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Research that matters.

Stuck in the slow lane

Electrification of buses in Australia

Electric buses are commercially available, economically viable, and popular with commuters. They have multiple advantages over diesel-fuelled buses, including reduced CO_2 emissions, noise, and air pollution.

Despite this, just 0.2% of Australia's bus fleet is electric. Most of this fleet is owned by state governments. Their failure to act on electrification suggests their commitments to net zero emissions are more symbol than substance.

Richard Denniss

Audrey Quicke

Sienna Parrott

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Level 1, Endeavour House, 1 Franklin St
Canberra, ACT 2601
Tel: (02) 61300530
Email: mail@australiainstitute.org.au
Website: www.australiainstitute.org.au
ISSN: 1836-9014

Summary

Much has been made of Australia's slow uptake of electric cars, which currently account for less than 0.2% of the vehicles on Australian roads. The switch to electric buses is just as slow: as of the end of 2022, less than 200 of the nearly 100,000 buses registered in Australia—0.2%—are electric.

Electric buses bring a range of benefits:

- **Reduced noise pollution**: electric buses are up to 20 dB(A) quieter than diesel buses.
- **Better air quality**: buses make up just 0.5% of Australia's registered vehicles, but account for up to 6% of key air pollutants and produce roughly 1.4m tonnes of CO_2 equivalent pollution each year—equivalent to the ACT's total annual emissions. Electric buses emit no CO_2 or other pollutants while operating, thus removing a significant source of air pollution.
- **Reduced carbon emissions**: while electric buses emit no carbon while operating, the production of the electricity used to power their batteries does produce carbon and will continue to do so for as long as fossil fuels are burned to generate power. However, the total CO_2-equivalent-per-km cost of operating an electric bus is already significantly lower than the equivalent cost for a diesel bus. Moreover, the cost of electric buses will continue to decline as fossil fuels are phased out of power generation.
- **Reduced road congestion**: as electric buses are popular with passengers, they are likely to increase public transport use and reduce private car use.
- **Reduced fuel and maintenance costs**: while initial purchase costs are higher for electric buses than diesel buses, the reduced fuel, maintenance, and pollution costs have seen multiple studies conclude that there is a strong economic case for their uptake.

Electric buses are economically viable and already operating internationally. Cities with bus fleets that are significantly larger than those operating in Australian cities have been able to achieve full electrification: the city of Shenzhen in China, for example, fully electrified its 16,359-strong bus fleet—more than twice the size of Sydney's fleet, which is Australia's largest—in under a decade.

Electrifying Australia's buses should be easier than electrifying passenger cars because most buses are publicly owned, and because electric buses are popular. Polling by The Australia Institute shows that more than seven out of ten (71%) of Victorians support the target of a zero-emissions bus fleet by 2030, with similar levels of support for local procurement of electric buses.

Despite all this, no Australian state or territory is currently making rapid progress towards the electrification of their bus fleet. The commitment that New South Wales made in 2020 to 100% electric buses by 2030 has already been wound back to “net zero” buses by 2035. As of December 2022, 101 electric buses are operating in the state, with a total of 200 promised by mid-2023.

Elsewhere, the ACT aims to be 100% electric by 2040. Victoria has 41 electric buses on the road, but no transition target other than a policy for buses purchased from 2025 onwards to be electric. Queensland has a similar 2025 purchase goal for the southeast of the state, and currently operates a handful of electric buses. The South Australian government proclaimed in September 2022 that it had taken delivery of its last diesel bus, but did not commit fully to electric buses, instead announcing that “from now on it’s either hybrid or electric”, with the latter “contingent on funding and fleet arrangements”.

The 2022-23 Federal Budget announced Perth as the location for the manufacture of 140 electric buses, which will be used as part of the city’s 1,400-strong bus fleet, but Western Australia lacks a firm target on transitioning the rest of the state’s buses to electricity. Tasmania is still in the process of tendering for zero-emissions buses and there is no timeline for a complete transition away from diesel. The Northern Territory’s 2021 EV Strategy and Implementation Plan makes no mention of buses.

Electrifying bus fleets is an easy first step that state governments can take toward achieving their net zero goals. If state governments are unable, or unwilling, to take such a simple step, this does not simply demonstrate a lack of interest in reducing transport sector emissions. It suggests that state governments’ commitments to net zero emissions are more symbol than substance.

Introduction

Much has been made of Australia's slow uptake of electric cars, which currently count for less than 0.2% of the vehicles on Australian roads.[1] While this is indeed concerning, the transition to electric buses is also a cause for similar—if not greater—concern.

Buses are a significant source of greenhouse gas emissions and are also responsible for disproportionately large amount of the noise and air pollution in our cities.[2] Even in the states that have ambitious targets for electric bus rollouts, such as NSW and Victoria, progress has been slow. Multiple other states, meanwhile, have set no targets at all.

Progress on electrification of bus fleets provides a simple litmus test for the commitment of state governments to their net zero targets. Electric bus adoption should be one of the first steps states take toward decarbonisation. Electric buses are:

- Readily available
- Affordable
- Able to deliver benefits beyond emissions reduction (such as cleaner air and quieter cities)
- Already operating at large scare in other countries
- Popular with the public

As of 2021, there were 97,000 registered buses on Australia's roads.[3] The majority of these are publicly owned and/or funded. As such, the pace of transition towards electric buses will be determined primarily by the ambition of state governments. If state governments will not deliver the rapid electrification of their bus fleets, it appears very unlikely that they will be able to deliver on their promises to significantly reduce fossil fuel usage across their entire economies.

As of late 2022, the signs are not good: at the time of publication, less than 200 of the nearly 100,000 buses (0.2%) in Australia are currently electric. This pitifully small number—especially considering the broad benefits of electric buses—suggests that state governments are simply not serious about their net zero targets.[4]

[1] Australian Bureau of Statistics (2021) *Motor Vehicle Census Australia ABS*, https://www.abs.gov.au/statistics/industry/tourism-and-transport/motor-vehicle-census-australia/latest-release

[2] BTRE (2005) *Health impacts of transport emissions in Australia: Economic costs,* https://www.bitre.gov.au/sites/default/files/wp_063.pdf

[3] Australian Bureau of Statistics, op cit.

[4] See Tables 1 and 2 on p 21 and p22, respectively, for sources for estimate of 100 electric buses.

BENEFITS TO CITIES OF ELECTRIC BUSES

One of the most marked social trends of the 20th century was the rapid urbanisation of the world's population. This trend has continued into the 21st century, and is expected to increase even further. In 1950, 25% of the world's population lived in cities.[5] Today, that figure is 56%,[6] and current estimates are that by 2050, cities will be home to at least two thirds of the global population. Some estimates put the figure as high as 80%.[7]

Cities currently consume 75% of the world's natural resources and account for more than 60% of its greenhouse gas emissions.[8] This means that effective urban planning is central to emissions reduction efforts. This is an even more important consideration in Australia: already one of the most urbanised nations on earth. Australia's capital cities contain two thirds of its population, and overall, 90% of Australians live in urban areas.[9]

Transport is key to greenhouse gas reduction efforts. Worldwide, transport has the highest reliance on fossil fuels of any sector, accounting for 37% of CO_2 emissions from end-use sectors.[10] The inherent density of cities means that mass public transport has a greater role to play in facilitating inhabitants' mobility than it does in less densely populated rural areas. As global urbanisation continues, reducing the emissions of cities' public transport options will be only become more important. Improvements to bus fleets are particularly important due to their production of greenhouse gases and other forms of air pollution.

THE RISE OF ELECTRIC BUSES WORLDWIDE

The International Energy Agency (IEA) notes that more than 120 countries pledged to reach net zero emissions in the coming decades. These countries account for around 85% of the global road vehicle fleet (excluding two- and three-wheeled vehicles).[11]

Australia is among these countries, but is trailing well behind most of its contemporaries in transitioning to electric vehicles (EVs). Bloomberg NEF's 2022 *Electric Vehicle Outlook*

[5] United Nations Human Settlements Programme (2022) *Envisaging the Future of Cities: World Cities Report 2022*, https://unhabitat.org/wcr/

[6] World Bank (2022) "Urban Development", https://www.worldbank.org/en/topic/urbandevelopment/overview

[7] United Nations Environment Programme (2022) "Resource efficiency and green economy", https://www.unep.org/explore-topics/resource-efficiency/what-we-do/cities/resource-efficiency-green-economy

[8] Ibid.

[9] Australian Bureau of Statistics (2016) *Historical population,* https://www.abs.gov.au/statistics/people/population/historical-population/latest-release

[10] International Energy Agency (2021) *Transport—improving the sustainability of passenger and freight transport*, https://www.iea.org/topics/transport

[11] International Energy Agency (2021) *Global EV Outlook 2021 report,* https://iea.blob.core.windows.net/assets/ed5f4484-f556-4110-8c5c-4ede8bcba637/GlobalEVOutlook2021.pdf

estimates that there are now almost 20 million passenger EVs on the world's roads, along with more than 1.3 million commercial EVs including buses, delivery vans and trucks. By 2025, Bloomberg projects that half of the global bus fleet will be electric; indeed, many countries (for example Norway, Germany, UK and France) are planning outright bans on fossil-fuelled vehicles.[12]

However, while electric bus registrations have increased across Europe, North America and China, the global fleet of electric buses must expand to 8 million buses by 2030 if net zero emissions is to be achieved by 2050.[13]

OPPORTUNITY FOR THE ELECTRIFICATION OF THE AUSTRALIAN BUS FLEET

The Australian Government's latest State of the Environment Report (2021) notes that since 1977, the total passenger-kilometres travelled each year has at least doubled in every Australian capital city but one (Adelaide). In Darwin and Brisbane, the distance has nearly tripled.[14] Nearly seven out of ten working Australians (69%) make their daily commute to work by car,[15] and a clear majority of Australians (54%) say the reason they do not use public transport is that there is either no service available or none at the time they need.[16]

There are numerous examples globally of cities that have transformed their public transport infrastructure systems, and with it, dramatically increased patronage: Vienna, Paris, London and Geneva all recorded an increase of at least 20% in the share of journeys taken by public transport over the period 2001 to 2012).[17] The evidence is clear: well-designed policies to encourage public transport use work.

The longitudinal Transport Opinion Survey found that Australians nominate investment in public transport infrastructure as the highest priority transport issue—above road expenditure.[18] Investment in electric buses presents a unique opportunity to tackle several problems with Australia's public transport infrastructure simultaneously. Rapidly rolling out well-connected fleets of electric buses in urban transit corridors would improve air quality,

[12] BloombergNEF (2022) *Electric Vehicle Outlook*, ht https://about.bnef.com/electric-vehicle-outlook/

[13] International Energy Agency (2021) *Transport,* op cit.

[14] DCCEEW (2021) *State of the Environment,* https://soe.dcceew.gov.au/

[15] ABS (2017) *More than two in three drive to work, Census reveals*, https://www.abs.gov.au/ausstats/abs@.nsf/mediareleasesbyreleasedate/

[16] McCrindle (2022) *Getting to Work: The Great Australian Commute*, https://mccrindle.com.au/article/getting-to-work-the-great-australian-commute/

[17] UITP (2015) *Advancing Public Transport*, https://cms.uitp.org/wp/wp-content/uploads/2020/06/MCD_2015_synthesis_web_0.pdf

[18] University of Sydney (2021) *Transport Opinion Survey: Understanding how the community views transport*, https://www.sydney.edu.au/business/our-research/institute-of-transport-and-logistics-studies/transport-opinion-survey.html

significantly lower carbon emissions, increase the quality of urban life, and vastly enhance the experience of millions of Australians' daily commute.

Transport for NSW's Transition Strategy notes that with recent rapid improvements in battery technology, electric buses have become commercially viable and can now be considered suitable for an estimated 80%–90% of uses in the state. (It also notes that while hydrogen fuel cell electric bus technology is also emerging rapidly, it is unlikely to be cost competitive for wide scale transition for five to ten years.)[19]

With clear policy direction from all states and territories, as well as support from the federal government, the ambitious goal of successfully transitioning Australia's bus fleets to zero-emissions electric vehicles by 2030 is achievable. However, due to the fact that buses are overwhelmingly operated or funded by state governments, such a transition is virtually impossible without the state government policies to enable it.

[19] Transport for NSW (2020) *Zero Emissions Buses: Our Transition Strategy*, https://www.transport.nsw.gov.au/projects/current-projects/zero-emission-buses

Benefits of electrifying Australia's public bus fleet

QUIETER NEIGHBOURHOODS

Diesel buses are noisy. At low speed, the main source of noise is the powertrain of these vehicles—and as buses generally travel at low speeds in inner-city traffic, it is their powertrains that generate the majority of noise pollution.[20]

Electric vehicles' powertrains are far simpler—and quieter—than those of internal combustion engines. As a result, the introduction of electric buses would mean far quieter journeys for passengers and much reduced traffic noise in the neighbourhoods that the buses traverse. Studies have found that it is at low speeds that electric buses offer the greatest noise reduction compared to conventionally powered diesel buses: they are up to 12 dB(A) quieter at a constant speed of 15km/hour, and up to 20 dB(A) quieter when buses are accelerated from rest, i.e. from bus stops.[21]

In a recent interview, Greg Balkin, the Chief Operating Officer of Transit Systems—the company overseeing the planned rollout of electric buses in Sydney—said:

> The passengers love [electric buses]. The drivers love them … [and] our engineers have smiles on their faces, because they're working with state-of-the-art technology and going home with clean hands.[22]

IMPROVED AIR QUALITY

Diesel-powered heavy-duty vehicles, including buses, produce major air pollutants. This including 45% of nitrogen oxides and 75% of particulate pollutants.[23] They also contribute a significant proportion of pollution in urban air. While just 0.5% of Australia's registered

[20] Laib et al. (2019) *Modelling noise reductions using electric buses in urban traffic. A case study from Stuttgart, Germany* in *Transportation Research Procedia*, Vol 37, pp 377-384 https://www.sciencedirect.com/science/article/pii/S2352146518306227

[21] Larsson and Holmes (2017) *Social benefit analysis of reduced noise from electrical city buses in Gothenburg* in *The Journal of the Acoustical Society of America*, Vol 141 Issue 5, p 3733 https://doi.org/10.1121/1.4988199

[22] Parkinson (2022) *How Sydney's first electric buses overcame range anxiety*, The Driven, https://thedriven.io/2022/08/05/how-sydneys-first-electric-buses-overcame-range-anxiety/

[23] Li (2016) *Battery-electric transit bus developments and operations: A review in International Journal of Sustainable Transportation*, Vol 10 Issue 3, pp 157-169 https://www.sciencedirect.com/org/science/article/abs/pii/S1556831822005160

vehicles are buses,[24] they account for 3%-4% of nitrogen oxide emissions, 2%-4% of sulfur dioxide emissions and 2%-6% of PM_{10} particulate pollution.[25]

These pollutants alone provide a strong case for electrification. In the Chinese city of Shenzhen, which achieved the extraordinary feat of converting the city's entire fleet of 16,359 buses to electric buses in under a decade, the main motivation was not reducing carbon emissions—it was reducing the amount harmful pollutants, such as nitrogen oxides, non-methane hydrocarbons and particulate matter, in the city's air. Nevertheless, the electrification of Shenzen's buses has also reduced its CO_2 emissions by 440,000 tonnes per year.[26]

While Australian cities are fortunate in comparison to many global cities when it comes to air quality, vehicle emissions remain harmful. For example, air pollution from vehicles is estimated to cause 21,000 serious health impacts every year in New South Wales. A recent report estimates this amounting to $3 billion worth of annual health costs for the Sydney-Newcastle-Wollongong region alone.[27] Meanwhile, the NSW EPA reports air pollution leads to 520 premature deaths in Sydney each year.[28]

Conventional diesel-fuelled buses are a significant part of this problem. The NSW Government estimates that $1 billion–$2 billion in environmental and health costs could be saved in the state over 30 years by transitioning the bus fleet from diesel to electric.[29]

REDUCED CO_2 EMISSIONS

In 2019-20, road vehicles contributed 85% of the direct greenhouse gas emissions generated by all transport modes in Australia.[30] Passenger buses are the second largest public transport mode in Australia, accounting for around 46% of public transport emissions.[31]

[24] Australian Bureau of Statistics, op cit.

[25] BTRE (2005) *Health impacts of transport emissions in Australia: Economic costs,* https://www.bitre.gov.au/sites/default/files/wp_063.pdf

[26] Keegan (2018) *Shenzhen's silent revolution: world's first fully electric bus fleet quietens Chinese megacity,* https://www.theguardian.com/cities/2018/dec/12/silence-shenzhen-world-first-electric-bus-fleet

[27] Electric Vehicle Council (2019) *Submission: NSW Upper House Inquiry into electric buses in regional and metropolitan public transport networks in NSW,* https://electricvehiclecouncil.com.au/wp-content/uploads/2021/07/2019-Submission-to-NSW-Parliament-on-buses-1.pdf

[28] NSW Government (2016) *Clean air for NSW*, https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Air/clean-air-for-nsw-consultation-paper-160415.pdf

[29] NSW Government (2021) *Zero Emission Buses: Our Transition Strategy*, https://www.transport.nsw.gov.au/projects/current-projects/zero-emission-buses

[30] BITRE (2020) *Yearbook 2020: Australian infrastructure statistics, statistical report,* p4 https://www.bitre.gov.au/publications/2020/australian-infrastructure-statistics-yearbook-2020

[31] CommBank (2021) *Why electric buses are the future of public transport: analysis,* https://www.commbank.com.au/articles/business/foresight/why-electric-buses-are-the-future-of-public-transport.html

There is thus significant potential for reducing CO_2 emissions through the electrification of public bus fleets throughout Australia.

Diesel vs electric: today

The ABS estimates that the total annual fuel consumption of diesel buses in Australia is 534.8 megalitres.[32] Burning one litre of diesel produces around 2.7kg of CO_2, which means that diesel buses produce about 1.4 million tonnes of CO_2 annually—roughly equivalent to the entire Australian Capital Territory's carbon emissions in 2020-21.[33]

Electric buses already emit far less carbon than diesel buses. A 2020 UK-based study found that in 2017—a year in which around 50% of the UK grid was powered by fossil fuels—operating an electric bus emitted 5.3 g of CO_2 per person, per kilometre, while a conventionally fuelled bus emitted 16.3 g.[34] If the buses are assumed to be full, this equates to 0.42kg/km for the electric bus and 1.3kg/km for the conventionally fuelled bus. In 2017, then, an electric bus in the UK emitted about a third of the carbon of a diesel bus.

Diesel vs electric: the future

As electric buses emit no carbon while operating, their ongoing emissions output is determined by the makeup of the electricity grid to which they are connected while their batteries are charged. As such, as fossil fuels are phased out and the use of renewable and low-carbon energy sources increases, electric buses' operating carbon emissions will decrease accordingly.

To estimate the extent of this decrease, the UK study examined the cost of operating electric buses under four different future energy scenarios, each of which modelled a different mixture of energy sources for the country's grid. Under the "two degrees" scenario—in which the UK meets the Paris Agreement's 2°C-warming-by-2050 target—operating an electric bus emits only 0.4g of $C0_2$/person/km. Again, if we assume the bus is full, this equates to 0.032kg per km. A conventionally fuelled bus, meanwhile, emits 14.2g/person/km, or 1.136kg/km if full. This means that in this scenario, an electric bus in 2050 will emit 35.5 times less carbon than a conventionally fuelled bus.

Clearly, the scope for an electrified bus fleet to reduce direct emissions is significant, even excluding the potential emission reductions from any induced reduction in passenger car use: in late 2022 NSW Environment Minister James Griffin estimated that "transitioning the

[32] Australian Bureau of Statistics, op cit.

[33] ACT Government (2021) *Measuring ACT greenhouse gas emissions*, https://www.climatechoices.act.gov.au/policy-programs/act-greenhouse-gas-emissions-inventory-reports

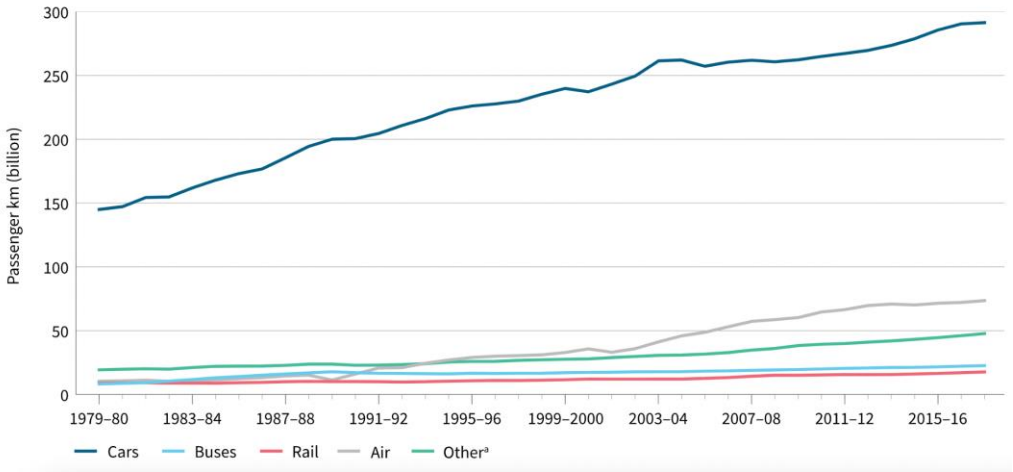
[34] Logan et al (2020) "Electric and hydrogen buses: Shifting from conventionally fueled cars in the UK", in *Transportation Research Part D: Transport and Environment*, Vol 85 Issue 1, https://doi.org/10.1016/j.trd.2020.102350

entire fleet of buses will reduce emissions from the State's public transport network by 78%."[35] The extent of the carbon savings in Australia will of course depend on the speed and extent of the transition to a renewable grid. Under a fully renewable grid, emissions would be cut dramatically.

REDUCED DEMAND FOR PRIVATE CAR USE

Most Australians travel by car.[36] In 2019-20, passenger transport activity by car (157.5 billion passenger kilometres) far outstripped all other modes (see Figure 1). This overwhelming reliance on private cars is a problem, and even with a wholesale transition to privately-owned EVs, a well-designed and resourced public transport network remains both a necessity for our cities, and a huge opportunity to reduce those cities' CO_2 emissions.

Figure 1: Australian domestic passenger kms, by mode of transport, 1979–80 to 2017–18



Source: BITRE (2020) Yearbook 2020: Australian infrastructure statistics, statistical report.

In Sydney, for example, an EPA survey that tracks trends in travel modes in the city shows that more than two thirds (68%) of trips taken by residents on an average weekday are by private vehicles. Just 6% are by bus.[37] Trends over the past decade show that while the proportion for each mode of travel (private vehicle, bus, train, light rail, ferry, taxi, walk/cycle) has remained largely the same, total distances travelled have increased. This means that Sydneysiders are spending longer in cars and on jammed roads.

[35] NSW Government (2022) *Zero Emission Buses powering-up with $3 billion in funding for new fleet*, https://www.transport.nsw.gov.au/news-and-events/media-releases/zero-emission-buses-powering-up-3-billion-funding-for-new-fleet

[36] DCCEW (2021) *State of the Environment,* https://soe.dcceew.gov.au/

[37] EPA (2021) *Modes of Transport: status and trends*, https://www.soe.epa.nsw.gov.au/all-themes/human-settlement/transport-2021

As shown in Figure 2, commuter travel is especially car-dependent: census figures reveal that in every capital city except Sydney, more than three quarters of commuters drive to work.[38] Sydney records the greatest patronage of bus services by some margin—and, as noted above, that figure is just 6%.

Figure 2: Method of Travel to work – by Greater Capital City

	Car, as driver (%)	Train, bus, tram or ferry (%)	Bicycle or walked only (%)
Sydney	65.5%	20.9%	5.9%
Melbourne	74.4%	13.4%	5.4%
Brisbane	75.3%	10.5%	4.9%
Adelaide	79.9%	8.3%	4.0%
Perth	79.3%	8.1%	3.8%
Hobart	76.0%	5.3%	8.1%
Darwin	75.2%	6.8%	7.1%
Canberra	74.9%	7.1%	8.4%

1 - Single method of travel only. Excludes "Worked from home", "Not stated", "Did not go to work" and all multi-response categories

Source: ABS (2017) *More than two in three drive to work, Census reveals*[39]

While it is not possible to accurately predict the reduction in passenger car use resulting from the electrification of the bus fleet, the improvements and extension of bus networks would likely lead to an increase in bus travel by commuters.

REDUCED CONGESTION COSTS

Infrastructure Australia estimates that road congestion costs the Australian economy $38.8 billion every year.[40] These costs are most significant for Australia's eight capital cities: the Bureau of Transport, Infrastructure and Regional Economics (BITRE) estimates the avoidable social costs of congestion—defined as accumulating in situations where "the benefits to [some] road users of … travel in congested conditions are less than the costs imposed on other road users and the wider community"—grew from $12.8 billion in 2010 to $16.5 billion in 2015. The 2015 figure comprised $6 billion in private time costs, $8 billion in business time costs, $1.5 billion in extra vehicle operating costs, and $1 billion in extra air pollution costs.[41]

These significant and rising costs are avoidable. Transitioning people away from private vehicle use towards active options like cycling and walking, as well as public transport options, has been shown to be more effective in mitigating these costs than increased

[38] ABS (2017) *More than two in three drive to work, Census reveals,* https://www.abs.gov.au/ausstats/abs@.nsf/mediareleasesbyreleasedate/

[39] Ibid.

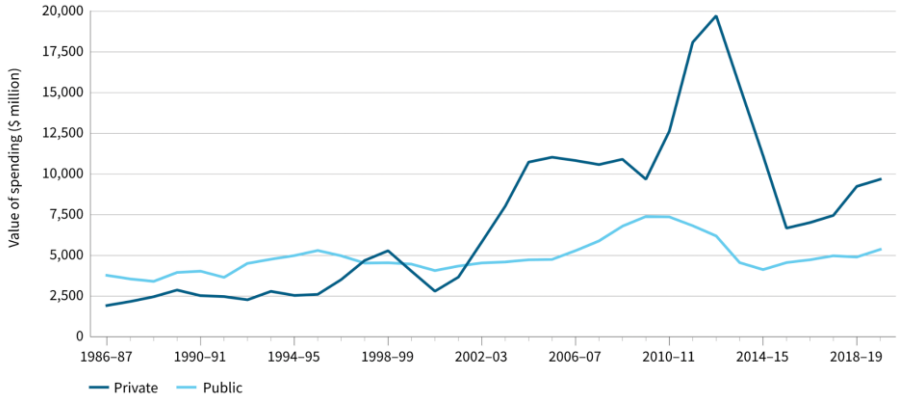
[40] Infrastructure Australia (2019) *Australian Infrastructure Audit*, https://www.infrastructureaustralia.gov.au/publications/australian-infrastructure-audit-2019#:~:text=The%202019%20Audit%20covers%20transport,next%2015%20years%20and%20beyond

[41] BITRE, op cit.

expenditure on road use.[42] Central to this transition is well designed public transport infrastructure which makes mass transit straightforward for a high proportion of a city's residents.[43] It is also important to note that work commutes are not all to and from urban centres; for example, in 2017, 86% of Sydney commuters travelled to work somewhere other than the CBD.[44] Buses are well placed to provide a distributed transport service to meet the needs of our cities beyond the routes already supported by train, ferry and light rail services.

However, as Figure 3 demonstrates, investment in public transport infrastructure still lags far behind private sector transport investment. In 2019-20, more than half (51%) of all infrastructure construction was in the transport sector, with governments spending $28.5 billion on roads alone.[45]

Figure 3: Value of transport infrastructure spending, 1986–87 to 2019–20



Source: BITRE (2020) Yearbook 2020: Australian infrastructure statistics, statistical report.

IMPROVED LIVEABILITY

The Australian Urban Observatory defines a liveable community as one that is "safe, socially cohesive, inclusive and environmentally sustainable".[46] Access to reliable and regular transport is a critical factor underpinning the liveability of our urban environments, and

[42] ATRF (2008) *Evaluating the congestion reduction impacts of public transport – a comparative assessment*, https://australasiantransportresearchforum.org.au/wp-content/uploads/2022/03/2008_Aftabuzzaman_Currie_Sarvi.pdf

[43] Buchanan (2019) *The benefits of public transport,* https://www.nature.com/articles/s41567-019-0656-8

[44] Terrill (2017) *Stuck in traffic? Road congestion in Sydney and Melbourne,* https://grattan.edu.au/wp-content/uploads/2017/10/892-Road-congestion.pdf

[45] DCCEW (2021) *State of the Environment,* https://soe.dcceew.gov.au/

[46] Ibid., "Livability", https://soe.dcceew.gov.au/urban/environment/livability

proximity to public transport encourages more active forms of travel, with a range of associated health and wellbeing benefits.

As being able to move efficiently around a city is a key measure of liveability, upgrading urban public transport modes, such as buses, to be quieter, cleaner and faster will inevitably improve the quality of life for residents and visitors. Sensible urban planning demands greater investment in public transport to deliver on the promise of improved liveability in our cities.

Taken together, travel on Australia's urban public transport across all available systems (i.e. train, light rail, buses and ferries) constitutes 1.56 billion passenger trips per year. Of these, bus trips—including school services—account for 692 million passenger trips each year.[47] That said, as noted above, the vast majority of urban passenger travel still happens by car. This suggests that there are significant potential benefits from policies to encourage public and active transport.

A recent study by Deloitte for the Australian Conservation Foundation found that when the health and social costs of air pollution, greenhouse gas emissions, noise and water pollution are all taken into account, a total of $492 billion could be saved by combining a complete transition to electric vehicles by 2035 with an increase in buses' mode share—i.e. the percentage of travellers choosing to travel by bus—to 10% by 2035 and 20% by 2045.[48] A well-managed transport network can also help curb urban sprawl and congestion, integrate with cycling and walking infrastructure, and provide affordable transport options for Australians.[49]

ECONOMIC OPPORTUNITY OF THE ELECTRIC VEHICLE INDUSTRY

The emergence of electric vehicles presents as significant an economic opportunity as it does an opportunity for emissions reduction. In its 2022 *Electric Vehicle Outlook* analysis, Bloomberg estimates electric vehicles present a global market opportunity of $9 trillion between 2022-2030.[50] This analysis suggests that if the EV industry is scaled up to the level required to actually meet net zero by 2050 commitments, that market opportunity will

[47] Department of Infrastructure & Regional Development (2015) *Urban Public Transport: updated trends*, https://www.bitre.gov.au/sites/default/files/is_059.pdf

[48] ACF (2021) *Local community benefits of Zero Emission Vehicles in Australia*, https://d3n8a8pro7vhmx.cloudfront.net/auscon/pages/19557/attachments/original/1634867677/Zero_emissions_vehicles_in_Australia.pdf?1634867677

[49] Stone et al. (2021) *Don't forget the need for zero-emission buses in the push for electric cars*, https://theconversation.com/dont-forget-the-need-for-zero-emission-buses-in-the-push-for-electric-cars160933

[50] BloombergNEF (2022) *Electric Vehicle Outlook,* https://about.bnef.com/electric-vehicle-outlook/

increase to $82 trillion between 2022 and 2050. Growth in this emerging industry presents a significant economic opportunity at a state and national level.

Already, between 2017 and 2022 nearly two thirds (64%) of buses sold in Australia were built locally using imported chassis and structures. There is an opportunity for Australia to establish a significant industry based upon the manufacture and assembly of electric buses.[51]

The local economic opportunities of electrifying the bus fleet also extend far beyond the manufacturing of the buses themselves. For example, Sydney-based software company Evenergi, which was recently contracted to help manage the EV fleet in the ACT, has developed a platform to model optimal fleet operation and management, and also to identify the best locations for charging infrastructure. Evenergi is now exporting its services worldwide to take up valuable contracts in the UK and US.[52]

LOWER FUEL & MAINTENANCE COSTS FOR ELECTRIC BUSES

While capital costs are higher for electric buses than diesel buses, the reduced fuel and maintenance cost of these vehicles means that on current figures, when total cost of ownership is considered, an electric bus costs $275,306 less over its lifetime than a diesel equivalent.[53] Electric buses have fewer moving parts than a conventional bus, meaning lower and more predictable operating costs, and that buses spend more time on the road and less time at the depot.[54] It has been estimated the costs of maintenance, running and procurement for electric buses are between a quarter and a third that of regular fossil-fuelled buses.[55]

Multiple studies have concluded that lower ongoing costs and reduced pollution result in a strong economic case for a switch to electric buses.[56]

[51] Quicke and Parrott (2022) *Next stop: Zero emissions buses by 2030*, https://australiainstitute.org.au/report/next-stop-zero-emissions-buses-by-2030/

[52] AFR (2021) *Start-up rides high on electric buses,* https://www.afr.com/chanticleer/start-up-rides-high-on-electric-buses-20211008-p58ych

[53] CommBank, op cit.

[54] Clean Mobility Shift (2021) *E-buses are more economical than their petrol or diesel counterparts,* https://cleanmobilityshift.com/market-trends/seven-charts-showing-how-e-buses-are-more-economical-than-their-petrol-or-diesel-counterparts-in-public-transport/

[55] Borén (2019) "Electric buses' sustainability effects, noise, energy use, and costs" in *International Journal of Sustainable Transportation*, Vol 14 Issue 12, p 1-16 https://www.tandfonline.com/doi/full/10.1080/15568318.2019.1666324

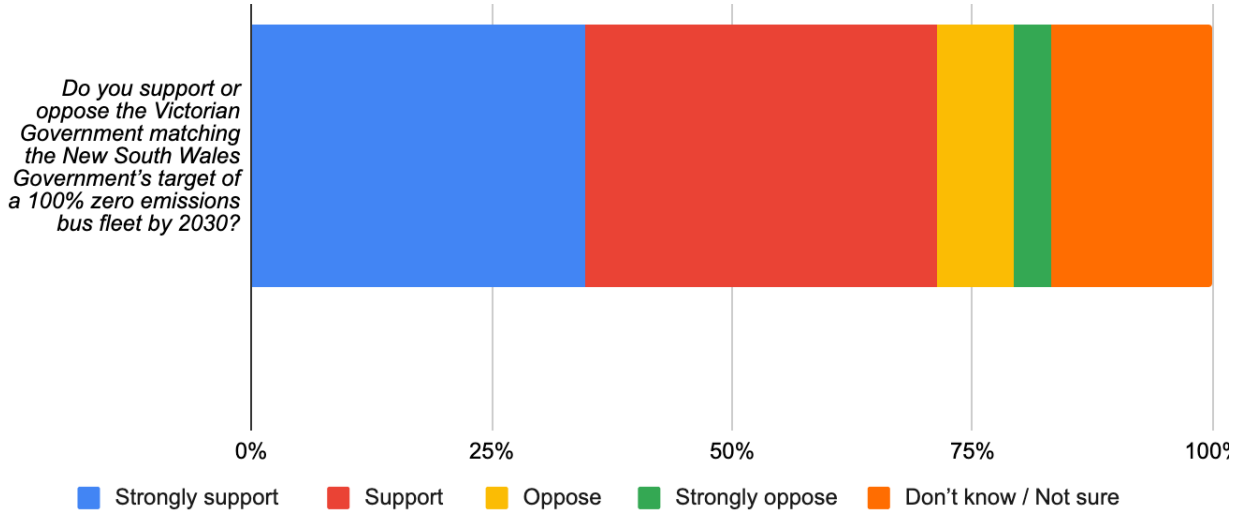
[56] ACT Government (2019) *Electric bus trial results released*, https://www.cmtedd.act.gov.au/open_government/inform/act_government_media_releases/chris-steel-mla-media-releases/2019/electric-bus-trial-results-released; Irish Department of Transport, Tourism & Sport

(2019) *Report on Diesel- and Alternative-Fuel Bus Trials*, https://www.gov.ie/en/publication/7251e2-low-emission-bus-trials-report/

Public support for electric buses

Polling by The Australia Institute shows that more than seven out of ten (71%) of Victorians support the idea of the Victorian state government matching the NSW state government's target of a zero-emissions bus fleet by 2030.[57] Just 12% oppose this proposition, as shown in Figure 4 below:

Figure 4: Polling results for electric buses in Victoria

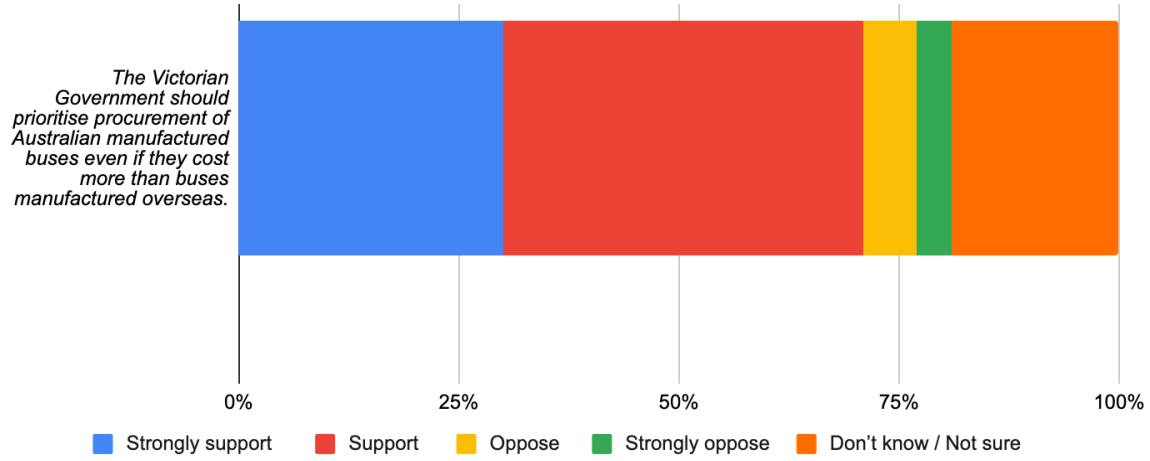


Source: Australia Institute (2022) Polling—Electric buses in Victoria

Similarly, more than seven out of ten (71%) of Victorians also support the procurement of electric buses manufactured in Australia, even if they cost more than those manufactured overseas, as shown in Figure 5.

[57] The Australia Institute (2022) *Surge of support for electrifying Vic buses: research*, https://australiainstitute.org.au/post/surge-of-support-for-electrifying-vic-buses-research/

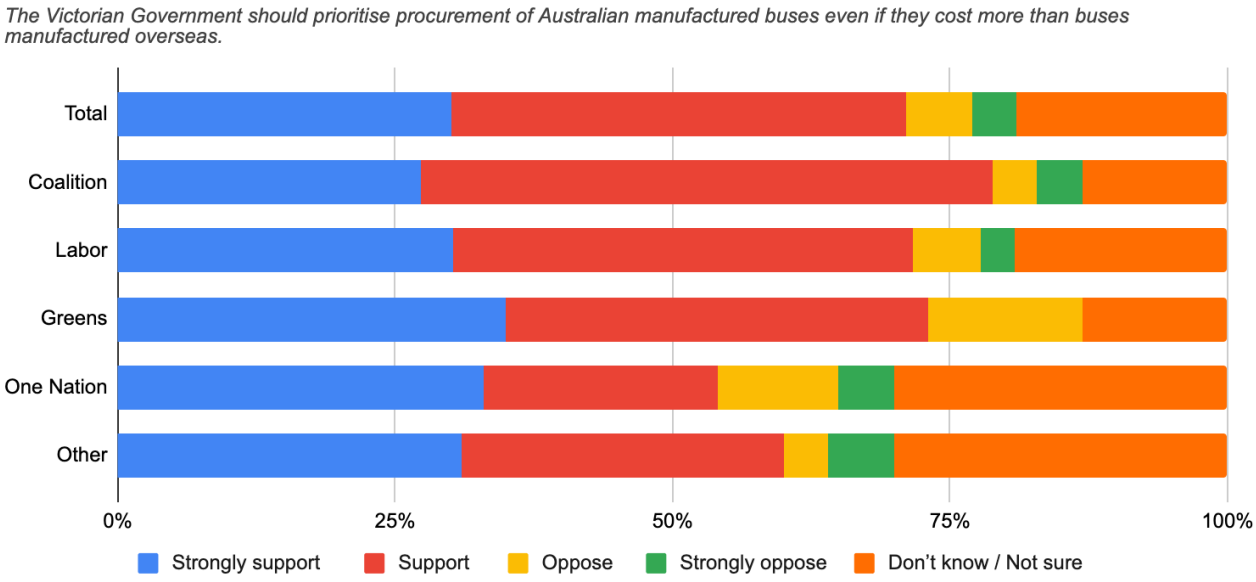
Figure 5: Polling results for manufacturing of electric buses in Victoria



Source: Australia Institute (2022) Polling—Electric buses in Victoria

This sentiment holds true across all political persuasions. As shown in Figure 6 below, 78% of Coalition voters, 71% of Labor voters, 73% of Greens voters, 54% of One Nation voters, and 60% of all other voters polled supported this proposition:

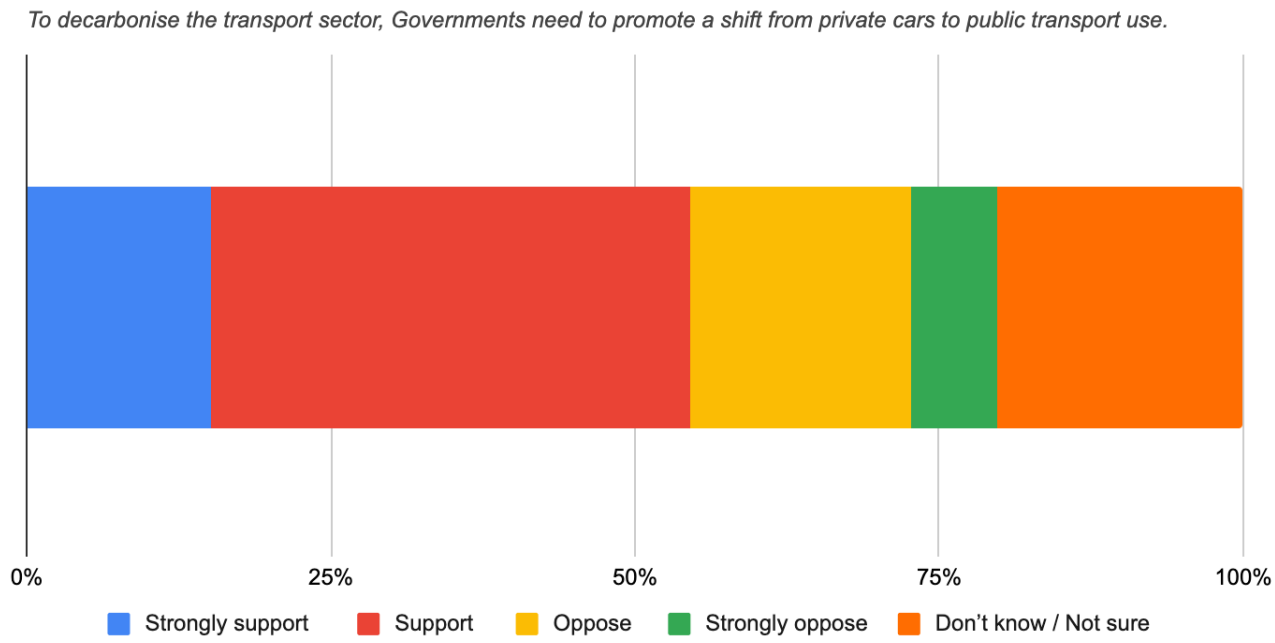
Figure 6: Polling results for manufacturing of electric buses in Victoria by voting intention



Source: Australia Institute (2022) Polling—Electric buses in Victoria

Further, a clear majority of Victorians recognise that in order to decarbonise the transport sector, the state government needs to drive a shift from private cars to public transport use. Indeed, more than twice as many Victorians agree than disagree with this proposition (54% agree vs 25% disagree), as shown in Figure 7 below:

Figure 7: Polling results for prioritisation of public transport in Victoria



Source: Australia Institute (2022) Polling—Electric buses in Victoria

The slow lane: bus electrification in Australian states

As of February 2023, no Australian state or territory is making rapid progress towards the electrification of its bus fleet—even those that have made commitments to ambitious transition targets. As demonstrated in Table 1 below, there are multiple states that have no such ambitious targets—and, indeed, no targets at all:

Table 1: Electrification of bus fleets by state and territory

	Current bus fleet	Target	Current number of electric buses
NSW	~8,000	100% electric buses by 2030	101 ordered to date, at least 40 delivered and 200 promised by mid-2023
Vic	~4,000	From 2025 all bus purchases to be electric	41 electric buses on the road, no fleet transition targets
Qld	~2,500 Translink funded buses across SE Qld	From 2025 all bus purchases to be electric in SE Qld, by 2030 for regional Qld	1 electric bus in Translink network at present, 17 promised by 2023
ACT	451	100% electric by 2040	12 on the road
WA	1,650 buses	No targets	4 on the road
SA		No targets	0
Tas		No targets	0
NT		No targets	0

Sources: See Table 2 below.

As shown in Table 1, NSW is the most ambitious state on electric buses, and announced in 2020 that it was aiming for a 100% electric fleet by 2030. However, only two years into this 10-year plan, Rob Stokes—the state's new Minister for Infrastructure, Cities and Active Transport—revised that target, stating that the government was instead pursuing net zero emissions across the state's bus fleet by 2035.[58]

While all Australian states and territories are committed to achieving net zero emissions by 2050 or sooner, no state is currently on track to electrify its own bus fleet by that time. The lack of commitment to, and progress towards, the electrification of public bus fleets demonstrates state governments' lack of commitment to taking the actions necessary to turn their net zero rhetoric into reality.

[58] Hayman (2022) *NSW government delays delivering electric bus fleet by at least five years,* https://www.abc.net.au/news/2022-09-06/nsw-government-green-bus-plan-delayed-by-five-years/101410796

Table 2 summarises the state and federal strategies currently in place, the commitments and investments that have been made to date, and the policy interventions and improvements needed in each jurisdiction.

Government	Current status	Policy & funding commitment required
Commonwealth	**Target and e-bus strategy** - None to date (from either current or former federal government) - No manufacturing strategy **Investment and progress to date** - 2021 pilot program - $2.95 million for 40 electric buses in Sydney via ARENA & CEFC	- Develop a local manufacturing strategy to support local manufacturing potential, e.g. through supporting partnership of Volvo Bus Australia and Volgren ComfortDelGro Corp to establish an electric bus manufacturing facility in Western Sydney - Propose new funding models to address higher up-front costs and risk associated with procurement - Introduce fuel efficiency and vehicle emissions standards to encourage zero-emission vehicle (ZEV) uptake - Support skills (re)training for current and new workforce to service electric bus fleet
New South Wales **8,000 buses** ***NSW Zero Emissions Bus Transition Strategy***	**Target and e-bus strategy** - 100% ZET bus fleet by 2030 - TAFE NSW electric vehicle training strategy **Investment and progress to date** - 101 electric buses ordered with "at least 40" delivered and 200 promised by mid-2023 - $218.9m over seven years in 2022-23 Budget as part of a broader $2 billion commitment	- An interim fleet target to ensure NSW is on track to meet 2030 fleet target - Sign C40 Green & Healthy Streets pledge[59], and seek alignment with local governments to do the same

[59] This pledge, signed in 2017 by 36 members of the C40 group—a group that currently comprises the mayors of 98 cities worldwide—commits to procure only ZEV buses from 2025 onwards and to "ensure a major area of [the] city is zero emission by 2030". While Melbourne and Sydney are both members of the C40 group, no Australian city has signed the pledge yet.

Victoria **~4,000 buses** ***Victoria's Bus Plan***	**Target and e-bus strategy** - From 2025, 100% ZEV bus purchases - There is no fleet transition target **Investment and progress to date** - AUD$20 million ZEV trial - 41 e-buses across three metro and one regional setting	- Introduce fleet target to complement purchase target - Commit at least $250m towards first phase of a rapidly scaled transition to e-buses in Melbourne and beyond - Sign C40 Green & Healthy Streets pledge, seek alignment with local governments to do the same
Queensland **2,500 Translink-funded buses across SEQLD** ***Zero Emission Vehicle Strategy 2022 - 2032***	**Target and e-bus strategy** - From 2025, 100% of Translink-funded buses purchased in SE QLD will be ZEV buses, and by 2030 across regional Queensland - There is no fleet transition target **Investment and progress to date** - There is currently just **one** electric bus operating in the TransLink SE QLD network - 17 electric buses are planned to rollout in the next year (10 on the Gold Coast, five on the Sunshine Coast, and two for Mackay) - $15.6 million investment to manufacture 16 buses on the Gold Coast, plus establish a zero emission bus depot	- Introduce 2030 fleet target to complement purchase target - Commit at least $250m towards the first phase of a rapidly scaled transition to e-buses in Brisbane and beyond - Sign C40 Green & Healthy Streets pledge, seek alignment with local governments to do the same
Australian Capital Territory (ACT) **451 buses** ***Zero emissions transition Plan for Transport Canberra***	**Target and e-bus strategy** - 100% ZEV bus fleet by 2040 or earlier **Investment and progress to date** - 12 electric buses leased and on the road - $37.5 million tender for first tranche of electric buses to replace 37 oldest diesel buses - Procurement for 90 electric buses by 2024	- Bring forward 2040 fleet target, in line with leading states and in recognition of scope for ACT to scale rapidly given operating context - Resolve grid capacity issues - Commit at least $200m towards the first phase of a rapidly scaled transition to e-buses in Canberra and beyond - Sign C40 Green & Healthy Streets pledge, seek alignment with local governments to do the same
Western Australia **1,138 diesel buses** **512 gas buses** ***State Electric Vehicle Strategy for Western Australia***	**Target and e-bus strategy** - No purchase or fleet target **Investment and progress to date** - Four-bus trial underway - $21 m electric vehicle fund commitment, but no specific bus-related commitments or funding within the strategy	- Introduce 2030 fleet target and purchase target - Commit at least $200m towards the first phase of a rapidly scaled transition to e-buses in Perth and beyond - Sign C40 Green & Healthy Streets pledge, seek alignment with local governments to do the same

South Australia ***South Australian Electric Vehicle Action Plan***	**Target and e-bus strategy** - No purchase or fleet target **Investment and progress to date** - $53.25 million commitment for the EV Action Plan, but no specific bus-related commitments or funding within the strategy	- Introduce 2030 fleet target to complement purchase target - Commit at least $150m towards the first phase of a rapidly scaled transition to e-buses in Adelaide and beyond - Support local manufacturing of electric buses e.g. BusTech Group currently fulfilling a contract for 60 buses for NSW e-bus roll-out - Sign C40 Green & Healthy Streets pledge, seek alignment with local governments to do the same
Tasmania **No strategy (a working group has been established)**	**Target and e-bus strategy** No purchase or fleet target	- Develop e-bus transition strategy - Introduce fleet and purchase target - Commit to the first phase of a rapidly scaled transition to e-buses in Hobart, Launceston, Burnie and Devonport
Northern Territory (NT) ***NT Electric Vehicle Strategy and Implementation Plan 2021-26***	**Target and e-bus strategy** - No purchase or fleet target - Only commitment in strategy is to "investigate feasibility of trialling low and zero emission buses in the Northern Territory urban fleet"	- Develop e-bus transition strategy - Introduce fleet and purchase target

Conclusion

A successful transition to electric bus fleets would require a collaborative effort across all levels of government, the private sector, manufacturers, bus operators, and the broader community. But above all, it requires serious commitments by state and federal governments, along with policy certainty from the former and financial support from the latter, to not just set targets, but also make the investments required to actually meet those targets.

Electrifying bus fleets is certainly not all that state governments must do to achieve their goals of net zero by 2050 or sooner. But it is a widely supported goal and relatively simple to meet given that most of those fleets are state-owned. If state governments cannot—or will not—rapidly electrify their own bus fleets, it is difficult to believe that they will be able to manage the significantly more complex and demanding task of rapidly decarbonising their entire economies.

Unfortunately, state governments have failed hitherto to put in place the frameworks and funding necessary to deliver the rapid electrification of buses. This does not just reveal a lack of interest in reducing emissions from the transport sector; it reveals that for most state governments, commitments to net zero emissions are more symbol than substance.