Deploying electric vehicles in New Zealand
A guide to the regulatory and market environment

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Introduction

Electric vehicles (EVs) are an emerging form of transport worldwide which could help New Zealanders meet their private transport needs while reducing their climate change impact.

The Energy Efficiency and Conservation Authority (EECA) is assisting the introduction of EVs into the New Zealand market, by working to overcome barriers such as uncertainty and inconsistency around Standards.

As EV technologies are advancing quickly, consideration of charging infrastructure becomes more urgent. Already some of the technologies being developed by industry are incompatible with one another. A wide mix of charging regimes and plug requirements would lead to:

- confusion among consumers about the requirements for different vehicles
- safety concerns arising from this confusion
- vehicles charging with some plugs but not with others
- homes needing significant (and costly) new wiring and sockets
- uncertainty regarding the Standards required to be met by the vehicle and associated charging equipment.

Outcomes such as these could inhibit the uptake and trade of EVs.

This guidance document has been produced by EECA in conjunction with the Ministry of Economic Development (MED), and the Ministry of Transport (MOT). It aims to help EV manufacturers and importers by providing with accurate information about the existing regulatory and market conditions, specifically:

- information about the New Zealand regulatory environment as it applies to EVs and charging technologies
- background information about the expected charging needs of New Zealand EV users.

The primary aim is to help manufacturers and importers come to safe solutions for electric vehicle charging. We expect the guide will also be useful for tradespeople such as electricians who may undertake EV-related work.
How will EVs fit in New Zealand?

Travel patterns

New Zealanders drive their cars less than 40 kilometres per day on average. Data from MOT’s New Zealand Household Travel Survey (Figure 1) shows that the majority of travel is work commute, household errands, and other local activities.

Figure 1: Kilometres and destination type by age group (2007-2010). Source: MOT

Given these distances, EVs that are currently (or soon to be) in the market could be used for several days before needing to be recharged. Figures from MOT indicate that up to 95% of daily travel needs could be covered by EVs, as shown in Figure 2.

Figure 2: New Zealand daily travel demand. Source: MOT
Home electrical infrastructure

Homes in New Zealand are well-equipped to fully charge an EV battery overnight, even from a fully depleted state.

- Many New Zealand homes have garages, meaning that EVs can be charged overnight in a safe place (over 85% of all dwellings).
- New Zealand uses a voltage of 230 V (volts), and has wiring standards that enable safe electricity draw to approximately 14 A (amps) using the existing infrastructure of a typical New Zealand house.
- The standard three pin flat pin sockets available in New Zealand for domestic wiring installations are rated at 10 A, but they can be upgraded to 15 A easily¹ (15 A plugs have a larger earth pin than a 10 A plug and require a corresponding socket).

Smart meters are currently being deployed in large number of homes around the country. The roll out is the result of several private sector initiatives and has not been mandated or sponsored by government. As a result, the service and features of the smart meters installed varies, sometimes significantly, depending on the priorities of the provider that installed them.

When bringing EVs to New Zealand, companies should consider how the vehicles will fit with existing infrastructure, such as:
- assessing where vehicles will be charging; outdoor or indoor, fast charge or trickle charge
- understanding that power supply greater than 15 A is unlikely to be available in the typical home without an infrastructure upgrade
- assessing whether the vehicles coming to New Zealand are fitted with safe and compatible plugs and fittings in relation to prevailing charging assumptions. This is of particular importance as it may heavily affect vehicle uptake.

Charging patterns

Given the travel patterns and existing infrastructure described above, it follows that the majority of EV charging will occur in homes, overnight, and probably not on a daily basis. Therefore, the demand for public charging infrastructure will be small in the initial stages of market development.

At the time of publication, public charging facilities in New Zealand are limited, but will grow over time. The Association for the Promotion of Electric Vehicles maintains an up-to-date map of public charging stations; refer to the following link: www.apev.org.nz/EV-Charging-Locations

Electricity in New Zealand

New Zealand has one of the highest proportions of renewable electricity generation in the world. In 2010, over 74% of total electricity was generated from renewable sources, primarily hydro and geothermal, and most of the planned new electricity generation is from wind or geothermal. The New Zealand Government aims to reach 90% by 2025.

New Zealand has an open and competitive electricity market in which consumers are able to choose from a number of retailers. Retailers offer a number of tariff regimes that customers can select from depending on their electricity demand profile. One key feature is that most retailers offer plans that provide off-peak or night time electricity at lower prices.

¹10 and 15 A sockets are available as dual sockets whereas draws above 15 A require a dedicated circuit to the main fuse board.
Laws and regulations affecting EV charging

As road vehicles, EVs are subject to a number of laws that ensure their safe operation and minimise health and environmental impacts – the same as any other car. However, EVs are markedly different on how they are fuelled, requiring a safe, reliable and durable connection to an electricity provider for battery charging.

While New Zealand does not have a regulation that directly targets EVs, there are regulations for the safe installation, use, and provision of electricity infrastructure. These regulations apply specifically to the 230 V fittings and appliances; the DC parts of EVs are not regulated. In a typical EV charging system this would include all fittings up to and including the charging unit.

**Electricity (Safety) Regulations, 2010**

The regulations aim to ensure that the work, design and use of works (electrical), installations, fittings and appliances are electrically safe. The regulations define electrically safe as follows:

"electrically safe means, in relation to works, installations, fittings, appliances, and associated equipment, that there is no significant risk that a person or property will be injured or damaged by dangers arising directly or indirectly from the use of, or passage of electricity through, the works, installations, fittings, appliances, or associated equipment."

The regulations apply this definition to a number of situations including systems of supply, safety of works, safety of installations, safety of fittings and appliances, and working practices. The regulations also include provisions for the requirement of licensed practitioners and certification processes to ensure that, when required, work is undertaken by properly trained and licensed individuals when necessary.

A copy of the Electricity (Safety) Regulations 2010 can be downloaded from www.legislation.govt.nz/Electrical Regs/download

Energy Safety is a New Zealand government agency that administers the technical provisions of the Electricity (Safety) Regulations 2010.

Energy Safety has published a general guide to existing regulations, A Guide to Supplying Safe Electrical and Gas Products. This can be found at following link at www.energysafety.govt.nz

Figure 4: An example of EV charging infrastructure.
Installation Standard

In terms of specific compliance, the Electricity Safety Regulations refer to relevant Standards that apply depending on the situation. Standards mentioned include Electrical Codes of Practice (ECPs), International Electrotechnical Commissions standards (IEC standards), and Australia New Zealand Standards (AS/NZS standards).

The regulations refer to AS/NZS 3000 (the Wiring Rules Standard) for specific guidance on electrical installations and wiring which will affect electric vehicle charging facilities and the wiring associated with it.

AS/NZS3000 sets out requirements for designing, constructing and checking electrical installations, which includes the electrical equipment used, and how it is installed.

These requirements are intended to protect persons, livestock, and property from electric shock, fire and physical injury hazards that may arise from an electrical installation (provided it is used with reasonable care and with due regard to the intended purpose of the electrical installation).

While several sections are of relevance when considering the installation and operation of electric gear for EV charging, section 4 focusing on the installation of appliances and accessories is the most relevant.

A copy of AS/NZS3000 can be purchased from Standards New Zealand at www.standards.org.nz/webshop

Charging options

Four main modes of charging electric vehicles are generally recognised in the industry. Each of these modes involve varying technologies and infrastructure requirements, however they are all subject to the electricity regulations.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
<th>Can be used with typical existing household wiring and infrastructure</th>
<th>Requires dedicated charging equipment to be installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode 1</td>
<td>Slow charging from a standard household socket with a standard lead</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Mode 2</td>
<td>Slow charging from a standard household socket with a lead equipped with a protection device</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Mode 3</td>
<td>Slow or fast charging using dedicated EV charging installation, equipped with a protection function</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Mode 4</td>
<td>Fast charging using external charger</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

General wiring considerations

Maximum current draw will affect the cost of implementation. In general the following guidelines can be followed:

<table>
<thead>
<tr>
<th>Vehicle draw</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 14 A</td>
<td>Able to use existing house wiring infrastructure</td>
</tr>
<tr>
<td>14 A – 30 A</td>
<td>Will require dedicated wiring within the house for charging</td>
</tr>
<tr>
<td>30 A or more</td>
<td>May require upgrade in house connection to the electrical network and/or smart connections</td>
</tr>
</tbody>
</table>

The New Zealand Safety Regulations and wiring rules do not prevent the use of fly leads. Companies wishing to bring EVs to New Zealand are recommended to engage engineering consultans with expertise in the regulations and standards to carry out suitability and risks assessments.

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\(^2\) Current draws are approximate and an electrical engineer should confirm safe designs for the specific charging requirements of each EV.

\(^3\) Fly leads that include electronic equipment such as RCDs will be required to meet appliance Standards and maybe high or medium risk appliances. This should be carefully considered and the specific regulatory requirements fully investigated prior to implementation.
Appliance and Fittings Safety Standards

New Zealand’s regulatory framework requires every electrical appliance or fitting that is sold (or offered for sale) to be safe. The Energy Safety guide provides more details on the requirements for products in each risk category.

The Electricity (Safety) Regulations 2010 list Standards applicable to most common appliances and fittings in schedule 4 (www.legislation.govt.nz/Electricity Regs/Schedule 4). A number of common components for EV charging infrastructure are listed here. Where the appliance or fitting is not listed the product must meet the essential safety requirements specified in AS/NZS 3820 – Essential Safety Requirements for Electrical Equipment. This standard aims to ensure that all appliances and devices are built safely to a good engineering standard.

Fittings recognised as having a higher risk, such as leads and residual current devices (RCDs) will have additional requirements. These requirements include self declarations of compliance, certificates, and/or regulatory approvals prior to the items entering the market. For more details see www.energysafety.govt.nz.

EV suppliers must assess the electrical safety compliance of all EV components. Note that there are specific prescriptive regulatory requirements in New Zealand for RCDs and leads, so these need particular attention.

Voluntary efficiency labelling

The automotive industry in New Zealand came together early in 2011 to develop a voluntary energy efficiency label for EVs.

The label is based on existing vehicle fuel economy labels, and includes information on the range, energy efficiency and annual energy costs. All electric vehicles receive the top rating of six stars. While it is understood that not all vehicles have the same efficiency, the high rating highlights EVs high energy efficiency compared to petrol and diesel cars.

The method used for calculating the overall running costs expressed in the label involves three key figures:

1. Distance travelled – based on driving 14,000 kilometres a year
2. Price of electricity – 15c per kilowatt hour (kWh) based largely on overnight charging
3. Vehicle energy efficiency – kWh per 100 kilometres.

NB. In New Zealand all non-petrol vehicles are required to pay a road user charge (RUC). For an average driver (driving 14,000 km a year) this is a NZ$620 charge. EVs in New Zealand are exempt from this levy until 2013.

As at November 2011 RUC was set at NZ$44.32 per 1,000 km for cars. For an up-to-date list of RUC rates refer to the New Zealand Transport Agency.