CLIMATE COUNCIL

SHIFTING GEAR: THE PATH TO CLEANER TRANSPORT

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The Climate Council acknowledges the Traditional Owners of the lands on which we live, meet and work. We wish to pay our respects to Elders past and present, and recognise the continuous connection of Aboriginal and Torres Strait Islander peoples to Country.

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Key findings

1

For Australia to meet its climate obligations, we need to fundamentally transform our transport system so everyone can get around easily and safely. Right now, a car-dependent system run on fossil fuels is harming our health, hip pockets and the environment.

- Climate change is accelerating with deadly consequences, as are transport emissions in Australia. We need to rapidly reverse this trend if we are to avoid further climate harm.
- Transport is the third largest contributor to greenhouse gas emissions in Australia. Cars and light commercial vehicles make up 62 percent of these emissions, therefore personal transport is the focus of this report.
- Australia's transport system is highly polluting by global standards, with more registered vehicles (20.1 million) than we have people who are licensed to drive them (18.7 million).
- Our car-dominated transport system cost more than 1,100 road crash deaths in 2021 and potentially thousands more in premature deaths from air pollution.
- Alongside this, pollution from vehicles is linked to more than 12,000 people being hospitalised with cardiovascular issues, more than 6,800 people being hospitalised with respiratory issues and 66,000 cases of childhood asthma each year.

2

Global sales of fossil fuel-powered vehicles are in structural decline, but to clean up Australia's transport system, we will need to go beyond simply replacing existing vehicles with electric ones.

- The sale of vehicles powered by petrol and diesel are considered to be in structural decline, having peaked at 86 million sales in 2017.
- In 2022, one in every seven passenger cars sold around the world was an electric vehicle, up from one in every 70 in 2017.
- To decarbonise the transport sector, the way we get around must transform from the majority of trips occurring via private vehicle to most happening on public transport or in an active way (such as walking, bike riding, scooting and rolling). This is also known as 'mode shift'.
- Alongside this, electric vehicles and shared and community transport should be affordable and available to those who need them most, such as people with a disability, older people, and those living in outer-suburban, regional, rural and remote areas.
- There is enormous potential for more Australians to get around in active ways. More than two million trips taken by car every day in Sydney are less than two kilometres in length, while in Melbourne half of all weekday trips are under 4.7 kilometres and most of these occur in a car.

3

To make it easier for Australians to increase their use of active and public transport for travel, decision makers need to apply visionary thinking and planning.

- Under all emissions reduction scenarios the Climate Council modelled, a major and dramatic shift in the way most people get around is required.
- This includes a scenario that is in line with existing national economy-wide emissions reduction plans of 43 percent by 2030 (from 2005 levels), as well as a transformational scenario in line with a science-aligned and economy-wide emissions reduction target of 75 percent by 2030 (from 2005 levels).
- This will not only require a mindset shift in the way we design transport policies, but also in the way we plan and design our cities and communities so more people are better connected to the services they need and want.
- Change at this scale would not only cut a quarter of our overall transport emissions, but would also improve our health and wellbeing, and make our communities much more enjoyable to live in.
- When expanding sustainable transport options, there should be a clear commitment to accessibility, affordability, and equity of access by putting the diverse needs of all Australians front and centre.

4

By the end of this decade, we should be aiming to more than halve the number of car trips that Australians make. This can be achieved by significant investment in electrified public transport and well-connected infrastructure for active modes like walking and cycling. We need this investment to enable 3.5 times more trips to be made on public transport, and 3 times more trips to be made using active modes.

- We have the solutions we need to do this, but it will require a structural shift in transport investment and design that prioritises active and public modes of transport, together with far greater investment, and changes in land use planning.
- Building on current commitments, the Climate Council recommends developing a National Transport Decarbonisation Plan to guide this. The plan should set mode shift targets to reduce car dependence on the scale required to rapidly reduce transport emissions. This should prioritise the transport needs of marginalised and vulnerable community groups.
- Investment in public and active transport will need to dramatically increase from the pitiful two percent of transport budgets, or less, that most governments spend today. The Climate Council recommends half of all transport budgets be dedicated to public transport, and 20 percent to active forms of transport in line with international best practice. All new investment should include commitments for inclusive and accessible transport and infrastructure.

- This needs to be coupled with a review and reform of all transport pricing, including road charges to disincentivise car travel (such as congestion charges) and measures to ensure that public, shared and community transport is affordable for all.

- To maximise emissions reductions, we need to electrify all public transport by 2035 at the latest, and ideally by the end of this decade.

- For trips that still need to be made by car, putting in place strong fuel efficiency standards will be essential for encouraging further uptake of electric vehicles. This needs to be coupled with equity considerations to ensure those who need electric vehicles most - such as people with a disability or older people - are able to obtain them.

5

We have the solutions we need to decarbonise personal transport, and it is a transformation all Australians can be a part of and benefit from.

- Moving to zero emissions vehicles and enabling more people to chose public and active transport options will mean safer streets, cleaner, healthier air and less pollution - particularly in our cities - with tremendous public health benefits.

- Many Australians are reliant on cars because our public and active transport infrastructure is often inadequate, which increases the costs of getting around. It is estimated we get a $2 return for every dollar invested in active transport infrastructure.

- Substantially increasing investment to improve and rapidly expand active and public transport options means greater choice for Australians in how they get around. Zero emissions transport needs to be equitably distributed and affordable.

- Active travel going forward means the prioritisation of pedestrians and bike riders on roads, with paths which are connected, safe, and given ample space separated from traffic, use of bike and scooter sharing programs, uptake of light electric vehicles (such as e-bikes) and walking and biking school buses to name a few.

- Public transport needs to be electrified, affordable, accessible, reliable and frequent. It should be given priority on roads, with networks designed to accommodate diverse destinations, and incorporate modes like on-demand and community transport.

- Electric vehicles need to be more available and affordable, with support for things such as ride-hailing, car sharing, and including smaller electric vehicles, such as sit-on scooters, motorbikes and micro cars.

- Transport systems that are focused on public transport and active ways of getting around create more connected and equitable communities. Places where more people have viable transport options have fewer barriers to work, education and engaging in community life.

Figure 1 (top): Safe Active Streets 30km/hr streets in Western Australia, Elizabeth Street towards Broadway.
Figure 2 (bottom): Manly 30km/h zones.

1. Introduction

Our ability to get around - safely and without barriers - is fundamental to our quality of life, wellbeing and participation in society. Transport connects us to everything: our communities, workplaces, friends and family, education, healthcare and all the essential services we need.

Transport also produces a large and rising share of Australia's harmful carbon pollution (19 percent) (DCCEEW 2023). To reverse this trend, we need to fundamentally alter the ways we get around, as well as the transport options available to Australians. Our cities and public spaces should be designed for people, rather than how they are presently designed: for private vehicles that run on fossil fuels, causing our streets to be congested and polluted. This has serious consequences for our health, as well as our planet - costing more than more than 1,100 road crash deaths in 2021 and potentially thousands more in premature deaths from air pollution (BITRE 2021; Walter and Say 2023).

The transport infrastructure in place determines the choices we make every day about how Australians can get around, and in turn the emissions profile of personal transport in Australia. Personal transport is the focus of this report - the way people move around (as opposed to freight, the way that goods are transported) and has significant potential for emissions reduction. Cars and light commercial vehicles contribute 62 percent of transport emissions (DCCEEW 2022a) and we have solutions readily available now to decarbonise. We all understand that climate change is accelerating with deadly consequences, and that we must take action. This requires transformative change across all parts of our economy and community, including transport.

The path to cleaner transport will not involve a direct replacement of every fossil fuel-powered car on the road with an electric one. Doing that would perpetuate our car-centric transport system and many of the problems it causes. Instead, we need to rethink, redesign and properly invest in

the solutions we have available to enable a massive shift away from cars toward public and active transport (known as mode shift). Greater investment, smart planning, better infrastructure and the right policies and pricing in place will provide most Australians with access to electrified public transport and active means of getting around (like walking, riding and rolling), alongside high uptake of electric vehicles (EVs) for those who need a private vehicle.

Decarbonising personal transport is a critical part of addressing harmful climate change. There are so many benefits to this, including improving people's quality of life by reducing our costs of living, enabling access to essential services and opportunities, improving our health and wellbeing, growing our economy, and creating high-quality jobs, and ensuring that all Australians have better choices and good access to quality transport. When we transform our transport system, we need to make sure it is redesigned in a way that works for all of us, ensuring no one is left behind. Sustainable transport must support the diverse needs and lifestyles of people across all ages, levels of mobility and ability, gender, age, level of income, cultural and linguistic diversity and geography. This means understanding that some people facing mobility challenges may never be able to use active or public transport modes.

This report examines the state of personal transport in Australia, and globally today. It highlights why mode shift is key to rapidly reducing transport emissions, and the huge potential to do this in Australia. In an Australian first, this report models four emissions scenarios for personal transport in 2030 and the corresponding shifts in modes of transport (Section 2). The scenarios are: a base case (the status quo); strong action (43 percent emissions reduction from 2005 levels); transformational action (75 percent emissions reduction from 2005 levels); and transformational and equitable action that accounts for high uptake of EVs by those that need them most: people with mobility challenges and those living in outer-suburban, regional and rural areas.

It then provides an overview for how policy makers can enable a rapid and dramatic transformation in mode shift by taking a holistic and system-wide approach that concentrates on five key principles outlined in Section 3: 1) planning transport around moving people, not cars; 2) structurally shifting public investment; 3) better integrating transport planning and land use planning; 4) promoting equity of access for all and addressing inequities; and 5) prioritising the electrification of transport. To bring this vision to reality, there are a number of established and emerging zero emissions transport initiatives and solutions which are outlined in Section 4.

Finally, it provides some key recommendations and actions for best-practice investments and initiatives that reduce barriers preventing people from choosing active and public transport, together with EVs when a private car is needed (Section 5). Governments at all levels should consider their plans against this breakdown to identify gaps and opportunities to reshape how Australians move around in the years to come.

In short, tackling climate change by cutting harmful carbon pollution from personal transport presents an opportunity to genuinely redesign our transport system for the better. Transforming our society from one dominated and dependent on cars, to one which prioritises the movement of people, with ample sustainable modes available to everyone is critical. We can design a system of getting from A to B for the diversity of people that use it. We can create healthier and more vibrant communities. We can have a zero emissions transport system that is accessible, affordable, and delivers a number of climate and societal benefits.

Figure 3: Streets should prioritise the movement of people first, with safe footpaths and bike paths and quality, frequent public transport. These modes of transport need to be cleaner, more affordable and capable of moving more people around than cars.

WHY TRANSPORT MATTERS

Climate change is accelerating with deadly consequences. Australia needs to rapidly reduce its greenhouse gas emissions this decade and end fossil fuel use as swiftly as possible. To play our part in global efforts, Australia should aim to reduce emissions by 75 percent below 2005 levels by 2030 and reach net zero by 2035 (Climate Council 2021). This requires transformative change across all parts of our economy and community. Transport produces a large and rising share of Australia's harmful carbon pollution, so it is essential that we take steps to reverse this trend. Thankfully, it is possible to make deep cuts in transport emissions with existing technology, available right now. To unlock these opportunities for cutting harmful pollution, we need policies, infrastructure and investment that can enable a major shift in how Australians move around.

Transport is Australia's third largest source of emissions, accounting for 19 percent of Australia's greenhouse gas emissions (DCCEEW 2023). Road transport - including cars, light commercial vehicles, trucks, buses and motorcycles - is responsible for 85 percent of these emissions. Cars and light commercial vehicles (vans, utes and SUVs) alone make up 62 percent of this pollution (DCCEEW 2022a).[1] Concerningly, at a time when emissions from other sectors have started a welcome and necessary decline, personal transport is one of Australia's fastest growing sources of emissions (DCCEEW 2022a).

Transport connects us to education, employment, essential services like hospitals, recreational activities, to friends and family, and so much more. It is an enabler of wellbeing, social inclusion, social participation and an important connector to services and opportunities. It needs to be accessible so that everyone can participate in society in the ways they wish.

Transport can be broadly separated into two categories: the movement of people (personal or passenger transport) and the movement of goods (freight). Land transport involves active transport (walking, bike riding, rolling), road transport (bus, tram, car, trucks) and rail transport (trains). Air travel involves helicopters and planes, while sea travel involves ferries, ships and smaller vessels. This report will focus on *personal ground transport*, where zero emissions options are available now and can be readily scaled up. There are also emerging clean solutions in freight and aviation which are under development, however these are out of scope of this report.

Climate change is accelerating, and so are emissions from transport. We need to turn this around to avoid the worst impacts of climate change for all Australians.

1 In 2019, light duty vehicle emissions accounted for 62 percent of all transport emissions, or 62 Mt CO_2e. Emissions are projected to return to this level in 2023 as activity returns to pre-pandemic levels (DCCEEW 2022a).

1.1 Transport today: car dependent and highly polluting

INTERNATIONAL CONTEXT

Globally, transport accounts for 37 percent of carbon dioxide (CO_2) emissions produced outside of the energy sector (IEA 2023a, based on 2021 data). In its Fifth Assessment report, the Intergovernmental Panel on Climate Change showed that direct transport-related greenhouse gas (GHG) emissions had risen 250 percent worldwide since the 1970s (IPCC 2014). Most of the increase in transport emissions has been due to road transport (Mattioli et al. 2020). Motorised transport is heavily dependent on fossil fuels - mostly oil, which is refined into petrol and diesel - which powers internal combustion engines (ICE). Indeed, transport continues to rely on oil products for 91 percent of energy consumed, down only three percentage points from the early 1970s (IEA 2022). For a liveable future, continued fossil fuel extraction and consumption must be phased out rapidly across our society, including fossil fuel-powered vehicles.

The era of ICE vehicles is ending. The global market for ICE passenger vehicles peaked in 2017 at 86 million vehicles sold and is now considered to be in structural decline (Bloomberg 2023). However, the automotive industry has not yet set out plans to cut its emissions in line with limiting global warming well below 2 degrees Celsius, and striving to limit it to 1.5 degrees Celsius in the long term, considered essential to avoid far more severe and irreversible changes to our climate. By one estimate, the global automotive industry is planning to manufacture between 330 to 463 million more ICE vehicles than would be compatible with limiting global warming to 1.5°C (Teske et al. 2022). At the same time, bigger, heavier and higher polluting cars are growing in popularity, with sports utility vehicles (SUVs) rising from 20 percent of new cars in 2012 to 46 percent in 2022. The cumulative emissions from SUVs reached almost 1 billion tonnes of harmful carbon pollution in 2022 (IEA 2023b).

Increasingly, we are seeing more EVs on our roads. In 2017, one in every 70 passenger cars sold globally was an EV. In 2022, this increased to one in seven (WEF 2023). While a welcome trend, driving deep cuts to emissions during this decade for climate action requires more than replacing every ICE vehicle with an EV. Adoption of EVs must occur *alongside major mode shift* - that is, a shift away from private vehicle use to electrified public transport and increased active transport like walking, bike riding and rolling.

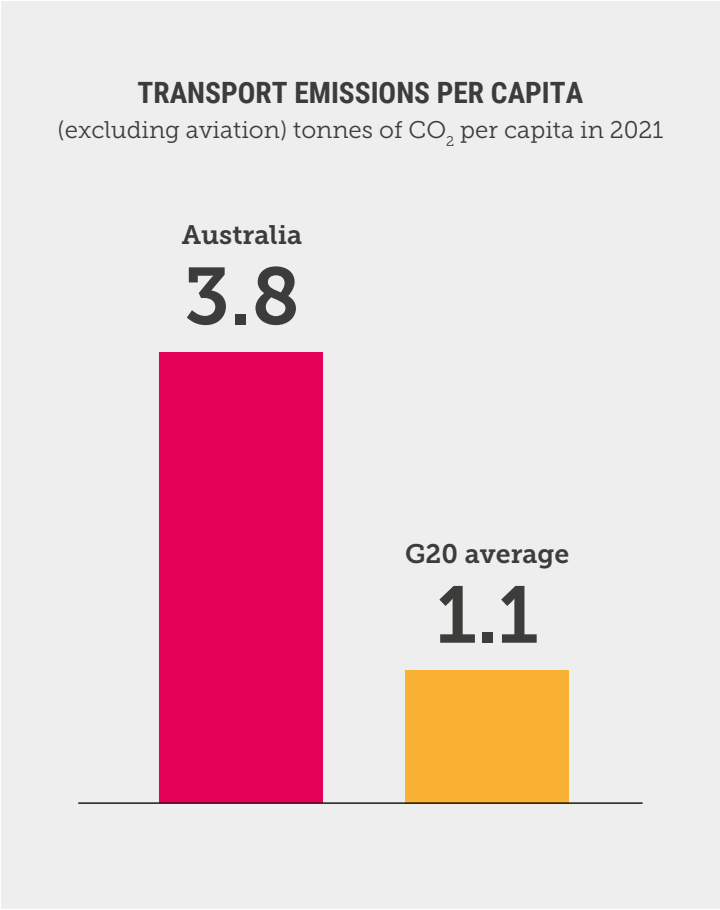
AUSTRALIA

As outlined previously, transport is Australia's third largest source of emissions (19 percent) and personal transport - cars, vans, utes and SUVs make up a significant part of this (62 percent) (DCCEEW 2023, DCCEEW 2022a). Australia's transport emissions (excluding aviation) are 3.8 tonnes of CO_2 per capita - more than three times the G20 average of 1.1 tonnes (Climate Transparency 2022). Australia has the fourth highest spend on roads in the OECD, superseded only by the United States (US), Japan and Germany (OECD 2021a). A car-dominated transport system comes at a considerable cost and suffering to people, with 1,123 road crash deaths in 2021. It may cause more than 11,000 premature deaths from air pollution caused by vehicles each year (BITRE 2021, Walter and Say 2023).

Nationwide, the most common way to travel to work is driving (by car, truck, motorbike or taxi), with 81 percent of people making

Electric vehicle sales are on the rise, but we also need a transport system that is designed for people, not cars.

Figure 4: Australia's transport emissions per capita.



Source: Climate Transparency 2022.

their daily commute in a private vehicle (BITRE 2021). About 14 percent use public transport, and a little over five percent walk or ride a bike (BITRE 2021). The national rate of active travel to or from school has dropped from 75 percent of trips to 25 percent over the past 40 years (Department of Transport 2021), with driving increasing due to time constraints, distances travelled and concerns over children's safety (SMH 2018). There are 0.78 vehicles per person in Australia, the seventh highest in the world (Which Car 2022). Alongside Turkiyë, Australia is the only country in the OECD without Fuel Efficiency Standards to limit the carbon pollution of vehicles sold. On average, new passenger vehicles in Australia are 20 percent more polluting than those sold in the United States, and 40 percent more polluting than those sold in Europe (DCCEEW 2022b). Increasingly, we are purchasing larger, more polluting and less efficient vehicles in the form of utes, vans and SUVs (NTC 2022).[2]

With 20.1 million registered motor vehicles as at 31 January 2021 (ABS 2021) and 18.7 million licence holders as at June 2021 (BITRE 2022a), Australia has more cars than people who are licensed to drive. Australia's transport system, our streets, cities and communities have been designed for cars first and people second. In our car-dominated and dependent society, people are limited in choice for transport and often need to rely on private fossil-fuelled vehicles. This setup is harming our environment, our health and our hip pockets.

2 In 2021 the average emissions intensity for passenger cars and light SUVs was 146.5g/km and 212.5g/km for SUVs and light commercial vehicles. If everyone had purchased vehicles with best-in-class CO_2 emissions in 2021, the national average CO_2 emissions intensity would have reduced 91 percent and 47 percent for the two categories respectively (NTC 2022).

1.2 Towards cleaner, healthier and more accessible ways to get around

Three broad approaches are required to transform our transport system from one that is highly polluting and dominated by cars to a system that is cleaner, healthier and more accessible for everyone:

- **Avoid and reduce** the need for motorised travel and minimise trip length, by adopting integrated land use planning and prioritising the movement of people over private vehicles.
- **Shift and maintain** transport investments towards lower and zero emissions public and active transport.
- **Improve** and adopt zero emissions vehicle technologies and fuels for road transport, ships and planes (UNEP 2022; GIZ 2019).

These approaches need to be underpinned by a commitment to inclusivity and ensuring that all members of our diverse society can access clean modes of transport, particularly more vulnerable and marginalised groups. We need to build and invest in infrastructure and transport options that are accessible for people with a disability and older people; safe and available to children, people of all genders, First Nations people and culturally and linguistically diverse groups; affordable for people on lower incomes; and which connects those in outer-suburban, regional, rural and remote areas.

There are welcome developments in Australia, with the formation of a Net Zero Unit to drive transport and infrastructure emissions reduction in late 2022, and the commitment to develop a Transport and Infrastructure Net Zero Roadmap and Action Plan in the 2023-24 Budget.

This report focuses particularly on mode shift and the levels of public and active transport required to rapidly reduce personal transport emissions this decade. We explore the extent of mode shift that would be required in order to achieve a 75 percent reduction in personal transport emissions from 2005 levels by 2030 - consistent with an economy-wide, science-based emissions reduction target for Australia. This analysis highlights both the challenges and opportunities that lie ahead. To cut emissions this deeply by 2030, Australia will need to more than halve the proportion of journeys undertaken by car, from 81 percent today to 36 percent in 2030. This can be achieved by electrifying and almost quadrupling public transport journeys - from 14 percent today to 49 percent in 2030 - and increasing active travel such as walking and bike riding three fold - from 5 percent today to 15 percent in 2030. A transformational mode shift on this scale, undertaken equitably, will bring enormous benefits beyond cutting emissions including for our health, the affordability and accessibility of transport, and the liveability of our cities and built environments.

2. Mode shift is the key to rapidly cutting transport emissions

The urgency of the climate crisis demands a rapid reduction in emissions this decade, including from transport. This requires a significant shift in the way we move around - known as a mode shift or modal shift - along with rapid adoption of EVs.

We must break away from a fossil-fuel car-dominated transport system. Instead, we need to create one where electrified public transport is abundant and accessible, where active transport options like walking and bike riding are safe and prioritised, and where EVs are available to those who need them.

International analysis has highlighted that a high mode shift in urban passenger transport, alongside vehicle electrification, is needed if we are to stand any chance of limiting warming to 1.5°C in the long term (Fulton and Reich 2021). As explored later, mode shift also delivers considerable benefits in addition to direct emissions reduction.

Shifting people from using private cars to active modes is possible for trips up to two kilometres by walking (~20-30 minutes), and up to 16 kilometres by bike (~30-60 minutes). On this basis, there is significant potential for mode shift in Australia right now considering:

- 28 percent of Australian workers live and work in the same postcode and about 55 percent of workers live within 10 kilometres of their place of work (Ye and Ma 2019).
- Everyday in Sydney, more than two million of the car trips taken are less than two kilometres (Australian Infrastructure Audit 2019).
- In Melbourne, 50 percent of all weekday trips were less than 4.7 kilometres and 41 percent were car trips (Department of Transport 2009).

The key change we need is for all Australians to have equal access to low or zero emissions transport to get where they need to go.

Figure 5 (opposite page): Re-designing a cleaner transport system needs to cater for the needs of all Australians, people with disabilities, elderly people, families with young children; it should be a safe environment and convenient option for all community groups.

Electrifying private cars is an essential part of the puzzle, especially as Australia lags behind many countries. EVs made up 3.8 percent of new car sales in 2022, miles behind Norway (86 percent), Iceland (64 percent) and Sweden (47 percent) (Euronews 2023). However, simply switching every ICE vehicle for an EV is not the answer for several reasons:

- The conversion of our vehicle stock to a completely electrified fleet will take decades, as just four percent of the fleet is replaced each year and about half of the 2030 fleet has already been sold (Institute for Sensible Transport 2023a). This is more time than we have to drive steep emissions reduction this decade;
- Although a substantial improvement on ICE vehicles, the lifecycle emissions of EVs (including manufacturing, fuelling and disposal) are still greater than active modes of travel like walking or rolling; and
- The challenges associated with car-dependent societies would remain, such as congestion, air pollution related to tyre and brake wear, and road injuries and fatalities.

BOX 1: EXISTING MODE SHIFT TARGETS

Australia

- **Nation-wide:** None.
- **State/territory:** Victoria is the only jurisdiction with partial mode shift targets; 25 percent active transport by 2030 (up from 18 percent in 2021) (DELWP 2021).
- Various councils across Australia have mode shift targets, such as the City of Melbourne (2019); aiming to increase public transport, walking and bike riding to 70 percent of all trips and increase the proportion of women cycling to 40 percent by 2030; and Randwick City Council (2021) aiming to increase active transport to 35 percent by 2031 (from 26 percent baseline) and reduce private vehicle trips from 58 percent to 45 percent.

International nation-wide targets:

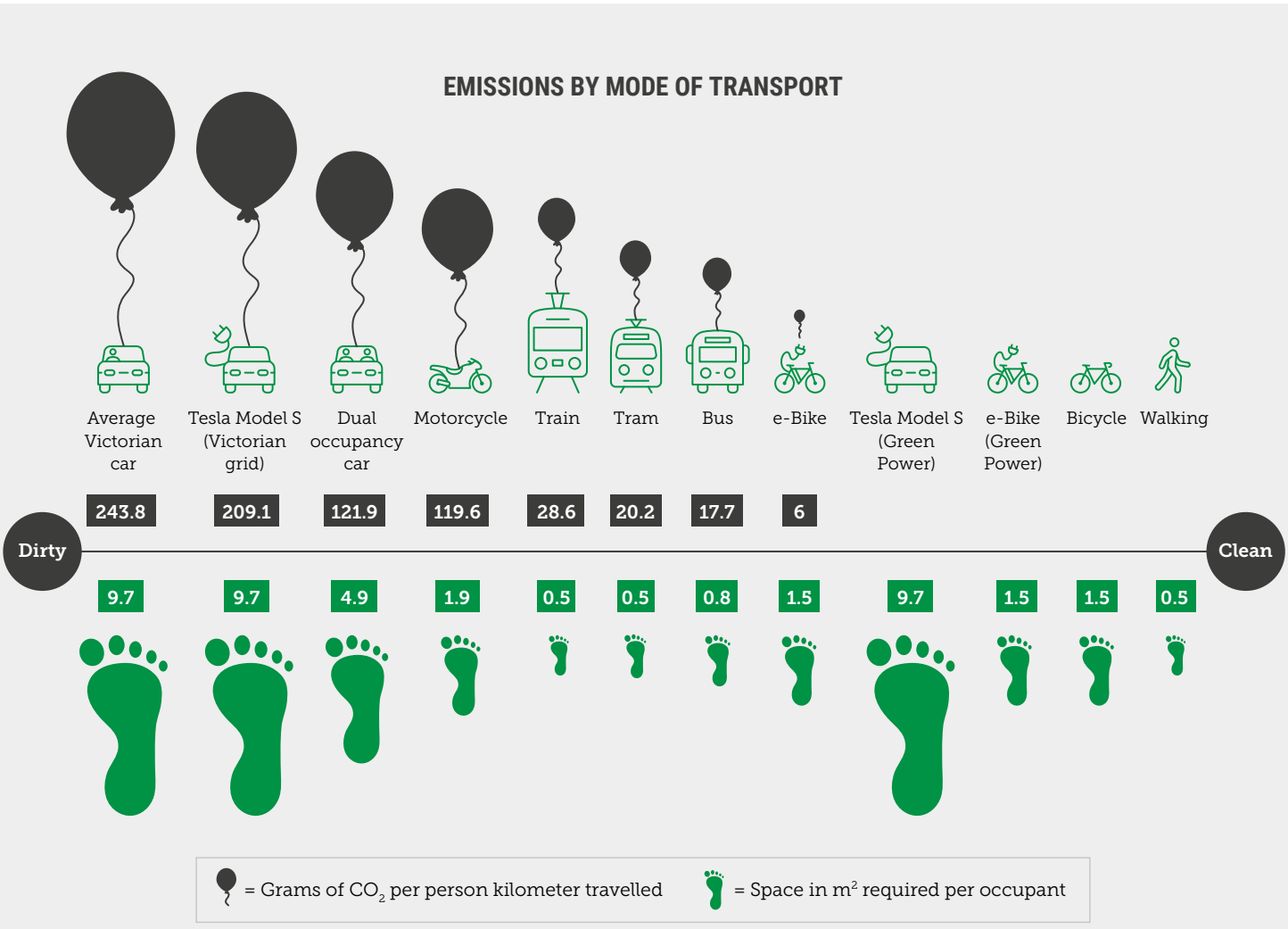
- In 2018 France, committed to tripling cycling use over the next six years going from three percent to nine percent (WEF 2018) by investing €350 million in bike riding infrastructure.
- Scotland is aiming for a 20 percent reduction in car kilometres by 2030 (Transport Scotland 2020).

2.1 Mode shift for emissions reduction

Active modes of transport like walking and bike riding produce zero emissions and are the cleanest form of transport. Even e-bikes (which run on a grid that is still dominated by fossil-fuels) produce 40 times fewer emissions than the average ICE passenger car (see Figure 6). Once our public transport is fully electrified and running on a completely renewable grid, these emissions will be eliminated. In the meantime, fossil-fuelled public transport still produces far fewer emissions than moving the same number of people by private car: nine times less for rail transport and 14 times less for transport by bus (see Figure 6).

Achieving a significant mode shift from motorised vehicles to active transport is one of the fastest ways to significantly cut emissions in the transport sector (World Bank 2021). A study in Europe (Brand et al., 2021) that observed 4,000 people over a two-year

Figure 6: Emissions by mode of transport.



Source: Institute for Sensible Transport (2023b). Based on emissions while in use and does not include lifecycle emissions from sourcing raw materials, manufacturing or disposal.

period found the carbon footprint for daily travel is 84 percent smaller for people who walk or cycle compared to other types of transport. Importantly, there are immediate benefits from making small changes. For example, the average person who shifted from using a car to a bike for one day of the week cut their carbon footprint by 3.2 kilograms of CO_2 per day. That is equivalent to driving a car for ten kilometres.

To better understand the degree of mode shift that we should be aiming for in Australia, the Climate Council has explored a number of emissions reduction scenarios and the mode shift required to achieve each of these. In this exercise we assume that, given the variety of options already available when it comes to decarbonising personal transport, we should be aiming to reduce personal transport emissions at a rate that is at least equal to our national economy-wide emissions reduction targets. We therefore modelled a scenario that aligns with the legislated national economy-wide emissions reduction target of at least 43 percent below 2005 by 2030, as well as scenarios that align with a national economy-wide emissions reduction target of 75 percent below 2005 by 2030 - this matches the level of ambition necessary if Australia is to play its part in global efforts to limit warming to well below 2°C (Climate Council 2021). We labelled these scenarios **strong action** (recognising the significant mode shifts this would require), **and transformational action** respectively. In addition, we modelled a **status quo** scenario, which is based on trends observed over recent years continuing. These scenarios are laid out in Table 1.

Achieving a 75 percent reduction in personal transport emissions by 2030 requires a substantial mode shift from private vehicles to active and public transport, alongside replacing ICE vehicles with EVs. Ultimately, achieving steep emissions reductions from personal transport is a matter of reducing the number of trips undertaken by ICE vehicles as much as possible. This is achieved by first reducing our dependence on private vehicles overall, and then ensuring that when trips by private vehicle are necessary, as many of those journeys as possible are made in EVs. It is generally much easier to reduce car dependence in urban settings, where many more trips can be undertaken by public and active transport, than in rural settings, where distances travelled are typically longer and there are fewer alternatives. To take account of these differences, we have provided a further variation on the **transformational action** scenario, labelled the **transformational and equitable action** scenario. Rather than assuming an even uptake of EVs across all settings, this scenario would see Australia make optimal use of opportunities for mode shift and switching to EVs. In essence, it prioritises EV uptake for those whose situation is more likely to require a private vehicle, especially for people with a disability and the elderly and those living including in outer suburban, regional and remote areas. It assumes that almost all journeys in the inner city are undertaken by active and public transport, for those who are able to.

Many of the car trips that Australians make in cities are short in length and could be replaced with public transport, or active transport, like walking, bike riding and rolling.

Under the **transformational and equitable** scenario, car travel would need to be more than halved by 2030, travel by public transport increased three and a half times, and active transport increased three-fold. Yearly emissions would be reduced by 55 Mt CO_2e. CO_2e is a metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential, by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential. This 75 percent reduction in personal transport emissions would mean a 25 percent reduction in overall transport emissions (from 2005 levels) and brings numerous co-benefits to society and the economy, while addressing harmful climate change. The remaining transport emissions in 2030 arise from air-related travel and freight (including trucks, rail and shipping).

Table 1: Mode shift scenarios. Further details on the methods and assumptions are provided in the Appendix.

Scenario	Emissions for personal transport in 2030	Mode share in 2030
Status quo The trends observed over recent years continue - with high car use, steady decarbonisation of the electricity grid, little further electrification of public transport, similar use of public and active transport, and EVs make up 10 percent of car trips.	63.1Mt CO_2e Equates to 34 percent increase in overall transport emissions from 2005 levels	81% cars 14% public transport 5% active transport
Strong action Personal transport emissions are reduced by 43 percent by 2030 (below 2005 levels). In this scenario, the electricity grid is mostly renewable by 2030 (82 percent as outlined in the federal government's Powering Australia Plan), all public transport is electrified and runs on renewable energy, and EVs make up 10 percent of car trips.	30.2Mt CO_2e Equates to 4.8 percent decrease in overall transport emissions from 2005 levels	43% cars 40% public transport 17% active transport
Transformational action Personal transport emissions are reduced by 75 percent below 2005 levels by 2030; in line with the Climate Council's estimate of the scale of action needed across the economy. In this scenario, the electricity grid is fully renewable, all public transport is electrified and runs on this renewable electricity, and EVs make up 20 percent of car trips.	13.0Mt CO_2e Equates to 25.4 percent decrease in overall transport emissions from 2005 levels	20% cars 62% public transport 18% active transport
Transformational and equitable action Aligned with a science-based target of reducing emissions by 75 percent by 2030 across the economy (Climate Council 2021), but considers how EV usage would be higher for elderly people and those with a disability and those outside of cities where more journeys need to be made by car. In this scenario, the electricity grid is fully renewable, all public transport is electrified and runs on this renewable electricity, and EVs make up 20 percent of car trips. Those living in cities with good public transport access make little to no use of private cars, with the exception of those who need to, such as people with a disability and the elderly.	13.3Mt CO_2e Equates to 25.0 percent decrease in overall transport emissions from 2005 levels	36% cars 49% public transport 15% active transport

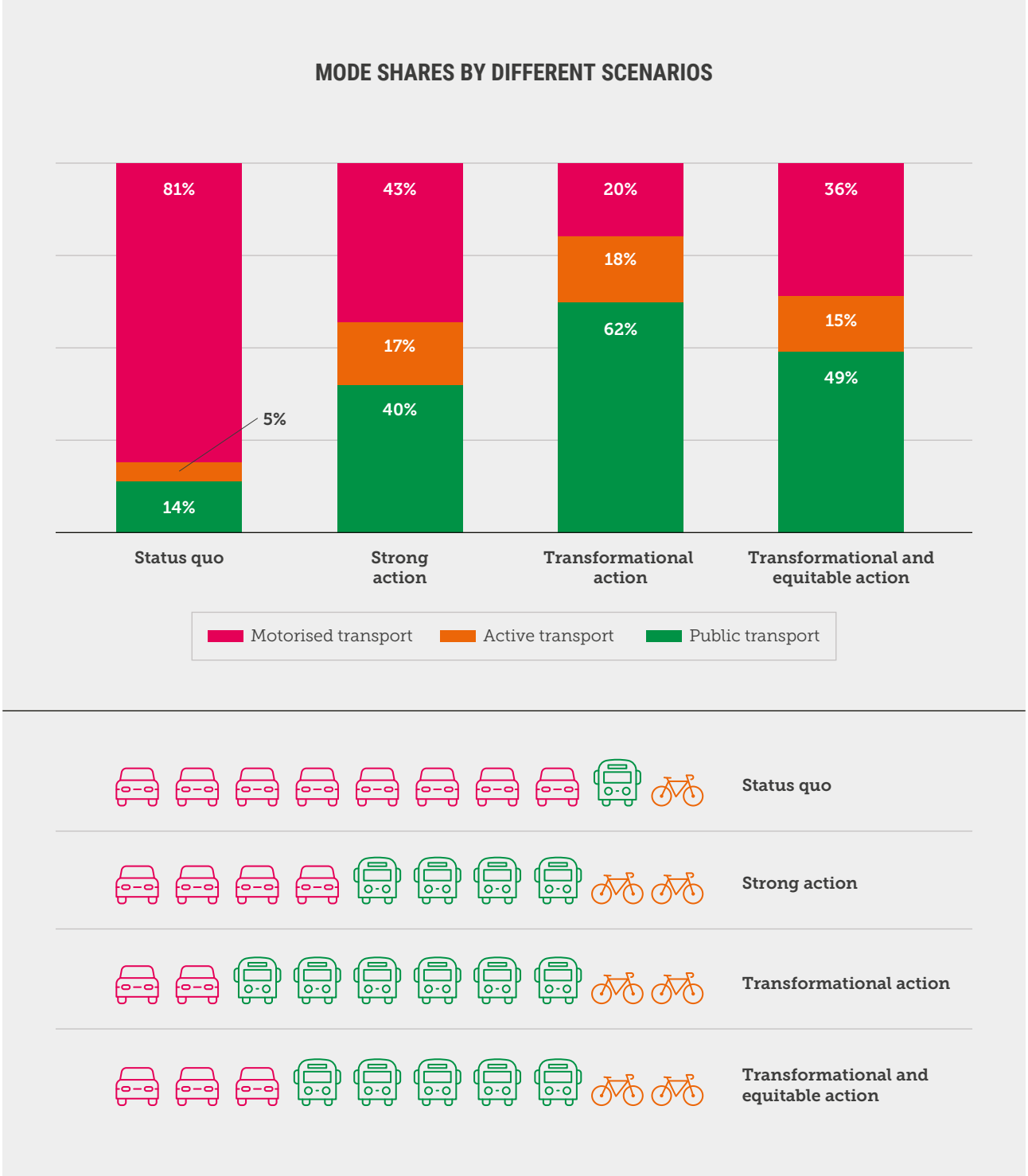


Figure 7: Mode shares by different scenario.

Active travel levels remain relatively similar for **Strong action**, **Transformational action**, and **Transformational and equitable action** (at 17, 18 and 15 percent respectively) as this is limited by the number of journeys active travel is considered realistic (i.e. below a certain distance). These levels of active travel involve a major shift in comparison to **Status quo** (five percent) and current trends. While these percentages may seem small, the corresponding number of people highlights the level of change. For example in the 2016 Census almost 480,000 people (five percent) walked or cycled to work, to achieve the mode shift in **Transformational and equitable action** (15 percent) this would be approximately 1.34 million people opting for active transport.

The mode shift required in personal transport to ensure emissions reductions are commensurate with Australia's current national emissions reduction target (our **Strong action** scenario), let alone our **Transformational action** scenarios is substantial and will require visionary thinking and planning. It will also require a structural shift in transport investment to prioritise active and public transport modes, together with major changes in land use planning so that people can live and work closer to life's essentials. As we undergo this transformation of our transport systems, we must ensure no one is left behind without adequate transport available to them - particularly people who face mobility challenges and rely on private vehicles to get around. Embedded in increased clean transport investment should be investments for accessible transport and built infrastructure.
There is a huge task ahead to drive this transformation of transport within this decade, but getting this right can deliver healthier, cleaner, more affordable and accessible mobility for all.

Figure 8: Significantly increasing transport spending towards active and public transport will mean more high quality infrastructure to provide Australians with greater choice in how they get around.

2.2 Social and economic benefits of major mode shift

Beyond reducing emissions and avoiding further climate harm, there are many additional benefits in shifting away from a car-dependent system. These include:

Cleaner, healthier air: In addition to greenhouse gas emissions, road transport is a significant source of air pollutants including nitrogen oxides and particulate matter (Requia et al. 2018). While EVs produce zero greenhouse gas tailpipe emissions in use, particulate matter from braking and tyre wear is still present. These air pollutants are associated with numerous adverse health effects, primarily respiratory and cardiovascular diseases (Dominski et al. 2021). In Australia, the latest available research indicates air pollution from vehicles is linked to more than 11,000 premature deaths each year (Walter and Say 2023). This is more than six times higher than previous estimates (Schofield et al. 2017) and almost 10 times more than the national road death toll in 2021 (BITRE 2022b). Alongside this, pollution from vehicles is linked to more than 12,000 people being hospitalised with cardiovascular issues, more than 6,800 people being hospitalised with respiratory issues and 66,000 cases of childhood asthma each year (aged 0-18) (Walter and Say 2023). Moving to zero emissions vehicles and enabling more people to use public and active transport options will deliver cleaner, healthier air - particularly in our cities - with tremendous benefits for public health.

Safer roads: A transport system which prioritises people rather than cars creates a safer environment for everyone - but particularly vulnerable road users like pedestrians and bike riders. Australia ranks 25 out of 39 countries in the OECD for road-related fatalities, with 4.36 road deaths per 100,000 people in 2021 (OECD 2021b). In 2022 there were 1,123 road crash deaths in Australia (BITRE 2022b).[3] Over the recent decade fatalities are declining, however deaths of vehicle occupants (driver and passenger) are declining faster than deaths for vulnerable road users (pedestrians, motorcyclists and bike riders) at 18.5 percent and 4.5 percent respectively. The death toll only measures a small part of road harm - there were 68,300 road-related

With cleaner air, quieter communities and safer streets, there are so many extra benefits to a transport system that is designed around people.

3 The majority of deaths are drivers (47 percent), followed by passengers (16 percent), pedestrians (12 percent), motorcyclists (21 percent), bike riders (4 percent).

hospitalisations in 2020-21 for example. Of these, almost a third were bike riders and pedestrians (AIHW 2022). Cutting the number of cars on our roads, particularly of larger vehicles like SUVs and utes that are growing in numbers, will reduce serious accidents and improve safety for vulnerable road users, so that everyone can get where they need to go safely.

Improved physical and mental health associated with sustainable transport: Increased uptake of public and active transport across society has other health benefits, and encourages and increases incidental physical exercise, recognising that active transport is not an accessible form of transport for all people, and there are many factors that influence people's ability and level of mobility to get around. The benefits of physical activity include: longer life and improved quality of life, reduced feelings of anxiety and depression, improved sleep, increased bone strength, improved cognitive and physical function (including among school children) and reduced risk of injury associated with falls among the elderly (WHO 2022). Active commuting has been associated with about a 10 percent decrease in risk for cardiovascular disease (Dinu et al. 2019). Remarkably, bike commuters have a 40 percent lower risk of dying from cancer and 52 percent lower risk of dying from heart disease compared to those commuting by car or public transport, alongside a 46 percent lower risk of developing heart disease and 45 percent lower risk of developing cancer at all (Celis-Morales et al. 2017).

Reduced cost of living: Not only are active transport and electrified public transport zero emissions, but they are also the cheapest forms of transport. However, many Australians are reliant on cars as our public and active transport infrastructure is often inadequate. In addition to the environmental, health and social costs - cars pose significant direct financial costs to users as well and the private car is one of the costliest items for many households. From fixed costs such as the car itself, loss of the car's value over time (depreciation), registration fees, compulsory third-party insurance and interest on a potential car loan; alongside variable costs such as fuel, servicing, repairs, non-compulsory insurance, roadside assistance, tolls and parking. In the December 2022 quarter, the typical weekly transport cost for Australians was almost $385 and the vast majority of this cost (an average of 94.4 percent across the nation) was associated with cars, while the remaining 5.5 percent was on public transport (AAA 2023). Greater investment and rethinking of our approach to pricing in public and active transport infrastructure will provide more affordable ways of getting around.

Better choice and availability for everyone: Quality urban design and investment that prioritises active and public transport gives people more choice in how they travel (International Transport Forum 2021). Many Australians currently have limited choices for how they move around and are often forced to rely on the private car - particularly in Australia's outer suburbs and regions. Transport access is a socio-economic issue - wealthier people are more likely to live closer to our city centres where there is access to better and more transport options (Scheurer et al. 2017). Those who would most benefit from the cost savings of leaving the car at home, on the other hand, often have the worst choices and least access to alternatives. Substantially increasing investment to improve and rapidly expand active and public transport options offers greater choice to Australians in how they get around. Zero emissions transport should be equitably distributed and affordable. For those who face mobility challenges using public or active transport, such as people with a disability and older people, zero emissions options like EVs and electrified shared and community transport need to be readily available and meet accessibility standards.

Figure 9: Significantly investing and creating more zero emissions transport options will bring a number of benefits to Australians, offering more choice in how we get around. It is important that these options are readily available and convenient for all, whether it be a young family with a pram or a person with a disability.

Growing the economy: The benefits to the broader economy of walking, bike-riding, public transport and EV infrastructure are high. It is estimated there are $2 in returns for every $1 of public funding invested in active transport infrastructure (ClimateWorks 2020a). Further, every dollar of public funds invested in transport could unlock 50 percent more in private co-investment (AlphaBeta and Climate Council 2020). Investments in active transport are particularly cost effective, as the required infrastructure is cheaper than that required for cars, suffers less wear and tear, and can be built faster and deliver benefits in a shorter period of time compared to major road projects (WHO 2022). Walking and bike riding are the only transport modes that create more external benefits than costs and active travellers tend to also spend more at local businesses.

Boosting productivity and more high-quality jobs: Car traffic congestion costs the Australian economy $38.8 billion annually (Infrastructure Australia Audit 2019). Numerous studies have shown that traffic congestion and associated costs are better reduced by shifting to active and public transport and by reducing private vehicle use than by spending more money on roads (Aftabuzzaman et al. 2008; Garrard 2009). A decarbonised transport system supports the creation and continuation of Australian jobs not only in transport directly, but in adjacent sectors such as manufacturing and construction. Investment in sustainable transport is a major job creator, with an estimated 12-15 jobs created per $1 million invested in active transport and EV charging infrastructure (ClimateWorks Australia 2020a). Australia has many of the foundations for an EV manufacturing industry (for electric cars and light EVs) including: rich critical mineral deposits, strong industrial infrastructure, a highly skilled workforce and consumer interest (Dean 2022). Previously the automotive industry increased the Australian economy by $21.5 billion each year (with $500 million in government funding annually) (Allen Consulting Group 2013).

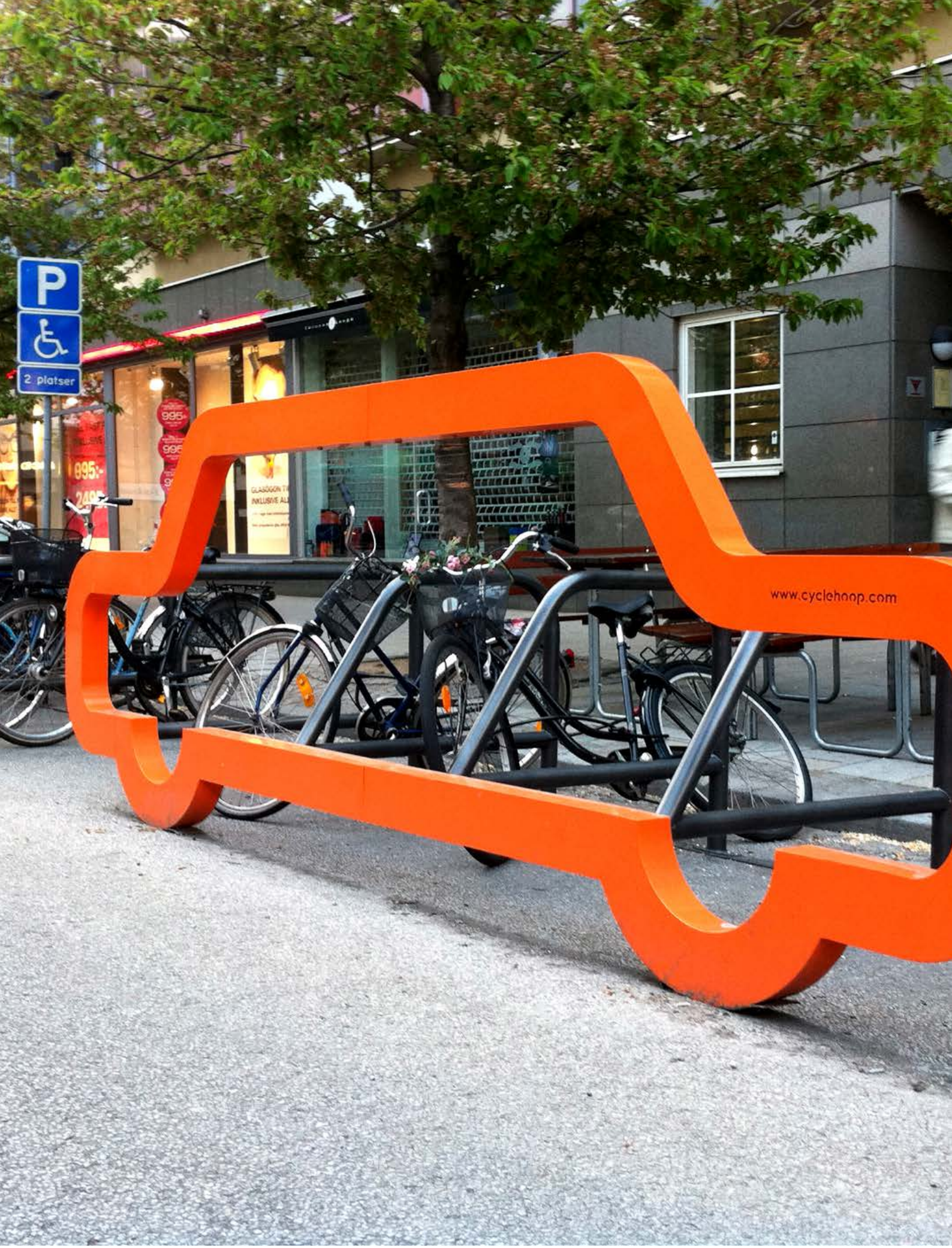


Figure 10: Street parking by default should accommodate more active modes of travel, such as bikes and scooters and less cars. Accessible car-parking for people with a disability, elderly people or those facing mobility challenges however, must always remain.

3. How can we enable a rapid and major mode shift?

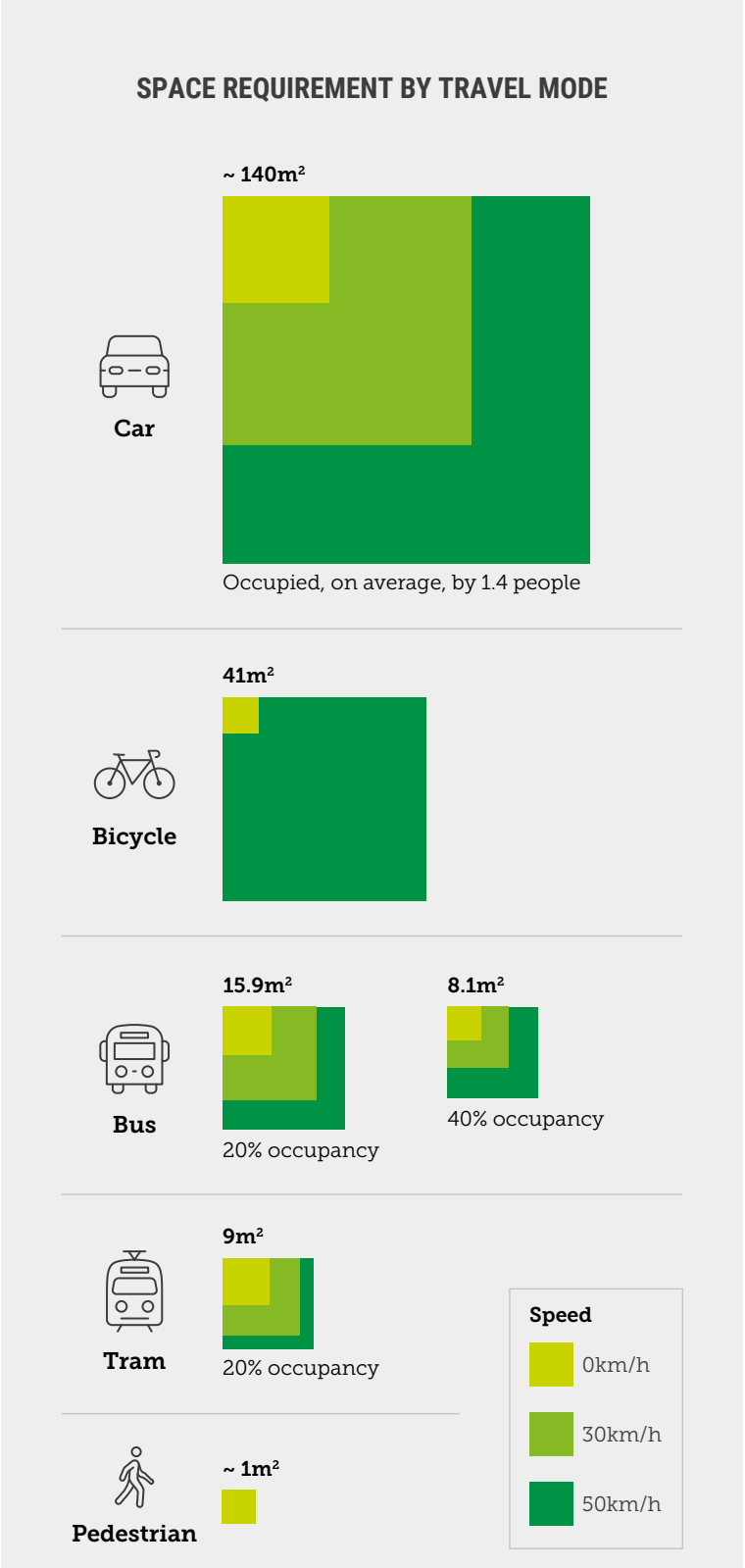
Achieving a shift to active and public modes of transport of the necessary scale for deep emissions reduction this decade calls for a fundamental re-think of how we plan for, and invest in, transport systems around Australia. In this section, we explore the factors that will need to guide transport planning to enable this big shift.

Climate Council's research has identified five key enablers:

- Planning transport around moving people, not cars
- Structurally shifting public investment
- Better integrating transport planning and land use planning
- Promoting equity of access for all and addressing inequalities
- Prioritising the electrification of transport.

Pursuing these five enablers together represents a holistic, system-wide approach to reshaping how Australians move around in the years to come. To ensure all levels of government make this shift and collaborate on these enablers, Climate Council recommends the development of a **National Transport Decarbonisation Plan** which explicitly identifies achieving mode shift on the scale explored in this report as one of its core objectives.

3.1 Planning transport around moving people, not cars



Traditional transport planning follows a clear hierarchy where cars are accommodated first and pedestrians and cyclists receive whatever space is left (WHO 2022). Setting ourselves up for a zero emissions future demands that we flip this paradigm. Instead of thinking about the most efficient way to move cars around our cities and regions, we need to plan for moving people efficiently through a combination of transport modes.

Allocation of space. Mixed transport streets, including active transport, public transport and cars can move far more people than solely car-orientated streets. Walking is the most space efficient mode of transport at 0.5m² standing still to 2m² in motion, followed by bike riding at 2m² parked to 5m² in motion at 15km/h; in comparison to a car at 20m² parked and 140m² in motion at 50km/h with just over one occupant (WHO 2022; Harms and Kansen 2018) (see Figure 11 for more detail on space by travel mode). Repurposing street space for the most efficient modes increases the total street capacity while reducing car use. The hourly capacity of a car-oriented street, where the majority of space is allocated to cars that are moving or parked and some to pedestrians is 12,300 people. However, the hourly capacity of a mixed transport street, with more space allocated toward active transport and public transport is 30,100 people (Global Designing Cities Initiative 2023).

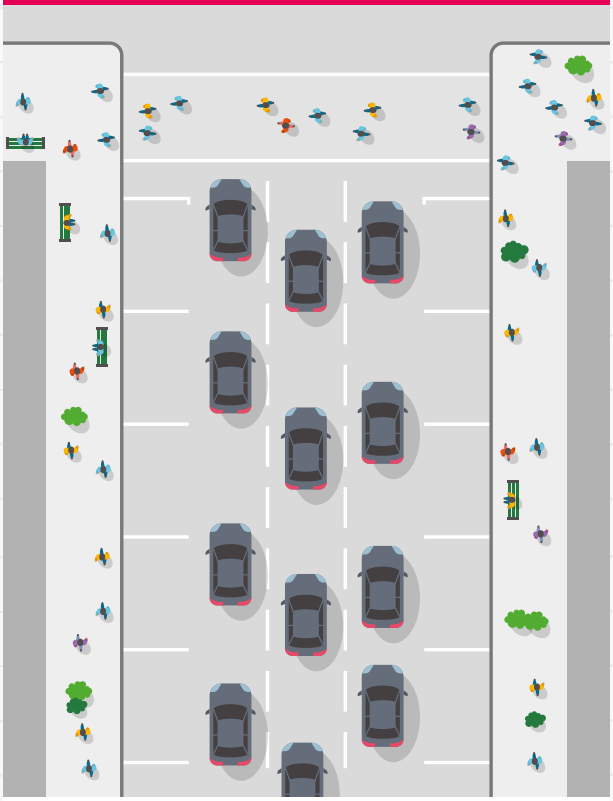
Prioritising the movement of people over cars can bring major productivity benefits by using our existing infrastructure to its fullest capacity. This is particularly important in Australia's big cities, where there may be limited space or community appetite to keep delivering new roads in urban areas as they densify.

Figure 11: Space requirements by travel mode.
Adapted from: WHO (2022) and Harms and Kansen (2018).

Figure 12: Mixed transport streets can move more people.

PRIORITISING PEOPLE (RATHER THAN CARS) ON OUR STREETS MEANS WE CAN MOVE MORE THAN DOUBLE THE NUMBER OF PEOPLE

CAR-ORIENTED STREET

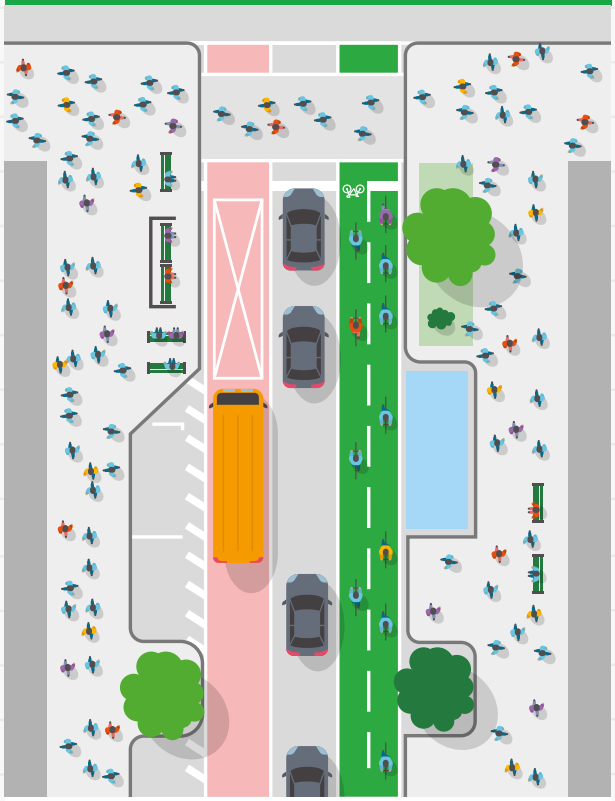


Hourly capacity of a car-oriented street

4,500	x	2 = 9,000 people
1,100	x	3 = 3,300 people

Total people capacity per hour **12,300**

MIXED TRANSPORT STREET



Hourly capacity of a multimodal street

8,000	x	2 = 16,000 people
1,100	x	1 = 1,100 people
7,000	x	1 = 7,000 people
6,000	x	1 = 6,000 people

Total people capacity per hour **30,100**

Adapted from: Global Designing Cities Initiative (2023).

To create a transport system designed around people, we need to understand where they are going, and the many reasons why they travel beyond the standard commute of yesteryear.

Well-designed active and public transport in practice. In practice, planning transport around the movement of people instead of cars requires an understanding of people's transport needs - where they want to go throughout the day, week and year; why they may be travelling; and how this travel may fit into their daily lives. Much of traditional transport planning is focused on getting commuters to and from major economic hubs at fixed times of day linked to 'standard' working hours. Far less consideration has often been given to the transport needs of people who may work outside standard business hours or do unpaid work with caring duties. Comprehensive and up-to-date data about all the transport needs across the community is an essential input for ensuring transport planning prioritises the movement of people over cars in the future. This will ensure that planning includes all people in the community and the different ways they move around.

When we plan for moving people instead of cars, we also need to think differently about urban streetscapes and the commuter experience. In particular, factors like safety, accessibility, weather proofing, travel distances, amenities along the way become much more important and need to be considered upfront when planning new or repurposed infrastructure.

Well-designed active travel networks involve elements such as:

- **Prioritisation of walking and bike riding** on roads through alterations to intersection and regulation of rights-of-way. E.g. dedicated traffic lights for bike riders, longer walk times for pedestrians at traffic lights, and diagonal crossings.
- **Safe, separated lanes for walking and riding**, such as off-road paths segregated from road traffic, with good lighting and clear lines of sight, accommodating traffic in two directions and with minimal obstacles.
- **Highly connected path infrastructure** that offers connectivity, continuity and directness. E.g. a network that connects residential areas with key destination areas via the most efficient routes, and has minimal gaps or 'missing links'.
- **Accessible pathways** with a continuous accessible path of travel that is consistent and predictable, including in gradient, surfaces should be as smooth as possible (without raised or cracking paving or tree root damage), with a slip resistant surface during dry and wet conditions and the minimum width for two wheelchairs passing is 1800mm. Where a hazard exists, hazard warnings will be included to alert people who are blind or have low vision.

- **Visibility and comprehensibility**, such as all walking and bike paths having recognisable pavement design and clear wayfinding.
- **Protection from weather**, such as shade and greenery for hot days, and weather protection for cold or wet ones.
- **End trip facilities and amenities**, such as showers, and bike or scooter parking, including for share programs.

Any user-friendly public transport network should involve:

- **Regular, reliable and frequent services** that run throughout the day and week, not just at peak times.
- **Network design that accommodates diverse destinations**, such as networks that resemble a grid or web pattern criss-crossing urban areas and networks that combine high capacity cross-city public transport links and local feeder bus services.
- **Priority on all roads**, including at intersections, merge points and other bottlenecks, to ensure public transport journeys are faster than driving.
- **Integrated network planning** with simple, coordinated timetables which enable commuters to quickly and easily switch from one route or mode to another, including "last mile solutions" (the last part of the user's journey, from a transport hub such as a train station or bus interchange to the final destination).
- **Integrated ticketing and fare regimes with affordable pricing**, involving systems which allow customers to purchase a single ticket for their entire journey and minimise any fee penalties when switching routes or modes, or subscriptions for which allow for unlimited travel for a fixed amount.
- **Clear information and wayfinding**, such as comprehensive public transport maps that are easy to use, effective signage at rail and bus stations, and available staff to assist, including when services change unexpectedly.
- **Visible safety features** to promote the comfort of all users, e.g. effective lighting, available transport personnel and women-only carriages or services.
- **Consistent accessibility features** to promote accessibility by all users, particularly for disabled and older people. E.g. dedicated seating, lifts and ramps to access stations, low floor buses and trains, visibility aids, priority drop off and pick up zones centrally located for those with mobility issues.

Sources: Aminpour 2022; CWANZ 2022; Healthy Streets 2022; WHO 2022; Climateworks 2020b; Lamu et al. 2020; Infrastructure Australia Audit 2019; Climate Council 2018; Mueller et al., 2018; Stone and Kirk 2017; Australian Human Rights Commission: Access to Premises 2014; Victorian Auditor General 2014).

BOX 2: ACTIVE TRAVEL IN AUSTRALIA

A global study which ranked the walkability of 25 cities found that less than half of the population in Sydney, Melbourne and Adelaide were in neighbourhoods above the median level of walkability (41.7 percent, 43.7 percent and 37.5 percent respectively). These scores compare poorly with people who live in Lisbon (99.2 percent), São Paulo (97 percent) and Hong Kong (96 percent) (Aminpour 2022; GOHSC 2022).

The Australian Urban Observatory has ranked 21 Australian cities by liveability, including measuring the percentage of the population with access to regular public transport within 400 metres. The rate varies significantly across the country, ranging from 23 percent in Darwin and Hobart, 46 percent in Perth, 48 percent in Melbourne, 57 percent in Adelaide, 61 percent in Sydney and 65 percent in Canberra (Gunn et al. 2020).

Active travellers, particularly bike riders, face significant aggression on our roads (Delbosc et al. 2019), with the majority of aggressors (85.7 percent in NSW) being motor vehicle drivers (Poulos et al. 2019). The majority of drivers surveyed (60-70 percent) self-reported engaging in minor aggressive behaviours such as expressing annoyance to other drivers and sounding the horn in anger, while more extreme behaviour such as chasing another driver when angry was less common, however still reported by 18 percent of the overall sample (Stephens and Fitzharris 2019). Aggressive driving can and often does lead to crashes (Conner and Smith 2014), and when drivers are aggressive the odds of being involved in a crash increase by up to 15-fold (Dingus et al. 2019).

Infrastructure and measures for complete streets and networks will help address safety and the practicality of active travel. These should be coupled with public awareness campaigns to promote active mobility and provide education and training on road safety and use. These campaigns can also help address psychological factors, such as habits and attitudes which influence decisions over modes of travel (Götschi et al., 2017). Examples include learning to ride a bike at school, campaigns on the benefits of active travel (National Center for Safe Routes to School 2022; WHO 2022; Carlson et al. 2020) and road safety. Counter-messaging and advertising which encourages fossil fuel and related product use should be banned or at least be accompanied by a warning label, such as billboards and television ads for heavily polluting ICE vehicles (The Driven 2023a; CommsDeclare 2022).

Street speeds and legal reform. Safety is a further key consideration when planning our transport system which gives greater priority to active and public transport modes over cars. Australian road speeds are currently too high in many urban environments where public spaces could otherwise be shared by vehicles and those on foot or bike. Lowering speed limits to 30 kilometres per hour (km/h) is considered best practice, or even 20 km/h when the space is shared with walkers (WHO 2022). This speed restriction is life-saving as pedestrians and bike riders currently make up a disproportionate share of road victims compared to their share of distance travelled. Crash risks per distance travelled can be 10-20 times higher for pedestrians and bike riders than for driving or public transport (Department for Transport 2019; Feleke et al. 2018). It is estimated that putting 30km/h speed limits on local residential streets would reduce the Australian road death toll by 13 percent (146 lives by 2021 road fatalities) (McLaughlin et al. 2021; van den Dool et al. 2017). Slower streets do not necessarily mean longer travel times, as the urban journey times are affected by other factors such as congestion and time waiting at lights. One study found less than a minute difference between a 50km/h and 30km/h speed limit for a 26 minute journey to work (van den Dool et al. 2019).

Shifting to a decarbonised and people-centred transport system may also involve legal reform. For example, the 'strict liability' approach that exists in France, Denmark and the Netherlands seeks to protect more vulnerable road users from more powerful road users. Such as the *'strict liability'* approach that exists in France, Denmark and the Netherlands, to protect more vulnerable road users from more powerful road users. Under this law, in crashes involving pedestrians or bike riders, unless it can be clearly proven the vulnerable user was at fault, the driver is found liable by default (Cycling Embassy n.d.), encouraging caution and care among drivers. Another aspect is updating *regulation around light electric vehicle technology* such as e-scooters, e-skateboards, e-bikes etcetera, for which different Australian jurisdictions currently have a range of different laws (see Leung and Bland 2022 for a breakdown by state and territory) including for people with disabilities. Updating regulation also involves considering the impact of electric personal transport on slower moving people, including older people and people with a disability. For example, using an e-skateboard as a mobility aid has only just been legalised following the campaigning of Mr Lyons in NSW (ABC 2023a). There should be no barriers to usage of mobility aids on public roads and paths, such as electric skateboards, wheelchairs and mobility scooters. Another consideration is the need to separate e-mobility paths from pedestrians potentially to be shared with bikes, due to differences in speed. Currently, e-scooters often obstruct footpaths, and can be hazardous to pedestrians when used on footpaths.

Lowering speed limits can be life-saving with pedestrians and bike riders making up a disproportionate share of road victims.

Figure 13: A number of trials for 30km/hr streets are being undertaken across Australia. For example, Western Australia's Department of Transport Safe Active Streets program began in 2015 and has developed 10 safe active streets with 11 more planned. These measures have resulted in significant increases in rider and pedestrian numbers (Bicycle Network 2022).

Road zoning. Alongside reducing the speed of vehicles on streets, roads can be zoned to maximise health and safety and reduce emissions. For example, low emissions zones, limited traffic zones (no cars except residents), car free zones and pollution barriers around schools (Walter and Say 2023, Whitehead et al. 2022, Verkade and Brömmelstroet 2022; Nicholas 2022). The introduction of anti-idling legislation and removal of engine idling time is the equivalent of taking 1.6 million cars off our roads (ABC 2021). This is due to the fact that in normal traffic conditions, Australians likely idle more than 20 percent of their drive time, which contributes between 1-8 percent of CO_2 emissions over the journey (Smit and Walter 2020).

Australia's streets today are car-centric and without significant change the barriers to building a more sustainable system will be perpetuated. Switching our paradigm for transport planning can unlock new ways of using public spaces and delivering transport infrastructure, to make using active and public transport the easy and enjoyable choice for more people, on more trips.

3.2 Structurally shifting public investment towards active and public transport

At the moment, the majority of transport infrastructure spending is directed to supporting the most emissions-intensive way of getting around - private cars. We need a structural shift in what governments fund and build, as well as how revenue is collected and spent across transport modes, so more Australians can take up cleaner transport choices.

The evidence is clear that building more roads to address car congestion is not the answer. Every time we increase highway lane kilometres by one percent, the total vehicle kilometres travelled also increases by approximately 1.2 percent (Garcia-López et al. 2021). Increasing road capacity only attracts more cars and increases car congestion by encouraging more car trips, as traffic fills the available road space (Climate Council 2018). Building more roads not only fails to address congestion challenges, but can also have a detrimental effect on society, the economy, the environment, and sites of cultural significance. A recent example of this was the destruction of the sacred Aboriginal 350-year-old Djab Wurrung Directions Tree that was cut down to make way for a highway upgrade in Victoria (ABC 2020). Looking overseas, Wales has placed a pause on all new-road building projects and an external panel has been established to review whether these are needed (The Guardian 2021).

Transport spending is ever increasing (above inflation)[4] and as we build new infrastructure to support the country's needs, it is critical that the projects in the pipeline reduce transport emissions and are in the interests of all. Particularly as transport infrastructure is long lasting - from a few years to over a century - and because what is built directly influences travel behaviour and the options available to us (Climateworks 2020c; Creutzig et al. 2016). As outlined in our 2030 mode shift scenarios, continuing with the **status Quo** - majority car travel, would see 63.1Mt CO_2e (34 percent increase in overall transport emissions from 2005 levels). However, **transformational and equitable action** - shifting toward public and active transport, would see 13.3Mt CO_2e (25 percent decrease in overall transport emissions from 2005 levels).

Alongside the amount of emissions transport modes enable while in use, whether it be more roads enabling greater tailpipe emissions from vehicles, or more public transport and active transport infrastructure

Australia's streets are car-centric today. However, with the right investment in public and active transport, they don't have to stay that way.

4 In 2021 the Federal Government announced a $110 billion (now $120 billion) commitment to infrastructure investment over ten years (AFR 2021) with a record $17.9 billion towards new and existing infrastructure projects in the March 2022 Federal budget (Treasury 2022). In 2021-22, 55 percent of infrastructure construction was in the transport sector (BITRE 2022a). Recent years have seen the 'era of megaprojects' arrive (Grattan Institute 2020). Ten years ago Australia saw its first transport project worth at least $5 billion and now many projects fall into this category.

to enable zero emissions journeys, emissions are also produced over the lifetime of the transport project. For example, during material production, material transport, construction, maintenance and use, and disposal of various transport infrastructures (Wei and Chen 2020; Lokesh et al. 2022). Emissions are released when fossil fuels are used to mine, refine, manufacture and transport materials and carry out the construction process, known as embodied emissions (Marsden et al. 2022). Key embodied carbon contributors are concrete, asphalt, steel, aggregates and pipes which account for over 96 percent of the embodied carbon in Australian road and rail projects (CEFC 2021) - much more of which is used in new and expansionary road and highway projects compared to active transport infrastructure. This is due to the fact that road projects are far greater in size and are designed for heavier loads, such as cars and trucks in comparison to bikes or scooters. New road infrastructure will almost certainly increase total carbon emissions, whereas by contrast, active and public transport schemes which can be designed to reduce overall emissions through the mode shift they deliver (Marsden et al. 2022).

Transport investment on public transport, active transport and roads should reflect the increased/decreased usage we want to see across each transport mode. For this reason, Climate Council recommends 50 percent of transport budgets be dedicated to public transport and 20 percent for active transport, in line with international best practice (Climate Council 2022, UNEP 2016). There is no doubt that this is a significant shift, as most states and territories allocate less than two percent of their budgets on active transport infrastructure like footpaths and bike lanes (Pojani et al. 2018). For example, in its 2022-23 budget, the New South Wales Government allocated just 0.2 percent of its transport budget on active travel which is around one tenth of the actual mode share (Bicycle Network 2023a). Active transport spending is often treated as an addition to major road projects and upgrades, rather than as standalone initiatives. Further, public transport investment is often highly ad-hoc, with occasional but very large investments in new train or tram lines obscuring an ongoing lack of investment to improve frequency, reliability and the overall passenger experience. A lot of the rolling public transport fleet is old, and a major, continued investment in new rolling stock is required.

This approach to investment needs to be turned on its head, with standalone active and public transport projects and consistent spending to improve existing services clearly prioritised across government transport budgets. Funding for accessibility of transport and built infrastructure must also be embedded in this expenditure.

BOX 3: DELIVERING WHAT AUSTRALIANS WANT

Australians support a clean transport system with greater options when it comes to electrified public transport, footpaths and bike lanes.

Polling by The Australia Institute (2022) shows almost seven in 10 Australians (69 percent) agree that Australia should have a National Transport Decarbonisation Plan. Three quarters of (75 percent) support electrifying bus fleets by 2030, alongside more than eight in 10 (82 percent) who want major capital cities to be connected via high speed rail. 80 percent support modifying and designing streets to encourage walking for all ages and abilities, and more than 6 in 10 (62 percent) support having a national subsidy scheme that provides 30 percent rebates for buying bikes, e-bikes or cargo bikes for work purposes (TAI 2022).

Polling for Climate Council by YouGov (2022) shows eight in 10 Australians (80 percent) believe governments should invest more in public transport. When surveyed on balancing budget priorities, almost eight in 10 (77 percent) want public transport, walking or bike-riding options prioritised in the budget; or want balanced spending between roads and these other options. This compares with just 16 percent of respondents who wanted road spending prioritised. Focusing on active transport, more than two-thirds (67 percent) of Australians think governments should deliver more footpaths and bike lanes across the country (Climate Council and YouGov 2022).

Similarly, there are a range of ways in which existing government policies subsidise personal car use, or fail to fully account for their many negative impacts. The social costs arising out of vehicle ownership exceed user fees and taxes (Gössling et al. 2022). Examples of these costs include: infrastructure construction and maintenance, free or subsidised parking, congestion delay, accident risk posed on other road users, noise pollution, air pollution, climate damage, soil and water quality, accidents (injuries, death, hospitalisations), health costs, resource requirements (to build vehicles and recycle resources), perceived dangers and discomfort, quality of life and tourism (Gössling et al. 2019; Gössling et al. 2022). The Federal Government subsidies around $0.42 for every litre of petrol and diesel sold in Australia, which is permanently embedded in the price of fuel for regular drivers (TAI 2021; TAI 2023a).[5] The government is also perversely encouraging the purchase of bigger and more polluting cars through the Instant Asset Write-off for businesses and the car concession in the Fringe Benefits Tax.

5 For some businesses this is also rebated through the Fuel Tax Credit Scheme, which is forecast to cost $7.8 billion in 2022-23, more than the $7.6 billion spent on the Australian Army (TAI 2023a).

Transport pricing. At the same time, Australia does not have any penalties for car pollution in dense urban areas, particularly during peak hour travel times, where air quality is poor due to the large number of private cars. Congestion charges for example, are increasingly being introduced in cities around the world to discourage the use of private cars, raise awareness of the true costs of their transport choices and encourage mode shift toward public and active transport (Walter and Say 2023; Whitehead et al. 2022; Nicholas 2022; WHO 2022; Grattan Institute 2019). Congestion charges can take a number of forms: cordon charging, where drivers pay to cross a boundary into (and sometimes out of) a designated zone, such as a CBD; corridor charging, where drivers pay to drive along an urban freeway or arterial road; and network-wide distance-based charging, where drivers pay to drive within a designated network or area, on a per-kilometre basis (Grattan 2019). Other considerations for road pricing reform could link to vehicle emissions or vehicle size. Another important aspect of road pricing is that it helps raise revenue to invest in sustainable transport modes. Congestion charging would mostly affect higher-income drivers and car ownership is lower for lower-income families (Grattan 2019). Regardless, any road pricing reform needs to be considered carefully to ensure chargers do not perpetuate or worsen inequalities, especially to those who face transport disadvantage or have no other alternatives. A universal feature of congestion pricing schemes for example, exempts emergency vehicles and disability permit holders, and there is a special case for people with impaired mobility and those on low incomes to access discounts (Grattan 2019).

Figure 14: Transport pricing and payment methods should be affordable, convenient and incentivise the shift towards cleaner transport options when they are available.

When it comes to public transport, Australian governments subsidise its cost through direct payments to system operators to make up the shortfall between fare revenue and operating costs. Most governments also provide some form of concessions to those who are more likely to need public transport such as young people, the elderly and those experiencing disadvantage. These subsidies are necessary to provide affordable transport for many people (Productivity Commission 2021). However, most jurisdictions use simple and ad hoc approaches to setting fares and subsidies, and could more effectively address equity or efficiency goals (Productivity Commission 2023; 2021).

A holistic rethink of how we charge commuters is required - in equitable ways that complement the diversity of how people get around, the affordability of transport, and the differing accessibility requirements people need. In particular, the design of fare structures could better account for the range of ways that people may use public transport - such as 'trip chaining' for parents and carers making multiple stops between home, school, work and services; and those travelling with multiple dependents. This includes consideration for different fare arrangements beyond pay as you go, such as subscription models which allow for unlimited access to differing transport modes for a fixed price. For example in Germany, the Deutschland-Ticket provides access to all local public transport from €49 a month (AU$81), covering regional rail, metro, trams and bus travel across the country (The Guardian 2023). A successor to the €9 a month ticket offered in summer 2022, the pilot project was a relief package developed to help relieve cost of living pressures. Companies in Australia, such as ODIN PASS, also offer transport subscriptions for MaaS, where an individual can sign up to different packages and get unlimited or discounted access to different transport modes for a fixed price no matter where they live (ODIN PASS 2023).

Where and how governments invest directly influences the transport choices Australians can make. For active and public transport to become the best and easiest choice for more people, we need to radically improve the quality of infrastructure and services. This can best be achieved through a major structural shift in the share of transport budgets directed to low and zero emissions types of transport.

3.3 Better integrating transport planning and land use planning

Two of the key factors shaping people's transport choices are time and convenience: *how long will it take me to get there,* and *how easy is the journey?* Prioritising the delivery of active and public transport over roads will go a long way to enabling more Australians to choose these modes more often. But another critical piece of this puzzle is designing our cities, suburbs and regions for maximum convenience and connectivity. If suburbs lack services and are located far from public transport hubs, personal vehicles will inevitably be the preferred transport mode. By contrast, if people can access life's daily essentials within a short distance and/or via efficient and well-connected active and public transport routes, these options will be chosen more often.

The way we plan and design our communities is a critical factor in how readily people can access life's daily essentials - and their transport choices.

Key transport and design features. A number of key factors should be considered to reduce car dependence and promote cleaner transport options in urban and regional planning (Giles-Corti et al. 2022; Giles-Corti et al. 2016).

In regional planning:

- **Destination accessibility** (regional employment, facilities and services accessible by public transport);
- **Distribution of employment** (a balanced ratio of jobs to housing); and
- **Demand management** (parking supply and pricing policies increase the attractiveness of alternative modes).

For local urban design this involves:

- **Design** (walkable catchments around activity centres which incorporate accessible public open space, street networks minimise distances between homes and daily living destinations, reduced traffic exposure and safe active and public transport networks and increased residential densities);
- **Density** (residential densities support the viability of local businesses and high-frequency public transport services);
- **Distance to public transport** (high-frequency public transport is located in walking distances from homes);
- **Diversity** (residential areas built with different types of housing and commercial, public and recreational opportunities); and
- **Desirability** (neighbourhoods are designed to be safe, attractive and accessible, where public transport is convenient, affordable, frequent, safe and comfortable).

All transport planning needs to consider affordability of public and community transport systems for users, and the accessibility needs of people with a disability and older people (see Section 3.5).

Sustainable transport by common destination. Measures and initiatives can be implemented according to common commutes to encourage uptake of active and public transport:

- **In workplaces** - to encourage remote work and avoid travel altogether; parking management, removal of spaces and car parking fees; infrastructure for free bike or scooter parking; end trip amenities such as showers; and discounted or free public transport provided by the employer (Whitehead et al. 2022; Nicholas 2022). In Brussels for example, employees who ride their (e)bike to work receive €0.27/km (AU$0.45) from their employer maxing out at €2,343 (AU$3,887) each year (Brussels Times 2023).
- **In schools** - walking and bike riding buses to get children to school safely; ride and walk to school incentives schemes; traffic safety and bike education and training; and advice and events to help students and parents take more sustainable routes to school (WHO 2022; Nicholas 2022). National Ride to School Day for example, is Australia's biggest celebration of active travel; in 2022, 370,777 students participated with 911 registered schools (Bicycle Network 2023b).

Figure 15: Lug+Carrie is an Australian company which offers ebike subscriptions. For a fixed fee, everything needed is included (the bike, maintenance, road-side assist and insurance). The company has been partnering with local councils to encourage riding to school, in Merri-bek local council for example there were 83 four week trials, 70 percent were women, 60 percent used to drive, 41 percent used their bike once or more a day and 78 percent are now more likely to continue riding for the school run (Lug+Carrie 2023).

Designing more sustainable cities. With 75 percent of the global population expected to live in cities in 2050, integrated land use and transport planning in our cities is particularly important (Münzel et al. 2021). Below are some examples of overlapping approaches being brought to life now in all corners of the world.

- The **"compact city"** is a high-density built environment with intensification of activities, shorter travel distances, more trees and animal life, efficient land use planning, diverse and mixed land uses with clear (non-sprawling) boundaries. The city is more space efficient as public and active transport are the primary modes and road space is repurposed to green space, cafes and stores. Examples include Amsterdam in the Netherlands and Copenhagen in Denmark.

- In the **"15 city"** people can fulfil their essential needs within a 15-minute walk or bike ride from their home. With greater greenery, bike lanes, community facilities, social housing, homes, workplaces, schools and entertainment closeby, the need for cross-city and other long distance travel is greatly reduced, as are CO_2 emissions, air pollution and noise levels. In Australia, the *Plan for Melbourne 2017-2050* is supported by the principle of 20 minute neighbourhoods (State Government of Victoria 2023) and Transport for NSW (2023) is planning for 30 minute cities and 15 minute neighbourhoods.

- In the **"superblock city"** motorised traffic is reduced in some areas of the block to provide space for people, active travel and green space. This design reduces air pollution, noise, heat-island effects (where the roads, buildings and infrastructure in urban areas absorb and re-emit the sun's heat and experience higher temperatures than natural landscapes) and increases green space and physical activity. It can also be done fairly easily in urban areas with a grid system, sufficient population and facility densities. Barcelona began introducing superblocks in 2016, with plans for over 500 in the future (Nanda 2019).

- In the **"car-free city"** unnecessary private motorised traffic is reduced with easy access to public and active transportation. The absence of cars reduces air pollution and noise, increases people's physical activity and access to green space, and increases the livability of neighbourhoods. Vauban in Germany is completely car free (Coates 2013), while other cities such as Hamburg also in Germany are planning to be car-free by 2034. Melbourne and Sydney have been proposed as ideal candidates (The Mandarin 2019).

Transforming what we already have.
While much of our urban infrastructure and housing is already built, it can be transformed to enable greater connectivity and access to transport options. One aspect is better distributing job and housing opportunities. Taking Sydney and New South Wales as an example, this would mean creating more jobs in the west which has a large population (e.g. moving the seat of government, Western Sydney Airport Development) and creating more housing in the east which has greater job opportunities (e.g. developments like Green Square with approximately 90,000 residents) (Levinson 2023). The NSW government's Six Cities Region vision hopes to develop the Lower Hunter and Greater Newcastle City, Central Coast City, Illawarra-Shoalhaven City, Western Parkland City, Central River City and Eastern Harbour City, with three seaports and three international airports, better job and housing distribution and key 24 hour corridors in and between our six cities (Transport for NSW 2023a). Further, in response to COVID-19, a number of cities adopted 15-minute city-style visions such as Portland, Seattle and Houston in the United States, Barcelona and Madrid in Spain, Paris in France, Shanghai and Guangzhou in China, Melbourne in Australia, Ottawa in Canada, Milan in Italy, Edinburgh in Scotland (see C40 (2023) for more detail).

Overall, a transport system which prioritises the movement of people, by investing in active transport and public transport over cars, requires close integration between land use and transport planning. Box 4 below further highlights how this approach could be applied in areas of our cities where it may not be possible to immediately change land uses.

Figure 16: Amsterdam, home to more than 35,000 kilometres of cycle paths, is a bike riding haven. Due to early activism in the 1970s, intentional urban planning policies allowed for people-friendly streets allowing for safer active transport.

BOX 4: CASE FOR BUS REFORM: MELBOURNE'S WESTERN SUBURBS

Melbourne's western suburbs (Wyndham, Melton, Brimbank, Hobsons Bay and Maribyrnong) have experienced some of Australia's fastest population growth rates. However, public transport services have failed to keep up with this growth and meet the community's needs. Households in this region suffer the financial burden of owning and running multiple cars. Despite lower incomes, there are many more three-car households in Melbourne's western suburbs than the inner-metropolitan average (ABS 2016).

Lawrie and Stone (2022) find that if the bus network was reformed, it would increase overall community access to activity centres within 30 minutes by more than 250 percent during weekday peak periods and more than 300 percent during evenings and on weekends. These major increases could be achieved with small capital investments. The steps to achieve it would include:

- Bus routes set in a grid at 1.5-2.0km intervals operating along major roads; meaning much of the region would be within 1km walking distance of a bus stop.
- Routes aligned to optimise access to major activity centres (such as shopping centres and service hubs).
- All bus services operate at a standard 10-minute frequency from 6am-9pm on weekdays, and 7am-9pm on weekends with very early morning and late evening services at a 12-minute frequency.
- Prioritising bus movement on roads, by separating them general traffic, with average bus speeds of 30km/h.

While the enhanced services described would require substantial capital investments, such an investment is consistent with many 'one-off' investments in freeway and road construction. Once established the enhanced network can be delivered at similar operating costs to current services.

BOX 4: CONTINUED

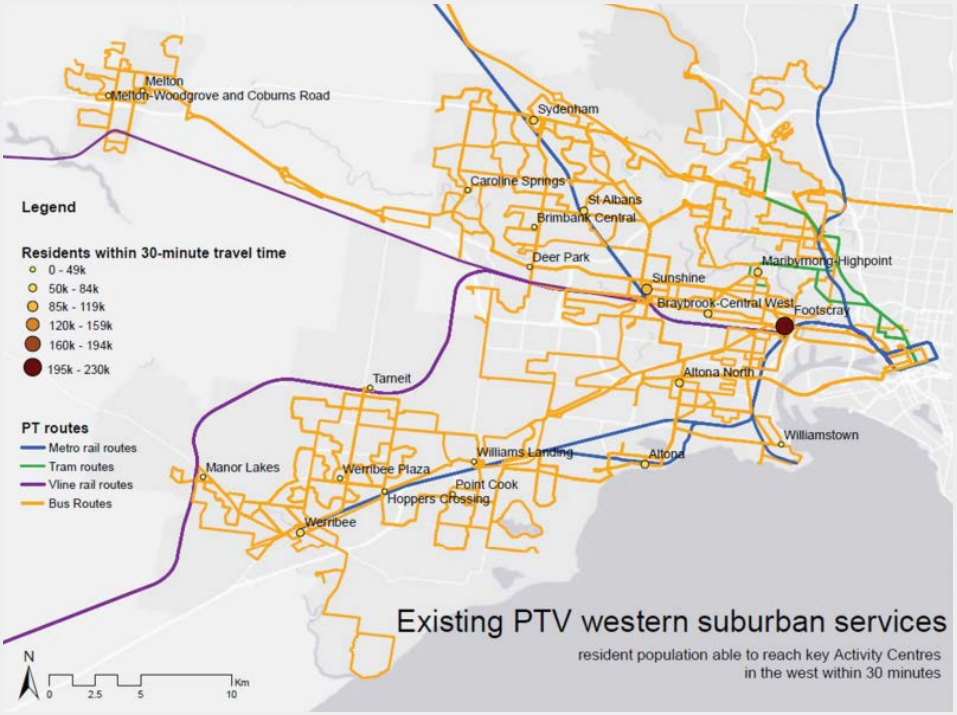


Figure 17: Existing western suburban public transport services and accessibility to key Activity Centres (Laurie and Stone 2022).

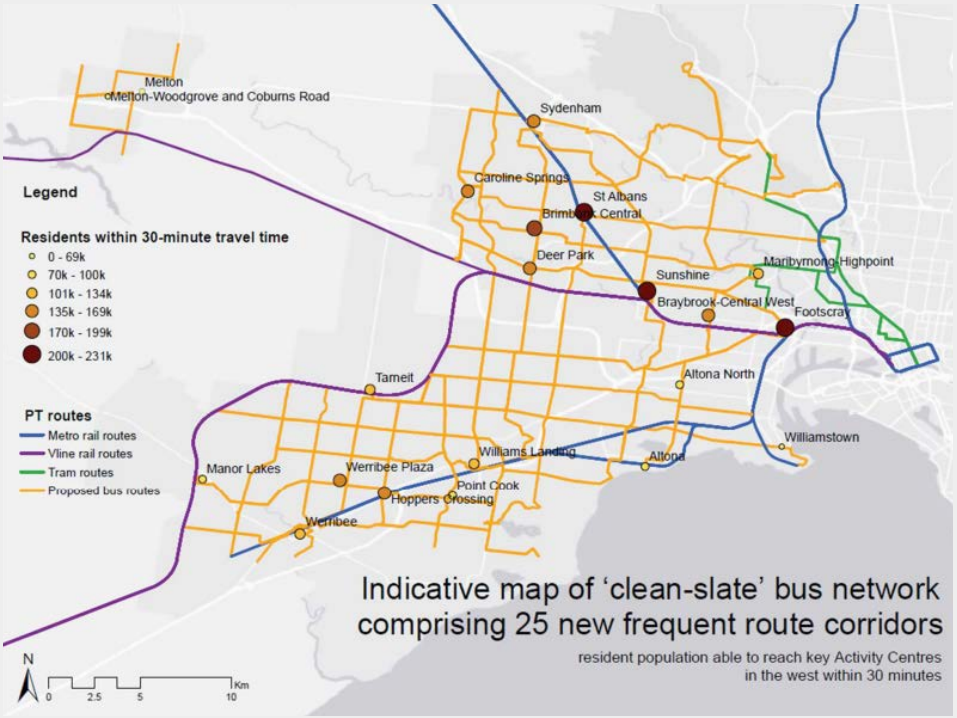


Figure 18: Indicative map of reformed bus network, comprising 25 new frequent service corridors (Laurie and Stone 2022).

3.4 Promoting equity of access for all and addressing inequalities

When expanding our sustainable transport system, there is an important opportunity to improve accessibility, inclusivity and equity of access by putting the diverse needs of all Australians front and centre. At the moment, there are many Australians who cannot use active or public transport because it does not meet their needs or abilities, and this will have to change as part of enabling major mode shift. There are a number of people nationwide of driving-age who do not or cannot drive, whether due to disability, choice, exclusion, do not have a driver's licence among other factors.

Figure 19: It is essential all public transport meets the accessibility standards and there are subsidies available to those who need to get around by private or shared electric vehicles. A review of the Disability Standards for Accessible Public Transport is underway from December 2022-June 2023 to assess progress on the standards, removal of discrimination and consider necessary amendments (DITRDCA 2022).

Transport disadvantage and transport poverty are terms used to describe the situation of households and individuals who struggle or are unable to afford to take the journeys that they need to make (Gates et al. 2019). They may have difficulty accessing public transport, face distances too great to travel by active means, and have financial difficulties maintaining private transport (Climateworks 2020b). There are three main and overlapping ways that transport is linked to inequality: where people live and the distribution of people with different levels of economic advantage; how opportunities (for example employment access) are distributed; and how accessible the transport system itself is (for example cost, proximity and scheduling) (Gates et al. 2019).

Transport is an important facilitator in social inclusion and wellbeing and intimately related to job opportunities, employment, education, cultural activities and essential services like healthcare (Climateworks 2020b; Gates et al. 2019). People's access to transport and uptake of particular options is influenced by a number of factors, such as availability, family, work and household circumstances, comparative costs, length of time required to travel and the directness of the route, comfort, convenience, social norms, and safety (WHO 2022; Climate Council 2018). Transport systems orientated around public and active transport modes create more connected and equitable communities. Equitable in this sense means that more people have viable transport options, which creates fewer barriers to work, education and engaging in community life.

Some groups are more likely to experience transport disadvantage than others, such as people with a disability; older and younger Australians; women; queer and gender-

Too many Australians don't have access to public and active transport options that suit their abilities - and that needs to change.

diverse people; families with young children; First Nations peoples; people experiencing unemployment; those on lower incomes; culturally and linguistically diverse groups; and those living in outer-urban and rural and remote areas (Rosier and McDonald 2011). Zero emissions transport and related infrastructure must consider diversity and be accessible to people of all mobility levels, abilities and needs. There needs to be a clear commitment to accessibility, which Australia is lacking. While the Disability Standards for Accessible Public Transport introduced in 2002 aimed to have all public transport and associated infrastructure fully accessible by the end of 2022, at best 50 percent of transport meets the standards (ABC 2023b). In NSW, a third of train and ferry stations are not independently accessible, 40 percent for Queensland Rail and Western Australia's train stations are not, and 73 percent of tram stops in Victoria do not meet the accessibility standards (ABC 2023b). Where public or active transport presents a challenge, on-demand services (Hughes 2023) and ride hailing services may be able to fill this gap.

There are particular challenges that different communities in our society face, which highlight the need to tailor transport experiences for all. For people with a disability - one in six people aged 15 and over have difficulty using some or all forms of public transport; and one in seven are not able to use public transport at all (Hughes 2023). Further, 35 percent of people who were surveyed and are blind or have low vision either had a collision or near-collision with an electric or hybrid vehicle (AAP 2023). Aboriginal and Torres Strait Islander Peoples have recorded higher levels of inaccessibility when compared to non-Indigenous Australians (NIAA 2017). Women generally drive less and are more likely to have extra domestic and care-giving responsibilities (Pojani 2022; Kalms and Korsmeyer 2017), while bike riding remains a male-dominated activity where men outnumber women two to one, and gendered barriers for exist for women such as lack of supportive infrastructure including inadequate lighting and lack of protected bike lanes (Pearson and Beck 2023). Safety is another key concern for women, queer and gender diverse people when using public transport and active travel, especially after dark.

There are some basic standards around accessibility that need to be met and are overdue. However, there is no single intervention that will increase equity of access to public and active transport, because the needs of Australians are diverse. That is why it is essential to involve people from a wide range of backgrounds when planning and designing transport infrastructure, and be open to addressing real or perceived barriers that may not be experienced by other groups. Active and public transport must be accessible for everyone, and that means communities should be far more involved in deciding how transport can be designed to best meet their needs.

3.5 Prioritising the electrification of transport

To help reduce transport emissions at pace, Australia should be putting in place infrastructure and policies that enable all public transport to be fully electrified by 2035 or earlier, while also reducing barriers to the rollout of electric cars for private and shared community use. This includes delivering the necessary charging infrastructure, establishing fuel efficiency standards, and equity-based incentives to drive down emissions from passenger vehicles and make it easier and cheaper to purchase an EV.

Despite state and territory commitments to zero emissions buses (Climate Council 2022), only 0.2 percent of the national bus fleet is electric (TAI 2023b). At the moment, the upfront costs of purchasing a battery electric vehicle (BEV) bus fleet is considerably higher than the diesel equivalent. However, in the long run they are cheaper to operate and their use would result in an immediate reduction in transport emissions. Analysis has shown that purchasing a BEV fleet in 2022 to service metro Melbourne, and factoring in a rate of grid decarbonisation consistent with achieving net zero economy-wide emissions by 2050, results in 74 percent less greenhouse gas emissions than an equivalent diesel fleet (Say et al. 2022).

To rapidly reduce emissions, all public transport fleets should be electrified and run on renewable energy.

BOX 5: POSSIBILITIES OF BUS ELECTRIFICATION

Australia's largest electrified bus depot (Leichhardt, NSW)

Early this year, Australia's largest electrified bus depot opened in Leichhardt in Sydney's Inner West. The depot is home to 55 electric buses, a 388 kW rooftop solar array, an onsite 1.25 MW/2.5 MWh Tesla battery, 120 kW DC fast chargers and 31 AC 80 kW chargers. The depot received $24.5 million from the Clean Energy Finance Corporation and $5 million from the Australian Renewable Energy Agency (The Driven 2023b). Leichhardt bus depot sets a blueprint for the 8,000 buses across the NSW network and nationwide.

Powering education (Maine, United States)

United States (US) Senator Angus King introduced the 'Bidirectional Act' to the US Senate in September 2022. The Act would create a program dedicated to deploying electric school buses with bidirectional V2G flow capability, in communities that need it most. Alongside the health benefits to the children and communities, the buses could improve electrical grid stability and reliability, and revenue from providing grid services could lessen initial costs for schools (Angus King 2022; Electrek 2022).

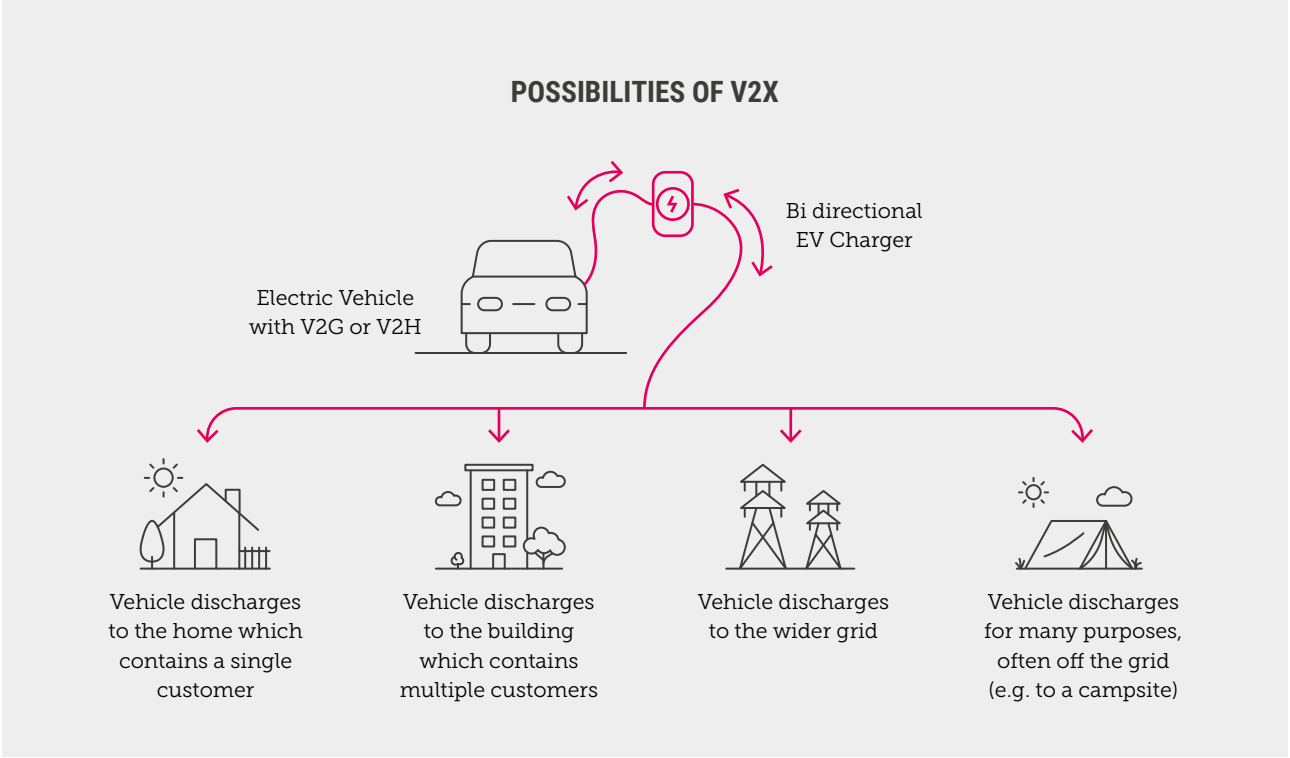
Figure 20: Investing in new Battery Electric Vehicle (BEV) buses and redesigning bus routes, as outlined in Box 4 in the western suburbs of Melbourne, will be able to connect greater numbers of people to clean transport options without the requirement for significant built infrastructure (such as train or tram tracks).

The electrification of private vehicles and public transport will place significant additional demand on the electricity grid as it undergoes a transformation from fossil fuels to renewable energy. In metropolitan Sydney for example, the electrification of all timetabled bus routes is found to require up to 945 megawatt hours (MWh) a day of electricity (Battery Storage and Integration Program 2023).

Fortunately, electrified public transport and private EVs do not need to be mere passive users of the grid. Rather, through vehicle-to-grid technologies and other similar technologies, they present a significant opportunity to get more battery storage into the system. An EV battery can be used to manage energy within a home (vehicle to home (V2H)), a building or microgrid (vehicle to building (V2B)), the grid itself (vehicle to grid (V2G)) or many other purposes (V2X) (Jones et al. 2021, see Figure 21). V2G has many benefits for the user and for the grid, such as frequency control, grid congestion management, and reducing energy prices. (Jones et al. 2021).

If all EVs in New South Wales as of 2021 had V2G capability, the fleet could provide a similar level of back up power capacity as the Hornsdale battery in South Australia (Jones et al. 2021). In fact, V2G technology could support all the world's short-term grid storage requirements by 2030, with a participation rate of just 12-43 percent (Xu et al. 2023). It should be noted that most EVs today do not have V2G capability.[6] However, work by a number of organisations and universities is underway to understand more about the opportunities of integrating EVs into our electricity grid (see the EV integration project from University of Melbourne and RACE for 2030).

Figure 21: Possibilities of V2X. **Sources:** Clean energy reviews (2023), Jones et al. (2021).



6 The only fully electric car with V2G capability in Australia is the Nissan Leaf (Solar Quotes 2023).

Electrifying all our transport will reduce costs in the long-term for those who run transport systems, as well as those who use them.

Alongside enabling the integration of EVs with Australia's grid, we need to address the current lack of choice and affordability of EVs in the Australian market. Electrification of shared transport and the associated charging infrastructure is also crucial. For example community transport, ride-hailing (e.g. Uber), taxis, car-sharing, and vehicle hire. A major barrier to electrification is access to dedicated locations with charging infrastructure.

Introducing fuel efficiency standards is an essential policy lever to incentivise vehicle manufacturers to bring more cheap, clean EVs to Australia so more people can buy them. Strong fuel efficiency standards:

- are mandatory for all manufacturers selling in the Australian market - voluntary standards will not be sufficient to drive rapid change;
- can be implemented as soon as possible - as every vehicle sold today will be on the road for 10 years or more;
- ensure *Paris Agreement* commitments remain within reach by seeing 100 percent of new vehicles sold being zero emissions as soon as possible (and not later than 2035);
- deliver the actual headline emissions reduction stated - without being watered down by credits and loopholes for manufacturers;
- address the recent trend of Australians buying larger and heavier vehicles and avoid inadvertently encouraging an ongoing shift to these vehicle types; and
- are supported by enabling policies - including tax policy, incentives, charging and equity initiatives.

The electrification of public and community transport, and use of private and shared electric cars where needed especially for people with a disability or the elderly, is an essential step in cutting transport emissions. However, on its own this will not be enough to drive the deep cuts to harmful carbon pollution needed this decade. Think of it like this: many Australian households have two ICE cars in the garage today. If we get the policies and investment right, in future for households in urban areas with plentiful public transport and active transport infrastructure, both of these cars could be replaced with zero emissions transport and an EV hailed or hired when needed. For households in outer suburban, rural and remote areas or people who have mobility challenges with public and active transport, one of those cars could be replaced by an EV and the second one by other forms of available transport if possible - like public transport, walking and riding. This would cut household bills and emissions at the same time, while making our cities much more liveable.

Pursued together, these five enablers can completely reshape how Australian transport is designed, planned and delivered to make it far easier for people to choose the cleanest modes. So what will it look like when we do this?

Figure 22 (opposite page): Creating zero emissions ways of getting around for everyone, means that accessibility needs for people with a disability to be embedded into our transport system - in all public transport; in shared vehicles and community transport; in private vehicles; and all surrounding infrastructure.


VOLGREN

4. From vision to reality

Having established that the path to cleaner personal transport in Australia involves a big shift from private vehicles to public and active transport and explored the key enablers of this, in this final section we take stock of some key policies, investments and technologies that can get us there.

This section should be considered a checklist for best-practice investments and initiatives that can make it far easier for people to choose active and public transport, together with EVs when a private car is needed. Governments at all levels should consider their current initiatives and investments to identify gaps and opportunities to further enable major mode shift.

Figure 23: The success of Barcelona's Bicibus (pictured below) has sparked similar schemes in Glasgow, Scotland and Portland, United Stated.

4.1 Active transport

WALK OR ROLL

- Person walking, including with mobility aids
- Person in wheelchair
- Skateboard

BIKE

- Unpowered
- Ebike
- Ecargo bike
- Tandem/family bikes
- Etrikes

SCOOTER

- Unpowered
- Electric

Goals:

- Increase active transport from 5 percent today to 15 percent by 2030
- Increase spending to 20 percent of transport budgets dedicated to active transport, from now

Focus actions:

- Prioritise walking and bike riding on our streets
- Improve safety - including 30km/hr roads, dedicated walking and bike lanes separated from traffic
- Boost convenience and ease - including priority of access, end trip facilities and parking
- Improve connectivity of walking and bike lanes - with each other as well as key locations
- Deliver public awareness campaigns to promote and normalise active transport for a range of daily trips
- Improve the accessibility of built active travel infrastructure

"Successful and sustainable promotion is the sum of many, often small improvements, each of which makes walking and cycling a bit more appealing to some people, for some trips, in some situations, on some days."

— WHO 2022

ESTABLISHED AND EMERGING SOLUTIONS:

Status	Solution
Established	**Safe, accessible, connected and convenient active transport infrastructure** - Slower travellers should be prioritised on our streets, with adequate space and quality footpaths and bike paths to encourage active travel. This is tied to many of the focus actions above and features outlined in Section 3.1, such as: ensuring footpaths meet accessibility standards for people, dedicated footpaths and bike paths which are separated from traffic and 30km/hr roads in shared zones for example.
	Bike and scooter sharing programs - Bike sharing programs originated in the 1960s in Amsterdam and have since evolved to include smartphone access and other advanced features. Today there are over 3,000 bike sharing systems worldwide and nearly ten million shared bikes (PBSC Urban Solutions 2021). Bike sharing programs can reduce barriers to upfront costs, eliminate personal storage needs and provide a last-mile solution in combination with public transport.
	Light electric vehicles (LEVs) - These are mobility devices too small or lightweight to conform to car design standards, which are powered by electric motors (Roth 2020). These include micromobility options - LEVs less than than 60kg and up to 250kg and generally with speeds limited to less than 25km/h, such as e-scooters, e-skates and e-bikes (Roth 2020; Eltis 2020). Other slightly faster and heavier LEVs include speed pedelecs (e-bikes speed limited in Europe can go up to 45 km/h) and mopeds (limited to 45km/h in Australia and New Zealand). A study in Germany found LEVs could replace up to three quarters of German car trips, which would reduce vehicle kilometres travelled by 50 percent, resulting in 44 percent less CO_2e from conventional motor vehicles (German Aerospace Center, 2022). LEVs have been included under active transport, as many smaller EVs such as e-bikes rely in part on the rider peddling or pushing, assisted by an electric motor. However, some LEVs are fully motorised. It is also important that these devices meet safety standards, particularly to minimise fire risk. E-scooters and e-bikes in particular present an exciting opportunity for sustainable mobility. It is estimated that with one kilowatt hour of energy an e-scooter can travel 100 times the distance a petrol car can, and 17 times the distance of an electric car (Leung and Bland 2022). Studies in North America and Canada estimated e-bike adoption could result in approximately 225 to 460kg CO_2 net emissions reduction per person, per year (McQueen et al. 2020; Berjisian and Bigazzi 2019). Personal use of an e-bike has also been shown to be linked with a reduction in motorised vehicle use (Bourne et al. 2020). A Dutch study found that people who purchased an e-bike increased their bicycle use from 2.1 to 9.2 km per day on average, representing a change in bike as share of all transport from 17 to 49 percent (Fyhri and Sundfør 2020). E-bikes use less resources in comparison to EVs - e-bike batteries use about 30 cylindrical lithium-ion cells while a Tesla 3 uses 4,416. In other words, one car battery uses the same materials about 147 e-bike batteries do. Five times more e-bikes were sold in Australia than electric cars in 2021-22, with sales growing more than 800 percent to 75,000 in the five years to 2021-22 (WeRide 2022).
	Walking school bus or the 'bicibus' - The 'bus' travels along a set route to or from school, picking up or dropping off children at designated 'bus stops' and ensuring children are safe when walking or bike riding to school (read more about how to start a Walking School Bus at Your Move (2023)). In Barcelona for example, there is a bike bus or 'bicibus' which allows hundreds of children to cycle to school in convoy which takes over the stress in Spain's second largest city. The citizen-led project, supported by Barcelona City Council began in March 2021 with just one route; it now has 15 routes and road safety is ensured by a police car escort and volunteer parents (Garcia 2022). The RideScore Program is another intervention encouraging children to walk, bike and scoot to school. A collaboration by the Sunshine Coast Council and WeRide Australia - smart sensors are attached to children's bikes or scooters and inform parents or carers when their child has arrived at and departed school, and trips track to milestones and provide reward incentives to children for active travel (RideScore 2023).

4.2 Public transport

 **BUS**

 **TRAIN**

 **TRAM**

 **FERRY**

Goals:

- Increase public transport from 14 percent today to 49 percent by 2030
- Increase spending to 50 percent of transport budgets dedicated to public transport, from now
- Fully electrified public transport fleets by 2035 at the latest, ideally by 2030

Focus actions:

- Improve service frequency and reliability - particularly for trips between suburbs and regions which do not involve travel via CBDs
- Redesign routes and networks based on up-to-date data and insights about travel patterns now
- Improve integration between modes of public transport to deliver more seamless end-to-end journeys
- Improve actual and perceived safety - particularly for women, young people and people from diverse communities
- Ensure public transport and surrounding infrastructure is accessible for people with a disability or older people
- Address affordability and pricing of public transport to ensure cost is not a limiting factor
- Deliver public awareness campaigns to promote and normalise public transport for a range of daily trips

ESTABLISHED AND EMERGING SOLUTIONS:

Status	Solution
Established	**Electrified public transport** **Bus** - The number of electric buses within public transport fleets are growing slowly. ACT plans to electrify its entire bus fleet by 2040, NSW by 2047, while Queensland and Victoria will buy only electric buses from 2025 and 2030 respectively. SA, WA, NT and TAS have not yet made any commitments on bus electrification (Climate Council 2022). **Train** - Most inner-city and suburban trains in Australia are electric, although rural and freight trains are diesel powered. **Tram** - All trams are already electric and as we decarbonise the energy system this will increase the sustainability of this transport mode. **Trackless trams** - This technology takes the best features of light rail, including higher speeds, capacity and ride quality, while minimising the disruption and cost of installing rail tracks. The first trackless tram arrived in Brisbane in April 2022, one of 60 that are expected to transport passengers on Brisbane roads. The 24.5 metre long lighTram can carry 150 passengers at one time (The Driven 2022). **Ferry** - There are calls to replace Sydney's ageing RiverCat ferries with electric-powered vessels although no commitment has been made yet (ABC 2023c). The first fully electric, high speed passenger ferry in the Southern Hemisphere began operation in New Zealand in March 2022 (Greater Wellington Te Pane Matua Taiao 2021). **Mobility as a Service (MaaS) -** This concept combines mobility services from public transport, taxis, car rental and car/bicycle sharing under a single platform accessible from a smartphone (Sipe and Pojani 2018) to plan, book, and pay for transport modes and services in one place (ITS 2018), with pricing models from pay-as-you-go through to unlimited transport options. On-demand transit is a part of MaaS - flexible services that do not follow fixed routes or timetables and riders can book a trip using an app, via phone or online, for a cost similar to a bus fare. Vehicles are often smaller buses, or larger vans (Kaufman 2020). Since October 2017, there have been 36 on-demand trials across Australia providing over one million rides to residents. MaaS can fill a crucial transport gap for those in outer-suburban, regional, rural and remote areas and is already playing a role for people with a disability and older people that face mobility challenges (see Box 7) and as outlined below in community transport. **Community transport** - Includes services for eligible seniors, pensioners, those with accessibility needs or those who have limited access to public transport. It is a form of MaaS that is tailored for accessibility, in addition to door to door transport to users' destinations and flexible pick up times, community transport also has - vehicles suitable for wheelchairs and people with specific mobility needs, trained drivers to assist users to and from the vehicle, assistants who can help carry shopping into people's homes, multilingual staff or resources to support diverse language needs (Transport NSW n.d.).

Status	Solution
Emerging	**High speed rail** - A form of transport that has captured many Australians' imaginations, however is yet to be realised. The High Speed Rail Authority Bill 2022, is an important first step in the Federal Government's commitment to establish the High Speed Rail Authority that will guide the development of a high speed rail network in Australia. However, transport experts warn a high speed railway from Brisbane through Sydney to Melbourne has little chance of passing any cost-benefit analysis and would be far too expensive. An alternative proposal for the Sydney to Melbourne train journey could slash the trip from 11 hours to six, at a fraction of the cost of high-speed rail plans if sections of the track were upgraded for medium speed rail. While a high speed rail line would take decades to build, laying just 200 kilometres of new, straighter track to replace an existing 250 kilometre stretch of steam-age railway would deliver quicker services in four years (news.com.au 2023; The Guardian 2022).
	Large electric ferries - An Australian firm, Incat Tasmania, is building what could be the world's largest electric ferry at 130 metres to carry 2,100 passengers and 226 vehicles. The vessel is expected to be launched in 2025 (Perthnow 2023).
	Renewable-powered trains - The Byron Bay Solar Train is the first train in the world to be 100 percent powered by solar energy. With a 6.5 KW custom curved solar array on the roofs and carriages which feeds the on-board 77kWh battery storage system, it has capacity to provide storage for 12-15 trips and carry almost 100 seated passengers (Climate Action 2017, Byron Bay Train 2023). 'The Infinity train', a project under development by Fortescue and Williams Advanced Engineering, is a train on batteries that also recovers energy on downhill sections, removing the need for additional renewable energy generation and recharging infrastructure (Railtech 2022).

BOX 6: COMBINING PUBLIC AND ACTIVE TRANSPORT

Providing infrastructure that connects different modes of sustainable transport is an important factor in enabling mode shift. This includes connection to 'last mile solutions', such as bike or scooter parking at train stations or bus interchanges, or space allocated for bikes on buses and trains, either inside or outside.

Bikes on Buses in the Bush trial

Bikes on Buses in the Bush was trialled in Queanbeyan and Yass (NSW) from December 2021 to March 2022, allowing users to combine a bike ride with a bus trip. Bike racks designed to take two bikes were fitted to buses on three routes. Beyond the benefits of active travel, this integration with bike riding increases convenience, reduces congestion and emissions. Initial research suggests the scheme may also appeal to those not currently using public transport (Transport NSW 2022). An earlier trial for Wagga Wagga (NSW) was placed on hold, with a need to address safety concerns. However, the community and bus operators were 'very supportive' and more than 400 people responded to the initial survey with 100 registering to take part in the trial (Transport NSW 2021).

Bike parking at train stations, bus stops and on the streets

Bike and scooter parking is critical infrastructure to ensure the convenience and peace of mind for active travellers when they arrive at their destination. While on street and venue parking for cars is provided by default, this is not the case for bikes and scooters. However, this is something that can be easily addressed with a fraction of the space allocated for cars - as one parking spot provides space for approximately ten bikes (Cyclehoop 2019, see Figure 27). Ample bike parking infrastructure should be available at major public transport hubs and venues, such as train stations (as seen in Figures 25 and 26 at the Nagano train station in Japan), common commute destinations such as workplaces, schools, universities, essential services and recreational venues such as beaches and parks.

Figure 24: People often use a combination of travel modes to get to their final destination and innovative measures like bike racks on buses can help reduce barriers to incorporating active travel and enable convenience.

BOX 6: CONTINUED

Figures 25, 26 and 27: Top two figures of Nagano train station in Japan which features significant bike parking infrastructure, making the last mile of the trip far easier. Bottom picture is of Cyclehoop bike parking which illustrates how many bikes can be docked in a single car parking spot.

BOX 7: ON-DEMAND SERVICES TO IMPROVE SERVICE AVAILABILITY OUTSIDE MAIN SERVICES

On-demand transport services can fill gaps in public transport, especially for people with disabilities or elderly people with more limited mobility. Making buses and other vehicles accessible is only one aspect of transport accessibility, noting that public transport journeys begin before we board the service and continue after we have left them. By providing greater flexibility, on-demand transport offers potential solutions to some of these issues, as users can travel between any two points at any time. Information through users' profiles can help reduce the need for people to restate their mobility needs.

On-demand services for people with disabilities and those in regional areas are already being used, for example:

- Rural and regional NSW services in the Far West (Ivanhoe to Hay, Collarenebri to Narrabri, Tottenham to Dubbo), New England North West (Moree), North Coast (Coffs Harbour, Northern Rivers), Riverina Murray (Burrumbuttock, Walla Walla and Jindera to Albury, Holbrook), South and East Tablelands (Sapphire Coast and South Coast to Canberra) (Transport for NSW 2023b).
- The FlexiRide on-demand bus service in Victoria has a focus on connecting outer suburban areas to key hubs such as train stations and shops, servicing areas such as Croydon, Lilydale, Melton South, Mooroolbark, Rosebud, Rowville, Tarneit North and Woodend (Public Transport Victoria 2023).
- The Flexible Bus Service is made up of wheelchair accessible minibuses and operates in five zones to help Canberra residents, such as people with mobility difficulties or the elderly, to get around (Transport Canberra 2023).

4.3 Electric vehicles

PASSENGER CAR	MICRO-EVS	TWO-WHEELERS	THREE-WHEELERS
› Passenger	› Very small car	› Motorbike	› Rickshaw
› SUV		› Sit on scooter	
› Ute			

Goals:

› Decrease car use from 81 percent today to 36 percent by 2030

Focus actions:

› Improve infrastructure for charging for private and shared EVs - both public and residential, including ensuring accessible charging points

› Pursue policies and incentives that ensure EVs are affordable and available to those most in need of a private vehicle

› Redesign regulatory and fee arrangements to prioritise and incentivise uptake of EVs over fossil fuel powered vehicles

ESTABLISHED AND EMERGING SOLUTIONS:

Status	Solution
Established	**Ride sharing** - A form of car pooling which connects drivers and passengers with similar origins and destinations. Projections show ride sharing can significantly reduce emissions. However there can be unintended consequences, such as people switching from public transport to ridesharing, or travelling longer distances (Yin et al. 2018).
	Ride sourcing/ride hailing - This connects drivers and passengers on demand and as a paid service (e.g. Uber, DiDi). The introduction of ride sourcing platforms can add to congestion and attract passengers away from public and active transport. By one account, they can create 69 percent more pollution than the trips they replace, compared to a private car trip a non-pooled ride-hailing trip produces 47 percent more emissions (Union of Concerned Scientists 2020). These increased emissions are due to the distance a ride-hailing vehicle travels without a passenger between rides and that ride-hailing is not just replacing personal car trips but increasing the total number of cartrips (Union of Concerned Scientists 2020). However, efforts are being made to reduce emissions from ride sourcing. For example, Uber partnered with the financing firm Splend to secure 500 Polestar 2 electric cars and offered discounted loans to drivers in NSW (The West 2022). The company is also exploring ways to enable sustainable transport through their 'car light' pilot, encouraging Australians to give up one of their cars for a month (Uber 2023).

Established and emerging solutions:

Status	Solution
Established	**Car sharing** - Allows drivers to rent their vehicles for short periods of time (e.g. GoGet, car next door). This embodies the mentality of switching from ownership to usership and provides access to a car for when it is needed. Rethinking transport means questioning our relationship with cars, from one of ownership to usership. As it is, private vehicles remain parked 95 percent of the time (UN Habitat III 2016) and when they are moving their average occupancy rate is well below two people per car, despite most cars having four seats. Shared mobility has the potential to offer environmental gains, such as fewer trips, mode shifts, distance reduction and less need for parking spaces (Muchado et al. 2018) as well as social benefits for those who would otherwise be unable to use a car when needed.
	Support for EV uptake - Policies and incentives to support uptake of EVs where people need a private vehicle such as: shifting the basis for registration from a vehicle's weight to its emissions intensity, where drivers can access lower fees for lower emissions across any motor type as in the ACT (2023), exemption from taxes such as stamp duty and the Fringe Benefits Tax, a higher Luxury Car Tax threshold for EVs compared to ICEs, and NDIS funding available for people with a disability to purchase an EV and for modifications consistent with existing standards. 'Cash for clunkers' programs for people to trade in an ICE vehicle for a discount on an EV, or for an e-bike or cargo bike (such as in France, Finland, Denmark and the Netherlands) or for free public transport (such as in Barcelona Clean Cities Campaign 2023). Fuel Efficiency Standards which cover 85 percent (DITRDCA 2023) of the global car market and in consideration by the federal government will also incentivise more EV models and greater affordability in Australia.
	Electric motorbikes, sit-on scooters and mopeds - Are the EV equivalent of their ICE counterparts. Similar to EV cars, household vehicle manufacturers are offering electric alternatives, such as Harley Davidon's Livewire model with a 146 mile range and a speed of up to 120m/h; and Vespa's Elettrica has a 100km range and a speed of up to 70km/h. Australian companies are also pioneering the way, with FONZ moto producing electric motorbikes and scooters and Super Soco producing scooters and mopeds. Mopeds are a type of small motorcycle that generally have a larger engine than a scooter.
	Electric rickshaws - Are three wheelers with a motorcycle at the front and have benches, seats or cargo space in the back. With fully enclosed boxes or more open options with a canopy, rickshaws are made for low speeds in urban settings. In 2022 half of the rickshaws sold in India were electric, and last month Indian manufacturer Mahindra manufactured its 50,000th e-Alfa electric rickshaw which retails at less than US$1,800 (The Atlantic 2023). The Mahindra Treo Electric Rickshaw is a three seater, with a range of 141km and a top speed of 55km/hr (E-Vehicle Info 2023).
Emerging	**Grid storage and integration** - Through V2G and V2H capabilities, EVs can power their homes and feed back to the electricity grid. Few fully electric cars have V2G and V2H capability, which should be rapidly expanded.
	Electric micro cars (also known as micro-cars, mini EVs, neighbourhood electric vehicles (NEVs) and low speed vehicles (LSVs)) - Are lightweight, small electric cars. The global micro EV market size was valued at US$8.2 billion in 2021 and expected to grow to US$22.11billion in 2029 (Fortune Business Insights 2021). Micro cars emerged in Europe 50 years ago but failed to gain market share as the fuel crisis receded and more speed and power was favoured (Roth 2020). Examples of micro EVs currently on the market include the Acrimoto - two seater, three wheels, weighs 550kg, driving range of 160km, speed of up to 120km/h; and the Eli Zero - two seater, weighs 398kg, driving range of 120km, and speed of up to 40km/h. (Electrek 2023; Roth 2020).

Figure 28: For a number of high priority groups, such as people with a disability, older people and those living regionally or rurally for example, public and active travel may never be an option. Electric vehicle policies for cars and associated infrastructure should be mindful of this gap and ensure no one is left behind. Pictured above is part of the Queensland Electric Super Highway in Rockhampton, regional Queensland.

Ready to talk about active and public transport with your community?

The Climate Council has developed a communications guide with evidence-based advice for sustainable transport advocacy (Climate Council 2022). Informed by the latest Australian research with both qualitative and quantitative aspects, the recommendations follow best-practice climate communications: values led, people first and solutions focused.

The golden rule: talk about the greater good - not benefits dependent on individual behaviour change. A common argument raised is that walking, using a wheelchair, bike-riding or public transport is not for everyone (ie. "not for me"). To people who use public or active transport options infrequently, it is much more compelling to hear about the greater good to society at large (such as ensuring everyone can get around easily, especially those who do not or cannot drive), rather than being convinced by potential personal gains (i.e. possible yearly personal cost savings) (Climate Council 2022).

For detailed examples of what to embrace and avoid when it comes to communicating about active and public transport see Climate Council's guide:

Sending the Right Signal: How to Effectively Talk About Sustainable Transport.

Figures 29, 30 and 31: Bike riding comes in many shapes and forms, to suit a range of lifestyles and life stages - a share bike, e-bike, cargo bike or tandem bike.

5. Summary of recommendations and focus actions

With solutions readily available today, decarbonising personal transport represent a significant opportunity to prevent further climate harm while delivering wide-ranging benefits for Australians.

Throughout this report, we have discussed a range of actions and opportunities which could set Australia on the path to cleaner transport. The top priority policy recommendations for government action are summarised below, followed by a consolidated list of focus actions which will make choosing clean transport modes more appealing and accessible for all Australians.

Recommendation:

1. Structurally shift investment to drive a major increase in active and public transport investment

The share of spending directed to different transport modes should reflect the priority each of these needs in our future clean transport system:

- 50 percent of transport budgets spent on public transport, embedding funding for increased accessibility
- 20 percent of transport budgets spent on active transport, embedding funding for increased accessibility
- Remainder spent on transport projects which improve access and availability for those who face the greatest barriers, such as infrastructure linking outer suburbs and regions to transport and service hubs

Recommendation:

2. Review and reform transport pricing to ensure it is equitable, affordable and encourages the mode shift required

This includes consideration of road pricing such as congestion charges, public transport fees and payment methods, and the costs of shared and community transport.

Recommendation:

3. Electrify all public transport by 2035 at the latest, and ideally by 2030

This includes delivering the necessary charging infrastructure and factoring in opportunities and requirements for EV grid integration.

Recommendation:

4. Implement fuel efficiency standards

Incentivising manufacturers to bring more affordable zero emissions vehicles to Australia will be essential for achieving the uptake of EVs needed to decarbonise those trips that still need to be taken by private vehicle. Fuel efficiency standards are the missing piece of the puzzle to boost supply and give Australians more access to affordable EVs.

Recommendation:

5. Develop a National Transport Decarbonisation Plan

Building on current commitments, a holistic, national and coordinated approach will be needed to achieve mode shift on the scale explored in this report. The Australian Government should lead the development of a National Transport Decarbonisation Plan in partnership with state, territory and local governments, designed around the following:

- An agreed emissions reduction target or trajectory for the transport sector as a whole by 2030, consistent with the scale and pace of action needed to avoid the worst impacts of harmful climate change
- Achieving mode shift targets and reducing car dependency on the scale required to rapidly reduce transport emissions

5.1 Focus actions

Action	Supporting uptake of... Active transport	Public transport	EVs
Implement road zoning - such as low emissions zones, limited traffic zones, car-free zones and pollution barriers around schools to lower emissions and encourage public and active transport	✓	✓	✓
Supporting the development of emerging clean transport technologies and initiatives and the role they can play in the transport mix - e.g. MaaS, electric micromobility, car sharing programs, bike and e-scooter sharing programs and adequate parking infrastructure	✓	✓	✓
Prioritisation of walking, bike riding and public transport on our streets	✓	✓	
Improve the accessibility of public and active transport and associated infrastructure	✓	✓	
Deliver public awareness campaigns to promote and normalise zero emissions for a range of daily trips	✓	✓	
Improve safety - including 30km/hr roads, dedicated walking and bike lanes separated from traffic, which are well lit - both actual and perceived, particularly for women, young people and diverse communities.	✓	✓	
Implement measures and initiatives at common commuting destinations to encourage uptake of active and public transport - such as schools, universities and workplaces	✓	✓	
Implement road charges to encourage public and active travel over car use - such as congestion charges and idling charges	✓	✓	
Review traffic laws - such as implementing a 'strict liability' approach to protect more vulnerable road users from more powerful road users, alongside legalising light electric vehicles	✓	✓	
Improve connectivity of walking and bike lanes - with each other as well as key locations	✓		
Boost convenience and ease - including priority of access on road, end trip facilities and parking for bikes and scooters and protection from weather	✓		
Improve service frequency and reliability - particularly for trips between suburbs and regions which do not involve travel via CBDs		✓	
Redesign public transport routes and networks based on up-to-date data and insights about travel patterns now		✓	
Improve integration - between modes of public transport to deliver more seamless end-to-end journeys, and with ticketing and fares		✓	
Address affordability of fares and pricing of public transport to ensure cost is not a barrier		✓	
Improve infrastructure for EV charging and potential grid integration - for electric public transport, EVs, shared cars, ride-sharing and taxis		✓	✓
Pursue policies and incentives that ensure EVs are affordable and available to those most in need of a private vehicle			✓
Review and redesign of taxes, regulatory measures and fee arrangements to prioritise and incentivise uptake of EVs over fossil fuel powered vehicles			✓

6. Appendix

6.1 Mode shift modelling

METHOD

This modelling is based on ABS Census data for journeys to work for the 2016 year. The model uses Census data to estimate how changes in mode shift affect total distance travelled per mode of transport, and associated emissions. The model also considers multiple transport factors, including:

- Uptake of private electric vehicles
- Emissions intensity of the electricity grid
- Uptake of electric buses
- Public transport vehicles powered using renewable energy vs grid energy.

Population growth, and trends in electricity emissions intensity are modelled for future years. Population growth estimates are based on ABS medium projections.

Data from the 2021 census was not used, as large amounts of Australia's population were subject to movement restrictions to stop the spread of COVID-19. As such, 2016 data better represents the trend in Australian transport patterns. However, 2016 ABS census data has been scaled up, based on population projections from 2016.

This analysis considers Australia as a whole, modelling all journeys to work across all areas. Each mode of transport has its own emissions intensity per kilometre travelled, calculated from BITRE data, ABS motor vehicle use data, alongside information from public transport agencies across Australia.

Mode shift is calculated by the tool based on shifting trips of appropriate distance from one mode to another. This is possible as the underlying dataset contains the number of trips per area, by mode and by distance. As such, the travel patterns for modes remain stable. For example, when the mode share of bicycles is increased, this shifts short trips by all other modes to bicycles, maintaining the average distance for bicycle trips, while reducing the number of short trips for other modes. Similarly, when the share of one mode is decreased, the model will allocate the decreased trips to other modes of appropriate distance. For example, decreasing car trips would result in very short car trips being primarily allocated to walking, short car trips being primarily allocated to bicycles, and medium to longer trips being primarily allocated to public transport modes.

The strength of this method is that trips distances for active transport align with what is currently observed, and the model will not allocate long car trips (e.g. over 15km) to walking or cycling as we know this rarely occurs.

Following modelling of potential mode shares, the model then calculates all person vehicle kilometres travelled and applies an emissions factor, estimating total transport emissions per mode. The resulting estimated emissions are for journeys to work, which account for roughly one quarter of all trips. To estimate total transport emissions, journey to work is scaled up to an annual figure for

all transport. The scaling is calibrated by Victorian Integrated Survey of Travel and Activity (VISTA) data. The observed person kilometres travelled in Melbourne's ABS journey to work data and Melbourne's VISTA all trips data are almost identical (78.4% private vehicles in journey to work; 79.1% private vehicles for all trips), giving a high level of confidence to this scaling.

Lastly, to understand the impact reductions in personal transport have on all transport emissions, this modelling is merged with BITRE data. This process subtracts modelled avoided emissions from future trend projections (based on linear regression of observed emissions), to understand overall impact on transport emissions from mode shift of personal transport.

It is important to recognise that this modelling is not looking at the impacts of individual interventions, or interventions in combination, to affect mode shift. Rather, this modelling is being used to reveal the level of mode shift required to reduce personal transport emissions.

Table 1: Assumptions for scenarios.

		Status quo	Strong action	Transformational action	Transformational and equitable action
Population growth		Medium	Medium	Medium	Medium
Grid decarbonisation		Trend (0.6kg CO_2-e per kWh)	82% renewable (0.15kg CO_2-e per kWh)	100% renewable	100% renewable
Train	Energy source	Grid	Renewable	Renewable	Renewable
Bus	EV composition	30%	100%	100%	100%
Ferry	Energy source	Grid	Renewable	Renewable	Renewable
Tram	Energy source	Grid	Renewable	Renewable	Renewable
Taxi	EV composition	0%	0%	0%	0%
Car, as driver	EV composition	10%	10%	20%	20%
Car, as passenger	EV composition	10%	10%	20%	20%
Truck	EV composition	0%	0%	0%	0%
Motorbike/ scooter	EV composition	0%	0%	0%	0%

Table 2: Overall impact on meeting reductions.

	Road vehicles (Mt CO_2e)	Rail (all) (Mt CO_2e)	Domestic maritime (Mt CO_2e)	Domestic aviation (Mt CO_2e)	Total (direct) (Mt CO_2e)	Change from 2005
2005	81.683	4.624	2.545	7.068	95.921	0.0%
2018	95.007	6.275	2.671	10.480	114.432	19.3%
2019	91.228	6,198	2.488	8.179	108.093	12.7%
2020	92.126	6.145	2.509	5.538	106.319	10.8%
2030 - Status quo	103.463	7.960	2.596	14.518	128.536	34.0%
2030 - Strong change	69.625	4.623	2.522	14.518	91.287	-4.8%
2030 - Transformational change	49.931	4.623	2.522	14.518	71.594	-25.4%
2030 - Transformational and equitable change	50.286	4.623	2.522	14.518	71.949	-25.0%

Table 3: Percentage of mode share.

Mode	Status quo	Strong action	Transformational action	Transformational and equitable action
Train	9%	23%	32%	32%
Bus	4%	15%	22%	14%
Ferry	0%	1%	1%	1%
Tram	1%	1%	2%	3%
Taxi	0%	0%	0%	0%
Car, as driver	73%	38%	16%	33%
Car, as passenger	5%	3%	1%	2%
Truck	1%	1%	1%	1%
Motorbike/scooter	1%	0%	0%	0%
Bicycle	1%	5%	7%	4%
Walked only	4%	12%	17%	11%
Other Mode	1%	1%	1%	1%

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