

new zealand electric car guide



By Sigurd Magnusson, Wellington, New Zealand. 3 March 2016. Download from www.electriceaven.nz

Questions, corrections, feedback to sigurdmagnusson@gmail.com or 021 42 12 08. Please share this document.¹

FULLY ELECTRIC CARS

These are cars that move using a large electric battery powering an electric motor. They do not take any petrol. Also called Battery Electric Vehicles (BEVs), they produce no exhaust, which is far kinder to the environment – petrol and diesel transport produce 20% of New Zealand’s greenhouse gases.² 80% of New Zealand electricity is generated by rain (hydro dams), geothermal, and wind³, so the *source* of the car’s fuel is environmentally friendly, and cheap (it does not need to be purchased from overseas as oil does). A 2015 government study shows electric cars also have environmental benefits versus petrol cars when the full lifecycle of manufacture, use, and disposal are assessed, and that the ingredients like lithium in batteries, aren’t scarce.⁴ Having no exhaust, fully electric cars produce no poisonous carbon monoxide fumes.

Electric cars have no clutch or gears, and accelerate very quickly and smoothly, in a “sporty” way, and climb hills easier than petrol cars. A fully electric engine has fewer moving parts, no spark plugs or engine oil, and requires less maintenance than a petrol equivalent. Such cars are extremely quiet and reduce noise pollution. Travelling down hills or braking recharges the batteries, and is known as regenerative braking. The motor uses no energy when the car is still.

Electric cars are safe, reliable, manufactured by large brands, and are beginning to be sold in high volume overseas. Norway, with a similar population and size to New Zealand, has over 70,000 fully electric cars, and they now account for more than 20% of all new car purchases⁵.

Affordable electric cars have a shorter range (100km+) than petrol cars. High-end cars with large batteries (400km+ range) are expensive. Battery prices are dropping significantly each year which will lead to long range fully electric cars becoming affordable⁶. On average New Zealand drivers travel 28km per day⁷, and electric cars can be charged at home overnight and be ‘full’ in the morning, so affordable electric cars remain practical for most daily journeys. The range of a car is dependent on the style of driving: you can drive less distance at highway speeds or up hills than you can on flat urban residential speeds, due to engine loads and wind resistance. The dashboard will display an estimate of how many kilometres you can drive with remaining battery.

In New Zealand the vast majority of fully electric cars are Nissan Leaf short-range hatchbacks. Some full sized, long-range, high performance cars by Tesla Motors are found here but are very popular overseas. A greater selection of cars not available in New Zealand are sold overseas: e.g. VW eGolf, Ford Focus, Kia Soul EV, Fiat 500e, Renault Zoe, and Chinese brands like BYD.⁸

¹ This document is released under the Creative Commons Attributions license at <http://creativecommons.org/licenses/by/3.0/nz/>

² transport.govt.nz/ourwork/climatechange/ cites a 2009 report: mfe.govt.nz/publications/climate/greenhouse-gas-inventory-2011/

³ 2015 MBIE report mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/publications/energy-in-new-zealand

⁴ ECCA Life Cycle Assessment of EVs eeca.govt.nz/assets/Resources-EECA/ev-lca-final-report-nov-2015.pdf

⁵ https://en.wikipedia.org/wiki/Plug-in_electric_vehicles_in_Norway

⁶ slate.com/articles/business/the_juice/2016/02/electric_cars_are_no_longer_held_back_by_crappy_expensive_batteries.html

⁷ Ministry of Transport study (2010-2013) section *Trends in distance driven per driver*.

transport.govt.nz/assets/Uploads/Research/Documents/Drivers-2014-y911-Final-v3.pdf

⁸ BYD tops Tesla, Nissan late 2015: <http://ev-sales.blogspot.com/2015/12/2015-in-review.html>

PLUG-IN HYBRIDS

These are cars that have both an electric and petrol motor. These cars are sometimes abbreviated as PHEVs (Plug-in Hybrid Electric Vehicles).

The electric battery can be recharged at home or wherever you find an electrical socket, and the fuel tank can be filled up at petrol stations. The purpose of this is to allow you to drive short distances electrically, at low cost and without pollution, and long distances using petrol, avoiding the need to recharge frequently for long trips. These vehicles also have regenerative braking, which captures energy that would be wasted as braking heat. They cost somewhere in the middle between affordable (short range) and expensive (long range) fully electric cars. The drawback of plug-in hybrids is a more complicated engine requiring maintenance, the petrol refueling costs, air pollution, and noise of a petrol engine. Depending on the model, the petrol engine either turns the wheels, or recharges the batteries (which in turn powers the wheels).

The most purchased vehicle in this category in New Zealand is the Mitsubishi Outlander SUV. The BMW i3 hatchback (over 100km electric range) and the Audi A3 e-tron hatchback (under 30km) are other cars available here. Again, a more diverse selection of plug-in hybrids are available overseas.

TRADITIONAL HYBRIDS NO LONGER COUNT

Cars such as the *traditional* Toyota Prius Hybrid⁹ found in this country over the past decade are different -- they can not be plugged into an electric socket to recharge. They can only fill up on petrol, and use the petrol motor and regenerative braking to recharge a small battery that gives a short (1-2 km) electric range. This type of car does not offer the same potential for low cost, low pollution travel.

WHAT ABOUT HYDROGEN?

A visible debate is forming about whether the long-term future of cars would use hydrogen fuel cells or stored electricity (i.e. batteries) for energy.

Hydrogen does not occur on earth naturally, and must be created, either from fossil energy resources (which would release greenhouse gases), or by using electricity. The hydrogen must then be pressurised, transported, and converted back into electricity inside the car, to power its electric motor. The car produces exhaust in the form of water (about a litre per 16km driven).

By comparison it is cleaner and more energy efficient, and only 25% of the cost, to generate electricity, send it through transmission wires, and recharge batteries in fully electric cars.

No hydrogen fuel cell electric vehicles (HFCVs) are available in New Zealand, and they are produced in very limited quantities globally.¹⁰

⁹Toyota Prius introduced a Plug-in Hybrid (PHEV) model in 2009; in NZ it is rare and only available imported.








¹⁰More information and sources about the hydrogen section: en.wikipedia.org/wiki/Hydrogen_vehicle#All-electric_vehicles

A test-drive of a hydrogen versus electric car is contrasted at

transportevolved.com/2015/08/25/first-drive-report-2016-toyota-mirai-hydrogen-fuel-cell-sedan/

Essay by hydrogen race-car builder has published essay at ssj3gohan.tweakblogs.net/blog/11470/why-fuel-cell-cars-dont-work-part-1

common electric cars in New Zealand¹¹

Car (and whether electric or hybrid)	Seats	Electric Range	Battery (kWh)	0-100, Power	Can fast charge?	Cost (\$000) used - new	# in NZ ¹²
Nissan Leaf (Fully electric) 	5	117 km 135 km 172 km (Generation 1, 2, or 3)	24 24 30	9 secs 80kW (110hp)	Yes	\$20 - \$45 <i>(New cars rare; used imports prevalent)</i>	414
Mitsubishi i-Miev (Fully electric) 	4	100 km	16	13 secs 43 kW (60 hp)	Yes	\$15+ (Imports only)	36
Tesla Motors Model S (Fully Electric) 	5 (plus 2 kids)	325 km 426 km	70 or 90	3 secs 568 kW (762 hp)	Yes	\$130 - \$150 <i>(Available new, can be imported from UK, Australia)</i>	26
Nissan e-NV200 (Fully Electric) 	2, 5, or 7	121 km	24	11 secs 80kW (110hp)	Yes	\$40k+ (Imports only)	3
Mitsubishi Outlander (Plug-in Hybrid) 	5	40km +700 km petrol	12	11 secs 120 kW (180hp) + 2L engine.	Only if imported.	\$39 - 60	358
BMW i3 (Hybrid NZ new; electric if imported) 	4	130 km (+116 km petrol if hybrid)	22	7 secs 125kW (168hp)		\$60 - \$85	63
Audi Sportback e-tron (Plug-in Hybrid) 	5	27km (+ typical petrol car range)	8	7 secs 75 kW (100 hp) +1.4L engine	No	\$75	32

¹¹ Costs from TradeMe and dealers, likely to fluctuate. Range reduces with age and highway speed and very hilly driving, and is sourced from U.S. EPA except Outlander from mmnz.co.nz/plug-in-hybrid/options/4wd-hybrid-specifications/ and nbr.co.nz/outlander.

¹² NZ Vehicle quantities from transport.govt.nz/research/newzealandvehiclefleetstatistics/

The next models likely to come to New Zealand are by Renault (renault.co.nz/electric-vehicles/). The Chevrolet Bolt and Tesla Model 3, due to launch overseas in 2017, are highly anticipated; they will create a new segment of medium range, medium cost electric cars (~ 300km, USD35,000).

Searching for electric cars models on TradeMe.co.nz will let you find dealers across the country, many of which will have cars in showrooms. The number of used imports is growing quickly, sourced from Japan and UK, generally with low milage (under 10,000 km). Dashboard consoles of Japanese imports are not in English, but some dealers replace these with English systems. You can get official local support and service for electric cars in New Zealand.

GO FOR A TEST DRIVE!

The experience of test-driving an electric car is what commonly gives buyers the confidence to proceed with the purchase. You can test drive an electric car by asking a dealer, asking existing owners if they're prepared to let you drive theirs. You can rent Nissan Leafs by the day from www.bluecars.nz in Auckland, Whangerei, Christchurch and (soon) Tauranga.

OTHER TYPES OF ELECTRIC VEHICLES ALSO EXIST

- Electric Bicycles are sold in local bicycle shops, often with 40+ km "pedal assisted" range.
- Motorbikes are produced in volume overseas (e.g. California-based Zero) but are yet to make a major appearance in New Zealand.
- Small "tuk tuks" are used for tourism¹³ and one-seat delivery buggies are used by NZ Post.¹⁴
- Electric Buses are mass produced by BYD. In 2015 the City of London began the shift to hundreds of pure electric and thousands of hybrid buses¹⁵.
- Vans are produced by Nissan (eNV200, available as a 5-7 seat "taxi" or 2 seat "cargo" van) and Renault (Kangoo ZE, either 2 or 5 seat), both being full electric.
- Trucks are now available for light and medium duty (e.g. locally manufactured zevnz.com). New Zealander (and Tesla co-founder) Ian Wright has founded a hybrid truck company¹⁶.
- The world's first battery powered electric ferry was built in 2015 by Siemens in Norway¹⁷.

COMMUNITY GROUPS AND EVENTS

Several events and active Facebook groups are run and organised by electric car owners, e.g.:

EVelocity, the largest annual national electric vehicle event, including test drives, demonstrations, workshops, competitions between petrol and electric race cars, and a high-school competition in which teams design and build their own electric vehicles. (Last was Nov 2015). evolocity.co.nz

Leading the Charge, an annual roadtrip of Tesla cars from the north to the south of New Zealand, stopping in major towns for public display. facebook.com/LeadingTheCharge/ (**April 2016**)

Facebook "EV Owner" groups

- NZ EV Owners: facebook.com/groups/NZEVOwners/ (*lots of discussion*)
- Christchurch: facebook.com/groups/ChristchurchEVGroup/
- Whangerei: facebook.com/WhangareiElectricVehicleMeetup/ and facebook.com/revupnz/
- Wellington: facebook.com/groups/WellyEV/ (*address recently changed*)

¹³ stuff.co.nz/travel/destinations/nz/77235562/tuktuks-taking-to-the-streets-of-wellington

¹⁴ nzpost.co.nz/about-us/media-centre/media-release/eco-vehicles-confirmed-as-way-of-future-for-new-zealand-post

¹⁵ tfl.gov.uk/info-for/media/press-releases/2015/july/more-than-50-all-electric-buses-to-enter-service-in-london

¹⁶ www.sfgate.com/business/article/Tesla-co-founder-Ian-Wright-snags-FedEx-for-new-5792082.php

¹⁷ cleantechnica.com/2015/06/13/worlds-first-electric-battery-powered-ferry/

COSTS & SUBSIDIES

BUYING THE CAR

The primary expense associated with an electric car is its upfront purchase. Electric cars remain relatively expensive to purchase brand new. The main force reducing electric car costs in New Zealand is that a growing number of used cars are being imported from Japan and UK.

ELECTRIC CARS CHEAPER THAN PETROL CARS WHEN YOU FACTOR RUNNING COSTS

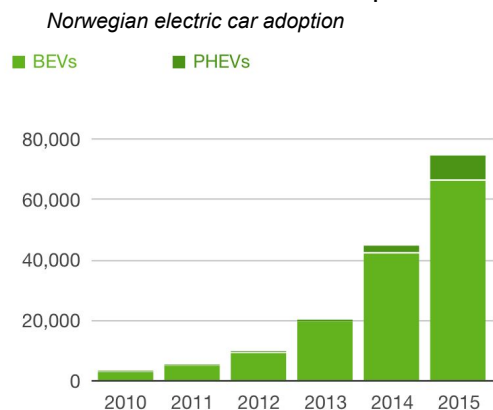
The cost of travelling by electricity is cheaper than petrol. EECA has calculated that an electric car is equivalent 30 cents a litre, which is about 7 times cheaper than petrol.¹⁸ This means that over the course of even one year, an electric car owner can save a few thousand dollars, which quickly pays off the higher initial car purchase price. Electric cars also need less maintenance.

EECA have released a tool for individuals and fleet managers to calculate total savings at eecabusiness.govt.nz/tools/vehicle-total-cost-of-ownership-tool/

SUBSIDIES AND FINANCIAL INCENTIVES

In many countries around the world, buyers receive discounts off the purchase price of an electric car. These are provided as subsidies by governments to achieve carbon emission goals by encouraging car owners to shift from petrol to electric cars. In some countries other incentives are also provided.

Norway has the greatest level of incentives: 25% off the purchase price is subsidised, fringe benefit tax is halved, cars can drive in bus lanes, and use toll roads and city street parking and charging stations for free. This has led to rapid adoption of electric cars - over 70,000 fully electric cars (BEVs) and over 7000 charging points in little over four years¹⁹. Norway shows that subsidies of electric cars can occur without a major local car manufacturing industry.



Denmark has similar incentives to Norway but only 4000 electric cars, with Denmark's dependence on coal to produce electricity a possible issue. Electric cars, even if recharged from coal-generated electricity, pollute the air less than petrol cars, but this is the opposite of popular belief.

Several governments have committed to goals to have all passenger cars being zero emission, including Norway, Germany, U.K., and New York and California states (see zevalliance.org).

¹⁸ energywise.govt.nz/on-the-road/electric-vehicles/

¹⁹ en.wikipedia.org/wiki/Plug-in_electric_vehicles_in_Norway. Norway graphs and pie charts: gronnbil.no/statistikk/

In New Zealand, the purchase of electric cars is unsubsidised, and there is no government target for growth of electric cars.

The only incentive provided is that electric cars do not pay road user charges (RUCs), a tax that pays for roading and transport programmes where car owners do not use petrol²⁰. These are paid by diesel car owners; a small diesel car driving 10,000km a year would pay \$620²¹. The RUC exemption on electric cars was introduced in 2009²² and will be reviewed in 2020²³, although other forms of incentives by the government may be introduced in 2016²⁴.

Fully electric and plug-in hybrid cars currently cost about \$230 per year in vehicle licensing²⁵. This is about \$100 more than petrol cars, due to ACC levies. When you purchase petrol, some of that purchase pays ACC. When you buy electricity, you are not funding ACC, and so this is substituted with a higher "non petrol driven car" ACC vehicle levy. Traditional hybrids, despite having batteries, gain all of their energy via petrol purchases, and use the cheaper "petrol driven car" ACC levy.²⁶

A comprehensive research report²⁷ on electric car policy was published by Barry Barton at University of Waikato in late 2015. The report reviewed what worked in other countries and how to apply that to New Zealand, and concluded electric car growth here would be best supported by introducing a cost-neutral "feebate" scheme. Used overseas, this is where the government adds a cost to buying "dirty" cars and uses that money to reduce the cost of electric and fuel-efficient cars. The report noted New Zealand is one of very few countries globally to have no fuel efficiency standards, which place costs or restrictions on buying cars with high greenhouse gas emissions.

The Green Party has proposed Fringe Benefit Tax exemptions, investment in public chargers, and transitioning the Crown limousine fleet to the Tesla Model S to grow electric car adoption²⁸.

KEY ORGANISATIONS SUPPORTING ELECTRIC CARS

The key New Zealand organisations who would play a natural role to do with electric cars are still in the early stages of supporting their adoption. The New Zealand government has officially stated it is a "fan" of electric cars and expects them to be common in future years²⁹. Ministry of Transport, New Zealand Transit Agency, EECA³⁰, the AA, councils, and power companies are starting to educate the public to the existence and financial savings associated with electric cars, and some are buying small numbers of electric cars for use by staff. However there is not yet highly visible or co-ordinated efforts across these organisations. No car brands have yet carried out any large scale promotions to create buyer awareness of their electric cars in New Zealand. An industry body named Drive Electric (DriveElectric.org.nz) was established in 2012.

Globally, the greatest amount of leadership in generating large-scale electric car adoption is Tesla Motors and its charismatic and detail-obsessed founder and leader Elon Musk.³¹

²⁰ <http://www.nzta.govt.nz/vehicles/licensing-rego/road-user-charges/about-ruc/>

²¹ Calculator available at <http://www.transport.govt.nz/land/roadusercharges/light-petrol-vs-diesel/>

²² <http://www.beehive.govt.nz/release/electric-vehicles-be-ruc-exempt>

²³ <http://www.beehive.govt.nz/speech/speech-2014-electric-vehicle-industry-and-government-roundtable>

²⁴ <https://www.national.org.nz/news/news/speeches/detail/2015/10/20/Opportunities-to-cut-NZ-s-road-transport-emissions->

²⁵ Nissan Leaf BEV, Outlander PHEV, Toyota traditional hybrid, Toyota Corolla (petrol) price checked at rightcar.govt.nz

²⁶ <http://www.acc.co.nz/for-individuals/other-motorists/WPC137732>

²⁷ http://www.waikato.ac.nz/_data/assets/pdf_file/0007/278080/Electric-Vehicle-Policy-New-Zealand-in-a-Comparative-Context.pdf

²⁸ greens.org.nz/policy/smarter-economy/business-tax-breaks-clean-transport-options and stuff.co.nz/national/politics/policies/10485790/Greens-plug-in-motorists-with-cash-tempter

²⁹ Several sources, e.g. national.org.nz/news/news/speeches/detail/2015/10/20/Opportunities-to-cut-NZ-s-road-transport-emissions-

³⁰ Of the organisations listed, EECA has the most complete guide: eecabusiness.govt.nz/technologies/electric-vehicles/

³¹ waitbutwhy.com/2015/06/how-tesla-will-change-your-life.html provides a very comprehensive look at Elon Musk and Tesla Motors, and the history and rationale of the electric car, and his spacecraft business, solar energy, and battery technology.

CHARGING and BATTERIES

A NEW UNIT OF MEASUREMENT

We use kilowatt-hours (kWh) not litres to measure electricity, so you're unlikely to talk to electric car drivers about dollars per litre, and instead hear them discuss:

- cents per kWh, the cost of electricity; determines the cost of travelling and charging
- km per kWh, similar to 'miles per gallon', or how far you're driving for a unit of electricity
- kWh as a size of battery, which gives you an idea of how far you can drive (range)
- kW as a speed of charging, which gives you an idea of how quick to recharge

Depending on driving style and car, you can usually expect to travel around 5 to 6km per kWh.

CHARGING CABLES and car sockets

Your car will come with a portable cable that goes into a wall socket at one end and the car at the other, like the one pictured here:

Charging cables and equipment are known as an EVSE (Electric Vehicle Supply Equipment).

The car will have one or two sockets for cables. For example, the Nissan Leaf (pictured below) has a socket for fast charging ("CHAdeMO" socket on left) and slow charging (SAE standard "J1772", also known as "Type 1", socket on right).



These are common standards for charging in New Zealand (and Japan and North America) for fast and slow charging.



Cars in Europe tend to use an alternative called Mennekes also known as "Type 2" for slow charging, and CHAdeMO for fast charging.

Some cars have a "combo charging socket" (CCS), allowing slow and fast charging from one socket. These are not yet common in New Zealand. Tesla cars have a non-standard combo socket compatible with Mennekes (Type 2) for slow charging and Tesla's SuperChargers for fast charging, and can take cable adapters to plug into J1772/Type 1 (slow) and CHAdeMO (fast) chargers.

SLOW CHARGING



Most electric car owners regularly slow-charge their cars overnight at home. A study of 8000 U.S. electric car owners showed 85% of charging was “slow charging” at home, much of the remainder at their place of employment, and the occasional recharge elsewhere during long trips.³²

The regular 230 volt AC electricity in our homes, and the regular socket we use for all household appliances is what we often use to slow-charge a car. You might plug into an existing socket inside your garage, or if you park outside, you might use an outdoor socket or dedicated charger.

Assuming you drive under 50km in a day, it should only take 3-5 hours to recharge, which would cost less than a dollar of electricity, especially if your power company has an off-peak rate of around 11 cents per kWh. This therefore is much cheaper than petrol driving.

You may see U.S. or other websites describe “Level 1” or “Level 2” charging. Level 1 describes the ~100 voltage found in USA and Japan, which is half what we have in New Zealand. This is very slow and has no relevance in New Zealand. Level 2 describes the 230 volts found in New Zealand.

Slow charging can occur with differently shaped (wall) sockets:

	<p>Normal 3 pin socket (S3112) 8 or 10 amp (1.8 - 2.3 kW, single phase). 10km+ / hour charging³³</p> <p>This is what you find throughout New Zealand homes and offices. For most people, it is sufficient to charge their cars overnight during low-cost off peak hours (11pm-7am). This is probably what you already have inside your garage at home.</p> <p>If your car doesn't come with a cable for this socket, you can purchase a portable 8 amp unit at JuicePoint.co.nz.</p> <p>Note: A larger 15 amp version of this 3-pin plug/socket is available, however is not recommended for continual use; the higher current warms the small metal pins, posing a fire risk.</p>
	<p>Blue Commando (IEC 60309) 16 amp (3.7 kW, single phase). ~18km+ / hour.</p> <p>These are the plugs found in campgrounds all over the country, used by campervans. Having an EVSE or adapter for this socket lets you recharge in many locations around the country, and allows a higher current, faster charge. You can get an electrician to fit this socket at home. The thick metal pins are well suited to repeated, prolonged use and rugged outdoor conditions, and won't heat up as easily, reducing fire risk. One supplier of Blue Commando based equipment is www.BlueCars.nz.</p>

³² See 0h50m on EVTV show <https://www.youtube.com/watch?v=7NlmTiaR1Zg> and various other research papers at <http://avt.inl.gov> (Advanced Vehicle Testing Activity, Idaho National Laboratory, USA)

³³ km/hour charging on this and next page is a rough guide on the basis of 5 km per kW; you'll go a little further in flat/urban driving.



Dedicated units (EVSEs)

15 to 40 amp (3 - 22kW, single or three phase) ~15-110km / hour

For around \$800 or more, you can buy a dedicated wall-mounted charger. These reduce the time it takes to start and stop charging - you don't have to grab or stow the charging cable in your car. There are several options in the market, with higher end devices able to take payment from users, able to draw much higher current, display information on your smartphone³⁴, or in the future, return electricity from your car back into your home.

The cable is permanently attached on most units. The cable has a specific plug at the end which fits into your car. This is typically a J1772 (aka "Type 1") plug. Pay attention to get the one that your car needs.

Because the plug is specific to electric cars, it deters others using the electrical socket, potentially useful in public locations.

Cars have a maximum pace of charging; e.g. older Nissan Leafs can charge up to 3.6 kW and newer Leafs up to 6.6 kW, so while a dedicated 10 kW charger will work, it will charge only as fast as the car supports.

Owners of cars with large batteries benefit the most from the faster charge times, and more likely to support, the higher "speed" (kW) of dedicated chargers (Tesla cars, for example, support up to 22 kW charging in 3-phase AC.)



Your car will normally come with a portable cable for only *one* of the two wall-sockets pictured on the previous page.

Consider owning your car for a few weeks so you can confirm whether you actually need to buy another cable, socket, or charging unit. Do not allow a car dealer to sell you a cable for a Japanese shaped wall socket; this will be unsafe. They must always provide equipment designed for the physical shape and 230 volt electricity found in New Zealand.

³⁴ Pictured EVSE: JuiceBox 40 by eMotorWerks, crowd-funded via KickStarter, available via juicepoint.co.nz.

FAST CHARGING

(Also known as Level 3 charging)

These enable electric car drivers travel on long distance journeys.

Whereas a slow charger is often rated between 1.8 to 7 kW, a fast charger is typically 50 kW³⁵ which is a significant electrical current, and will let your car travel over 250km per hour charging³⁶.

This type of charging equipment is expensive to purchase (tens of thousands of dollars) and requires consent by electricity lines companies to install. Therefore they will be purchased by large organisations and put in public locations where a high volume of car owners can drive to.

The most common fast-charge plug type (pictured) in New Zealand is the Japanese CHAdeMO standard, which is an abbreviated pun for “How about some tea?”. A Nissan Leaf can perform fast-charge to 80% battery in about 20 minutes, about enough time to take a tea or coffee and a convenience break. Given the short charge time, chargers make sense where a car will naturally stay for that length of time (cafes, supermarkets) and make much little sense where people park for hours (hotels, parking buildings, malls, cinemas).



Fast charging differs from slow charging also in that it uses DC (Direct Current) instead of AC (Alternating Current).

New Zealand’s first fast charger opened in 2014 in Whangarei, pictured here with a Nissan Leaf:



³⁵ Overseas, Tesla has “SuperChargers” that charge as high as 120kW. See teslamotors.com/supercharger

³⁶ Assuming your battery is large enough and you travel 5km per kWh; you could go further with urban/flat driving.

WHERE CAN I CHARGE?

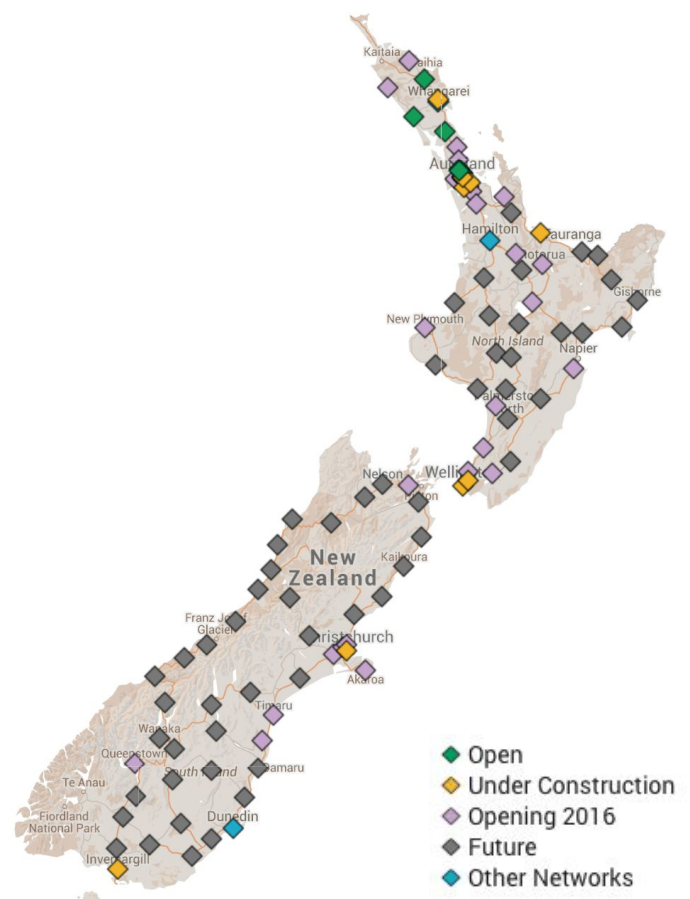
Besides home, which is where the majority of charging takes place, some employers are providing slow charging sockets in staff car parks. There are also public charging locations:

- Fast and slow chargers provided by electricity companies, currently concentrated to Whangarei, Auckland and Hamilton.
- A national network of nearly 100 fast chargers being installed by www.charge.net.nz enabling long distance electric car travel along state highways. The first chargers were installed in 2015 and the network is growing month to month.
- A nationwide coverage of hotels, motels and campervan grounds where you can plug in at powered car parks for slow charging. These often require a Blue Commando plug.

Slow Charging (for destinations)



Fast Charging Network



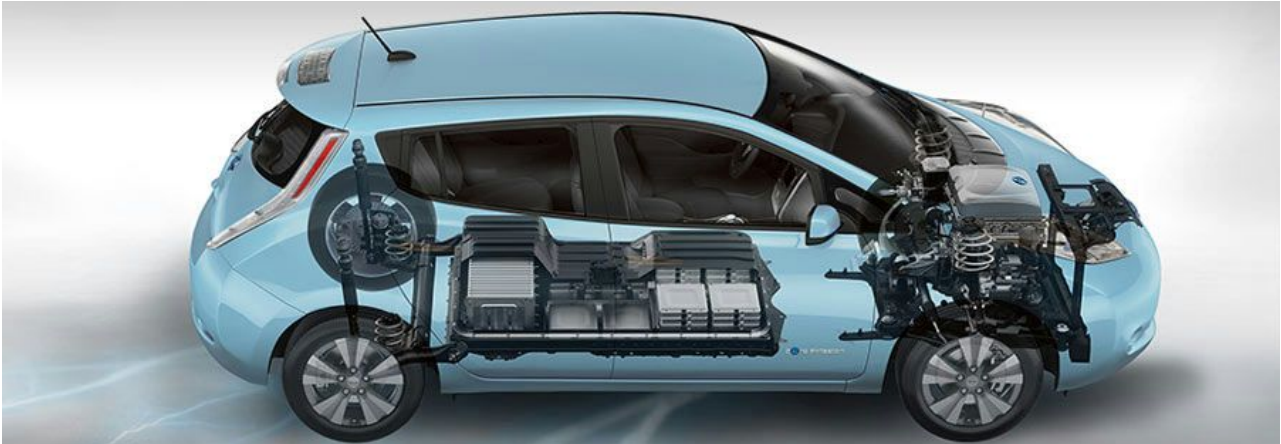
Visit www.plugshare.com (pictured above) or use the PlugShare smartphone app for a map. PlugShare explains whether there is a cost involved in charging at that location.

If you offer car charging to staff, customers, or the public, you should certainly list it on PlugShare (it's free). Include a description on whether charging is free to the public, free to customers, or paid, or restricted to employees, the hours of operation (hopefully 24/7!), and upload photos to promote your listing. Add signage to the physical space (e.g. "Electric car charging park"), to increase public awareness of electric cars, and to stop petrol cars blocking the park.

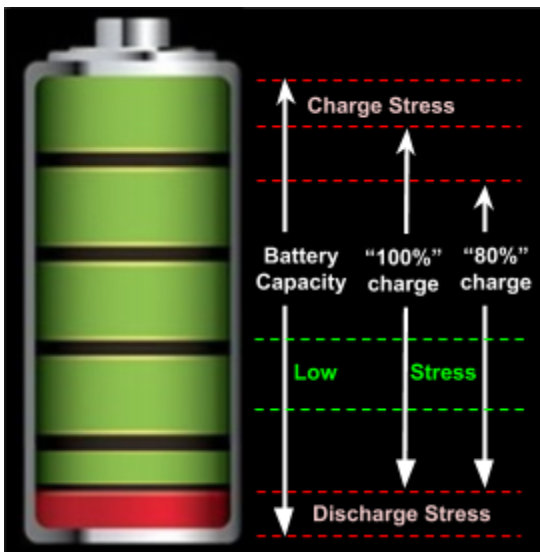


BATTERIES: SIZE, LIFE, REPLACEMENT

Electric car batteries weigh several hundred kilograms and sit in the floor of the car. This gives the cars a low centre of gravity, adding stability when cornering and accelerating.



Battery size is measured in kilowatt-hours, or kWh. Lower priced electric cars have ~24 kWh batteries and the high-end Tesla Motors cars come close to 100 kWh. This affects range and cost.



The life of a battery is reduced when at extreme high or low levels of charge³⁷. To avoid cars reaching either end, not all of the battery capacity is made available.

You can lengthen the life of your battery by fully charging it only on occasion (hence the “80% charge” option on most cars) and by avoiding the car being left too long at a high or low level of charge; the battery will last longer if it is generally around a third to half charged.

Hot temperatures (particularly over 30°C) reduce battery life. Excessive (more than daily, for years) fast-charging will slightly reduce battery life³⁸.

Nissan state expected battery capacity to reduce to 80% after 5 years and 70% at 10 years, assuming 20,000km of annual driving in a Los Angeles climate (10-30°C, average ~20°C)³⁹. Car manufacturers use different battery chemistries which may offer different lifespans. You can assess battery capacity on the dashboard or smartphone app when you test drive a car⁴⁰. While minor loss of capacity is typical in a used vehicle (e.g. 10%), you might be saving half or a third of the cost of a new car, and the range will be still be higher than a typical daily drive. Car batteries have warranties, but conditions vary. Only some dealers provide warranties with used imports.

Eventually the battery will need replacement. It can then be recycled or, reused, for example by homeowners who want to store electricity from solar panels or overnight off-peak power.

- You may be able to buy a battery with more capacity than the car initially came with.
- You may need to replace only individual dead cells, at lower price than a full replacement.
- A new Nissan Leaf battery costs little under \$10,000 (2015); prices are falling.

³⁷ Wealth of battery information at batteryuniversity.com; Dalhousie Uni lecture by Jeff Dahn [youtube.com/watch?v=9qi03QawZEK](https://www.youtube.com/watch?v=9qi03QawZEK)

³⁸ US government study on slow vs fast charging: [avt.inl.gov/pdf/energystorage/FastChargeEffects.pdf](https://www.avt.inl.gov/pdf/energystorage/FastChargeEffects.pdf)

³⁹ www.electricvehiclewiki.com/Battery_Capacity_Loss#Nissan.27s_Responses_and_Actions

⁴⁰ Nissan Leaf shows health on dashboard; LeafSpy is an iOS / Android app showing more detail. Similar tools exist for other cars.