

# THE ROAD TO NET ZERO

## Decarbonisation of the Surface Transport Sector

April 2023





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### Acknowledgements



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# CONTEXT

- The transport sector has a greater potential for early decarbonisation compared with many other sectors of the economy, and can make a material contribution to reaching carbon emission reduction targets by 2030.
- Several transport decarbonisation initiatives have begun, such as a transition to zero emission buses, financial incentives to roll-out charging infrastructure and a national commitment to increase the uptake of EVs. However, current policies and committed investments are unlikely to be sufficient to meet Australia's carbon emission reduction targets.
- This report contains recommendations for Commonwealth and State Governments to consider policy changes that can accelerate the decarbonisation of the surface transport sector.
- This report focuses on decarbonisation of the surface transport industry and acknowledges the importance of embodied emissions in transport infrastructure. The reduction of other greenhouse noxious gases, such as nitrous oxide and sulphur dioxide, is also likely to occur as a consequence of decarbonisation initiatives.



The surface transport sector accounts for a significant c.17% of Australia's CO<sub>2</sub> emissions and has grown by 14% since 2005<sup>5</sup>

- The Australian and State Governments have made commitments to significantly reduce carbon emissions by 2030, with the longer-term goal of achieving net zero emissions by 2050.
- Surface transport makes up a material component of CO<sub>2</sub> emissions in Australia, comprising c.17% in 2022 (September Year to Date). The contribution from Transport has increased over the past 25 years with cars comprising c.50% of transport's emissions and trucks and commercial vehicles comprising 45%.

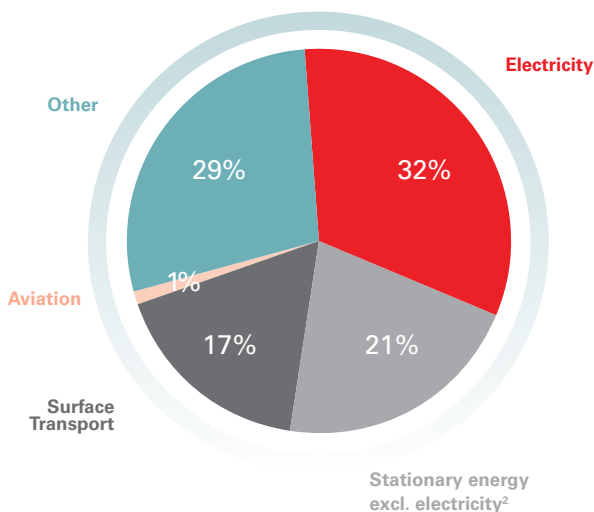
Transportation comprises c.17% of total CO<sub>2</sub> emissions

Australian carbon emissions by sector (2022 Sep YTD)<sup>1</sup>

Percentage:

**c.17%** of Australia's total greenhouse gas emissions come from the surface transport sector

**c.14%** increase in surface transport emissions from 2005-2021<sup>3</sup>



#### Current state of motorized transport in Australia



**c.20 million** registered motor vehicles (c. 26% diesel)



**3% EV market share** of all passenger vehicle sales in 2022

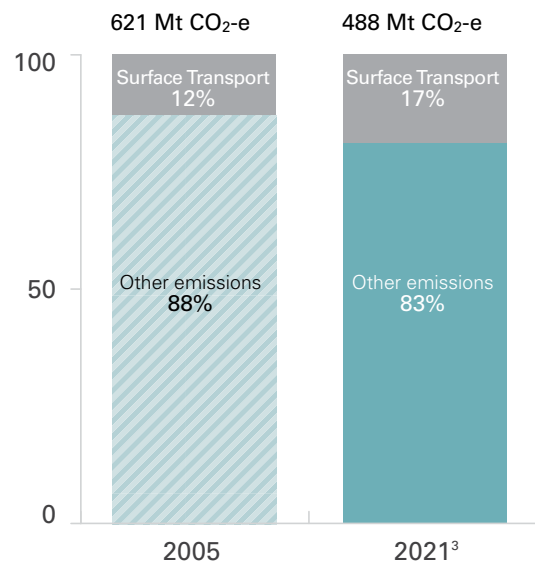


**12% of motorised trips** use public transport

Cars and trucks comprise c.75% of total transport CO<sub>2</sub> emissions

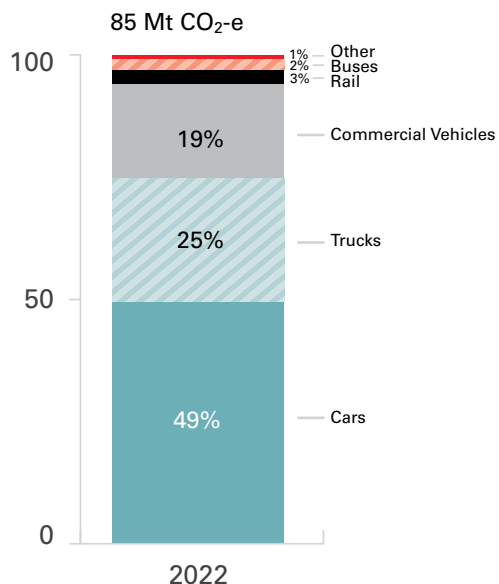
Proportion of surface transport to total emissions (2005; 2021)

Percentage:



Carbon emissions by surface transport (2022 Sep YTD)

Percentage:



# GOVERNMENT GOAL

The Commonwealth Government is targeting a 43% reduction in 2005 carbon emissions by 2030 (as at September 2022), supported by similar state government goals to reach net zero by 2050.<sup>6</sup>

## Commonwealth and state government aims for carbon reduction

- As of September 2022, Australia's CO<sub>2</sub> level was recorded at 22% below CO<sub>2</sub> levels<sup>4</sup> in 2005.
- The Commonwealth Government has increased its carbon emissions reduction target to 43% (below 2005 levels) by 2030.
- This is an interim milestone towards Australia's Long-Term Emissions Reduction plan to achieve net zero emissions by 2050.
- Some states and territories have an interim reduction goal (relative to 2005) by 2030. All states and territories are aiming for net zero by 2050 at the latest.

The states and territories have various targets for reaching Net Zero.<sup>7</sup>



### AUSTRALIA TOTAL

**43%**

A 15-point increase on Australia's previous 2030 target (as at Sep 2022)

Australia's Long-Term Emissions Reduction plan is to achieve net zero emissions by 2050





# POLICIES FOR DECARBONISATION<sup>8</sup>

- The level of investment and policies vary considerably between state and Commonwealth governments and by mode.
- Until recently the states and territories have had the most progressive decarbonisation policy positions, each with their respective strategies or roadmaps. These include financial incentives to encourage uptake of passenger EVs, decarbonisation of PT, supporting the use of micro mobility, investing in charging infrastructure and setting government fleet transition targets.
- There has been increasing decarbonisation activity at the Commonwealth level, especially for passenger vehicles. The Commonwealth recently announced

a National Electric Vehicle Strategy. It also recently released a National Battery Strategy, and has existing commitments to support charging and refueling infrastructure, grid investment, local industry, and aspirations to be a global hydrogen leader. Collectively, once implemented, these actions will benefit multiple modes.

- Industry has also responded to the challenge, and in some cases taken steps to voluntarily decarbonise (e.g. some passenger service operators), or trial and test new zero emission technologies (e.g. buses).
- Despite these efforts, existing policies continue to fall short of incentives by leading international jurisdictions.


## Current policy context and decarbonisation initiatives: Passenger transport modes (Non-Exhaustive)<sup>9</sup>

| Transport mode   | Commonwealth policy  | State initiatives  | Industry initiatives  |
|--|--|--|---|
| <b>Passenger vehicles</b><br> | <ul style="list-style-type: none"> <li>✓ Financial incentives for EVs including amendments to FBT and import duties</li> <li>✓ Investments and support for refueling and charging infrastructure</li> <li>✓ Developed a comprehensive National Electric Vehicle strategy</li> <li>✓ Support for grid upgrades and increase in local manufacturing</li> <li>✗ Commitment to introduce a vehicle fuel efficiency standard, but not yet legislated</li> </ul> | <ul style="list-style-type: none"> <li>✓ Various financial incentives, such as stamp duty reductions and rebates/subsidies</li> <li>✓ 'Cleaner' mode share initiatives including rideshare and active modes</li> <li>✓ Initial investments in public charging</li> <li>✗ Limited progress decreasing use of single occupancy motorised vehicles</li> </ul> | <ul style="list-style-type: none"> <li>✓ Investment in charging and refuelling infrastructure</li> <li>✓ Voluntary commitments by some hire car and ride share participants to transition to ZEVs</li> <li>✓ OEMs launching EV models</li> <li>✗ Prices and supply issues slowing uptake</li> </ul>         |
| <b>Buses</b><br>              | <ul style="list-style-type: none"> <li>✓ Australian Design Rules regulate bus emissions, mass and vehicle width</li> <li>✗ These have not yet been amended to accelerate ZEV update</li> </ul>   | <ul style="list-style-type: none"> <li>✓ All states have targets for ceasing diesel bus purchases (typically by 2025)</li> <li>✓ Initial deployments and depot conversions are underway</li> <li>✗ Fleet transition is not yet fully funded (however, NSW has funded 1,200 ZE buses by 2028)</li> </ul>  | <ul style="list-style-type: none"> <li>✓ Most operators are willing to accelerate transition subject to Government funding</li> </ul>   |
| <b>Passenger Rail</b><br>     | <ul style="list-style-type: none"> <li>✗ No regulations or emission standards in place for non-road diesel engines</li> </ul>  | <ul style="list-style-type: none"> <li>✓ Most states procuring zero emissions electricity for metropolitan passenger rail</li> <li>✓ Some states are designing more efficient trains and rail transport infrastructure</li> <li>✗ For longer distances, some investment in diesel electric bi-mode rail, but no ZE technology yet viable</li> </ul>        | <ul style="list-style-type: none"> <li>✓ Many transit operators have voluntarily set emissions reductions plans</li> <li>✓ OEMs bringing ZE models to market</li> </ul>   |
| <b>Ferries</b><br>            | <ul style="list-style-type: none"> <li>✗ No regulations on fuel standards for the ferry sector</li> <li>✗ No Commonwealth policy specifically targeting decarbonisation of the ferry sector</li> </ul>   | <ul style="list-style-type: none"> <li>✓ Small scale deployment of electric ferries underway</li> <li>✓ Funding for a pilot to construct and operate a hydrogen ferry</li> </ul>   | <ul style="list-style-type: none"> <li>✓ Working in collaboration with the states to deliver small scale trials</li> <li>✓ OEMs exploring alternative powertrains</li> <li>✓ Overseas trials of electric and hybrid ferries underway, but the technology is not yet commercially viable at scale</li> </ul> |



- The focus has been on modes that are easier to decarbonise, such as bus, passenger vehicles and metropolitan rail.
- The biggest policy gaps are currently in the freight sector and the harder to abate passenger segments:
  - there are limited government policies in place to support the decarbonisation of the freight sector, however, early stage infrastructure and technology investments are underway
- shipping has limited government decarbonisation policy and largely relies on global maritime regulations or industry development
- Furthermore, the construction of Australian transport infrastructure relies on carbon heavy resources such as concrete materials, carbon fuels and diesel transportation vehicles. By example, NSW has developed a Decarbonising Infrastructure Delivery Roadmap to provide guidance on reducing embodied emissions in infrastructure delivery.

## Current policy context and decarbonisation initiatives: Freight transport modes (Non-Exhaustive) <sup>10</sup>

| Transport mode  | Commonwealth policy  | State initiatives  | Industry initiatives  |
|---|--|--|---|
| <b>Freight Rail</b><br>  | <ul style="list-style-type: none"> <li>✗ No regulations or emission standards in place for non-road diesel engines</li> <li>✓ The two largest freight rail operators are obliged to reduce emissions under the safeguard policy mechanism</li> </ul>   | <ul style="list-style-type: none"> <li>✓ Some state regulations of emissions via operator licenses</li> <li>✗ Limited state plans targeting decarbonisation of freight rail</li> </ul>   | <ul style="list-style-type: none"> <li>✓ Freight rail operators are converting fleet to lower emissions diesel and investigating other low and zero emissions alternatives (biofuels, electric, hydrogen)</li> <li>✓ Electrified freight networks are switching to zero emissions electricity</li> <li>✗ Low emission technologies are not yet commercially viable</li> </ul> |
| <b>Trucking</b><br>    | <ul style="list-style-type: none"> <li>✓ Future Fuels Fund includes funding for enabling infrastructure for battery and hydrogen heavy vehicles</li> <li>✗ ADR specs not well aligned with emerging international EV truck specifications</li> <li>✗ Euro 5 standards lag behind more stringent Euro 6 standards globally</li> </ul> | <ul style="list-style-type: none"> <li>✓ Some investments in charging and refuelling infrastructure across many states</li> <li>✓ Some state governments undertaking trials or setting targets to partly transition their heavy vehicle fleet to hydrogen</li> </ul> | <ul style="list-style-type: none"> <li>✓ Short haul electric trucks beginning to be imported in small volumes</li> <li>✗ Early deployments of longer haul battery and hydrogen trucks are underway, but not yet widely adopted</li> </ul>   |
| <b>Cargo Ships</b><br> | <ul style="list-style-type: none"> <li>✓ Complies with International Maritime Organisation (IMO)'s standards on greenhouse gas reduction measures</li> <li>✗ No Commonwealth policy specifically targeting decarbonisation of the shipping sector</li> </ul>   | <ul style="list-style-type: none"> <li>✓ Early trials and investment to support biodiesel fuel blending</li> <li>✓ Some states regulate maritime emissions in select areas</li> <li>✓ Some port authorities have committed to net zero emissions targets</li> </ul>  | <ul style="list-style-type: none"> <li>✓ Shipping operator trials of biofuels in partnership with government</li> <li>✗ Overseas trials of electric and hybrid cargo ships underway, but the technology is not yet commercially viable at scale</li> </ul>  |

# ACCELERATING DECARBONISATION

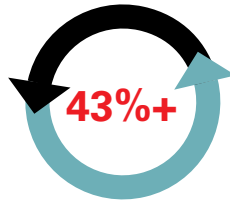
To accelerate decarbonisation of surface transport, further action is required in infrastructure, systems, financial incentives and policy, coordinated across Commonwealth and state governments

- A comprehensive and collaborative approach is required to meet the Government's national targets.
- Commonwealth and state governments have many levers to support the decarbonisation of surface transport.
- A combination of policy, financial incentives, network planning and ecosystem development will accelerate Australia towards its 2030 carbon emission targets. However, we must act quickly.
- Legislative frameworks should be favourable to support zero/low emission fuel development and production, and a watching brief on technology development will be important.
- Governments can support the development of necessary infrastructure to enable clean energy adoption such as EV charging, hydrogen refuelling stations and grid investment. Financial incentives can also drive decarbonisation such as ZEV tax breaks and subsidies to support clean energy adoption and private sector investment.
- Active modes, mobility as a service, micromobility and other last mile technologies should also be explored to reduce the dependence on and number of single passenger vehicle journeys. Micromobility and last mile technologies can also be used to support the decarbonisation of the urban freight task.
- During planning, transport should be considered as a system. A holistic view should be taken to network pricing and ticketing for public transport, roads and other modes.
- Similarly, taking a whole of emissions view towards transport infrastructure will be important to delivering on our net zero commitment.
- To get the biggest impact, it will be important to prioritise high intensity segments, such as rideshare, taxis and freight.
- Lastly, investing in a local industry ecosystem that supports decarbonisation innovation will maximise overall economic benefits.










# Six Key Goals For Emissions Reduction



2030 target for CO<sub>2</sub> emissions reduction on 2005 levels

## GOALS

| 1. Reduce emissions intensity of the current fleet                                  |   | 2. Transition to lower emissions fleet  |   | 3. Shift to lower emissions modes   |   |
|---|---|---|---|---|---|
|    |    |    |      |  |  |
| Improve fuel efficiency and quality   | Switch to alternative low & zero emissions fuels                                    | Transition fleet  | Decarbonise energy sources  | Decrease use of single occupancy motorised vehicles                                 | Increase use of active transport and micromobility                                  |
| Key enablers (non-exhaustive)   | Fuel quality standards  | Government fleet transition targets   | Charging infrastructure   | Active and public transport investment  |   |
|   | Robust fuel efficiency standards that align to leading jurisdictions                | Fossil fuel subsidy reform  | Hydrogen production, supply and refueling infrastructure                              | Holistic pricing reform   |   |
|   | Support for zero/low emission fuel development and production                       | ZEV tax breaks & uptake incentives  | Grid investment   | Innovative last mile technologies   |   |
|   | Procure renewable energy for electrified fleet                                      | ZEV ready building codes  | Develop new clean energy sources  | Mobility as a Service   |   |
|   |   |   |   | Develop high occupancy vehicle lanes  |   |
|   |   |   |   | Increased micromobility options   |   |
| 4. Reduce inefficient journeys  |   | 5. Reduce embodied emissions  |   | 6. Support industry development   |   |
|  |  |  |  |   |   |
| Change travel patterns  | Optimise travel networks  | Evaluate emissions intensity of transport infrastructure                            | Build a local manufacturing and decarbonisation ecosystem                             |   |   |
| Key enablers (non-exhaustive)   | Placemaking & '20-30 minute cities'   | National infrastructure decarbonisation plan  | Investment and support for innovation   |   |   |
|   | Land use planning and zoning  | Guidelines on use of low carbon materials   | Investment in local manufacturing   |   |   |
|   | Smart data and integrated transport monitoring and optimisation systems             | Measurement for embodied emissions across projects                                  | Train and develop skilled workforce   |   |   |
|   | Transport pricing & ticketing   |   |   |   |   |
|   | Transition to on-demand or non timetabled transport services                        |   |   |   |   |
|   | Route and network redesign  |   |   |   |   |

# BARRIERS TO DECARBONISATION









































- Barriers to successful decarbonisation vary across the key passenger and freight transport modes.
- Key passenger vehicle barriers include product supply and availability, as well as developing national public charging infrastructure capacity.
- Decarbonisation solutions already exist for buses and are being readily adopted internationally. Upfront capital and capital conviction are key barriers to adoption, along with bus specific charging infrastructure.
- The slow pace of technology development and availability of alternative fuels is slowing the speed of transition for long haul (diesel) passenger and freight rail.
- While battery electric technology is increasingly available for short haul trucking, there are not yet viable commercially viable technologies for long haul. Green hydrogen has the potential to decarbonise longer haul, heavier freight tasks, however, more investment is required to increase the availability and cost competitiveness of green hydrogen
- Similarly, technology for low emissions ferries is currently limited to smaller vessels on shorter routes with limited technological availability to replace large shipping vessels.





# STATUS QUO

Several barriers may slow the roll-out of decarbonisation



























|                 |   | Technology availability   | Technology maturity & cost competitiveness  | Fuel & charging availability   | Speed of adoption   | Commentary on key barriers  |
|-----------------|---|---|---|--|---|---|
| Passenger modes |  Passenger vehicles        |    |    |    |    | EV technology is increasingly available, but requires an accelerated roll-out Australia-wide                              |
|                 |  Buses                     |    |    |    |    | EV technology is readily available, but requires government conviction and upfront capital for deployment                 |
|                 |  Passenger rail (electric) |    |    |    |    | Metro services require cost competitive green electricity   |
|                 |  Passenger rail (diesel) |  |  |  |  | Long haul diesel services require viable technology alternatives  |
|                 |  Ferries                 |  |  |  |  | Requires commercially viable zero emissions technologies  |
| Freight modes   |  Freight rail            |  |  |  |  | Requires commercially viable zero emissions alternatives to diesel locomotives  |
|                 |  Trucking                |  |  |  |  | Short haul technology is maturing and requires infrastructure investment; Long haul trucking requires viable alternatives |
|                 |  Cargo Ships             |  |  |  |  | Requires viable alternatives to fossil fuel powered ships   |

Fully developed  —————> Not developed 

# DECARBONISATION PRIORITIES

- There are several key decarbonisation priorities in the near term that should be considered, with varying levels of impact on passenger and freight transport modes.
- To improve uptake of consumer and commercial ZEV vehicles, greater Commonwealth, state and local government alignment on policy and financial incentives, and urban planning is required.
- To support ZEV uptake, Australia needs to implement stricter vehicle and fuel standards, including for buses, passenger vehicles and heavy vehicles to align with global emission standards and accelerate adoption of the latest ZEV models.
- To improve freight decarbonisation, greater national coordination would be valuable in the preparation of a freight decarbonisation plan that can influence all freight transport modes.
- Specific policies should be introduced to reduce the heavy reliance on embodied emissions in transport infrastructure to direct investment and construction.
- Finally, common to most modes is the need to increase the availability of renewable energy (such as green electricity and hydrogen fuels) as well as a local supply chain and manufacturing capabilities to provide a runway for long term industry decarbonisation.

## There are eight priorities for transport leaders

|   | Key priorities  | Key outcomes  | Priority mode/industries  |
|---|---|---|---|
| 1 | Implement robust fuel efficiency standards that are in line with leading jurisdictions              | To drive supply and adoption                            |        |
| 2 | Support the investigation and deployment of interim and new technologies for hard to abate segments | To enable interim reductions across all segments        |       |
| 3 | Align on policy incentives for ZEVs across Government levels  | To drive uptake   |     |
| 4 | Develop a national freight decarbonisation plan   | To drive technology deployment across all freight modes |      |
| 5 | Facilitate greater use of PT and active transport modes   | To reduce car travel                                    |      |
| 6 | Develop a national low emissions manufacturing strategy   | To maximise economic benefit                            |    |
| 7 | Develop policies to reduce embodied emissions in transport infrastructure                           | To direct investment and construction                   |    |
| 8 | Accelerate the availability of renewable energy   | To ensure delivery of transport decarbonisation         |       |



## ENDNOTES

- 1 Year to September 2022
- 2 Stationary energy includes manufacturing, mining, residential and commercial fuel use; energy is burning fossil fuels to produce electricity; other includes agriculture, fugitive emissions, industrial processes and waste
- 3 2021 is the most recent full year recording of carbon emissions
- 4 Calculations based on seasonally adjusted, and weather normalized CO<sub>2</sub> emission from Quarterly update of Australia's National Greenhouse Gas Inventory database

## SOURCE

- 5 Department of Industry, Science, Energy and Resources; IEA; CSIRO; Electric Vehicle Council; Department of Climate Change, Energy, the Environment and Water
- 6 Department of Climate Change, Energy, the Environment and Water
- 7 Department of Climate Change, Energy, the Environment and Water
- 8 State Government websites; Department of Industry, Science, Energy and Resources; ABC News; Department for Environment and Water; Department of Land Water and Planning, AdaptNSW
- 9 ATO; NTC; DELWP; DIT; DITRDC; DITRDC Trainline; Ministers Treasury portfolio; NSW Dept of Planning, Industry and Environment; TfNSW; NSW Energy; Victoria DoT; PTV; QLD Government; QLD Department of State Development; Adelaide Metro; Bus Industry Confederation; Infrastructure Australia; BOC; Uber; Drive News; AFR; Kinetic; Transdev; ABB Company; ABC; EPA; Vline; Keolis Downer; E-ferry project; Hysea3; MF Hydra; Ship technology articles; L.E.K. research and analysis
- 10 Australian Maritime Safety Authority; DITRDC; ADR; Ministers Treasury portfolio; QLD Government; QLD Department of State Development; SA Government; WA Government; NSW Energy; NSW Port Authority; Bus Industry Confederation; Sydney Morning Herald; AFR; Rio Tinto; BHP; Brookfield Infrastructure; Pacific National; Grattan Institute; Department of Industry; Climate Council; State Governments; Maritime Executive articles; Offshore energy; L.E.K. research and analysis