

# **Guidelines for Electric Vehicle Charging**

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29 November 2022

Time in Life Cycle	Electric Vehicles	Charging Infrastructure	Electricity to the Plug/Charger
Design	Standards, tech development, meeting market	Standards, compatibility, fit-for-purpose	Electricity supply system, planning
Build	Capacity, market demand by	Capacity, demand by different	Gen Co.s/Line Co.s
Supply	Availability		Gen Co.s/Lines Co.s, general information on
Purchase (and resell)	Experience EV		network upgrade, on type switching ... y and country plans
Installation	Insurance, warranty, registration identification. WoF	Approval, site works, certification. industry training	Gen Co.s/Lines Co.s
In-service operation			
General use	Uncertainty		controls (pricing and other).
Charging	Under		, time of charging, billing
Servicing/maintenance	Uncertainty capabilities		Co.s/Lines Co.s
Breakdown	Guidelines/best practice	Response, industry training, map.	Gen Co.s/Lines Co.s
Accident	1 <sup>st</sup> response, repair, fleet re-entry	1 <sup>st</sup> response, repair, re-cert.	Gen Co.s/Lines Co.s
Retirement	Decision to, reuse of battery/electrics through scrap/recycle .	Decision to, re-use/upgrade through scrap	Gen Co.s/Lines Co.s

Need Charging Standards:

- Safety (minimum requirements)
- Interoperability (EV and charger)
- Convenience (spec for ordering vehicles)

Need Guidelines:

- Safety (of installations and use)
- Convenience (... closest station ...)
- Faster to deploy
- Flexible for new technology

Time in Life Cycle

Electric Vehicles

Charging Infrastructure

Electricity to the Plug/Charger

Electricity supply system, planning

en Co.s/Line Co.s

s/Lines Co.s, general information on

network upgrade, on type switching ... and country plans

Co.s/Lines Co.s

controls (pricing and other).

; time of charging, billing

s/Lines Co.s

/Lines Co.s

/Lines Co.s

'Lines Co.s

AS/NZS 3000:2018

Australian/New Zealand Standard  
**Electrical installations**

Known as the Australian/New Zealand  
**Wiring Rules**

Superseding AS/NZS 3000:2007



AS/NZS 3000:2018

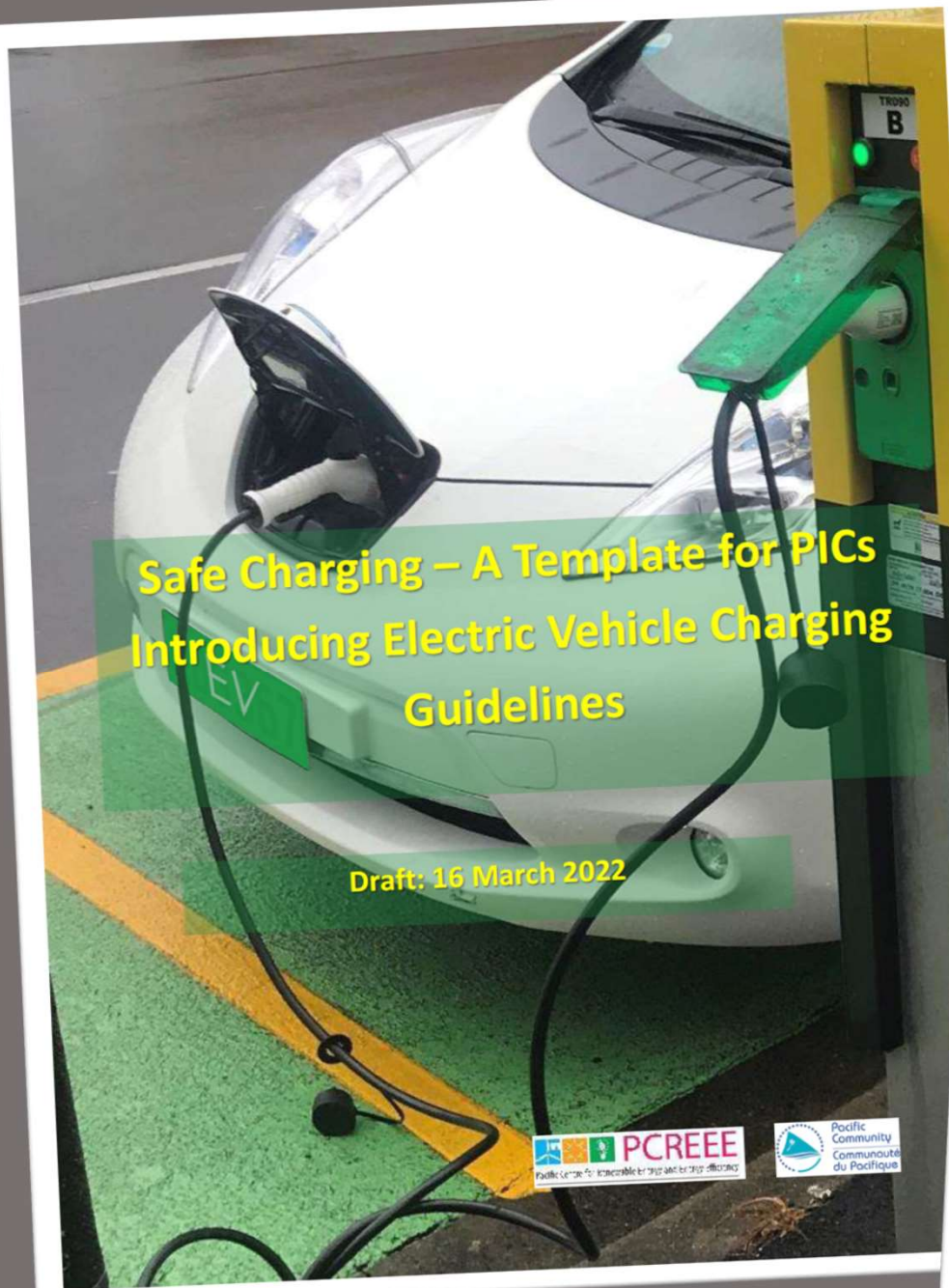


**IEC 61851-1**

Edition 2.0 2010-11

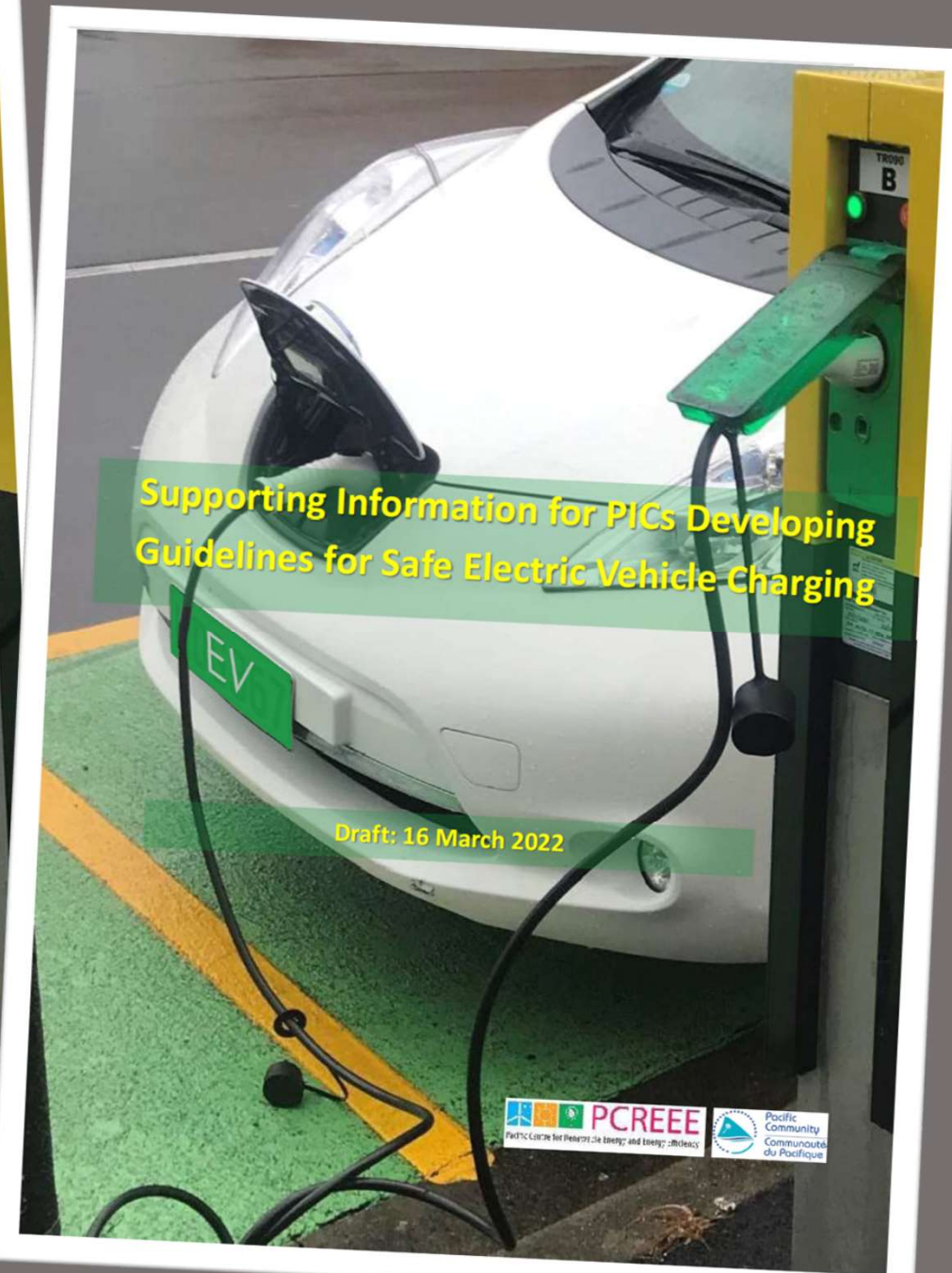


rules électriques --



# Safe Charging – A Template for PICs Introducing Electric Vehicle Charging Guidelines

Draft: 16 March 2022



# Supporting Information for PICs Developing Guidelines for Safe Electric Vehicle Charging

Draft: 16 March 2022





Destination

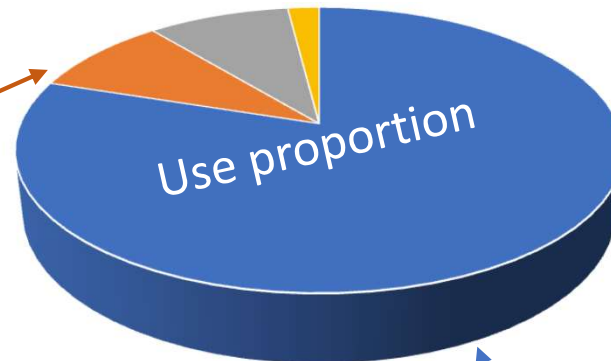


## Conductive Charging

On the go/journey (and 'oops')



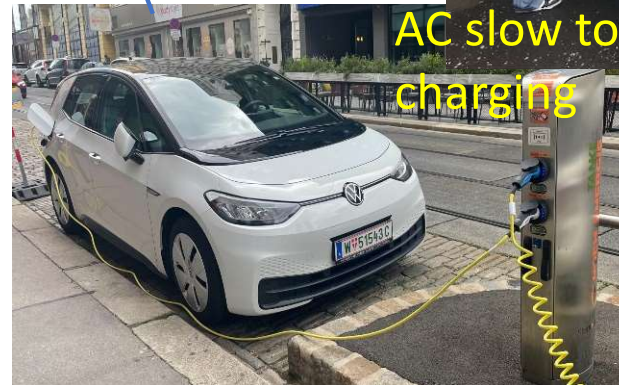
At work



At home



AC slow to med  
charging

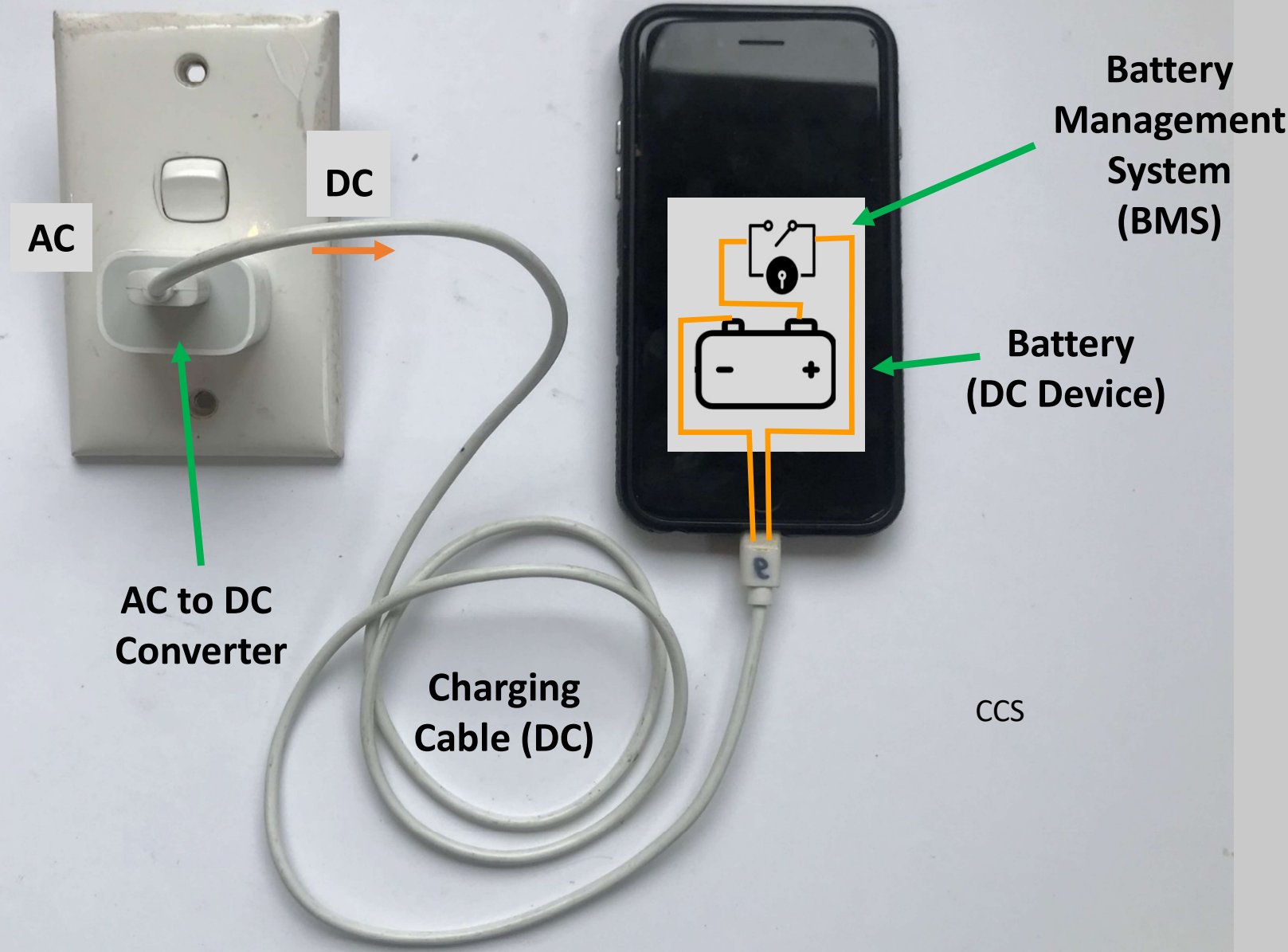


and in neighbourhood



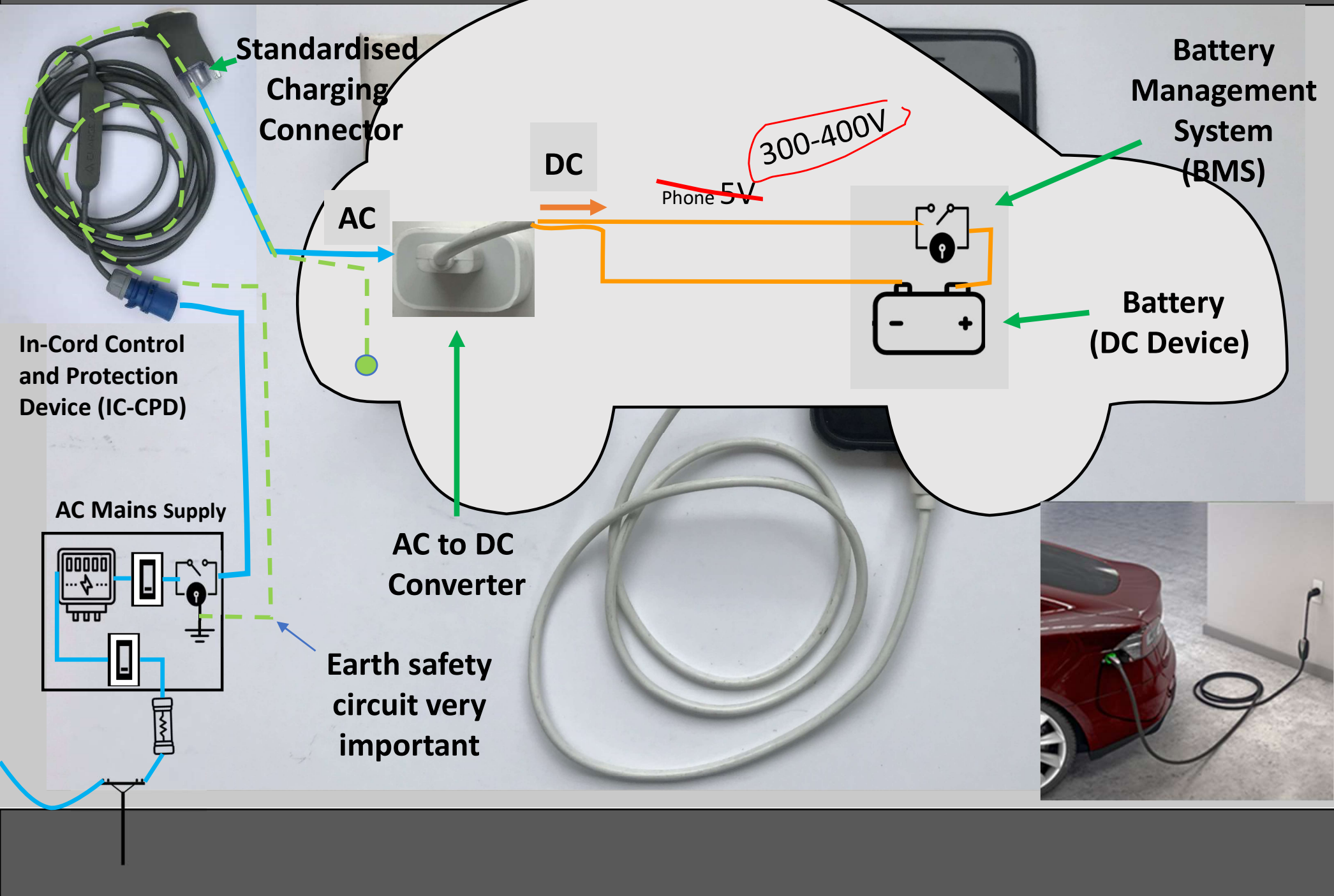
## Charging basics ...

## Conductive 'DC Charging'



Charging basics ...

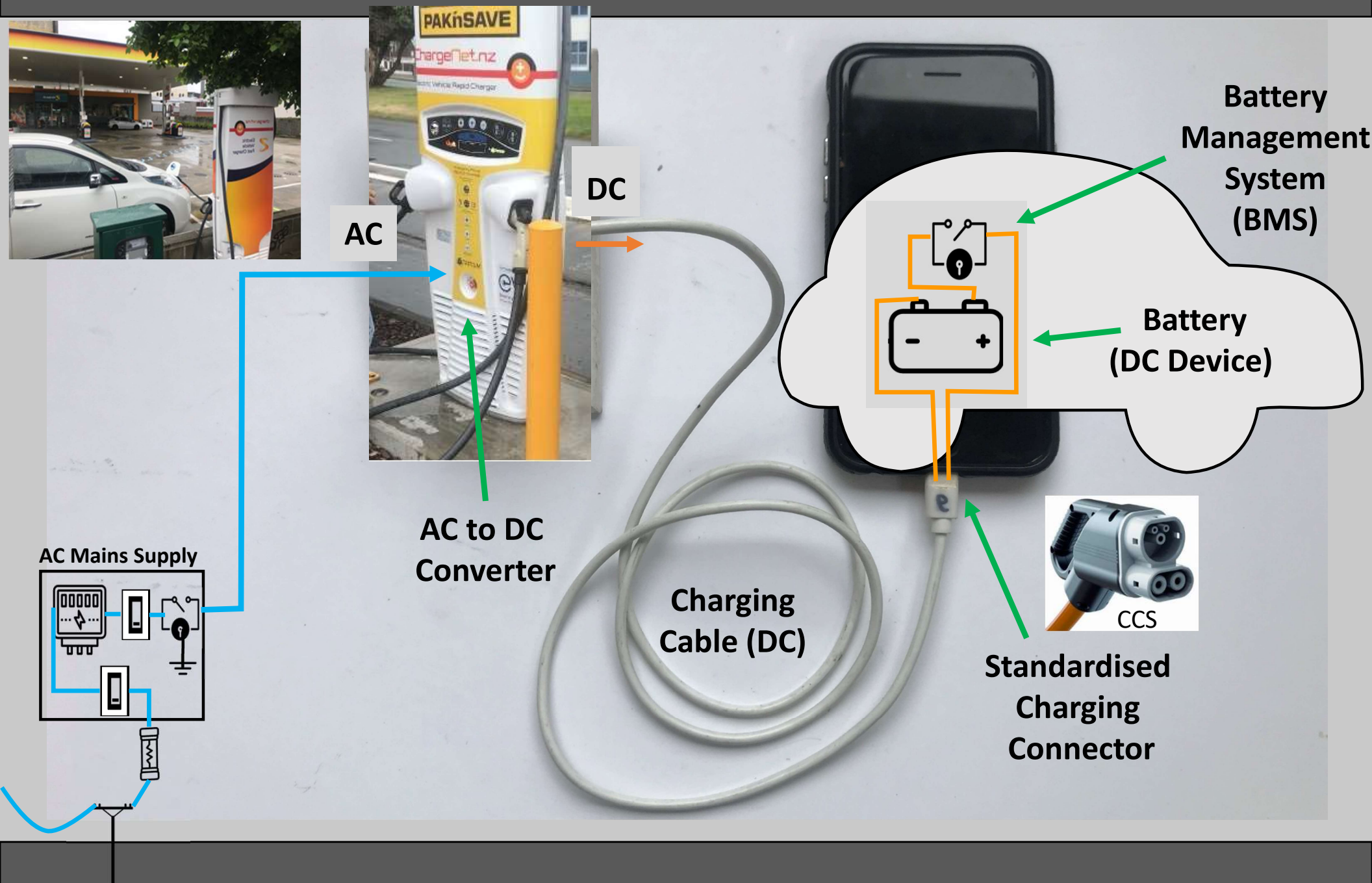
Conductive 'AC Charging'





# Charging basics ...

# Conductive 'DC Charging'





# IEC Standards refer to four charging modes

## ‘Mode 1’ AC Charging ...

### e.g., Simple EV, Domestic Charging

- No pilot/checking system.
- May have little safety functions.
- **Not recommended** for HV charging.
- **Not permitted** in some countries.



## ‘Mode 2’ AC Charging ...

### ‘At-Home’ Slow Charging

#### In-Cord Control and Protection Device (IC-CPD):

- (Low voltage) pilot handshakes with EV and checks for faults before charging goes live.
- Regulates the charge rate.
- ‘Installation’ by plugging into socket outlet ... requires electricity supply circuit to be safe.



# Modes 3 and 4 ...

## 'Mode 3' AC Charging ...

### At-Home, Work, and in Public Spaces

Pilot handshakes with EV and checks for electric faults before going live (as for Mode 2).

Permanently wired to mains supply:

- Earth safety circuit more robust.
- Installed by a qualified electrician.







## 'Mode 4' AC Charging ...

### Fast, Public Charging

- Pilot handshakes with EV and checks for electric faults before going live.
- Permanently wired.
- Tethered charging cable (water cooled for high kW).
- AC-to-DC converter off the vehicle → larger and heavier → faster charge rates.





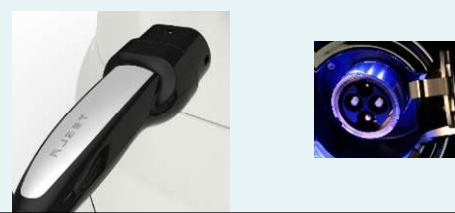


# Comparing the Four Charging Modes

Consideration	Mode 1	Mode 2	Mode 3	Mode 4
AC or DC Charging	AC	AC	AC	DC
Supply Wiring	Socket outlet	Socket Outlet	Permanent	Permanent
Pilot Control	None	Yes	Yes	Yes
Isolates on Detecting Residual Current	No	Yes	Yes	Yes
Typical Charge Rate	1-2kW	1.2kW-3.6kW	2.4kW-11kW	30kW-350kW
Time to add 100km range	7-15 hours	4-15 hours	2-7 hours	2-30 mins
Recommended use	Not recommended	At-home only, not preferred.	Domestic, commercial and public charging.	Commercial and public charging.
				



# Charging connectors ... **important to guide use at public charging stations**

	Name	AC/DC	Rate	Vehicle
	<b>"Type 1"</b> (SAE J1772)	AC	1-7kW	Japan, US origin, Some EU
	European Mennekes <b>"Type 2"</b>	AC and DC	1-22kW AC BYD/Tesla up to 100-130kW	EU-sourced
	<b>Type 3</b> (CHAdeMO)	DC	50-100kW	mainly Japan origin
	<b>Combo or CSS</b> (Combined Charging System, Type 1 and 2)	AC and DC	50-350kW DC	EU-sourced
	<b>Tesla Super- charger</b>	AC And DC	Up to 250kW	Tesla

**Preferred for AC public  
charging stations**

# AC Public Charging ... providing for different vehicle connectors



Portable cable with: Type 1 at EV and Type 2 at charger








Type 2 CS  
Connector

Type 1 EV Connector



Type 2 EV Connector

# Charging connectors ... **important to guide use at public charging stations**

	Name	AC/DC	Rate	Vehicle
	<b>"Type 1"</b> (SAE J1772)	AC	1-7kW	Japan, US origin, Some EU
	EU M "Type 2"	AC	3-22kW	EU-sourced
	<b>CHAdeMo</b> (time for tea)	DC	10-80kW (now up to 400kW DC)	mainly Japan origin
	<b>Combo or CSS</b> (Combined Charging System, Type 1 and 2)	AC and DC	50-350kW DC	EU-sourced
	<b>Tesla Super-charger</b>	AC And DC	Up to 250kW	Tesla

**Preferred for DC public charging stations**



# DC Public Charging ... providing for different vehicle connectors



# Charging at home ...

# Common plugs used



Is the electricity supply circuit safe?

- 4 hours charging very different to boiling a kettle for 2 minutes!
- → reduce charging rate over label rating.
- Earth circuit important for safety

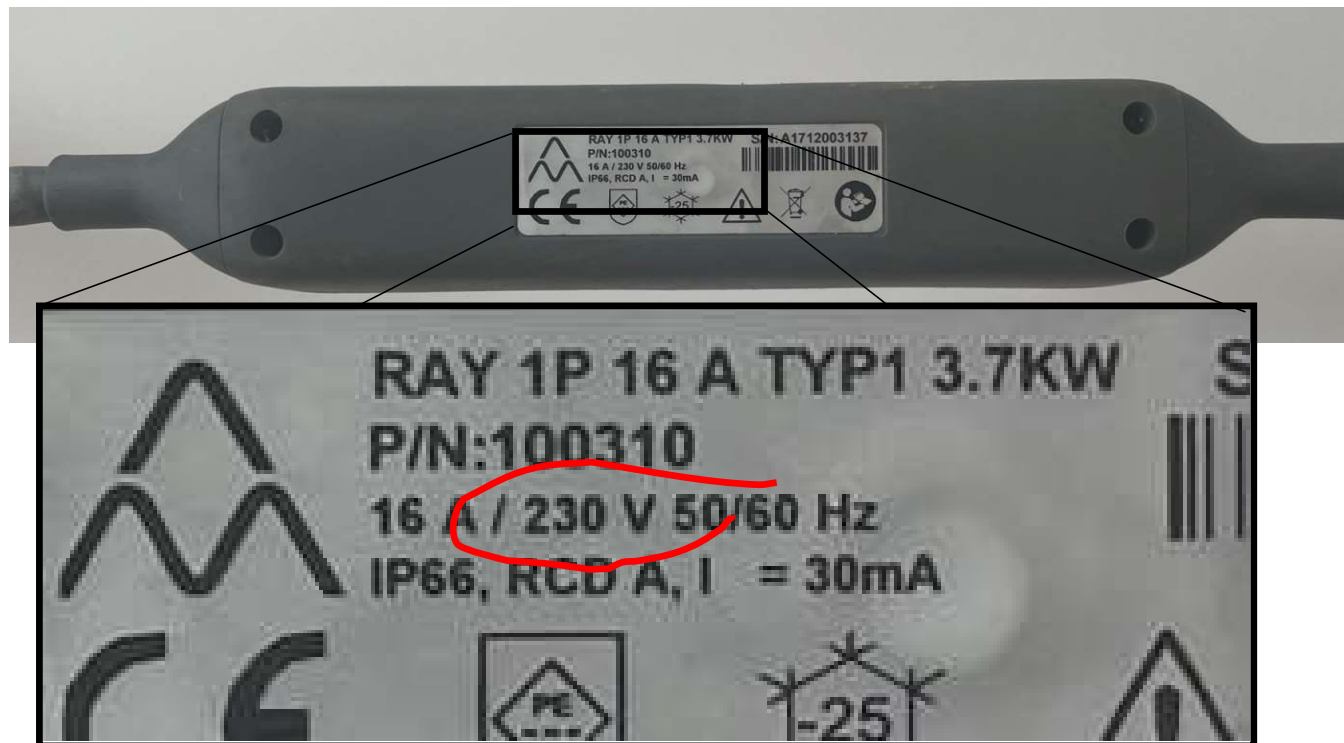
	Common plugs used				
Rating of plug	Type A 15A	Type B 15A	Type C 5A	Type E 16A	Type I <del>8A</del> <del>10A</del>
Fiji 240Vx50Hz					✓
French Polynesia 220x60			✓	✓	
Kiribati 240Vx50Hz					✓
Marshall Islands 120Vx60	✓	✓			
Nauru 240Vx50Hz					✓
New Caledonia 220x50			✓	✓	
New Zealand 230/240x50					✓
Palau 120Vx60Hz	✓	✓			
Solomon Islands 220x50	+Type G				✓
Tonga 240Vx50Hz					✓
Tuvalu 220Vx50Hz					✓
Vanuatu 220Vx50Hz					✓
Wallis and Futuna 220x50				✓	

# Charging at home ...

Most users start with using the portable charging cable that came with the EV



But is the charger compatible with the electricity supply circuit?



→ Electrical equipment must be used within its design specification



# Recommendations, making charging safer and convenient ...



1. Equipment built to recognised **international standards** (e.g., IEC).

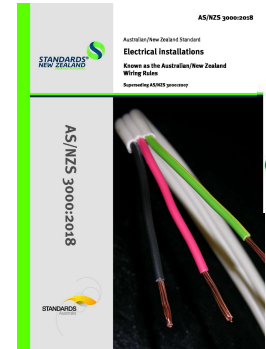
2. Installation/works to meet **national standards** and regulations.

3. Use RCD/**GFFI protection** on electric supply circuits used for charging.

4. Strongly **discourage Mode 1** charging.

5. **Encourage female Type 2 (Mennekes)** for public AC charging.

6. **Encourage CHAdeMO and CCS Type 2** for DC public charging.



Type 2



CHAdeMO



CCS Type 2

## Proposed next steps:

1. Template and supporting information on PCREEE's website.
2. Now requires country-specific calibration.
3. Country acceptance of (voluntary) guidelines.
4. Awareness raising (develop/provide infographics, webinars, other).
5. As required update of guidelines.

**Thank you**