

# ZERO EMISSIONS VEHICLES: PART OF OUR TRANSITION TO A NET ZERO EMISSIONS ECONOMY



# Zero emissions vehicles: part of our transition to a net zero emissions economy

Zero emission vehicles – accompanied by changes to our electricity system – provide an opportunity to achieve significant reductions in our greenhouse gas emissions over the medium term. The transition to zero emission vehicles will help Victoria create a net zero emissions, climate resilient community and economy.

The transport sector is Victoria's second most emission intensive sector. It accounts for around 20 per cent of state's total emissions (22.3 million tonnes (Mt) of carbon dioxide emissions (CO<sub>2</sub>e) out of a total of 113.9 Mt (CO<sub>2</sub>e) – 2016 data). And our transport-related emissions have been increasing. Since 1990, the Victorian transport sector's emissions has risen by nearly 39 per cent (figure 1). Emissions from transport are an increasing proportion of the total state's emissions (increasing by around 5 per cent since 1990).

Image credit: ChargeFox



# WHAT ARE ZERO EMISSION VEHICLES?

There are two main types of vehicles that emit no greenhouse gases from the vehicle's exhaust:

## FULLY ELECTRIC OR BATTERY ELECTRIC VEHICLES

These vehicles (currently the main type of zero emission vehicles) use energy stored in rechargeable battery packs. They don't have an internal combustion engine or a fuel tank.

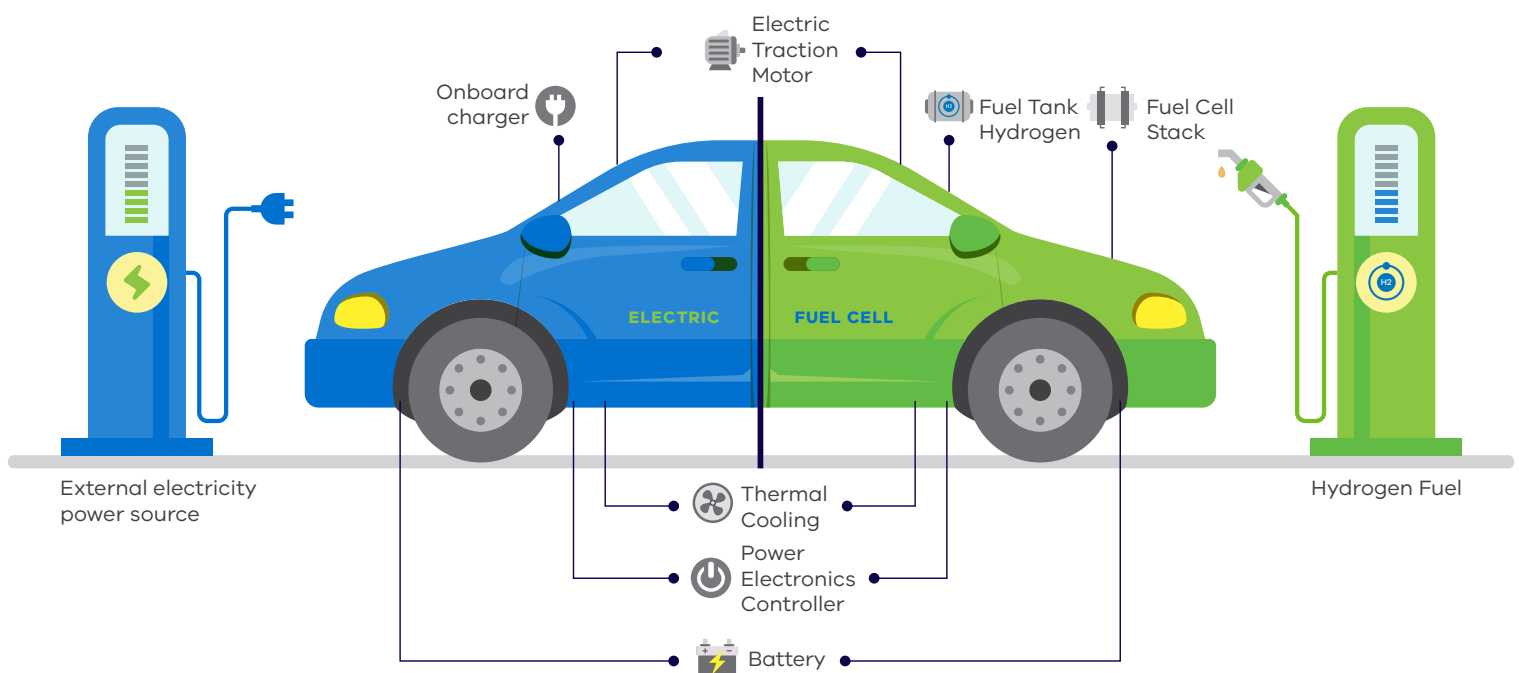
The battery packs are recharged by an electrical plug connection to an external electricity power source.

These vehicles achieve zero emissions where the electricity used to charge the vehicles is sourced from 100 per cent renewable energy – this is being offered now by the new public highway charging stations in Victoria. Victoria's grid connected electricity system is reducing its emissions intensity as new large scale renewable energy generation is coming into the system – in 2018, renewable energy represented 21 per cent of Victoria's generation, up from 16 per cent in 2017. The government is committed to achieving 40 per cent renewable generation by 2025 and 50 per cent by 2030.

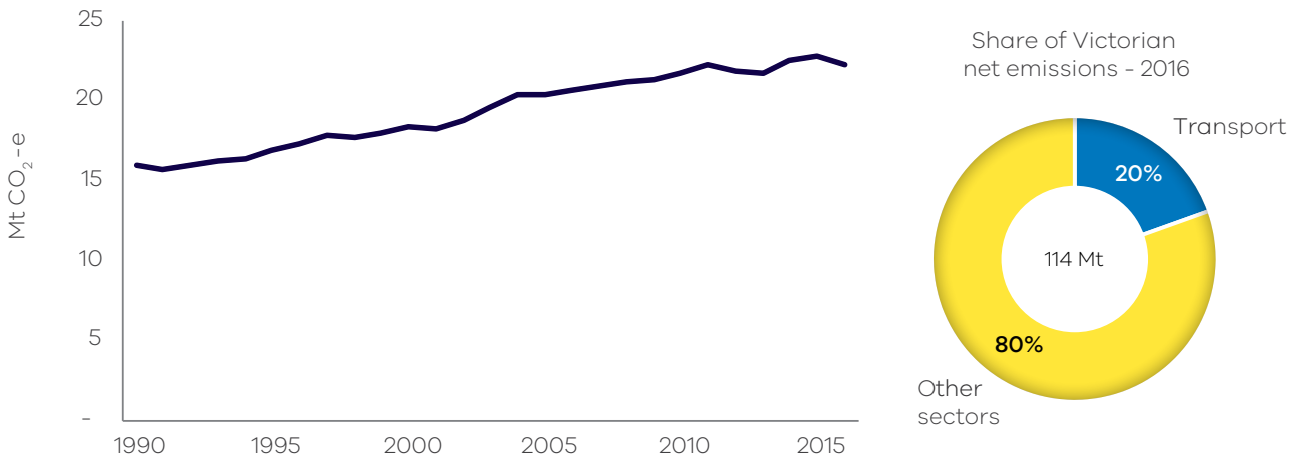
## HYDROGEN FUEL CELL VEHICLES

Hydrogen fuel cell vehicles also have an electric motor, but the battery packs use energy from compressed hydrogen in onboard fuel tanks rather than charging from an external power source. Refuelling these vehicles is a similar process to refuelling a conventional vehicle. This vehicle technology is just emerging and represents only a very small proportion of the current zero emission vehicles available.

The hydrogen fuel is either produced via electrolysis (using electricity to split water into hydrogen and oxygen) or from industrial processes that capture hydrogen using fossil fuels. The emissions profile of the hydrogen fuel source will be dependent on how it is generated. Electrolysis using 100 per cent renewable energy will have zero emissions.



**Figure 1: Transport sector’s greenhouse gas emissions, Victoria**

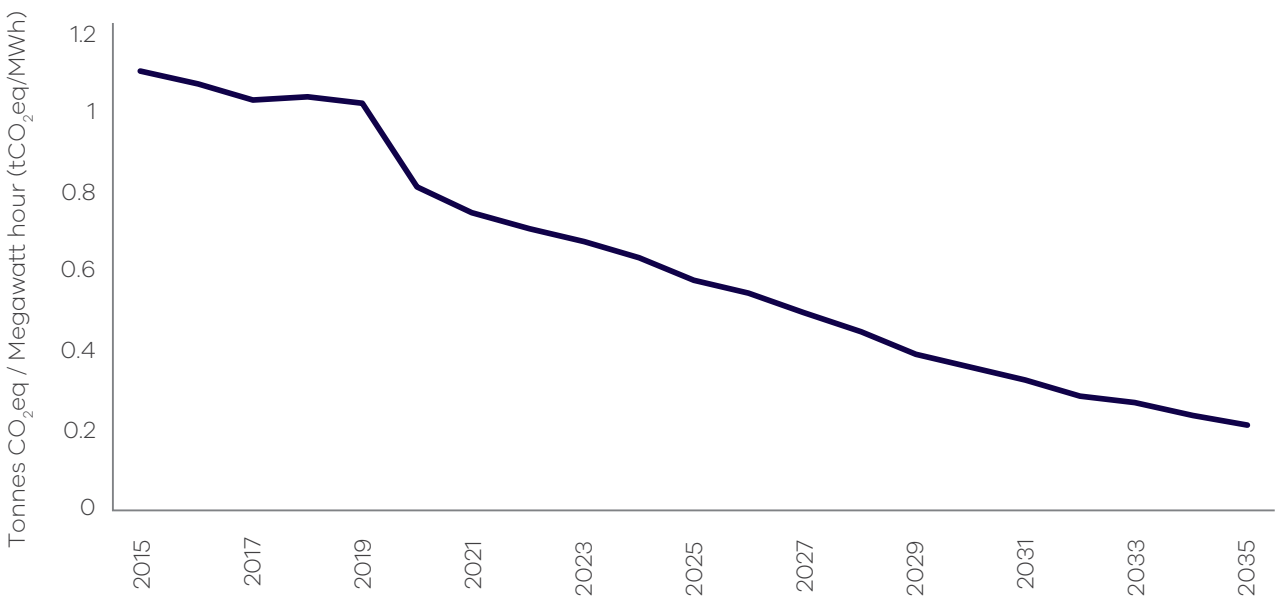


Source: Department of Environment and Energy 2018, *Australian Greenhouse Emissions Information System*.

The transition to zero emissions vehicles – including electric vehicles – is supported by changes in our energy system that are reducing the emissions intensity of our electricity. The Victorian Government is taking decisive action to deliver on its legislated renewable energy generation targets of 25 per cent by 2020 and 40 per cent by 2025 under the *Renewable Energy (Jobs and Investment) Act 2017*.

Victoria has experienced unprecedented growth in renewable energy since 2014. To provide ongoing certainty for investment, the government has introduced legislation in 2019 to establish a new target of 50 per cent renewable energy generation by 2030. This will ensure that the anticipated shift to zero emission vehicles over the next decade will deliver significant emission reductions (figure 2).

**Figure 2: Annual emissions intensity of the Victorian Electricity Market (tCO<sub>2</sub>eq/MWh)**

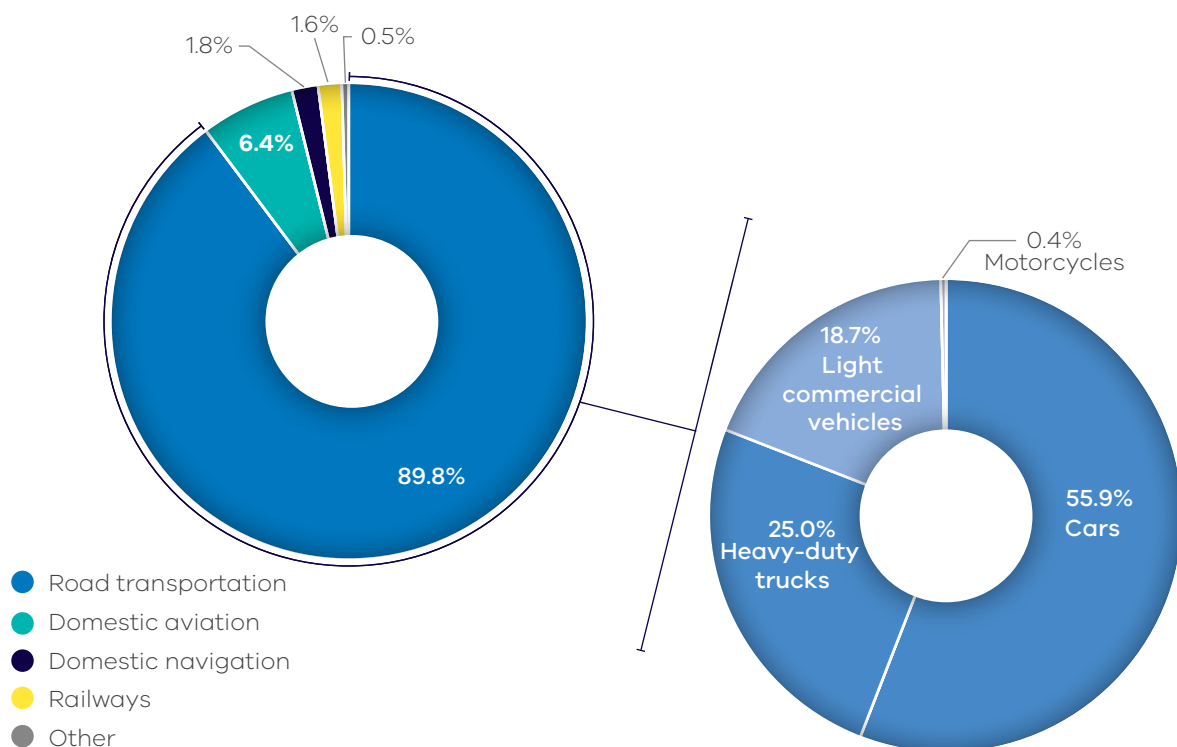


Modelling shows that if zero emission vehicle uptake reaches 100 per cent by 2046, Victoria could avoid up to 27 Mt (CO<sub>2</sub>e) each year from road vehicles, assuming 100 per cent renewable electricity generation<sup>1</sup>.

Road transportation is the major contributor of emissions at nearly 90 per cent of the total transport sector emissions in Victoria (figure 3) given that

a significant proportion of rail, particularly in the Melbourne metropolitan region, and Melbourne’s tram network is already electrified. The transition to zero emissions vehicles in the road transportation segment of the transport sector would therefore provide the biggest benefit in terms of emissions reduction – and is a key priority for the Victorian Government.

**Figure 3: Transport emissions by mode, Victoria, 2016**



Source: Department of Environment and Energy 2018, *Australian Greenhouse Emissions Information System*.

Battery electric vehicles in the passenger vehicle (car) sector are expected to lead the transition to zero emission vehicles as this technology is already well established and readily available in significant volume. The passenger vehicle sector is also the largest contributor of road transport related emissions (56 per cent).

It is expected that battery electric vehicles will also play a greater role in the light commercial vehicle sector with vans and light commercial trucks already starting to appear in the market.

Hydrogen fuel cell vehicles, as an emerging zero emission vehicle technology, could also play a part in helping to reduce emissions in the transport sector. The technology could offer some potential advantages of longer driving range, lighter weight and quicker refueling capability, which may make it more suitable for heavy commercial vehicles such as long-distance freight operation, once it is commercially available. Emissions from heavy duty trucks currently comprise 25 per cent of road transport-related emissions.

<sup>1</sup> Aurecon 2018, AV/ZEZ environmental and health impact assessment: final report for Infrastructure Victoria, [http://www.infrastructurevictoria.com.au/wp-content/uploads/2019/04/AVZEZ\\_Environmental\\_\\_Health\\_Impact\\_Assessment.pdf](http://www.infrastructurevictoria.com.au/wp-content/uploads/2019/04/AVZEZ_Environmental__Health_Impact_Assessment.pdf).

## THE MOVE TO ZERO EMISSION VEHICLES WILL ALSO HELP US IMPROVE OUR AIR QUALITY AND HEALTH

Exhaust fumes from conventional road transport reduce air quality, especially in congested areas of our metropolitan and regional cities. The change to zero emission vehicles will also improve air quality, especially in our metropolitan and regional cities. And better air quality will likely improve health outcomes for Victorians, by reducing the incidence and severity of health issues caused by high vehicle exhaust concentrations.

Around 3000 Australian deaths each year can be attributed to urban air pollution. Conventional internal combustion engine vehicles emit pollutants that can affect human health and the environment, including particulate matter, nitrogen oxides, volatile organic compounds and carbon monoxide. Particulate matter and nitrogen oxides may provide increased risks of cardiovascular and respiratory diseases, and premature deaths.

It is anticipated that healthcare costs would reduce too. Air pollution from road transport cost the Australian economy close to \$6 billion in healthcare in 2010.

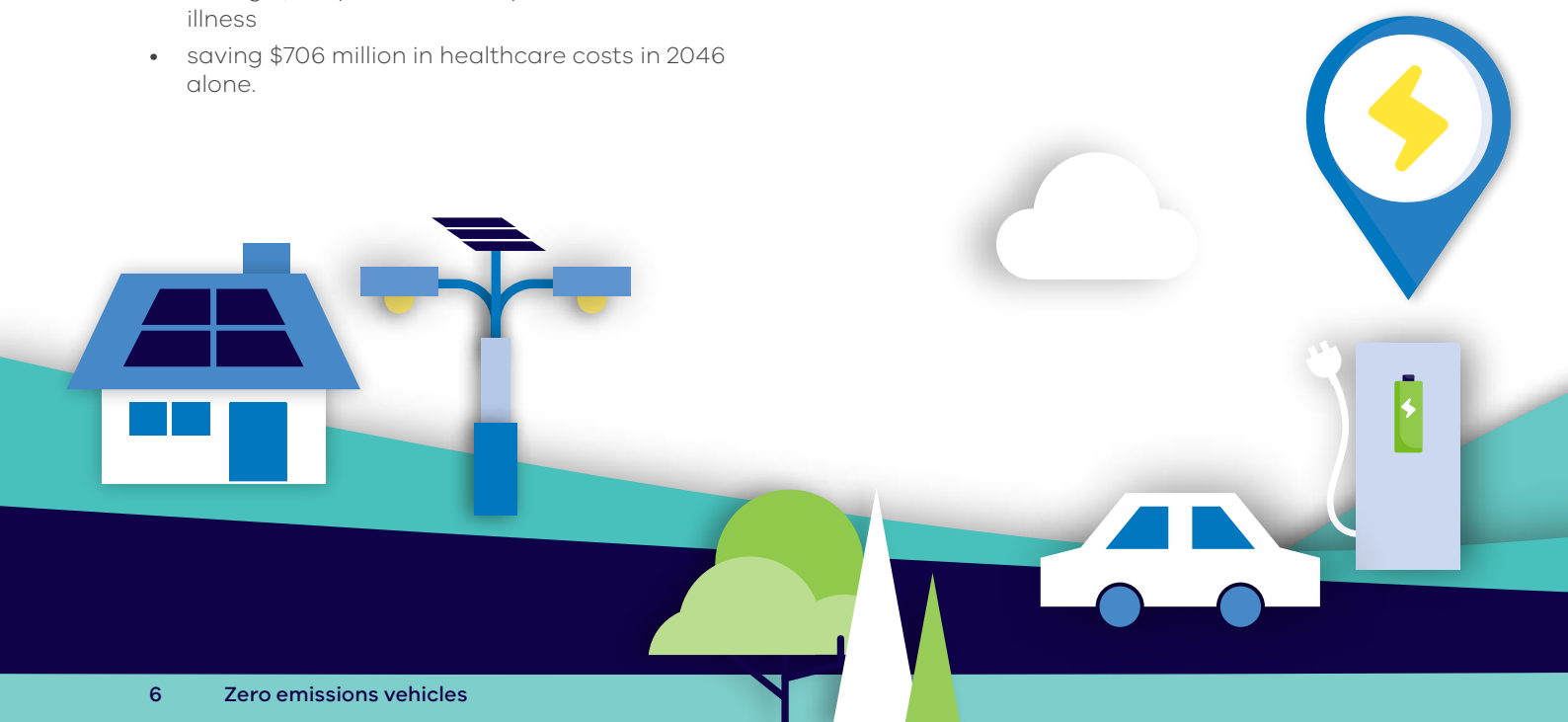
Infrastructure Victoria's modelling indicates that achieving 100 per cent uptake of zero emissions vehicles by 2046 would reduce particulate matter emissions by 1.2 million kilograms each subsequent year and deliver the following health-related benefits:

- saving 3,632 years of healthy life from death or illness
- saving \$706 million in healthcare costs in 2046 alone.

## THE VICTORIAN GOVERNMENT IS INVESTIGATING THE POTENTIAL FOR HYDROGEN IN TRANSPORT

The Victorian Government is investigating the potential of a green hydrogen economy under the Victorian Hydrogen Investment Program (VHIP) which will explore which industry sectors could capture the benefits of hydrogen as a competitive fit for Victoria, including potential transport opportunities. For further details refer: <https://www.energy.vic.gov.au/renewable-energy/victorian-hydrogen-investment-program>

We are contributing to the National Hydrogen Strategy, a cross-jurisdictional government working group developing a transport sector pathway for hydrogen fuel cell vehicles in Australia. The National Hydrogen Strategy is anticipated to be released by the end of 2019.



## TRENDS IN ZERO EMISSIONS VEHICLE UPTAKE

Globally, the uptake of zero emission vehicles has been rapidly growing with over 2 million vehicles sold in 2018 (over 2% of global sales) compared to 1.1 million sold in 2017. As well, there are over 5 million zero emissions vehicles registered on the road, world-wide.

Currently, zero emission vehicle uptake in Australia is low—only 1,194 (0.1 per cent) zero emission vehicles (all being fully electric vehicles) out of a total of over 1.1 million of new car sales in 2018—and behind that of other economically developed countries. Indeed, Australia is ranked in the bottom half of the 30 International Energy Agency member states for total electric vehicles and charging points. Similarly, there are only a small number of hydrogen fuel cell vehicles as demonstration vehicles in Australia.

Price is the major constraint on uptake. Prices for zero emission vehicles are currently high compared with prices for conventional vehicles, for two main reasons. First, the technology is new, and the high prices largely reflect the cost of lithium batteries. Second, Australia has a limited range of models, of which most are luxury brands such as BMW and Tesla.

The good news is battery prices have fallen by around 85 per cent since 2010, and are expected to keep falling, following a similar technology price reduction pathway as seen with photovoltaic solar panels. And, globally, manufacturers are increasing the number of cars they make and the range of models, further driving down prices and improving choice. As a result, prices for zero emission vehicles are expected to match those of conventional vehicles from around 2025.



