Vector®

CREATING A NEW
ENERGY FUTURE

CONNECTING ELECTRIC VEHICLE CHARGERS

GUIDELINES FOR BUSINESS, COMMERCIAL AND APARTMENT BUILDINGS

Version 2.0 July 2019

PURPOSE OF THIS DOCUMENT

This document provides guidelines for those considering buying and installing Electric Vehicle (EV) chargers in business, commercial or apartment buildings on Vector's electricity distribution network in Auckland, New Zealand. Residential guidelines will be provided in a separate document.

For context on the evolving discussion around EV adoption in New Zealand, read Vector's EV Integration Green Paper here.

If you are planning to install EV charging for fleets, including specialised electrical vehicle charging infrastructure, then please get in touch with us on evinfo@vector.co.nz. We can assist you with the process of connecting to our network.

Note: EV Green Paper link: http://bit.ly/EVGreenPaper

Regulation and standards governing the installation and management of EV chargers are subject to change. Please let us know about your EV charger installation by emailing us on evinfo@vector.co.nz so we can keen you updated on any changes.

Disclaimer

These guidelines have been prepared for information purposes only for individuals and other entities considering buying or installing electrical vehicle chargers in business, commercial or apartment buildings on Vector's electricity distribution network in Auckland, New Zealand. We've made every effort to make sure that the information set out in these guidelines is accurate as at the date of this document, however we advise you that:

- the information provided doesn't replace or alter the laws of New Zealand and other official guidelines or requirements;
- the information provided shouldn't be used as a substitute for electrical, legal, health and safety, business, or any other professional advice;
- Vector Limited, its related companies, and their respective directors, officers and employees ("Vector") make no representation, undertaking or warranty (express or implied) as to the completeness or accuracy of any information provided. To the maximum extent permitted by law, Vector doesn't accept any responsibility or liability whatsoever, whether in contract, tort, equity or otherwise, for any action taken, or reliance placed, as a result of reading any part, or all, of the information in these guidelines or for any error, inadequacy, deficiency, flaw in or omission from the information provided; and
- Vector doesn't accept any legal liability for any damage or loss that may result, either directly or indirectly, from any information contained in these guidelines, or any actions taken as a result of the content of these guidelines.

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WHAT IS AN ELECTRIC VEHICLE?

Just as a conventional car uses petrol as fuel and stores it in a fuel tank, an EV uses electricity as fuel and stores it in an on-board battery. Its battery is charged through the electricity supply available at home, the workplace or in public places. It uses the stored energy to power an electric motor that sets the wheels in motion. This means a fully electric vehicle does not need a clutch and gearbox or an exhaust pipe, which makes them much quieter and smoother to drive, and it's considered better for the environment compared to traditional vehicles.

There are generally three types of cars that are considered 'electric':

Conventional hybrids like the Toyota Prius have both a petrol engine and electric motor. However, the battery charges only from using the car's kinetic energy from braking or from the petrol engine.

Plug-in hybrids which have both petrol engines and electric motors can be plugged-in to charge and can generally run for a period on electric power before the battery is drained and the car switches over to the petrol engine.

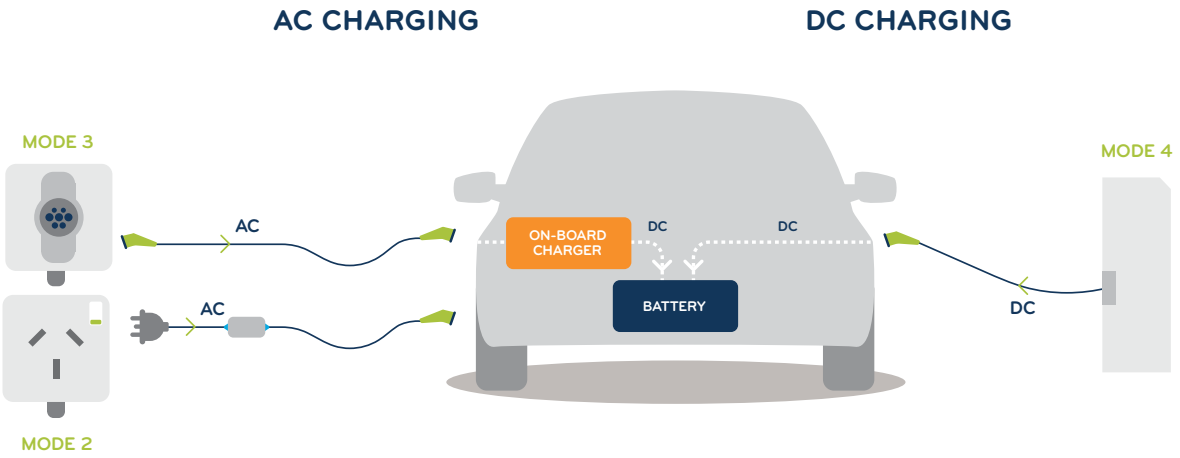
Battery Electric Vehicles are 100% electrically powered, with an electric motor running only on electricity.

WHAT ARE THE DIFFERENT TYPES OF EV CHARGERS & CONNECTORS?

EV charging can primarily be performed through two broad categories:

- Alternating Current (AC) EV charging - if you have AC charger or a portable 3-pin charging cable
- Direct Current (DC) EV charging – if you have DC charger

There are three main modes for EV charging (mode 2, 3 and 4) defined by international technical standards. A technical explanation of the modes can be found in Appendix 1.



EV owners should purchase EV charger cables which are compatible with their EV and not use adaptors, unless recommended by the EV manufacturer. Different EVs accept different types of EV charger connectors. Figure below describes commonly used EV charging connectors.

CONNECTOR TYPE	TYPE 1 BS EN 62196-2 (J1772) 	TYPE 2 BS EN 62196-2 (Mennekes) 	CHADEMO 	COMBINED CHARGING SYSTEM (CCS) 
Mode	2 or 3	2 or 3	4	4
Typical power	Single phase only - 7.4kW	Single phase - 7.4kW Three phase - 22kW	Three phase - 25kW Three phase - 50kW	Three phase - 25kW Three phase - 50kW
Power type	AC	AC	DC	DC
Note:	Suitable for EVs such as: Chevrolet Volt, Citroen C-Zero, Fiat 500e, KIA Soul, Nissan Leaf	Suitable for EVs such as: Audi A3 e-tron, Hyundai IONIQ, BMW330e/ i3/ i8/X5, Mercedes B-Class Electric, Tesla Model S/X	EVs with AC Type 1 connectors normally have this as a DC connector	EVs with AC Type 2 connectors normally have this as a DC connector

Note: Some EV charger cables have a Type 1 connector at one end, and a Type 2 connector at the other end. Other cables have Type 2 connectors at both ends.

RECOMMENDED TYPES OF EV CHARGERS

Vector strongly recommends the use of dedicated EV charging equipment that safely and conveniently connects an EV to the electricity distribution network.

Dedicated AC Charger (Mode 3)

Vector recommends the use of dedicated Type 2 Open-Socket Smart EV Chargers for business, commercial and apartment buildings. A Smart Charger is connected to a fixed and dedicated power supply from a switchboard or distribution panel. It typically comes in 7.4kW (single phase) and 22kW (three phase) sizes. Domestic urban homes normally have a single phase connection. Apartment blocks, commercial businesses and farms typically have a three phase connection.

The Type 2 Open-Socket chargers can be used with a range of EVs and will future-proof the location for newer EV models to come. They are used with charging cables that have a Type 2 connector on the source-end and either Type 1 or Type 2 on the EV-end.

Whilst some chargers may have a cable ready to use, others may have a 'bring your own cable' approach where customers will be required to bring their Type 2-Type 1 or Type 2-Type 2 cable.

It is recommended that all Smart Chargers have internet connectivity, i.e. ethernet, WiFi or cellular network connection capability and comply with international open charge point software standards (the recommended software capability for the charger is OCPP 1.6 or above and non-proprietary systems).

A Smart Charger enables Dynamic Load Management – An automatic sharing of the available electricity capacity of the electricity supply connection to all connected charge points. This is critical when using multiple chargers, or for the ability to add more chargers in the future. This optimises charging and available capacity without paying a large supply upgrade cost.

Dedicated DC Charger (Mode 4)

Vector recommends the use of DC rapid chargers with in-built CCS and CHAdeMO charging plugs for semi-public/public charging applications such as a supermarket carpark. A DC charger is connected to a fixed and dedicated power supply from a switch board or distribution panel.

High power DC charging technology can come in sizes greater than 25kW (three phase) and may require a special electricity supply connection.

It is recommended that DC charging is used for quick top ups in public charging environments.

It is recommended that all DC chargers have internet connectivity, i.e. must also have ethernet, WiFi or cellular network connection capability and comply with international open charge point software standard (the recommended software capability for the charger is OCPP 1.6 or above and non-proprietary systems).

Other New Emerging Types of Electric Vehicle Chargers

There are several new types of EV chargers emerging in the EV market, for example:

- Vehicle to Grid (V2G) bi-directional charger
- Vehicle to Home (V2H) uni or bi-directional charger
- High Power Charger for Heavy EVs

If you are wishing to install a bi-directional charger, you will need to make a special connection request to Vector. If you are planning to or would like more information on this, please get in touch with us directly on evinfo@vector.co.nz

EVs can be used as an energy storage system to support solar PV systems. During the day when the sun is shining and your PV system is generating energy you can setup your PV system to store excess generation in your EV for later use. You'll need to speak with your PV system supplier to understand how this can be done at your place.

WHAT IS SMART CHARGING?

A Smart Charger is connected to the internet and can be remotely monitored and controlled.

This enables new services to be offered, such as:

- Remotely monitor the status of charging points, to see if the charger is available, or in use
- Remote authorisation of users to access your chargers
- Remote diagnostics – enabling better servicing and reduced down-time of charging points
- Energy management – shift charging times to take advantage of times when electricity prices are lower
- Ability to remotely upgrade the charger firmware

BACK UP AC CHARGERS (MODE 2)

A back up AC charger is typically supplied with the EV at the time of purchase or can be bought separately from reputable distributors. This type of charger plugs into a standard household 3-pin power socket and comes in 2.4kW (single phase) size. Vector recommends the use of this type of AC charger for back up purposes only. Please note that Mode 2 chargers are not permitted for public charging* use.

Things to consider when buying a Mode 2 AC charger:

- All chargers that connect to the Vector electricity network are required by law to comply with New Zealand's Electrical Safety Regulations and Standards. Ask your EV charger supplier for Electrical Safety (IEC 61851-1 for AC and DC + IEC 61851-23 for DC) and EMC (EN 61000) compliance documents (Suppliers Declaration of Conformity - SDoC). This assures you that your charger is compliant to NZ safety and regulation standards.
- Imported used vehicles may come with a back up AC charger (especially Japanese imports) that may not be compliant to NZ Electrical Safety Regulations and Standards. Vector strongly recommends using compliant AC chargers to ensure that electrical safety is not compromised.
- Some cables come with an industrial or caravan plug that allows faster charging. A special wall power socket should be installed for this plug by a licensed electrician from the Electrical Workers Registration Board (EWRB).
- Don't use extension cables or non-standard adaptors for AC EV charging.

*Public charging is defined as the charging of an electric vehicle using Electric Vehicle Supply Equipment (EVSE), that is intended for use by the public. It includes the use of an electronic key, or similar device, to control or enable charging using the EVSE. Public charging comprises of (but is not limited to): roadside charging, and charging in public places or commercial facilities that are open to the public.

Public charging excludes:

- charging in locations that are not accessible to the public;
- charging from socket-outlets that are not installed with the specific intention of being used for electric vehicle charging (e.g. socket-outlets used to provide power to caravans and motorhomes in caravan parks), and
- charging provided by accommodation facilities, for exclusive use by their guests.

SELECTING AN EV CHARGER

	DEDICATED AC CHARGER (MODE 3) Type 2 Open-Socket Smart EV Charger Typical charging time 7-11kW (1ph): 2-3hrs 22kW (3ph): < 1hr	DEDICATED DC CHARGER (MODE 4) Rapid Chargers with CCS and CHAdeMO plugs Typical charging time 25kW or 50kW (3ph): 20-40mins	BACK UP AC CHARGER (MODE 2) 'In-cable' charge controller - plugs into a standard 3-pin power plug Typical charging time 6-12hrs
Household – Private owned parking	★★★	★	★★
Apartment Buildings	★★★	★	–
Office Buildings	★★★	★	–
Public Accessible Carparks (i.e. supermarkets, hotels, etc.)	★★★	★★★	–
Public Carparks	★★★	★★★	–
En-route Areas (Service stations, motorway service stations, etc.)	★★★	★★★	–

★★★ Highly recommended ★ Least recommended – Not recommended

OPTIONS TO POWER YOUR EV CHARGERS

When considering options to power your EV chargers you will need to understand your existing electricity usage, electricity connection capacity and potential future EV charging needs. You can request this data from your electricity retailer. Ask for your annual [half hourly] consumption data and connection capacity.

Understanding your future EV charging needs is more complex and we recommend that you perform this analysis with a registered electrician or engineer. You'll need to consider things such as:

- How many chargers do you need to install?
- How many EVs will be charging at your premises at any given point in time?
- What type and size of chargers do you need to install?

Appendix 4 can be used as a guide by electricians and engineers to perform the electricity capacity analysis.

After performing the electricity capacity analysis, you may find that you have sufficient existing capacity and in which case, you don't need a connection capacity upgrade. In cases where a connection capacity upgrade maybe required, there are various solutions available that you could discuss with an electrician or engineer. These solutions include:

Upgrade existing connection capacity: This solution involves upgrading your existing distribution service line, the connection fuse for your premises; and potentially also the distribution transformer in some cases. This is typically an expensive and least preferred solution unless there is a strong requirement of guaranteed capacity to supply all EV chargers at all times. Contact us on info@vector.co.nz for more details on this option.

Smart Charging: This solution encompasses the use of Smart EV chargers which are internet connected and communicating to a software platform. The software platform manages the Smart EV chargers depending on the number of chargers in use and the available electricity capacity.

OPTIONS TO POWER YOUR EV CHARGERS CONTINUED

This can happen in two ways:

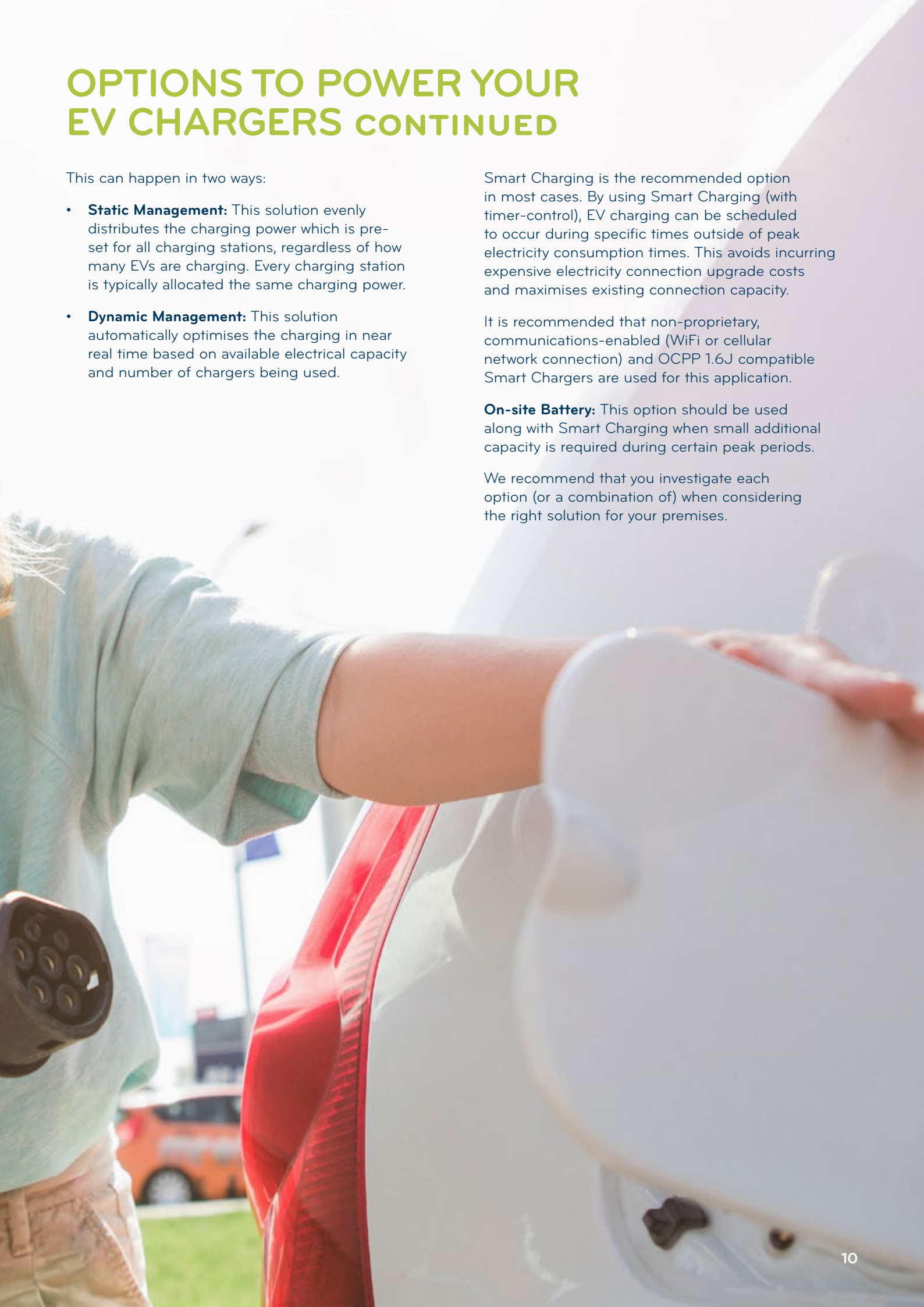
- **Static Management:** This solution evenly distributes the charging power which is pre-set for all charging stations, regardless of how many EVs are charging. Every charging station is typically allocated the same charging power.
- **Dynamic Management:** This solution automatically optimises the charging in near real time based on available electrical capacity and number of chargers being used.

Smart Charging is the recommended option in most cases. By using Smart Charging (with timer-control), EV charging can be scheduled to occur during specific times outside of peak electricity consumption times. This avoids incurring expensive electricity connection upgrade costs and maximises existing connection capacity.

It is recommended that non-proprietary, communications-enabled (WiFi or cellular network connection) and OCPP 1.6J compatible Smart Chargers are used for this application.

On-site Battery: This option should be used along with Smart Charging when small additional capacity is required during certain peak periods.

We recommend that you investigate each option (or a combination of) when considering the right solution for your premises.



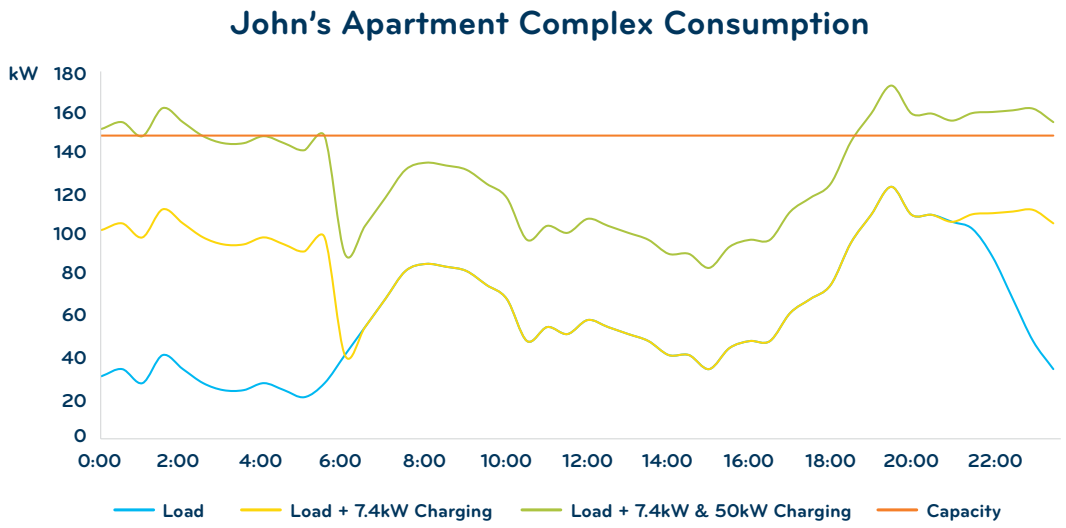
EXAMPLE:
JOHN'S APARTMENT COMPLEX*

John is looking to install EV chargers in his apartment complex basement to accommodate EV charging for his tenants. He has been in touch with his electricity retailer and has obtained his consumption data for his peak day (shown in the figure below). His retailer also confirmed that his connection capacity is 220A, three phase (150kVA).

HIS EV CHARGING REQUIREMENTS:

- His basement has 10 EV parking spaces, he wants an EV charger at each of them plus one additional charging space for a fast charger, to be used in emergencies
- He has conducted a survey with his tenants and understands he needs to install:
  - Mode 3 charging, because it's the most suited for his environment
  - A 7.4kW single phase AC EV charger at each EV parking space, because his tenants only require charging overnight and the average EV car battery size will be 60kWh and they only drive 40km per day on average (circa 8kWh, 1 hour of charging required.)
  - A special 50kW three phase DC charger for emergencies, which will be used on rare occasions and must be always available
  - He wants to use Smart Charging as he's looking to keep the costs down

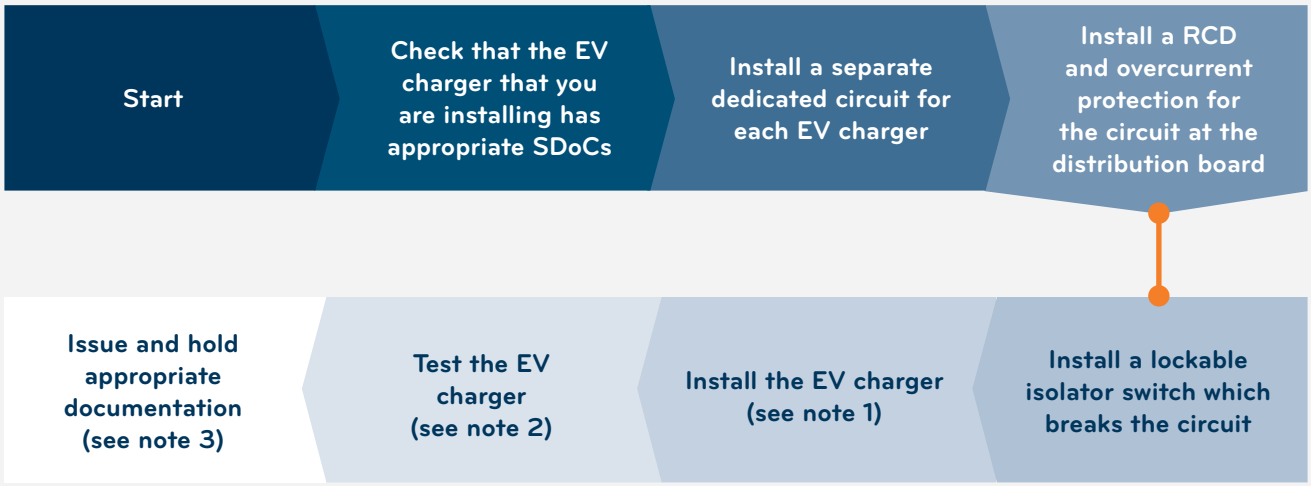
Summary: Based on John's EV Charging requirements, he (along with his electrician) performed a rough analysis (as shown below) which shows that he will be within his connection capacity limit if he implements Smart Charging for his 7.4kW EV chargers. He could install a localised battery just in case he wishes to install the 50kW DC charger for emergencies. During peak times, it will provide him with the required additional capacity or can be used as a back up supply. See Appendix 3 for the detailed analysis.



* This is a simplified example. Users should consider all electricity consumption variables and the electricity distribution design within the building when performing this assessment.

THE TYPICAL PROCESS OF INSTALLING EV CHARGERS

This diagram highlights the process of installing dedicated EV chargers, which must be done by a registered electrician.



NOTES:

1. If it is a public charger then:

- Equipment must be positioned to avoid damage in accordance with IEC TS 61439-7, including foreseeable damage, by impact
- There must be a provision of local or general mechanical protection (compliant with IK07 in accordance with IEC 62262)
- Socket outlet must be positioned 800mm above finished ground level
- Ensure that positioning and signage is in accordance with this guide's specifications

If the charger is not public, then we recommend you consider the guidance on page 14 before selecting the location for installing your charger.

2. Following testing is recommended:

- EV charger safely disconnects if there is a fault
- RCD is operational
- Earth continuity protection is operational
- If installation is outdoor, comply with IPX4 in accordance with AS 60529
- Appropriate protection co-ordination is achieved
- LV supply cable circuit and protection should be tested as per AS/NZS 3000'

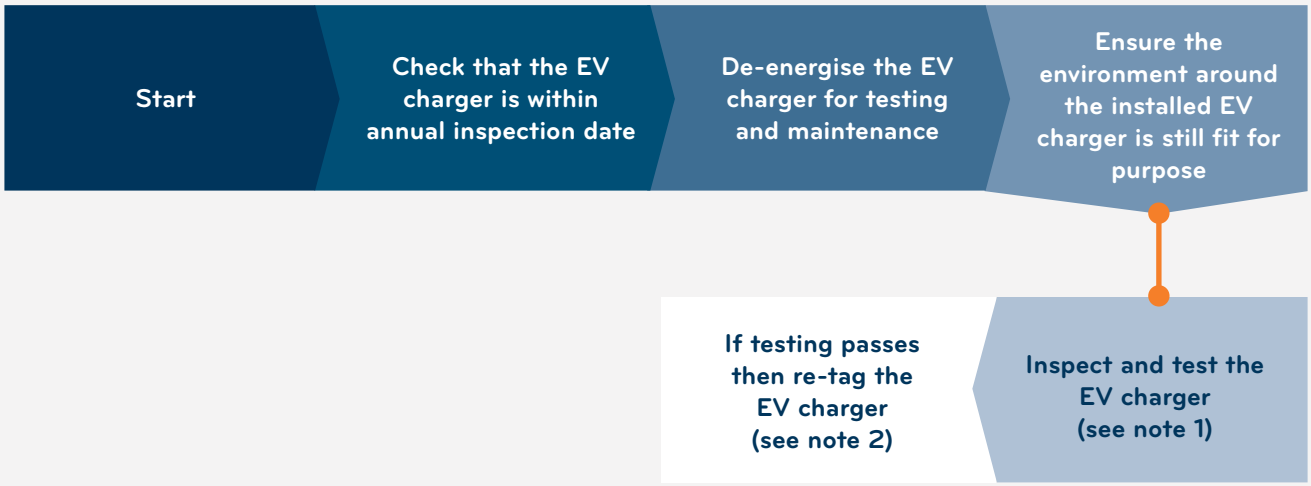
3. If public charger then:

- Issue a Certificate of Compliance (CoC), Record of Inspection and Electrical Safety Certificate for the installation

Otherwise only a CoC is required, which can only be issued by a registered electrician.

THE TYPICAL PROCESS OF MAINTAINING EV CHARGERS

This diagram highlights the process of maintaining dedicated EV chargers, which must be done by a registered electrician.



NOTES:

1. Inspect and test:

- All cables, leads and plugs
- RCDs and Overcurrent devices
- Functional EV check
- Earth continuity protection
- Ensure compliance with the most up to date WorkSafe guidelines as something may have changed since your installation

2. Re-tagging involves sticking a non-reusable tag with the following details:

- Date of assessment
- Date of next assessment
- EWRB licence number
- A statement from tester stating compliance
- Details of EV charger operator

THINGS TO CONSIDER WHEN CHOOSING AN EV CHARGER LOCATION

- There must be sufficient space around the EV charging equipment to allow the full opening of any doors or covers for operational purposes (maintenance, inspection, etc.)
- There must be sufficient space to allow adequate ventilation and cooling
- The EV charging station must be installed appropriately to avoid the charging cables causing tripping hazards
- EV charging stations must be installed in appropriate locations to avoid being damaged by vehicles. They should be installed 0.75m to 1.2m above ground
- Where the above is not possible, protective barriers or wheel stoppers should be considered
- Provision must be made for safe storage of any tethered charging cables
- EV chargers should not be installed within any hazardous area of a gas station. The cable connection to the EV charging inlet should be located within the non-hazardous areas
- Ensure that the EV charger unit is accessible, given the length of the EV charger connecting cable
- The positioning of the EV charging connection inlet must be easily accessible
- The distance between the EV charger and the EV should be kept to a minimum
- Access to and from the parking space must be considered
- The ability for the EV charger to be connected to the internet/WIFI must be considered
- Security of the EV charger sites must be considered
- Any potential for future expansion must be considered
- Ensure the EV chargers are sheltered from salt spray, wind and rain damage
- For public charging, consider NZTA's guidance **here**
- For public charging signage requirements refer **here** and **here**

Note:
NZTA guidance link: http://bit.ly/nztachargingsite
Signage requirements links:
http://bit.ly/nztachargingsigns
http://bit.ly/worksafeevguidelines

SAFETY CHECKLISTS FOR EV CHARGER INSTALLERS

The following checklists have been developed from WorkSafe's guidelines for safe electric vehicle charging, which provides safety guidelines for EV charging station equipment. Anyone installing EV charging infrastructure should ensure they comply with the guidelines (as summarised in our checklist below).

Note: At the time that this document was developed WKS-17 was in draft. Therefore, to keep up to date with the most recent guidance from WorkSafe please visit their website **here.**

When installing Mode 3 and 4 EV chargers:

ITEM	✓
All final sub-circuits must include a lockable isolator that operates in all live conductors.	
When designing and constructing the facility, demand factor and diversity of each EV charger circuit must be taken as 1.	
Must be compatible with NZ electrical supply system - TNC-S (MEN system).	
Must have a voltage independent Type B RCD (installed inside the switchboard) supplying the final sub-circuit, providing personal protection that is compatible with a charging supply for an EV. The RCD must operate on all live conductors including the neutral. It must be permanently marked as the EV circuit.	
Must have an earth continuity monitoring system that disconnects the supply if the earthing connection to the vehicle becomes ineffective. If the monitoring system were to fail, it should disconnect the supply to the EV Charger.	
Must have an overload protection device (may be combined with the RCD) which protects the charging supply fittings and incoming supply fittings.	
For charging stations with multiple connecting points, each connecting point must be protected by a voltage independent RCD that is compatible with a charging supply for an EV in addition to the primary RCD protecting the final sub-circuit.	
All EV charging stations installations must fail to safety.	
All installers must keep Certificate of Compliance (CoC) and have attached records that prove; • EV charging station is suitable for NZ conditions (low voltage 230V/400V at 50Hz) • Compliance with AS/NZS 3000 • All RCDs are performing according to requirements • Charging station safety functions work correctly (incl. earth continuity testing) • Any other testing specified by manufacturer of RCD or EV Charger • SDoCs • Test certificates demonstrating supplier's compliance with technical standards	
If installation is outdoor, or in a damp location, or in a dusty environment, the equipment must a have a degree of protection of at least IPX4 in accordance with AS 60529.	
Where required, protection co-ordination must be maintained.	

When installing Public EV chargers:

Before installation ensure compliance with the consenting process covered **here.**	
The system of supply, the charging station and the CoC (incl. attachments) must be inspected by a person that is competent to inspect charging stations and licenced to inspect Prescribed Electrical Works (PEW).	
Details of the inspection, including the details of the CoC must be lodged on the database referred to in the Electricity Safety Regulations 2010, Part 9, Section 112A, by a person that inspected the work, within 20 working days after the date of inspection.	
Position or location of the equipment must be in accordance with IEC TS 61439-7.	
Must be a provision of local or general mechanical protection.	
Complies with minimum degree of protection against external mechanical impact of IK07 (in accordance with IEC62262).	
Socket-outlet position must be at least 800mm above the finished ground level.	

The checklist is a summary of WorkSafe's Guidelines and should be read in conjunction with those Guidelines. It is not intended to be a substitute for compliance with legislation or regulation.

Note: WorkSafe Guidelines link http://bit.ly/worksafeevguidelines
NZTA consenting process link: http://bit.ly/nztaconsent

SAFETY CHECKLIST FOR OWNERS, OPERATORS AND MANAGERS OF EV CHARGING STATIONS

Recommended points to be considered by Public EV charging station owners, operators, and managers:

ITEM	✓
Ensure compliance with the consenting process covered **here**	
All new Public EV charging stations must be assessed before their first anniversary, after which they must be assessed at intervals of no more than 12 months. All records are required to be kept.	
Assessment of Public EV chargers includes the following: • Inspection of leads • Testing and verification of all RCDs and overcurrent protection • Testing of EV charging station safety function (incl. earth continuity) • Inspection of condition of EV charging station • Verification that the EV charging station still complies with appropriate WorkSafe and manufacturer guidelines and appropriate standards	
If the Public EV charger passes the assessment then a non-reusable tag must be affixed in a position that will be seen by users. This tag should include: • Date of assessment • Date of next assessment • EWRB licence number • A statement from that person stating compliance • Phone number and email of EV charging station operator The assessor normally issues this tag.	
An EV charging station which is found to be unsafe at any time by any person must be taken out of service. It should not be reconnected until its safety has been confirmed.	

Note: NZTA consenting process link: http://bit.ly/nztaconsent

APPENDIX 1:
THREE MAIN MODES FOR EV CHARGING
DEFINED BY INTERNATIONAL TECHNICAL STANDARDS (IEC 62195)

Mode 2 (AC Charging)

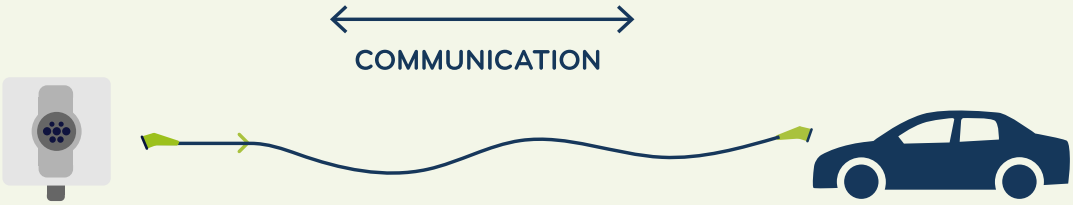
Mode 2 chargers connect to a domestic 3 pin socket-outlet (10A rated) or for larger Mode 2 chargers, you may use a dedicated socket (for example AS/NZS 3112 and AS/NZS 3123 compliant), rated between 16A - 20A. The type of socket that a Mode 2 EV charger is connected to depends on the rating of Mode 2 charger. Mode 2 chargers can be rated between 2.3 and 7.4kW.

Vector only recommends the use of Mode 2 chargers for Back Up Purposes Only.

Mode 3 (AC Charging)

Mode 3 chargers are specialised charging systems that is connected to a dedicated circuit from a switchboard. Control, communications, and protection functions are incorporated in the EV charger with "smart" charging potential. Mode 3 chargers in household, commercial or public applications can be either 230V 1ph or 400V 3ph.

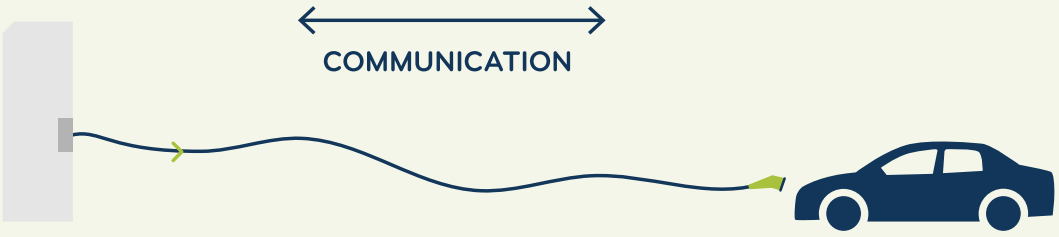
Mode 3 chargers are suitable for most Dedicated AC EV Charging.



Mode 4 (DC Charging)

Mode 4 chargers provide DC charge to the vehicle and carry out the control functions within the EV charger. Mode 4 bypasses the on-board charger on the vehicle and utilises external large EV charging equipment to provide high charge currents. Commonly, Mode 4 chargers operate at around 22kW-50kW and emerging high power DC charging equipment have the potential to operate up to 320kW.

Mode 3 chargers are suitable for most Dedicated DC EV Charging.



APPENDIX 2: TECHNICAL COMPLIANCE REQUIREMENTS OF EV CHARGER

All charging stations must comply with:

CHARGER TYPE	STANDARD	OR STANDARD
Mode 2 IC-CPD	IEC 62752, 61851-1	UL 2251
Mode 3 AC Charging	IEC 61851-1, 61851-22	
Mode 4 DC Charging	IEC 61851-1, 61851-23	

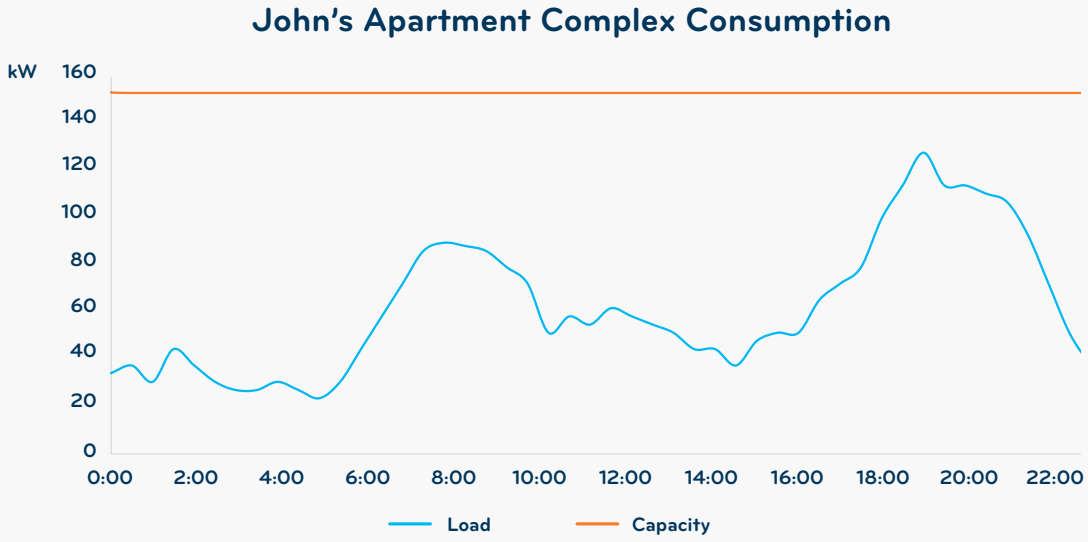
Note: New standards may be added at a later date.

EQUIPMENT	APPLICABLE STANDARD
RCD	IEC 62423
Overload protection device	IEC 60947-2, IEC 60947-6-2 or AS/NZS 61009-1 or relevant parts of AS/NZS 60898 series or IEC 60269 series
IC-CPD leads (all leads must be labelled by the manufacturer to show ratings of intended use)	IEC 61851-1 in conjunction with IEC 62196-1 or UL 2202 or UL 2251
Connectors	IEC 61851:2017 and other relevant standards governing either the EV plug or EV socket-outlet portions of the adaptor. They should be marked to indicate specific conditions of use allowed by manufacturer.

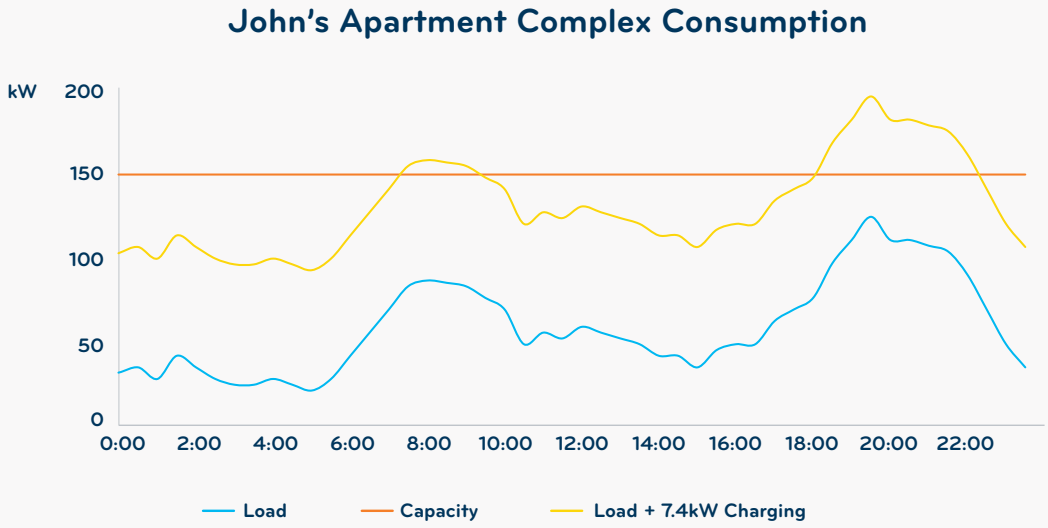
APPENDIX 3:
ANALYSING YOUR LOAD TO ACCOMMODATE EV CHARGING

To demonstrate the analysis required, the example from page 11 ("John's apartment complex"), will be used.

1. John approaches his retailer for his half hourly consumption data and capacity information
2. John starts by looking for the day with the highest peak electricity consumption (kWh) using the data received from his electricity retailer
3. He records the date on which peak electricity consumption took place and uses this date's full electricity consumption data/profile (from "00:00" till "23:30") for his analysis
4. He converts the "kWh" values into "kW" by multiplying them by 2
5. He is now able to compare the difference between his connection capacity and peak electricity consumption by creating a graph (below).

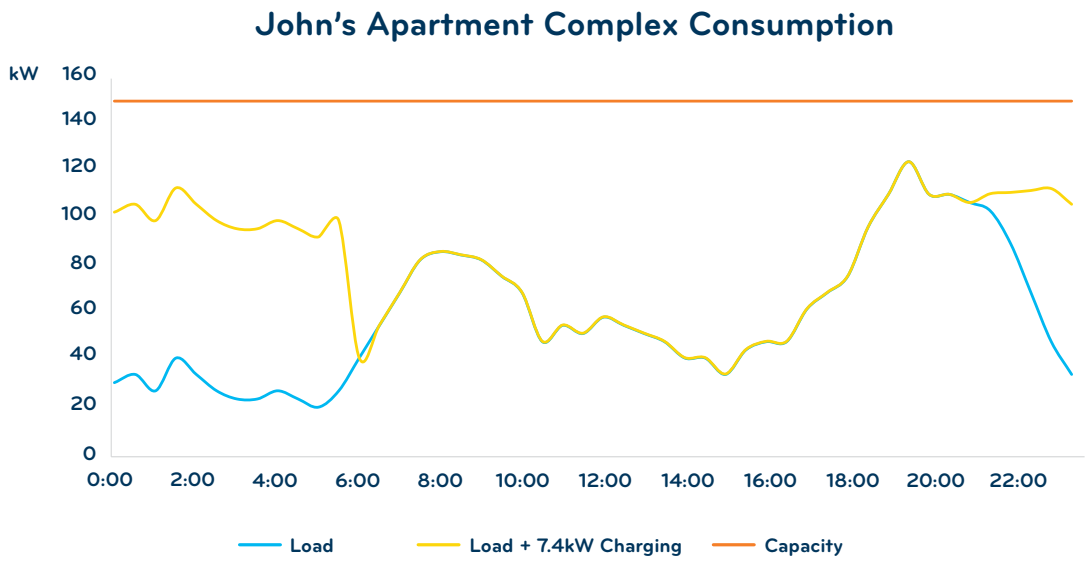


6. Since John wanted to add 10 x 7.4kW EV chargers', he adds all 'kW' values with 74kW (10 x 7.4kW = 74kW) to get his new consumption profile. John's new consumption profile looks like this:

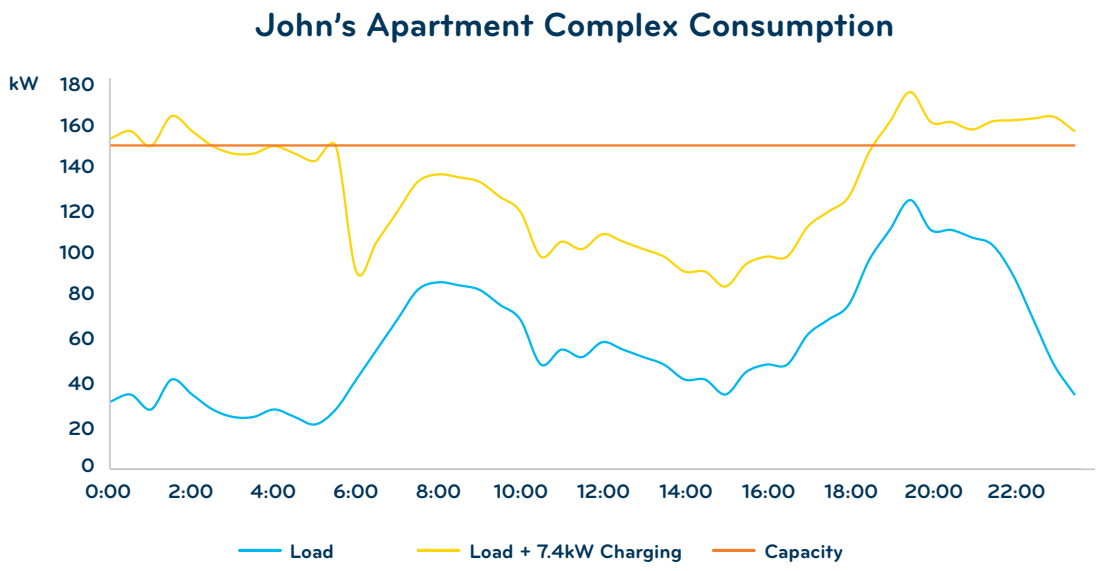


APPENDIX 3:
ANALYSING YOUR LOAD TO ACCOMMODATE EV CHARGING
CONTINUED

7. John finds that his new load will breach his existing connection capacity. He would now like to factor in setting a Smart Charging timer-function between 06:00 and 21:30 on his EV chargers to manage his peak consumption. He removes the EV charging component (74kW) of the consumption during this time period and gets the following following profile:



8. He is now happy that Smart Charging will save him money by avoiding the cost of a connection capacity upgrade but he still wishes to add a 50kW charger for emergencies which is available at all times. He adds a further 50kW to his new consumption profile and gets the following profile:



9. John notices that there will be times where he may require additional capacity and he opts to install a battery that is designed to provide additional capacity for the 50kW EV Charger.

APPENDIX 4:
A GUIDE TO PERFORMING THE ELECTRICITY CAPACITY ANALYSIS

We recommend you perform this analysis with the help of a professional electrician or engineer.

Step One: Get your electricity consumption data

Request your electricity consumption data from your electricity retailer to understand how much spare capacity you typically have in your electricity supply connection - ask for:

a) Half hourly consumption data over the past year.

b) Capacity of the electricity connection to the premises.

Step Two: Understand your EV Charging Requirements

Consider the answers to the following questions when planning to install EV Chargers:

a) How many EVs will the location serve in the future?

b) How quickly do they need to be charged? i.e. consider speed at which the EVs can be charged and their average battery size.

c) What is the average driving distance of the EVs per day?

d) When do they need to be charged? Consider if Smart Charging could help save installation costs and enable cheaper tariffs for night-time charging.

e) Is installing solar beneficial at the charging location? Can EVs be used as energy storage during high solar generation?

Step Three: Calculate your requirements

a) Using the consumption data, pick the day where the highest electricity consumption was seen. This is normally between June – August, during peak winter months.

b) Calculate the EV charging requirements in kWs based on how often and how frequently all EV charges will be used at the same time.

c) Add the EV charging requirements to the day of peak consumption to determine whether there is sufficient capacity to support the EV load. Consider leaving a buffer for emergency charging.

Step Four: Understanding options when further capacity is required

In cases where a connection capacity upgrade maybe required, the following options can be considered:

a) **Upgrade to existing connection capacity:** If there is a strong requirement of guaranteed capacity to supply all EV chargers at all times, a larger electricity supply connection can be requested from Vector, contact info@vector.co.nz. In most cases this is likely to be an expensive option which should be avoided by using Smart Charging.

b) **Smart Charging:** This enables smart distribution of the available electricity capacity to all connected chargers. It is critical when using multiple chargers or if you're likely to add more chargers in the future. It optimises charging and available capacity without paying a large supply upgrade cost. There are two methods of Smart Charging:

   1. **Static Management:** This method limits the maximum power supplied by the EV charger based on the number of chargers and their pre-set capacity values.

      For example: If the available electricity supply capacity is 10Amps and 2 x EV chargers are required, the maximum power draw on each charger can be pre-set to 5Amps each.

APPENDIX 4:
A GUIDE TO PERFORMING THE ELECTRICITY CAPACITY ANALYSIS
CONTINUED

2. **Dynamic Management:** This method allows an automatic sharing of the available electricity capacity to all connected chargers by dynamically changing the charge rate based on how many chargers are in use. This approach requires the EV chargers to communicate to the internet and be managed by a software platform. If you'd like to learn more about Dynamic Management, contact us on evinfo@vector.co.nz

c) **Battery Solution:** If there is a small capacity deficit between the EV charging requirements and installed electricity supply capacity (i.e. less than 100kVA for 2-4 hours), a battery storage solution can be an option to consider. A battery would provide a small boost to the existing capacity and avoid an expensive upgrade to the existing connection capacity. You will require a special connection request for this option. Contact us on dginfo.applications@vector.co.nz to request approval to connect your battery.

Step Five: Find an installer

Engage a registered electrician to perform the installation. Ask the electrician to produce their Electrical Workers Registration Board (EWRB) number to be sure that the person you've engaged is accredited and competent. You may need to engage a registered engineer to design your installation.

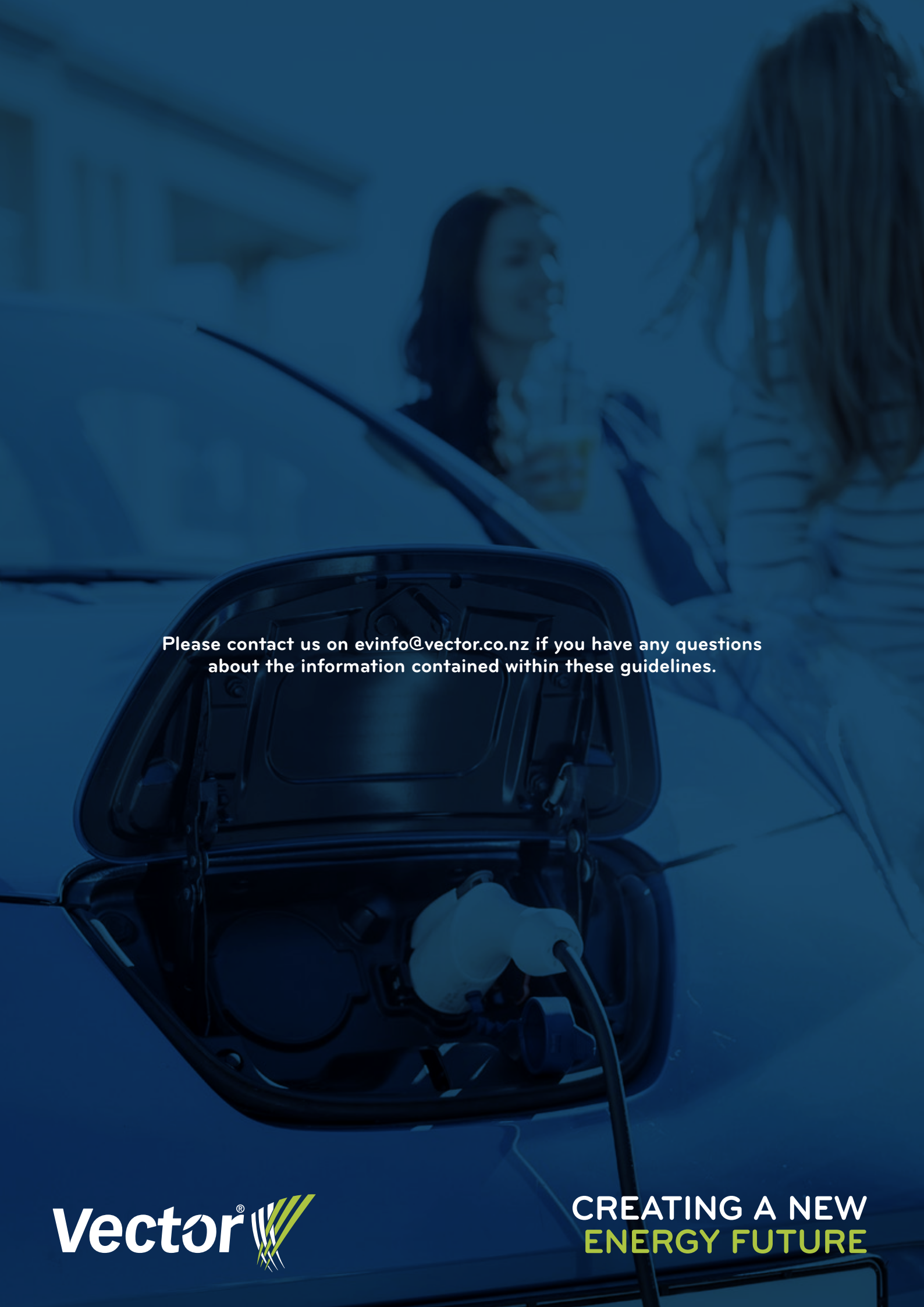
Note: Remember to balance your loads across the three phases, if you have a three-phase supply.

Step Six: Before buying your EV charger(s)

Purchase and install the EV chargers only after consulting with the electrician or engineer on installation locations and understanding the available electricity supply capacity.

Step Seven: Tell Vector

Please let us know about your EV charger installation on evinfo@vector.co.nz. This will help us operate and maintain the electricity network.



Please contact us on evinfo@vector.co.nz if you have any questions about the information contained within these guidelines.

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