

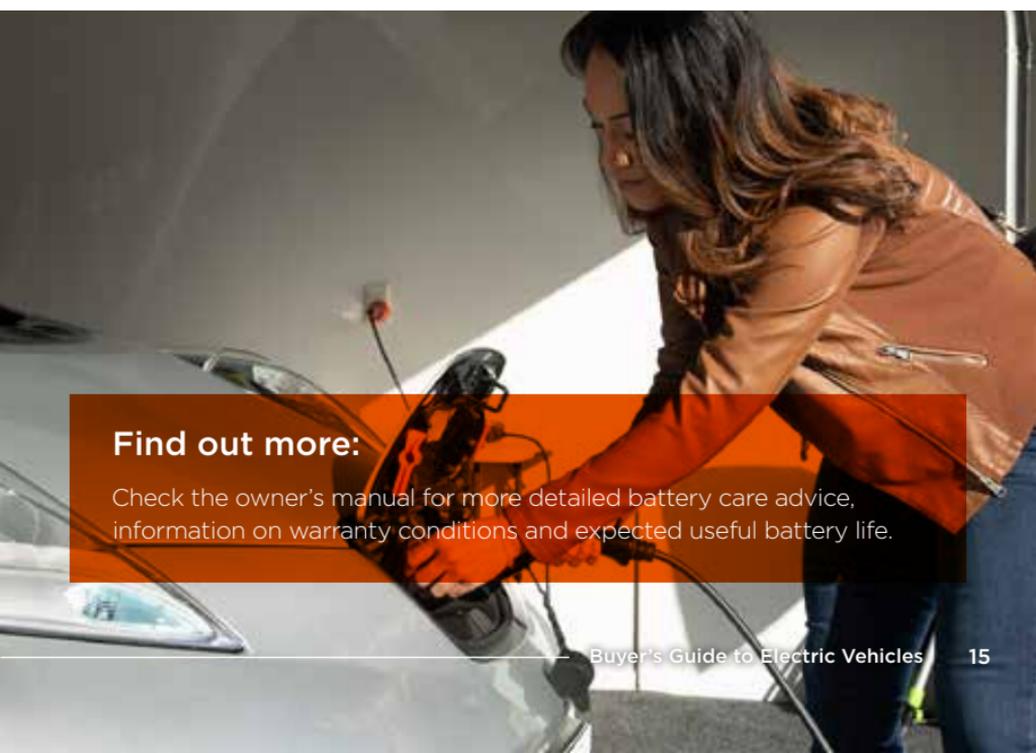
The 12V battery

As well as the main battery, most EVs have a 12 volt (V) battery that stores power to run the management computer and accessories like lights and stereo. It's a traditional lead-acid battery that doesn't need to be plugged in to charge – but if it runs flat the car won't go, even if there's charge in the EV battery.

Get the best out of your battery

As with any car, the driver of an EV has the biggest influence on its performance over time. You'll get more out of your battery if you:

- ☛ Drive smoothly, avoiding harsh acceleration and/or braking.
- ☛ Minimise frequent fast charging. (This may differ depending on the EV model and the climate it is operating in – the EV manual or manufacturer should provide more details.)
- ☛ Only recharge the battery when needed. Many EV owners find they only need to charge every few days.
- ☛ Limit battery exposure to extreme heat or cold. In very hot weather (over 30 degrees C), park and charge in the shade or in a garage. In very cold weather (below freezing), follow battery care instructions in the manual. Some batteries have thermal management systems that use a small amount of energy to protect the battery by regulating its temperature.
- ☛ When storing an EV for a long time, follow the battery care instructions in the manual. Don't store it with a fully charged battery.
- ☛ Follow the manufacturer's servicing recommendations. EVs should always be serviced by a qualified technician.

A woman with long dark hair, wearing a brown leather jacket and blue jeans, is leaning over to plug a charging cable into the front of a silver electric vehicle. The background is a plain, light-colored wall.

Find out more:

Check the owner's manual for more detailed battery care advice, information on warranty conditions and expected useful battery life.



Charging an EV

Charging an EV is as easy as charging a phone – you just plug it in.

You can charge inside or outside, in any weather, so long as all equipment is designed for use in New Zealand and for the conditions in which it will be used.

Charging at home

Charging at home overnight is the simplest, cheapest and most convenient way to charge.

You may be able to take advantage of off-peak electricity rates. Some power companies offer special rates for EVs.

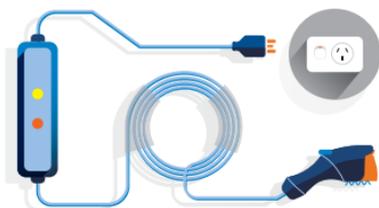
Portable 3-pin charging cable

This plugs into a standard household power point and is typically supplied with the EV when you buy it. It can be called an in-cable control and protection device (IC-CPD).

Check: Used vehicles from other countries may be supplied with an original charging cable. These should not be used and should be replaced with a charging cable that is suitable for New Zealand's power supply. Some cables come with an industrial or caravan plug that allows faster charging. These require an electrician to install a special wall power point.

Safety: Do not use extension cables or adaptors.

Tip: To maximise the EV's battery life, avoid charging to full every day unless needed. See other tips on page 15.



Wall-mounted charging unit

A dedicated wall-mounted AC charging unit is great to have at home or work. They provide more safety than a regular charging cable and can charge faster, yet they're easier on the battery than fast (DC) charging. Some devices have timers to make off-peak charging easy. They may display information and allow you to control charging with a smartphone.

The units need to be installed by a registered electrician who should:

- ❏ install a separate sub-circuit.
- ❏ make sure the cable to the socket is capable of supplying the power that the unit can deliver. A circuit capable of supplying 32 Amps will futureproof the installation.
- ❏ install a Type B RCD.
- ❏ be able to confirm the charging equipment has a Supplier Declaration of Conformity to show the unit has been tested and meets electrical safety law.



Safety checks

When buying an EV, including a used import, you should only be supplied with charging equipment (such as cables) designed for use in New Zealand. If the vehicle comes with equipment that doesn't display a voltage range that includes 230 V, doesn't have a New Zealand plug, or has been modified (even to fit a New Zealand plug), it should not be used as it isn't suitable for New Zealand's electricity supply. Even if it appears to work, you can't be sure the in-cable safety device will work when it needs to.

When buying a charging cable or wall-mounted charging unit, or purchasing an EV with a charging cable included, ask the seller for a signed copy of a Supplier Declaration of Conformity. This declaration shows the unit has been tested and meets electrical safety standards.

To charge an EV safely:

- ⚡ Never use extension cables.
- ⚡ Never take a cable across a footpath to charge.
- ⚡ Do not use devices to connect the charging cable to the power supply (such as multi-boxes, double plugs or travel plugs).
- ⚡ You can use an adaptor to connect the charging cable to the car, provided it is confirmed for use by the manufacturers of the vehicle and the cable.
- ⚡ Never use modified charging equipment such as overseas equipment that has been fitted with a New Zealand plug. Never use damaged or faulty charging equipment. Have it checked by the manufacturer.

Find out more on www.worksafe.govt.nz

Charging out and about

You may sometimes want to top up when you're out, or on a longer trip.

An ever-increasing number of public charging stations are popping up on New Zealand highways and at places like shopping malls, airports, supermarkets and even petrol stations.

Websites and apps show the locations of public chargers, whether they're slow (AC) or fast (DC) and what type of connectors or sockets are provided or required. It's easy to plan a long-distance route online - see the New Zealand Transport Agency website (www.nzta.govt.nz/evroam) or visit PlugShare, ChargeNet and Vector websites.



Public fast charging

Fast chargers typically cost about \$10 per 100km. They can add 100km of range to the battery in 20-30 minutes.

Companies installing fast charging stations include local electricity networks, ChargeNet and Chargemaster. To access a fast charging network you generally need to create an account online first.

Tips:

- € All fast charge stations have tethered CHAdeMO and/or CCS Type 2 cables so you don't need to bring one.
- € Sign-up to a fast charging network for easy billing and payment.
- € It's better for your battery to fast charge occasionally rather than frequently.
- € The last 20% of the battery takes longer to charge - that's why fast chargers have an option to charge only to 80%.

Check:

Most pure EVs can fast charge, but many plug-in hybrid EVs cannot.



Public slow charging

These are often found at locations where drivers stop longer (such as shops, hotels, tourist attractions).

Charging is usually free and can take several hours.

Tip:

You usually need to bring your own supply lead to use this type of charger.



Q&A

What's the resale value of an EV?

The market is still relatively new so resale values are only starting to become established. It will also take time to determine how EVs, with their lower running costs, will affect the resale value of petrol and diesel vehicles in the longer term.

How safe are EVs?

EVs sold in New Zealand must meet the same minimum vehicle safety standards as petrol and diesel vehicles. The vehicle safety rating shows how safe the vehicle is – see

www.rightcar.govt.nz

The maximum 5-star ANCAP rating is recommended. An EV's high-voltage electric system is designed to automatically deactivate in a crash. They are far less likely to catch fire in a crash than petrol or diesel vehicles. In addition, the weight of the battery packs give EVs a lower centre of gravity, so they are less likely to roll.

What servicing does an EV need?

The AA recommends EVs are serviced as often as petrol/diesel vehicles – every 12 months or 15,000km (whichever comes first), or according to the manufacturer's recommendation. PHEVs need the same regular

servicing as a petrol/diesel car. BEVs don't have a petrol/diesel engine but items such as brakes, tyres, lights and wipers still need taking care of. The Motor Trade Association (MTA) and AA can help you find technicians to service the EV component of a PHEV or BEV, or you can seek advice from a local EV owner's group.

Who does battery replacements?

A servicing industry is starting to emerge and will grow as the New Zealand EV market matures and batteries begin to age. This will support owners with battery replacement, refurbishment and repair. Battery replacement should only be carried out by a qualified service provider, such as an approved service agent for the vehicle.

What if the information systems are in another language?

The dash cluster/instrument panel of imported vehicles can be converted into English by EV specialists.

Can I test drive an EV?

Free public rides and drives are offered at events around the country, see www.electricvehicles.govt.nz or visit an EV dealer.

What if there's a software glitch?

Electronics or software problems can usually be fixed with a software update, like smartphones.

Can EVs cope with hills?

Yes - EVs are great hill climbers. The high torque and lack of gears mean they usually climb better and more smoothly than a petrol or diesel vehicle, and regenerative braking means they recharge going downhill.

Are EVs affected by climate?

New Zealand's temperate climate is well suited to EVs. Battery life can be reduced by extreme temperatures - below freezing and above 30 degrees Celsius. In these conditions, look for advice in the car manual.

What tyres should I fit?

Fuel efficient tyres will maximise efficiency and range.

Can an EV be towed?

Check the vehicle manual. Many EVs should only be transported on the back of a truck.

Can an EV tow a trailer?

Many manufacturers state their EVs should not be used for towing. Check the vehicle manual or talk to a dealer.

Can pedestrians hear an EV?

EVs can be very quiet until they reach about 25km per hour, when the tyre noise can be heard from outside the car. Some EVs emit audible sounds at low speeds to alert pedestrians and cyclists.

What forums are there for EV owners?

You might like to join local and national owner groups on Facebook, the citizen science project Flip the Fleet, or low-carbon champions Better NZ Trust.

Does New Zealand have enough electricity to charge a national fleet of EVs?

If all light vehicles in New Zealand were electric (which is a long way off), this would increase our current total electricity demand by around 20%, EECA estimates. This could be accommodated within New Zealand's current electricity generation output, even allowing for the uncertainties of renewable generation, provided the majority of EVs are charged during off-peak periods.

Many electricity network companies are working with councils and other third parties to build more charging infrastructure to meet the demand from electric cars.

Will your next car be an EV?

www.electricvehicles.govt.nz



EECO118 February 2019

Produced by the Energy Efficiency and Conservation Authority (EECA)
