

JuicePoint

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Implications of EV

Charging for

Body Corps



About JuicePoint

- Founded 2009 by Mark Yates - Oldest EV Charging Supplier in NZ
- 100% NZ privately owned
- Work closely with our US based supplier eMotorWerks, a subsidiary of EnerNOC the largest demand response provider to the NZ national grid operator (TransPower)
- Supplier to ChargeNet, the largest nationwide public rapid EV company in New Zealand
- Grant and Nick are both Electrical and Electronic Engineers.

*This presentation was originally presented to the [Body Corporate Chairs' Group](#) 2018 AGM.
Updated May 2019.*



Implications for Body Corps

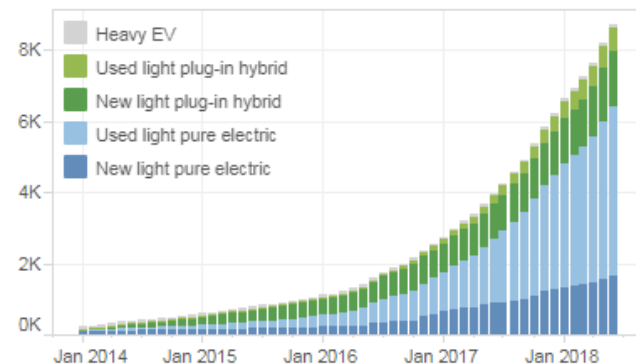
- Different Electric Vehicles use one of 4 commonly used plugs. None are compatible
- Power Consumption - from 1.5 to 500 kW
- Compliance - Electrical Wiring Regulations, WorkSafe Guidelines, Radio Frequency emission regulations, Electrical Safety Inspections, Health & Safety
- Who pays for the electricity to charge a car?
- Who is permitted to use a charge station?
- Is public charging offered?
- Maintenance of the Installation?
- Who deals with faults/outages?



EV's are coming - are you ready?

<https://www.transport.govt.nz/resources/vehicle-fleet-statistics/monthly-electric-and-hybrid-light-vehicle-registrations/>

EV fleet size



	2013	2014	2015	2016	2017	2018
Jan	192	232	592	1,114	2,752	6,620
Feb	192	243	622	1,150	2,980	6,908
Mar	200	283	680	1,223	3,187	7,245
Apr	200	326	713	1,316	3,371	7,621
May	202	364	742	1,401	3,654	8,189
Jun	205	388	793	1,595	3,962	8,696
Jul	206	415	841	1,747	4,250	
Aug	208	439	870	1,871	4,585	
Sep	210	464	914	1,985	4,918	
Oct	218	491	954	2,149	5,353	
Nov	223	524	999	2,369	5,832	
Dec	227	551	1,053	2,549	6,207	

Consider these EVs



Nissan LEAF

24kWh or 30kWh battery

15kW / 100km

Range: 135km

in NZ 7300



Renault Zoe

41 kWh battery

15kW / 100km

Range: 250km

in NZ 168



Tesla Model S




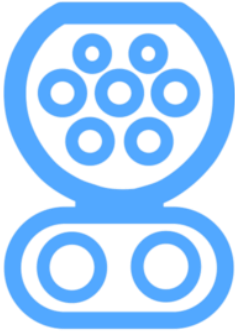
75kWh or 100 kWh battery

20kW / 100km

Range: 400km to 500km

in NZ 306

Connectors & Chargers

AC Charging	DC Rapid Charging
<p>Type 1 (J1772) Single Phase 7.4kW Max</p> <p>Japan / US</p> 	<p>CHAdeMO</p> <p>50 to 500 kW Max</p> <p>Japan / US</p> 
<p>Type 2 Single Phase 7.4kW Max 3 Phase 22kW Max</p> <p>Europe / NZ / AU Most NZ new EVs are Type 2.</p> 	<p>CCS Type 2</p> <p>50kW Max</p> <p>Europe / NZ / AU</p> 

Charger Types

Mode 2



AC Single Phase
Plug into wall
1.8kW Max

Mode 3



AC Single or 3 Phase
Hard wired Wall Mount
7.4kW or 22kW

Mode 4



Rapid DC
Floor Mount
50kW

EVSE Mode Comparison

Mode	Advantages	Disadvantages
2 Plug In <\$1k	<ul style="list-style-type: none"> • Cheap • Portable 	<ul style="list-style-type: none"> • Very slow charge • Can't use an extension cord, must have a dedicated 3-pin outlet at a prescribed height and location
3 Wall <\$3.5k	<ul style="list-style-type: none"> • Available Charge Rate \geq Most EVs • Robustness 	<ul style="list-style-type: none"> • Not Portable • Hard-wired by electrician
4 Rapid DC >\$50k	<ul style="list-style-type: none"> • Rapid DC Charging 	<ul style="list-style-type: none"> • Very expensive • Can reduce battery life • Needs strong grid connection • Not supported by all EVs

How Fast does an EV Charge?

The following factors determine the speed to charge an EV

- Battery size - Bigger takes longer
- Battery health and age
- Battery charge level
 - Cell balancing reduces charge rate
 - Generally takes longer to charge from 80% to 100%
- EV's onboard AC charger
- EV's onboard DC charger
- Electric Vehicle Supply Equipment (EVSE)'s Power Supply
 - Mode
 - Single or 3 Phase AC power
 - Load Sharing



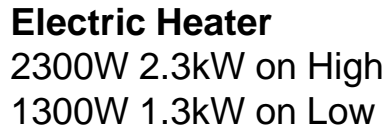
LEAF:

3.6kW Single Phase AC
50kW DC Rapid Charge

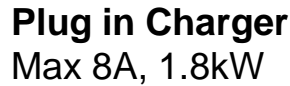


ZOE:

7.4kW Single Phase AC
22kW 3 Phase AC
No DC Rapid Charge



Run the heater for 1 hour
on low = 1.3kWh.



Charge an EV for 1 hour
= 1.8kWh
= 10km Range



80% charge at 1.8kW
10 hours for 24kWh battery.

Wall Chargers - Mode 3 Single Phase



Electric Heater
3x 2.3kW on High

Run 3 heaters on high for
1 hour = 7.2kWh.



AC Wall Charger
Max 32A, 7.2kW

Charge an EV for 1 hour
= 7.2kWh
= 45km Range

Nissan LEAF

80% charge at 3.6kW (Limited by LEAF) Except some UK LEAFs 7.2kW
5.5 hours for 24kW battery.

Renault Zoe

Max charge rate 7.2kW
4.5 hours

Tesla S

Max Charge rate 11kW
9 hours (100kWh battery)

Wall Chargers - Mode 3 Three Phase



Electric Heater

9x 2.3kW on High

Run 9 heaters on high for
1 hour = 22kWh.



AC Wall Charger

Max 32A, 22kW

Charge an EV for 1 hour
= 22kWh
= 140km Range

Nissan LEAF

80% charge at 3.6kW Single Phase
(Limited by LEAF)
5.5 hours for 24kW battery.

Renault Zoe

Max Charge rate 22kW
2 hours for 80% Charge

Tesla S

Max Charge rate 11kW
9 hours (100kWh battery)

DC Rapid Chargers - Mode 4



22

Electric Heater

22x 2.3kW on High

Run 22 heaters on high for
1 hour = 50kWh.



DC Charger

Max 50kW

Charge an EV for 1 hour
= 50kWh
= 300km Range

Nissan LEAF

Max Charge rate 50kW
80% charge is 25 mins for 24kW
battery.

Renault Zoe

Not Supported

Tesla S

Max Charge rate 50kW
1 hour 10 mins for 75kW battery

Tethered vs Untethered Chargers

JuiceBoxes come with a tethered Type 2 cable.

Some chargers come with a Type 2 socket (untethered) - bring your own cable.

NZTA requires untethered for roadside units (e.g. in Wellington where residents might not have parking spaces at home).



	Tethered	Untethered
Advantages	<ul style="list-style-type: none"> • EVSE owner does not have to bring a cable • Plug and go 	<ul style="list-style-type: none"> • User can use appropriate T2-T2 or T2-T1 cable • No hanging cable on the charge station when not in use
Disadvantages	<ul style="list-style-type: none"> • Only supports T2 <ul style="list-style-type: none"> ◦ JuiceJ T2 to T1 fitting • User is responsible to leave cable tidy after use 	<ul style="list-style-type: none"> • User has to bring own cable and they must carry, maintain, and store in in the car • Operator has no control over quality or condition of cable • Cable is not secure if not charging • Purchase cable at additional cost

JuiceJ - T2 to T1 Fitting

JuicePoint's JuiceJ Fitting allows a Nissan Leaf to charge from a T2 connector.



What do EV owners want?

- Charge EVs overnight at home
 - As long as EV is charged by morning - you don't care when the charge started or ended
 - Make use of cheaper electricity and solar PV
- Ability to top up quickly
 - Adding extra range with plug in chargers is slow!
 - Add a specific range and be notified by smartphone app or when complete
- Is my EV compatible?
 - If the connector fits, generally yes.
- How much power they they have used and the savings (Helps with bragging!)
- Prevent others using their power / charger
 - No access dongles / RFID tags to forget or lose
 - Allow Guests to charge with my charger
- Convenience of having tethered cables
- User interface - web or cell phone access using Android or Apple apps is desirable.
- Want an affordable installation
- Reliability
- Resale value

What do Body Corps want?

- Not overload the power supply and trip the building
 - Load management
 - Time of use management
- Compliance and safety
- Cost effective installation
 - Especially is Body Corp is investing in running mains feed to parking areas
 - Avoid additional work when unit holders move, uninstalling “their” charger and the next holder installing another.
- A means to apportion power usage to unitholders
 - Don’t want additional meters in parking area to manually read or 3 party accounting
 - Download usage information from the Cloud
- Support
 - Local Engineering Support
 - Reliability
 - Minimize different EVSEs
 - Warranty

What Body Corps Don't Want



Mode 2 Chargers

As adoption increases there will be a point where these overload the building supply.

Leach off power in car park, unless you meter them.




A Variety of Mode 3 Chargers

As adoption increases there will be a point where these overload the building supply. While Tesla chargers can load share between 4 units, what happens when you get more? How is the Body Corp going to apportion power from all these different systems? Require a dedicated meter per charger? Also increases support knowledge required. Owner moves out – do they take their charger with them?

Can We Avoid Wiring the Car park?

Let's say there are at least two car parks available near the building's main power supply.
Installing two **Rapid DC Chargers** between them is going to cost ~\$100k.

Advantages	Disadvantages
<ul style="list-style-type: none"> ● EV's charge quickly to 80% ● Offer public charging ● Billing can be outsourced (ChargeNet) ● JuiceNet billing launching soon 	<ul style="list-style-type: none"> ● Only 2 EVs can charge at once ● When charged EV's have to be moved back to their car park <ul style="list-style-type: none"> ○ Concierge could be utilised ● Charging to 100% is much slower after 80% is reached ● Need spare car parks ● Rapid charging can reduce battery life ● Bigger peak load on the building ● Congestion at peak times <ul style="list-style-type: none"> ○ Owners will want to charge when they return rather than overnight. ● Less likely to charge off peak

Technical Considerations

Install with 3 phase power where available for future proofing. Users want bigger batteries for more range which will drive need for faster chargers.


Not just power

- WiFi / Network access for EVSEs (Network and cellular reception can be poor in carparks). There could be costs of network connections, or wiring LAN connections to EVSEs.
- If network goes down what happens? JuiceBoxes default to a safe operating current.
- If EVSE has RFID tokens - replace lost tokens, setup etc. How easy will this be for unit holders and managers?
- User requirements for cost effective quick charging.
- Compatibility between EVSE and EVs

Metering

JuiceBoxes built in metering can be managed in the portal website.

The web portal allows building managers to download usage information and control load sharing.


JuicePoints Balance: 2928 JPs
Val

- My JuiceNet Devices
- Add JuiceNet Device
- Reports
 - JuicePoints History
 - User Sessions
- Help/Manual
- Contact
- Admin Utilities

Sessions Report

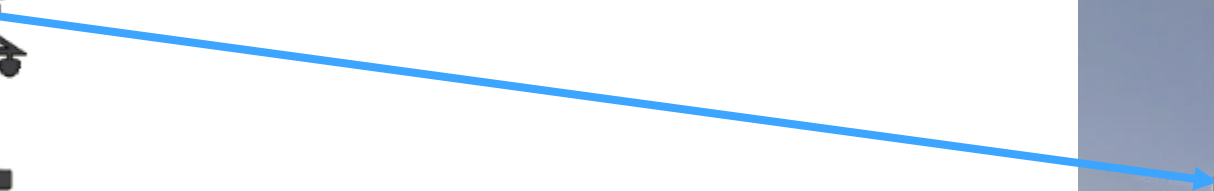
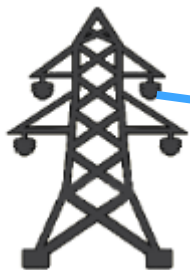
Unit: All Units
Start date: 04-08-2017
End date: 04-14-2017

Show 25 entries
Search:

Account	Unit	Time start	Time end	Charging Time	kWh
-	Sim - JB Azure Green	4/14/2017 6:59:29 PM	4/14/2017 6:59:39 PM	00:00:10	64.71
Val	EMW Pro 75 JB 3.1 (#7)	4/14/2017 4:54:14 PM	4/14/2017 5:00:22 PM	00:06:08	1.651
-	EMW Happy Hour JB 2.1 (#4)	4/14/2017 4:47:14 PM	4/14/2017 5:28:42 PM	00:41:28	3.998
Vinay Krishnan	EMW Happy Hour JB 2.1 (#4)	4/14/2017 4:37:02 PM	4/14/2017 4:37:09 PM	00:00:07	0
Vinay Krishnan	EMW Happy Hour JB 2.2 (#5)	4/14/2017 4:27:06 PM	4/14/2017 4:40:41 PM	00:13:35	1.62
-	EMW Happy Hour JB 2.3 (#6)	4/14/2017 4:21:36 PM	4/14/2017 4:22:20 PM	00:00:44	0
Vinay Krishnan	EMW Happy Hour JB 1.3 test	4/14/2017 4:06:32 PM	4/14/2017 4:35:09 PM	00:28:37	1.565
Val	EMW Pro 75 JB 3.1 (#7)	4/14/2017 3:51:37 PM	4/14/2017 4:51:48 PM	01:00:11	17.566

Load Sharing

Smart load sharing EVSEs lower installation costs.



If the building has 180kW of spare capacity at peak times
Then 8x 22kW EVSE's can be supported.

If you need more than 8, then it gets expensive unless you
get smart.



Load Sharing

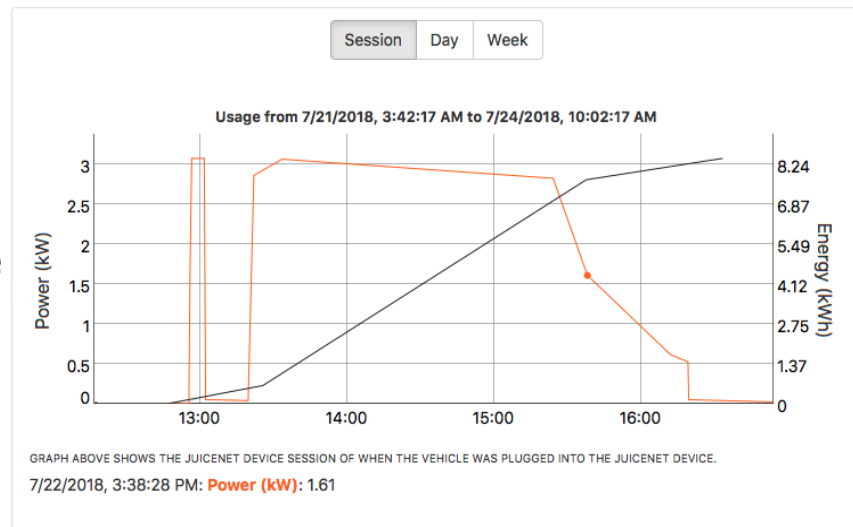
For example adding up the maximum 10 EVSEs can draw (22kW each) this would 220kW. If the supply available is only (say) 180kW, then without load sharing the supply needs to be upgraded at great expense.

With JuiceBox and JuiceNet we can limit the total consumption to 180kW.

If all 10 EVs are plugged in and charging they are still getting 80% of 22kW each (17kW).
If only 8 EVs are plugged in they will get 22kW each.


Also note that the only EVs in NZ that can charge at 22kW at the moment is the Renault Zoe, most EVs are much lower at 11kW or less each.



The minimum amount to allow is 6A per EVSE (1.4kW single phase) .



Load Group Management

Online web portal



JuicePoints Balance: **10966** JPs
 
 Matt Smith

My JuiceNet

My JuiceNet Devices

Add JuiceNet Device

Load groups

Reports

Help/Manual

Contact

Admin Utilities

Load Group Management

New Load Group

Load Groups

Name	Maximum Current (A)	Units #	
3 Car Garage	75	0	<div>Edit</div> <div>Delete</div>

Showing 1 to 1 of 1 entries

JuiceNet devices

Check at least one device

Add selected JNDevices to Load Group


List of JuiceNet devices under selected group

ID	Name	Current Limit by group (A)	Instant current (mA)	
0817010902010483676117019101	EMW Happy Hour v2 JB 1.2	32	30000	Remove
0817010902020443769117016703	EMW Happy Hour v2 JB 1.1	8	0	Remove
0817010902020446903117016703	EMW Happy Hour v2 JB 1.3	8	0	Remove

Showing 1 to 3 of 3 entries

Advancing Technology

EVs

- Cheaper Batteries
- Bigger Batteries  More range
 - E.g. Tesla
- Faster AC Onboard Chargers
 - E.g Renault Zoe

Chargers

- More Smarts
 - JuiceBox smarts are in the cloud
For easier updating.
- Rapid Chargers Reduce in Price
 - But still going to be expensive

Electricity Market

- NZ has enough power
 - But need to use it effectively
 - Time of use cost for charging
 - Improved spot market to signal demand management
 - Off peak rewards for charging
- “Dumb” chargers add to 6PM peak
- 11PM off peak charging not sustainable

Global Warming

- Solar & renewables getting cheaper
- NZ needs EVs by 2050 to meet emissions targets

Future Compatibility - Solar PV Integration?

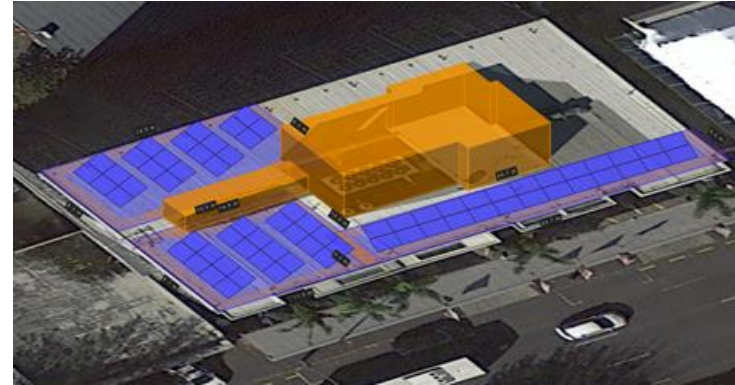


Solar - Economic If You Can Self Consume

- Solar PV prices are dropping quickly - so payback times are reducing
- 68.4kWp of Solar PV (228 Panels 300W) on Zone 23 roof.
 - Generates 96MWh over 1 year.
 - \$14,500 at 15c/kWh.
- Might be a cheaper option than upgrading grid connections
 - If its a cloudy day the EVSEs can have their load scaled back
 - Scalable installation if you have the roof space
- Improve Green Star rating

Example in Auckland

- \$45k installation cost for 19.4 kWp 72 panels
- Save almost \$4,000 per year on electricity
- Commercial Electricity plan costing ~\$14.5c/kWh
- >10% of daytime Electricity use
- Payback is ~6 years



Conclusion

Need to plan now for EVs

- Take the time to consider the best options before an EV is purchased
 - CAP-EX for common power feeds to carparks
- Else it will end up costing the body corp more with
 - Increased support
 - Increased admin
 - Increased installation costs
 - Increased operational costs
- Disgruntled tenants with stranded EVs and EVSE assets



Thank You

For more information please see

Juicepoint.co.nz

We are building a knowledge base of common questions.

Search

EV Charging (20 Articles)

Information about EV Charging



at Home (1 Article)

Charging a Nissan LEAF



at Apartments and Body Corps (2 Articles)

JuiceBox Flyer for Body Corps and Apartments

Presentation for Body Corporate Chairs' Group

Products (11 Articles)

Product Information



JuiceBox 32 (3 Articles)

Juice Box 32 Documentation

Features and Benefits of JuiceBox 32

JuiceBox 32 Full Specifications



JuiceMeter (2 Articles)

What is a JuiceMeter?