STATE OF THE NATION REPORT

E-MOBILITY IN NEW ZEALAND · 2023

DRIVE ELECTRIC

CONTENTS

Drive Electric has made every attempt to ensure this report has been prepared from accurate sources as of 30 June 2023, however we are not responsible for any errors or omissions, or for the results obtained from the use of this information.

ABOUT DRIVE ELECTRIC

Drive Electric is New Zealand's leading apolitical not-for-profit organisation advocating for electric vehicle uptake and the decarbonisation of New Zealand's transport sector.[1.0]

We engage with government, media, industry and individuals to promote the benefits of making e-mobility mainstream. Over the past decade, we have played a key role in shaping EV-related policy, facilitating conversations between industry and Government, and in the distribution of accurate research and information to help Kiwi consumers and businesses make informed transport choices.

Our board, members and research partners are at the forefront of the electric vehicle movement, and represent all aspects of the EV ecosystem.[1.1, 1.2]

We are proud to instigate change and impart brand-agnostic expertise in the effort to bring New Zealand closer to a fully electric future.

This report is informed by our network of industry experts, global and local research, and the insights of our members.

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bakertilly STAPLES RODWAY
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CardLink
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EVPOWER EST. 2016
THUNDERGRID
driveline leasing and finance
CRITCHLOW GEOSPATIAL
GO rentals
Directtrack
RAM
OPTIFLEET
AUTOLINK CARS DRIVE
TransNet
wallbox
Reliance TRANSPORT Ltd
McLaren
1:5 PROJECT
WeEV Powered by WEL Networks
FIAT
ARUP
JET CHARGE
ASTON MARTIN
retyna
boostauto
BENTLEY
GYRO
OEM WHOLESALE AUDIO
JUMP CHARGING
GREENHOUSE CAPITAL
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CUPRA
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EXECUTIVE SUMMARY

New Zealand is on the threshold of a transformation that presents fantastic opportunities and unique challenges.

As key automotive markets and major car manufacturers commit to electric vehicles, and governments align on the efforts to mitigate climate change, we have the chance to position ourselves at the forefront of the electric vehicle movement and create a better, cleaner transport future for our country. As electric vehicles and other forms of e-mobility get cheaper this will only accelerate uptake of this form of transportation.

Decarbonising our transport system will be crucial in meeting our climate obligations. A myriad of other advantages also come with the transition to electric vehicles.

Transport accounts for 18% of our nation's emissions, but the solution exists to decarbonise - mainly through electrification. Make no mistake, it is not clear that electric vehicles will come to dominate ICE vehicles by 2030. While EVs produce lower life cycle emissions regardless of where in the world they are driven, New Zealand's high proportion of renewable electricity grid maximises their emissions reduction potential. An electrified transport system also reduces New Zealand's exposure to the price of fossil fuels; will reduce household spending on transport and energy; and will reduce health impacts of air pollution.

While e-mobility is fast becoming dominant, we must be alert to technological advancements and how these will provide new opportunities. Marine, aviation and heavy transport may all lend themselves to technologies like hydrogen or cleaner forms of fuel.

The nature of New Zealand's vehicle market amplifies the urgency to transition to electric sooner rather than later.

We are a small, right-hand drive market, with a high rate of vehicle ownership and a relatively old fleet. A high-emission vehicle entering New Zealand today will continue to impact our fleet for nearly two decades.

While recent sales figures, the sentiments of consumers and businesses, and the success of the Clean Car Discount bode well for uptake in the coming years, EVs currently account for a small part ~(2%) of our car fleet.

Embracing innovation and moving swiftly to accommodate EV uptake across all modes of transport in the 2020s will help to set New Zealand up for success in the effort to achieve net zero emissions by 2050.

This transition to e-mobility is about more than cars.

We advocate for electrification of the transport sector as a whole because realising the benefits of decarbonising transport will require more than simply swapping all the cars in New Zealand for EVs.

New Zealanders have a propensity for short car trips. A better transport sector would also see increased uptake of electric micro-mobility, ride-sharing and mobility-as-a-service models along with a lower-emission, more efficient public transport system.

Low availability and high costs of suitable light or heavy commercial transport options are hindering electric vehicle uptake in those segments. Our utes, vans and trucks tend to be higher-emitting, and driven much more regularly, so addressing adoption barriers for these vehicles will be crucial in the coming years.

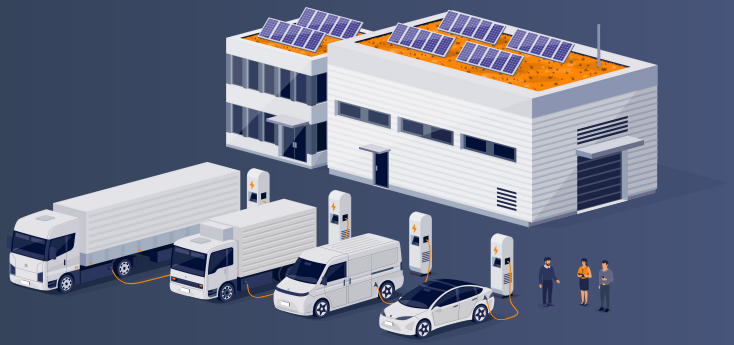
Besides our road vehicles, electric marine transport and aviation technologies are still in their infancy, but have shown great promise for the coming decades. While it's important to have the right settings in place to enable those sectors to progress, the shorter-term wins for New Zealand are to be had with road transport.

The main challenge that sits across electrification of transport is charging.

Charging readiness can make or break a successful transition to electric vehicles, and is an area in which New Zealand has some catching up to do. While the majority of electric vehicle charging is done at home, our public network needs to become more robust and more fit-for-purpose, especially as more commercial electric vehicles (both light and heavy) enter the fleet. When it comes to home charging, widespread adoption of smart chargers will be key to managing demand in future.

New Zealand's energy sector is already well-positioned to accommodate the expected 20% increase in electricity demand from light electric vehicle uptake. Our electricity generators, distributors and retailers, along with our public charge point operators and home charging installers, all need to work to ensure that our nationwide charging infrastructure can act as an enabler of, rather than a barrier to accelerated EV adoption.

New Zealand is heading in the right direction with policy, but we must maintain momentum.



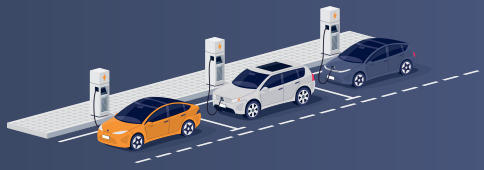
We are now armed with the learnings of other countries who have successfully implemented policy and market settings to enable successful EV uptake. New Zealand hasmade a number of important strides with policies such as:

- The Clean Car Programme
- The Low Emissions Transport Fund
- FBT exemptions for e-bikes and e-scooters
- Funding programmes for electric buses and trucks

It is essential that policy that works is maintained to continue the transition to e-mobility. The Clean Car Programme has been particularly successful in driving EV uptake and cleaning up emissions from the fleet.

However, much more needs to be done through the implementation of the forthcoming National EV Charging Strategy. It is likely that hundreds of millions will need to be invested in charging infrastructure, both public and private, before the end of the decade. Well targeted public investment can catalyse private sector investment many times over in the short term, by overcoming barriers. Longer term, the regulatory settings need to be right to enable electricity network business to support the connections required by decarbonisation. We also need to ensure there is a workforce strategy to service the growing e-mobility industry and associated infrastructure.

Through the implementation of smart policies, collaboration between key stakeholders, and innovative solutions, New Zealand has the opportunity to lead the charge towards a cleaner, more sustainable transportation system. Electric transport will transform how we move around our country, and it's up to our consumers, businesses and policy makers to affect the kind of change that sets New Zealand up for success.



The time for action is now, and the potential rewards for our people, environment and our economy are immense.

UNDERSTANDING EVs IN NEW ZEALAND

TERMS USED IN THIS REPORT

WHAT IS AN EV?

EV stands for Electric Vehicle, which is a plug-in vehicle powered at least partly by electricity. This includes Battery Electric Vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs).

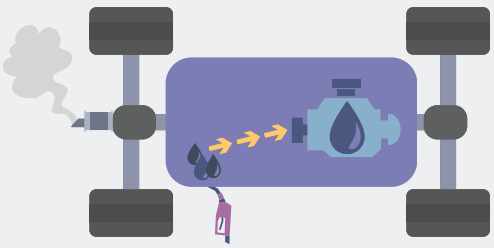
The term 'EV' doesn't just cover cars; electrified options are developing for most modes of transport. E-bikes and e-scooters are already commonplace; electric trucks, vans and buses are gaining traction in New Zealand and global markets, and electric drivetrain technologies for boats and planes are developing at pace.

KEY

- Petrol / diesel engine
- Electric motor
- EV battery
- Petrol / diesel
- Tailpipe emissions
- Energy flow

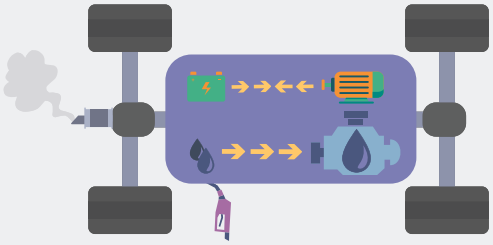
ICE
(Internal Combustion Engine)

An engine in which the combustion of a fuel (normally petrol or diesel) occurs with an oxidiser (usually air) in a combustion chamber. This has historically been the main engine type for cars and almost every other motorised vehicle.



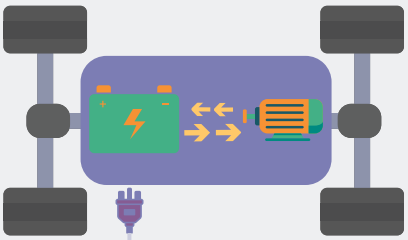
HEV
(Hybrid Electric Vehicle)

Combines an internal combustion engine with a small electric motor, but cannot be plugged in to charge. Electric propulsion is usually achieved via regenerative braking.



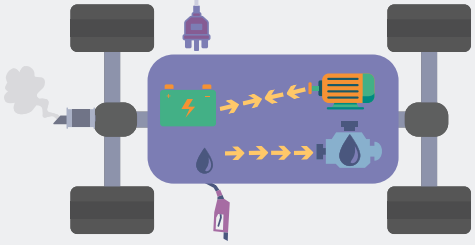
BEV
(Battery Electric Vehicle)

Operates entirely on an electrically powered motor.



PHEV
(Plug-In Hybrid Electric Vehicle)

Operates on both an ICE and an electric motor. Can be plugged into a power source to recharge its battery, extending the distance it can travel on electricity alone before switching to ICE propulsion.



Electric Vehicle or 'plug-in vehicle'

Can be recharged from an external source of electricity, such as wall sockets or an EV charging station, and the energy is stored in rechargeable battery packs.

FCEV (Fuel Cell Electric Vehicle)

Runs on electricity generated by fuel cells within the vehicle; the fuel is typically hydrogen.

ZEV
(Zero-Emission Vehicle)

Emits no exhaust gas (tailpipe emissions) from the onboard source of power. This usually refers to both BEVs and FCEVs.

Sources: Drive Electric, Standards New Zealand, Gen Less [2.0, 2.1, 2.2, 2.3]

WHY DO EVs MAKE SENSE FOR NEW ZEALAND?

Electric vehicles are rapidly gaining popularity with consumers and fleets because they have a myriad of advantages in comparison to ICE vehicles.

Our **electricity grid** is currently more than

87% RENEWABLE

...and counting.[2.6]

Embracing renewable energy to produce a relatively low-emissions grid has put New Zealand in an excellent position when it comes to keeping our EV operating emissions as low as possible.

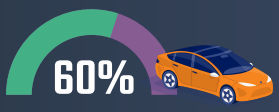
Total lifecycle emissions of EVs are significantly lower, especially if charged on a predominantly renewable-powered electricity grid.[2.7]

The life cycle of a vehicle includes:

- Resources extraction
- Manufacturing
- Shipping
- Operating life
- Total kilometres travelled
- End-of-life and disposal

Compared to an equivalent ICE vehicle, over its total lifecycle a BEV used in New Zealand will produce:[2.8]

80% fewer operating emissions



60% fewer lifecycle emissions

LOWER COST OF OWNERSHIP

'Filling up' an EV in NZ is equivalent to paying

40¢ / LITRE[2.3]

1/2 COSTS for ongoing maintenance[2.4]

$7,015 maximum rebate available[2.5]

BEVs PRODUCE:

0 exhaust fumes or tailpipe emissions[2.0]

and an almost **SILENT** ride[2.0]

WHAT ABOUT STANDARD HYBRIDS?

Petrol Hybrids only achieve a 21% reduction in lifecycle GHG emissions compared to an equivalent petrol car.[2.9]

THE E-MOBILITY ECOSYSTEM

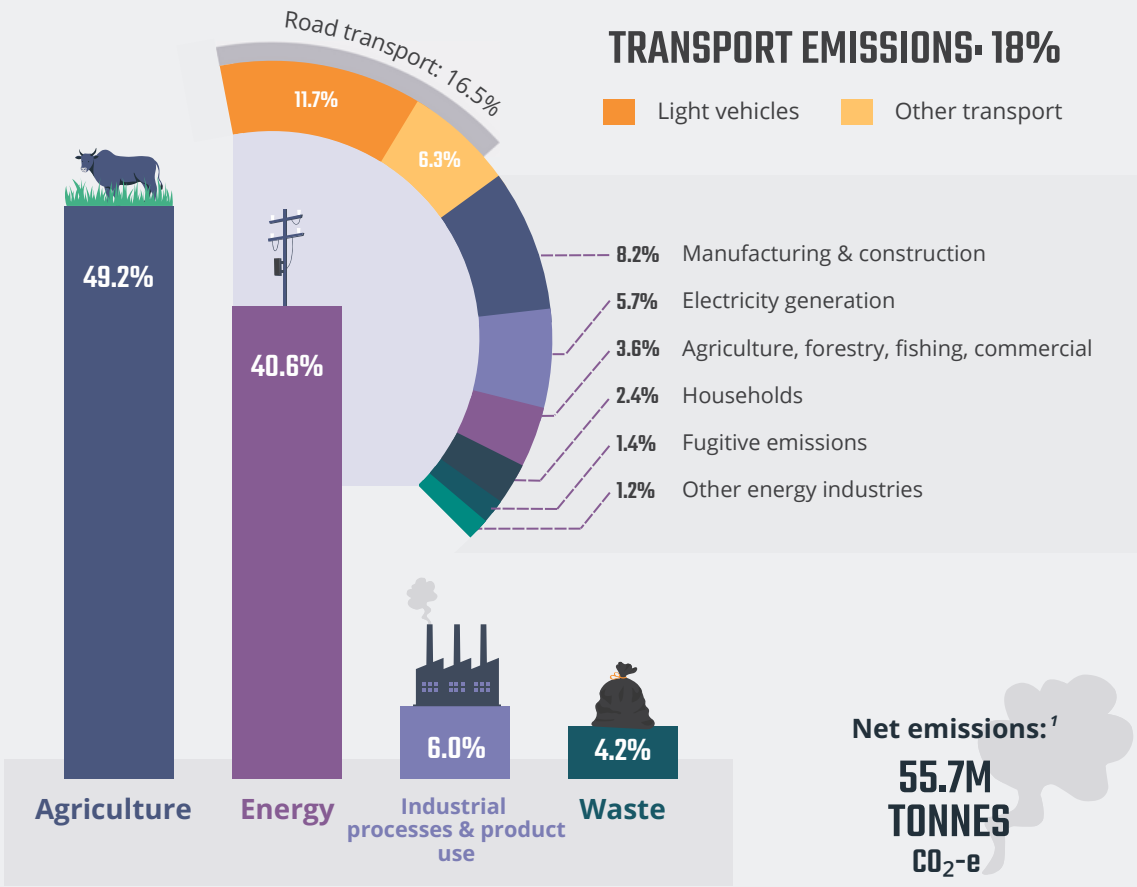
Decarbonising our transport sector involves so much more than simply sourcing lower-emission cars. A full ecosystem is required to facilitate successful EV uptake.

Charging providers, power companies, local and national government, roading and infrastructure providers, public transport, heavy transport, corporates and SMEs, along with every individual consumer, all have their part to play in a better, cleaner transport future for New Zealand.

OUR CURRENT EMISSIONS PROFILE

Figure 1:

New Zealand GHG emissions snapshot - 2021



Sources: Manatū Mō Te Taiao | Ministry for the Environment, Hīkina Whakatutuki | MBIE [2.10, 2.11]

Transport is responsible for

39%

of our CO_2 emissions [2.10]

We are reliant on fossil fuels for

99%

of our transport energy [2.11]

ENERGY INDEPENDENCE

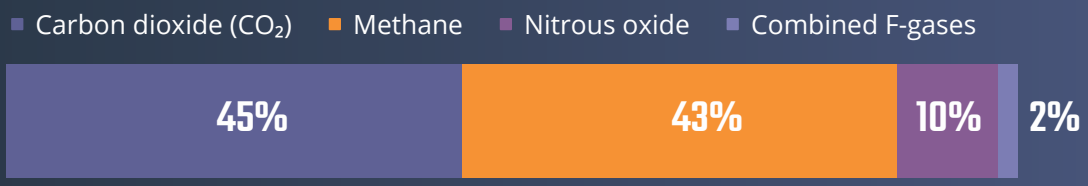
The more we 'fuel up' with renewable electricity produced in New Zealand, the less we rely on oil products. We currently import the majority of our petrol and diesel, at an estimated cost of $8-9B per year.[2]

Producing more renewable energy for transport, rather than relying on fossil fuels from overseas, will reduce New Zealand's vulnerability to the price and supply fluctuations of the global oil market, while also reducing our emissions.

1 *Mt CO_2-e: Million tonnes of carbon dioxide equivalent*

2 *Estimates are based on data from Statistics NZ, MBIE data and industry insight. Precise figures are not publicly available.* [2.12, 2.13]

Figure 2:
New Zealand emissions by gas type - 2021



Source: Manatū Mō Te Taiao | Ministry for the Environment [2.10]

Figure 3:
Domestic transport GHG emissions by sector - 2021

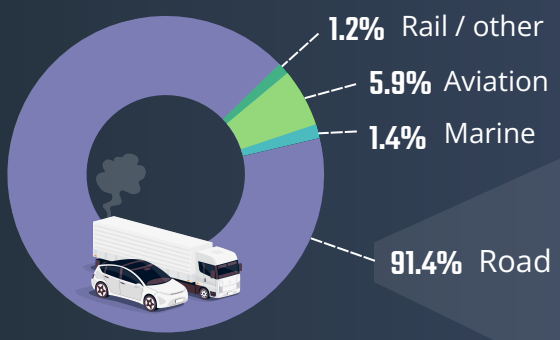
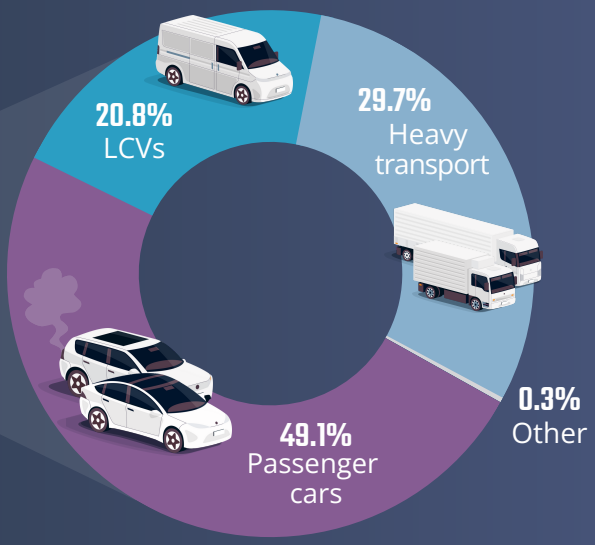


Figure 4:
Road transport GHG emissions by vehicle class - 2021



Source: Manatū Mō Te Taiao | Ministry for the Environment [2.10]

AIR POLLUTION AND HUMAN HEALTH

Transport is responsible for two-thirds of our 'harmful emissions' (air pollution).[2.14]

Each year, harmful emissions from transport result in:[2.15]

- 2,200+ premature deaths
- 9,200+ hospital admissions for respiratory and cardiac illnesses
- 13,200+ cases of childhood asthma
- $10.5 billion+ in social costs

Research indicates that widespread EV uptake could result in a ~50% reduction in the health impacts of air pollution.[2.16]

Not only do EVs provide less air pollution, they also contribute to quieter cities.

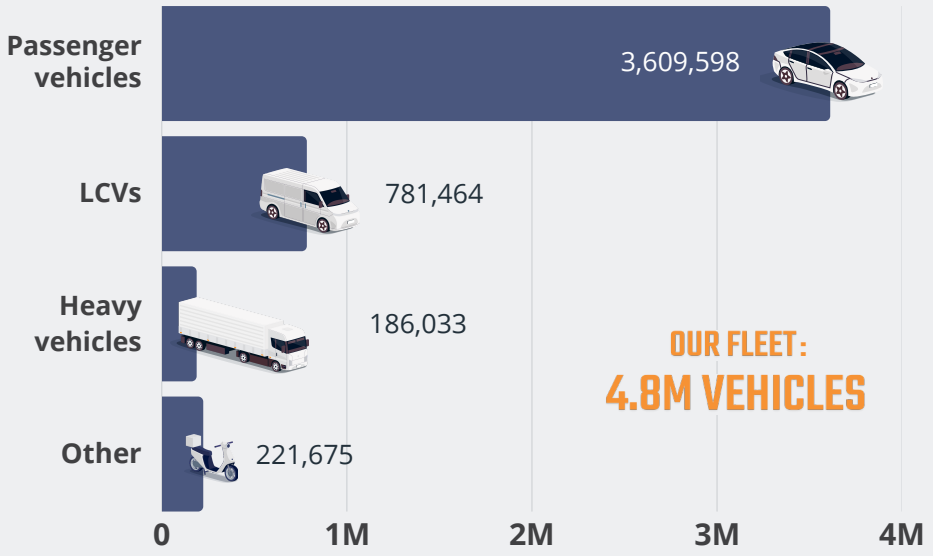
NEW ZEALAND'S FLEET PROFILE

New Zealand has one of the highest rates of car ownership in the OECD.[2.17] This is in part due to New Zealand's geography; outside of urban centres, private vehicles are often the only available practical mode of transport.

Emissions from our light vehicle fleet are the single largest source of transport emissions in New Zealand.[2.10]

Heavy vehicles are the second-largest source (29.7%) of transport emissions,[2.10] despite this sector only making up 4% of our fleet.[2.18]

Figure 5:
New Zealand fleet size by vehicle class - June 2023



Source: Te Manatū Waka | Ministry of Transport [2.18]

OUR TRANSPORT HABITS

Transport makes up **37%** of a typical household's **carbon footprint** [2.19]

1/3 of all car trips in NZ are **2 km or less** [2.20]

We have a **low average commute**: **22KM RETURN** per day [2.20]

Personal cars are scrapped at an **average age of 19 YEARS** [2.21]

We keep **commercial vehicles** on the road for **10+ YEARS** [2.22]

The elevated level of climate pollution from every greenhouse gas-emitting vehicle entering our fleet today will be locked in for one to two decades.

Our highest-emitting passenger vehicles tend to be driven more.

In 2019, cars and SUVs greater than 3,000cc were driven 11,506km on average; vehicles between 1,600cc and 1,999cc were driven 8,826km.[2.21]

OUR CLIMATE TARGETS

PARIS AGREEMENT
RATIFIED IN 2016

New Zealand is one of over 194 parties (193 states plus the EU) that have committed to limit the global temperature increase this century to 2˚C above pre-industrial levels, and to pursue efforts to further limit this increase to 1.5˚C.[2.23]

NET ZERO
EMISSIONS BY 2050

The **Climate Change Response (Zero Carbon) Act 2019** legislates our Paris Agreement obligations. It formalises our target for net zero emissions of all greenhouse gases (other than biogenic methane) by 2050.[2.24]

Our overall emissions reduction success will rely heavily on the progress we make in reducing transport emissions.

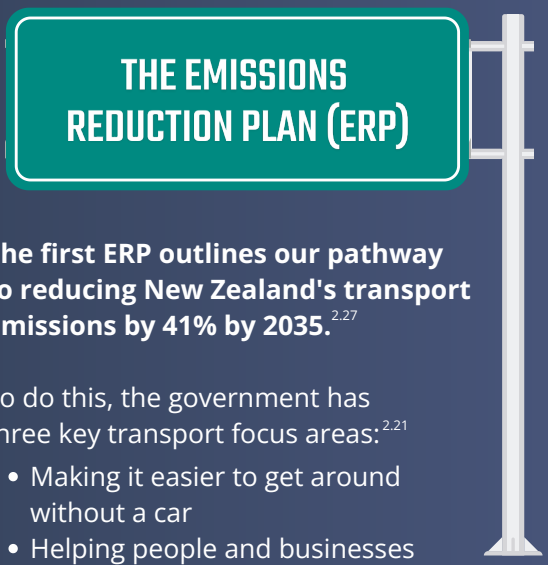
Many other countries are targeting their fossil-fuel dependent electricity mixes to reduce emissions.[2.25] However, New Zealand already has a high proportion of renewable energy generation.

Transport accounts for almost 18% of total New Zealand's GHG emissions, and the Climate Change Commission's advice identifies the transport sector as having the potential to almost completely decarbonise before 2050.[2.26]

Given New Zealand's relatively clean grid, which is only expected to provide even more renewable energy, decarbonising road transport is one of the most significant opportunities for decarbonising. And, we have the technology to do it: public transport, active transport, and e-mobility.

Almost all vehicles driven on our roads will need to be zero emissions before 2050 to reach net zero emissions.[2.26]

THE EMISSIONS REDUCTION PLAN (ERP)



The first ERP outlines our pathway to reducing New Zealand's transport emissions by 41% by 2035.[2.27]

To do this, the government has three key transport focus areas:[2.21]

- Making it easier to get around without a car
- Helping people and businesses switch to zero emission vehicles
- Encouraging low-emissions freight options

ERP 2035 TARGETS:[2.21]

1. 20% reduction in total kilometres travelled by the light fleet
2. 30% zero-emission vehicles in the light fleet
3. 35% reduction in freight transport emissions
4. 10% reduction in total fuel emissions intensity

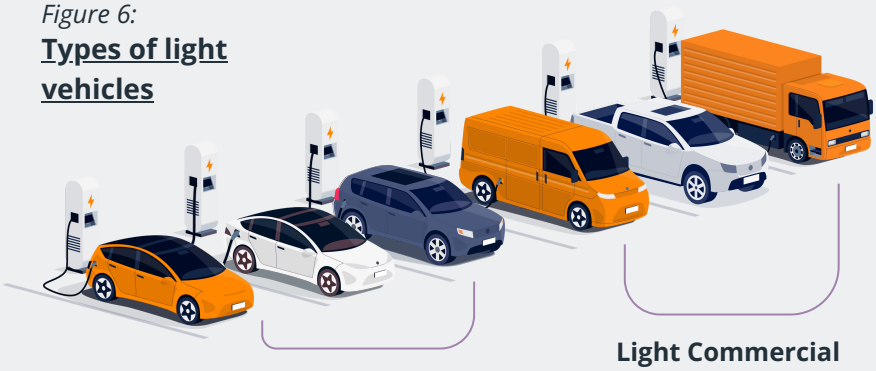
Missing these 2035 targets will make meeting our 2050 target extremely challenging.[2.21]

If the transport sector falls short by 2035, New Zealand will need to find ways to make more drastic changes to our transport system later, or shift burden onto other sectors of the economy. Te Manatū Waka Ministry of Transport notes that both options are likely to have "unacceptably high costs and impacts for current and future generations".[2.21]

LIGHT ELECTRIC VEHICLES

'Light vehicles' have a maximum weight of less than 3.5 tonnes. Light vehicles include passenger and commercial vehicles such as cars, vans, utes, SUVs and 4WDs.[3.0]

Figure 6:
Types of light vehicles



Light Passenger Vehicles
Cars, SUVs and 4WDs

Light Commercial Vehicles (LCVs)
Utes, vans and light trucks

THE GLOBAL MARKET

The electric light passenger vehicle market grew slowly between 2010-2015, but in recent years has rapidly, and dramatically, expanded.

2022 was a historic year for the global EV market.[3.1]

10.5M

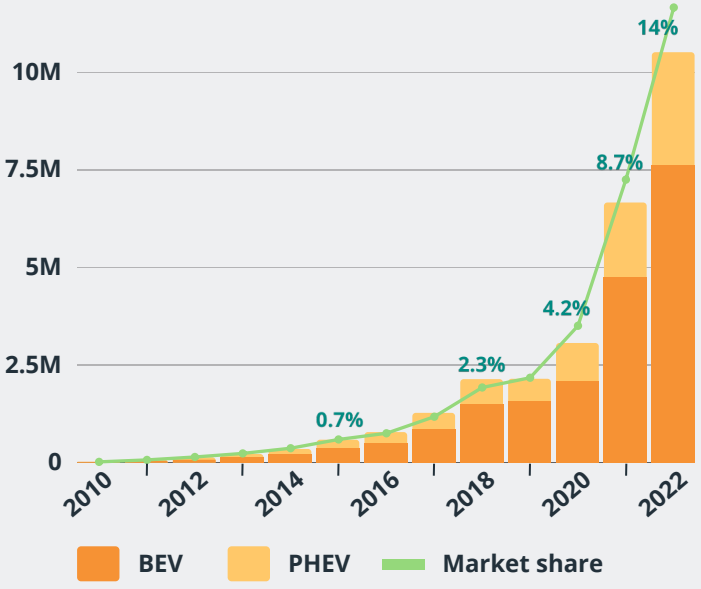
Plug-in passenger vehicle sales in 2022

+58% since 2021

+730% since 2017

14%
Plug-in share of passenger vehicle sales in 2022

Figure 7:
Global sales - Light electric passenger vehicles
2010-2022



Source: International Energy Agency (IEA)[3.1]
New and used vehicles.

There are more plug-in models available than ever, and EV fleets are growing rapidly across the world.

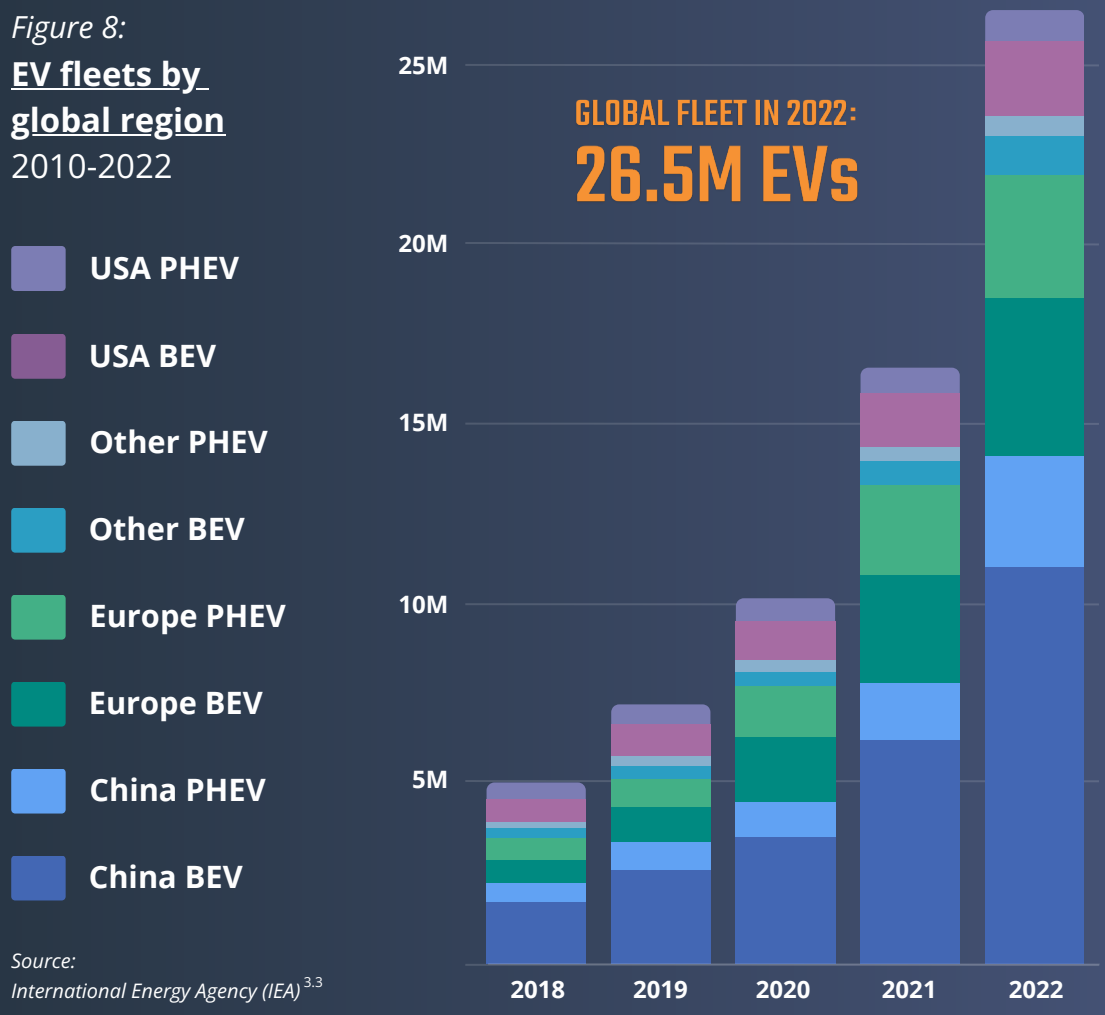
Globally, China leads the way in both light EV fleet numbers and model selection, with over 280 EV models available as of 2022, followed by Europe, with 206 models available.[3.2]

LIGHT EV MODELS AVAILABLE GLOBALLY:[3.2]

2020	2022
244 new BEVs available	343 new BEVs available
126 new PHEVs available	170 new PHEVs available

39% INCREASE in model options in 2 years

Figure 8:
EV fleets by global region
2010-2022

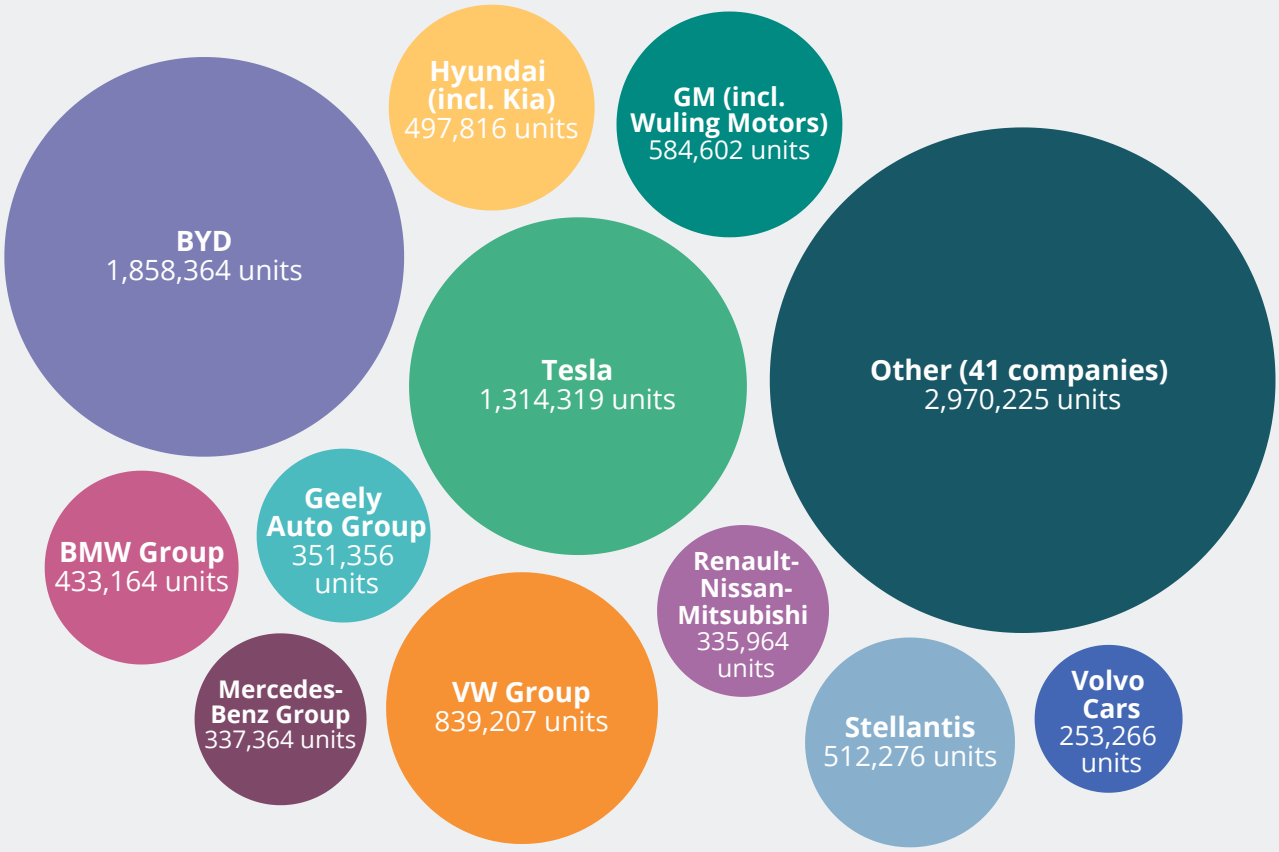


Source:
International Energy Agency (IEA)[3.3]

WHICH AUTOMAKERS ARE LEADING THE WAY IN LIGHT EV PRODUCTION?

Figure 9:

Light EVs produced globally in 2022, by auto brand



Source: Visual Capitalist. Includes BEVs and PHEVs.[3.4]

Globally, electric cars have become cheaper, and specs are rapidly improving.

Why?[3.5]

- Increasing consumer demand.
- Policy and government incentives.
- More competition.
- Scaling and improvement of EV tech and manufacturing processes.

Average light passenger BEV price (USD) over ten years:

2011 $44,600[3.6] → **2016** $39,900[3.6] → **2021** $36,000[3.5]

Average **range** has increased **101%**

As EV technology has matured, automakers have been able to improve the efficiency of EV batteries and motors.

Average light BEV range over ten years:

2013 189 km[3.6] → **2022** 380 km[3.7]

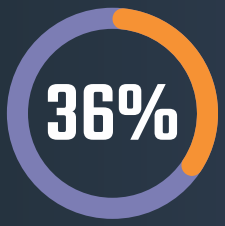
New models released in **2023** will increase average range to **480+ km**[3.7]

Maximum range available globally now: **830 km**[3.8]

GLOBAL MARKET OUTLOOK: 2030

Sales will be accelerated by governmental policies and ICE vehicle phase-out dates around the world. The IEA projects: [3.1]

37M Annual plug-in passenger vehicle sales by 2030



Plug-in share of passenger vehicle sales by 2030

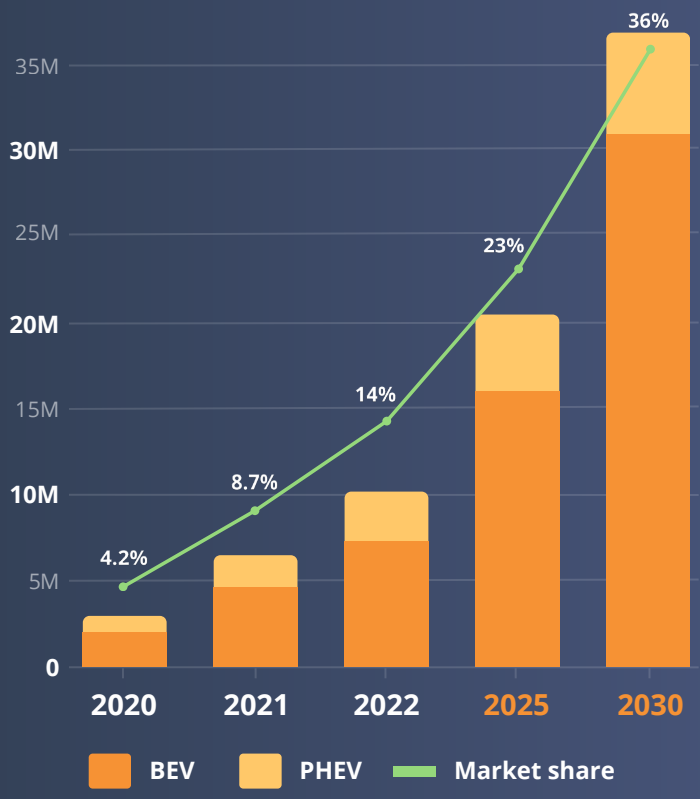
By 2030, there will be 226 million light EVs on roads around the world.

That's an increase of 200 million from 2022.

Figure 10:

Annual sales projections for plug-in cars under the Stated Policies Scenario (STEPS) 2020-2030

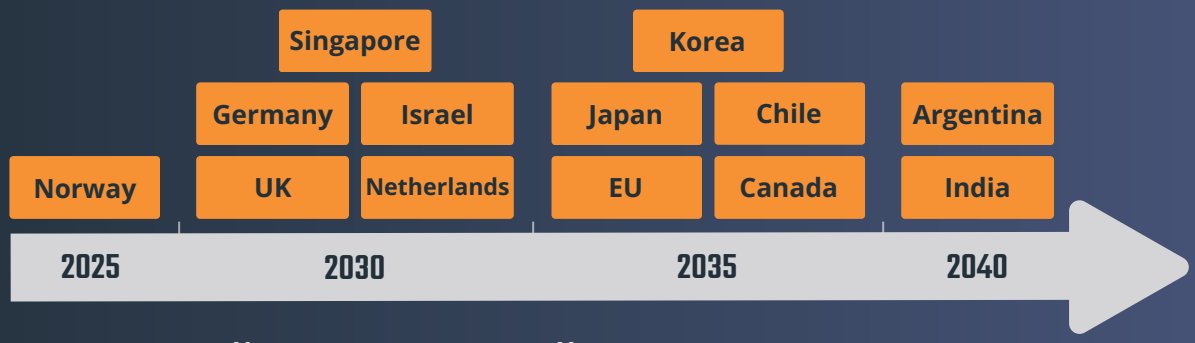
The STEPS scenario predicts EV market growth based on current policy settings, and policies confirmed to be in development, around the world as of September 2022.[3]



Source: International Energy Agency (IEA) [3.1]

Figure 11:

Global zero-emission vehicle mandates and/or ICE bans in selected markets [4]



Sources: Bloomberg NEF, [3.2] *International Energy Agency (IEA),* [3.3] *Accelerating to Zero Coalition,* [3.10] *Council of the European Union,* [3.11] *Coltura* [3.12]

3 STEPS is a relatively conservative scenario that doesn't take governmental 'ambitions' or 'targets' into account unless formalised implementation is underway. Ideally, market share will exceed these projections, if more governments implement measures to accelerate EV adoption in the coming years. [3.1, 3.9]

4 These mandates and bans take different forms and include: 100% EV sales targets; 100% EV stock; and ICE ban. These dates represent the first target set for each of these countries.

MORE AUTOMAKERS, MORE MODEL CHOICE

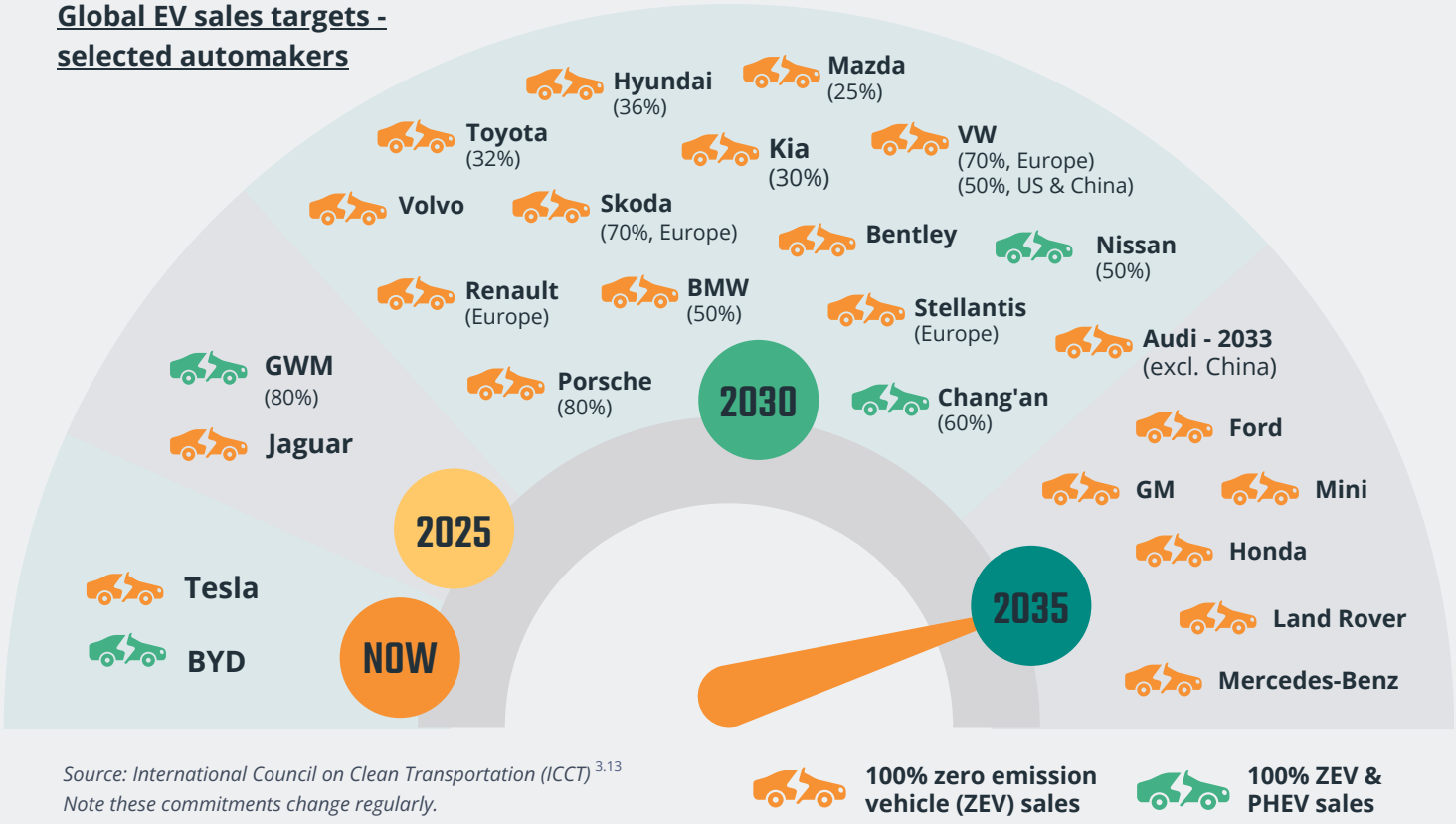
New entrants such as BYD and Tesla have truly disrupted the auto industry with their EV offerings, but many legacy carmakers are switching to electric, especially in Europe.[3.13]

2022-2023 saw a series of electrification commitments from automakers: fully electric fleets, more affordable cars and greater investment from an increasing cohort of manufacturers across all price points.[3.13]

According to Reuters, automakers collectively intend to produce **54 million BEVs by 2030**, which would account for more than 50% of vehicle production worldwide.[3.14]

If these commitments are realised, sales would likely exceed the IEA projections for 2030.

Figure 12:
Global EV sales targets - selected automakers



Source: International Council on Clean Transportation (ICCT) [3.13]
Note these commitments change regularly.

100% zero emission vehicle (ZEV) sales

100% ZEV & PHEV sales

This means that model options will also continue to increase. In fact, given the amount of ICE models that have historically come to market each year, the current number of EV options will likely at least double, before stabilising.[3.3] As the EV market matures, these models will continue to improve in performance and efficiency, and more competition will continue to drive purchase prices lower.[3.15]

GLOBAL PROJECTIONS: 2023

After analysis of Q1 sales, modelling by the IEA bodes well for passenger EV market growth throughout the remainder of 2023.[3.3]

14M Passenger EV sales

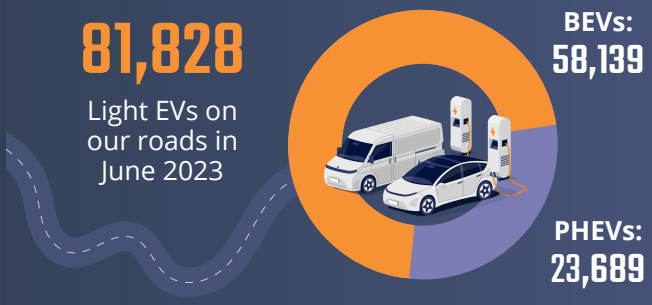
18% Market share

THE NEW ZEALAND MARKET

*In this section, when referring to the existing fleet of all vehicles registered for road use in New Zealand, we use the word **'fleet'**.*

When talking about cars registered in New Zealand for the first time (ie. cars sold into our fleet), we identify whether the data covers 'new imports', 'used imports' or both new and used imports.

Figure 13:
New Zealand's Light Electric Fleet



Source: Te Manatū Waka | Ministry of Transport [3.16]

In five years, our total light EV fleet has grown

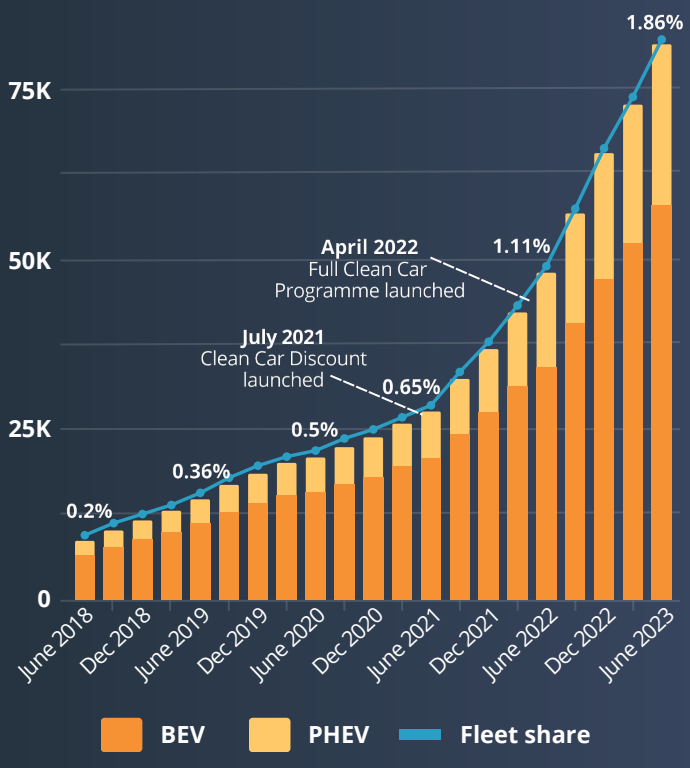
9.5x

in just the past year.

Despite this progress, BEVs and PHEVs only account for

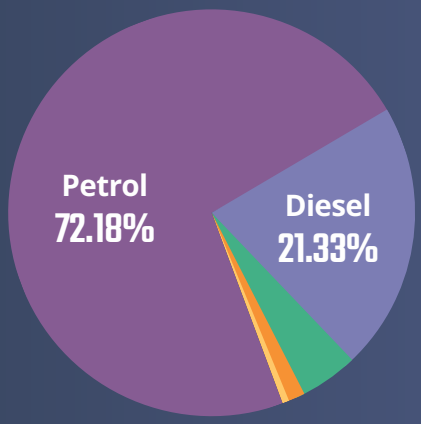
of our light fleet.

Figure 14:
Light electric vehicles in the New Zealand fleet
June 2018 - June 2023



Source: Te Manatū Waka | Ministry of Transport [3.16]

Figure 15:
The motor tech of our current light fleet
June 2023



PHEV	BEV	Hybrid
0.54%	1.32%	4.6%

Our total light fleet:

Source: Te Manatū Waka | Ministry of Transport [3.16]

152
NEW LIGHT EVs
available in June 2023

84
NEW BEVs AVAILABLE
31 eligible for Clean Car Discount

68
NEW PHEVs AVAILABLE
22 eligible for Clean Car Discount

Source: Jato [3.17]

THE CLEAN CAR DISCOUNT

The Clean Car Discount, formally launched 1 July 2021 and adjusted as of 1 July 2023, consists of rebates and fees based on CO_2 emissions for light vehicles when they are first registered in New Zealand.[3.18]

The higher the CO_2 emissions rating, the greater the fee, and the lower the emissions rating the greater the rebate. Only BEVs and PHEVs, and a small number of standard hybrids, are now eligible for the Discount.[3.21]

The Discount, alongside the Clean Car Standard (which regulates vehicle importers) aims to accelerate low-emission vehicle uptake across the New Zealand market.[3.19] Uptake has already exceeded the original government projections for 2027.[3.20]

100,000+
rebates under the CCD granted so far

Average emissions of newly registered vehicles in NZ have dropped
21%

Clean Car Discount rebate values
before and after July 1 2023

Applies to vehicles registered for the first time in NZ with a purchase price of less than $80,000.

	1 April 2022	1 July 2023
BEV (new)	$8,625	$7,015
BEV (used)	$3,450	$3,507
PHEV (new)	$4,205	$2,012

Source: Waka Kotahi | New Zealand Transport Agency [3.18]

BY 2035, THIS SCHEME IS FORECAST TO REDUCE:

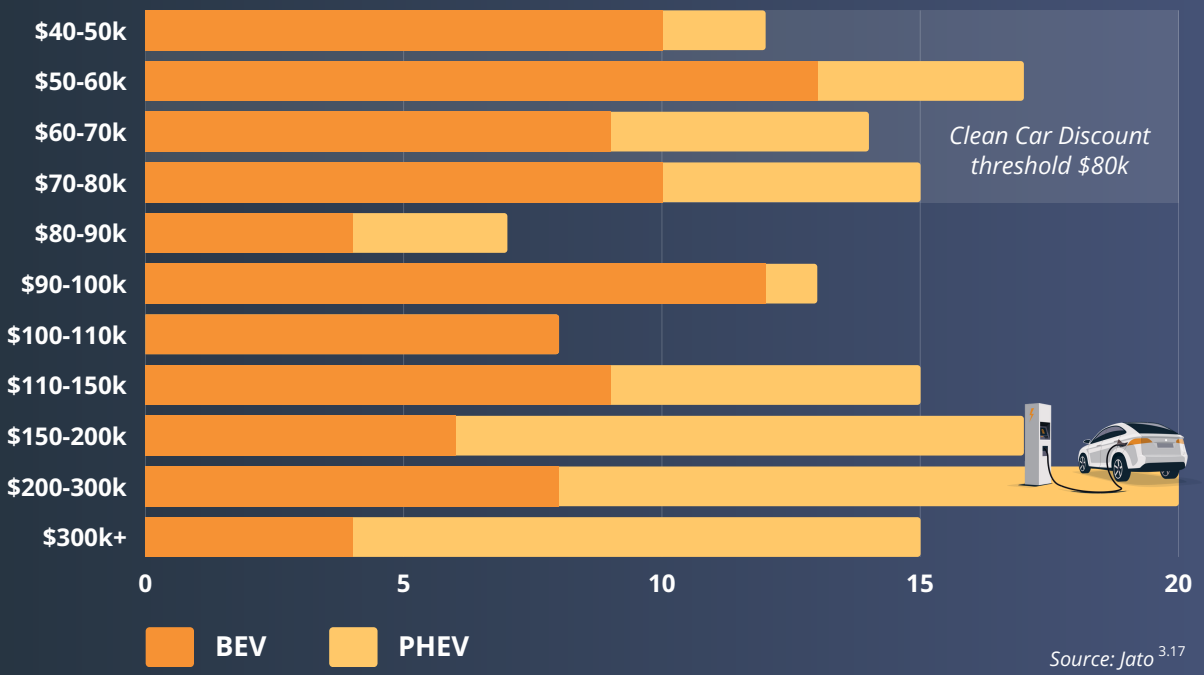
Transport emissions by
3.4M TONNES

Petrol imports by [3.20]
1.4B LITRES

The Clean Car Programme is a signal to automakers that there is an active market for light electric vehicles here; model availability has almost quadrupled since the discount was announced in 2021.[3.21]

The Clean Car Discount was originally designed to be fiscally neutral. Prior to the changes coming on 1 July 2023, the scheme was paying out more rebates than it was receiving in fees, reflecting the strong uptake of low emissions vehicles.[3.22] In May 2023, the Ministry of Transport estimated the scheme to have a negative marginal abatement cost (MAC) per tonne of CO_2 ranging from -$170 to - $199, saving the economy money in reducing CO_2, rather than imposing costs.

Figure 16:
Available light EV models by price in New Zealand
June 2023



Source: Jato [3.17]

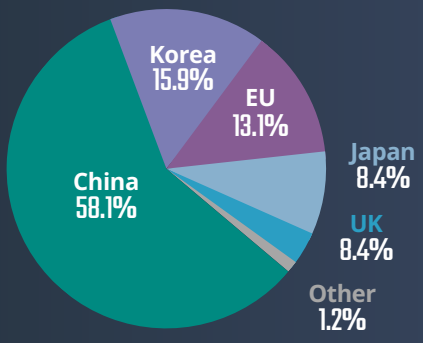
When will EVs reach price parity with ICE vehicles in New Zealand?

EECA analysis shows that parity is here in New Zealand now if you are taking a total cost of ownership view over five years (depending on use). [3.24]

Projections from BloombergNEF indicate that globally, BEVs may become available at a similar purchase price to their ICEV counterparts between 2025 and 2029, depending on the vehicle segment. This is almost entirely due to falling battery costs. [3.23]

Where are our EVs coming from?

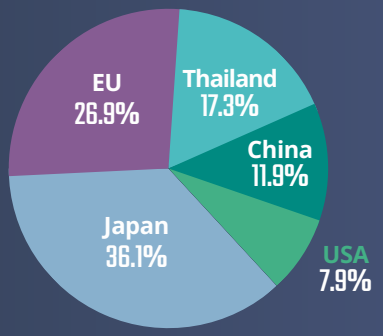
Figure 17:
Plug-in light vehicle imports by country origin
April 2022 - March 2023



Source: Statistics NZ [3.25, 3.26]

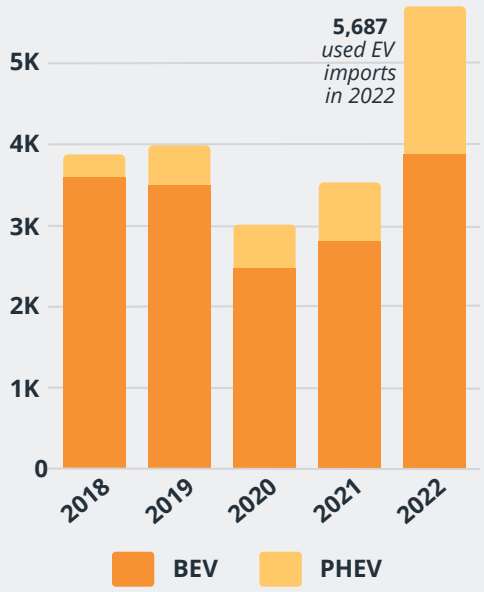
How does this compare to where our total fleet comes from?

Figure 18:
Value ($) of all light vehicle imports and parts from top five trading partners
July 2021



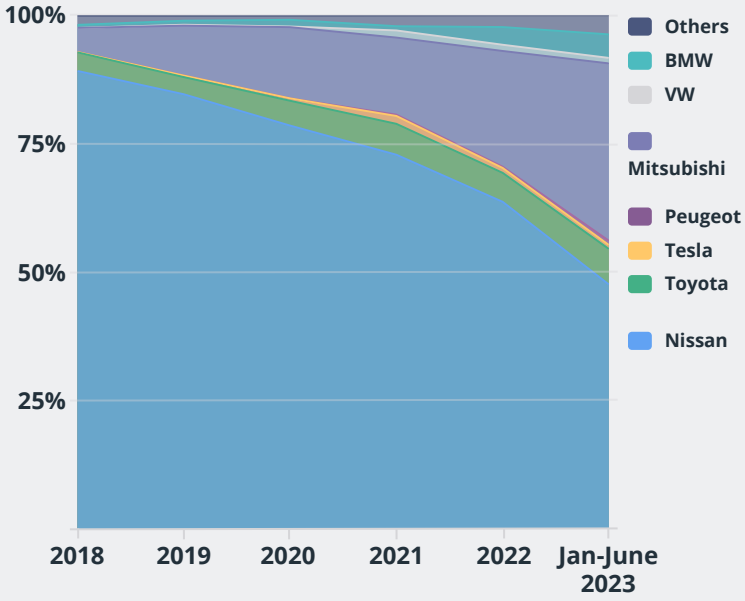
SPOTLIGHT: THE USED LIGHT VEHICLE MARKET

Figure 19:
Used plug-in light vehicle import registrations in New Zealand
2018-2022



Source: Te Manatū Waka | Ministry of Transport [3.16]

Figure 20:
Used plug-in import market share in New Zealand by OEM
January 2018 - June 2023



Source: Te Manatū Waka | Ministry of Transport [3.16]

LIMITED CHOICE

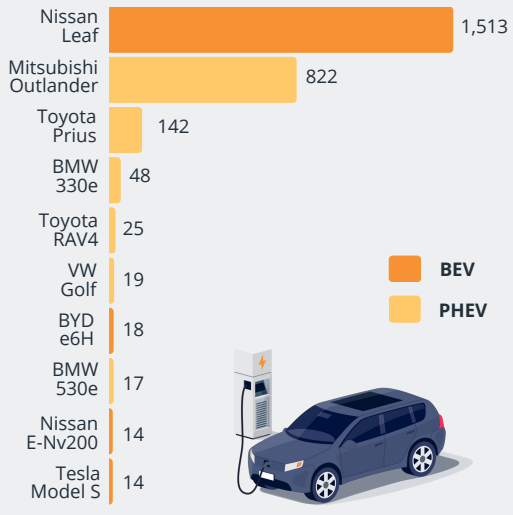
Around half of New Zealand's total monthly vehicle imports are used imports - primarily from Japan, where EV uptake is relatively low.[3.1] 80% of used imports are petrol or hybrid vehicles; the main exception is the Nissan Leaf (BEV).

There is still an upfront cost barrier, even with used EVs.

Some earlier EV models are now entering the domestic used car market. However, there are limited options below a $30k price point, and these models can have significantly less range than their next-generation counterparts.[3.27]

While the recent adjustment to the Clean Car Discount has increased the rebate for used EV imports, upfront cost can still be a major barrier to purchase exacerbated by the lack of supply. The Climate Change Commission has noted that a second-hand EV shortage is possible in the next few years.[3.28]

Figure 21:
Used plug-in light vehicle import registrations by model
January - June 2023



Source: Te Manatū Waka | Ministry of Transport [3.16]

SPOTLIGHT: LIGHT COMMERCIAL VEHICLES

Light Commercial Vehicles (LCVs) account for

16%

of New Zealand's entire vehicle fleet.

Plug-in vehicles account for just

1%

of our LCV fleet.

Source: Te Manatū Waka | Ministry of Transport [3.16]

UTES

In New Zealand, utes are popular as both a trade and lifestyle vehicle. They currently account for ⅔ of our LCV fleet.[3.16]

Our most popular ICEV utes, including the Toyota Hilux, Ford Ranger and Nissan Navara, are among the most polluting light vehicles available.[3.16, 3.29]

Currently, we only have one electric ute model available.

While electric car model availability in New Zealand has drastically increased, especially since the Clean Car Discount came into effect, ute models have not yet followed in numbers. In fact, the only ute currently available is the LDV eT60.[3.30]

With low-emission model options limited, and the purchase rebate, ute purchasers have had little choice but to pay what has become known as the 'ute tax'. Despite this, utes accounted for 1 in every 10 vehicle registrations in New Zealand in June 2023.[3.16]

Most of New Zealand's popular automakers are already phasing out ICE vehicles, and it is expected they will include utes in their new plug-in offerings.

As noted on p.16, Ford will produce only zero-emission vehicles from 2035, and Toyota and Nissan both have 2030 electrification targets - 30% and 50% EV production, respectively.[3.13]

Vans are traditionally a workhorse vehicle in the New Zealand fleet, often carrying heavy loads and travelling significant kms each day.

Vans make up 4% of New Zealand's total vehicle fleet, but are responsible for up to six times more carbon emissions per year than the average car.[3.16]

A courier's day may involve 200 to 400 stops per day, which combined with the load they carry, results in poor fuel consumption and high emissions.

Additionally, courier runs are often in urban areas; vans contribute to poor air quality and 'harmful emissions' about five times more than a passenger vehicle.[3.16, 3.31]

So, vans are an important category to decarbonise in the effort to meet our emissions reduction targets.

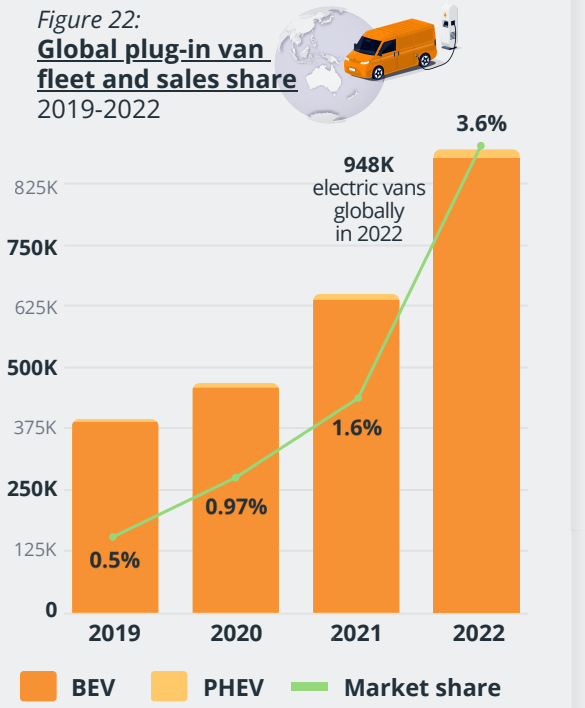
Currently, we have 15 electric van models available.[3.17] New Zealand has seen electric vans enter the market from LDV, Renault, Mercedes and more recently Ford and Peugeot.[3.32] Both the range and weight capacity of the available models has steadily improved each year.

Electric vans make up 1.1% of all vans on NZ roads. The global electric van fleet has grown at a much faster rate than in New Zealand; market share of electric van sales globally in 2022 was 3.6%; more than double the market share in New Zealand.[3.16]

Why?
The electric vans available in New Zealand that provide significant range, weight capacity and safety ratings are above the Clean Car Discount purchase price threshold. This has likely contributed to a lower than expected uptake of electric vans to date.

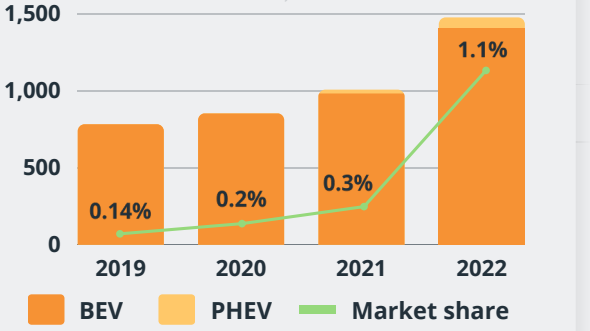
If expanded incentives were implemented for vans, uptake would likely accelerate, and would achieve a much higher return on investment in terms of reduced emissions per model than passenger cars.

Figure 22:
Global plug-in van fleet and sales share
2019-2022



Source: International Energy Agency (IEA) [3.1]

Figure 23:
New Zealand plug-in van fleet and sales share
2019-2022



Source: Te Manatū Waka | Ministry of Transport [3.16]

New electric van models are expected to enter the New Zealand market from 2024.

The annual sales share of electric vans globally is projected to increase to 23% by 2030; hopefully, New Zealand will follow a similar trend in the coming years.[3.1]

SPOTLIGHT:
MOBILITY-AS-A-SERVICE AND RIDE SHARING

Whilst we have seen growth in the Mobility As A Service (MaaS) and ride-sharing sectors, these new models of car ownership and passenger travel are still in their infancy in New Zealand compared to Europe, North America and Australia.

Shared micro-mobility (such as e-scooter and e-bike app services) has seen significant growth in New Zealand, but the passenger sector needs further investment to encourage New Zealanders to mode shift.

By bundling transport services, MaaS and ride sharing services reduce the need for individual vehicle ownership, leading to less incidental usage of vehicles and less traffic congestion, ultimately contributing to a lower carbon footprint; it is reported that 5-15 cars are replaced for each shared car that is added to a fleet.[3.33] If these services are primarily run using electric vehicles, the emissions reduction benefits are further amplified.

New Zealand currently has one of the highest car ownership rates in the OECD, and car parking across most of the country is still relatively cheap compared to Europe and North America.[3.33] Our public transport is also limited in many settings, and the majority of our urban design still encourages car ownership.[3.34]

EECA's Low Emissions Transport Fund has supported demonstration projects that expand car sharing services, and there is an increasing spotlight on businesses that continue to include cars and car parks in salary packages for staff who do not require a car for business requirements. Several businesses have already adopted MaaS services, such as Zilch, as an alternative to managing a traditional corporate fleet.[3.35]

Ride Sharing in our large cities is increasing, with services like Uber and Ola, and with an increased offering of electric vehicles available for rides. In a landmark move, Uber recently announced a $7.5 million investment designed to accelerate New Zealand's electric vehicle (EV) transition with a new EV subsidy programme for drivers from 1 July 2023; BEV drivers will be eligible for a 50% service fee discount of up to $5,000 per year over two years. [3.36]

Whilst scaled autonomy is still a long way off for New Zealand, we only have to look at the emergence of autonomous electric Robotaxis for fare-paying customers in San Francisco with Alphabet's Waymo and General Motors' backed Cruise, to appreciate that this change is already happening globally. [3.37, 3.38]

Policy and private investment that supports the growth of MaaS and ride sharing businesses, and eventually autonomous ride sharing, will help to reduce overall transport emissions and facilitate convenient, affordable transport solutions for New Zealanders.

LIGHT VEHICLE SALES TRENDS

In June 2020, 2.3% of light vehicles registered in New Zealand for the first time were plug-in vehicles.

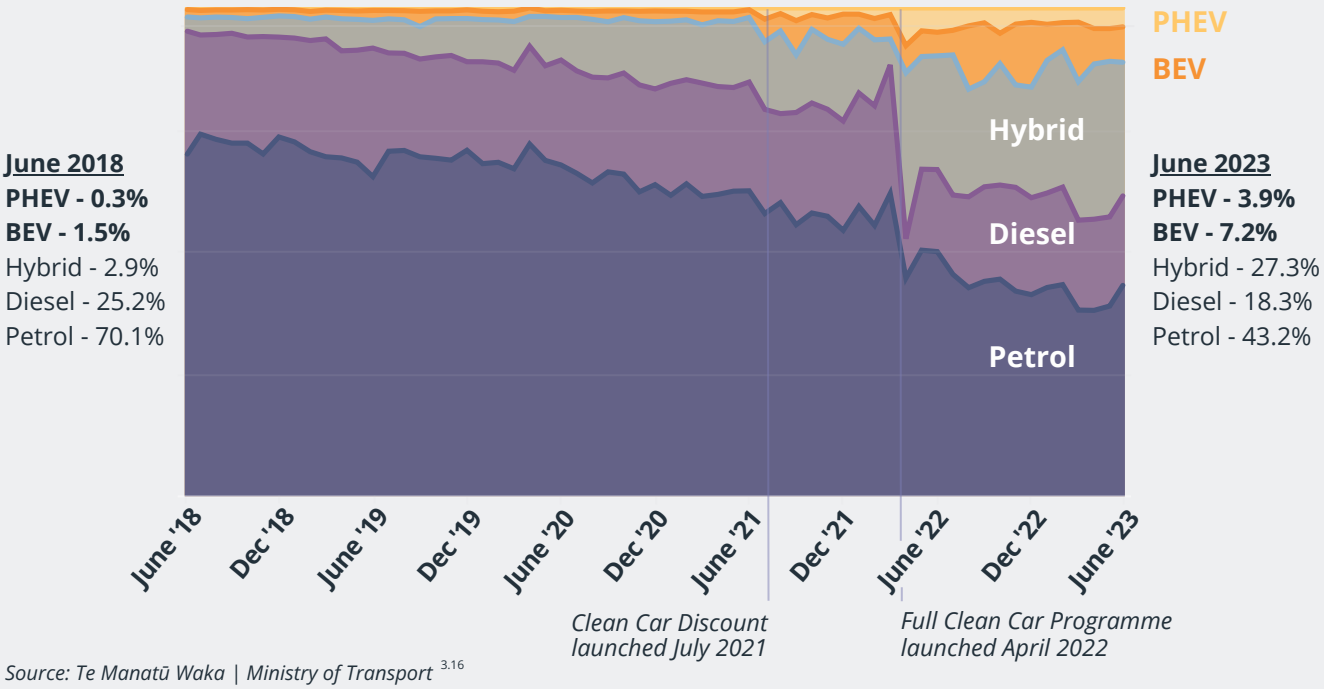
Just three years later, the average monthly market share of EVs is 12.6%.[3.16]

EV registrations progressed slowly until July 2021 (the first stage of the Clean Car Programme), then more than doubled in 2021, and almost tripled between 2021 and 2022. Increasing model availability and downward price movement have also likely contributed to uptake.

New and used BEVs comfortably outsell PHEVs by almost two to one.

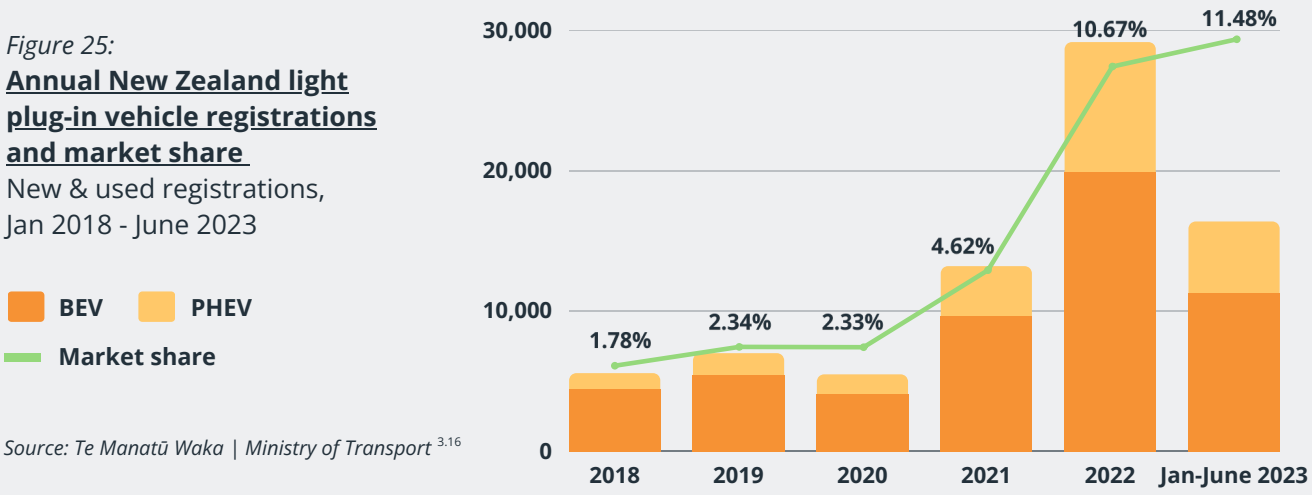
It's worth noting that plug-in registrations account for a much larger share of the new light vehicle market than our total light vehicle market. This is because our used import market, which accounts for half of our monthly registrations, is still dominated by ICE vehicles in part down to the lack of secondhand plug-in stock.

Figure 24:
New Zealand light vehicle market share by fuel type
New & used registrations, June 2018 - June 2023



Source: Te Manatū Waka | Ministry of Transport [3.16]

Figure 25:
Annual New Zealand light plug-in vehicle registrations and market share
New & used registrations, Jan 2018 - June 2023



Source: Te Manatū Waka | Ministry of Transport [3.16]

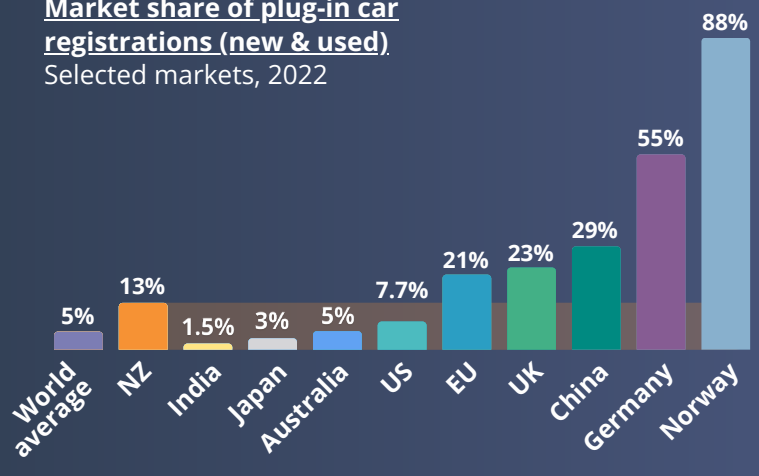
INTERNATIONAL SALES COMPARISONS

How does our EV market share compare globally?

New Zealand ranks 17th globally in new and used electric car sales share of total light vehicle sales in each country. Norway leads with 88% of all light sales being plug-in.

Norway remains the global leader in uptake, with China emerging quickly as a fast follower.

Figure 26:
Market share of plug-in car registrations (new & used)
Selected markets, 2022

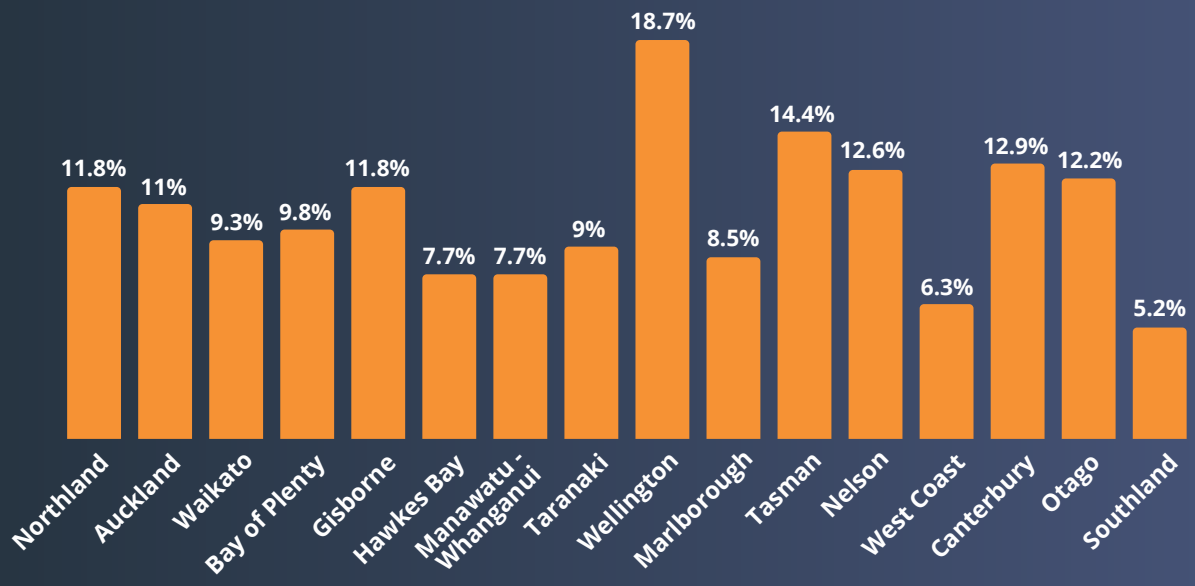


Source: International Energy Agency (IEA) [3.1]

REGIONAL LEADERS

Wellington, Canterbury, Nelson, Tasman and Otago are leading in EV registrations per capita.

Figure 27:
EV market share by New Zealand region
Registrations of new & used cars
June 2023



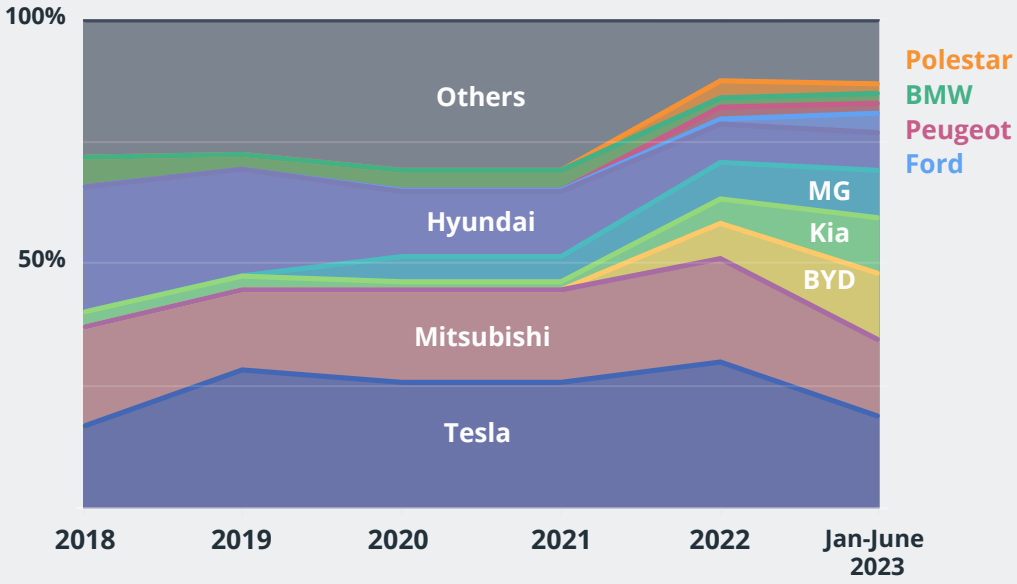
Source: EVDB [3.39]

Figure 28:

Market share of new plug-in light vehicle registrations by brand

June 2018 - June 2023

While Tesla, Hyundai and Nissan have historically dominated new plug-in sales, new market players such as BYD, MG, Kia and Polestar are gaining traction.

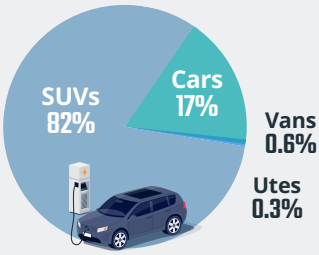


Source: Te Manatū Waka | Ministry of Transport [3.16]

Figure 29:

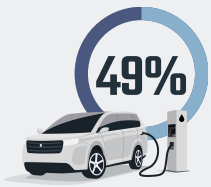
Light EV market share by body type

January- June 2023

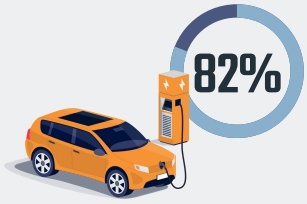


New import registrations - BEVs and PHEVs
Source: Te Manatū Waka | Ministry of Transport [3.16]

SUVs dominate our light vehicle sector.



of **total** new light vehicle registrations are SUVs [3.16]

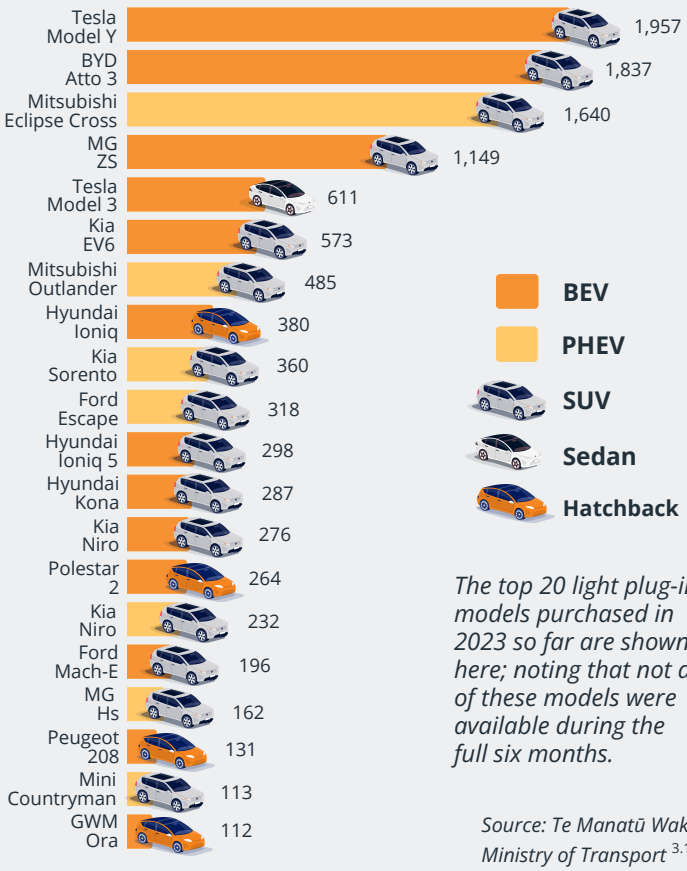


of new light **plug-in** registrations are SUVs [3.16]

Figure 30:

Top 20 light plug-in models in New Zealand

New import registrations January - June 2023



The top 20 light plug-in models purchased in 2023 so far are shown here; noting that not all of these models were available during the full six months.

Source: Te Manatū Waka | Ministry of Transport [3.16]

LIGHT EV MARKET OUTLOOK FOR NZ

WE ARE CURRENTLY ON TRACK FOR OUR 2035 FLEET TARGET.

Given the impact of the Clean Car Discount and Standard, the increase in model availability and current sales trends, New Zealand is currently on track to meet our target of a **30% zero-emission light fleet by 2035.**

Projections by both EECA and the Climate Change Commission see EV market share exceeding targets. This relies on continued growth in supply, and on the continuation of government policies that drive uptake.

> **EECA in 2021:**
> *"50% of light vehicle imports will be electric by 2027, with 40% of the fleet electric by 2035."* [3.40]

> **Climate Change Commission in April 2023:**
> *"From 2025 to 2030, our demonstration path sees annual light EV registrations climb from 11.5% to 67% of the market and reach 100% percent by 2035. This means 100% of cars entering the New Zealand fleet, whether new or used, are electric in 2035."* [3.28]

How many EV registrations do we need to hit our 30% zero-emission fleet target by 2035?

5x GROWTH in annual EV registrations between 2022-2030.

Plug-in vehicles will need to account for

of annual light vehicle registrations.

This requires a jump from 29K EV registrations in 2022 to

150,000 annual EV registrations by 2030.

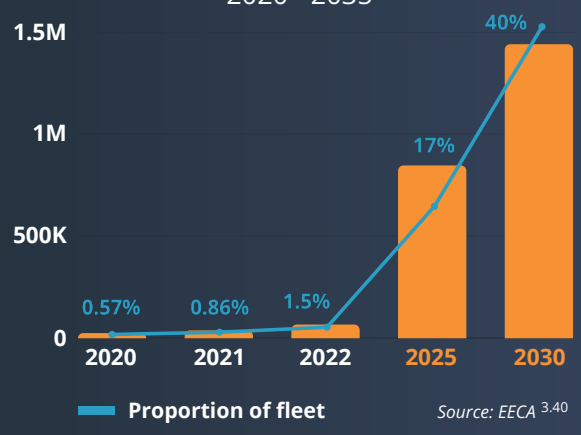
If the NZ light vehicle fleet stays the same size (~4.4 m vehicles), we would need to **add**

2.12M more EVs to our fleet by 2035

and **eliminate** **2.12M** ICE vehicles

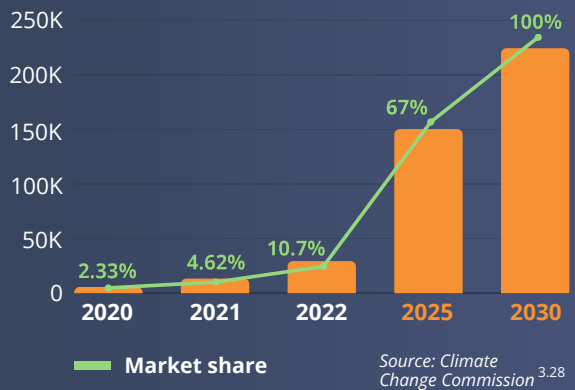
3.16, 3.28, 3.40

Figure 31:
EECA - light BEV fleet projections for NZ
2020 - 2035



Source: EECA [3.40]

Figure 32:
Climate Change Commission - annual BEV registration projections for New Zealand
2020 - 2035



Source: Climate Change Commission [3.28]

ELECTRIC MICRO-MOBILITY

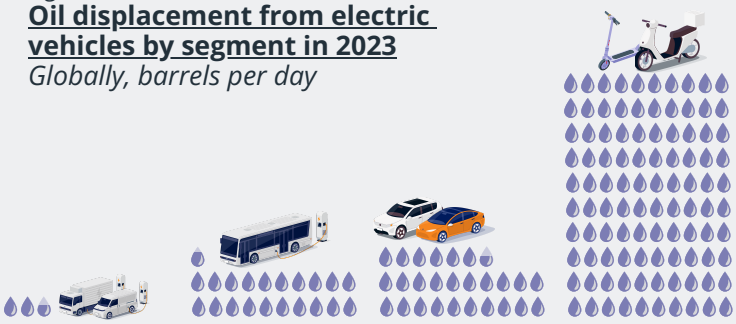
Micro-mobility refers to small two or three-wheeler vehicles such as bikes, mopeds, scooters and motorcycles. It is the most electrified vehicle market segment in the world today; in emerging markets and developing economies, these vehicles outnumber cars.[4.0]

As city populations continue to grow over the coming decades, this sector will play an increasingly important role in decongestion and emissions reduction. Micro-mobility is an ideal solution for many commuters, and for last-mile delivery for couriers and commercial operators.

Electric micro-mobility adoption has not progressed as rapidly in New Zealand as it has globally.

Globally, there are 10 times as many electric scooters, mopeds and motorcycles on the road as electric cars, accounting now for almost half of all micro-mobility sales, and responsible already for eliminating more carbon emissions and displacing more oil than the entire four-wheel EV market.[4.1, 4.2]

Figure 33:
Oil displacement from electric vehicles by segment in 2023
Globally, barrels per day

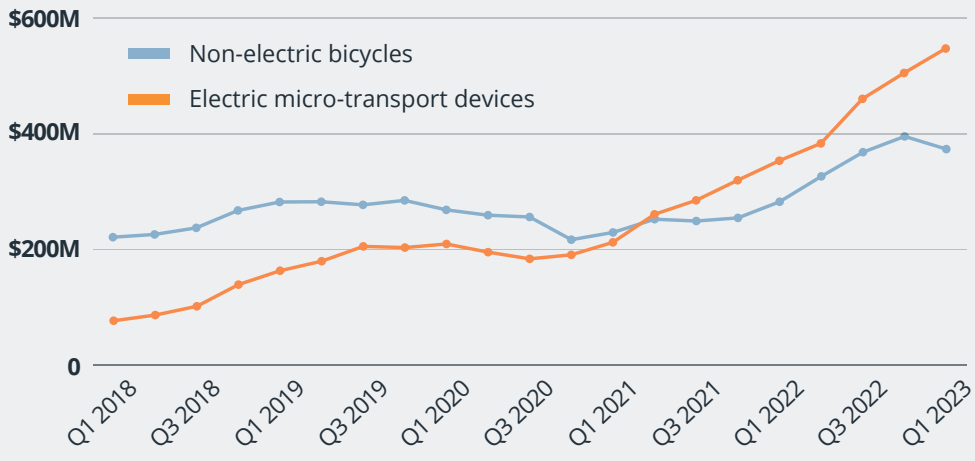


Vans and trucks	Buses	Passenger vehicles	2 and 3 wheelers
26,164	207,482	264,382	997,230

EVs of all types are already displacing 1.5 million barrels of oil usage per day, equivalent to about 3% of total road fuel demand.

Source: BloombergNEF [4.2]

Figure 34:
Value of micro-transport device imports in New Zealand
March 2018–March 2023



'Electric micro-transport devices' includes electric bicycles, scooters, mopeds and motorcycles.

Source: Statistics NZ [4.3]

Out of the **2,556** mopeds sold last year in NZ, only **613** were electric.[4.4]

1/3

of our car trips in New Zealand are **2 km or less.**[4.5]

The driver is the sole vehicle occupant on **two-thirds of our trips** (rising to 90% when commuting to work).[4.6]

Given our propensity for short solo trips, there is a large opportunity to mode shift to active transport and electric micro-mobility while travelling and commuting in our urban areas.

This would require a significant mindset shift amongst NZ drivers, and for the electric two-wheeler market to dramatically expand.

A growing number of New Zealand-based and international electric micro-mobility options are entering the market for outright sale, as well as subscription and ride-share business models.

New Zealand electric micro-mobility innovators:

- **UBCO** has developed a unique e-moped classified vehicle for the on-road and off-road segments.[4.7]
- **Hybrid Bikes** builds lightweight carbon fibre E-bikes for off-road riding, commuting and touring.[4.8]
- **FTN Motion** is launching an electric urban motorbike in December 2023.[4.9]

Electric micro-mobility uptake has increased, but there's considerable scope for more.

- E-scooters and bike-share schemes have become commonplace in our larger cities and are being used by a wider range of riders; however, these schemes have seen mixed success so far.
- Councils in New Zealand are increasingly installing cycle lanes and shared multi-modal service ways as part of their overall transportation strategies.[4.10]
- In April 2023, the Government removed Fringe Benefit Tax (FBT) from e-bikes, e-scooters and public transport to encourage businesses to support employees to mode shift. Other micro-mobility options such as e-mopeds weren't included in this policy.[4.11]

Having the right roading infrastructure and policy settings in place will be essential to encouraging change in consumer mindsets and transport behaviours.

Experience in several European countries and the UK has shown that modest incentives can be transformative for the adoption of e-mopeds and e-bikes, and therefore are a quick win for congestion reduction as well as decarbonisation.[4.12]

WHAT COULD HELP TO ENCOURAGE ELECTRIC MICRO-MOBILITY UPTAKE IN NEW ZEALAND?

- Nationwide campaigns and programs that encourage transitions to micro-mobility and active transport
- Standardisation of safety policy and speed limits for micro-mobility devices
- Urban planning that makes micro-mobility safer and more convenient
- Incentives for schools and businesses to offer micro-mobility options to staff and students
- Financial incentives for purchases of electric micro-mobility solutions

HEAVY ELECTRIC VEHICLES

Heavy vehicles account for only 3-4% of New Zealand's vehicle fleet, but they produce nearly 30% of our transport carbon emissions.[5.0, 5.1]

Heavy vehicles use diesel fuel, which has significantly greater impacts on air quality and human health than petrol vehicles. In 2016, diesel vehicles were responsible for most of the $10.5 billion per year of social costs and 2,200 premature deaths from vehicle-generated air pollution in New Zealand.[5.2]

Freight demand is projected to increase by 46% over the next 20 years,[5.3] so the need to electrify our heavy fleet to reduce our overall transport emissions will only intensify.

ELECTRIC TRUCK MARKET

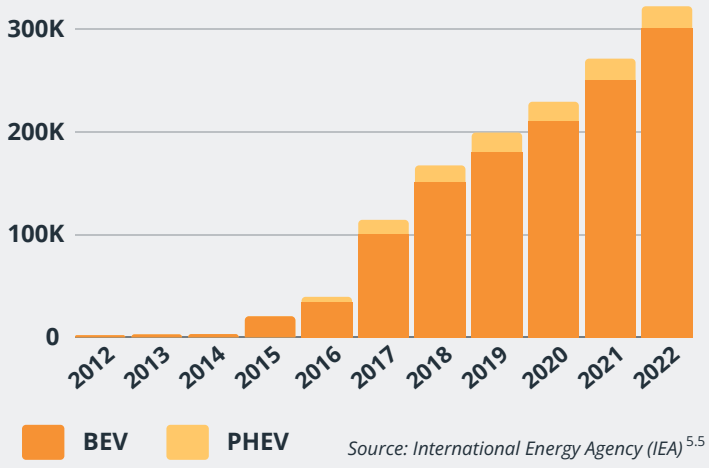
In 2022, nearly 60,000 electric trucks were sold worldwide, representing about 1.2% of truck sales.[5.4]

While the global electric truck fleet has grown from 1,600 to 320,000 since 2012, these vehicles only account for 0.4% of the total fleet.[5.4, 5.5]

In New Zealand, registration numbers of electric trucks more than doubled between the end of 2021 and 2022. These sales were almost entirely BEVs. Despite this, we only have 141 heavy electric trucks on our roads.[5.0] Out of this limited fleet, 31 of these BEVs are Waste Management's self-converted rubbish trucks, and around another 30 are other retrofit conversions, mainly from SEA Electric.[5.6, 5.7]

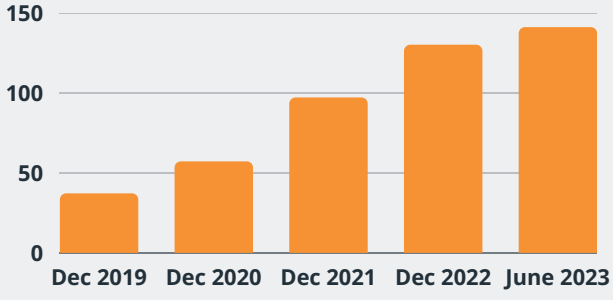
While there are around 280 heavy and mid-duty electric truck models available globally, only 10-15 are currently available in New Zealand.[5.8]

Figure 35:
Global plug-in truck fleet
2012 - 2022



Source: International Energy Agency (IEA) [5.5]

Figure 36:
Battery electric truck fleet in New Zealand
2019 - 2023



Source: Te Manatū Waka | Ministry of Transport [5.0]

Lack of electric truck uptake, especially compared to uptake within our light fleet, could be down to a few factors: [5.3]

- New Zealand currently has no fuel efficiency standards or targets for heavy vehicles.
- New Zealand is a right-hand drive (RHD) market, which limits vehicle supply.
- The upfront cost of electric trucks are still significant barriers for fleet operators.
- There is limited heavy charging infrastructure and this is also expensive.

Japan and the UK - two of the largest RHD markets - have both set electrification targets and implemented purchase subsidies or grants for their heavy fleets.[5.9] Suppliers will prioritise countries where uptake is most likely.

BEVs are inherently heavier than their ICE counterparts, so New Zealand's viability as a market for OEM suppliers is also compounded by our weight restrictions on axle loadings.[5.3]

Estimated annual operating COST SAVINGS for a BEV truck: [5.3, 5.4, 5.10]

$30K saved in Road User Charges

$7K saved in maintenance costs

33% of the cost of diesel per 80,000km

ELECTRIC TRUCK MARKET OUTLOOK

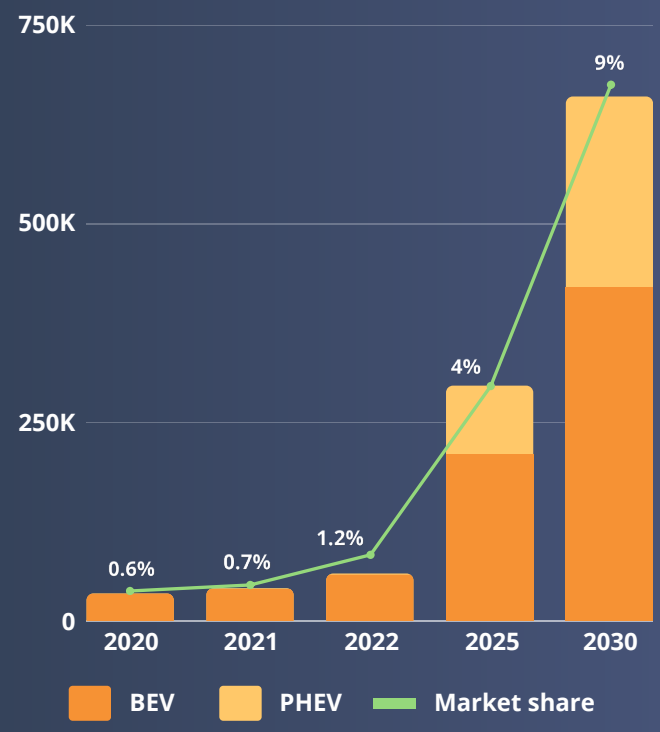
New Zealand has committed to electrifying our heavy truck fleet.

While we have not yet implemented legislation, New Zealand is one of 27 governments who have pledged to achieve 100% zero-emission bus and truck sales by 2040 under the Drive To Zero agreement.[5.11] So, we are globally accountable to accelerate uptake.

Global availability will increase.

Major brands such as Daimler, Volvo, and Scania have made commitments to either solely produce BEV trucks or become carbon neutral by 2040, and purchase price parity with diesel trucks is expected within the next decade.[5.12] Global market share is projected to increase significantly, from 1.2% in 2022 to 9% in 2030.[5.5]

Figure 37:
Global annual sales projections for plug-in trucks under the Stated Policies Scenario (STEPS)
2020-2030



Source: International Energy Agency (IEA) [5.5]

Electrification will start at the lighter end of the heavy truck sector.

Our medium-duty truck fleet is easier to electrify; medium trucks with urban routes have more opportunity to use stop/start regenerative braking and return to depots regularly throughout the day, so charging top-ups are possible.[5.3] So, short-haul freight delivery, courier trucks and waste or recycling trucks will likely be the sectors to lead in electric truck adoption in the next few years; several applications have already been successfully demonstrated via funding through the Low Emission Transport Fund.

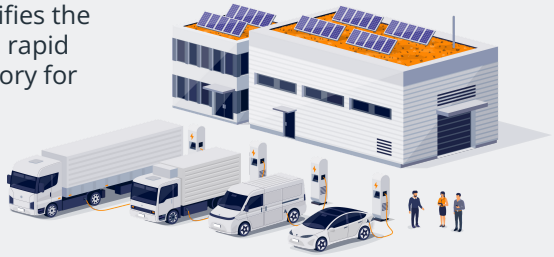
Around 80% of all truck movements in New Zealand are within regions, and so can be electrified with today's battery electric technology and average range.[5.13]

What could accelerate the electrification of the New Zealand truck fleet?

Policies that reduce the upfront costs of heavy vehicles and depot based charging infrastructure, including network upgrades, and enable the development of a public heavy charging network.

The Government's Budget 2023 announced financial incentives for zero emission trucks.[5.14]

$30 million over three years has been allocated for grants towards the purchase of around 500 low emissions heavy vehicles, including trucks, heavy vans and non-public transport buses. This announcement hopefully signifies the beginning of a rapid growth trajectory for heavy EVs.



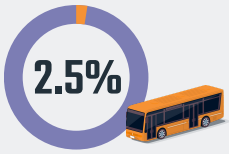
ELECTRIC BUS MARKET

In 2022, 65,000 electric buses were sold worldwide, representing 3.8% of all bus sales.[5.5] The global electric bus fleet has grown from 7,180 to 800,000 since 2012; electric buses now account for 3% of the total global bus fleet.[5.5]

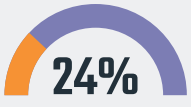
The 11,600 buses on our roads are a crucial component of New Zealand's transport decarbonisation puzzle.[5.0, 5.15]

Our ~2,600-strong public bus fleet in New Zealand drives 80,000km on average, nearly six times the average distance of our light vehicle fleet.[5.15, 5.16] So, each bus we electrify delivers a significantly larger reduction in emissions per vehicle.

We also have roughly 9,000 buses on our roads used by schools and the private sector.[5.16]

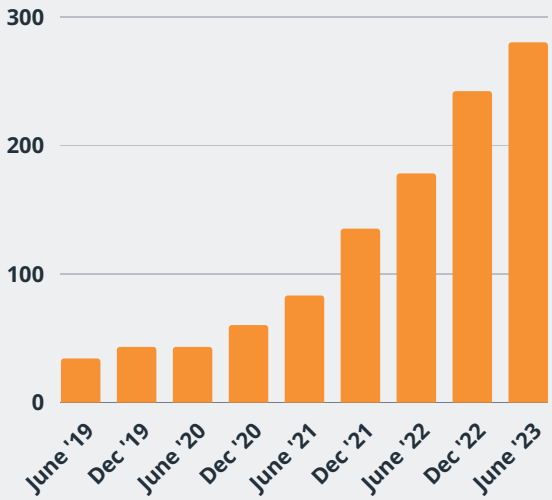


of New Zealand's current bus fleet is a BEV or PHEV [5.0]



of all new bus registrations in NZ were electric in 2022 [5.0]

Figure 38:
Battery electric bus fleet in New Zealand
June 2019 - June 2023



Source: Te Manatū Waka | Ministry of Transport [5.0]

Currently, the NZ fleet has 280 BEV and 3 PHEV buses; all but 10 of these electrified buses are used by the public transport sector.[5.17]

While New Zealand has made good progress, electric bus sales in countries with strong nationwide public transport decarbonisation policies have reached much higher market shares; in Finland, for example, electric bus sales accounted for over 65% market share in 2022.[5.5] New Zealand public transport policy is often split between regional councils and central government, which can constrain progress.[5.15]

While there are around 400 electric bus models available worldwide, only 12 models are currently available in New Zealand.[5.0, 5.8]

Besides lack of availability, there are also significant cost barriers to BEV bus uptake:[5.13]

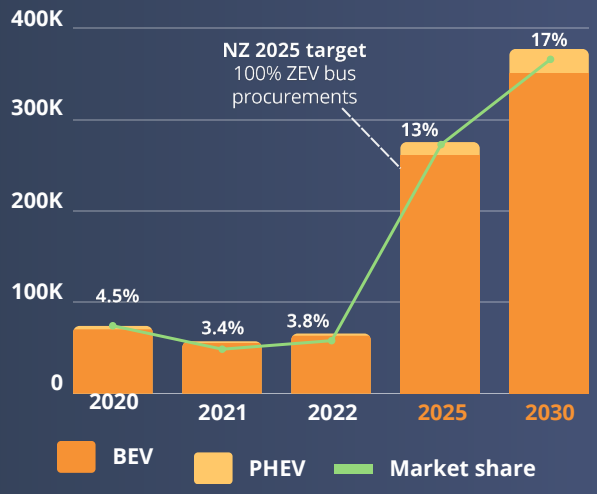
- Estimated upfront capital cost for a new BEV bus is ~$750,000, whereas a new diesel bus costs ~$420,000.
- There is not a mature used vehicle market for electric buses.
- Charging units for buses cost ~$70,000 per 80kW charger.
- Depot reconfiguration and grid connection upgrades are often costly and logistically complex.

ELECTRIC BUS MARKET OUTLOOK

Global market share will increase to 17%, with over 377,000 annual bus sales by 2030.[5.5]

Several right-hand drive markets, including the UK and Japan, have also implemented decarbonisation targets and subsidy schemes for their public bus fleets,[5.9] and many of the world's largest bus manufacturers have made commitments to zero-emission technologies.[5.18] This bodes well for future BEV bus availability for New Zealand, and more competition will likely lead to a decrease in purchase prices; both factors will help to accelerate uptake.

Figure 39:
Global annual sales projections for plug-in buses under the Stated Policies Scenario (STEPS)
2020-2030



Source: International Energy Agency (IEA)[5.5]

New Zealand targets go much further:[5.19]

2025

All new buses procured from 1st July must be zero-emission

2035

Public transport bus fleet completely decarbonised

BEV buses have been rolled out across several routes in Auckland, Tauranga, Wellington, and Christchurch, and most public transport contracting authorities in regions with larger bus fleets have signalled intentions to accelerate uptake.[5.15, 5.17]

MARINE ELECTRIC TRANSPORT

Our $2.9B boating industry is growing and constantly innovating.[6.0]

1.9 MILLION

New Zealanders take part in boating annually.[6.0]

There are 

1.5 MILLION

boats on our waters, growing by an additional **45,000 annually**[6.0]

The marine industry is New Zealand's largest non-agricultural manufacturing industry. We have an international reputation for high-tech design and world-firsts in boating.[6.0]

BENEFITS OF ELECTRIC MARITIME TRANSPORT

Source: WEBBCo [6.1]

Electric marine transport is in its early stages; upfront costs are still relatively high, there are different sets of challenges with charging, and there are limited models available globally. That said, New Zealand's boat makers and operators are making great progress in this space, and uptake will only accelerate from here.

ELECTRIC FERRIES

Ferries are an important component of our public transport system. As a means of mass transit, they help to alleviate congestion from our roads, provide access to island communities and shortcut much longer road journeys.

Initial capital costs for electric ferries are significant, so they are currently only financially viable for our busiest routes.[6.2]

Ferry transport is energy-intensive.

Auckland's ferries deliver

of all public transport journeys...

...but are currently responsible for

of public transport emissions.[6.2]

In terms of diesel use, replacing just one of Auckland's 30 diesel ferries with a BEV is equivalent to replacing 25 buses.[6.2]

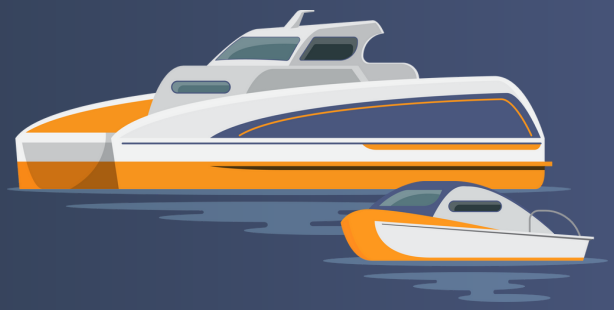
Auckland and Wellington are already showing excellent global leadership with their ferry fleets.

- Auckland has committed to decarbonising its ferry fleet by the early 2030s, and is procuring a megawatt-level charging network for its ferries.[6.3]
- A total of seven electric or electric hybrid ferries are currently on order for Auckland's ferry network, to be launched from 2024 onwards.[6.4]
- New Zealand's first fully-electric passenger ferry, East By West's Ika Rere, has been in full commercial operation in Wellington early 2022 and has saved more than 220,000kg in carbon emissions in just one year of operation, costs 82% less to run and needs significantly less maintenance than its ICE counterparts.[6.5]

COMMERCIAL ELECTRIC BOATS

Electrified commercial work boats and tourism vessels are being adopted nationwide.

- Ngāi Tahu is planning to electrify at least half of their jet boat fleet (Central Otago and Taupō) by 2030. They launched the world's first electric jet boat in 2022, with co-funding support from EECA.[6.6]
- A 10-seat electric foiling boat will be offering high-end tourism trips in the Hauraki Gulf from September 2023, in a partnership between Fullers360 and Seachange.[6.7]
- Ports of Auckland is aiming to significantly reduce fleet emissions by 2040; they are currently operating an electric tug boat, and have plans for further electrification.[6.8]
- Electric and hybrid catamarans, either new or converted, are becoming more commonplace amongst tourism operators in Taupō, Rotorua and the Southern Lakes, and for commercial use in Tauranga.[6.9, 6.10, 6.11, 6.12]



PRIVATE ELECTRIC BOATS

A range of electric boat options for personal use are entering the market at pace.

- Electric outboards and outboard propulsion systems are available through providers like E-Stroke and Evocean, and many popular models 'easily match a 3-hp petrol outboard'.[6.13]
- Next Generation Boats in Wānaka is currently showcasing one of Candela's electric hydrofoils, ahead of their release on the New Zealand market in December 2023.[6.14, 6.15]
- Start-ups such as ZeroJet and Naut have secured private funding and are now scaling their electric propulsion manufacturing operations rapidly.[6.6, 6.16]
- Kiwi success story Sealegs has announced the development and release of an electric amphibious tender.[6.17]

To assist in the decarbonisation of our marine fleet, continued public investment will likely be needed until the market matures further, both to close the cost gap and to de-risk uptake for manufacturers and operators.[6.1]

ELECTRIC AVIATION

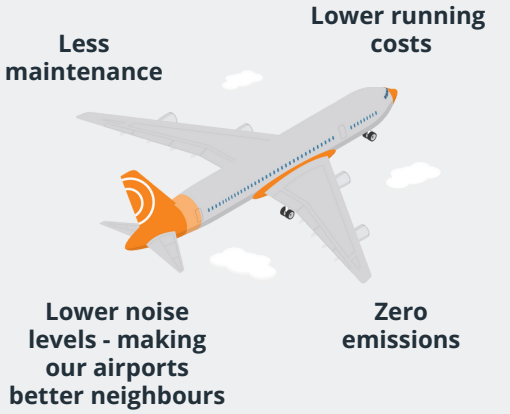
New Zealand has one of the highest rates of short-haul flights per capita of any country in the world, mainly due to our unique geography.

We rely heavily on aviation for personal, business and cargo transport between our hubs, particularly across the Cook Strait and between areas with difficult roads or limited public transport.[7.0]

Domestic aviation accounts for approximately 6% of New Zealand's greenhouse gas emissions.[7.1] However, the Climate Change Commission notes that because aviation is so vital to New Zealand, emissions need to be addressed by lower-emission technologies rather than reducing air travel.[7.2]

Aviation electrification will require deployment of charging facilities across New Zealand, supportive infrastructure such as increased line capacity, and significant investment from our operators and airports.[7.0]

BENEFITS OF ELECTRIC AVIATION



Source: Electric Air [7.0]

Electric aircraft technology is still in its infancy, but New Zealand operators are preparing for the future of flight.

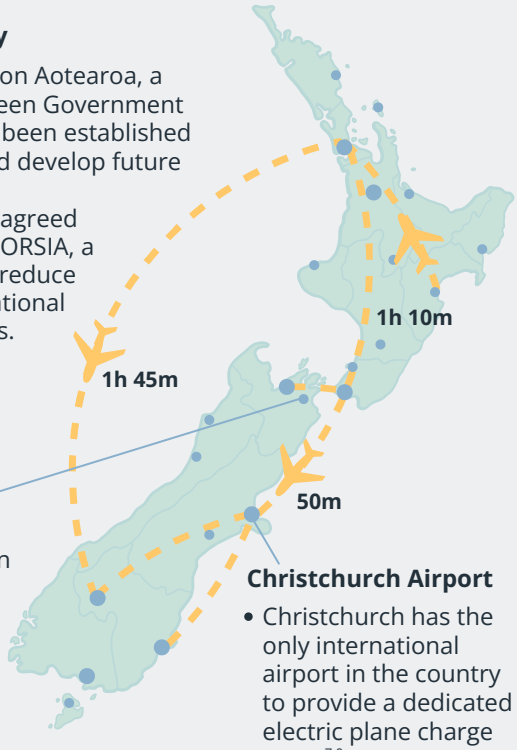
- Only one manufacturer currently produces a certified electric plane - a two seater designed for pilot training. ElectricAir operates one of these e-planes in New Zealand; it's used for training and demonstration flights.[7.0]
- Air New Zealand and Sounds Air are actively working with manufacturers to see 19-seater aircraft operating on domestic routes within the next five years.[7.3, 7.4]

Air New Zealand has committed to net-zero carbon emissions by 2050.[7.3] They are exploring four different zero-emissions aircraft, including battery electric, hydrogen and hybrid powertrains; indications are for BEV freight flights to commence in 2024 and passenger flights in 2025.[7.5]

The biggest electric plane currently in development globally is a 30-seater plane built by Heart Aerospace.[7.6] This model has been indicated as the likely 'next step up' for New Zealand; it is likely to be completing test flights in 2028.[7.7]

Government policy

- Sustainable Aviation Aotearoa, a partnership between Government and industry, has been established to help inform and develop future aviation policy.[7.8]
- New Zealand has agreed to participate in CORSIA, a global scheme to reduce and offset international aviation emissions. This will be implemented via the Civil Aviation Act 2023.[7.9, 7.10]



Blenheim

Sounds Air has been working towards becoming the first Australasian regional airline to offer electric passenger flights. In partnership with Heart Aerospace, they plan to have at least three 19-seater aircrafts set for take-off by 2026, and to fully electrify their fleet by 2030.[7.6]

Christchurch Airport

- Christchurch has the only international airport in the country to provide a dedicated electric plane charge point.[7.0]
- Electric autonomous air taxis have been undergoing testing in Christchurch by Wisk since 2017.[7.11]

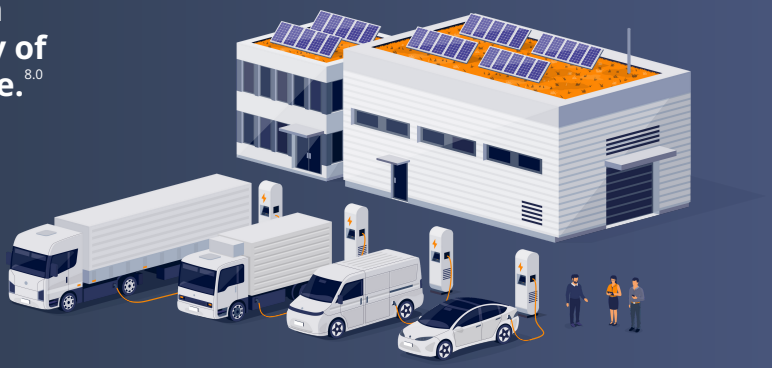
Source: 100% Pure New Zealand [7.12]

ELECTRIC VEHICLE CHARGING

Successful electric transport uptake in New Zealand hinges on the availability of robust, reliable charging infrastructure.[8.0]

While the number of charge points grows, our network requires further investment to keep up with current and future demand.

In our homes and workplaces, we need safe, energy-efficient and smart charging facilities, so that New Zealanders can be confident in their transition to electric transport.



UNDERSTANDING EV CHARGING IN NEW ZEALAND

A NEW LANGUAGE FOR DRIVERS

CHARGING PHASES

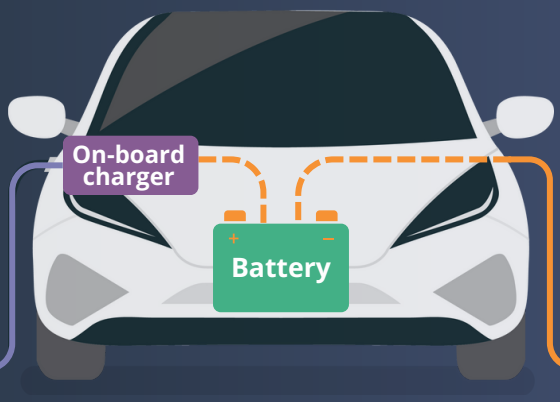
AC CHARGING

(Alternating Current)

- **Home**
- **Work**
- **Public**

AC power

1.8kW wall socket - 22kW charge point



DC CHARGING

(Direct Current)

- **Work**
- **Public**

DC power

25kW to 350kW+ charge point

The power that comes directly from our electricity grid is AC power, but EV batteries store DC energy.[8.1]

When you plug into an AC charger or your standard 3-pin power socket, your car will convert the power to DC. This is why AC chargers take a little longer to charge your vehicle than DC chargers.

AC charging is ideal for overnight charging at home, for daily top-ups and for fleet locations where vehicles have several hours to charge.

In public or for commercial applications, faster charging becomes more crucial; this is where DC chargers come in, because they feed DC power directly into the car's battery. They can deliver higher power outputs, but require robust 3-phase power supply to do so.[8.1]

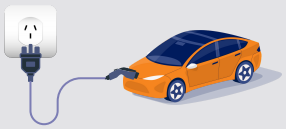
In New Zealand, public DC chargers have been deployed with power ranges spanning from 25kW to 350kW.[8.2]

CHARGING MODES

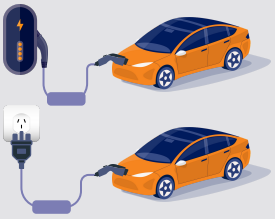
AC only

AC & DC

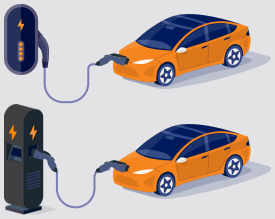
Mode 1
~1.8kW
Domestic socket



Mode 2
~1.8 - 7kW



Mode 3
22 - 50kW



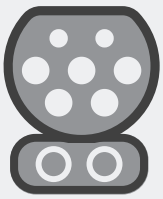
Mode 4
22 - 350kW DC
50kW AC

CHARGING CONNECTORS

Type 1

Type 2 (Mennekes)

CCS



CHAdeMO

Tesla

Sources: Standards New Zealand, Gen Less [8.4, 8.5]

For more details on charging terminology, see Appendix I.

CHARGING SPEEDS

These charging speed categories are currently the terminology used by Waka Kotahi New Zealand Transport Agency. Note that terminology varies between EV charging companies and between countries, and will also continue to shift as technology advances and faster charging solutions become more widely available.

<3kW
Trickle charge
Domestic wall socket

3-7kW
Slow
Home / workplace

7-22kW
Medium
Home, workplace, public

22-43kW
Fast
Workplace, public

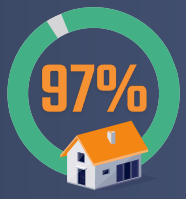
>43kW
Rapid
Workplace, public

Source: Waka Kotahi | New Zealand Transport Agency [8.6]

WHERE ARE WE CHARGING?

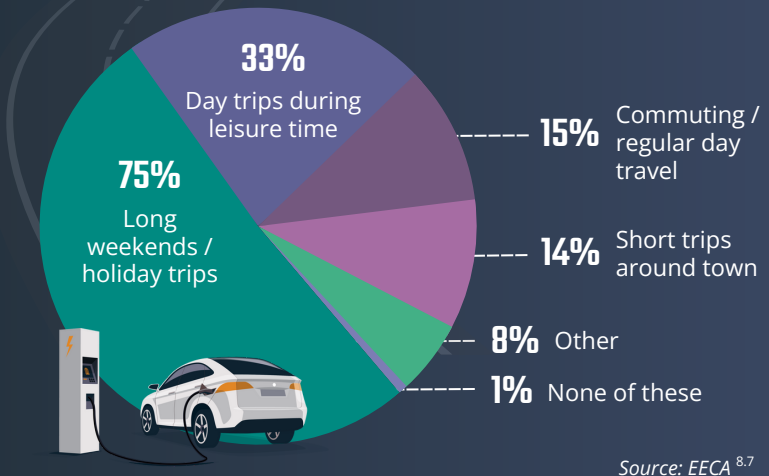
82%
of charging in New Zealand is done privately [8.7]

76%
of EV drivers use public chargers
(27% more than in 2021)[8.7]



of current EV owners charge at home at least some of the time [8.7]

Figure 40:
On what types of trips do New Zealand EV drivers typically use public chargers?



Source: EECA [8.7]

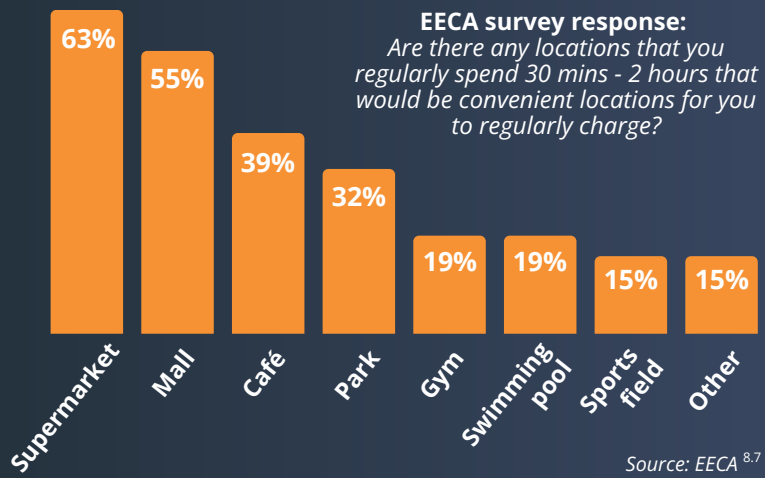
70% of BEV owners are taking trips that exceed their battery range every few months or less (therefore requiring public charging)[8.7]

Amongst EV drivers, the use of public charging stations has risen from 49% in 2021 to 76% in 2023.[8.7] This demonstrates growing reliance on public charging infrastructure to support long journeys, but it also speaks to the fact that our public charging network is starting to develop more quickly. New Zealand has a number of market players now including Jolt, Z Energy, BP, Tesla, ChargeNet and Meridian.

In New Zealand, the majority of electric vehicle charging currently takes place at home. However, around 15% of households in New Zealand lack a dedicated car park, making access to public charging crucial for these EV drivers in particular.[8.8]

Supermarkets and malls are seen as the most convenient option for public charging in New Zealand.

Figure 41:
Preferred charging locations for New Zealand EV drivers



EECA survey response:
Are there any locations that you regularly spend 30 mins - 2 hours that would be convenient locations for you to regularly charge?

Source: EECA [8.7]

Charging a BEV at home is the cheapest way to drive 100km in New Zealand.

LESS THAN $5
to charge at home;
even less if you take advantage of off-peak times.

$15
using a public fast charger

$18
using petrol

Source: Gen Less [8.9]

OUR PUBLIC CHARGING NETWORK

Charging providers have invested heavily in our public charging network so far, sometimes with support through EECA.[8.10]

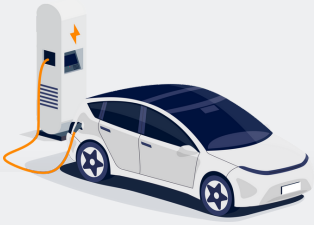
More operators are entering the market, and more sophisticated chargers are being rolled out, at an increasing pace.

680 PUBLIC CHARGERS

operating in New Zealand as of 2022, according to the IEA.[5]

We had just 20 public chargers at the end of 2016.[8.11]

The government target, set in 2021, of a public charging station every 75 km along our state highways, has nearly been met.[8.12]



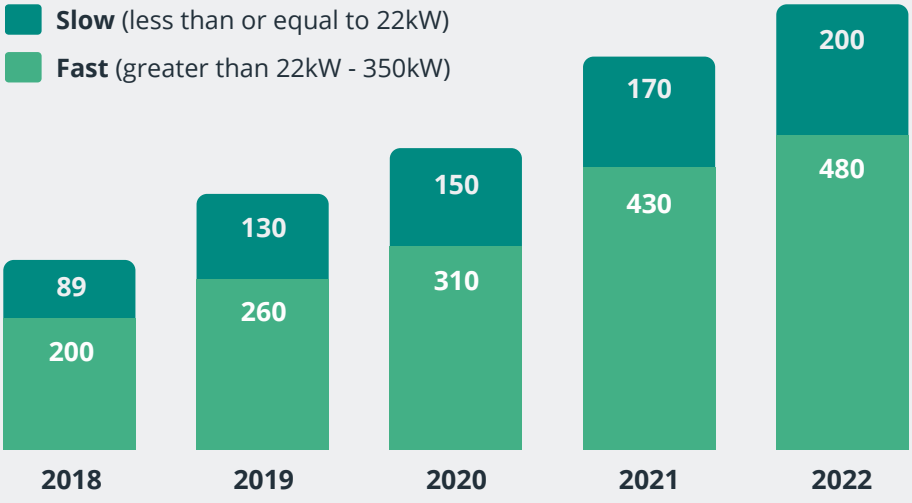
As of June 2023, the only gaps remaining within the targeted network are in low-traffic and hard-to-reticulate areas. There are plans to close these gaps in the near future.[8.13]

The forthcoming National EV Charging Strategy is likely to create new targets for roll-out.

Figure 42:
Publicly available EV chargers in New Zealand
2018 - 2022

Charging infrastructure growth in New Zealand has been steady, but needs to accelerate to match EV uptake.

Source: International Energy Agency (IEA)[8.14]

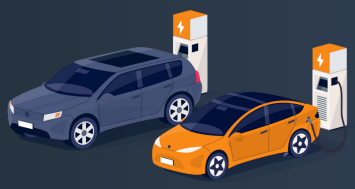


5 Currently there is not a publicly available and up to date source of all public chargers in New Zealand, covering all types of charger. In part this is because the NZ network is evolving in real time. As such we have used data from EV Roam and the International Energy Agency and sourced these as such. We acknowledge these are at a moment in time and depend on the methodologies used by those data providers. [8.10, 8.14]

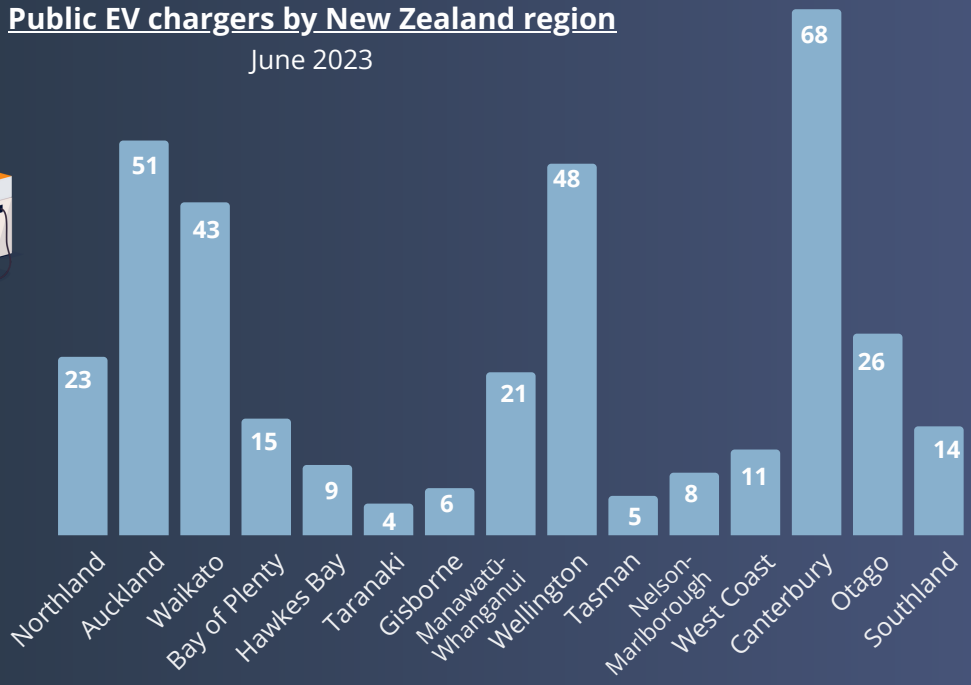
Figure 43:

Public EV chargers by New Zealand region

June 2023



Some regions are better served by public chargers (mainly metro regions).



Source: EV Roam [8.10]

Although the network is expanding, more investment is required to meet user demand.

- 42% of EV drivers feel there is a lack of public chargers within New Zealand.
- Queues are stopping 55% of drivers from using public chargers more often (Aucklanders particularly noting this is an issue.)
- There is also clear demand for more ultra-fast chargers on well-trafficked routes, particularly at petrol stations.

Along with increased convenience, charger etiquette will be key to ensuring that EV drivers have a positive public charging experience in future.[8.17]

Figure 44:

Common barriers to using public chargers for New Zealand EV owners

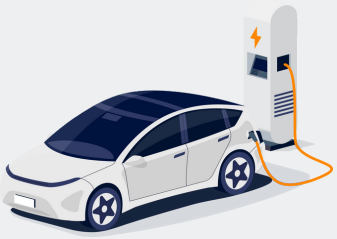
Having to queue / wait for a charger	**55%**
Cost to charge	**36%**
They aren't located in convenient places I'm passing/going	**29%**
It takes too long to charge	**17%**
There aren't any near enough to me	**16%**
Concerned about degrading battery through a fast charging network	**13%**
No room at public chargers when towing	**10%**
They're not all compatible with my EV	**9%**
I don't always know where to find them	**9%**
Concern about safety	**4%**

Source: EECA [8.7]

Currently there is not a publicly available and up to date source of all public chargers in New Zealand, covering all types of charger. In part this is because the NZ network is evolving in real time. As such we have used data from EV Roam and the International Energy Agency and sourced these as such. We acknowledge these are at a moment in time and depend on the methodologies used by those data providers. [8.10, 8.14]

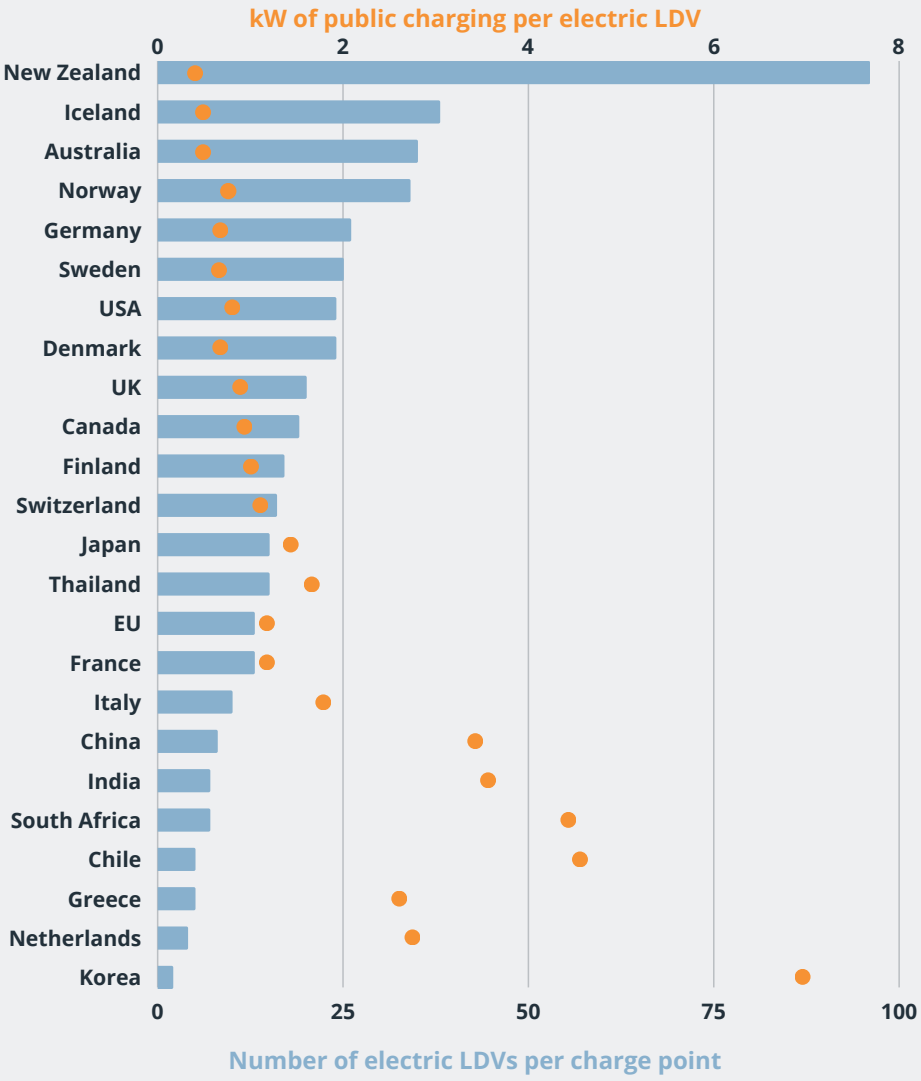
How do we compare globally?

Figure 45:
Number of electric light-duty vehicles per public charging point and kW per electric light-duty vehicle 2022



New Zealand is lagging behind comparable countries in public charging.

Source: International Energy Agency (IEA) [8.3]



PRIVATE CHARGING

HOMES AND WORKPLACES

82%
of charging in New Zealand is done privately [8.7]

61%
of home charging is done via a 3-pin socket [8.7]

What's available for home charging?

Wall chargers (non-smart)

Wall chargers are dedicated devices that allow you to safely draw larger amounts of energy and charge your EV at a faster rate.[8.4] However, smart chargers provide more benefits and are not much more expensive, so the sector is moving away from non-smart technology.

Smart chargers can: [8.4, 8.18]

- Integrate with smart-phones and schedule charging sessions remotely, and for off-peak times, when energy is more likely to be generated by renewables and prices are more likely to be low
- Optimise charging to protect EV batteries and 'load balance' with other home appliances
- Provide data to reimburse employees with company EVs
- Update via cloud technology so chargers do not 'age out'
- Interface with both battery storage and solar technology
- Provide remote visibility so technicians can address most errors without call-out fees

SMART CHARGING FOR HOME AND WORK

EV owners are already taking advantage of off-peak charging schemes via several forward-thinking energy retailers.

69%
Have access to off-peak pricing plans[8.7]

96%
Use off-peak times to charge most / some of the time[8.7]

The use of smart Mode 3 chargers is increasing significantly. We expect this to increase as more options enter the market and awareness of smart charging grows.

Figure 46:
Types of charging points New Zealand EV owners have at home in 2023

Charging cable - Mode 2 AC (3- pin plug)	**61%**
Wall mounted charger – Mode 3 AC with connectivity (smart)	**32%**
Wall mounted charger - Mode 3 AC without connectivity	**13%**
Caravan adapter	**14%**
Other	**2%**

+21% since 2021

Source: EECA [8.7]

Smart chargers can help reduce energy costs for households and enable effective fleet management for businesses.

Smart charging will be crucial to managing peak electricity demand nationwide as more EVs enter our fleet, and could also save the New Zealand energy sector close to $6.1 billion by 2050.[8.19]

Current barriers to smart charger adoption reported by New Zealand EV drivers:[8.7]

40% Happy with trickle charging

13% Cost or complexity of installation

8% No suitable location for a smart charger at home

28% Device cost

As EV uptake accelerates, measures must also be taken by policy makers to support the widespread adoption of smart chargers and move away from 3-pin charging.

Retro-fitting charging infrastructure typically doubles installation costs.[8.20] So, local and central governments should implement measures that incentivise or mandate installation of smart chargers in new commercial and residential builds.

WHAT ARE THE BARRIERS TO EFFECTIVE EV CHARGING AT HOME?

⅓ of New Zealanders live in rental properties and there is an increase in apartments.[8.21]
If tenants are interested in purchasing a BEV but lack access to an efficient charging setup at home, a transition may not be feasible for them.

EV charging isn't possible for some households in dense urban areas.
Although 85% of Kiwi homes have a dedicated car park,[8.0] the remaining 15% of these households will continue to depend on public charging facilities. The Worksafe Addendum also needs to be modified to encourage installations outside of the garage.

Retrofitting and power supply upgrades can be complex and expensive.
Most homes in New Zealand only have access to single phase power.[8.19] This is an AC supply system that is fairly limited in output capacity. If a household has multiple EVs, drivers may need to consider upgrading their switchboard capacity.

Charging installations require specialised expertise.
While there are several specialised EV charger installers in New Zealand, many Kiwis do not consider or research their home charging setup during the EV purchase process. There needs to be increased awareness around costs, timeframes and safety.

EV CHARGING OUTLOOK

Our charging sector is growing and evolving at pace.

That said, our public infrastructure is not yet matching demand in New Zealand, and is lagging behind other countries with notable EV uptake.

Drive Electric,[8.20] the Climate Change Commission[8.0] and many other organisations have stressed the importance of rapid action to build a high-quality public charging network that avoids the poor experiences currently hampering electrification, and minimises range anxiety.

Charging providers are planning to roll out many more stations across the national network; ChargeNet alone has committed to an additional 400 charging points over the next three years.[8.2]

It is estimated that around $400m will need to be invested in the public charging network in just the next 3-5 years.[8.19]

These operators are facing several barriers to investment in public charging:[8.20]

- New Zealand has 29 different electricity network businesses with different connection costs, charges, and processes.
- Depending on the region and site, these connection costs and ongoing charges can be prohibitive to investment.
- Connection processes and requirements are time-consuming.

Looking ahead, the regulatory environment for electricity network businesses must enable the rapid decarbonisation of transport through electrification. Both the Commerce Commission and Electricity Authority are currently considering this.

The government has consulted on its first National EV Charging Strategy which is set for release in 2023. This strategy must enable the systematic identification and resolution to the barriers to private sector investment in the charging network.[8.23]

2023 budget commitments announced in May, and the ambitions outlined in the draft national charging strategy bode well for the charging industry.[8.22]

The Government has allocated $120 million to the expansion of our charging network over the next four years.[8.22]

This funding will support:

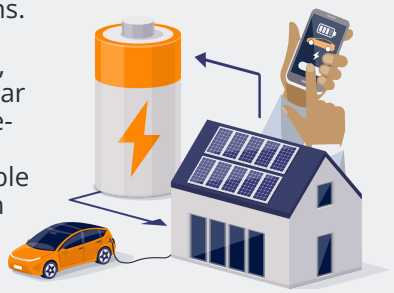
- Establishing 'charging hubs' with multiple fast chargers every 150-200 km along our state highways
- A public charger for every 20-40 EVs in urban areas
- Public charging at community facilities for all settlements with 2,000 or more people
- Addressing charger scarcity in rural and regional communities

There are also some key factors to consider in the private charging space to ensure long-term success, namely:

- Establishing more safety regulations and operating standards.
- Raising awareness of, and removing barriers to the adoption of smart chargers.
- Introducing standards for new builds to ensure future demand can be met.

The public and private chargers of the future will be more efficient and more sophisticated.

Technological progress will help us further harness the potential of EV charging to strengthen our energy system and reduce our transport emissions. The technology for bi-directional charging, emissions tracking, solar integration and vehicle-to-grid capabilities will become more affordable and more accessible in the coming years.[8.3, 8.19]



EV CHARGING STANDARDS

These guidelines will ensure safety and longevity for our charging infrastructure.

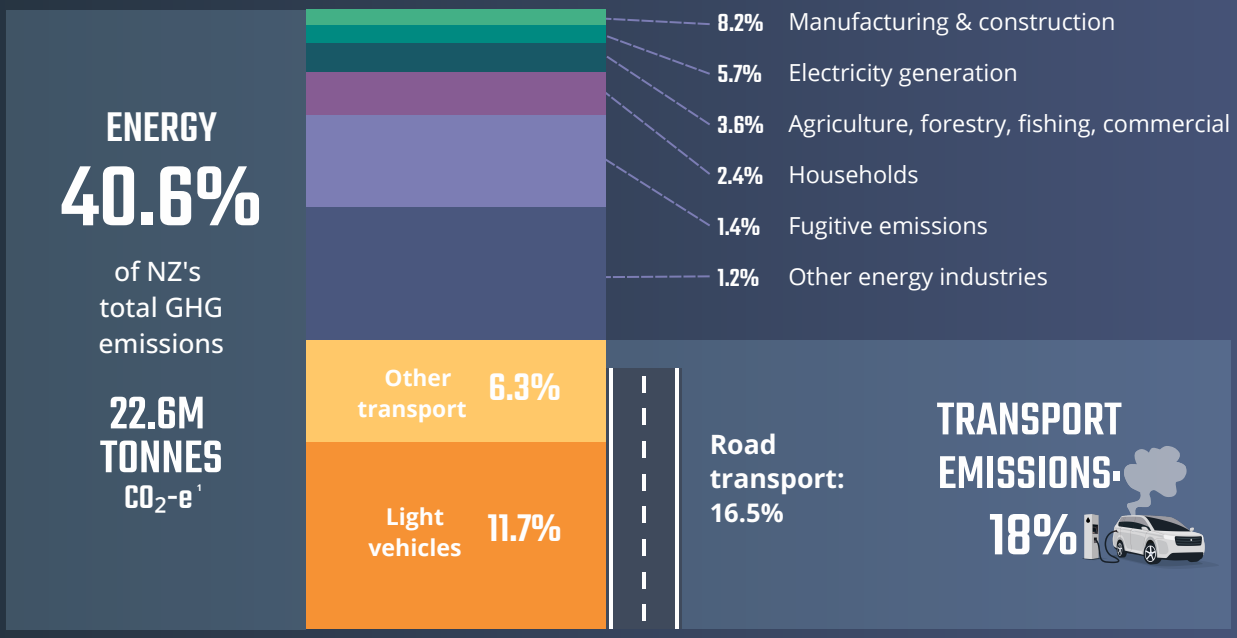
- **Standards New Zealand** - Guidelines for residential charging installations[8.4]
- **Standards New Zealand** - Electric Vehicle chargers for commercial applications[8.24]
- **WorkSafe** - Guidelines for safe EV charging[8.25]
- **Waka Kotahi | New Zealand Transport Agency** - National guidance for public EV charging infrastructure[8.26]

THE ENERGY SECTOR

Decarbonising our transport sector is an opportunity to almost halve New Zealand's total energy emissions.

Figure 47:

New Zealand GHG emissions from energy - 2021



Sources: Manatū Mō Te Taiao | Ministry for the Environment, Hīkina Whakatutuki | MBIE [9.0, 9.1]

Achieving our climate change commitments largely hinges on decades of powering our economy with low-emission electricity.

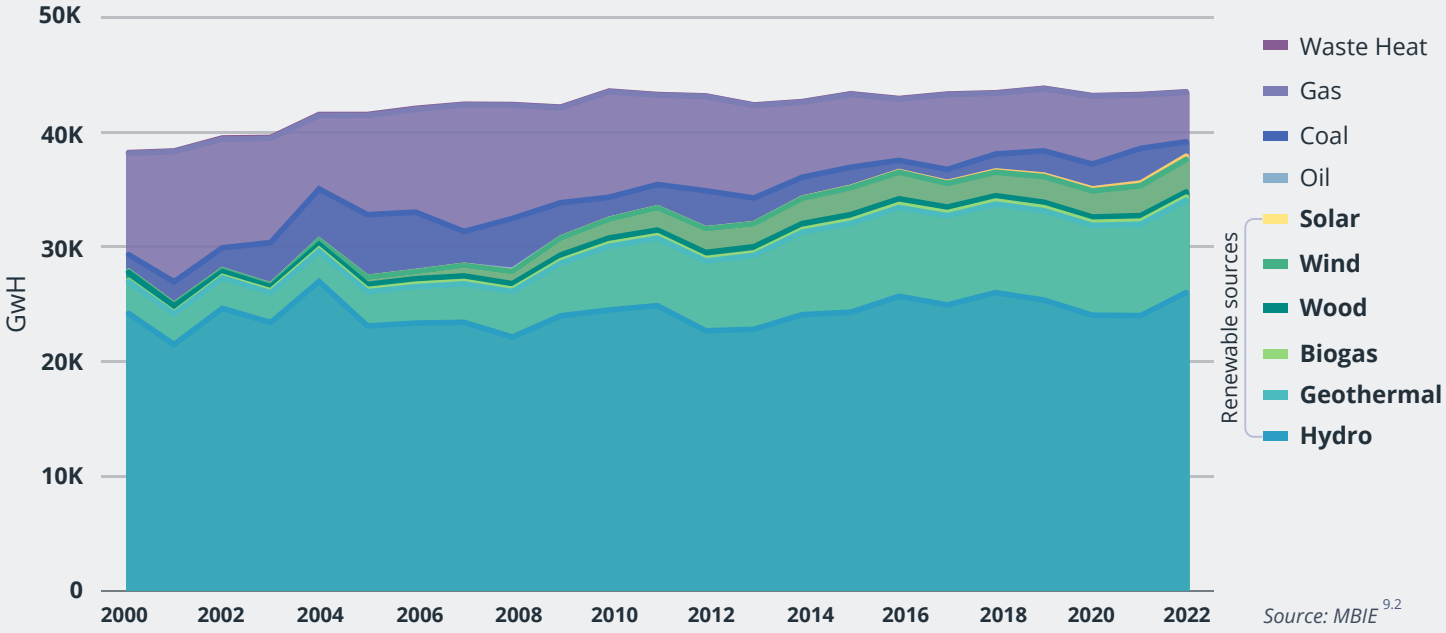
In 2023, we achieved

87% RENEWABLES

in our electricity mix [9.2]

New Zealand has made significant strides in developing a sustainable, renewable-dominant energy system over the past decades. We have the third highest rate of renewable energy adoption in the OECD.[9.3]

Figure 48:
Annual electricity generation in New Zealand
2000-2022

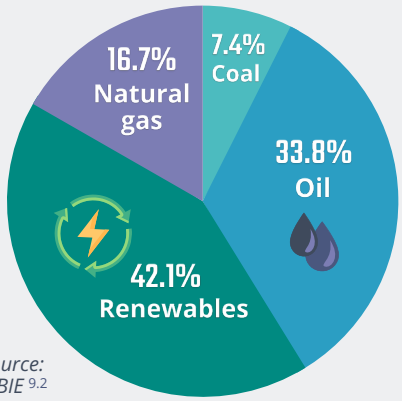


Source: MBIE [9.2]

ENERGY INDEPENDENCE

While our electricity grid is relatively clean, a third of our 'energy' still comes from oil. And, our oil is almost entirely used for transport.

Figure 49:
Energy consumption in New Zealand by source
2021

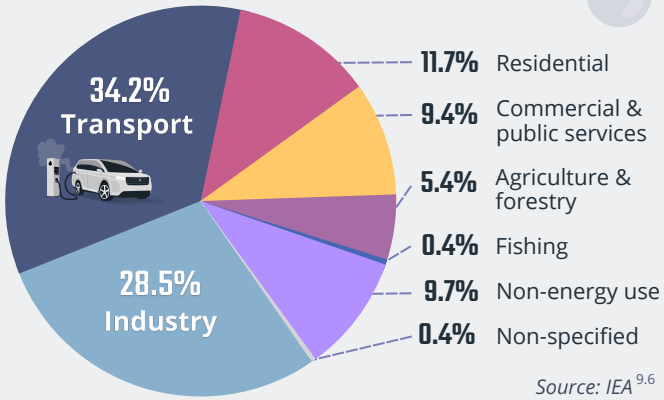


Source: MBIE [9.2]

Petrol and diesel for road transport is estimated to cost New Zealanders $8-9 billion per year.[6]

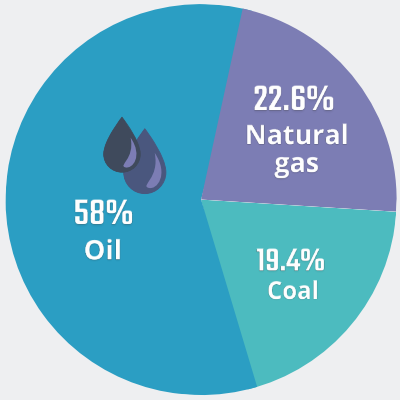
Fuelling our transport system with domestic renewable electricity instead of imported oil won't just make a positive impact by reducing emissions, it makes sense for our economy too.

Figure 50:
Oil products, final consumption by sector in NZ
2020



Source: IEA [9.6]

Figure 51:
CO2 emissions by fuel source in NZ in 2020



Oil is also responsible for the majority of our total CO_2 emissions.

Source: IEA [9.6]

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6 *Estimates are based on data from Statistics NZ, MBIE data and industry insight. Precise figures are not publicly available.* [9.4, 9.5]

According to Boston Consulting Group, in order to achieve net-zero emissions by 2050, New Zealand's energy sector could move through these milestones:

	SUMMARY	TRANSPORT ELECTRIFICATION ENABLERS
2020s	• Rapidly build renewable generation to reach 98% renewable electricity; phase out coal • Ramp up electrification supported by targeted thermal generation, demand flexibility and storage	• **Rapidly electrify light vehicle fleet** • **1 million EVs by 2030** • Commence large-scale transition of low/med temperature heat processes to electrification and biomass
2030s	• Turbocharge electrification through a continued fast build of renewable electricity • Develop new flexible renewables, storage options and highly automated demand flexibility mechanisms	• **Phase out ICE vehicles; transition heavy vehicles to electric/hydrogen** • **2.4 million EVs by 2040** • Transition low and medium temperature processes
2040s	• Continue electrification at pace to support close to full decarbonisation of key sectors • Significantly scale up batteries and embrace new smart demand technologies	• **Electrify almost all land transport** • **4.3 million EVs by 2050** • Scale up electricity and hydrogen for high temperature processes; phase out fossil fuels in buildings

Source: Boston Consulting Group [9.3]

If we achieve 100% renewable electricity by 2030, New Zealand will abate

22M TONNES

of CO_2 emissions annually by 2050.[9.3]

There are several strategies and work programmes in place to help New Zealand achieve this. However, the Climate Change Commission projects that we are currently on track to only reach 96% renewable by 2030.[9.7]

In the mission to reach net zero by 2050, it is crucial that we do not lose momentum in the 2020s. Early action, the right policy settings and likely some form of market intervention will be required.

OUR ELECTRICITY MARKET

New Zealand's electricity market operates with the guidance of the Electricity Authority (EA).[9.8] The EA regulates the wholesale electricity market, ensures fair competition, and facilitates the efficient operation of the electricity sector.

The market consists of:

- **Retailers** who sell electricity to consumers. There are 41 retailers operating in New Zealand, and many already offer a range of EV-specific pricing plans and services to residential, commercial, and industrial customers.
- **Generators** who produce electricity using various energy sources. Generators can be privately owned, state-owned, or a combination of both.
- **Transmission and distribution systems** responsible for delivering electricity across the country.

Transmission and distribution systems require regular upgrades to accommodate the changing energy landscape, including:[9.9]

- The integration of renewable energy sources
- Increasing demand for electricity from a growing population
- Demand from new sources such as EVs and heat pumps
- Two-way flows of power from EVs and home solar energy systems

Much of New Zealand's electricity network is ageing and will require investment over the next 10 years to ensure safe, efficient delivery of energy in future.[9.10]

DEMAND & SUPPLY

WILL EVs OVERLOAD OUR ELECTRICITY GRID?

The short answer is: no.

If all light vehicles in New Zealand were electric today, our total electricity demand would increase by around 20%. This can already be accommodated within New Zealand's existing electricity grid, particularly if most EVs were charged during off-peak periods.[9.11]

Note that peak demand periods are usually when we need to use fossil fuels to supplement our grid with extra energy. Off-peak EV charging doesn't just take pressure off the grid, it further lowers your carbon footprint.

An example from Norway:

Between 2010 and 2020, global EV market leader, Norway, transitioned 20% of their light fleet to electric, and experienced a negligible increase in peak demand, mainly because most EV drivers in Norway tend to charge at night, or with short top-ups across their robust public charging network.[9.12]

Figure 52:

Impact on an average household demand profile of charging an EV 'passively'

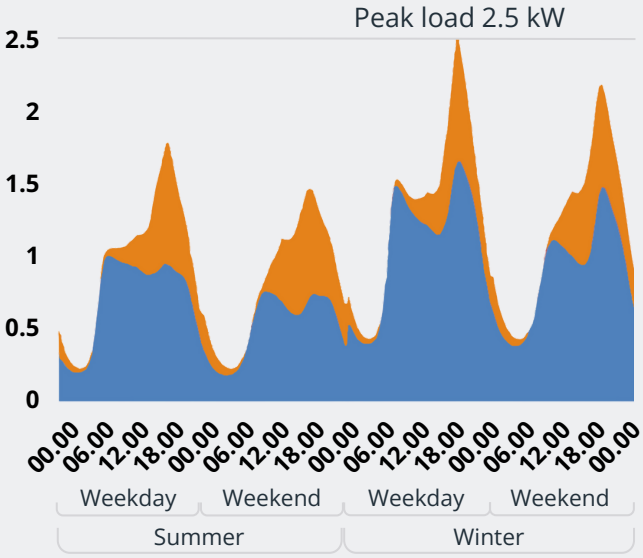
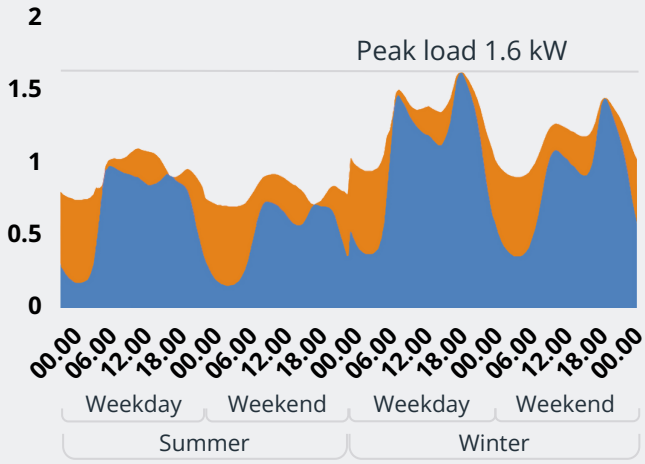


Figure 53:

Impact on an average household demand profile of charging an EV 'smartly'



Pre-EV demand **Plus EV charging**

Source: Concept Consulting [9.13]

Gross electricity demand in New Zealand has remained relatively stable over the past two decades.

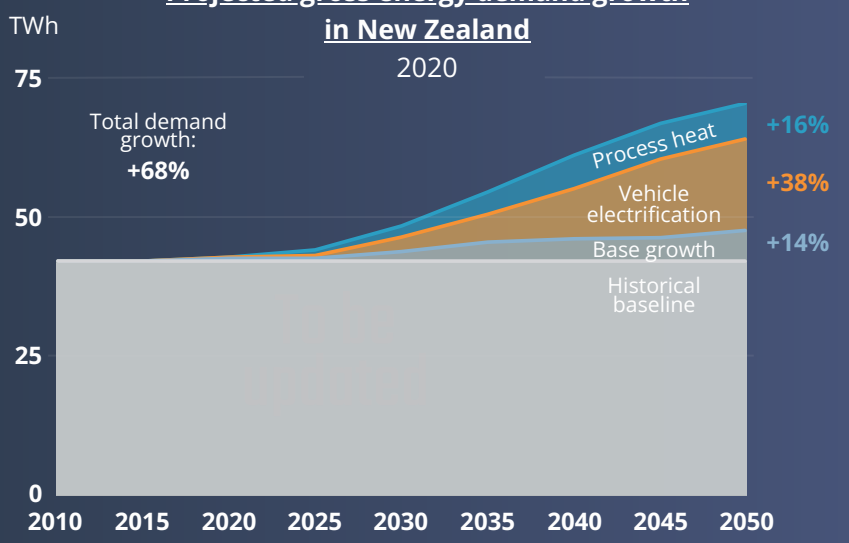
However, Transpower projects significant increases in demand between 2020 and 2050.[9.10]

2035
28%
increased electricity demand

2050
68%
increased electricity demand

More than half of the anticipated demand growth will come from the electrification of transport.

Figure 54:
Projected gross energy demand growth in New Zealand



Source: Transpower [9.10]

To meet demand, just over 10 TWh of new renewable generation supply will need to be built by 2030. There is a very healthy pipeline of new generation options to meet that demand, across solar, wind and geothermal sources.

In fact, there are already enough infrastructure projects in the pipeline to achieve 98% renewable generation in that time period.

If we assume the right policy settings to continue rapid EV uptake, two-thirds of New Zealand's transport energy needs could be powered by electricity by 2050.[9.10]

The industry has a strong track record of executing the necessary renewable generation projects to support increases in electricity demand.

Since 1996, we have added enough generation capacity to our energy system to support 2-3 complete EV fleets, and the market is well-positioned to continue delivering new infrastructure to meet projected demand while also supporting our 2050 net-zero target.[9.3]

FUTURE ENERGY COSTS FOR HOUSEHOLDS

A renewable future promises to be more affordable for New Zealand consumers.

Electrification of a typical household will deliver:[9.3]

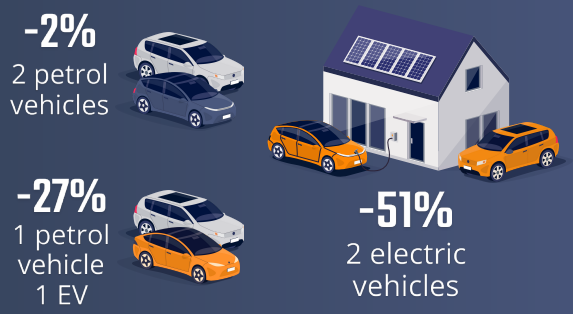
-10%
reduction in household energy bills by **2030**

-27%
reduction in household energy bills by **2035**

-45%
reduction in household energy bills by **2050**

This is primarily due to the fact that transport electrification leads to significantly lower overall energy costs for consumers.

FORECAST CHANGE IN ANNUAL 2035 ENERGY BILLS FOR A HOUSEHOLD WITH TWO VEHICLES



Source: Transpower [9.14]

KEY EV-RELATED CONSIDERATIONS FOR THE ENERGY SECTOR

Managing increased energy demand while simultaneously working to increase the capacity of our electricity grid, ensuring the right policy settings and enhancing the visibility of EV charging will be crucial in ensuring a seamless and sustainable integration of electric transport into New Zealand's energy ecosystem.

MANAGING PEAK DEMAND

The best way to manage increasing electricity demand from EVs is through the widespread adoption of smart charging to spread the load across off-peak times of the day and night, alongside Time of Use pricing measures.[9.15]

Some policy measures will likely need to be implemented to support widespread adoption of 'smart chargers' in parallel with the adoption of EVs. Local EV clustering can also add considerable load during peak times; network upgrades will likely be required in some areas to manage this.[9.16]

Figure 55:

2035 peak profile *with* smart EV charging and time-of-use pricing

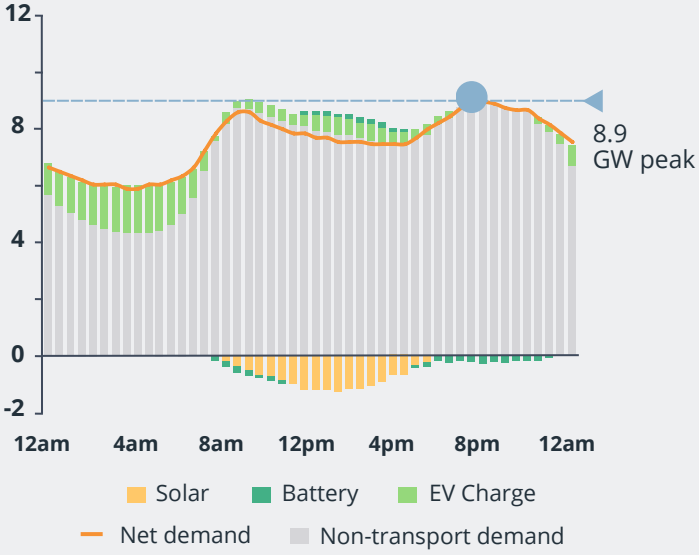
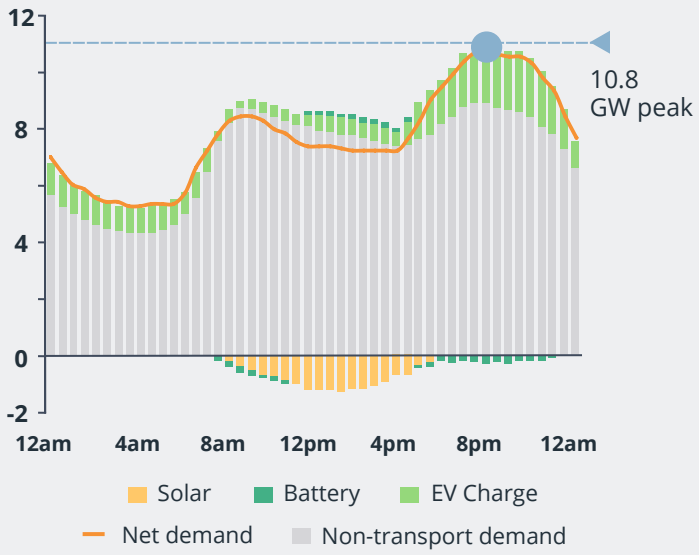


Figure 56:

2035 peak profile *without* smart EV charging and time-of-use pricing



Smart charging and Time of Use pricing can reduce peak demand by 1.9 GW.

Source: BCG [9.3]

TWO-WAY FLOWS OF ENERGY

As Vehicle-to-grid (V2G) technology matures, this capability will help to stabilise grid fluctuations in electricity supply and demand.[9.3]

VISIBILITY OF EV CHARGING

Currently, distributors and retailers have limited visibility over charging behaviour. If the energy sector is able to leverage advanced metering infrastructure, smart charging and data analytics, operators will be able to optimise grid operations, plan for infrastructure upgrades, and implement demand response programs.

Regulatory frameworks & sector cooperation

A smooth transition to electric mobility requires coordination among energy distributors, retailers and generators, regulators, and charging providers.

An Integrated System Plan (ISP)
A clearly articulated whole-of-system plan for the electricity grid is crucial for bringing the sector together to collectively work through challenges and facilitate success for the energy sector. Transpower is currently developing an ISP titled 'Net Zero Grid Pathways'.[9.17]

Policymakers should also be looking to address systemic challenges that hamper the pace of electrification, including the complexities and costs of our current resource consenting system.

ELECTRIC VEHICLE POLICY

GLOBAL POLICY

Despite some good progress in many vehicle segments, most nations are still struggling to keep pace with their emissions reduction goals for transportation.[10.0]

Policymakers need to maintain momentum and continue lessening the barriers to widespread EV adoption.

Several countries have joined international initiatives to share knowledge and collectively accelerate transport electrification.

ELECTRIC VEHICLES INITIATIVE (EVI)

The EVI is a multi-government policy forum, established in 2010, and coordinated by the International Energy Agency. Sixteen countries participate, including New Zealand.[10.1]

Some of their key goals include:

- Strengthen the understanding of the opportunities offered by electric mobility to meet multiple policy goals.
- Improve awareness of the drivers of EV deployment through capacity building and sharing knowledge and experiences.
- Build consensuses on policy goals (e.g. EV30@30)
- Accelerate the geographical coverage of policy deployment on electric mobility through specific activities such as the EVI Global Pilot Cities Program.

COP26 DECLARATION

An agreement amongst states, cities and automakers to progress sales of new zero-emission cars and vans to 100% market share globally by 2040, or by no later than 2035 in leading markets. New Zealand is a signatory to this. At COP27, this became the "Accelerating to Zero Coalition."[10.2]

DRIVE TO ZERO

An agreement amongst countries to pursue 100% zero-emission new truck and bus sales and manufacturing by 2040, announced at COP26. New Zealand is amongst the signatories.[10.3]

Policies that have successfully facilitated EV uptake in multiple countries:

- **Mandated phase-out dates or fleet targets**
- **Strategies for heavy fleet electrification**
- **Policies to support EV readiness in buildings (home and work)**
- **Consumer incentives and / or tax exemptions**
- **Governmental investment in charging infrastructure**

Sources: Bloomberg NEF, Accelerating to Zero Coalition, International Energy Agency (IEA) [10.0, 10.2, 10.4]

NORWAY

plug-in car sales share in 2022 [10.4]

Norway has established itself as a global leader in the electric vehicle market, largely attributed to policy mechanisms geared towards early, rapid EV adoption.[10.4]

Incentives:

Norway's government has built an incentive system to encourage electric vehicle uptake. These incentives include exemption from import taxes and 25% VAT on purchase, free parking in city centres, no charges on toll roads and ferries, access to bus lanes, and exemptions from annual road traffic insurance tax.[10.5]

Infrastructure:

Norway has heavily invested in public charging infrastructure since 2011.[10.6] With one of the highest densities of charging points globally, EV owners in Norway have convenient access to fast chargers at least every 50 km along all main roads, reducing 'range anxiety' and promoting the use of EVs.[10.7] Grants for 20-50% of the cost of home charger installations are also available via most regional housing associations in Norway.[10.8]

Phase-out of ICE vehicles:

Norway has planned a total phase-out of cars with ICEs by 2025; the most aggressive target of any country.[10.5] This target sends a strong signal to consumers and automakers about market demand for electric vehicles.

UNITED KINGDOM

plug-in car sales share in 2022 [10.4]

The United Kingdom has also set clear policy directions to encourage the uptake of electric vehicles.[10.4]

Incentives:

The UK government offers grants to reduce the purchase and operating costs of EVs.

- Plug-In Car Grant: Up to 35% off the cost of a plug-in car, up to the value of £3,500.[10.9]
- Electric Vehicle Homecharge and Workplace Charging Schemes: up to 75% contributions towards the cost of installing charging points in home or workplaces.[10.10]

Infrastructure:

The UK government has pledged £1.6bn of investment through its Electric Vehicle Infrastructure Strategy, which promises 300,000 chargers on public roads by 2030; more than five times the current number of petrol and diesel pumps. It aims to have at least six high-speed chargers at all motorway services by the end of 2023.[10.11]

Phase-out of ICE vehicles:

Similar to Norway, the UK has committed to phasing out the sale of new petrol and diesel cars and vans by 2030, a decade earlier than initially planned, and hybrids by 2035.[10.12]

Clean Air Zones (CAZs):

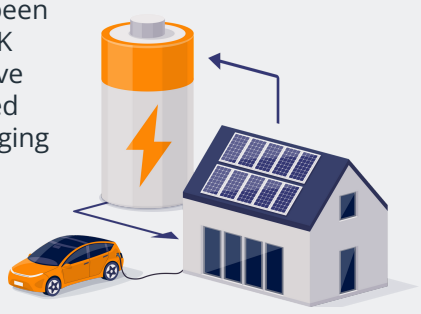
The introduction of Clean Air Zones across several cities imposes additional charges on the most polluting vehicles, incentivising electric, active and public transport as alternatives to cars.[10.4]

Company Car Taxation:

From April 2020, all fully electric company cars pay 0% Benefit in Kind Tax, further encouraging businesses to go electric.[10.13]

EV readiness in building development:

EV charge point provision in new builds has been mandated in the UK since 2021, and have also been mandated to have smart charging capabilities since January 2023.[10.14]



EUROPEAN UNION

plug-in car sales share in 2022 [10.4]

The European Union (EU) has several policies in place to stimulate the transition to electric vehicles, and a phase-out date for the sale of fossil-fuel cars by 2035.

Emission Standards:

The EU has set strict CO2 emission standards for new cars. It requires car manufacturers to decrease their fleet-wide average emissions; otherwise, they face heavy fines. This effectively forces carmakers to produce more efficient vehicles and increases EV sales.[10.15]

Charging Infrastructure:

The EU is investing in EV infrastructure through its Alternative Fuels Infrastructure Directive, which sets out minimum infrastructure requirements for member states.[10.16] Several projects, such as the European Green Vehicles Initiative, also aid in infrastructure development.

Financial Incentives:

Different EU countries provide various financial incentives like purchase subsidies, tax rebates or exemptions, and bonuses for scrapping old, polluting vehicles. For example, Germany offers incentives of up to €9,000 for new EVs.[10.7]

Renewable Energy Directive:

This directive encourages the use of renewable energy in the transport sector, indirectly boosting EV uptake as it can lead to lower emissions when running EVs.[10.17]

Directive on the Promotion of Clean and Energy-Efficient Road Transport Vehicles:

Public authorities are a major transport services buyer, and this directive requires them to consider energy and climate impacts when purchasing vehicles, thus stimulating the market for cleaner vehicles.[10.18]

Together, these policies have created a strong regulatory push towards EVs across all member states, leading to increased EV market share within the union. Some countries have even more ambitious electrification policies in place.[10.4] The shift to EVs is perceived not just as an environmental necessity, but also a means for Europe to maintain automotive leadership globally.[10.4]

CHINA

plug-in car sales share in 2022 [10.4]

China is the world's largest EV market, accounting for around 60% of global electric car sales. More than half of the electric cars on roads worldwide are now in China and the country has already exceeded its 2025 target for new energy vehicle sales.[10.4] This is because China has developed a domestic manufacturing market and for a long time incentivised uptake in the population.

Purchase incentives:

New energy vehicles (NEVs) purchased in 2024 and 2025 will be exempted from purchase tax amounting to as much as 30,000 yuan ($4,170) per vehicle.[10.19] From 2009 to 2022, the government invested 200 billion RMB ($29B) into relevant subsidies and tax breaks.[10.20]

Other incentives:

There are city-level incentives in place too, such as the ability to obtain a number plate, which in some cities can be rationed.[10.20]

Charging:

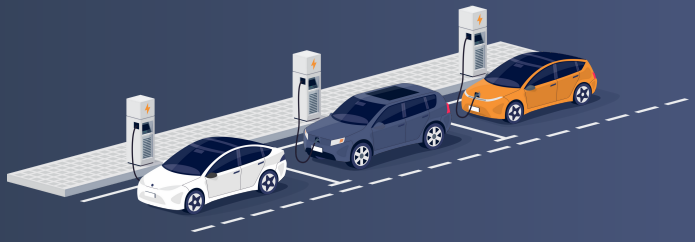
China has the largest public charging market in the world. China's Electric Vehicle Charging alliance recently reported that in 2022, 650,000 public chargers were built, bringing China to a total of 1.8 million chargers.[10.21, 10.22]

Domestic industry:

China has developed its own OEM industry, BYD, SAIC-GM-Wuling, Geely, Nio, Xpeng, and LiAuto. This industry is beginning to turn its mind to exports. In 2022, China exported 679,000 EVs, a 120% increase from the year before.[10.23]

Critical minerals:

China has had one key advantage in battery manufacturing: materials. China has the majority of the refinery capacity in the world when it comes to critical components like cobalt, nickel sulphate, lithium hydroxide, and graphite.[10.4]



JAPAN

plug-in car sales share in 2022 [10.4]

While Japan has been a leader in hybrid vehicles and fuel cell technology, it has been slower in the transition to fully electric vehicles.[10.4]

Eco-Car Tax Reduction:

Japan offers tax breaks for eco-friendly vehicles, including EVs, where consumers can receive substantial reductions on automobile tax, tonnage tax, and acquisition tax.[10.24]

Charging Infrastructure:

A lack of charging is perhaps one of the most significant challenges that Japan faces in terms of barriers to uptake.[10.4]

Limited model offerings:

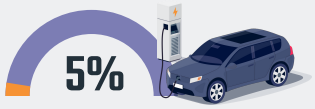
There are currently fewer EV models available in Japan compared to hybrid vehicles, which are more popular. This is reflective of the market dynamics and the fact that automakers like Toyota have been focussed on hybrid and hydrogen fuel cell vehicles.[10.4]

Consumer Preferences:

The Japanese public has shown a preference for hybrid vehicles, likely encouraged by positive experiences with domestic models and concerns about the driving range of EVs.[10.25]

The Japanese government is gradually shifting its focus toward the promotion of EVs, as indicated by their recent strategic plan aiming to have all new cars electric or hybrid by 2035.[10.16] However, they still have a lot to do to encourage more wide scale EV adoption. Given that Japan is New Zealand's most prolific supplier of new and used vehicles, Japan's EV adoption rate has the potential to either hinder or accelerate progress in the New Zealand market.

AUSTRALIA



plug-in car sales share in 2022 [10.4]

Australia is behind many other advanced and emerging economies in EV uptake, but demand is growing. The EV market share in Australia increased from 2.05% in 2021 to 5% of new light vehicle car sales in 2022.[10.26]

Incentives:

The Australian Government has cut taxes on electric cars through the Electric Car Discount. This removes the 5% import tariff on eligible EVs and where the car is used to provide a fringe benefit, including through salary sacrifice or novated lease arrangements, provides exemption from fringe benefits tax (FBT).[10.27] The Electric Car Discount only applies to EVs priced below the Luxury Car Tax threshold for fuel efficient vehicles. For an electric car valued at about $50,000, the FBT exemption saves an employer up to $9,000 a year or an individual using a salary sacrifice up to $4,700 per year. States and territories also have their own programmes targeted at EV uptake.[10.26]

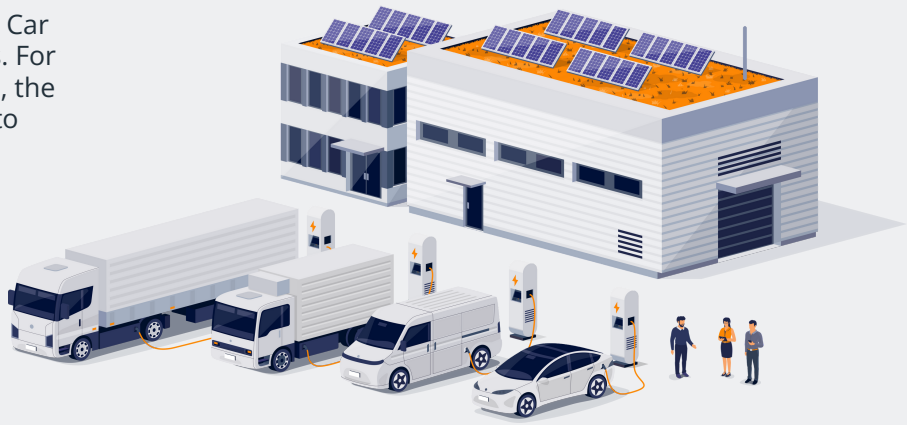
Infrastructure:

The development of EV charging infrastructure has been primarily market-driven in Australia until recently. The Government is expanding the rollout of charging infrastructure through the $500 million Driving the Nation Fund and the National EV Charging Network.[10.26]

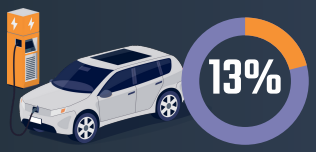
Federal Emissions Standard:

Australia does not have a federal emissions standard. It is currently consulting on the introduction of one.[10.26]

Australia's first Electric Vehicle Strategy was released in 2023 to better coordinate efforts and policies to increase EV uptake.[10.26] It aims to address hurdles such as charging infrastructure, price, model availability, and misconceptions about EVs.



NEW ZEALAND POLICY



plug-in car sales share in 2022[10.4]

This State of the Nation report sets out what policy the government has implemented to date in New Zealand, what is underway, and some specific considerations for various aspects of the electric transport ecosystem. This section makes four headline points about the future of EV policy in New Zealand.

1. CERTAINTY AND CONSISTENCY OVER THE LONG TERM

The Climate Change Response (Zero Carbon) Act was agreed with bipartisan support in 2019.[10.28] It set net-zero targets; established the Climate Change Commission; and established the mechanisms for preparing emissions budgets and emissions reductions plans. The investment in infrastructure; adopting new transport technologies; and climate change are all long-term issues. A bipartisanship approach on decarbonising transport is desirable as it creates certainty for business and citizens.

2. IMPLEMENT A NATIONAL EV CHARGING STRATEGY

A National EV Charging Strategy must be implemented in partnership with the local government and the private sector. At its core, this Strategy must recognise that it is the private sector that will predominantly invest in and install the public charging network. As such, the strategy must be an enabling one. There is an essential role for public investment in the immediate term to catalyse private sector investment by overcoming barriers and accelerating deployment. There is also a need for policy-makers and regulators to reconsider the settings around electricity network businesses and enable them to invest to support the electrification of transport.

At home and in the office, we need to adopt 'smart charging' to minimise the impact of EV charging on the grid. The strategy must also consider the specific requirements of heavy vehicles, marine and aviation, and the future workforce (as outlined on p.59).

3. MAINTAIN MOMENTUM FOR CONSUMERS AND SUPPORT FLEETS

Consumer uptake of electric vehicles is accelerating. However, penetration is only at 2%. We must maintain momentum to support uptake for consumers. Given the limited numbers of EV stocks globally, we must generate a secondhand fleet in New Zealand to provide a wider range of buyers access to electric vehicles. The Clean Car Programme is working and playing an important role on the demand and supply sides. This programme saves the country money over the longer term, by lowering our exposure to foreign petrol/diesel imports and our emissions liabilities under Paris.

There is also an opportunity to look at FBT incentives around fleets; the exemption scheme recently launched in Australia is showing considerable promise.[10.29] When it comes to total cost of ownership, EVs are already cheaper for most consumers.[10.27] In other words, EVs save households money and this is only likely to become more true. In other words, the faster we move to EVs, the faster households can save money on energy.

4. ELECTRIC VEHICLE POLICY NEEDS TO EXTEND BEYOND THE LIGHT FLEET

This paper looks at potential initiatives to support the uptake of heavy vehicles, light commercial vehicles, and electronic micro-mobility. The electrification of the bus fleet in New Zealand is showing real promise, as we have outlined on page 33. However, we need to ensure there are the right policies and incentives in place to support the upfront costs of heavy vehicles and light commercial vehicles. These vehicles are relatively high emitting, electric versions of these vehicles have high upfront price tags. Working with the sectors, policies will need evolution around maritime and aviation as technology matures.

SPOTLIGHT:

UPSKILLING OUR E-MOBILITY WORKFORCE

Key industry stakeholders have emphasised the need for New Zealand to address the significant workforce gap in the EV industry.[10.30]

The traditional skills of mechanics and electricians are no longer sufficient; an adept understanding of digital technologies and smart hardware has become critical to maintaining our future fleet. Also, installing EV smart chargers demands a functional understanding of their connectivity to the internet, which requires additional training for electricians - along with an in-depth understanding of load management and safe connections. Leading manufacturers and installers of charging infrastructure need to hire technical staff who can oversee installation work and handle the emerging pressure of increased demand.

Advancing towards a more renewable energy industry could directly create 350 new permanent jobs and enable 7,500 construction jobs within New Zealand over the next decade.[10.31]

By 2025, the government plans to have commissioned comprehensive research for the energy and transport sectors, specifically addressing labour and technology accessibility.[10.32]

The IEA notes in their New Zealand 2023 Energy Policy Review: *"To advance energy efficiency strategies, the government should ensure sufficient capacity and skills to deliver on projects. As in other countries, the scale of upcoming energy efficiency upgrades to meet decarbonisation plans will require a significant expansion of skilled workers across the sector. As the government pursues a new NZEECS and decides on budgetary outlays, specialty skills training in the energy efficiency space should be given due consideration."* [10.33]

A proactive approach will help to foster a more capable and skilled EV workforce as demand for these services continues to grow. If we do not develop these skill sets internally, then we must look to attract talent from overseas.[10.30]

CONSUMER SENTIMENT

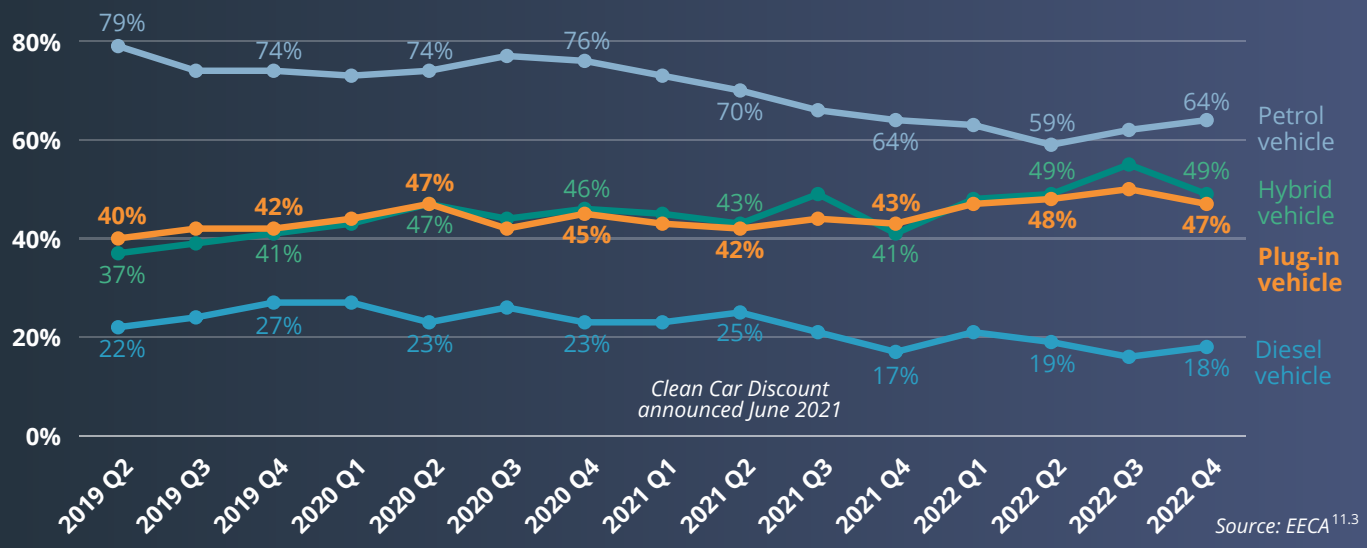
NEW ZEALANDERS AND EVs

An increasing number of New Zealanders are considering an EV as their next vehicle, and fewer New Zealanders are considering petrol or diesel cars. Consumers are attracted by the cheaper running costs and the use of cleaner, renewable energy.[11.0, 11.1]

In a 2023 EECA study, 62% of EV owners in New Zealand said they purchased their EV/PHEV sooner than they otherwise would have, because of the Clean Car Discount. (22% of respondents had purchased it before the discount was available).[11.2]

Figure 57:
Consumer consideration of different vehicle types for their next purchase

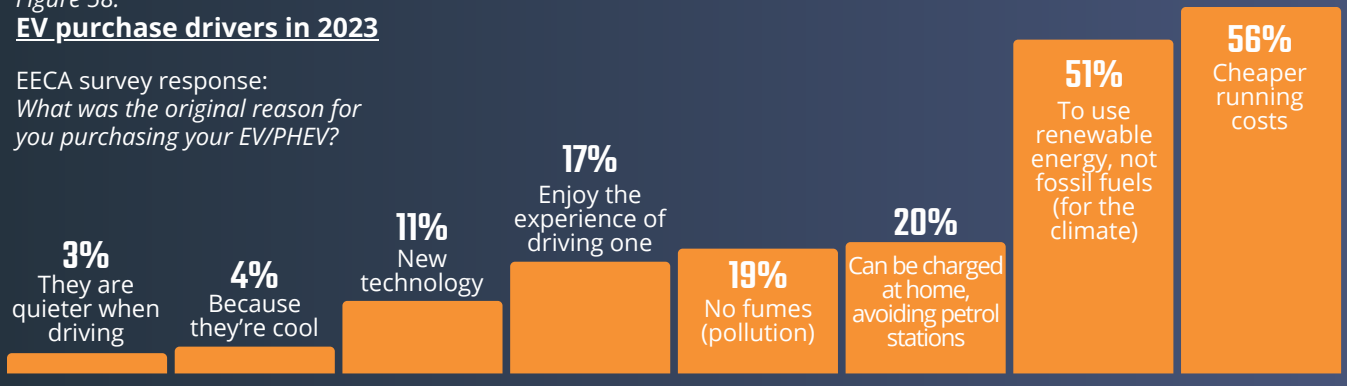
EECA survey response:
Thinking about your next vehicle purchase, how likely are you to consider the following vehicles?
NET Somewhat likely / Very likely



Source: EECA[11.3]

Figure 58:
EV purchase drivers in 2023

EECA survey response:
What was the original reason for you purchasing your EV/PHEV?



Source: EECA[11.2]

EV UPTAKE AMONGST BUSINESSES

Businesses have a significant impact on New Zealand's emissions profile and vehicle availability; they are responsible for purchasing up to 60% of New Zealand's new cars each year.[12.0]

Commercial vehicle drivers typically use their vehicles more intensively; businesses account for around 40% of New Zealand's transport emissions.[12.1]

Typically a business keeps their cars for 3-5 years and for light commercial vehicles 5-7 years before replacing their assets, so they are an important channel to create our second hand EV market.[12.1]

With the increasing ESG focus for businesses, many are engaging in the transition to EVs, and there is a compelling business case to do so.[12.2]

THE BUSINESS CASE FOR EV ADOPTION

Increasing accountability

- Most large companies in New Zealand are under pressure from regulations, boards, shareholders, and their employees to drive down emissions across their operations and supply chains.[12.3]
- 81% of New Zealand consumers want businesses to do more to decrease their environmental impact.[12.3]

Cost savings in the medium to long term

- Operating costs of EVs are significantly lower than ICE vehicles; a transition to electric isn't just about emissions, it's a long-term cost saving exercise for fleet operators.
- Companies taking the largest steps against climate change are reporting the greatest financial returns.[12.4]

Climate-related regulation

- New Zealand's Emissions Trading Scheme (ETS) serves as the primary mechanism to reduce greenhouse gas emissions by creating a market-driven price for emissions units.[12.5] Both EECA and the Climate Change Commission assume that carbon prices will more than double between now and 2050.
- New legislation mandating climate risk related disclosures from 2024 for NZX listed businesses and financial institutions will increase transparency around climate action in corporate New Zealand.[12.6]

ADOPTION BARRIERS FOR BUSINESS

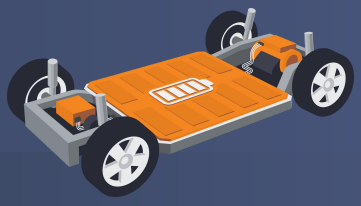
The most common barriers to EV adoption for businesses globally are:[12.7]

- Lack of EV public charging infrastructure
- Lack of fit-for-purpose EV models eg 4WD EV options
- Higher upfront cost of EVs
- Challenge of installing both work and home-based charging for staff
- Significant stakeholder engagement and change management
- Uncertain/underdeveloped policy landscapes to enable accelerated business uptake

Accelerating uptake:
Changing Fringe Benefit Tax (FBT)?

The current application of FBT to the capital purchase of vehicles, without taking operating costs into account, encourages fleets to opt for cheaper high-emission vehicles with higher running costs (e.g. petrol). Removing or adjusting FBT could encourage fleet companies in particular to accelerate their EV uptake, and in turn create a stronger used car market.

EV BATTERIES

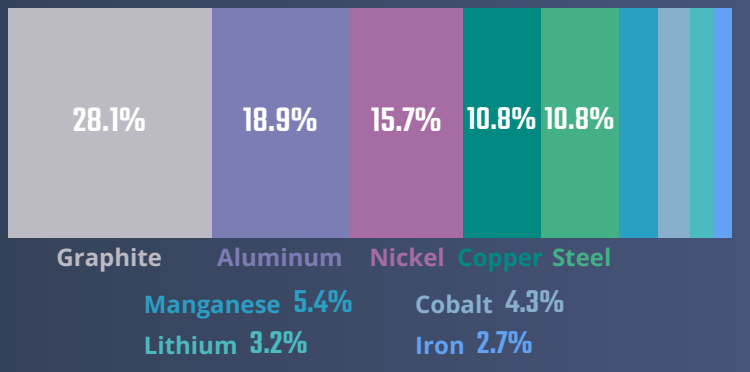


RAW MATERIALS FOR MANUFACTURING

Vehicle manufacturing, regardless of powertrain, requires mineral extraction. EVs do require a wider range of minerals for their motors and batteries than ICE vehicles.[13.1] Mineral demand associated with EVs is projected to quadruple in the next 20 years.[13.2]

Traditionally, EV batteries have been based on lithium-ion technology, just like the batteries in our phones and laptops. The manufacturing of lithium-ion batteries has, until recently, been dominated by a few large multinationals, and involves mining metals like lithium, cobalt, copper, nickel, graphite, and manganese.[13.1]

Figure 59:
Minerals in a lithium-ion battery in 2020



Source: Visual Capitalist [13.0]

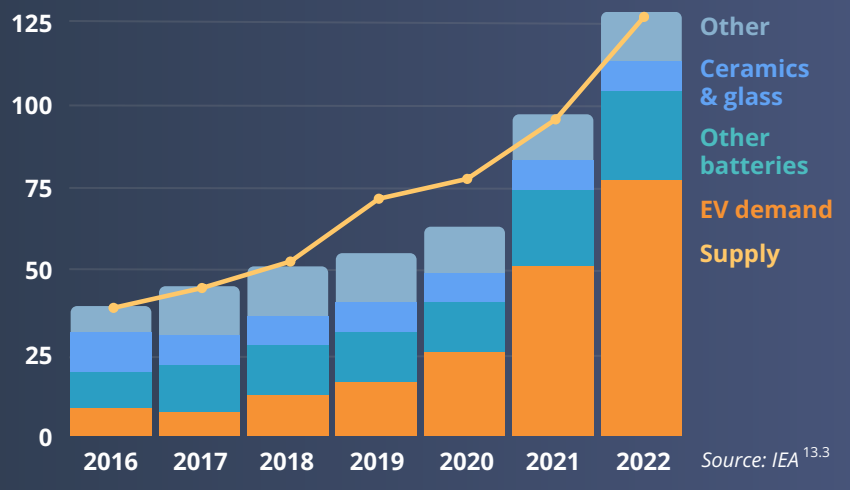
LITHIUM SUPPLY & DEMAND

Supply of lithium is often cited as a major concern when it comes to the viability of mass EV uptake.

Supply has, so far, kept up with increasing demand, and is forecast to continue doing so.[13.3]

The world is not likely to run out of lithium anytime soon.

Figure 60:
Overall supply and demand of lithium for batteries by sector, 2016-2022 (unit kt)



Source: IEA [13.3]

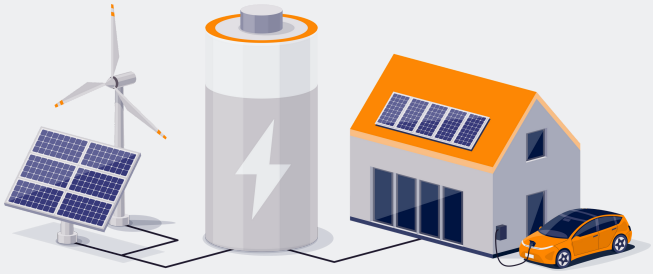
Known lithium reserves are abundant globally.

With 21 million tonnes, Bolivia has the world's largest known lithium reserves, followed by Argentina (20 million), the US (12 million) and Chile (11 million). There are also significant reserves across Europe. Total known global reserves are estimated at more than 80 million tonnes.[13.4]

More lithium sources are still being discovered.

Many regions are yet to be fully explored, and researchers are investigating seawater as a potential source of lithium, which could greatly expand global reserves.[13.5] Advances in technology have enabled the extraction of lithium from sources that were previously too difficult or expensive to access.[13.6]

ETHICAL CONSIDERATIONS



Cobalt and copper are among the most problematic metals associated with EV production, mainly because reserves are concentrated in countries known for irresponsible mining practices.[13.7]

Battery alternatives that reduce or eliminate these metals are becoming more viable.

The accelerated adoption of EVs up to this point is the result of decades of technological advances that have more than tripled energy density and reduced battery costs by 97%.[13.8, 13.9] Now, companies are exploring new battery types that reduce reliance on problematic and expensive minerals.

Concurrently, technologies like Vehicle to Load (V2L) and Vehicle to Grid (V2G) are emerging, enhancing the utility of EVs beyond transportation.[13.10]

LFP BATTERIES

Some automakers, including Tesla, have already switched to lithium iron phosphate (LFP) batteries, which are safer, longer-lasting, and require no cobalt or nickel.[13.11] In 2022, around 40% of batteries used in passenger EVs were LFP, up from just 16% in 2020.[13.12]

SOLID-STATE BATTERIES

Solid-state batteries are seen as the future of EVs.[13.10] They are lighter, with two to ten times more energy density than lithium-ion batteries and are forecast to be more cost effective by 2030.[13.13] Thanks to these batteries, the next generation of EVs will have longer range, faster charging capacity and a lower degradation rate.

Let's not forget about the oil industry...

Most analysts suggest that the EV industry will never see the shortages, cartels or sales restrictions that oil does.

The oil industry has been a catalyst of geopolitical conflict for well over a century, and ICE tailpipe emissions continue to cause air pollution and harm to human health.

Even taking into account the future EV-related increase in mineral demand,[13.14] the amount of mining that goes into extracting fossil fuels is orders of magnitude larger than what will be required to manufacture EVs.[13.15] The rise of EVs will reduce global oil demand, which will diminish potential for associated geopolitical conflicts, while also reducing transport-related emissions globally.

Of course, there's still an urgency to curb the environmental, labour, and ethical issues connected to mineral extraction for EVs. Key stakeholders can act by prioritising or establishing ethical, sustainable supply chains with robust regulations (Tesla and BYD have already made great progress in this space), while research continues into alternative, less problematic battery chemistries.[13.16]

While challenges exist in the EV sector, innovation continues to pave the way for a more sustainable and efficient future. EVs will continue to become more accessible, ethical and affordable for end consumers.

BATTERY END-OF-LIFE

THE 'LIFESPAN' OF EV BATTERIES

The lifespan of the current generation of EV batteries often surpasses the average life of ICEVs.[13.17]

- Manufacturers currently offer 8-10 year battery warranties on new EV sales.
- Case studies show Tesla batteries losing **only 10% of their range after 250,000km**.[13.18]
- In New Zealand, the social science initiative Flip the Fleet, with the support of EECA, found that degradation doesn't usually exceed 3% per year, and that an EV battery should last 10-20 years before it no longer provides useful range.[13.19]

Battery longevity is constantly improving.

Studies on technological advances in thermal management suggest that the batteries of the future could power an electric car for over 1.6 million kilometres and last for 20 years in grid storage.[13.20]

REPURPOSING AND REPLACING EV BATTERIES

Work is taking place in New Zealand and globally to consider all the ways to refurbish, repurpose or recycle batteries.

Upgrading or refurbishing battery cells

Batteries are becoming more sophisticated; now, if only a few individual cells in an EV battery are defunct, it is possible to replace them. Otherwise, any remaining viable cells can be reassembled into new battery packs. New Zealand is just starting to see some earlier generation Nissan Leafs needing battery upgrades or replacements; companies like Upcycle, InfinitEV and Blue Cars are already fulfilling this need, and several others will likely enter the market as our EV fleet matures.[13.21, 13.22, 13.23]

Energy resilience for New Zealand

Stationary battery storage will minimise the need for fossil fuel plants during peak demand periods, and will reduce our reliance on diesel generators during extreme weather-related power outages.

Stationary storage

After its usable life in a car, an EV battery can be repurposed for stationary energy storage - often for more than 10 years. For New Zealand, the best part about this method of repurposing is that our next generation of EVs will be powered by a 'cleaner' grid and a more circular economy.

There are three main stationary applications:

- Grid stabilisation, which will be crucial as energy demand rises
- Renewable energy storage for our electricity grid, which will help facilitate our 10% increase in renewable generation by 2035
- Home storage for solar energy, allowing New Zealanders to become more self-sufficient.

RESPONSIBLE DISPOSAL AND RECYCLING OF EV BATTERIES IN NEW ZEALAND

After spending another **10+ years** in stationary applications, at least

of an EV battery is recyclable

leaving only 2% of the battery as unusable cells.[13.20]

Recycling initiatives across the world could cut lithium supply requirements by 10% by 2040.[13.20]

New Zealand is implementing several initiatives to transform battery recycling and disposal into a more sustainable process.

The Battery Industry Group (BIG), now part of Auto Stewardship New Zealand, is researching and helping the Ministry for the Environment to establish stewardship guidelines and mitigate battery waste streams, members of the MIA have committed to responsible codes of practice for battery end-of-life, and several OEMs are offering programmes to take batteries back at end of life, to avoid unnecessary loss of these minerals.[13.24, 13.25]

ALTERNATIVE FUELS

The spotlight has been firmly placed on electric vehicles as the avenue for reducing carbon emissions in New Zealand. However, other alternative transport fuel solutions - hydrogen and biofuels - are also gaining some attention, particularly with their applications in the heavy transport sector.

While biofuels are expensive, and still produce emissions, hydrogen fuel cell electric vehicles (FCEVs) are uniquely suited to long-haul transport tasks, offering capabilities such as longer range, enhanced flexibility, and faster refuelling times compared to their battery electric counterparts.[13.26]

This makes FCEVs ideal for heavy transport requirements, including trucking services where speed and efficiency are crucial. FCEVs work by storing hydrogen under high pressure in on-board cylinders, which is then converted into electricity by combining it with oxygen from the air to run an electric motor, only emitting water vapour at the tailpipe.[13.26]

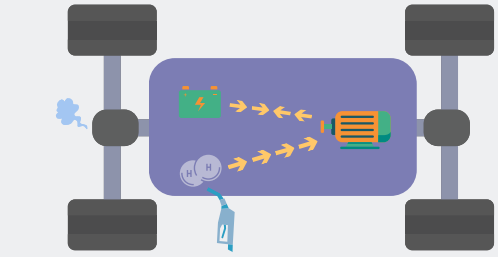
However, the development of hydrogen as a widely used transport fuel faces challenges.[13.27]

Firstly, to support the transition to hydrogen, New Zealand needs to develop a commercial-scale supply of green hydrogen, which is generated using electricity. Currently, the supply is limited, and the development of hydrogen plants and a refuelling network is expensive, necessitating Government funding to mitigate the risks attached to private sector investment. The process of producing green hydrogen is not currently efficient; it requires a large amount of electricity to separate hydrogen from water, which makes it three times less efficient than directly charging battery electric vehicles.[13.28]

The scale of hydrogen infrastructure needed to support our light fleet is not something New Zealand is capable of delivering for many decades.

Direct electrification via batteries is still the most efficient, cost-effective and commercially available route to fully decarbonise road transport, but hydrogen could be the solution for some hard-to-electrify heavy transport applications.

Hydrogen Fuel Cell Electric Vehicles (FCEVs)

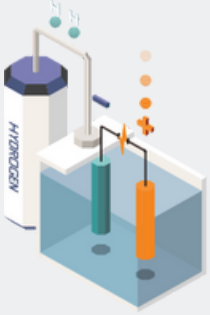


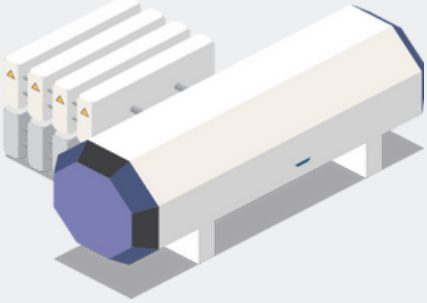
Electric motor
Hydrogen
Water vapour
Energy flow
EV battery (powered by regenerative braking)

Despite the hurdles, there is a commitment to explore the potential of green hydrogen. The Government has investigated ways to produce green hydrogen domestically, including its utilisation in transport. Given the high percentage of electricity produced from renewable sources in New Zealand, this offers an opportunity to create green hydrogen on a larger scale and increase energy security.[13.29]

Critically, the Government has recognised that hydrogen is not a one-size-fits-all solution but a complementary technology.[13.30]

Experts lean towards a dual-approach, drawing from both electric and hydrogen technologies, depending on the application, and advocate for hydrogen strategy and regulatory framework to assure investors and ensure safety standards. The Ministry of Business, Innovation and Employment is developing a hydrogen roadmap, signifying commitment towards making hydrogen a part of New Zealand's forthcoming Energy Strategy.[13.30]





LOOKING AHEAD

This report has been a first effort to set out the current state of the nation when it comes to New Zealand's adoption of e-mobility. The electrification of transport presents New Zealand with a once in a hundred-year opportunity to reduce climate and air pollution; remove our reliance on fossil fuels; and decrease long-term household costs. Whichever way you look at it, decarbonising transport through electrification presents a better future.

This report demonstrates that New Zealand has made a lot of progress across the e-mobility sector. Uptake of electric cars; electric buses; and e-bikes and e-scooters have been particularly successful.

However, there's a long way to go with respect to technological solutions for heavy vehicles, aviation and commercial ships. Policy-makers must continue to engage with these sectors to ensure policy can unlock uptake at scale.

We cannot take this progress for granted, and need to maintain momentum with policies such as the Clean Car Discount and Standard. Even with our passenger cars, EV penetration is only at 2% of the entire fleet. This transformation of our transport system will take a couple of decades to complete. However, the most important aspects of this must happen soon.

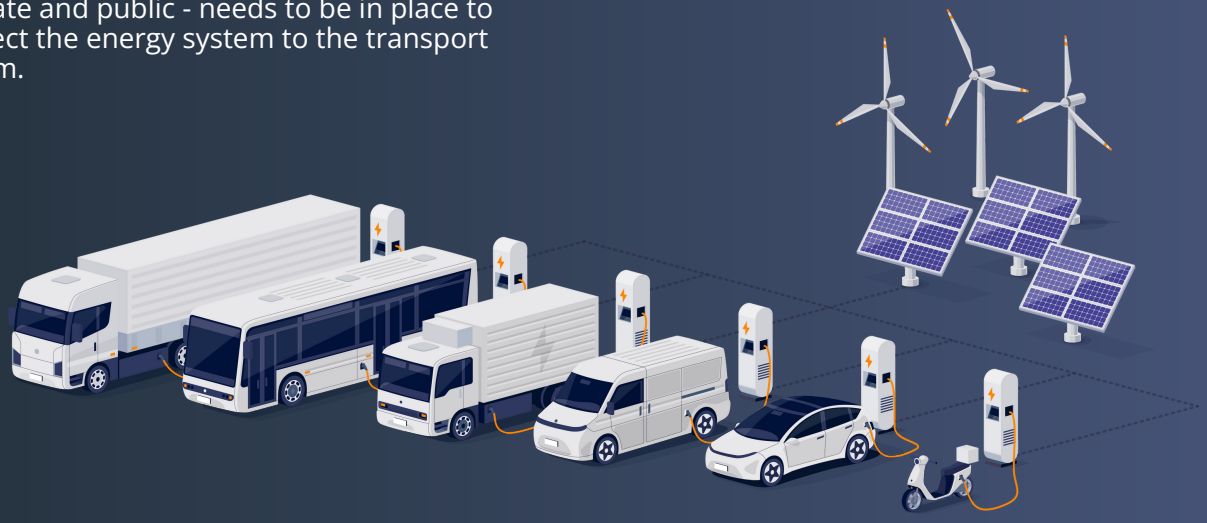
Fundamentally, the production, transmission, distribution of renewable energy will underpin this transition. As such, charging infrastructure - private and public - needs to be in place to connect the energy system to the transport system.

If electric vehicles - in all their forms - cannot be charged conveniently and affordably, we will not reap the benefits of e-mobility. Investment in charging infrastructure will run into the billions of dollars. Most of this investment can come from the private sector, but the regulatory and policy settings must be right, and well targeted public investment must be used to overcome short term barriers. On this front, where we stand today, there is much work to be done.

This year we expect the launch of the first National EV Charging Strategy - a coordinated approach to removing obstacles to charging that Drive Electric has advocated for, for a long time. This is going to be a significant milestone, but the real test will be its implementation.

What is clear is that the electrification of New Zealand's transport system will need close collaboration between government, local authorities, electricity distribution businesses, electricity companies, vehicle importers, fleet companies, and the providers of charging infrastructure.

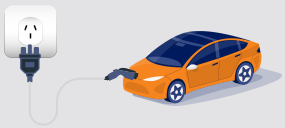
No one sector will be able to play their part, without all parts of the system moving together. Drive Electric is here to play its role as the voice of the ecosystem.



APPENDIX I - CHARGING TERMINOLOGY

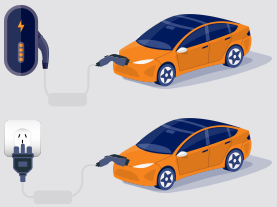
CHARGING MODES IN NEW ZEALAND

MODE 1
~1.8kW
Domestic socket
AC only



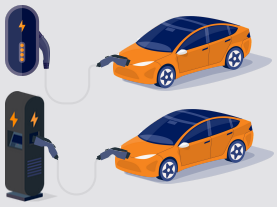
Mode 1 charging uses a portable charging cable to draw power from the standard 3-pin socket found in New Zealand homes. It is the slowest form of charging, and is only allowed in domestic settings. Mode 1 charging must still be protected by a Type A Residual Current Device.

MODE 2
~1.8 - 7kW
AC only



Mode 2 charging also uses a 3-pin plug, but via a charging cable with an integrated control box that regulates the charging process, providing safety against electric shocks or fires, and protecting your car from potential faults. It is suitable for charging low-medium power BEVs and PHEVs in a domestic setting only.

MODE 3
22 - 50kW
AC only



Mode 3 charging uses a dedicated charging station or wallbox with a Type 2 connector. It delivers a higher charging rate, and is designed to communicate with the vehicle to ensure safe and efficient charging. Mode 3 charging is suitable for all types of EVs, including high-power EVs with large battery capacities.

MODE 4
22 - 350kW **DC**
50kW **AC**

Mode 4 charging is the fastest and most efficient form of EV charging. It can be accessed at some high-powered AC stations and any DC station in New Zealand. Some earlier-model BEVs and PHEVs can't accept DC fast charging, so make sure you check the specifications of your vehicle before using this mode.

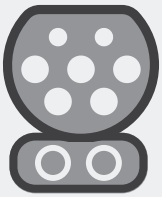
CHARGING CONNECTORS IN NEW ZEALAND

Type 1

An AC plug used in North America and Japan. You can use adaptors to charge EVs with this inlet in New Zealand.

Type 2
(Mennekes)

A European plug for AC charging that has been adopted by New Zealand.



CCS
(Combined Charging System)

A DC charging standard that allows Type 1 and Type 2 EVs to access the same power supply.

CHAdeMO

A DC standard, compatible with many Japanese manufacturers.

Tesla

Specifically designed for Tesla EVs and Superchargers.

SOCKETED

Socketed chargers are simply a socket for a BYO cable to be plugged into. In NZ, this is generally a universal Type 2 socket.

TETHERED

Tethered chargers have a cable permanently attached to the charger, with the plug corresponding to the vehicle's connector Type. These cables are usually 5-6m long and are hung with the charger.

Sources: Standards New Zealand , Gen Less [8.4]

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