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B. Gatton, 2023.

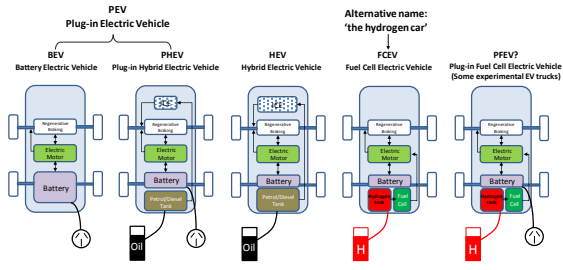
By: Bryce Gatton
EV transition consultant, writer for TheDriven.io and Renew magazine

Electric Vehicles: Time to make the switch?

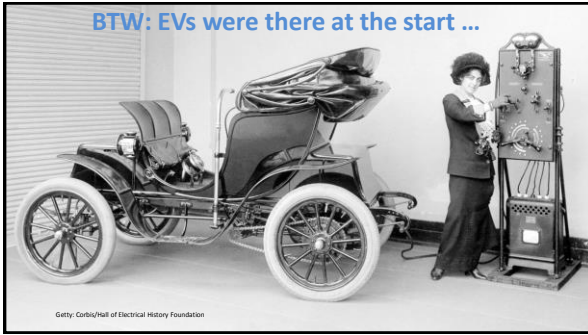
What is an EV?
The wider EV transition
A brief history of the EV
The Australian state of play
Choosing an EV to suit YOU
Current and coming EVs to Australia
Further EV information sources

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So what is an 'EV'?



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EV Transition is coming in ALL forms:

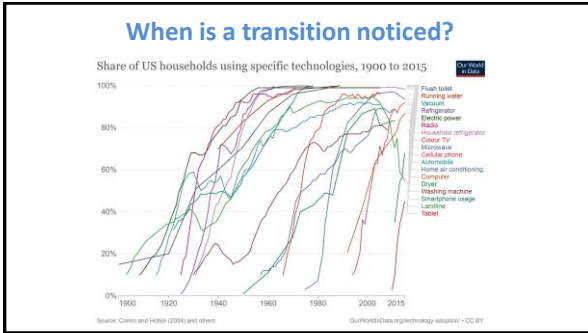
- Trucks
- Machinery
- Bicycles
- motorbikes
- Planes
- 'Flying cars'
- Autonomous cars
- Busses
- Ferries
- General equipment

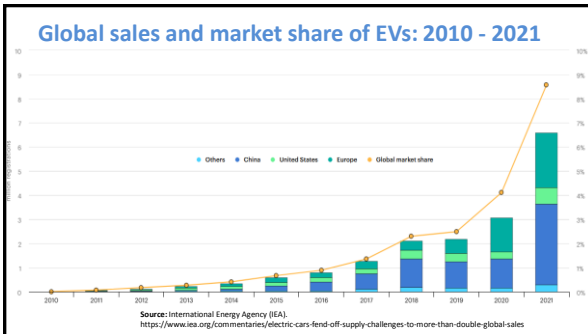
Source: Various sources including Wikipedia and George Eastman Film Collection

Transitions often happen faster than you expect ...

April 1900
Source: US National Archives/Wikipedia

New York: 5th Avenue
Easter 1913
Source: George Eastman Film Collection







What is bidirectional charging?

- V2L = Vehicle to Load (appliances only)
- V2H = Vehicle to Home (behind the meter)
- V2G = Vehicle to Grid (feeds to grid as well)
- V2X = general term for all

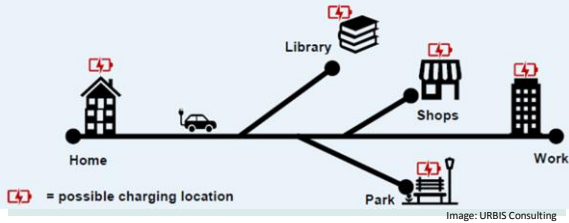
Currently:

- a) CHAdeMO does V2X, BUT CHAdeMO lost the Plug War, CCS won
- b) CCS being developed to do V2X (Some cars now V2L)
- c) Likely 2025-26 before CCS V2X systems available



How do I 'refuel'?

DECENTRALISED VEHICLE CHARGING MODEL



Key point: EV 'refuelling' paradigm is different

Think plug-n-ignore 'mobile phone' model



find, stop and act as a 'fuel pump attendant'



How fast do I NEED to charge at home?



- Less than 100km in a day
 - Overnight charge @ 8A/2kW will have you recharged in less than 8hrs
 - \$500 up installed.
 - BTW: don't rely on a power point as your MAIN home charging method ...



- Within range of one car charge/day (Kona = 400+km)
 - Overnight charge @ 32A/7.2kW = full charge in 9hrs
 - \$1500 up installed.

How far can I go on a charge? (Range estimates)

Beware: one of three test standards may have been used.

Vehicle	NEDC	WLTP	US EPA
	Range estimates in kilometres (km)		
Nissan Leaf 40kWh	315	285	243
Hyundai Kona 64kWh	557	484	413
BMW i3 42kWh	359	310	245
Renault Zoe	403	300	Not sold in US

- NEDC = Old European standard/still regularly quoted here.**

Commonly around 30% too high.

More detail:
Renew ed. 155 or EVchoice.au

- WLTP = New European standard (since 2017).**

Very close to mainly city/middle to outer suburban use.

- US EPA = United States Environmental Protection Agency**

Very close to mainly middle/outer suburban and regional driving.

What does it cost to run an EV?

Assumptions:

- Renault Zoe EV (133Wh/km, Australian Green Vehicle Guide)
- 10,000 km/yr
- charge overnight only, off-peak tariff of 20c/kWh
- 2022 Corolla at 6L/100km using 98 RON premium fuel at \$2/L



Fuel cost comparison (per 10,000km):

Zoe EV: **\$266** **Fuel savings: \$934**

ICE Corolla: **\$1200**

Service savings: estimate **\$250/yr**

MINUS: in Victoria, ADD \$260/10,000km RUC

Total saving using EV/10,000km (approx.): **\$900/10,000km**



Does an EV go the distance?

Early days?

The first petrol pumps were introduced just after WW1:

- This was 25 years *after* the first ICE vehicles

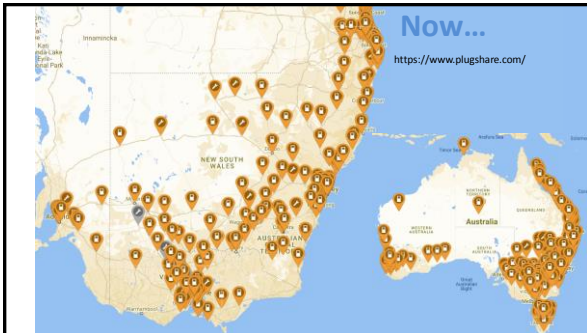
Before that ...

... were only 2 gallon tins:



Now...

<https://www.plugshare.com/>





The future:



End of the ICE age: bans on new ICE sales

Country	ICE sales end date
Norway	2025
India	2030
Israel	2030
Chile	2035
South Korea	2035
China	2040
New Zealand	2040
Uruguay	2040
US states:	
Washington State	2030
California	2035
New York State	2035



When will there be only EVs to buy?

Year	Manufacturer
2025	Jaguar
2028	Opel: Europe to be BEV only
2030	Bentley
	Cadillac
	Lotus
	Maserati
2033	Renault brand: Europe to be BEV only Ford: Europe to be BEV only Jeep: Europe to be electric (BEV?) only Porsche: 80% of sales to be BEV
2035	VW: End of ICE production in Europe
2035	General Motors
2040	Honda
2050	Mazda
	Mitsubishi Nissan



Selection of BEVs coming soon to Australia: (some 'perhaps')

Cupra Born: Q1 2023 (VW ID.3 based) From \$65k? TBC	Tesla Roadster 2.0: H2 2023???	Lotus Eletre: H2 2023?	Toyota b24X (Q1 2023) From \$80,000? (inc ORCs)
Ona Good Cat (H1 2023?) From \$40k (exc ORCs)	Renault e-tech Megane: H2 2023 From \$75k? TBC	Hyundai Ioniq 6: Q1 2023 From \$65k? TBC	Nissan Ariya: H2 2023? From \$70k? TBC
Mercedes EQB: H2 2022. Price: TBC	Genesis GV70: H2, 2022. Price: TBC	MG4: H1, 2023 Price: from \$45k? TBC	

BEV utes and vans are coming (2023: year of the electric LCV?)

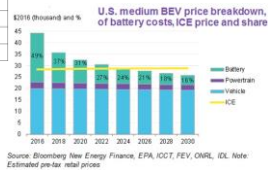
LDV aT60 UC: via Australia: here now. N2579,990, Au \$100k (19T)	LDV eDeliver: Australia: Here now \$100k + ORCs	LDV Mifa 9 people mover: Australia: here now \$106k + ORCs	Ford e-Transit 1.7 van: Australia: Q4 2022 (11 Custom: 2024)
Renault Master E-Tech: H1 2023	Fuso eCanter series (4t up): Limited numbers now.	Rivian R1T: On sale in US. Confirmed for Australia. Date TBC: 2024?	Renault Kangoo E-Tech: H1 2023
Foton Blue EV van: H3 2023 Price: TBC	Ford F150 Lightning: On sale in US, not for Australia (yet)	GM Hummer electric: On sale in US. Not for Australia.	Mercedes EQV people mover: Australia: here now. \$116k + ORCs

When can I afford one?

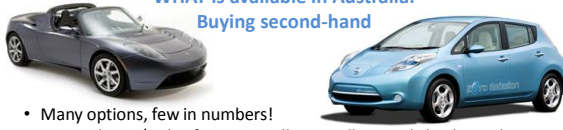
First vehicle segment BEV prices predicted to reach ICE price parity by 2024, fall below ICE thereafter:

Segment	US	EE	China	Japan
Small	2027	2023	2019	2040
Medium	2025	2024	2024	2029
Large	2026	2025	2029	2027
SUV	2024	2026	2040	2025

Source: Statista enquiry into Electric Vehicles report, 2019



WHAT is available in Australia: Buying second-hand



- Many options, few in numbers!
- Remember, 2/3rds of an EV is still a car. All normal checks apply.
- Added tests: battery and drive functions.
- Battery Apps available for some EVs:
 - ❖ LeafSpy (Leaf)
 - ❖ CANion (iMIEV)
 - ❖ CanZE (Zoe)
 - ❖ MyGreenVolt (Holden Volt)
 - ❖ EvBatMon (Outlander PHEV)

More info: PPT Addendum 5, Renew edition 158 or EVChoice.com.au

Second-hand vehicles: private imports



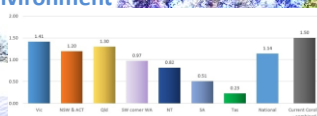
MIEV minicab
Nissan E-NV200 van/wagon
Nissan Leaf (Private import)

Points to remember:

- Are mainly second-hand Japanese imports.
- Maps and switches may be in Japanese! (Check they have been converted).
- Use CHAdeMO DC socket – not likely to see much competition for CHAdeMO chargers :-)
- Use Type 1 AC socket – need adaptor to use Australian chargers (check portable charger is with car).
- Australian dealers **will not** work on them. You'll need an independent EV mechanic in your area.

Caveat emptor: (buyer beware)
Private imports can seem cheap, but check warranty, features & dealer support

WHY EVs benefit the environment (and you)



Vehicle Type	CO2 Emissions (g/km)
ICE	155
Hybrid	120
EV	100
EV (with solar)	50
EV (with wind)	20
EV (with hydro)	10
EV (with geothermal)	5
EV (with nuclear)	2
EV (with biomass)	1
EV (with solar + storage)	0.5

- 1. The environment:**
 - No tailpipe pollution
 - Reduced overall emissions - grid
 - Negligible emissions - solar
 - Reduced waste – eg. coolants, oils, plugs, filters, brake pads
- 2. You:**
 - Service costs reduced
 - Electricity is much cheaper than petrol

To find out more: Australian organisations



<https://renew.org.au/>
Edition 158: (Jan – Mar 2022)
• How to check a second-hand EV
Edition 161: (Oct - Dec 2022)
• EVs on the Australian horizon



<https://www.aeva.asn.au>
AEVA discussion forum: (free to join)
<http://forums.aeva.asn.au/>

To find out more: Australian websites

- TheDriven: <https://thedriven.io/>
- Electric Vehicle Council: <https://electricvehiclecouncil.com.au/>
- EV Choice: www.EVchoice.com.au



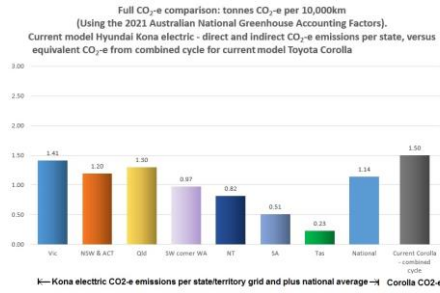
Any burning questions?



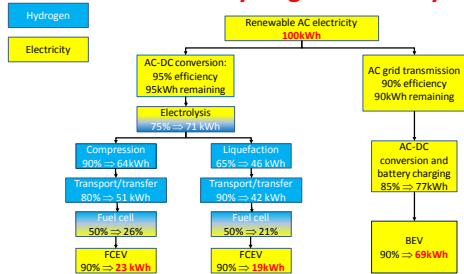
Addendum 1: Further reading:

- European air quality standards: <https://ec.europa.eu/environment/air/quality/standards.htm>
- EV Council report (Australia) reports: <https://electricvehiclecouncil.com.au/reports/>
 - > <https://electricvehiclecouncil.com.au/reports/home-ev-charging-and-the-grid-impact-to-2030-in-australia/>
 - > <https://electricvehiclecouncil.com.au/reports/increasing-the-supply-of-evs-to-australia/>
 - > <https://electricvehiclecouncil.com.au/reports/state-of-electric-vehicles-march-2022/>
- Smit, Whitehead and Washington, 2018. Where are we heading with electric vehicles, *Air Quality and Climate Change*, V52, No.3, September 2018, 18 – 27.
- Climate Council report: Waiting for the Green Light: Transport Solutions to Climate Change. 2018. <https://www.climatecouncil.org.au/resources/transport-climate-change/>
- Australian Vehicle Emission Standards: <https://www.infrastructure.gov.au/vehicles/environment/emission/index.aspx>
- Senate Select Committee Report on Electric Vehicles: https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Electric_Vehicles
- Union of Concerned Scientists: Top Five Reasons to Choose an Electric Car <https://www.ucsusa.org/resources/top-five-reasons-choose-electric-car>

Addendum 2: Aust. Grid EV Carbon Footprint



Addendum 3: Hydrogen efficiency



Source: "Does a Hydrogen Economy Make Sense?" *Proceedings of the IEEE*, Vol. 94, No. 10, October 2006.

Addendum 5: Second-hand EV offerings

Tesla Model S
 • 2013 – current
 • \$55k up.
 • Range still close to new: batteries holding up well



Tesla Roadster
 • 2010 – 2012
 • \$120k up? Rare to get hold of.
 • Batteries holding up well; Tesla also offer upgrades



Tesla Model X
 • 2017 – current
 • \$135k up.
 • Range/battery issues: As per Model S



Nissan Leaf (Australian delivered)

• 2012 (A few 2011 ex Vic EV trial)

• \$10 – 20k

• Range:

◆ Gen 1 (24kWh): 130 – 140 km (new)

◆ Now: approx 60 – 90 km

◆ NB: Some Gen 1 batteries (2011 to 2013) not holding up.



2011 – 2013 Mitsubishi iMIEV

• \$10 – 15k

• Range:

◆ New 120 km;

◆ now approx. 60 – 100 (depending on battery ageing)



2015 – 2021 BMW i3

• \$35k up

• Note: larger & smaller batteries, some REX petrol

• Range (BEV only):

◆ Older: 130km (23kWh), newer: 184km (33kWh);

◆ Latest: 40kWh, no REX

◆ No reported battery issues, range holding so far

◆ Early (up to 2018) have CCS DC charge port.



Renault Zoe

• 2017-2019

• \$37 – 42k

• 40 kWh battery

• Up to 22kW AC charging

• No DC charging option

◆ Range: 240 winter/280-300 summer



2018-2022 Ioniq

• \$38k up

• 28kWh battery (38kWh from mid 2019)

• Range:

◆ 28kWh: 200km;

◆ 38kWh: 270km



WHAT is available in Australia: Private imports/mass conversions

Note: Private imports can seem cheap, but check warranty & dealer support

MIEV minicab (Private import)

• 2011 – 2015

• \$15 – 25k

• Private importer in Qld

• Mechanically an iMIEV

• 10.5 & 16kWh battery sizes



Nissan E-NV200 van/wagon (Private import)

• 2014 – 2017

• \$23-28k

• Private importer in Qld: Good Car Co too.

• Mechanically a 24kWh Leaf, but many have battery cooling. (Unlike the Leaf).



Nissan Leaf (Private import)

• 2012 - 2020

• \$18 – 50k (generally 30 & 40kWh, some 63kWh)

• Private importers in Qld and Vic

• GoodCarCo doing bulk buys

• Range:

◆ Gen 1 (24kWh): 100 – 120 km

◆ Gen 1a (30kWh) 160km

◆ Z1: (40kWh) 220km

◆ Z1.e+ (63kWh) 364km



Blade Electron (Converted Hyundai Getz)

• 2007 - 2011

• \$500 – 12,000 (depending if going or not)

• Range: 40 – 150km depending on version and battery age (originally quoted as 100 – 200km)

• Approximately 50 built: NOT for the faint-hearted, technical and build quality issues abound!