



Queensland's Zero Emission Vehicle Strategy 2022–2032



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Foreword



“Queenslanders will benefit from greater choice in zero emission vehicles and other net zero emission transport options...”

To contribute to a cleaner future, the transport status quo must be challenged, and we need to make sure that Queensland is in the best position to capitalise on the clean transport revolution.

That is why I am proud to deliver *Queensland’s Zero Emission Vehicle (ZEV) Strategy*. The ZEV Strategy is both vehicle type and fuel agnostic, it extends our focus beyond electric vehicles to the opportunities that zero emission technologies and manufacturing can bring, and how we can maximise these opportunities for Queensland.

Globally, more zero emission and low emission transport options are emerging. We’re seeing this occur across a range of transport modes, from passenger cars, e-bikes, e-scooters, public transport solutions and even heavy vehicles.

The Queensland Government has set a target to reach zero net emissions by 2050 and our Queensland Climate Action Plan details how we will reach this target. As transport is one of the main contributors to Queensland’s emissions, we have a significant responsibility to examine alternative and cleaner, more sustainable options to move people and goods around our state. Queensland remains committed to being at the forefront of a zero emission transport future.

Building on the achievements of Australia’s first electric vehicle strategy, *The Future is Electric: Queensland’s Electric Vehicle Strategy 2017*, this

ZEV Strategy sets out our pathway forward to make Queensland a clean transport powerhouse.

Developed with the input from 4,700 Queenslanders, and in consultation with state and local government, transport and energy industries and the environmental and sustainability sectors, it is a strategy shaped by Queenslanders for Queenslanders.

To realise the ambitious targets set out in this ZEV Strategy, the Palaszczuk Government is also developing the *Zero Net Emissions for Transport Roadmap and Action Plan* to provide the strategic direction and vision for a decarbonised Queensland transport sector. The ZEV Strategy builds on the success of the Queensland Electric Super Highway charging infrastructure and existing incentives for electric vehicle motorists in Queensland in the form of the lowest rate of registration and lower stamp duty concessions.

It signals a fundamental shift in how we move around. Queenslanders will benefit from greater choice in zero emission vehicles and other net zero emission transport options, with targeted incentives, infrastructure, a stable energy system and partnerships that build awareness and confidence in the transition.

The Honourable Mark Bailey MP
Minister for Transport and Main Roads

Foreword



the decarbonisation of transport is one of the most obvious routes we can take”

As we travel toward our 2050 net zero emissions target the decarbonisation of transport is one of the clearest routes we can take, and zero emission vehicles (ZEVs) are central to our strategy.

Our state has a unique combination of energy asset ownership and abundant renewable energy, which positions us as a national leader in developing clean energy transport solutions.

Queensland has been clear in our commitments: 50 per cent renewables by 2030, a 30 per cent reduction in emissions by the same year, and zero net emissions by 2050.

Achieving these targets and ensuring continued growth of renewable energy and low carbon technology will require a significant uptake of electric vehicles. The upcoming Queensland Energy Plan will outline how we will contribute to our targets.

An effective ZEV strategy must consider several key issues including:

- vehicle interactivity with built environments, including houses, workplaces and public spaces
- planning for new developments and roads that considers shifts in how people use their vehicles
- investment in electricity infrastructure to accommodate new demand created by a shift to ZEVs
- tariffs that reward motorists for charging their vehicles in a way that supports more renewables, lower emissions, and cheaper electricity for all consumers

- expansion of the Queensland Government’s fleet of ZEVs to ensure a pipeline of quality, low-cost second-hand vehicles.

This Strategy will do that.

Developing a low carbon economy through renewable energy and low emissions electricity requires us to focus on attracting clean industrial investment in the resources industry and manufacturing sector to Queensland.

Driving increased demand for uptake of ZEVs creates flow-on demand for battery manufacturing and resource extraction in our state.

As we transition to a low-carbon future, we acknowledge the fossil fuel industry in Queensland remains a significant employer.

Those livelihoods and the communities they support are important, and we commit to working with those companies who have announced their intention to transition to emissions free fuels or low emissions fuels.

We also commit to working closely with workers and unions to protect their livelihoods and communities as we transform the energy sector.

Ultimately, this strategy is not just about supporting the continued uptake and use of renewable energy in Queensland.

It’s about creating more jobs, stimulating economic growth, and setting up our state for a prosperous future.

**The Honourable Mick de Brenni MP
Minister for Energy, Renewables and Hydrogen and
Minister for Public Works and Procurement**



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Executive summary

The Queensland Government is committed to reducing Queensland's emissions. We aim to achieve:

- powering Queensland with 50% renewable energy by 2030
- a 30% reduction on 2005 emissions levels by 2030
- zero net emissions by 2050.

The energy and transport sectors are the two largest carbon dioxide emitters in Queensland. Focusing on these sectors will maximise the reduction of greenhouse gas emissions and will be a major contributor to achieving net zero emissions by 2050.

Queensland's Zero Emission Vehicle Strategy 2022–2032 sets out our vision and strategic direction towards ZEVs over the next 10 years.

Associated action plans will detail the key initiatives and actions that will shift Queensland to ZEVs. This includes actions that enable the development of alternative fuels and new and emerging clean technologies. Actions will create jobs for Queenslanders through local manufacturing opportunities and emerging ZEV industries.

A key driver to reducing emissions includes increasing the proportion of ZEVs across all transport modes and sectors. This needs to be balanced with keeping electricity costs low, providing a stable electricity network and increasing renewable energy supply in Queensland.

To achieve this, we will:

- inform Queenslanders about the opportunities that ZEVs offer
- encourage Queenslanders to choose ZEVs over internal combustion engine (ICE) vehicles
- support available and affordable ZEVs in Queensland, including a second-hand ZEV market
- review regulation and policies to ensure the market facilitates Queenslanders to switch to ZEVs

What is a zero emission vehicle?

A zero emission vehicle (ZEV) produces no exhaust fumes or emissions from its on-board source of power. [Find out about types of ZEVs on page 16.](#)

- partner with industry to inform Queenslanders about using energy in a smarter, more cost-efficient and environmentally sustainable way
- consider appropriate tariff design to reward ZEV owners to charge vehicles in an optimum way
- lead the development of a national approach to zero emission buildings to support their integration into the built environment
- identify ways to ensure planning of new developments considers electric vehicle use, storage and charging
- consider the required electricity system augmentation to facilitate higher uptake of electric vehicles
- support appropriate and accessible charging and refuelling infrastructure
- ensure government policy settings facilitate and incentivise Queenslanders to switch to ZEVs
- make the most of research and emerging technologies to deliver 'jobs of the future'
- enhance supply chains and skills training and capability across renewables and emerging ZEV technologies, to support new jobs and a coordinated transition by industry to a ZEV future
- work with industry and all levels of government to prepare for, and leverage, global shifts in technologies that improve the way we travel and use energy into the future.

Vision

A cleaner, greener, integrated transport and energy network that encourages zero emission transport solutions and contributes to Queensland's net zero emissions future.

Principles

Our strategy will:

- remove barriers to enable all Queenslanders, our communities and our industries, to access and benefit from ZEVs over the next 10 years
- support the uptake and development of ZEV technologies in Queensland and build industry and supply capability
- strategically integrate ZEV technology into the energy system and the built environment in a way that benefits all Queenslanders
- support the renewable energy and hydrogen industry to power Queensland's zero emission energy needs
- create a sustainable, accessible and affordable ZEV economy.



Linking Queensland transport, climate change and energy

The ZEV Strategy complements the:

- Queensland Transport Strategy
- Queensland Climate Action Plan
- Queensland Hydrogen Industry Strategy
- Queensland Procurement Policy and Queensland Indigenous (Aboriginal and Torres Strait Islander) Procurement Policy.

It has also been developed with consideration for other strategies currently under development, including the:

- Queensland Zero Net Emissions for Transport Roadmap
- Queensland Energy Plan
- Queensland Resource Industry Development Plan and associated Battery Industry Strategy
- Queensland Innovation Places Strategy.

The Queensland Transport Strategy, through the ‘sustainable, resilient and liveable communities’ outcome, recognises that a shift to ZEVs and alternative modes of transport is critical to reducing emissions, and improving the communities we live in.



Through the following key strategies we are:

- powering Queensland with 50% renewable energy by 2030
- achieving a 30% reduction on 2005 emission levels by 2030
- achieving zero net emissions by 2050.



Queensland Transport Strategy

The *Queensland Transport Strategy* provides a 30-year strategic direction for transport to achieve:

- accessible and convenient transport
- safe journeys for all
- seamless and personalised journeys
- efficient, reliable and productive transport for people and goods
- sustainable, resilient and liveable communities.



Queensland Climate Action Plan

The *Queensland Climate Action Plan* outlines how we will achieve a zero net emissions future.

It provides the way forward for Queensland to meet our ambitious but achievable climate targets, while ensuring Queensland's industries, workers and communities—including our First Nations, rural and regional people—see economic benefits from new technologies and growing markets for low carbon products.



Queensland Hydrogen Industry Strategy

The *Queensland Hydrogen Industry Strategy 2019–2024* is driving the development of an economically sustainable and competitive hydrogen industry that creates economic growth, opportunities for new export markets, and generates the highly skilled jobs of the future, while supporting the transition to a low-emission economy. The strategy will ensure that government and industry work towards a common vision for Queensland's future hydrogen industry, with specific actions in five focus areas, including:

- supporting innovation
- facilitating private sector investment
- ensuring an effective policy framework
- building community awareness and confidence
- facilitating skills development for new technology.



Queensland Procurement Policy

The *Queensland Procurement Policy* is the government's overarching policy for the procurement of goods and services. Procurement needs to deliver with probity and value for money to advance our economic, environmental and social objectives for the community over the long term. The policy aims to:

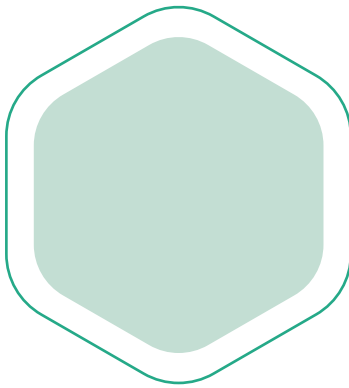
- focus on the economic benefit to Queensland
- maximise Queensland suppliers' opportunity to participate
- support regional and remote economies
- support disadvantaged Queenslanders
- stimulate the ICT sector and drive innovation.



Queensland Indigenous (Aboriginal and Torres Strait Islander) Procurement Policy

The *Queensland Indigenous (Aboriginal and Torres Strait Islander) Procurement Policy* provides a whole-of-government framework to increase procurement with Indigenous businesses. It aims to:

- increase the capacity and capability of Indigenous businesses to successfully tender for Queensland Government contracts
- grow and develop a diverse and sustainable Indigenous business sector in Queensland by increasing the capacity and capability of Indigenous businesses to supply to the Queensland Government and the private sector through supply chains and increased private sector demand
- improve employment outcomes and opportunities for Aboriginal peoples and Torres Strait Islander peoples to participate in the Queensland economy.



Zero Net Emissions for Transport Roadmap (in development)

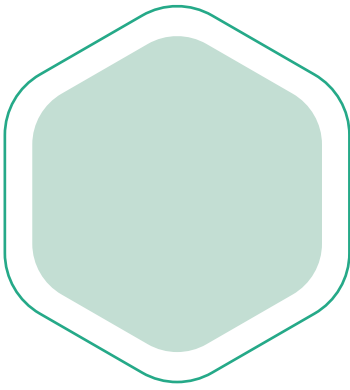
The Zero Net Emissions for Transport Roadmap will:

- provide a plan for the transport sector to demonstrate and deliver actions to reduce transport emissions across all modes and infrastructure
- provide the strategic direction and vision for a decarbonised Queensland transport sector
- demonstrate the Queensland Government's continued leadership to reduce both tailpipe and transport infrastructure emissions
- outline the transport sector contribution to our 2030 and 2050 emission reduction targets.

Taking action to reduce transport sector emissions will unlock opportunities that improve the overall transport system. Enhancing passenger and active transport options, embracing ZEVs and harnessing new or emerging technologies (such as automated vehicles and innovative service solutions like Mobility-as-a-Service) will:

- reduce costs
- decrease travel time
- improve transport equity, accessibility and safety.

Creating a decarbonised transport sector will support new job opportunities in vehicle manufacturing, and complementary industries such as mineral and battery development. Building new infrastructure—using low carbon materials—that encourages increased active and passenger transport will support new supply chains and improve the health and wellbeing of all Queenslanders.



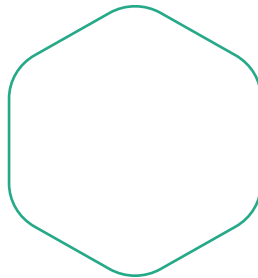
Queensland Energy Plan (in development)

In addition to outlining how we will achieve our 50% renewable energy target by 2030, the Queensland Energy Plan will position the state as a leader in integrating decentralised energy sources and ZEVs into our electricity grid.

The Queensland Energy Plan will support delivery of firm zero emission electricity for transport at a price that makes it not only affordable, but attractive for Queenslanders.

As part of the Queensland Energy Plan (currently under development) we will consider various ways to integrate ZEVs within our electricity grid, and into our homes, workplaces and communities, including the benefits of:

- amending building codes to require new houses and apartment buildings to be EV ready, including the capability to integrate bi-directional charging capability
- developing tariffs that reward motorists for charging their vehicles during the day
- investing in network augmentation to support the deployment of charging infrastructure in urban areas
- rolling out charging infrastructure and optimised tariffs for Queensland Government publicly owned sites and facilities including carparks, hospital and health service campuses and parklands
- developing a local value chain around the ZEV industry, including vehicle, infrastructure, and battery manufacturing capability.



Our priorities

This strategy outlines how we will shift to a zero emissions future. The five priorities underpinning this strategy are:

Priority 1: Encouraging cleaner, greener transport modes

Priority 2: Building ZEV manufacturing and supply chain capability

Priority 3: Facilitating supportive ZEV infrastructure

Priority 4: Driving towards renewables and smart charging

Priority 5: Partnerships, innovation and advocacy.



Need for national leadership

This strategy sets the direction for Queensland and strengthens our ongoing dialogue with the Australian Government for greater national leadership of ZEV policy.

The Australian Government has committed Australia to net zero emissions by 2050. The *Future Fuels and Vehicles Strategy 2021* outlines a technology-led approach to reducing emissions in the transport sector, with a focus on charging infrastructure.

National leadership is important, because it provides the direction that contributes to overall transport emissions reduction, and helps Australia to overcome barriers in the shift to ZEVs, through:

- improved vehicle emission standards, including the adoption of a carbon dioxide standard similar to other international markets
- improved national fuel quality standards
- market support to attract international vehicle manufacturers
- adoption of vehicle emission control technologies
- luxury car tax and second-hand vehicle import regulations on ZEVs
- National Construction Code requirements to facilitate the provision of appropriate ZEV-charging infrastructure to future-proof new residential and commercial developments
- a renewable energy procurement and manufacturing policy
- fringe benefit tax legislation to encourage the purchase of ZEVs over ICE vehicles.

Some of these measures are out of state and territory governments' control, and we need all levels of government to work together to achieve them.

Where possible, we will align Queensland's priority targets and actions with those of other states and territories, to help provide certainty for industry and the market.

Targets

To support Queensland's 50% renewable energy target by 2030 and zero net emissions by 2050, we have set targets to stimulate investment and provide consumer confidence to transition to ZEVs in Queensland.



100%

of eligible QFleet passenger* vehicles to be zero emissions vehicles by 2026



Every new TransLink funded bus added to the fleet to be a zero emission bus

from 2025

in South-East Queensland

from 2025–2030

across regional Queensland



50%

of new passenger* vehicle sales to be zero emission vehicles by 2030

200,000 passenger* zero emission vehicles by 2027



100%

of new passenger* vehicle sales to be zero emission vehicles by

2036

**Passenger vehicles include light passenger vehicles and SUVs*

State of the market

Zero emission vehicles around the globe

After significant growth over the past decade, the global ZEV market broke through the 10 million vehicle mark in 2020. However, this is still only 1% of vehicles globally.

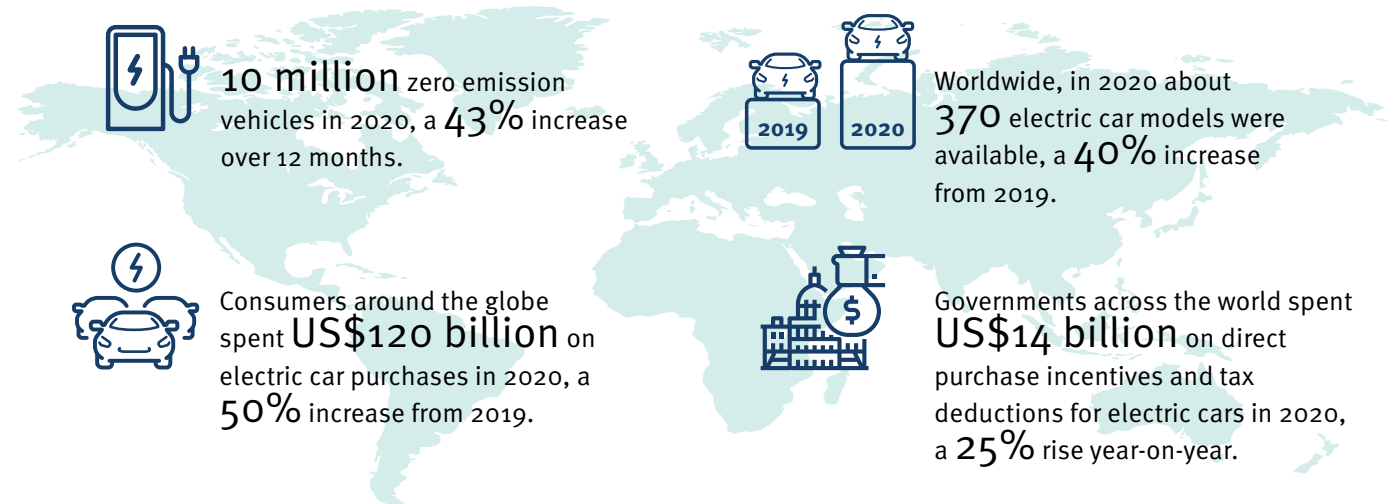


Figure 1. State of the market for EVs across the globe¹

Zero emission vehicles in Australia

In 2021, Australian consumers paid much more for electric vehicles (EVs) than in Europe and the United States, which is likely to continue in the short term. In total, **31 electric vehicle models are available in Australia**, with 58 models expected by the end of 2022. This is still well below the number of models available in other international markets².

Queensland ZEV state of play in 2022

The uptake of ZEVs in Queensland continues to increase, with a **132% increase in battery electric vehicle registrations in the 12 months to 28 February 2022**—from 3,737 to 8,676 vehicles⁴. This accounts for 0.18% of all registered Queensland passenger vehicles (excluding trailers).

Since 2021, we added five zero emission hydrogen-powered Hyundai NEXOs to the Queensland Government's fleet. These are the first hydrogen cars in our state.

As at 25 January 2022, 146 EVs were active in QFleet—102 battery electric vehicles, 39 plug-in hybrid electric vehicles, and 5 fuel cell electric vehicles. With another 39 EVs on order, QFleet has a total of 185 EVs active and on order, well exceeding the 2021 target of 144.

Australian electric vehicle sales

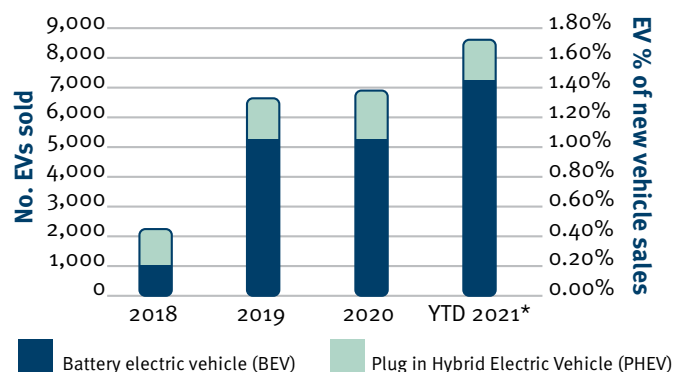
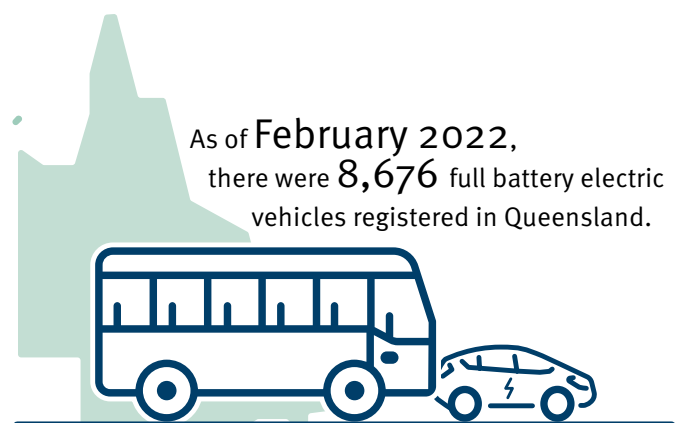


Figure 2. Australian electric vehicle sales³



Price parity

Compared with ICE vehicles, ZEVs typically have higher upfront prices and lower running and maintenance costs. Price parity can be measured in two ways:

1. Purchase price parity—when the purchase price of a ZEV is equal to that of a comparable ICE vehicle.
2. Total cost of ownership parity—when cost of buying, operating, fuelling and maintaining a ZEV over its lifetime is equal to that of a comparable ICE vehicle.

One of the main advantages of owning a ZEV is that fuel is likely to be far cheaper than for an ICE vehicle. In 2022, fuelling a petrol vehicle is likely to cost greater than five times more per kilometre than charging a comparable battery electric vehicle at home. So, as ZEV technology improves, buyers will begin to realise that buying a ZEV is a trade-off between a higher purchase price and much lower running costs.

This difference means that, for motorists who travel often and/or over long distances, total cost of ownership price parity may be reached earlier, while for most motorists, it is likely to occur as ZEV prices are expected to fall in the coming years.

EV projections by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for the Australian Energy Market Operator in 2021⁵ assume that short-range EVs will reach purchase price parity with ICE light vehicles between 2025 and 2035.

Because operating a ZEV is generally cheaper than an ICE vehicle, total cost of ownership parity may occur before this date.



Zero emission vehicle types

Queenslanders have access to a range of different modes of ZEVs and transport options—from passenger cars, buses, heavy trucks and ferries to e-scooters, e-bikes, and even aircraft.

Over the next 10 years, we expect more zero emission technologies to become available.

This includes hydrogen-powered passenger vehicles, light commercial and freight vehicles, bio-fuelled heavy vehicles and buses, and electric utes, off-road vehicles and marine crafts. Changes in technology will continue to affect and increase the transport options available.

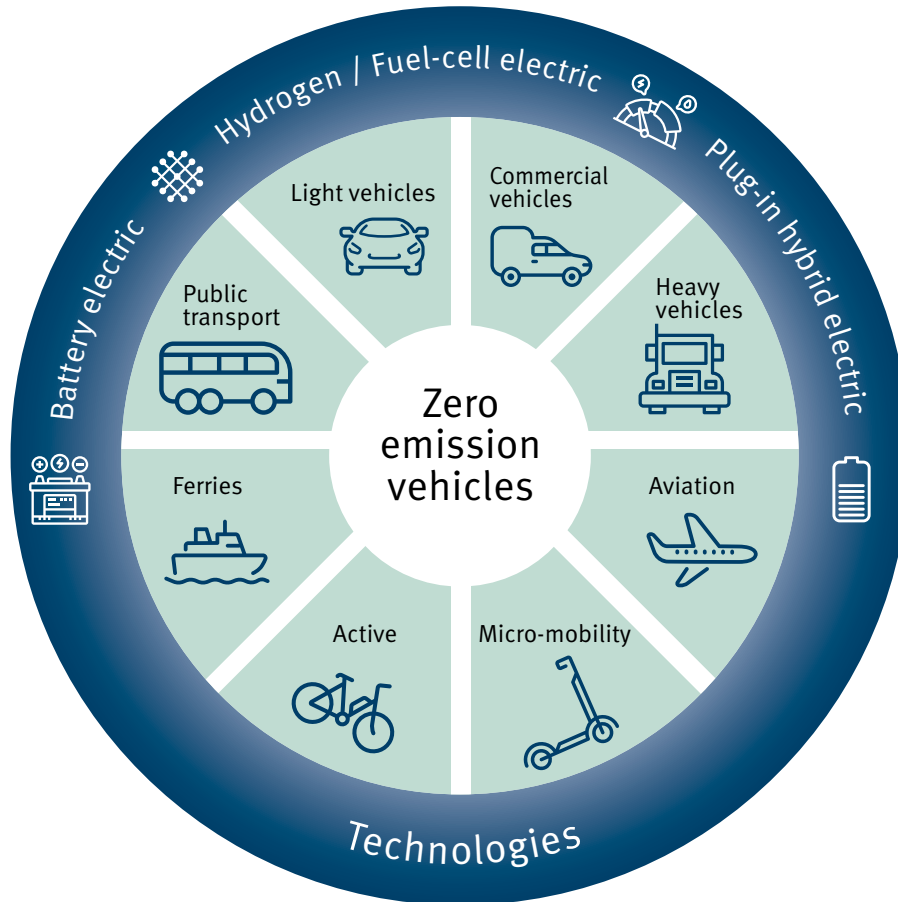


Figure 3. Types of ZEVs and the technologies that are available to support them.

Battery electric vehicles (BEVs) are a mature technology and use stored energy from the electricity grid to drive an electric motor supplied from an on-board battery. BEVs produce no direct tailpipe greenhouse gas emissions. A BEV is a fully zero emission vehicle when powered by renewable energy.

Hydrogen vehicles or fuel cell electric vehicles (FCEVs) are an emerging market technology that convert hydrogen to electricity to power an electric motor. FCEVs produce no direct tailpipe greenhouse gas emissions. A FCEV is a fully zero emission vehicle when powered by renewable energy.

Plug-in hybrid electric vehicles (PHEVs) are not zero emission vehicles. They are a mature technology and can use electricity and/or another fuel source (like petrol). Unlike other hybrid vehicles, PHEVs can be plugged in and charged from the electricity grid. PHEVs produce more tailpipe emissions than BEVs, but are able to produce fewer emissions than ICE vehicles, though only when used mainly on battery power. If driven mainly on the petrol cycle, they are likely to produce higher emissions than similar size ICE vehicles, as the battery pack makes PHEVs heavier and requires greater acceleration.

Moving to zero emission vehicles

Changing the way we travel

This strategy supports many zero emission transport modes and consumer and industry choices to improve the emission-free ways we can travel in our everyday lives. It also recognises the different transport and vehicle needs of our diverse regional, rural and urban environments.

To reduce transport emissions and improve network efficiency, we must change how we currently use the Queensland transport network across both the movement of people and goods. This means having more people use active travel or zero emission cars, buses, ferries and trains. While shifting from ICE vehicles to ZEVs helps to reduce emissions, improving congestion also relies on a shift to public transport. It also means supporting the movement of freight and goods with zero emission technologies as they mature, such as zero emission trains, shipping and, in the future, aviation.

We are also seeing changes in when and how we use transport as a result of changes in society. An example of this is the increase in people working from home and buying goods online instead of in-store, mainly in response to COVID-19. Globally, as new technologies emerge, people are changing their purchasing and personal transport habits by:

- sharing personal vehicles
- using ride sharing services
- moving to e-bikes and rideables, such as e-scooters and other forms of micro-mobility
- using drones for freight and passengers
- using automated vehicles
- using in-vehicle tracking and monitoring systems.



Vehicle technologies will continue to evolve and improve. Through this strategy and our related strategies, we will encourage Queenslanders to access zero emission transport options available and suited to them, while integrating other future transport trends and technologies, such as automated vehicles and mobility-as-a-service.

	Active travel	Micro-mobility	Light vehicle personal travel	Public/shared transport and mobility-as-a-service
Modes	Walking Bicycles e-bicycles	Rideables e-scooters Electric mopeds	BEVs FCEVs PHEVs	Electric buses Electric trains Electric light rail Electric ferries Personalised transport (such as ZEV taxis) Digital/apps promoting zero emission journeys
Benefits	<p>Walking and riding bicycles is emission free, improves health and wellbeing, reduces congestion and is low or no cost.</p> <p>E-bikes make longer and hillier trips easier and are used much like a car—for recreation, shopping, errands, visiting friends and family, carrying cargo, and commuting to work and education.</p>	<p>Zero emission micro-mobility helps with longer or time-constrained journeys or to connect first and last mile to other transport modes (such as travelling to a train or bus stop).</p>	<p>The electrification of vehicles, the rise in ride- and vehicle-sharing schemes, and driverless vehicles are improving accessibility of passenger transport.</p> <p>ZEVs help to reduce transport emissions, improve local amenity and decrease transport costs over the life of the vehicle.</p>	<p>ZEV public transport and tools such as mobility-as-a-service help to provide seamless travel, inform transport choice and reduce emissions.</p>

‘More than **4 million trips** have taken place on **e-scooters in Brisbane** since late 2018. Brisbane City Council data reveals that **between 30% and 50%** of e-scooter and e-bike trips replaced car trips in Brisbane.’⁶



Benefits of zero emission vehicles

Transitioning the transport sector away from fossil fuels and integrating it with the energy system will help to reduce transport and energy sector emissions. ZEVs will:

- benefit our environment
- contribute to better health
- contribute to a low-cost, reliable supply of electricity
- improve domestic fuel security
- support local manufacturing and jobs
- benefit the Queensland economy
- drive investment in supply chains and the resources sector
- save households money on energy and vehicle costs.

“I have found that...electric vehicles are vastly superior in almost all aspects to an ICE car, including: performance, safety, practicality, environmental aspects, comfort (noise), technology, resale, convenience of charging at home, low operating costs and better reliability.”

(Community survey respondent)

Consumers

There are many reasons why Queenslanders will want to shift to ZEVs, and these benefits will become more apparent as Queensland continues to experience the opportunities of the global shift to ZEVs.

The transition to ZEVs will provide more affordable transport, particularly when integrated with smart charging solutions. While the upfront cost to buy ZEVs is currently higher than comparable ICE vehicles, the Electric Vehicle Council of Australia⁷ estimates that the running costs of a BEV are about 70% cheaper per kilometre. This is because of lower costs for charging compared with refuelling and vehicle maintenance.

We expect the price of ZEVs to reduce over time, while the user experience will continue to be enhanced with technology advancement. For example, batteries continue to become easier to charge and achieve greater range. The potential value for owners of electric vehicles includes:

- using the vehicle as a home or on-site battery
- having the convenience of at-home charging applied to your home electricity bill
- capturing and storing renewable electricity for later use.



Communities

Shifting from ICE vehicles to ZEVs will benefit Queensland's cities and regional communities through:

- zero air pollution
- quieter neighbourhoods and streets
- increased investment in, and greater accessibility to, zero emission infrastructure
- better health for individuals and the environment.

Nationally, transport-related health illness due to air pollution (particularly tailpipe emissions) accounts for billions of dollars in health-care costs annually.

In addition, enabling zero emission travel options encourages the use of more active travel, which provides health benefits through physical activity, less traffic and less road congestion.

Environment

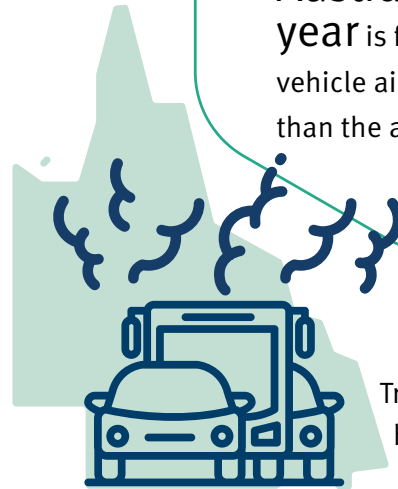
One of the greatest benefits of ZEVs is the positive impact they will have on our environment.

Transport emissions in Queensland account for about 14 per cent of total emissions, and have steadily risen each year, except for 2020 during the peak of the COVID-19 pandemic.

Between 2005 and 2019, transport sector emissions rose by 32 per cent. On the current trajectory, transport emissions are expected to grow to a further 10 per cent on the previous 15 years (or 26MtCO₂-e by 2030)¹¹ as our population and the number of vehicles on Queensland roads continues to rise.

As the Queensland electricity network continues to decarbonise, the emissions reduction potential of ZEVs—in particular BEVs—will improve. Reduced vehicle lifecycle emissions of between 16 per cent to 40 per cent¹² will occur even on the current Queensland electricity grid mix compared with an ICE vehicle.

In 2019 a report found that the **cause of death** for over **1,700 Australians per year** is from motor vehicle air pollution, more than the annual road toll.



Transport is the second highest emitting sector, producing about

14% of Queensland's total greenhouse gas emissions.

Light passenger and commercial vehicles contribute about **45%** of these emissions

Sources: Electric Vehicle Council (2021)⁸; Department of Environment and Science (2019)⁹, Department of Environment and Science (2020)¹⁰



Renewables and hydrogen

Renewable energy is currently meeting 20% of our energy needs, and Queensland is well on its way to reach a 50% renewable energy target by 2030.

In Queensland, since 2015, 50 large-scale renewable energy projects have either been operating, are under construction or are financially committed. This represents a \$10.9 billion investment in our economy, and about 7,900 jobs in the construction industry. Our publicly-owned generators—CleanCo, Stanwell and CS Energy—are leading the way, already supporting more than 2,000MW of renewable energy capacity.

Queensland has over 3,900 megawatts of rooftop solar, which is more than twice the size of our largest power station in capacity. There are now more than 723,000 grid-connected small-scale solar systems in Queensland.

Increasing large-scale renewable projects is critical to support the uptake of zero emission technologies. Establishing a target for electric vehicles will send an investment signal to the energy sector to construct further renewables, storage and grid infrastructure.

Modelling shows that achieving the target of 50% new EV sales by 2030 would create demand equivalent to an extra 1,000 MW solar farm generated renewable energy—nearly six times Queensland’s largest currently operating solar farm.

We want to make the most of Queensland’s competitive strengths in renewable energy, zero emission manufacturing and the emerging hydrogen industry. To support this, Queensland has a dedicated Hydrogen Minister, taskforce and strategy focusing on how we develop hydrogen as a strong renewable resource industry for our state to create jobs and strengthen our economy.

Growing local energy supply

Australia currently imports 90% of its liquid fossil fuels, of which 75% is attributed to the transport sector. Australian company Ampol—which employs about 600 people—refines most of this in Queensland. This is primarily refined in Queensland by an Australian company, Ampol, employing around 600 persons. We will work closely with that industry and its workforce to ensure that we can support its future to transition into a producer of low carbon fuels like renewable hydrogen.

Unlike ICE vehicles, ZEVs are all powered from the electricity grid, hydrogen refuellers or household solar systems and stationary batteries. This can help to reduce the nation’s reliance on liquid fossil fuel imports.

Fossil fuel imports to Australia were estimated to be worth about \$40 billion in 2018–19¹³. Queensland accounts for almost one-quarter (24%) of Australia’s total consumption. Queensland’s oil and petroleum product spend is an estimated \$9.6 billion per year.

Economy

The economic benefits for Queensland’s cities and regions as a result of the shift to ZEVs include:

- supporting our renewable energy sector, especially in regional areas
- creating new jobs and economic development, and helping those employed in existing industries to transition into emerging industries through:
 - growing the state’s automotive manufacturing capabilities, including for ZEVs and their components
 - new economy minerals
 - repurposing and recycling components
 - building, operating and maintaining renewable energy installations
- enhancing energy and fuel security due to lower reliance on imported liquid fossil fuels.

This will build on the success of the existing ZEV industry in Queensland, including:

- the world-leading charging infrastructure manufacturer Tritium
- local manufacturers of zero emission buses, trucks and trains
- the growing circular economy industry.

Overcoming challenges to shift to ZEVs

ZEVs will play a major role in shifting to a zero emissions future. The Queensland Government acknowledges that we need to act now to help identify and remove barriers and overcome potential challenges.

This is hindered by a lack of national policy supporting the shift to ZEVs, such as the reluctance by the Australian Government to subsidise the purchase price like other nations and to introduce national vehicle emissions and fuel efficiency standards in line with other OECD countries¹⁴.

Barriers to zero emission vehicle uptake

In 2022, common barriers to ZEV uptake, include:

- a higher purchase price than equivalent ICE vehicles
- a perceived lack of accessible charging/ refuelling infrastructure and knowledge about smart charging capability
- limited ZEV model availability
- low public awareness on the benefits of owning a ZEV.

The 2021 community survey helped to inform what is needed to overcome barriers and support people to shift to ZEV journeys in Queensland. **This is demonstrated in the customer journey (p. 23).**

Almost 4,600 people completed our 2021 community survey, which found that the most common barrier to ZEV uptake in Queensland was the initial purchase price¹⁵.



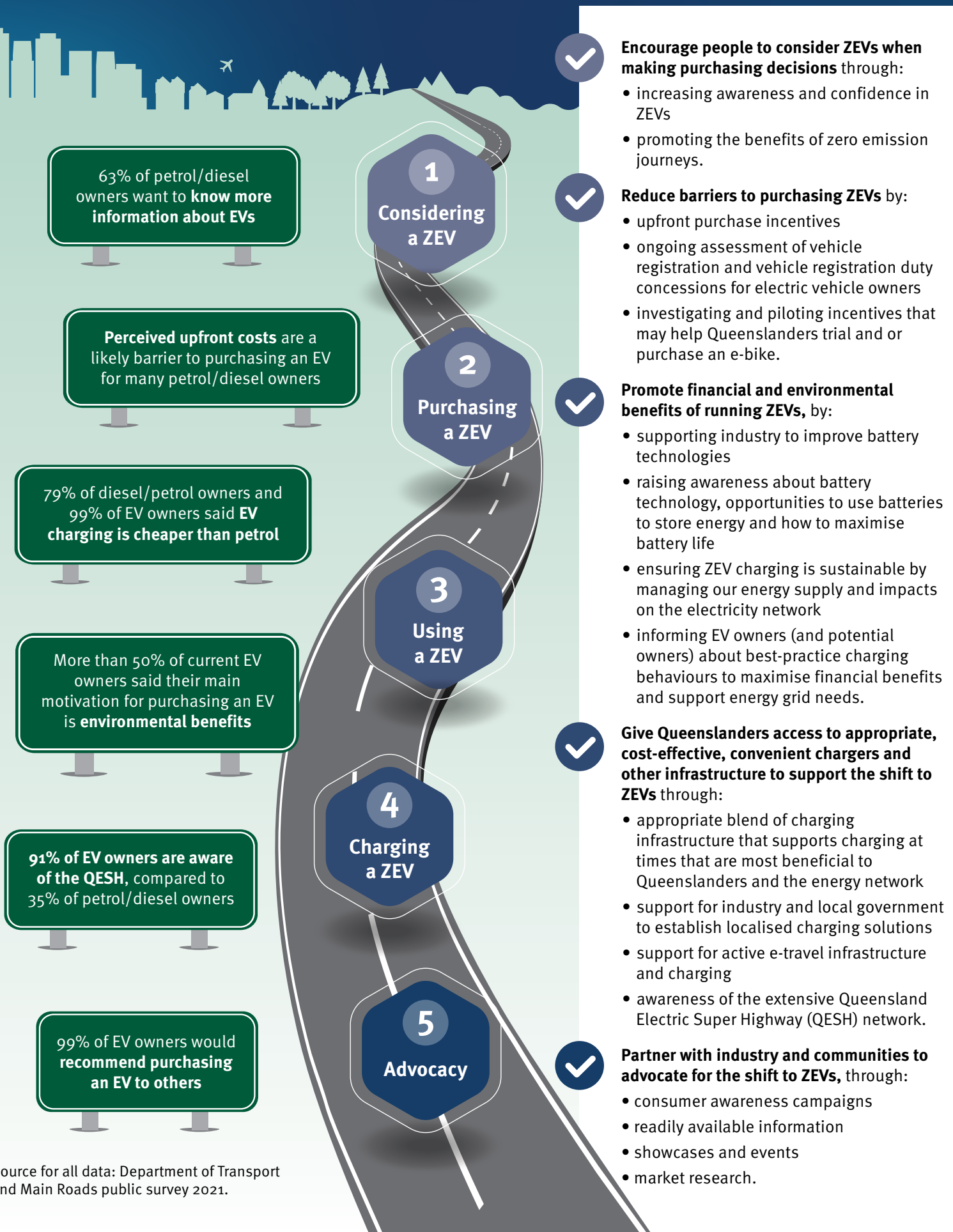
In Australia and internationally, incentives have helped lower the barrier of initial purchase cost, successfully increasing ZEV uptake¹⁶.

Another barrier for consumers is the real and perceived concern about the distance (or range) an electric vehicle can travel. In the *State of electric vehicles* survey in 2020¹⁷, 45% of respondents said anxiety about electric vehicle range was a factor that discouraged them from buying an electric vehicle. But almost 80% of people underestimate electric vehicle range—poor consumer awareness can exacerbate barriers to shifting to ZEVs.

Battery technology continues to mature and improve ZEV range. In 2020, the weighted average range for a new battery electric car was about 400km, up from 200km in 2015¹⁸.

A customer journey

How we can overcome barriers and support people to shift to ZEVs



Opportunities for charging choice, equity and affordability

Queensland has high-quality solar renewable energy and is a world leader in renewable energy. Queenslanders have led the nation for installing rooftop solar systems, with Queensland postcodes consistently appearing in the top 10 locations with the most solar systems every year. Now Queenslanders are installing batteries and buying ZEVs at a record rate, which is only set to increase.

Queensland's renewable track record means we are ideally positioned to power this next phase of growth, and charge Queensland ZEVs with our high-quality solar and wind energy, either directly, or from a variety of storage solutions being developed across the network.

To help facilitate and fast-track the uptake of ZEVs, the Queensland Government is fine tuning the policy settings to support the integration of ZEVs and ensure these can be easily and cheaply charged with renewable energy. This means the right infrastructure in the right places, competitive pricing options and planning for the future.

This planning is essential to ensure the lowest cost electricity for Queenslanders. It will support their choices to purchase and drive ZEVs and lower their emissions footprint. Every Queensland ZEV motorist will be contributing to achieving our 50% renewable energy target by 2030.

Grid planning and solar to power battery electric vehicles

Over the coming decades, growing BEV uptake will lead to increased demand for cleaner electricity. Queensland vehicles will be powered more by wind and solar than petroleum products.

At the same time, Queenslanders are installing rooftop solar systems on homes and businesses. This gives direct access to low-cost solar energy. During the day, these systems are often exporting that solar energy directly into the grid when it is not being used by the owner. However, some of this energy is currently not consumed in the system and is creating challenges for system stability.

During the day, the solar energy produced is plentiful and cheap, so this would be the best possible time for BEV motorists to charge their vehicles. There are many benefits to charging BEVs during the day:

- A BEV charged from solar energy during the middle of the day can help soak up excess energy and avoid charging at peak times like the evening. This makes the most of the available energy and reduces the need for costly grid upgrades that would add to BEV charging costs.
- It supports further investment in the renewable energy sector in Queensland, and associated construction jobs, because more demand for solar energy means more solar projects.
- BEVs can double as a battery for the average household. Solar energy soaked up in the day at work or car parks can be used to power homes or export to the grid, giving BEV owners the choice to get more value from their vehicle. However, this is contingent on technological advancements in buildings.



To take advantage of the high-quality solar energy, BEV chargers will need to be in the locations where people park their cars during the day. This might include workplaces, government buildings, shopping centres, car parks and community facilities.

While most people will charge at home and workplaces using slow chargers, planning for fast chargers will be essential for motorists to be able to travel longer distances, including in regional Queensland.



Bi-directional energy

The bi-directional capabilities of electric vehicles can be fully utilised if they are also used as battery storage. In the future, electric vehicle owners may be able to supplement electricity consumption in their homes, or feed it back into the electricity grid when the vehicle is not being used. This would provide an additional incentive to buy a BEV but will require upgrades to current systems in homes and buildings.

Hydrogen transport opportunities

Hydrogen is a clean, renewable fuel that can be used in transport, power supply and various industrial processes, including the manufacturing and agricultural sectors. FCEVs, powered by hydrogen, complement electric transport modes and offer benefits in terms of range, large payloads and faster refuelling times.

Using hydrogen as a fuel source is likely to be fundamental to achieving net zero emissions, and there is widespread research and development of zero emission technologies, such as FCEVs, to decarbonise freight and heavy vehicles, shipping and aviation transport modes.

The development of a domestic hydrogen industry, including the production of competitively priced renewable hydrogen, will have widespread economic benefits. Domestic applications will not only deliver opportunities for domestic users but will also help open new export markets and deliver skilled jobs in a growing international hydrogen industry.

Industry needs guidance and clarity so that they can place charging stations in locations that optimise network upgrades and are convenient for motorists, to reduce costs for both industry and the consumer. The Queensland Government, with Energy Queensland Limited, is developing resources to help provide investment signals and stimulate third-party investment in, and planning of, appropriate infrastructure.

Hydrogen has the potential to decarbonise the heavy and long-haul vehicle industry. This is because it is harder for these sectors to shift to battery electric technology, due to the sheer size of batteries needed to power these vehicles, and the offset in payload capacity if powered by batteries. Biofuels also provide an immediate decarbonisation option for heavy vehicles and long-haul freight and passenger transport (including within the rail, aviation and maritime sectors).

But to realise the full benefits of hydrogen in our transport modes, we need a mature industry, so that we have a strong supply of product, refuelling infrastructure and vehicle availability.

We are developing and expanding renewable hydrogen production under the *Queensland Hydrogen Industry Strategy 2019–2024*, and actively supporting the use of hydrogen in the transport sector through the Hydrogen Industry Development Fund.



Industry snapshot: Aurizon

Headquartered in Queensland, Australia's largest rail freight operator, Aurizon uses over 200 million litres of diesel to fuel its locomotive fleet each year.

In an agreement with mining company, Anglo American, Aurizon has announced a study exploring the application of Anglo American's proprietary hydrogen fuel cell and battery hybrid power units in heavy haul freight rail operations.

The feasibility study will focus on the potential deployment of Anglo American's hydrogen power technology on:

- Aurizon's Moura rail corridor, which operates between Anglo American's Dawson metallurgical coal mine and the Gladstone Port)
- the Mount Isa rail corridor, which operates between the North West Minerals Province to Townsville Port, via Aurizon's Stuart Terminal.

Case study

Hydrogen fleets

In 2021, QFleet leased five hydrogen FCEVs as part of a three-year trial. This was the first deployment of hydrogen vehicles for the state.

The vehicles emit only oxygen, water vapour and heat, and remove particulate matter from the air they use in the process. They can be refuelled in three to five minutes and have a range of about 650km on a single tank.

The FCEV trial project encouraged BOC Gas to develop the \$4.2 million end-to-end renewable

hydrogen project, which will see the first publicly available hydrogen refueller in Queensland.

Increased awareness of how hydrogen vehicles can help decarbonise the transport sector can encourage other fleet operators to consider hydrogen vehicles for their fleets.

Growing hydrogen fleets and investing in this industry will have wide-ranging benefits for Queensland in the coming years.

Manufacturing and supply chain opportunities

Sourcing locally made vehicles supports Queensland's manufacturing industry, and the use of renewable energy supports our renewables industry in urban and regional Queensland. The focus on ZEVs provides various opportunities, now and into the future for Queensland businesses. Queensland is already manufacturing zero emission buses for public transport, and the opportunities for businesses are only set to grow as ZEV uptake takes off in Queensland. We will build on our existing manufacturing capability and further support manufacturing ZEV technologies and component parts, including developing a battery manufacturing and recycling industry.

The draft Queensland Resources Industry Development Plan proposes the development of a Queensland Battery Industry Strategy. In developing the Queensland Battery Industry Strategy, the Queensland Government will consider opportunities to expand battery manufacturing. Battery manufacturing has the potential to extend the local supply chain for new economy minerals and the development of battery chemicals potentially creating additional economic development and employment in Queensland.



While local manufacturing of ZEVs and associated infrastructure is in its very early stages, our focus on ZEVs will support local capacity growth. QFleet is already procuring ZEVs from Queensland dealers who benefit from sales, accessories and maintenance of ZEVs. We are closely monitoring local industry and supply chains as they develop, ranging from the manufacture of direct current (DC) chargers for global use, to companies on the verge of manufacturing EVs from imported components.

Tritium, a local manufacturer making DC fast chargers, is a great example. Tritium chargers have added to our EV charging infrastructure arrangement, so that agencies across government can purchase them. This supports the Making it for Queensland initiative. Other companies are close to manufacturing passenger EVs from imported components, and we are seeing potential in the heavy vehicles sector, including buses and light trucks.

As capacity develops, our 'Buy Queensland' procurement approach will further support Queensland companies' ability to supply to government. This will help to develop and drive the transport revolution and support employment opportunities for local businesses and communities, including those owned by Aboriginal and Torres Strait Islander Queenslanders.

Industry snapshot: Keolis Downer and BusTech Group

Queensland is already supporting investment in local manufacturing and jobs. This includes the \$15.6 million strategic partnership between Keolis Downer and BusTech Group to:

- manufacture 16 new zero emission buses on the Gold Coast
- build Queensland's first 100% zero emission bus depot in North Lakes at the home of Hornibrook Bus Lines.

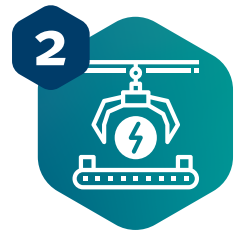
The distinctive wrap on TransLink's zero emission buses brings awareness of electric vehicles to more Queenslanders and visitors.



Priorities for Queensland's Zero Emission Vehicle Strategy



Priority 1:
Encouraging cleaner,
greener transport modes



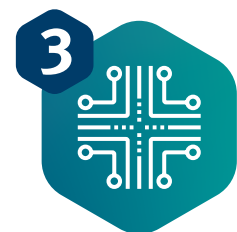
Priority 2:
Building ZEV
manufacturing
and supply chain
capability



Priority 5:
Partnerships, innovation
and advocacy



Priority 4:
Driving towards renewables
and smart charging



Priority 3:
Facilitating supportive
ZEV infrastructure

Priority 1: Encouraging cleaner, greener transport modes



Key outcomes

- Shift from ICE vehicles to public and private ZEVs and/or e-mobility and active transport opportunities.
- Increase Queensland-based zero emission technology manufacturing and automotive industries.
- Grow the second-hand ZEV market.
- Contribute to Queensland emissions reduction targets through lower transport and energy emissions.
- Generate renewable energy through smart charging, when available.

Encouraging people to shift to cleaner, greener transport modes requires strong policy actions that:

- make it easier for Queenslanders to select a ZEV over an ICE vehicle
- encourage people to walk, ride a bike, or use an e-bike, micro-mobility (e-scooters and rideables) or public transport
- support and enable ZEV uptake and technology
- set clear direction for supporting emerging technological solutions to move us to cleaner, greener transport in the future.

Shifting to zero emission vehicles

Through this strategy, we are investing in actions that will encourage Queenslanders—both individuals and businesses—to consider buying ZEVs (including cars, buses and trucks) over ICE vehicles. We will focus on:

- reducing upfront price
- encouraging optimal charging when solar is generating energy during the day
- improving availability of convenient public charging infrastructure locations
- providing information to increase consumer confidence about the range and reliability of ZEVs.

To drive Queensland's ZEV uptake, we have a target for new ZEV sales that provides industry and international markets with a clear market signal to increase the number of ZEVs supplied to Queensland. This can also help to drive down the price of ZEVs through increased model availability and variety.



We have set a target of 50% of new light vehicle sales to be ZEVs by 2030.

To help us reach this target, we propose a target of 200,000 light ZEVs in the Queensland fleet by 2027. Based on current vehicles in 2022 (excluding trailers), this accounts for 4.4% of the total vehicle fleet.

Further demonstrating Queensland's leadership to transition to ZEVs, we will aim for 100% light ZEV sales by 2036. Longer term, 100% of our light vehicle fleet will be zero emissions by 2050.

We will monitor measures to start a graduated ICE vehicle phase out. We will also look at new opportunities to further increase ZEV uptake to meet our greenhouse gas emission targets and recycle ICE vehicles (and eventually batteries) to support the circular economy.

1.1

Action area 1.1—Supporting zero emission journeys

We support the transition to ZEVs across all vehicle segments and transport tasks (such as commuting, recreational travelling and moving freight/goods).

This includes providing financial incentives to support ZEV uptake, such as:

- upfront purchase incentives (subject to a value cap) on ZEVs for individuals and business fleets
- ongoing assessment of vehicle registration and vehicle registration duty concessions for ZEV owners.

Transitioning public transport to zero emissions:

- reduces greenhouse gas emissions
- reduces harmful pollutants, especially in high pedestrian areas (such as cities and schools)
- reduces public transport noise
- can make public transport more attractive for users, so more people shift from private vehicles.

Where possible, we also want Queenslanders to maximise opportunities to walk, cycle and catch public transport. The Queensland Cycling and Walking Strategies outline improvements to walking and cycling infrastructure and encourage more people to participate in active travel.

Active transport and smaller ZEVs, such as e-bikes and other rideables (electric scooters, skateboards and so on) make it possible for people to shift their journeys from cars to other options. This includes for journeys that might have previously been considered as only suitable to do by car (such as using an e-bike to get to work or school). By doing so, they reduce greenhouse gas emissions, pollutants and traffic congestion.



1.2

Action area 1.2—Transitioning Government and corporate fleets

We will transition our vehicle fleet, as part of achieving our emission reduction targets, supporting the development of the battery industry, and providing a pipeline of quality second-hand ZEVs.

Motor vehicles are essential to delivering government programs and supporting frontline services. QFleet (the Queensland Government’s fleet manager) manages over 10,000 vehicles.

The Queensland Government will mandate an approach across government to make sure all eligible government fleet passenger vehicles transition to electric as current leases expire, where a ZEV alternative and sufficient charging infrastructure is available.

All QFleet’s eligible petrol vehicles will transition to ZEVs. Once the transition is complete, it is estimated that QFleet will progressively deliver 2,400 quality second-hand vehicles to the market each year (starting with the sale of 12 EVs in 2022).

Our increased demand for ZEVs will have many benefits. It will:

- help generate interest from ZEV manufacturers to supply larger numbers and varieties of vehicles into Queensland
- create a second-hand vehicle market for ZEVs, making ZEVs more affordable for more people

- generate about \$2.4 million in fuel savings for Queensland Government agencies over three financial years.

Making charging infrastructure available in government buildings and the leasing of vehicles at a cost close or equivalent to an ICE vehicle will encourage the uptake of ZEVs by agencies.

QFleet’s adoption of ZEVs will be supported by a roll out of charging infrastructure in government buildings, including hospitals and schools, which will deliver opportunities for manufacturing and local business.

We will work to encourage private companies to transition their fleet vehicles, to further build on Queensland’s ZEV supply and charging infrastructure in non-government workplaces.

We will also work with stakeholders to ensure we:

- place minimal administrative and technical burden on delivery partners around the design, purchase, connection and operation of charging infrastructure
- use ‘green’ electricity to charge zero emission buses
- leverage from the positive impact of QFleet and the zero emission bus fleet’s charging behaviour to maximise renewable generation, network investment and network use.



1.3

Action area 1.3—Zero emission vehicles in our public transport networks

We will replace current diesel buses in the TransLink public transport fleet with zero emission buses, which will reduce greenhouse gas emissions and minimise harmful pollutants in our communities.

In 2021, we piloted zero emission buses across South East Queensland and on some regional routes. From 2025, all new buses added to the fleet in South East Queensland will be zero emission buses, with regional rollout from 2025 to 2030¹⁹.

With about 2,500 TransLink-funded buses operating on the South East Queensland urban and school

network, this alone will achieve significant progress towards reducing passenger transport emissions and supporting manufacturing and assembly opportunities in Queensland.

As the electricity grid decarbonises, we will continue to see emissions reduce across the electrified Queensland Rail City Network in South East Queensland. This includes exploring opportunities for zero emission trains and non-electrified rail networks throughout Queensland.

Case study

Transdev battery electric bus at Redland Bay

In April 2021, Transdev Queensland introduced their first battery electric bus onto the TransLink network in the Redland Bay/ Capalaba area.

The Department of Transport and Main Roads and Transdev are working together to collect data to evaluate the performance of the bus. The total battery capacity is 348kWh, delivering a driving range of up to 340km on a single charge. The electric bus is fitted with two groups of battery power packs, located on the roof and behind the rear wheel.

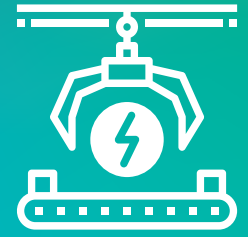
Transdev has installed 250 solar panels on the roof the Capalaba depot. Depot storage is provided by 15 Tesla batteries with a total capacity of 200kWh. The bus receives a midday charge and overnight charge using the 120kW ABB charger.

The bus travels about 6,500km per month and has been tested on urban and school routes.



Transdev battery electric bus stopping at bus stop.

Priority 2: Building ZEV manufacturing and supply chain capability



Key outcomes

- Enable a skilled workforce to support and service Queensland's increased ZEV fleet uptake
- Increase local manufacturing and recycling battery technology
- Support new and sustainable economy minerals industries
- Build local hydrogen production facilities
- Locally manufacture components to support the renewable energy industry.

2.1

Action area 2.1—Supporting industry to develop alongside growing markets

Our existing partnerships to manufacture zero emission buses in Queensland demonstrate how we will generate lasting economic benefits through employment opportunities and stronger local supply chain and renewables industry.

We will build on our existing manufacturing capability and further support manufacturing of ZEV technologies and component parts. This includes developing a battery manufacturing and recycling industry as part of the draft Queensland Resources Industry Development Plan.

Creating the domestic markets to develop a thriving battery industry in Queensland provides further opportunities for manufacturing and extends the local supply chain for new economy minerals development, supporting regional development and employment.

We will continue to use our purchasing power to increase manufacturing opportunities and support industry to upskill the workforce to support Queensland's growing ZEV fleet and produce and recycle batteries.

Case study

Training and upskilling our workforce—TAFE Queensland Heavy Plant Centre of Excellence

As the ZEV market continues to grow in Queensland, it is important that our automotive industry is equipped with the skills and training to respond to shifting consumer needs.

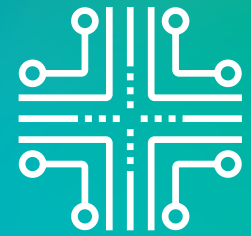
With funding from the Queensland Government, TAFE Queensland has opened the Heavy Plant Centre of Excellence at Acacia Ridge. The new centre will provide world-class training for the electric, hybrid and autonomous vehicle industry, using new machinery that produces lower emissions.



Heavy Plant Centre of Excellence at Acacia Ridge, TAFE Queensland.

A skilled and prepared workforce will help transition to a cleaner, greener future.

Priority 3: Facilitating supportive ZEV infrastructure



Key outcomes

- Support regions to invest in ZEV infrastructure.
- Drive tourism opportunities in Queensland's regions through increased ZEV use.
- Support ZEV infrastructure within Queensland's planning system.
- Stimulate and facilitate third party investment in appropriate charging infrastructure, through visibility of distribution network conditions.

As ZEV uptake continues, we must have appropriate charging and refuelling infrastructure to provide convenient and cost-effective energy.

Various types of zero emission transport modes will require a mix of different charging and refuelling options and locations.

Unlike the traditional petrol and diesel fleet, ZEVs can be refuelled in various places, including at work, at home and when undertaking daily activities, such as shopping or eating out. Fast and ultra-fast chargers can provide immediate charging for intercity and interstate trips, as well as for freight.



Reducing battery price

Research company BloombergNEF's 2020 Battery Price Survey²⁰—which considers passenger EVs, e-buses, commercial EVs and stationary storage—predicts that by 2023, average pack prices will be \$101/kWh. It is at around this price point that auto-makers should be able to produce and sell mass market electric vehicles at the same price (and with the same margin) as comparable ICE vehicles in some markets.



3.1

Action area 3.1—Charging infrastructure connecting Queensland

The Queensland Electric Super Highway has made it more convenient and more accessible to travel in an electric vehicle. It has served as a catalyst for the private sector, local governments and other parties to provide additional charging infrastructure.

This will continue to support the development of the Queensland charging and refuelling infrastructure manufacturing industry, with world-leading charging manufacturer Tritium already established in Queensland.

With this foundation established, and increasing numbers of private businesses entering the charging market, our need to subsidise charging infrastructure is reducing, providing greater opportunities for other parties to enter the market.

We will ensure that infrastructure for charging and parking e-bikes, e-scooters and rideables is available in more Queensland communities. This also includes installing charging infrastructure in Queensland Government-owned and leased buildings and facilities to support QFleet’s transition to ZEVs. We will investigate ways to ensure that access to ZEV charging stations is not inhibited by ICE vehicles parking in those locations.

We are also working on strategies to support hydrogen refuelling infrastructure. Through the Hydrogen Industry Development Fund, we actively support hydrogen refuelling and transport projects. We will identify opportunities for hydrogen heavy vehicles and develop principles to determine and identify infrastructure refuelling locations. Similarly, as small to medium heavy vehicles increasingly mature to undertake various local and regional freight tasks, opportunities will arise for appropriate charging infrastructure on freight routes and precincts to support the decarbonisation of Queensland’s freight network.

3.2

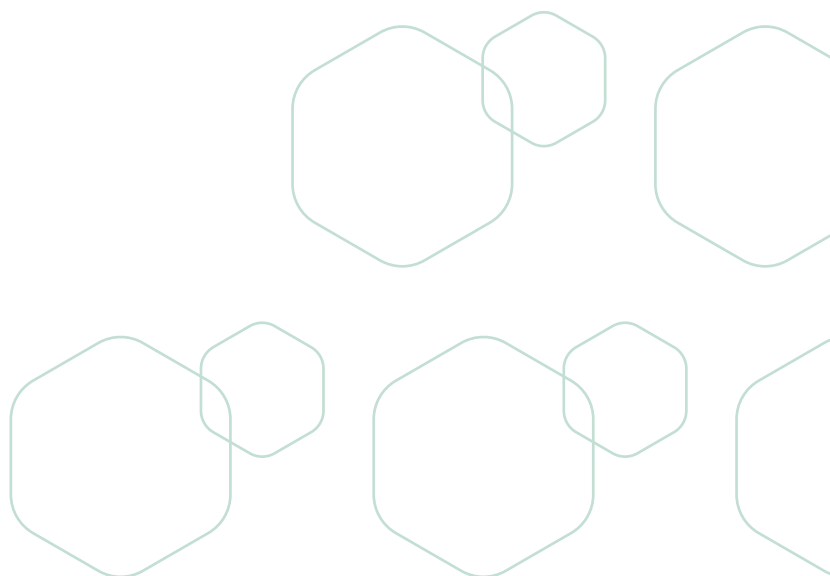
Action area 3.2—Investment to support Queensland charging and refuelling infrastructure

It is important that people can charge during the day when and where they need to—at home, at work and in other places people go, such as shopping centres, schools, hospitals and recreational areas.

The Queensland Government will work closely with network service providers and industry to plan for charging infrastructure and pair investment with capacity in grid and tariff reform. This will include making sure there are opportunities for third-party investment in appropriate charging infrastructure and locations.

To enable efficient use by consumers, charging infrastructure must be visible to electricity retailers, aggregation businesses and the network, so that smart control systems are embedded both within the charging infrastructure and in the right places in the network.

We will explore opportunities to increase electric vehicle charging stations through co-funding with industry, councils, tourism operators and other interested parties.



3.3

Action area 3.3—Buildings and new developments

We must plan for the wide uptake of charging infrastructure where people are parked for long periods. It may be more cost-effective for adequate electrical infrastructure to be incorporated at the time of construction rather than retrofitted, particularly for multi-use dwellings, apartments and workplaces.

Ensuring new buildings are ZEV and rooftop solar-ready includes providing for:

- the installation and routing of electrical cabling
- switchboard capacity
- physical space for the future connection of distributed energy resources equipment, such as for EV charging infrastructure.

Providing for charging infrastructure for new multi-residential buildings will also help avoid expensive retrofitting costs and body corporate resolutions.

The Queensland Government will support the transition to ZEVs by:

- work through the Australian Building Codes Board to investigate amendments to the National Construction Code to ensure all suitable new buildings are BEV-charging ready
- leverage on the work at Economic Development Queensland’s new housing projects, Carseldine Village and Songbird Oxley, to develop conditions and definitions for BEV charging requirements for developers to inform planning rules for public spaces and new developments
- work with local government to ensure they consider BEV charging infrastructure in development assessment, where appropriate
- provide local government planning and development guidance on electric vehicle charging infrastructure and hydrogen refuelling infrastructure.

Case study

BEV charged homes and buildings

Queensland is leading the way on new buildings being ready for zero emission infrastructure. Economic Development Queensland is a government agency that delivers property development and provides specialist land use planning and infrastructure functions. It is rolling out requirements for developments to be ready for BEV charging infrastructure.

Its updated Bowen Hills Development Scheme was Australia’s first statutory planning scheme in 2019 to require a new development to be ZEV ready and for BEV charging infrastructure to be installed.

At Economic Development Queensland’s two new housing projects, Carseldine Village and Songbird Oxley, garages in every home are being built with a dedicated circuit for simple installation of a future BEV charger.



Priority 4: Driving towards renewables and smart charging



Key outcomes

- Consumers are rewarded for charging during optimal times.
- Support regional areas to develop Queensland's hydrogen industry.
- An energy network that is responsive and resilient to changing energy outputs and inputs through cost-effective investment and future planning.
- Rollout of digital meters to provide two-way communication between utilities and smart meters that will allow for more charging options, customer convenience and cost savings.

As our transport shifts to zero emission, the way we source and distribute energy to power those journeys is critical to the safe, reliable and cost-effective operation of the electricity network.

To foster increased zero emission technologies, we must educate consumers on the various ways they can recharge, and ensure they have access to charging infrastructure when and where they need it.

We will help consumers make informed and cost-effective decisions about when and how they to charge their vehicles. This requires:

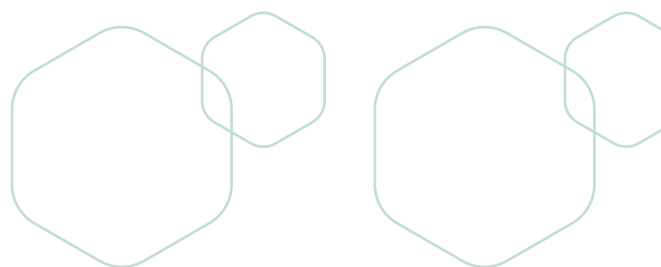
- appropriate charging infrastructure where it is needed
- pricing mechanisms, such as tariffs to encourage charging at optimal times
- policies and technology to ensure our electricity network can meet demand, including supporting Queenslanders to charge their BEVs at the optimal times for the network.

To support Queenslanders who want to buy and drive ZEVs, we must provide them with affordable BEV charging choices where and when they need them. We must do this in a way that supports the broader grid and keeps downward pressure on energy prices.

Electricity network tariffs that support BEV integration will be essential to informing investment decisions and supporting charging behaviour that is of benefit to motorists and the grid.

Currently, tariffs offer a discounted electricity rate to customers who charge their vehicle and other devices outside of peak hours and are accessible to consumers with their own network connection (such as at home).

Other suitable tariffs that encourage solar charging would reward customers who charge their vehicles with cheaper grid electricity during the day. Figure 4 shows the abundant solar generated in Queensland and how the excess solar energy produced during daytime hours (curtailed solar generation) could be available for EV charging.



Indicative Queensland generation and solar curtailment - Spring day 2021

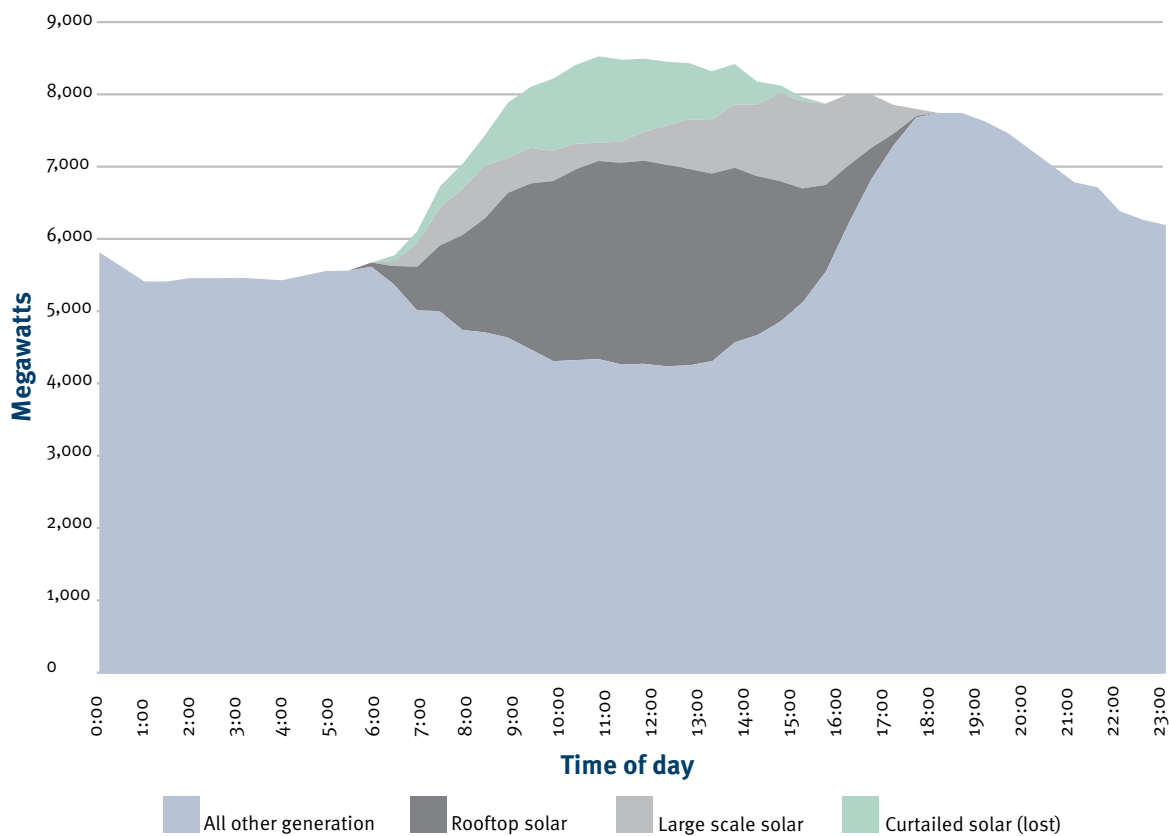


Figure 4: Generated and curtailed solar. Department of Energy and Public Works (2022), internal analysis.



Daytime charging at public infrastructure sites could also offer very low-cost charging during the day from our plentiful solar resources, keeping network and electricity costs down.

If motorists charge their BEV at peak times, it is likely to be charged with coal or gas power. Offering cheaper prices at off-peak times would encourage motorists to charge during those times, using renewable energy sources, reducing emissions and helping the grid.

We are also looking at how we use hydrogen for transport. We have the building blocks in place to integrate hydrogen hubs with transport offtake, which could enable Queensland to become a global green hydrogen powerhouse over the next 10 years.

4.1

Action area 4.1—Distributed energy resources and transport integration

To reduce the impact on the electricity network, reduce emissions and maximise benefits for consumers and motorists, the Queensland Government is working to:

- create and support opportunities for local supply benefits as part of roll out of future charging infrastructure
- ensure the process to connect BEV chargers is easy, and connection costs are fair
- work with industry and transport providers to identify when and where passenger fleets and heavy vehicles need to charge, and support local manufacturing of fleet vehicles and smart charging infrastructure
- ensure policy, planning and investment is in line with energy and transport priorities in a way that will minimise network upgrades and deliver most value to Queensland electricity consumers.

In the future, smart control systems embedded both within charging infrastructure and strategically deployed across the network will:

- deliver efficient network operation
- enable users to automatically respond to signals about the best time to charge
- enable bi-directional charging.

This could be through smart phone apps or devices that can manage different pricing mechanisms automatically.

4.2

Action area 4.2—Charging choice

We will inform people on the best times to charge their vehicles, and the tariffs that will suit them best. We will work with Energy Queensland, and in consultation with industry and retailers, to:

- ensure tariff choice for customers—reflecting the needs of the power system and in coordination with other tariff updates that can reward BEV customers for charging at certain times
- consider appropriate targets for charging infrastructure at Queensland Government-owned sites—such as carparks, hospitals, health campuses, parklands and convention centres—with charging to include associated retail tariff design, to deliver low-cost charging availability during the day when cheap, high-quality solar energy is available
- assess the class of network tariffs required for fast charging, to provide certainty for investors to deploy fast-charging facilities
- develop a customer engagement and education strategy for ZEV uptake and integration.

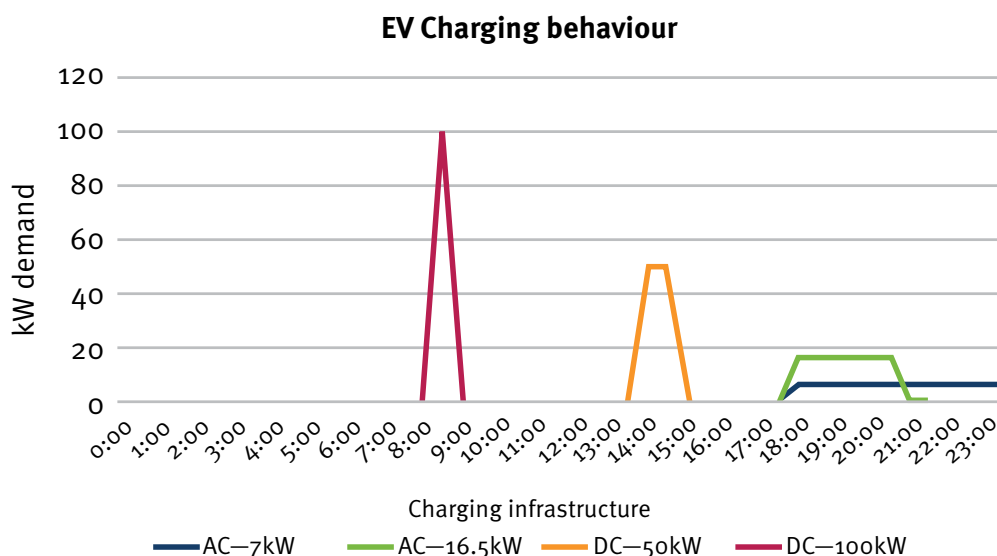


Figure 5: Impacts on networks when charging at different times of day²¹.

Charging behaviour and its impact on the network

Charging behaviour can have a significant impact on our energy system. Queensland’s distribution networks have a finite capacity to carry energy either upstream (from distributed generators) or downstream (from centralised generators). At every moment of every day, energy supply must match demand (for homes, for businesses, and for increased ZEVs in the future).

In areas with high levels of rooftop solar systems, networks are reaching their capacity in the middle of the day, as customer systems export to the grid, and there is limited demand for this energy. This can result in local and system-wide issues for network operation when the physical limits of network infrastructure are reached. Upgrades are often required to maintain safe and reliable electricity supply for all customers on that section of the network.

Figure 5 shows the different network impacts of charging behaviour from the same vehicle receiving the same amount of energy (50kWh), but via four different types of charging infrastructure. A quicker charging time for electric vehicles (with high demand—red line) means a greater requirement for network capacity, even though the total amount of energy delivered to the customer is the same across all charge sessions.

4.3

Action area 4.3—Hydrogen refuelling

The Queensland Government is supporting the domestic hydrogen industry to grow, with flow on benefits for transport users and the economy. Successfully producing renewable hydrogen to fuel Queensland’s domestic industry will put us in a good position to be an exporter to the world of this growing renewable fuel source. There are several exciting applications for hydrogen fuels across maritime, rail, bus and other heavy vehicles that will support decarbonisation of the transport sector and Queensland’s burgeoning hydrogen industry.

Building on our investment in electric charging infrastructure, we are powering ahead to create opportunities to supercharge our future hydrogen transport. We will also explore optimal refuelling station locations.

Hydrogen plants for domestic applications are expected to be more distributed compared with an export industry. It is likely smaller scale plants would be located close to the user of the fuel or along major freight routes. For example, a hydrogen refuelling

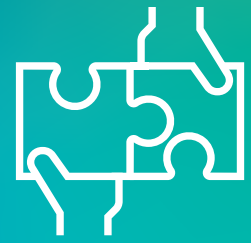
station could consist of a 10MW electrolyser with 40MW of solar as its energy source, either from the network or from behind the meter. Water would be acquired locally.

A station of this size could produce about 1,000 tonnes of hydrogen per year, which would enable about 50 trucks to be refuelled each day (assuming 50kg tank).

Supporting refuelling stations on major freight and passenger road corridors is a commitment outlined in the National Hydrogen Strategy. Heavy haulage vehicles have been identified as key to unlocking domestic application of hydrogen for further future uses.



Priority 5: Partnerships, innovation and advocacy



Key outcomes

- Establish partnerships that improve the ZEV market.
- Grow ZEV technology and innovation in Queensland.
- Improve data sharing across all sectors.
- Increase awareness on the benefits of ZEVs.

The transition to ZEVs requires partnerships across governments, the community, business and industry. Providing an environment that supports and shares learnings from research and market-led innovation across different vehicle segments will drive Queensland to the forefront of the ZEV transition.

We will leverage lessons learned and the knowledge of the transport, energy and sustainability sectors to create a high level of buy-in from all stakeholders, including consumers, partners, businesses and industry.



5.1

Action area 5.1—Driving change in communities

We will partner with industry associations, and environmental and community organisations to promote more sustainable modes of transport, ZEV technologies and the benefits of transitioning to zero emission options. We will:

- work with partners—including community organisations and local government—to design and implement awareness campaigns that help to encourage ZEV uptake
- encourage industry to develop a one-stop-shop information hub for Queenslanders—events and community activities help build community awareness, and enable increased uptake and local manufacturing and investment
- promote ZEVs in Queensland's regions through QFleet showcases and demonstrations involving state and local government fleet vehicles
- support local government to drive change in ZEV uptake.

ZEV champions—such as existing EV users, industry advocacy groups and the Queensland Government—will help to promote the benefits of using EVs. We know that 99% of EV owners in Queensland say they would recommend purchasing an EV to others²².

5.2

Action area 5.2—Research and innovation partnerships

Our Advance Queensland initiative supports new technologies to be developed, trialled and delivered in Queensland to drive economic growth and jobs. It supports programs that help innovative companies commercialise their products and connect Queensland technologies to larger markets.

Advance Queensland is supporting small and medium enterprises, entrepreneurs and researchers in our state to fast-track their technologies in battery innovations, charging systems, robotics and vehicle components.

In the maritime industry, we are partnering with industry to test hydrogen as an alternative fuel for our Maritime Safety Queensland vessel fleet.

5.3

Action area 5.3—Advocacy and leadership

We must build awareness of the benefits of owning and using a ZEV, which includes debunking the myths around EVs. We will work with local councils, industry, user groups and communities to implement awareness programs that help to transition Queenslanders to ZEVs.

We will continue to provide information to current and future owners of ZEVs, and, as the market and technology matures, look for new ways to deliver value to all consumers of energy in Queensland. This means leading by example through our own actions (like replacing the Queensland Government fleet) and encouraging the wider uptake of ZEVs through our partnerships, innovation and advocacy.

We will publish the results of the supporting actions set out in the priority areas of the strategy.

Case study

Raising awareness in our communities—Zero Emissions Noosa

Several initiatives and organisations in Queensland already provide opportunities for the community to learn more about ZEVs.

In 2018, not-for-profit community group Zero Emissions Noosa held its first ever Noosa EV Expo. The event continues to grow, and showcases the world of electric vehicles by letting people test e-bikes and e-scooters and speak with electric vehicle owners and suppliers.

Community-led events like this will play a key role in educating Queenslanders on the benefits of ZEVs, and give consumers the information they need to navigate their purchasing journey.



Crowds walk by an electric bus at the 2021 Noosa Electric Vehicle Expo.



Implementing Queensland's Zero Emission Vehicle Strategy

- Action plans
- Working together
- Keeping track of progress

Action plans

We will develop action plans to implement this Strategy.

We will track progress and report on actions every two years to show progress towards achieving our vision for a cleaner, greener, integrated transport and energy network that encourages zero emission transport options and contributes to a zero emissions future.

Action plans will enable us to continually refocus and improve our policies over the next 10 years, based on emerging technologies, and to build on the foundations and successes of the previous action plan. This may include revising or adding targets as technology matures.

Our first action plan provides the building blocks for future investment and action to transition Queensland to ZEVs, supported by readily available renewable energy and infrastructure.

Other Queensland Government strategies and plans also detail actions that complement and relate to achieving our vision, including the:

- Queensland Climate Action Plan
- Queensland Transport Strategy
- Zero Net Emissions for Transport Roadmap (under development)
- Queensland's Energy Plan (under development)
- Queensland Hydrogen Industry Strategy
- Queensland Cycling Strategy
- Queensland Walking Strategy
- Creating Better Connections for Queenslanders
- Queensland Freight Strategy—Advancing Freight in Queensland and the Queensland Freight Action Plan
- The Queensland Innovation Places Strategy (under development)
- Queensland Resources Industry Development Plan and associated Battery Industry Strategy (under development).



Working together

This is a whole-of-government strategy. We will:

- work across government, including with local government, industry, manufacturers, business and our communities to implement this strategy
- report on the actions through existing governance arrangements under the Queensland Climate Action Plan
- continue to work with local government, empowering them to drive change in their communities through fleet transition support, advice on ZEV charging and refuelling infrastructure in planning schemes, and QFleet showcases and demonstrations.

The Queensland Zero Emission Vehicle Forum will be the primary non-government group to advise relevant Ministers on ZEV innovations and future actions.

The forum will help us to monitor this strategy and its associated action plans. It includes members with a wide range of expertise in emerging zero emission technologies, and key industry representatives who can influence change across our supporting industries and markets.

Keeping track of progress

Improved data sharing

We will continue to work across government to improve data sharing. We need to understand whether incentives are working to shift Queenslanders from ICE vehicles to ZEVs. We will use existing systems, such as the Queensland vehicle registration system, to track and report on the level of ZEV uptake in our community.

We will continue to provide current data and trends on ZEV statistics. We will build on our quarterly EV snapshot, which provides an overview of measurable ZEV statistics. It includes:

- the registration of ZEVs in Queensland suburbs
- market share of different models
- usage figures for the Queensland Electric Super Highway.

As we move towards a smarter, more integrated energy environment, it is crucial that networks have the information they need to ensure the safe, reliable and cost-effective operation of the energy system. This information also helps customers make informed decisions about how and when they use energy.

Collecting information on energy use at the device and network level will help us make informed decisions about the operation of the network and where investments are needed. This sharing of data will also help ZEV owners to maximise the energy use opportunities of owning a ZEV.

ZEV community survey

To ensure we include customer perspectives and understand the evolving needs and expectations of our customers, we will continue to undertake a customer survey. The 2021 survey has provided us with baseline data, and future surveys will identify changing consumer preferences. This will help us develop and refine policies and programs to support and encourage more people and industries to move to ZEVs.

Measuring progress

Each priority area includes outcomes that will help us to measure the effectiveness of our strategy and actions.

We will show progress about what we have delivered under the strategy every two years. We will use an internal measurement framework to show how we are tracking towards achieving our short and long-term outcomes.

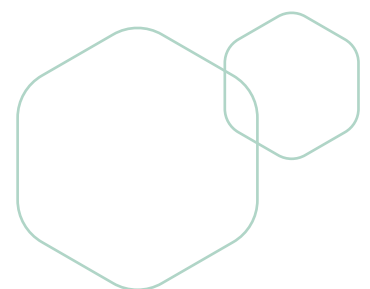


Glossary

Term	Definition
Active transport	Incorporates cycling , walking and other physically active ways of travelling that can be done alone or combined with public transport. (https://www.tmr.qld.gov.au/Travel-and-transport/Cycling/About-cycling)
Automated vehicles	A vehicle that has an automated driving system. It is distinct from a vehicle with advanced driver-assistance systems such as lane-keep assist.
Automated driving system	The hardware and software collectively capable of performing the entire dynamic driving task on a sustained basis without human input.
Battery electric vehicle (BEVs)	BEVs use stored electricity from the electricity grid to drive an electric motor supplied from an on-board battery. BEVs produce no direct tailpipe emissions. A BEV is a zero emission vehicle.
Bi-directional capability	The ability to both receive and send out electricity from the device.
Circular economy	An economy that factors in regenerative solutions to challenges such as climate change, waste and pollution. This approach is in contrast to a linear economical approach, which takes a natural resource and turns it into a product that ultimately becomes waste.
Decarbonising	Reducing carbon emissions through the use of low or zero carbon power sources.
e-bikes	Also referred to as a power-assisted bicycle, e-bikes have one or more auxiliary motors capable of generating power for pedal assist.
e-mobility/micro-mobility	A method of travel using wheeled electric devices, excluding motorised wheelchairs, with powered speeds of no more than 25km/h. It is sometimes also referred to as e-wheeling.
e-scooters	A type of personal mobility device and rideable. They are similar to 'foot scooters' but are powered by an electric motor.
Electric vehicle (EV)	Any vehicle that is fully or partially driven by an electric motor and that can be plugged in to charge. This primarily consists of BEVs, FCEVs and PHEVs.
Electricity network	Transmission and/or distribution systems consisting of electrical apparatus used to convey or control the conveyance of electricity between generators' points of connection and customers' points of connection.
Electrolysis	Electrolysis is the process of using electricity to split water into hydrogen and oxygen. The reaction takes place in a unit called an electrolyser.
Heavy vehicle	A vehicle that has a gross vehicle mass or aggregate trailer mass of more than 4.5 tonnes.
Hydrogen-powered fuel cell electric vehicles (FCEVs)	Hydrogen-powered fuel cell vehicles convert hydrogen to electricity, to power an electric motor. FCEVs produce no direct tailpipe greenhouse gas emissions. An FCEV is a zero emission vehicle.

Term	Definition
Internal combustion engine (ICE) vehicle	ICE vehicles use an engine that generates power by burning petrol, oil or other fuel with air inside the engine. ICE vehicles produce a significant amount of tailpipe greenhouse gas emissions.
Light vehicle	A vehicle that is propelled by a motor that forms part of the vehicle and has a gross vehicle mass not exceeding 4.5 tonnes.
Mobility-as-a-service	A shift away from the privately owned car towards mobility solutions that are used as a service. It is a combination of public and private transportation services accessed via one application that provides personalised journey planning, booking and payment. (https://www.tmr.qld.gov.au/About-us/Our-organisation/Accessibility-and-inclusion/Accessibility-and-inclusion-strategy/Introduction/Definitions)
Network business	The organisations that own and control the hardware of the energy network, such as electricity transmission towers and lines, power poles, wires, transformers, and substations that move electricity around the network. They also supply the electricity meter in homes. In Queensland, this is Powerlink, Energex and Ergon Energy.
New economy minerals	New economy minerals (sometimes referred to as critical minerals) are a range of metals and minerals used in many emerging technologies including electric vehicles, renewable energy products, low-emission power sources, consumer devices, and products for the medical, defence and scientific research sectors. (https://www.resources.qld.gov.au/mining-exploration/initiatives/new-economy-minerals)
Passenger transport	The movement of passengers via the transport system, including ride share, trains, buses, light rail and ferries. It helps manage congestion.
Proton exchange membrane	An electrolyser that splits deionized water (H ₂ O) into its constituent parts, hydrogen (H ₂) and oxygen (O ₂).
Plug-in hybrid electric vehicles (PHEVs)	PHEVs can use electricity and/or another fuel source (like petrol). Unlike other hybrid vehicles, PHEVs can be plugged-in and charged from the grid. PHEVs have more tailpipe emissions than BEVs, but generally fewer than ICE vehicles when used mainly on battery power. If driven mainly on the petrol cycle, they produce more emissions than ICE vehicles, as the battery pack makes them heavier.
Optimal charging	Charging at the time that provides maximum benefits to the energy network and consumer.
Queensland Electric Super Highway	A series of Queensland Government-led fast-charging sites that connect Queenslanders and tourists travelling in a low or zero emission vehicle.
Renewable energy	Energy that is collected from renewable resources, which are naturally replenished on a human timescale, including sunlight, wind, rain, tides, waves and geothermal heat.
Rideables	Also referred to as a personal mobility device, a rideable is designed for use by a single person only, with a maximum speed of 25km/h, and is powered by an electric motor. This can include e-scooters and other devices such as solo wheels.

Term	Definition
Rideshare and booked hire services	A for-hire service in which a passenger travels in a vehicle for a fee. This includes taxis and booked hire (private vehicles operating under a booked hire service licence, with trips usually facilitated by a third party such as Uber, Didi or Ola).
Smart charging	A system where an electric vehicle and a charging device share a data connection, and the charging device shares a data connection with a charging operator who is able to manage electric car charging times on the consumer's behalf.
Solar photovoltaic	Solar photovoltaic cells that produce electrical energy from sunlight.
Virtual power plant	A centrally managed group of devices that combines capacity for various purposes, including trading or selling power or network support services on the market.
Walking	Walking also refers to jogging, running, and moving with the help of a mobility device such as a wheelchair, mobility cane or a walking frame in public places.
Zero emission vehicles (ZEVs)	ZEVs produce no exhaust fumes or other pollutants from their onboard source of power.



Abbreviations

AC	alternating current
BEV	battery electric vehicle/s
CO ₂	carbon dioxide
CO ₂ -e	carbon dioxide equivalent
DC	direct current
EV	electric vehicle/s
FCEV	hydrogen-powered fuel cell electric vehicle/s
h	hour
ICE	internal combustion engine
kg	kilogram
km	kilometre
kWh	kilowatt-hour
Mt	megatonne
MW	megawatt
OECD	Organisation for Economic Co-operation and Development
PHEV	plug-in hybrid electric vehicle/s
SUV	sport utility vehicle
ZEV	zero emission vehicle/s

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