2022 Australasian Fleet Conference & Exhibition AND FLEET AWARDS MAY 3-4 ROSEHILL GARDENS RACECOURSE SYDNEY

Transport Options for Your Net Zero Emissions Journey

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Evenergi

AFMA AUSTRALASIAN FLEET MANAGEMENT ASSOCIATION

Emulation, optimisation and management software and services to accelerate the transition to zero emissions transport in complex fleets

Make it **accurate** Make it **simple** Make it **fast** Make it **cost effective**

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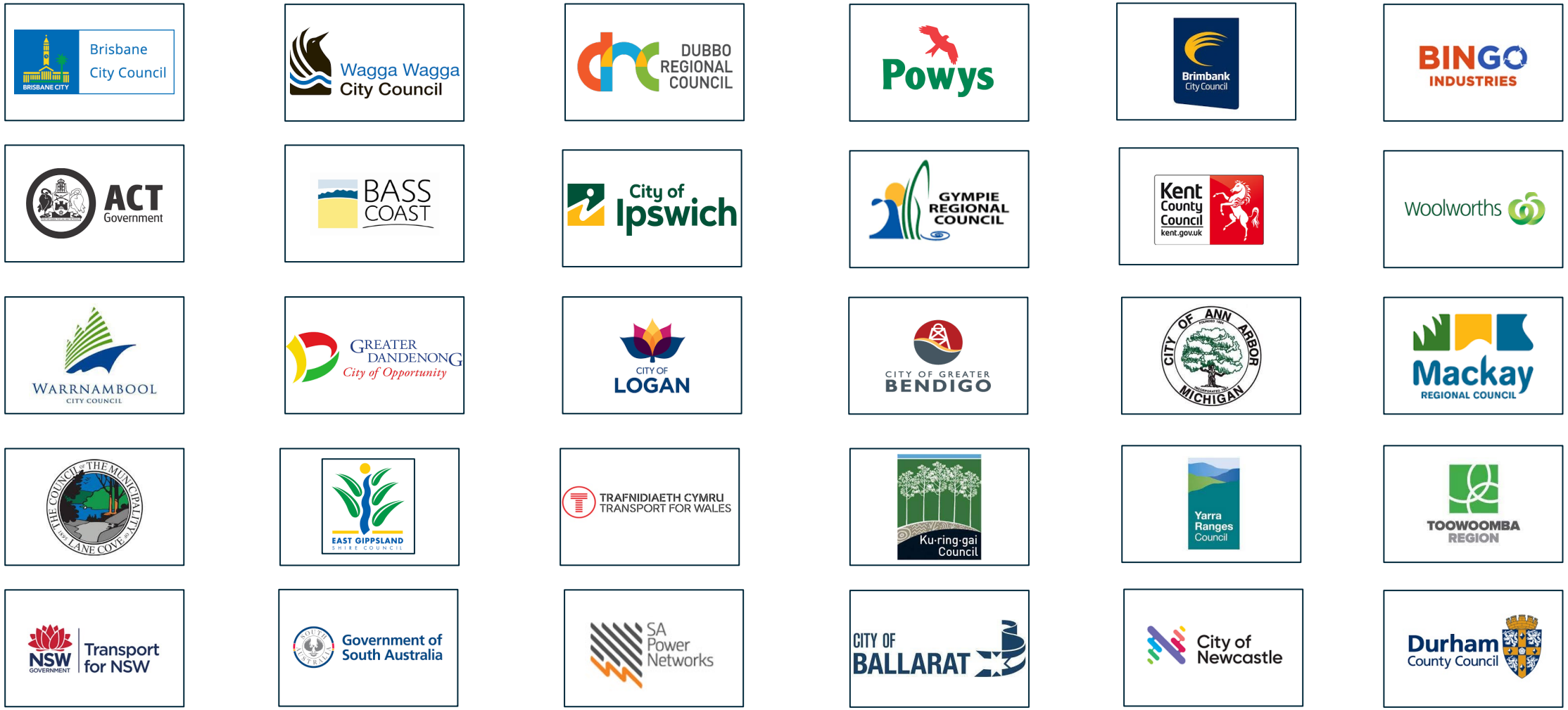
CITY OF GREATER BENDIGO
BAWBAW SHIRE COUNCIL
CENTRAL NSW COUNCILS

Who we work with

United Kingdom, Australia, Singapore, Canada and US

Using our BetterFleet tool, we've provided fleet transition plans and future fleet asset planning for over 30 companies. We currently have over 100 organisations using our platforms.



The globe is rapidly turning to zero emissions vehicles as a means of achieving emissions targets

The Intergovernmental Panel on Climate Change (IPCC) noted zero emissions vehicles (ZEV) as one of four key pillars to avoid the worst of global warming impacts in its 2021 report.

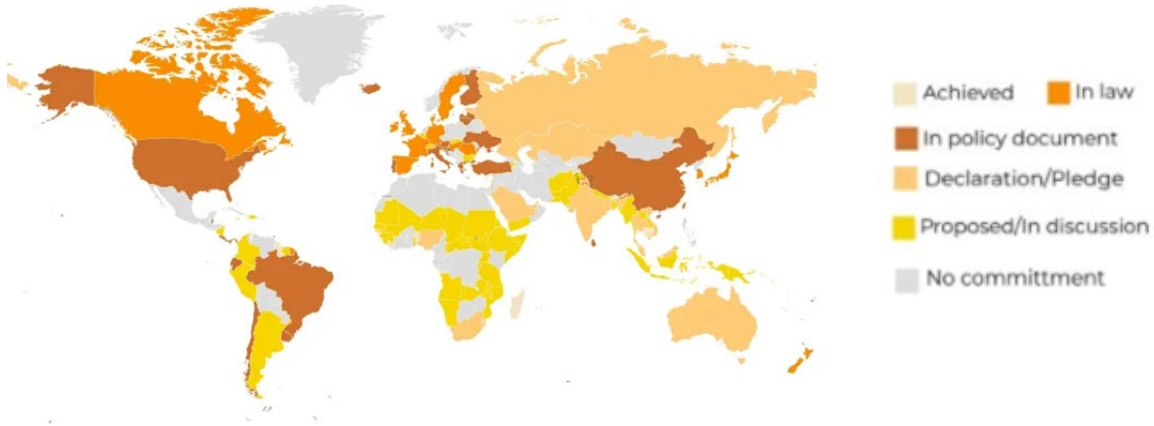
As of Nov 2021, 138 countries have now committed to net zero, carbon neutrality or being climate neutral.[1]

Countries around the globe, are now either implementing incentives for ZEV's or phasing out internal combustion engines (ICE) vehicles as early as 2025 (Norway).

Australia is supporting this trend with state level rebates and tax exemptions for ZEV's and transitioning government fleets such as NSW Government's recent announcement to electrify its passenger fleet (c. 12,000 vehicles) by 2030.[2]

Local governments are also well into this journey with Evenergi having already assisted over 150 local governments and councils in developing their own fleet transition plans.

Countries with a net zero commitment



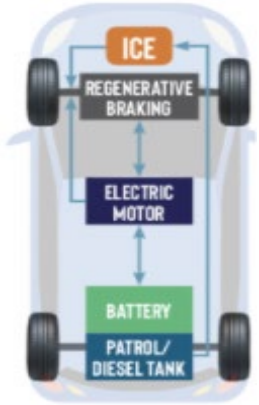
Example state level electric vehicle incentives in Australia

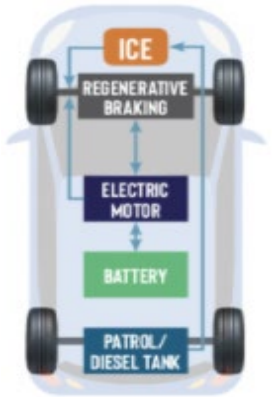
Region	Policy, Target
ACT	2-year free registration on approved EV's and stamp duty waiver Conversion of ACT gov fleet to EV's (c. 400 cars)
NSW	NSW Government EV Strategy - $595m in total Rebates of up to $3,000 on upfront costs and abolish stamp duty Reverse bidding auction for financial support to bridge EV gap Conversion of NSW passenger fleet to EV by 2030 (c. 12,000 cars)
Sth Aust.	$3,000 subsidy for first 7,000 EV purchased in state Recently announced rebate on smart chargers linked into grid mgt

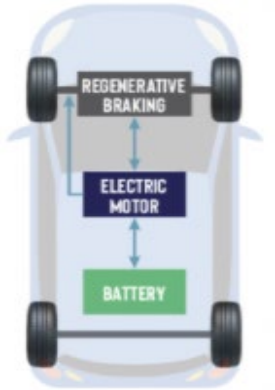
1 Energy and Climate intelligence Unit, 2nd Nov 2021

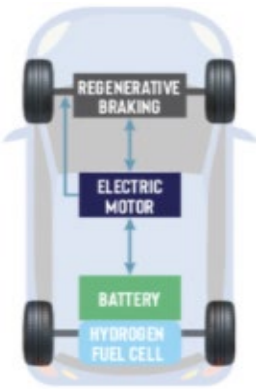
2. https://www.nsw.gov.au/initiative/nsw-governments-electric-vehicle-strategy/government-fleet

There are a range of low and zero emission vehicles emerging with plug - in battery and fuel cell vehicles having zero emission potential









	Petrol/Diesel (ICE)	Hybrid Electric (HEV)	Plug-In Hybrid (PHEV)	Battery Electric (BEV)	Fuel Cell (FCEV)
Fuel Type	**Fossil Fuels**	**Fossil Fuels**	**Electricity & Fossil Fuels**	**Electricity**	**Hydrogen** (predominate fuel)
Impact on vehicle exhaust emissions	**Small** - fuel efficient cars and E10	**Some** - are effectively efficient ICE	**Yes** - for short trips (up to 50km)	**Yes** - 100%	**Yes** - 100%
Impact on whole of supply chain emissions	**Small**	**Small**	**Yes** - if recharged from renewables and only short trips made	**Yes** - if recharged from renewables	**Yes** - if refilled with renewable hydrogen
Price parity to fossil fuel options	**N/A**	**Now**	**Now**	**Now to 2025** light **2030+** heavy vehicles	**Still ~2x price Parity 2030+**
Availability in Australia	**Yes**	**Yes**	**Yes**	**Yes** passenger Appearing for light	First models in live trials

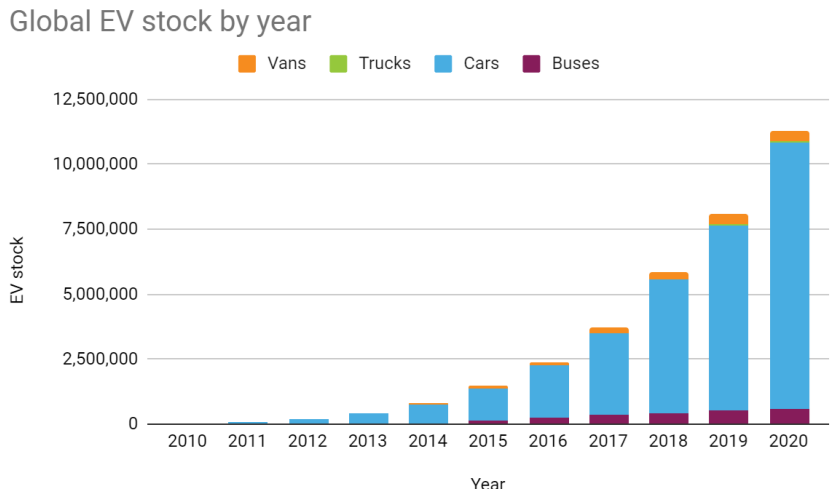
Segments by fleet market size

- A number of use-cases work commercially today
- Car share and ride sharing are economic if charging can be delivered
- Significant opportunity in last mile-delivery
- In most categories vehicle availability remains the major challenge

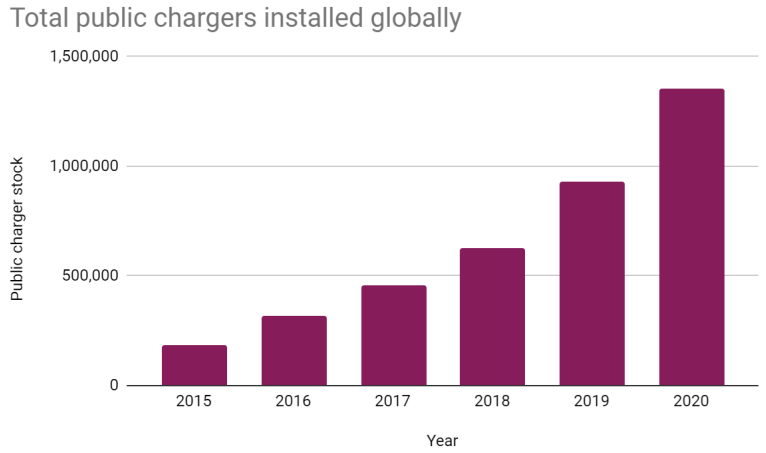
	Use	Gvm (Tonnes)	Daily Mileage (Km)	TCO	Vehicle Availbility	Range*
	Tray	5.5	110	🟡	🟡	🟡
	Road Construction Truck	16	80	🟡	🟢	🟡
	Tipper	7.5	40	🟡	🟢	🟡
	Sweeper	14	7	🟡	🟢	🟡
	Water Tank	30	60	🟡	🔴	🟡
	Prime Mover	26	150	🟡	🟡	🟡
	Garbage	24.5	130	🟡	🟡	🟡
	Fuel	14	120	🟡	🔴	🟡
	Metro Bus	18	200	🟡	🟢	🟡
	School Bus	18	60	🟡	🟢	🟡
	Coaches	18	150	🟡	🟢	🟡
	Mini Bus (Tourist)	5.5	110	🟡	🟢	🟡
	Parcel Courier	3.5	150	🟡	🟡	🟡
	Grocery Delivery Van	3.5	200	🟡	🟡	🟡
	Large Parcel Delivery	8	200	🟡	🟡	🔴

Battery Electric Vehicles (BEV) have reached a point of maturity where they are fast reaching price parity, with model commitments exploding

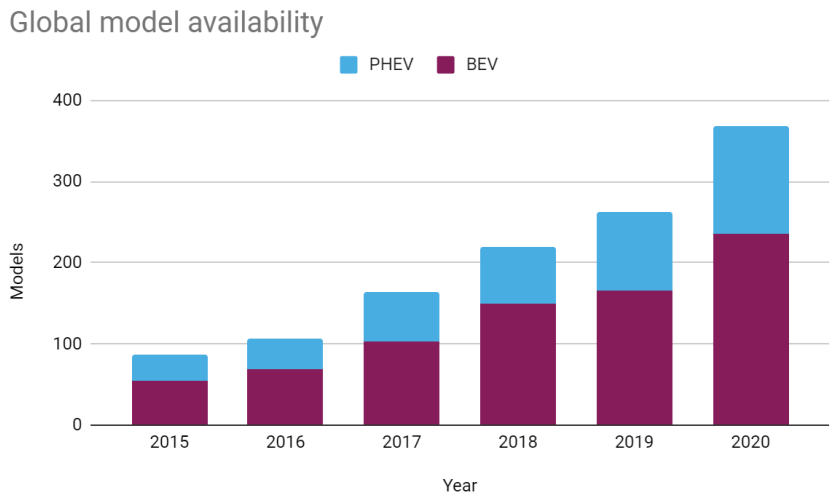
The number of EVs registered is constantly increasing



The global stock of public chargers are increasing too



This is supported by increasing number of models that are available



Major manufacturers are committing to increase the number of EV options

Original equipment manufacturer	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
BMW Group			25		15-25%					10
BAIC Group	2				1.3					50%
Changan Automobile (Group)					33					
Daimler		10			25%					50%
Dongfeng Motor Co	1	30%	1		1				1	1
FAW					40%					60%
Ford		40				100%*				
GM Group			22		30	1				1
Honda										40%†
Hyundai-Kia					1					
					29					
Mazda		1								5%
Renault-Nissan		20								
		20%								
Maruti Suzuki	1									1.5
SAIC					30%					30
Stellantis					38%*					70%*
					31%**					35%**
Toyota Group	1				15					>1
Volkswagen					20%					70%*
			1		3				26	50%**
					75					
Volvo (Geely Group)	1	1	1	1	50%					100%*

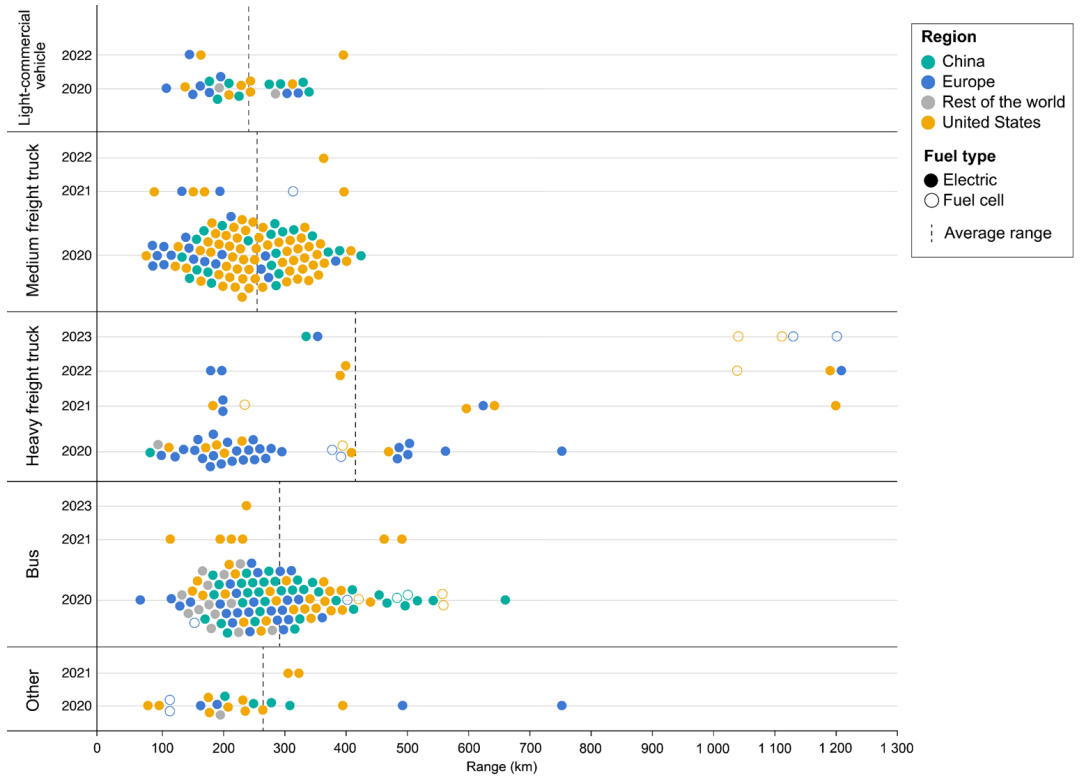
% of sales electric
Annual sales (million)
New EV models (number)
Cumulative sales (million)

* European market only
** Chinese and US markets only
† Includes both EVs and FCEVs

Storage capacity for long range and heavy vehicle demand is still a challenge for BEV's, which while improving is not there yet.

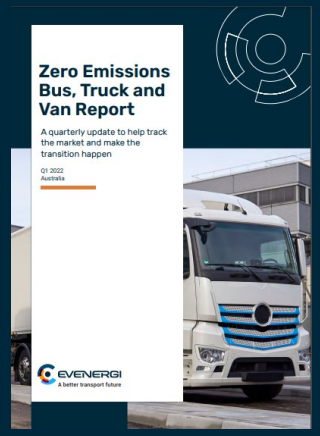
- BEV passenger vehicles are starting to reach ranges that cover virtually all needs - Mercedes have a concept car with 1,000km range slated for 2024
- Light commercial vehicles (<3.5T GVM) are expected to closely follow passenger, having only slightly more load and km barriers
- Heavy commercial is where the vehicle haulage and inter day demands can start to really stretch the capacity of current battery technology
- Long Haulage semi trailers have both extreme range and loads and are likely to be the hardest challenge for BEV's to solve

Availability and range of new ZEVs by category



Availability in Australia remains constrained?

- In Australia, there are currently 17 full battery electric passenger vehicles on the market and an additional 18 plug-in hybrid models available.
- At the value end there are 6 battery electric vehicles under $65,000 AUD and 8 plug in hybrids. Passenger and SUV small and medium market segments now have a wider variety of low and zero emission choices.



Download the full report on the link below

evenergi.com/btv-report/

Cab Chassis - Light duty

Type	Freight	General Purpose	General Purpose	General Purpose	General Purpose	General Purpose
Model	Fuso eCanter	JAC N55	SEA 300 -45 70-7	SEA 300 -85 100-10	SEA 300 -85 100-15	SEA 300 -85 120-15

Cab Chassis - Medium duty

Type	General Purpose Small	General Purpose Small	General Purpose
Model	Volvo FL	SEA 500 – 165 120 -35	SEA 500 – 165 180 -35

Cab Chassis - Heavy duty

Type	Freight	General Purpose
Model	Volvo FE	SEA 500 – 225 280 -35

Supply chain issues are challenging - but likely to ease

- Fundamental challenge in Australia is lack of fuel efficiency standards which constrain strategic focus by OEMs on this market
- Bulk material prices increasing for the entire auto industry. In 2021, the price of steel rose by as much as 100%, aluminium around 70%, and copper more than 33%, affecting both conventional and electric cars.
- For electric cars, additional challenges were posed by increased prices for materials needed to manufacture batteries: the price of lithium carbonate increased by 150% year on year, graphite by 15%, and nickel by 25%, to name just a few.
- Microchip shortages that held back output. The shortage is problematic for EVs, which require around twice as many chips as equivalent conventional vehicles

New innovations:

1. Cobalt free batteries
2. Solid state batteries
3. Lithium sulfur- high energy density , lower environmental impact
4. Structural batteries
5. Aluminum air batteries

Fuelcell EVs (FCEV) are slightly behind BEV in their market maturity but are rapidly being developed as a viable alternative to BEV

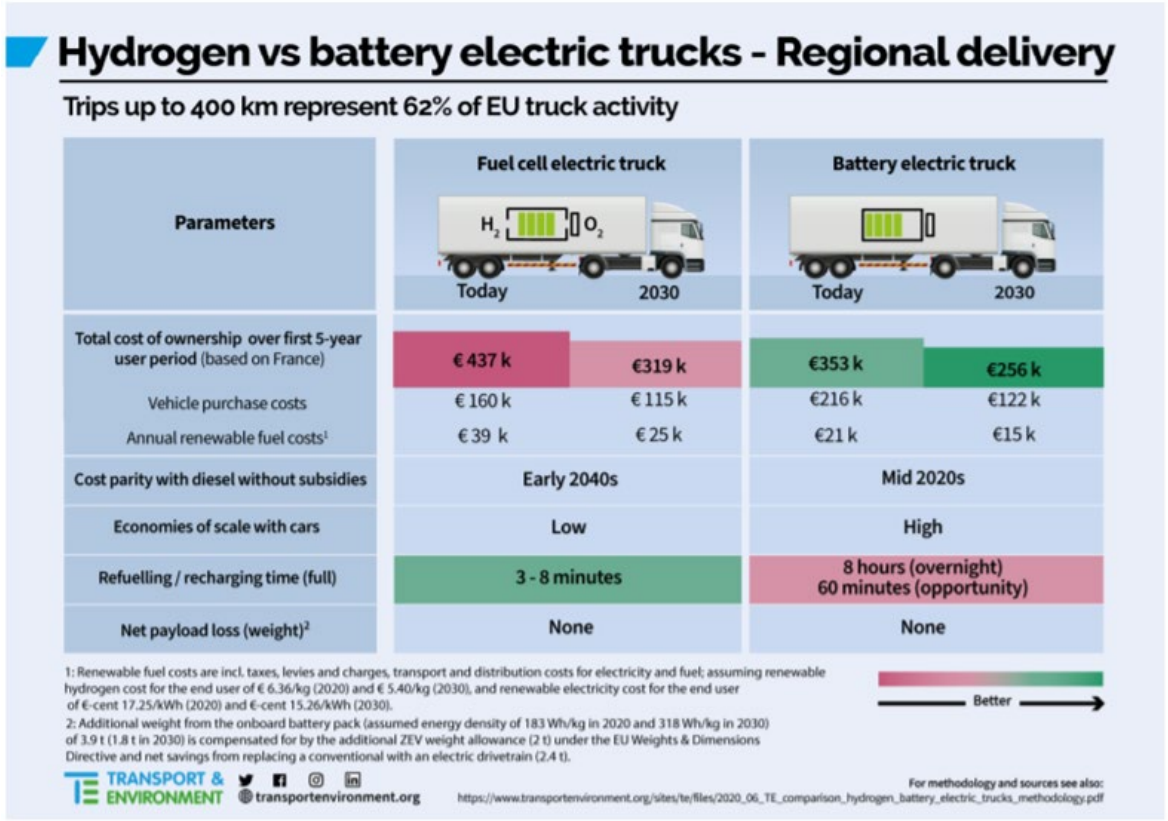
- In the future, a potential strong competitor of BEV technology is hydrogen based fuel cell electric vehicle (FCEV) technology
- In FCEVs, refuelling can occur within about 3 minutes
- Current generation of vehicles have a range in excess of 600 km
- Hyundai Nexo ~ $95k vs $60k for battery EV equivalent
- Prices are coming down, but EV prices dropping faster

In market

Coming soon

FCEV technology is has yet to become fully cost competitive with BEV and has energy efficiency challenges to overcome

FCEVs have a higher total cost of ownership than BEVs and are expected to still be higher in 2030



Hydrogen vs battery electric trucks - Regional delivery

Trips up to 400 km represent 62% of EU truck activity

Parameters	Fuel cell electric truck		Battery electric truck	
	Today	2030	Today	2030
Total cost of ownership over first 5-year user period (based on France)	€ 437 k	€319 k	€353 k	€256 k
Vehicle purchase costs	€ 160 k	€ 115 k	€216 k	€122 k
Annual renewable fuel costs[1]	€ 39 k	€ 25 k	€21 k	€15 k
Cost parity with diesel without subsidies	Early 2040s		Mid 2020s	
Economies of scale with cars	Low		High	
Refuelling / recharging time (full)	3 - 8 minutes		8 hours (overnight) 60 minutes (opportunity)	
Net payload loss (weight)[2]	None		None	

1: Renewable fuel costs are incl. taxes, levies and charges, transport and distribution costs for electricity and fuel; assuming renewable hydrogen cost for the end user of € 6.36/kg (2020) and € 5.40/kg (2030), and renewable electricity cost for the end user of €-cent 17.25/kWh (2020) and €-cent 15.26/kWh (2030).

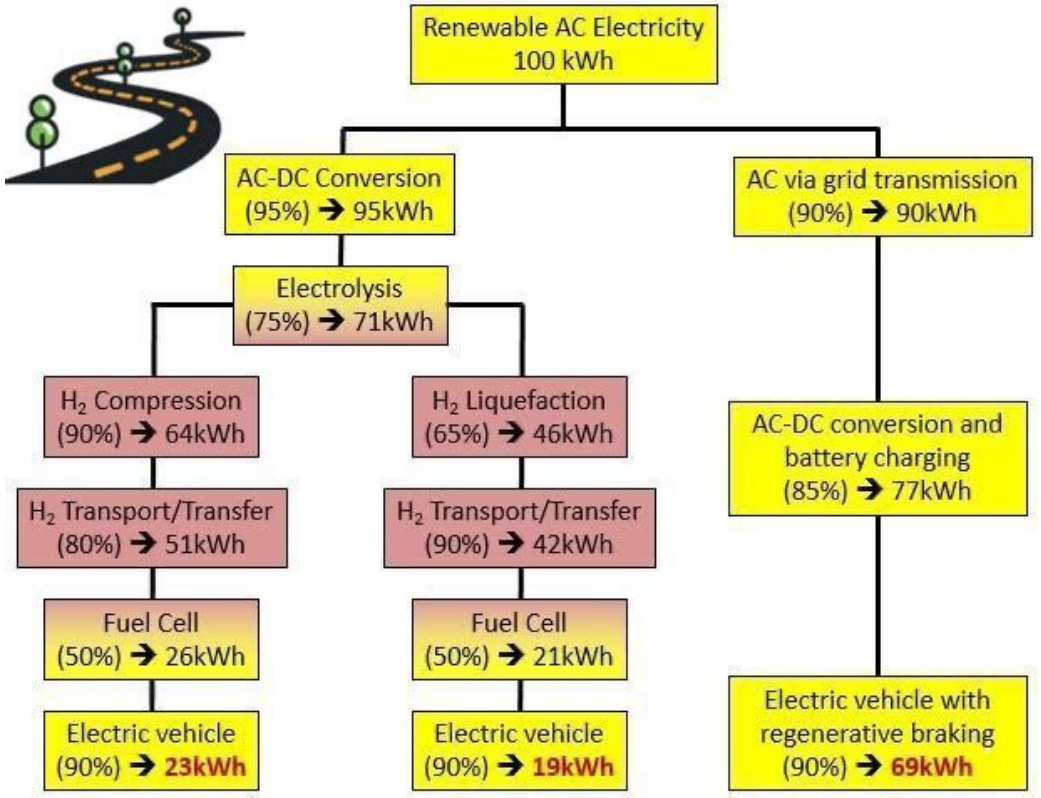
2: Additional weight from the onboard battery pack (assumed energy density of 183 Wh/kg in 2020 and 318 Wh/kg in 2030) of 3.9 t (1.8 t in 2030) is compensated for by the additional ZEV weight allowance (2 t) under the EU Weights & Dimensions Directive and net savings from replacing a conventional with an electric drivetrain (2.4 t).

Better

TRANSPORT & ENVIRONMENT transportenvironment.org

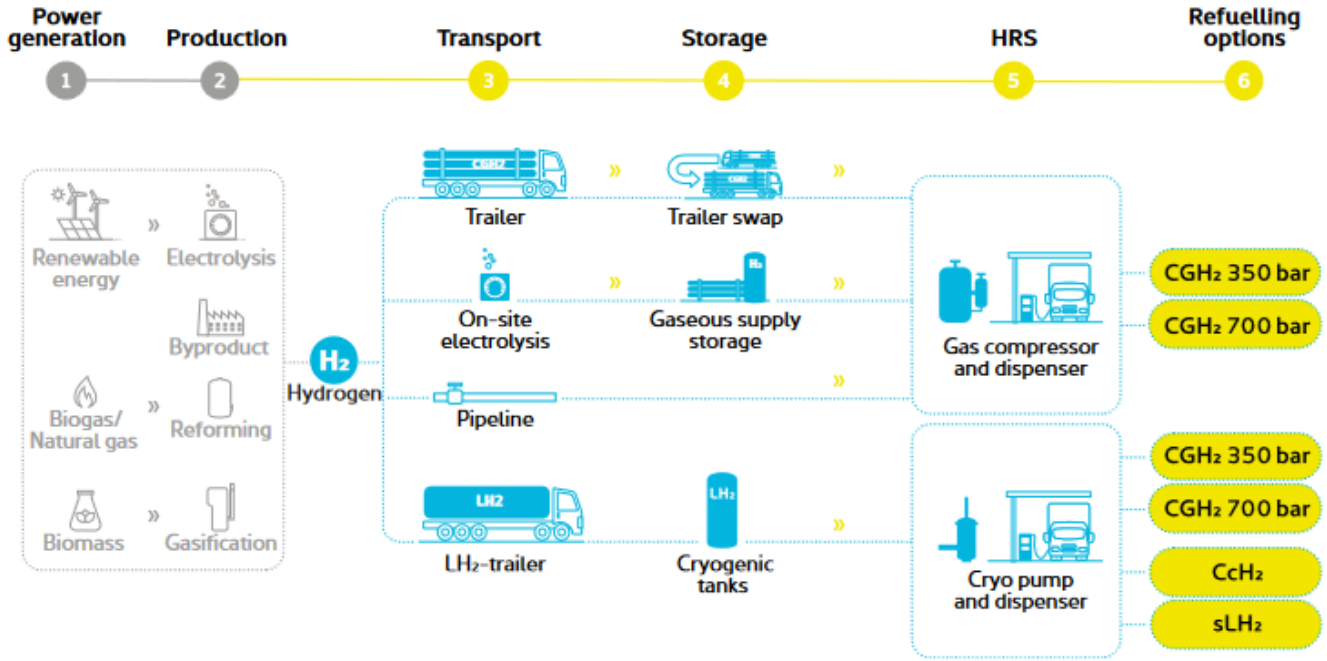
For methodology and sources see also: https://www.transportenvironment.org/sites/te/files/2020_06_TE_comparison_hydrogen_battery_electric_trucks_methodology.pdf

The farm-to-wheel efficiency of FCEVs are lower than BEVs

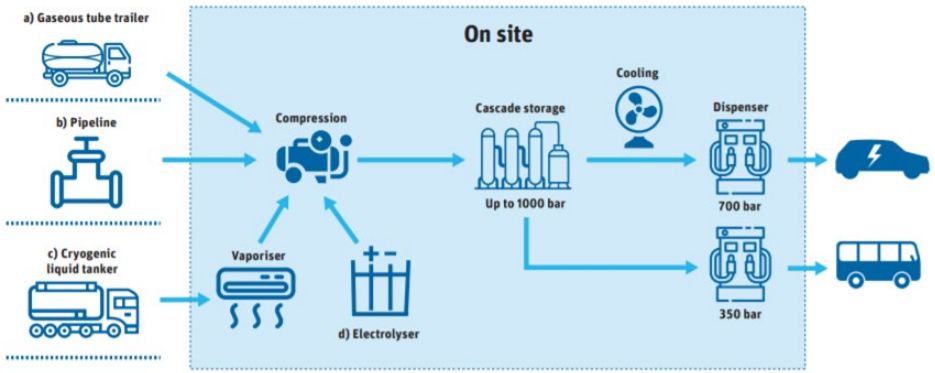


Refuelling FCEV's requires new processing tech and overcoming storage challenges but no new refuelling behaviours

Some refuelling options are commercially available while a few others such as subcooled liquid hydrogen and cryo-compressed hydrogen are under R&D

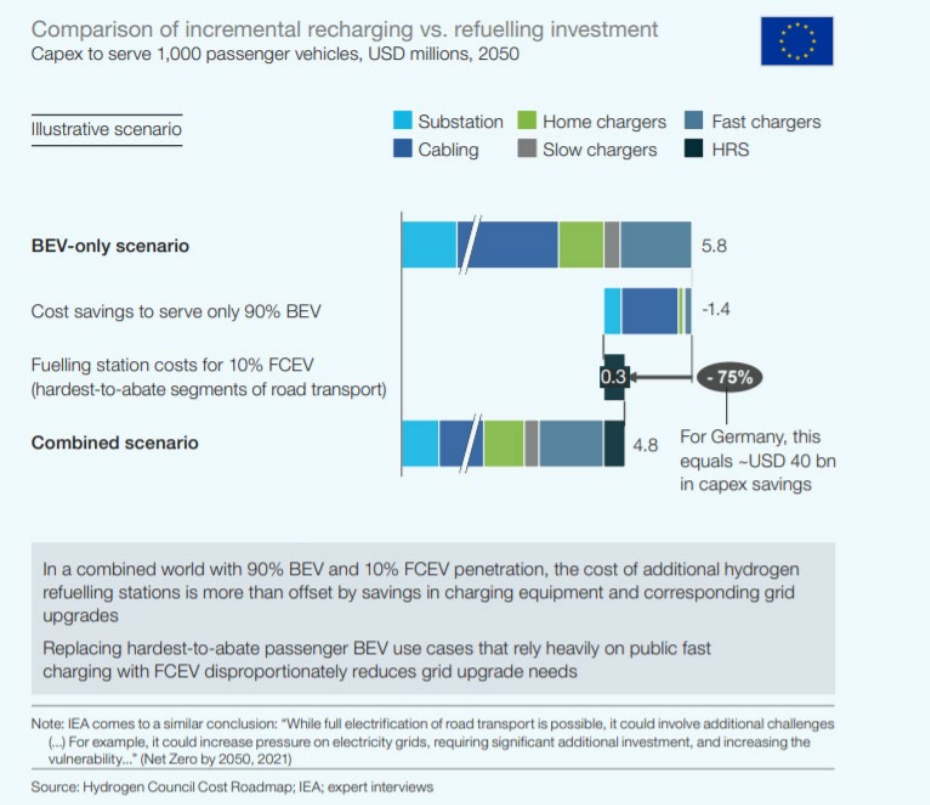


Components required on-site for hydrogen refueling stations



Both technologies have pros and cons with there likely being a space for each in a diverse fleet

Example holistic solution: 90% BEV and 10% FCEV scenario reduces the cost of refuelling infrastructure by 75%

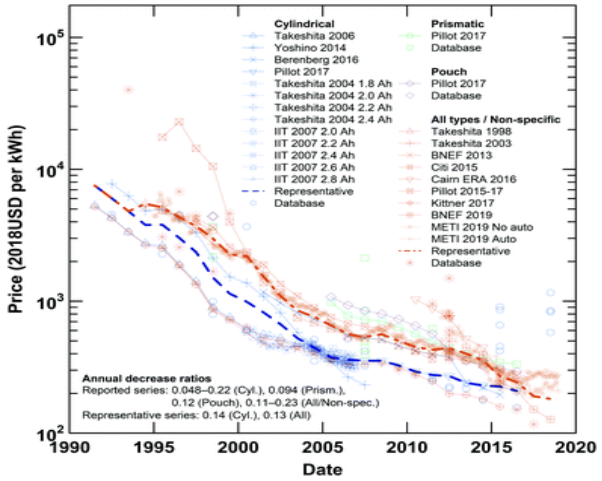


Battery electric and fuel cell vehicles can support different use cases in the zero emissions transition

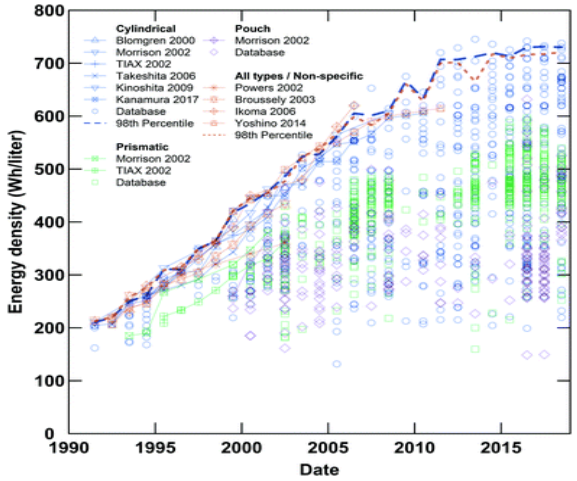
Parameter	FCEV	BEV
Maturity	Prototype stage	Pre series stage
Typical use case	Long haul	Low to medium range
Cost	High vehicle and fuel cost	High vehicle cost but potentially lower fuel costs
Emissions	Potential to meet emissions targets	Potential to meet emissions targets
Operational suitability	Long daily driving range Shorter refuelling time	Long refuelling time Battery size can limit payload
Infrastructure	Limited refueling stations HRS utilisation can be challenging in early adoption	Limited refuelling options but growing Station utilisation and grid upgrades can be challenging

Zero emissions solutions are still emerging and this will expand their capability over the next few decades

Decreases in battery prices and improvements in energy density will improve the viability of battery electric vehicles for more use cases.

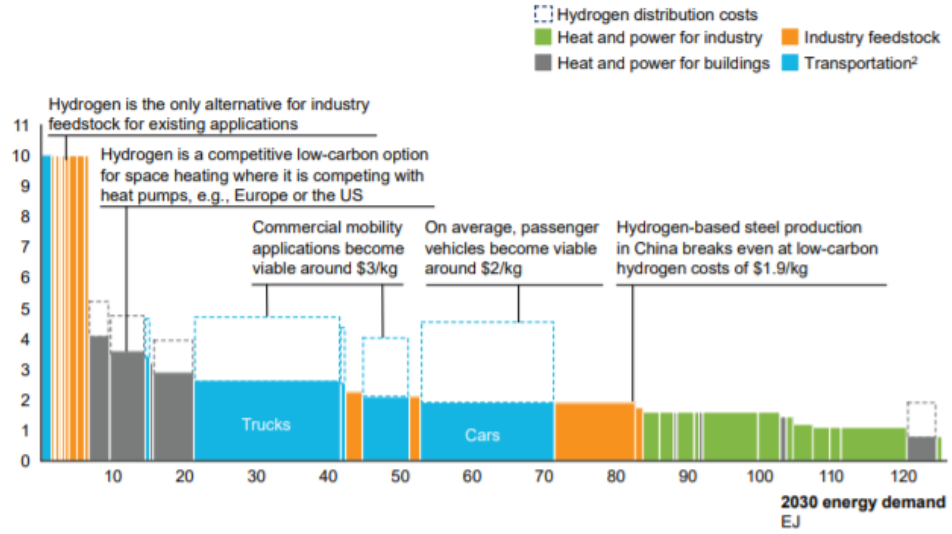


Decrease in prices



Improvements in energy density

Breakeven hydrogen costs at which hydrogen application becomes competitive against low-carbon alternative in a given segment



1. Regions assessed are the US, China, Japan/Korea, and Europe
2. Transportation segments breakeven calculated as weighted average

Market barriers

- Vehicle availability
- Vehicle costs
- Range anxiety
- Resale value

Organisational barriers

- **Lots of stakeholders** with different drivers potentially - sustainability, fleet and finance
- Fleet has so many other responsibilities - often hard to **get time** to focus on this often
- Need to meet **aggressive carbon reduction targets**, or work out how to set targets
- **Uncertain technology** availability and costs makes medium term planning difficult
- Technology is so fast moving that any **plan is outdated** as soon as it is written

Organisational barriers

- Dealing with **charging infrastructure** requires new budgeting planning
- Managing electric vehicle assets and charging infrastructure requires **new skills and processes**
- Many organisations **lack solid data** with which to plan
- Electric or Hydrogen?

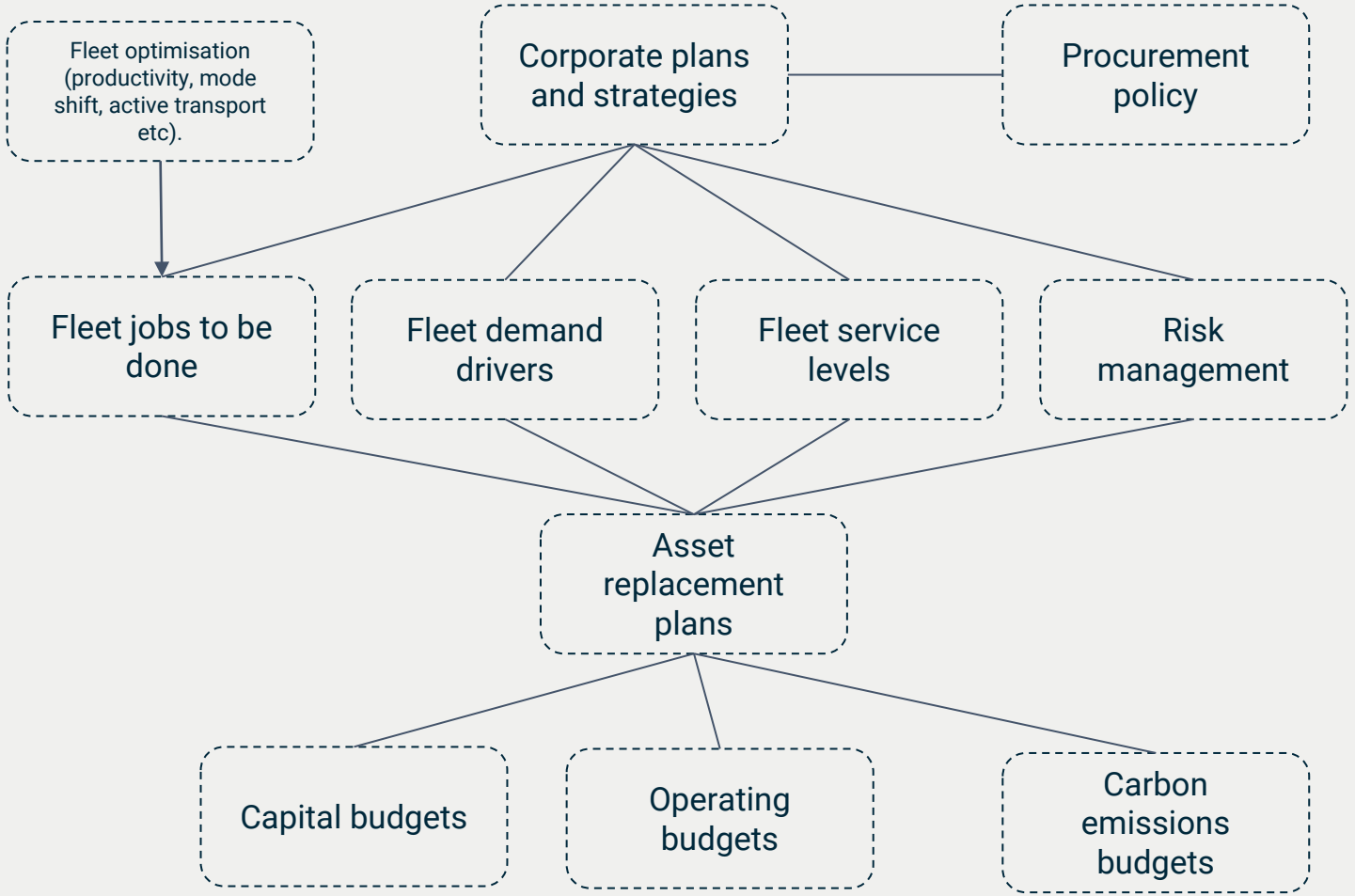
Charging BEV's requires much new infrastructure with fast and slow charging options becoming available

The most important considerations with respect to charging infrastructure will be the charging speed and cost. The table below outlines the different charger speeds, types and potential costs

		AC Charger			DC Wall Charger	DC Charger			
Power level	**Level 1**	**Level 2**			**Level 3**				
Common name	**Socket Charger**	**AC fast charging**			**DC Wall Charger**	**DC fast charging**			**Ultra-fast charging**
Power	**2.3 kW**	**3.5 kW**	**7.4 kW**	**22.1 kW**	25 kW	50 kW	100 kW	120 kW	**> 350 kW**
Time to charge *(100 km range*)*	**> 8 hr**	**5 hr 43 min**	**2 hr 42 min**	**54 min**	**48 min**	**24 min**	**12 min**	**10 min**	**< 10 min**
Cost per charge point	**Installation only**	**$3,000 - $10,000**	**$3,000 - $10,000**	**$10,000 - $20,000**	**$10,000 - $20,000**	**$40,000 - $100,000**			

*For vehicle with driving energy efficiency of 20 kWh/100 km

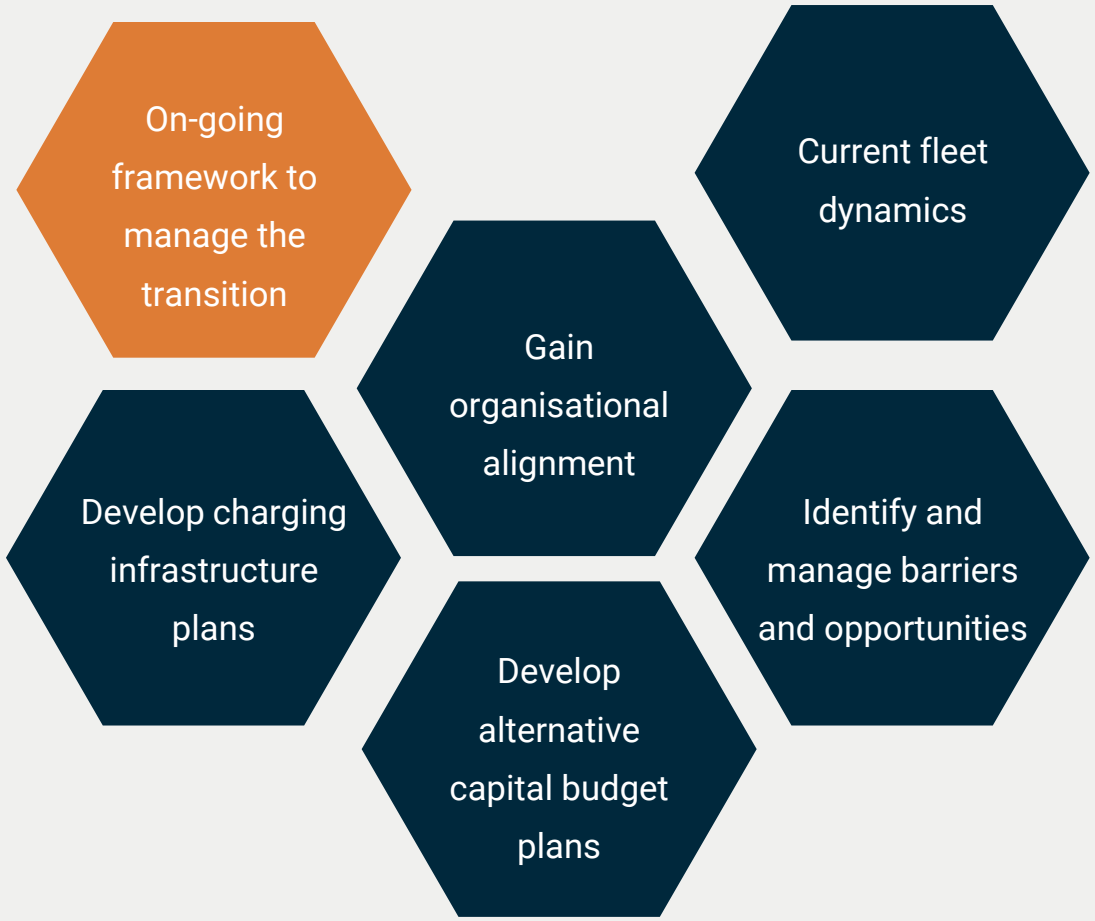
Context of a project

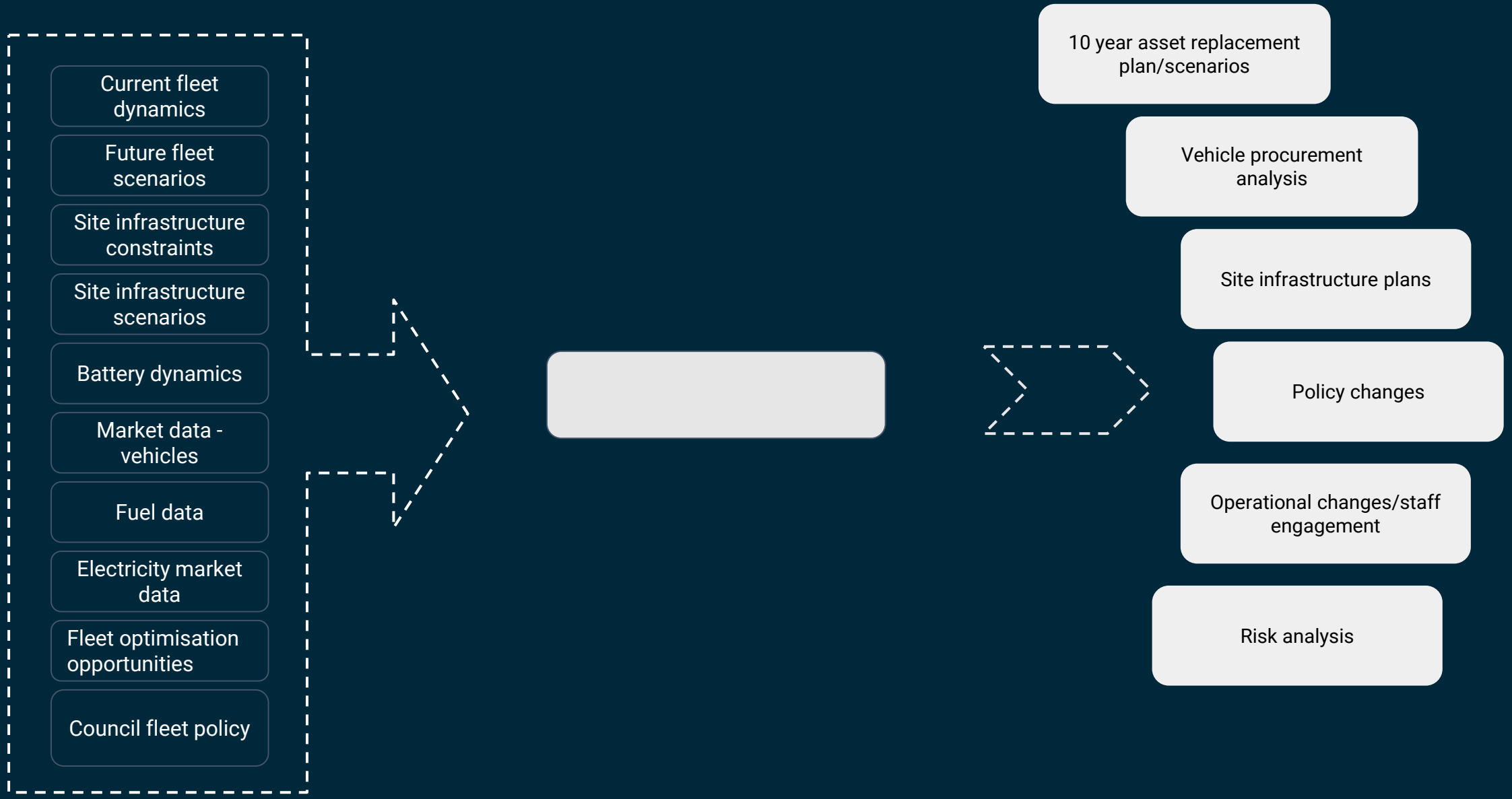


This process is about using data analytics and your knowledge to build a fleet transition plan

Need for a solid process that deals with organisational and market barriers

- Need to combine strong quantitative data with a process that aligns all stakeholders - sustainability, fleet and finance
- Need a process that becomes part of the organisational DNA - not a one-off
- Need a process that brings charging infrastructure into business as usual process





What are the benefits of this approach?

- Allocate the right budget at the right time
- Reduce costly procurement mistakes
- Align the organisation around a clear goal
- Create a framework to manage change in a cost efficient way
- Improve total cost of ownership-based decision making
- Improve EV residual value management
- Reduce depot infrastructure costs

Case Study: Brisbane City Council

Fleet Transition plan

The Brief

Key requirement: To guide a transition of Council's fleet to zero emissions technologies.

Required a business case for the transition of the Council's vehicles to zero emissions by 2030, and sooner where possible.

Fleet included more than 1361, 20 key garaging sites, Waste Collection, Commercial Trucks, Passenger vehicles, Buses, Utes and Vans.

The Approach

Project background/preparation

Low-emission vehicle suitability analysis

Infrastructure analysis

Review of value-added services and co-benefits of project

Synthesis of data and provision of a detailed fleet transition plan

The Results

Clearly articulated transition pathways used by management to align on potential required budget

EVENERGI

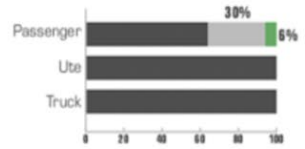
Case Study: Brisbane City Council

Fleet Transition plan

Scenario 1

Business as usual

Continue to manage the fleet as it exists in 2020.

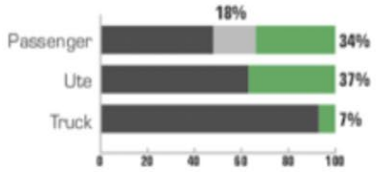


NPV	$111M
CO2e	9024 t/yr
NOx	4.2 t/yr
PM	0.14 t/yr

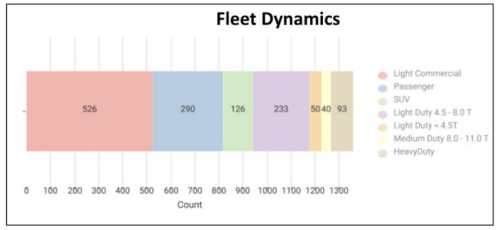
Scenario 2

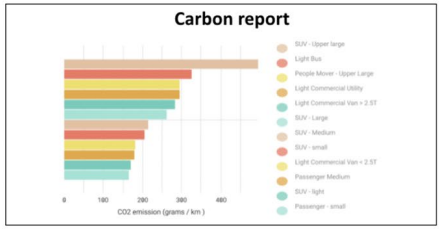
Cost-led transition

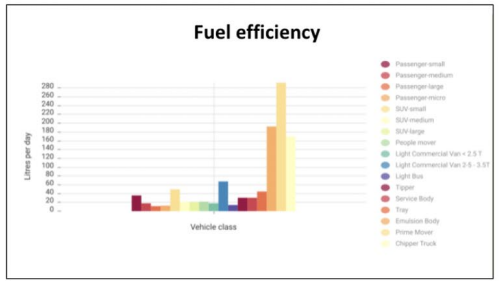
Fixed 10-year expenses budget based on current fleet management cost, to select vehicles.



NPV	$112M
CO2e	7805 t/yr
NOx	3.7 t/yr
PM	0.11 t/yr







Scenario 1

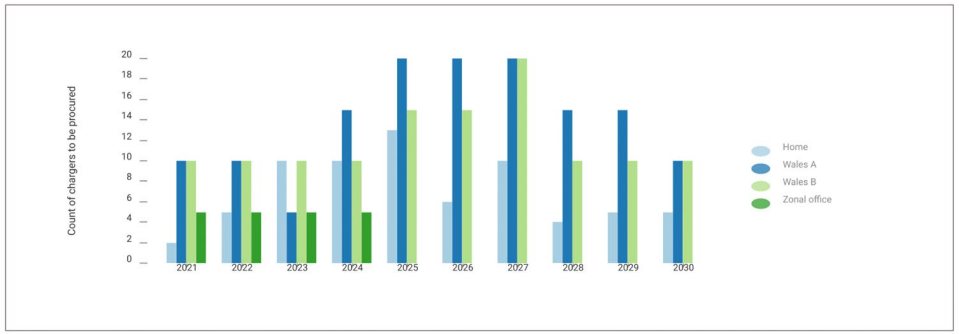
Business as Usual
Charger count / cost

0
$0

Scenario 2

Cost-led transition
Charger count / cost

350
$248,400



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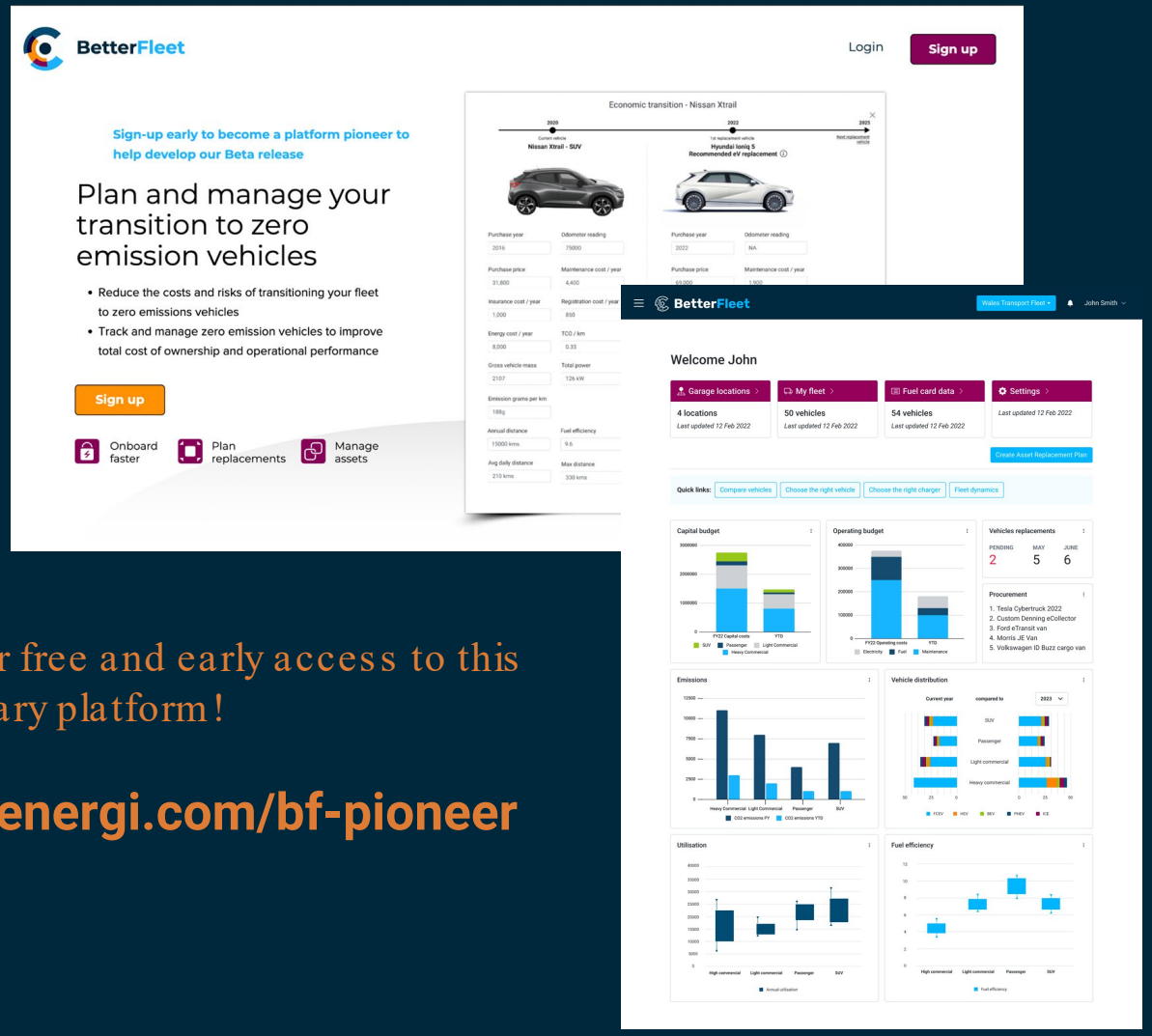
- **AFMA was a major contributor to the platform**
- **Now launching free versions in South Australia and the ACT**
- **Investing in BetterFleet 2.0 now - a platform for more comprehensive**



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Audience Q&A Session

ⓘ Start presenting to display the audience questions on this slide.