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Electric vehicles in New Zealand – opportunities, challenges and responses

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Summary

Image 1: New Zealand has 85% renewable energy generation, ideal for powering EVs

New Zealand's high level of renewable electricity generation – currently over 85% – and dependency on private motor vehicles, makes it an ideal candidate for increased use of electric vehicles (EVs). However, New Zealand is a small and remote vehicle market, with an old fleet of vehicles which turns over slowly. This paper will take you through how New Zealand's EV fleet increased by two and a half times in twelve months following the Government announcing a package of measures to encourage EV uptake, developed in conjunction with the private and public sectors. This increase occurred despite the absence of the purchase incentives common in other markets.

Keywords: consumers, federal government, market development, incentives, policy

1 Background

New Zealand is an island nation in the south-western Pacific Ocean with a population of approximately 4.8 million people.[1] Its closest neighbour, Australia, is a three-hour flight away. Its area is 270,000 square kilometres, making it a little smaller than Italy (with which it shares a long, thin shape) and a little larger than the United Kingdom.[2]

Due to New Zealand's low population density, travel by private motor vehicle is common. New Zealand had the eighth-highest per capita car ownership in the world in 2014.[3]

2 What makes New Zealand the ideal environment for EVs?

2.1 Government's commitment to emissions reduction

The New Zealand Government is committed to the reduction of CO_2 emissions. New Zealand was a signatory to the Kyoto protocol, and implemented a Kyoto-based emissions trading scheme (ETS).[4] That ETS continues to operate, now using domestic units. New Zealand participated in the COP 22 discussions in Marrakech, and has committed to reducing its emissions to 30% below 2005 levels by 2030.[5]

Greater EV uptake would help to reduce emissions from New Zealand's transport sector.

2.2 Population's interest in environmental outcomes

The New Zealand population takes pride in New Zealand's "clean, green" environment. New Zealanders value the high quality of life which results, in part, from living in an unpolluted environment.

The importance of the environment to economic performance is well understood. New Zealand is a substantial exporter of agricultural products – for example, New Zealand exports 95% of all its dairy products, and is the world's largest exporter, representing around one-third of global dairy trade.[6] International tourists are also drawn to New Zealand because of its environmental reputation, with the "100% Pure New Zealand" brand part of the campaign which brought around 3.5 million tourists to New Zealand in 2016 – equivalent to 73% of the resident population.[7]

EVs support this brand, and drivers are likely to perceive EVs as a "clean, green" alternative to internal combustion engine vehicles (ICEVs).

2.3 High levels of renewable electricity generation

New Zealand's electricity is primarily generated from renewable sources. Currently renewables account for over 85% of total electricity generation in New Zealand and a target is place for 90% renewable generation by 2025. Its renewable electricity is sourced mostly from hydro, although geothermal generation makes a significant contribution, and wind a smaller one.[8] Enerdata ranked New Zealand's share of renewable electricity generation as second in the OECD in 2016, behind only Norway.[9]

This high level of renewable electricity generation means that the environmental benefits of moving from ICEs to EVs are substantial, and readily understood by vehicle buyers.

2.4 Responsive and agile electricity markets

New Zealand has a highly responsive, agile, and competitive retail electricity market. The market is divided into three separate groupings – the generators, the transmission/distribution companies, and retailers.[10] All consumers have a choice of different retailers, who bid to buy electricity from the generators on the spot market. Competition between retailers is strong, and consumers frequently change retailers.[11] Therefore, EV owners can expect competitive prices to charge their vehicles.

2.5 Widespread ability to charge at home

New Zealand's standard electricity supply is 230V, meaning EVs can be charged at a faster rate than countries with 100 – 120V standard supplies such as Japan and the Americas. A normal power outlet in New Zealand is rated at 10A.

New Zealand's relatively low population density, even in cities, means that off-street parking, whether in a garage, driveway, or carport, is common. Around 85% of New Zealand homes have off-street parking.[12]

These two factors support overnight charging at home – with most EV owners able to use low-cost hardware typically supplied with their vehicles.

Image 2: author's EVs in their usual overnight parking location

2.6 Prevalence of multiple-car households

Private vehicle ownership in New Zealand is high, and an increasingly large proportion of households have more than one vehicle – 54.5% in 2013.[13] Many of these households will be ideally suited to have one BEV used for short-distance journeys, and a second vehicle (an ICE or ideally PHEV) which can be used for longer journeys.

2.7 Most journeys are short

New Zealand's low population means most people are able to live close to where they work. 95% of daily travel demand is for distances less than 120 kilometres, which is within the range of most low-cost BEVs, and for many also within the electric range of PHEVs.[14]

2.8 Availability of used imported vehicles

Since the late 1980s, used vehicles imported from foreign markets are permitted to be driven in New Zealand provided they are right-hand-drive, meet certain safety and emissions standards, they have been inspected for mechanical and structural integrity, and GST (a New Zealand form of value added tax) has been paid on their landed cost. No additional duties or tariffs are payable on their import, which makes these vehicles attractive to used vehicle buyers where they can be sourced from countries where vehicles in good condition can be purchased at significantly lower cost than New Zealand.[15] The vast majority of used import vehicles in New Zealand are sourced from Japan (which also dominates the new car market) but some are sourced from the UK and Singapore.

Image 3: author's Nissan Leaf at auction in Japan prior to being shipped to New Zealand

Used import vehicles make up a significant share of the New Zealand market – in the year to 31 December 2016, 141,771 new light vehicles were added to the fleet, compared to 158,669 used import light vehicles.[16] Used imports now make up almost half of the light vehicle fleet.[17] Used imports have reduced the price and increased the range of vehicles available to New Zealand used car buyers. Used import EVs have similarly lowered the price and widened the variety of EVs available to the New Zealand car buyer.

3 Barriers to EV uptake in New Zealand

In the process of developing the Government's Electric Vehicles Programme (the Programme), discussed in detail in part 5, the government identified the following barriers to EV uptake in New Zealand.

3.1 EVs have a higher purchase price in New Zealand than equivalent ICEs

While there were a relatively small number of EVs on sale in New Zealand at the time of the announcement of the Programme, they were significantly more expensive than equivalent petrol or diesel vehicles. The Nissan Leaf (prior to the discounting of unsold stock and the discontinuation of New Zealand sales) had sold for NZD$60,000 (approximately 40,000 euro), around twice the price of an equivalent ICE. The Mitsubishi Outlander PHEV was similarly priced at NZD$60,000, around $10,000 - $15,000 (6,000 – 10,000 euro) more than an equivalent petrol or diesel Outlander. A small number of used import vehicles were available at that time, but again at prices higher than equivalent ICEs.

3.2 The limited variety of EVs available in New Zealand

The limited global demand for EVs, and practical constraints around size and shape and expected use patterns, mean that most manufacturers do not offer EVs across all vehicle categories. For example, at the time of writing, no volume manufacturer produces electric utility vehicles for Western markets – which is particularly problematic in New Zealand given that the largest selling vehicle by volume in 2015 and 2016 was the Ford Ranger.[18] The relatively small size of the New Zealand market means that increased demand for EVs in New Zealand could be expected to have no effect whatsoever on global manufacturers' decisions to produce different types of EV (unlike, for example, the US market).

At the time the Programme was introduced, there were a number of EVs sold in global markets, which were potentially suitable for the New Zealand market, but not sold here. For example, the Nissan Leaf and Toyota Prius PHEV were not available new in New Zealand, nor were any EVs from manufacturers such as Ford and Renault. In fact, the only EVs available new in New Zealand in April 2016 were the Mitsubishi Outlander PHEV, BMW i3, and Audi A3 eTron.[19]

Used EVs were readily available in the traditional supply markets of Japan (primarily the Nissan Leaf) and the UK, which could be imported into New Zealand, but few were being imported at the time of the EV Programme.

3.3 The lack of public charging infrastructure in New Zealand

An important mental shift is required for drivers to move from ICEs to EVs. For an ICE, refuelling is done infrequently with a product available only from a limited number of specialist suppliers. For an EV, refuelling is much more frequent, but a specialist supplier is generally not needed – refuelling can be done at home, at work, or places visited for recreation. The need for specialist refuelling stations is therefore greatly reduced.

However, dedicated fast (DC) charging infrastructure is needed for longer journeys, and its availability serves as an important signal to those considering switching to an EV that longer journeys will be possible. When the Programme was introduced there were approximately 20 fast chargers in New Zealand, meaning much of the country (approximately the land mass of the UK) was out-of-reach of a fast charger.

3.4 The lack of awareness and misconceptions about EVs

Due to the small number and relatively low profile of EVs in the fleet when the Programme was announced (at that time there were 1,309 EVs in New Zealand, out of a total light vehicle fleet of approximately 3.5m vehicles [20], the vast majority of New Zealanders knew almost nothing about EVs, had probably had never seen one, and were very unlikely to know anyone who had one or ridden in one. Misconceptions about key EV information such as performance, battery range and battery longevity were identified as one of the key barriers holding back uptake.

4 What other factors makes uptake of EVs in New Zealand difficult?

4.1 New Zealand is a remote market

Despite its high level of vehicle ownership, New Zealand's population of only 4.8 million makes it a very small vehicle market by global standards. As noted above total sales in 2016 – a record year– was around 300,000 light vehicles (141,771 new vehicles and 158,669 used import vehicles).

Unlike, for example, small countries in Europe, it is geographically very remote from neighbouring markets. Manufacturers therefore limit the number of models sold in New Zealand, and are understandably reluctant to import models unless they are confident they will sell well.

4.2 Fleet turnover is slow

New Zealand's mild climate, relatively low average annual distances travelled per vehicle, and strong demand for cheap used imported vehicles, means that it has an old fleet by international standards – the average age of a light vehicle now exceeds 14 years. Light vehicles typically leave the fleet at around 19 years old – often when they fail an annual safety check and remediation is uneconomic.[21]

This slow turnover rate means that new technology takes a very long time to become widely dispersed across the fleet.

5 The EV Programme – May 2016

The New Zealand Government announced its EV Programme in May 2016.[22] This followed a collaborative development period of approximately twelve months, involving key stakeholders from the private and local government sectors.[23] The EV Programme set out a bold target for EV uptake – 64,000 EVs by the end of 2021, approximately 2% of the national fleet. This was a significant increase of the number of EVs then in New Zealand (around 1,300 EVs).

Rather than relying on purchase subsidies, as some other countries have done, the EV Programme contained a large number of relatively low-cost measures. They were designed to address the identified barriers, but instead of being stand-alone initiatives, the measures were typically designed to support activities being carried out, or expected to be carried out, by private sector parties.

Image 4: branding developed as part of the EV Programme

These measures are explained below in the context of the barriers they were intended to address.

5.1 EVs have a higher purchase price in New Zealand than equivalent ICE vehicles

This barrier is perhaps the most difficult to address in a package which does not include purchase subsidies. Globally, the price of new EVs remains higher than equivalent ICEs for non-premium brands at least. Used import EVs are available in New Zealand at prices much closer to those of their ICE equivalents – but have not reached price parity. Global market commentators continue to state that the price of new EVs will fall as batteries become cheaper to produce, but these price movements are yet to be realised in New Zealand.

The EV Programme indirectly addresses the higher up-front purchase price via two methods. The first is to promotes the lower running costs of EVs. One of the key messages of the information campaign (discussed

further below, and in the companion EVS 30 paper *Jump-starting New Zealand's EV future – touching hearts to drive change*) is that charging an EV at home overnight is equivalent to buying petrol for 30 cents per litre.[24] At the time of writing, petrol costs around NZ$1.85 per litre, so this is a substantial saving. This should influence potential EV buyers to take a whole-of-life approach when making vehicle purchase decisions (rather than only looking at up-front price).

The Programme then goes further – actually reducing the running costs of EVs. In New Zealand, roads are funded out of a dedicated fund. Operators of petrol vehicles contribute to this fund by way of a levy charged on petrol sales, and operators of non-petrol vehicles (primarily diesel-fuelled, but also including EVs) pay a levy (road user charges, or RUC) based on distance travelled and the weight class of the vehicle. The EV Programme has exempted light EV owners from RUC until light EVs make up 2% of the light vehicle fleet, and heavy EVs owners until heavy EVs make up 2% of the heavy vehicle fleet. Given that an owner of a light vehicle (such as a passenger car or small commercial vehicle) currently pays a rate of NZD$62 (40 euro) per 1,000 km, and that an owner of a large truck could pay a rate in excess of NZD$300 (200 euro) per 1,000 km,[25] these exemptions represent a substantial saving for EV owners.

5.2 The limited variety of EVs available in New Zealand

As noted earlier in this paper, global manufacturers produce a limited variety of EV models, and the New Zealand market is far too small to be influential. So, the best that can be achieved is for distributors (of new and used import vehicles) to bring to New Zealand those models which are available internationally.

There are a number of ways this is done under the EV Programme, which are essentially all different ways of stimulating demand. The first is the Government's general support for EV uptake, as expressed in the announcement of the EV Programme. This gives manufacturers confidence that their vehicles will be welcomed on to the market from a regulatory and compliance perspective. The second is the increased level of consumer and business demand which the information campaign discussed below is expected to provide.

The third is the efforts by public sector procurement specialists to increase fleet sales of EVs. A central government agency negotiates standing purchase arrangements which all government agencies (including local councils and district health boards) can use, and it has increased the number of EVs on its catalogue from one to 15. It has also been working on aggregating demand for a bulk purchase of EVs, and unusually, has invited large private sector fleets to participate.[26]

5.3 The lack of public charging infrastructure in New Zealand

Public charging infrastructure in New Zealand is provided by a range of private sector entities. The largest provider of fast (DC) charging infrastructure is the private company charge.net [27], and other private entities, often electricity retailers or lines companies, also provide fast charging facilities.[28] Some public slow (AC) charging infrastructure is also available in New Zealand – again, typically provided by the private sector, but in some instances by local government.

At the time the EV Programme was introduced, there were only around 20 fast public chargers for all of New Zealand – although as noted above, there were also only around 1,300 EVs at that time, not all of which would have been fast-charge capable.

In response, the EV Programme tasked the New Zealand Transport Agency (NZTA) with clarifying the regulatory framework and providing national information and guidance on public charging infrastructure. In the twelve months since the EV Programme was launched, the NZTA has:

- established a set of standards for connector types, so that installers of charging equipment know what kinds of connector types to use, those importing EVs into New Zealand know what kind of sockets to specify their vehicles with, and EV drivers can visit a charging station with the confidence they will be able to charge their vehicle [29]
- published guidance on how to set up public charging infrastructure, to make it easy and efficient for investors to install public charging infrastructure which will deliver the highest return to them and the best charging experience to users.[30]

- developed a vision for a nationwide network of fast and slow chargers. A database of existing chargers which meets the required service, safety, and interoperability standards has been produced. The database will provide a high quality source of raw data for third parties to develop customer-facing tools, and when overlaid with traffic information, will provide a powerful tool for investors to identify gaps and opportunities in the charging network.[31]

The Government has invested directly in public charging stations where there were key gaps in the network (for example, where there was no fast charger between two mid-sized cities 150-200km apart) and where it would not have been economic for private investors to fund the entire cost of the infrastructure.[32] This funding has been delivered through the Low Emissions Vehicles Contestable Fund (the Fund), discussed further below. The Fund has also supported projects which aim to increase the number of chargers available in higher-density urban areas.[33]

5.4 The lack of awareness and misconceptions about EVs

One element of the EV Programme was to task the Energy Efficiency and Conservation Authority (EECA) with improving the awareness and understanding of EVs over a five-year period. EECA is a government body with a long history in public-facing energy conservation campaigns.[34]

The information and communication campaign led by EECA is detailed in the EVS 30 paper *Jump-starting New Zealand's EV future – touching hearts to drive change*, and readers are encouraged to read that paper for detailed information about that campaign and its impact. Its key components are:

- the development of the web portal, www.electricvehicles.govt.nz, which brings together in a consumer-facing form the activities of all of the various government agencies involved with EVs
- partnerships with existing EV advocacy bodies to deliver community outreach events – recognising that the most effective way to improve wider understanding of EVs is for people to see, ride in, and drive them
- promotion and publication of the life cycle analysis of EVs – an independent report commissioned to dispel the common misconception that EVs have significant "hidden" environmental impacts from non-renewably generated electricity, and battery production and disposal [35]
- promotion and publication of EV battery research – an independent report commissioned to dispel the common misconception that EV batteries are short-lived [36]

The other key element of the EV Programme designed to increase awareness of EVs is the Low Emissions Vehicles Contestable Fund. This is an annual grant programme, of up to NZD$6 million per year, which contributes a maximum of 50% funding to projects. In the first two years of the fund, the focus has been on demonstration projects that can be implemented relatively quickly. Some examples of the projects funded in the first round are: [37]

- establishing a fleet of electric delivery vans for a supermarket chain
- a 50-car car sharing scheme using EVs
- electric bus trials
- a heavy vehicle conversion workshop.

Image 6: electric delivery vans for a supermarket chain

6 Market Responses to the Electric Vehicles Programme

6.1 Sales of new and used import vehicles

Sales of EVs – both new and used imports – have increased dramatically since the announcement of the EV Programme. At the time of its announcement, the total number of EVs in New Zealand was approximately 1,300; at the time of writing, a little more than twelve months later, EVs totalled approximately 3,800 [38];

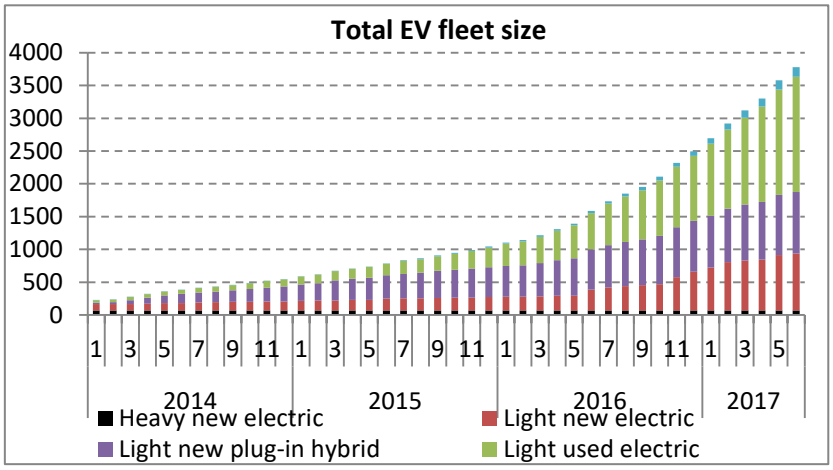

Figure 1: Cumulative monthly EV uptake to 25 June 2017 (last bar represents an incomplete month)

This dramatic increase in sales has been driven by a large increase in the number of used import vehicles available for purchase [39] and a significant increase in the variety of new vehicles available. When the EV Programme was announced, there were three different models of EVs available in New Zealand; there are now 20, with Hyundai, Renault, Tesla, Volvo, Porsche and Mercedes-Benz adding EVs to their New Zealand product offering, and Audi and BMW now supplying multiple models, rather than just one.[40]

Image 7: Air New Zealand BMW i3s

6.2 Fleet initiatives

The EV Programme was developed jointly with the private sector, and a number of New Zealand's larger corporate businesses identified the marketing and running cost benefits that switching their fleets to EVs would deliver. 30 of New Zealand's largest corporate have committed to having 30% of their fleets made up of EVs by 2019.[41] Leaders to date include New Zealand's national carrier, Air New Zealand [42], and one of the largest waste disposal businesses in New Zealand, Waste Management.[43]

Image 8: charge.net fast charger, Turangi

6.3 Public charging infrastructure

Public charging infrastructure has increased significantly since the EV Programme was announced, with now over 64 fast (DC) chargers operating. The majority of those fast chargers have been installed by the private business

charge.net.[44] At present, all fast chargers where payment is required use the billing system operated by charge.net, where a user swipe a RFID tag linked to their account, and are billed via credit card on a monthly basis. Some fast chargers – particularly those installed by electricity companies – are currently free for EV drivers to use.

In addition to the fast chargers, there are a larger number of public slow (AC) chargers, typically installed by retailers or at tourist destinations. A full listing of all public chargers, both fast and slow, can be found on www.plugshare.com, or a local presentation of it, www.electrichighway.co.nz. Almost all public fast charging, and some public slow charging, complies with the guidelines specified by the NZTA. These guidelines recommend both CHAdeMO and CCS Type 2 tethered cables for fast chargers, and Type 2 sockets for slow chargers.

6.4 Electricity retailers

Electricity retailers have identified the opportunity to both raise the profile of their businesses in a positive way as supporters of an environmentally friendly transport solution, and sell greater quantities of electricity to people who need to charge EVs. They have been the strongest advocates of EV uptake outside Government and the "EV enthusiasts" (EV owners who actively support greater EV uptake). They have been more proactive than the automotive retail sector, although this is presumably because vehicle retailers are to some extent indifferent as to which kind of vehicle they sell.

Electricity retailer responses typically take three forms. Some have been keen to raise the profile of EVs by increasing the proportion of EVs in their own fleet, and in some instances advocating that other businesses follow suit.[45]

Some electricity retailers have developed specific pricing packages for EV owners – typically identifying that EV owners will draw reasonably large amounts of electricity, but can be readily encouraged to do so during cheaper, off-peak periods.[46]

Finally, some electricity retailers undertake general promotional or informational activities to increase their customers' familiarity with EVs, no doubt on the basis that some will switch from ICEs to EVs.[47]

7 Conclusion

The EV Programme in New Zealand has been highly successful at delivering a significant increase in EV uptake without purchase price subsidies. There are several factors which have been key in achieving this:

- a high, and well-understood, level of renewable electricity generation, making it easy for drivers to understand the environmental benefits of switching from ICEs to EVs
- a high level of off-street parking, meaning public charging facilities are largely only required for long journeys
- the availability of used import EVs, which has meant that an "instant" market of competitively-priced used EVs is available, without the need to subsidise and then wait for new vehicles to exit fleets

However, substantial challenges remain to be addressed if this rate of growth is to continue to a point where a significant proportion of New Zealand's fleet is electric:

- the price of new EVs will need to fall to a level closer to ICEs if fleet purchases are to become significant – most fleets will not buy used import vehicles
- global manufacturers will need to produce a wider variety of EVs (and sell them in New Zealand)
- traditional sources of used import vehicles (e.g. Japan and the UK) need to be able to supply sufficient vehicles to the New Zealand market, and the price of used import EVs needs to remain competitive with used import ICEs.

Image 9: Japanese used import Nissan Leaf tackles New Zealand mountain road

References

[1] *Stats NZ population clock*, http://stats.govt.nz/tools_and_services/population_clock.aspx, accessed on 2017-06-17

[2] *List of countries by area*, https://en.wikipedia.org/wiki/List_of_countries_and_dependencies_by_area, accessed on 2017-06-17

[3] *List of countries by vehicles per capita*, https://en.wikipedia.org/wiki/List_of_countries_by_vehicles_per_capita, accessed on 2017-06-17

[4] *Climate Change Response Act 2002 (as amended)*, http://legislation.govt.nz/act/public/2002/0040/latest/DLM158584.html?src=qs, accessed on 2017-06-17

[5] *Press release – Hon Paula Bennett, Minister for Climate Change Issues, 21 November 2016*, https://www.beehive.govt.nz/release/growing-global-momentum-climate-change-action, accessed on 2017-06-17

[6] *Fonterra website*, http://www.nzdairies.com/nz/en/financial/global+dairy+industry/new+zealand+dairy+industry, accessed on 2017-06-17

[7] *Tourism in New Zealand*, https://en.wikipedia.org/wiki/Tourism_in_New_Zealand, accessed on 2017-06-17

[8] *New Zealand Energy Quarterly – March quarter 2017, http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/publications/new-zealand-energy-quarterly/*, accessed on 2017-06-30

[9] *Enerdata Global Energy Statistical Yearbook 2016 – Share of Renewables in Electricity Production*, , https://yearbook.enerdata.net/renewable-in-electricity-production-share-by-region.html, accessed on 2017-06-17

[10] *Electricity industry – Ministry of Business, Innovation and Employment*, http://www.mbie.govt.nz/info-services/sectors-industries/energy/electricity-market/electricity-industry, accessed on 2017-06-18

[11] *More choice and more brands as competition increases again in the retail electricity market – Electricity Authority*, https://www.ea.govt.nz/about-us/media-and-publications/media-releases/2016/5-july-2016/, accessed on 2017-06-18

[12] *Electric vehicles in New Zealand – Ministry of Transport Fact sheet* http://www.transport.govt.nz/assets/Uploads/Our-Work/Documents/NZ-Electric-Vehicles-fact-sheet.pdf, accessed on 2017-06-18

[13] *2013 Census QuickStats about transport and communications – number of motor vehicles* http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-transport-comms/number-motor-vehicles.aspx, accessed on 2017-06-18

[14] See note 12 above.

[15] *Advice on private motor vehicle imports – Customs fact sheet,* http://www.customs.govt.nz/news/resources/factsheets/Documents/Fact%20Sheet%2029.pdf, accessed on 2017-06-18

[16] *Quarterly vehicle fleet statistics,* http://www.transport.govt.nz/research/newzealandvehiclefleetstatistics/#quarterly, accessed on 2017-06-18

[18] *Automobile Association – Motoring Blog – Ford Ranger announced as the top selling vehicle for 2016,* http://www.aa.co.nz/cars/motoring-blog/motoring-news/ford-ranger-announced-as-the-top-selling-vehicle-in-new-zealand-for-2016/, accessed on 2017-06-17

[19] *NZ Electric Car Guide, 16 April 2016,* supplied by author, sigurdmagnusson@gmail.com

[20] *2015 New Zealand Vehicle Fleet Annual Spreadsheet,* http://www.transport.govt.nz/research/newzealandvehiclefleetstatistics/, accessed on 2017-06-30

[21] *Annual fleet statistics, fig 2.2,* http://www.transport.govt.nz/research/newzealandvehiclefleetstatistics/#annual, accessed on 2017-06-18

[22] *Press release – Hon Simon Bridges, Minister of Transport, 5 May 2016,* https://www.beehive.govt.nz/release/govt-driving-switch-electric-vehicles, accessed on 2017-06-17

[23] *Cabinet Paper – Package of Measures to Encourage Electric Vehicle Uptake,* http://www.transport.govt.nz/assets/Uploads/Our-Work/Documents/Electric-Vehicles-Package-of-Measures-to-Encourage-Uptake.pdf, accessed on 2017-06-17

[24] *Electric vehicles – Advantages of electric vehicles,* https://www.energywise.govt.nz/on-the-road/electric-vehicles/#Advantagesofelectricvehicles, accessed on 2017-06-19

[25] RUC rates and transaction fees, New Zealand Transport Agency, *https://www.nzta.govt.nz/vehicles/licensing-rego/road-user-charges/ruc-rates-and-transaction-fees/*, accessed on 2017-06-28

[26] *New electric vehicles added to All-of-Government procurement contract,* http://www.procurement.govt.nz/procurement/news/new-electric-vehicles-added-to-all-of-government-vehicles-contracte, accessed on 2017-06-20

[27] *charge.net,* https://charge.net.nz/, accessed on 2017-06-20

[28] *See for example, Vector's network of charging facilities,* https://www.vector.co.nz/personal/ev-charging, accessed on 2017-06-20

[29] *Charging point connectors and socket outlets,* http://www.nzta.govt.nz/planning-and-investment/planning/planning-for-electric-vehicles/national-guidance-for-public-electric-vehicle-charging-infrastructure/charging-point-connectors-and-socket-outlets/, accessed on 2017-06-20

[30] *Setting up public charging infrastructure,* http://www.nzta.govt.nz/planning-and-investment/planning/planning-for-electric-vehicles/national-guidance-for-public-electric-vehicle-charging-infrastructure/setting-up-public-charging-infrastructure/, accessed on 2017-06-20

[31] *Enabling a nationwide network of public charging infrastructure,* https://www.nzta.govt.nz/planning-and-investment/planning/planning-for-electric-vehicles/national-guidance-for-public-electric-vehicle-charging-infrastructure/enabling-a-nationwide-network-of-public-charging-infrastructure/, accessed on 2017-06-21

[32] See for example *Chargers for electric vehicles to be installed on the Napier-Taupo Road,* http://www.stuff.co.nz/motoring/88576509/chargers-for-electric-vehicles-to-be-installed-on-napiertaupo-road, accessed on 2017-06-21

[33] See for example *The Warehouse to help fill charging station gap in New Zealand,* http://business.scoop.co.nz/2017/01/19/the-warehouse-to-help-fill-ev-charging-station-gap-in-nz/, accessed on 2017-06-21

[34] Energy Efficiency and Conservation Authority, *https://www.eeca.govt.nz/*, accessed on 2017-06-25

[35] Research confirms environmental benefits of electric vehicles, *https://www.eeca.govt.nz/news-and-events/media-releases/research-confirms-environmental-benefits-of-electric-vehicles/*, accessed on 2017-06-25

[36] Electric vehicles battery research released, *https://www.eeca.govt.nz/news-and-events/media-releases/electric-vehicle-batteries-research-released/*, accessed on 2017-06-25

[37] Low Emission Vehicles Contestable Fund, *https://www.eeca.govt.nz/funding-and-support/electric-vehicles-programme/*, accessed on 2017-06-25

[38] For detailed analysis see Monthly electric and hybrid light vehicle registrations, *http://www.transport.govt.nz/research/newzealandvehiclefleetstatistics/monthly-electric-and-hybrid-light-vehicle-registrations-dec-2016/*, accessed on 2017-06-25

[39] TradeMe electric vehicles, *http://www.trademe.co.nz/Browse/CategoryAttributeSearchResults.aspx?key=782261199&advanced=1&rptpath=1-268-*, accessed on 2017-06-25

[40] New Zealand Electric Car Guide 3 June 2017, *http://www.electricheaven.nz/NZ-Electric-Car-Guide-3June2017.pdf*, accessed on 2017-06-25

[41] NZ major corporates commit to electric vehicle fleet expansion, *http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11729103*, accessed on 2017-06-25

[42] Landmark commitment will boost NZ EV numbers by more than 75%, *https://www.airnewzealand.co.nz/press-release-2016-landmark-commitment-will-boost-new-zealand-ev-numbers*, accessed on 2017-06-25

[43] Launching New Zealand's first electric vehicle dedicated to waste collection, *https://www.wastemanagement.co.nz/blog/news/launching-new-zealand-s-first-electric-vehicle-dedicated-to-waste-collection*, accessed on 2017-06-25

[44] charge.net, *https://charge.net.nz/map/*, accessed on 2017-06-26

[45] See footnote 41 above – Mercury, and Contact Energy are electricity retailers; Orion, PowerCo and Transpower are lines companies.

[46] See for example Meridian, *https://www.meridianenergy.co.nz/your-home/pricing-and-rates/electric-vehicles-rate*, accessed on 2017-06-26

[47] See for example Meridian, *https://www.meridianenergy.co.nz/* and *https://www.meridianenergy.co.nz/your-home/sustainability/electric-cars-vehicles*, Mercury, *https://www.mercury.co.nz/* and *https://www.mercury.co.nz/Products/E-transport/Electric-vehicles.aspx*, accessed on 2017-06-26

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