



Australian Government

Transport and Infrastructure Net Zero Roadmap and Action Plan

Transport Sector Plan

September 2025



© Commonwealth of Australia 2025

September 2025 / INFRA7027

Ownership of intellectual property rights in this publication

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Commonwealth of Australia (referred to below as the Commonwealth).

Disclaimer

The material contained in this publication is made available on the understanding that the Commonwealth is not providing professional advice, and that users exercise their own skill and care with respect to its use, and seek independent advice if necessary.

The Commonwealth makes no representations or warranties as to the contents or accuracy of the information contained in this publication. To the extent permitted by law, the Commonwealth disclaims liability to any person or organisation in respect of anything done, or omitted to be done, in reliance upon information contained in this publication.

Creative Commons licence



With the exception of (a) the Coat of Arms; (b) the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts photos and graphics; (c) content supplied by third parties; (d) content otherwise labelled; copyright in this publication is licensed under a Creative Commons BY Attribution 4.0 International Licence.

Use of the Coat of Arms

The Department of the Prime Minister and Cabinet sets the terms under which the Coat of Arms is used. Please refer to the Commonwealth Coat of Arms - Information and Guidelines publication available at <http://www.pmc.gov.au>

Contact us

This publication is available in PDF format. All other rights are reserved, including in relation to any departmental logos or trademarks which may exist. For enquiries regarding the licence and any use of this publication, please contact:

Director – Creative Services
Communication Branch
Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

GPO Box 594
Canberra ACT 2601
Australia

Email: creative.design@infrastructure.gov.au
Website: www.infrastructure.gov.au

Acknowledgement of Country

We acknowledge the Traditional Owners of Country throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past and present.

We thank First Nations people for their continuing custodianship of, and care for, the Country that we live and work within today. It is fitting to reflect on the thousands of generations of traditional knowledge First Nations people hold, and generously share, as we look to decarbonise how we move people and goods across Australia.

We acknowledge the diversity of First Nations cultures, languages and practices across the country and the resilience of First Nations people in keeping these alive. We recognise the importance of listening to local First Nations people and responding to the uniqueness of each place.

We are committed to working in partnership with First Nations people in meeting current and future challenges and achieving opportunities, including through the net zero sector plans.

Contents

Ministers' foreword	3
Executive summary	4
1. Introduction	13
2. Emissions outlook	19
3. Roadmap: decarbonisation pathways to 2050	23
3.1. Road – light vehicles	26
3.2. Road – heavy vehicles	28
3.3. Rail	30
3.4. Maritime	32
3.5. Aviation	34
3.6. Transport infrastructure	36
4. Action plan	39
Guiding principles	41
Priority action 1: invest in enabling low and zero emissions transport infrastructure	43
Priority action 2: electrify and increase transport's energy performance	45
Priority action 3: switch to low carbon alternatives (LCLFs) to power transport where electrification is not feasible	49
Priority action 4: innovate to expand cost competitive transport technology options	51
Priority action 5: scale up efforts to reduce embodied emissions in transport infrastructure	52
5. Enabling the transition	55
5.1. Sustainable finance	57
5.2. Workforce and skills	57
5.3. Enabling partnerships	59
5.4. Building a resilient transport and infrastructure sector	61
6. Moving forward	63
List of abbreviations	65
Glossary	66





Ministers' foreword

Transport shapes our cities and regions. It supports economic and social development and determines how we can engage with the communities around us. Today, the transport sector emits 22% of Australia's annual carbon dioxide equivalent gas emissions. If we do not act, transport emissions are on track to be the largest source of greenhouse gas emissions in Australia by 2030. Ensuring the transport sector is fit for our net zero future is essential.

Decarbonising the transport sector also brings other benefits and opportunities beyond mitigating climate change. This includes consumer savings through electric vehicles that offer savings on lifetime costs; increased fuel security through decreased demand for fossil fuels and the development of a domestic low carbon liquid fuel sector; export opportunities for low carbon transport infrastructure materials and low carbon liquid fuels; health improvements due to reduction in noxious tailpipe emissions and increased use of active transport; and productivity gains from optimising passenger and freight network routes and nationally coordinating infrastructure decarbonisation policies.

The Transport and Infrastructure Net Zero Roadmap and Action Plan is one of 6 sector plans that supports the Government's Net Zero Plan, to ensure Australia maximises the benefits of the global transition to net zero and provides long-term policy certainty to drive investment in low emissions and renewable technologies.

This Roadmap and Action Plan has been informed by feedback, insights and analysis provided through public and industry consultations, as well as the Climate Change Authority's Sector Pathways Review and analysis and modelling from the Treasury. In response to the Transport and Infrastructure Net Zero Consultation Roadmap released in May 2024, we received 284 written submissions, and 28 targeted consultation sessions were held, with engagement from 166 organisations and over 400 participants.

The Roadmap and Action Plan establishes a policy direction that benefits all Australians. It will build on initiatives introduced by the Australian Government to reduce emissions in the transport and infrastructure sectors. These initiatives include: increasing the uptake of

electric and more efficient vehicles through the National Electric Vehicle Strategy and an Australian New Vehicle Efficiency Standard; as part of our Future Made in Australia agenda, fast-tracking support for a low carbon liquid fuel industry, with an initial focus on sustainable aviation fuel and renewable diesel to support emissions reduction in the aviation, heavy vehicle, rail and maritime sectors; establishing the Australian Jet Zero Council; developing a Maritime Emissions Reduction National Action Plan; the National Rail Manufacturing Plan and establishing the High Speed Rail Authority; supporting zero emissions travel with the Active Transport Fund; embedding sustainability as a key strategic theme in the Infrastructure Policy Statement; and working with the states and territories through the Infrastructure and Transport Ministers' Meeting to reduce transport and transport infrastructure emissions.

The decarbonisation of Australia's transport system will require significant public and private sector investment in emerging low and zero emissions technology and enabling infrastructure. It will also require collective action between all levels of government, business, industry and the community to ensure a fair and equitable transition.

The Roadmap and Action Plan will enable this investment and collective action by providing a clear strategy to reduce emissions across the transport and transport infrastructure sectors. It covers all transport modes and considers cross-cutting issues including low carbon liquid fuels, freight and supply chains, system wide efficiencies and transport infrastructure. It is robust, ambitious and achievable.

The Hon Catherine King MP

Minister for Infrastructure, Transport, Regional Development and Local Government

The Hon Chris Bowen MP

Minister for Climate Change and Energy

Executive summary

The Australian Government has an ambitious climate agenda, committing to reduce national emissions by 43% on 2005 levels by 2030, 62–70% by 2035 and net zero by 2050, in line with the global goal to keep warming to well below 2°C and efforts to keep it to 1.5°C.

The Net Zero Plan sets out and extends Australia's action on climate change. The Plan helps ensure Australia maximises the benefits of the global transition to net zero and provides long-term policy certainty to drive investment in low emissions and renewable technologies. To support the Plan, the Government has developed six sector plans. These plans cover the following sectors: electricity and energy; industry; resources; the built environment; agriculture and land; and transport.

The Transport and Infrastructure Net Zero Roadmap and Action Plan is the sector plan for transport and transport infrastructure. It covers all transport modes and considers cross cutting issues including low carbon fuels, freight and supply chains, systemwide efficiencies and transport infrastructure.

While the transport sector is critical to our economy, it is also the third largest source of greenhouse gas emissions in Australia, with direct emissions amounting to 22% of Australia's greenhouse gas emissions. With Australia's population and economy expected to grow, transport activity is also expected to continue to increase to 2050. The challenge is to reduce emissions while the sector grows.

Reducing transport emissions will also bring a range of other benefits and opportunities, including consumer savings, enhanced fuel security, health benefits and productivity gains. These co-benefits are outlined in Chapter 1, along with information on how this plan was developed.

Informed by Treasury modelling, Chapters 2 and 3 outline the Roadmap to 2050, including the emissions outlook and the potential decarbonisation pathways for each transport mode and transport infrastructure. Chapter 4 is the Action Plan and sets out the actions the Government is taking to reduce transport emissions. Chapters 5 and 6 explain how the Government will continue to work collaboratively with all levels of government, the community, business, industry and unions to deliver the plan.



Roadmap to 2050

Treasury Baseline Scenario presents an efficient pathway Australia could take to reach its net zero goal. This shows it is technically and economically feasible to achieve deep reductions in transport emissions by 2050.

Electrification and improved energy efficiency will be the primary decarbonisation pathway for light vehicles, such as cars and vans.

The decarbonisation pathway for heavy vehicles is likely to require a range of different technologies, including electrification for buses and rigid trucks, and a mixture of low carbon liquid fuels (LCLFs) for larger vehicles that carry heavier payloads over longer distances.

Rail is generally a lower emissions mode than road transport, so increasing the share of freight moved on rail will reduce emissions, even with existing technologies. The decarbonisation pathway for rail will come from a mix of track electrification, battery electric trains, LCLFs and hydrogen.

For maritime, shipping will require the use of LCLFs and other low carbon alternatives, including hydrogen-derived fuels such as methanol and ammonia, and hydrogen. There will be opportunities for battery electric technology for use in smaller vessels and other domestic maritime applications with shorter voyages.

For aviation, sustainable aviation fuel (SAF) will be the key technology. Other technologies such as battery electric and hydrogen powered aircraft are expected to be used for some short-haul flights in the long term.

Decarbonising transport infrastructure (such as roads, railways, ports and airports) will require national standards for data collection, measurement and reporting of embodied emissions, and increased investment in low and zero carbon construction materials.

Figure 1 (as seen on page 8) outlines the decarbonisation technology pathways for each transport mode and transport infrastructure.



The Action Plan

This plan is guided by five guiding principles: maximise emissions reduction, provide value for money, maximise economic opportunity, be inclusive and equitable and be evidence-based.

The avoid-shift-improve (ASI) framework is used to identify all opportunities for abatement.

There are five key priority actions across our transport systems, modes and enabling inputs in this Roadmap and Action Plan:

1. Invest in enabling low and zero emissions transport infrastructure.
2. Electrify and increase transport's energy performance.
3. Switch to low carbon alternatives (LCLFs) to power transport where electrification is not feasible.
4. Innovate to expand cost competitive transport technology options.
5. Scale up efforts to reduce embodied emissions in transport infrastructure.

Figure 2 provides a summary of these priority actions and the Government's policies to reduce transport emissions.

Enabling the transition

The decarbonisation of Australia's transport system will require significant public and private sector investment in emerging low and zero emissions technology and enabling infrastructure.

Major industry shifts are needed to prepare Australia's workforce to meet the needs of the transition, including improving Vocational Educational Training, improving workforce diversity for those that do not traditionally have high participation rates in the sector (e.g. Aboriginal and Torres Strait Islanders people, women, people with disability) and addressing training opportunities and digital literacy, especially in rural and remote areas.

Collective action is needed between all levels of government, business, industry and the community to reduce transport emissions. Australia will continue to be actively engaged in international fora to reduce emissions and look to establish international partnerships to advance low emission technologies.

Moving forward

The *Climate Change Act 2022* (Cth) sets up a strong framework to ensure Australia remains on track to reach net zero emissions. It requires the Minister for Climate Change and Energy to report progress through an Annual Climate Change Statement to Parliament, outlining progress towards emissions targets, and whether current policies are effective.

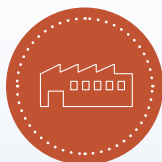


The Transport Sector Plan is one of 6 sector plans underpinning the Net Zero Plan



Energy/ Electricity

Energy performance; and the supply of electricity, liquid fuels, and gas



Industry

Alumina and aluminium, cement and concrete, chemicals and plastics, food and beverages, iron and steel, manufacturing and additional industries, other metals refining and smelting, pulp, paper and paperboard, waste and resource recovery



Resources

Oil and gas extraction, processing, liquefaction, coal mining and processing, mining and processing of metallic and non-metallic minerals, resource exploration and support services



Built Environment

Residential, commercial and public buildings as well as urban open spaces and water infrastructure



Agriculture and Land

Livestock, cropping, on-farm energy use, fisheries, forestry and land use

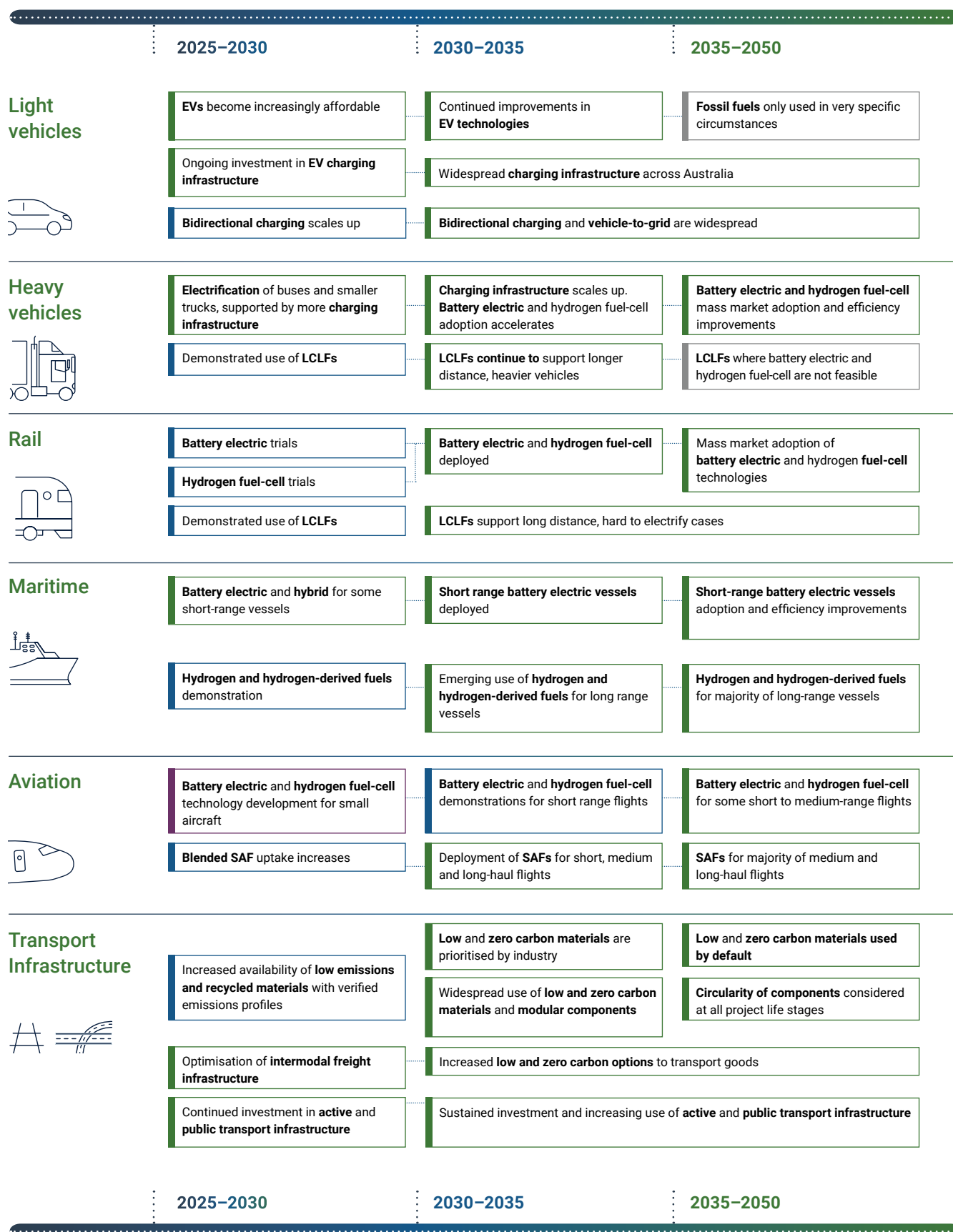


Transport

Light and heavy road transport, rail, maritime, aviation, including transport infrastructure's embodied emissions



Figure 1: Transport and Infrastructure Net Zero Roadmap: a timeline of transport decarbonisation technology pathways



■ The technology requires development
 ■ Demonstrate scale and commercial viability
 ■ Deploy commercially ready technology
 ■ Used in limited, tailored applications

Figure 2: Transport and Infrastructure Net Zero Action Plan

Guiding principles

Maximise emissions reduction (using avoid-shift-improve framework), value for money, maximise economic opportunity, inclusive and equitable, evidence based.



Priority Action 1: Invest in enabling low and zero emissions transport infrastructure (avoid and shift)

Achieving low and zero emissions transport infrastructure (roads and bridges, rail, ports and airports) will require rethinking our transport networks and systems to decarbonise how we move people and goods across our large and geographically diverse country.

1.1 Invest in transport infrastructure projects that support sustainable and decarbonised transport systems

Key initiatives: Infrastructure Policy Statement; Infrastructure Investment Program; Active Transport Fund; High Speed Rail; Inland Rail; National Freight and Supply Chain Strategy; Investments in intermodal hubs.

1.2 Support the path to net zero in the planning and development of urban areas

Key initiatives: National Urban Policy; National Urban Freight Planning Principles.

1.3 Develop place-based solutions to drive transport sustainability and decarbonisation at a local level

Key initiatives: Regional Investment Framework.

1.4 Embed resilience to current and future climate change

Key initiatives: National Climate Risk Assessment; National Adaptation Plan; National Freight and Supply Chain Strategy; Infrastructure Policy Statement.



Priority Action 2: Electrify and increase transport's energy performance (shift and improve)

Electrification and energy efficiency will be the primary decarbonisation pathway for much of the transport sector, especially light vehicles.

2.1 Maintain, review and improve regulatory frameworks to drive emissions down

Key initiatives: New Vehicle Efficiency Standard; Safeguard Mechanism.

2.2 Increase the supply of affordable and accessible EVs

Key initiatives: National Electric Vehicle Strategy; Australian Design Rule (ADR) Harmonisation Review; Reforms to heavy vehicle mass limits; Safer Freight Vehicles package.

2.3 Encourage increased uptake of more efficient vehicles, supported by energy performance improvements

Key initiatives: Driving the Nation Program; Electric Car Discount; Green car fleet loans; Green Vehicle Guide; ev.gov.au

2.4 Support the efficient rollout of electric vehicle charging infrastructure

Key initiatives: Driving the Nation Fund; Guides to help multi-residence (strata) buildings become 'EV ready'; National Roadmap for Bidirectional EV Charging; Minimum operating standards for EV charging infrastructure; \$40 million to accelerate rollout of kerbside and fast charging.

2.5 Enhance the operations of ports, railways and airports to advance decarbonisation

Key initiatives:

- Rail: National Rail Action Plan; Inland Rail; High Speed Rail; National Rail Manufacturing Plan.
- Maritime: Maritime Emissions Reduction National Action Plan.
- Aviation: Aviation White Paper; Airports Regulation 2024; Regional Airports Program.



Priority Action 3: Switch to low carbon alternatives to power transport where electrification is not feasible (improve)

To support the transport sector's net zero pathways, low carbon alternatives such as low carbon liquid fuel (LCLF), including sustainable aviation fuel (SAF) and renewable diesel, and hydrogen, will be important to decarbonise hard-to-electrify transport modes, including heavy vehicles, rail, maritime and aviation.

3.1 Establish frameworks to verify and track the emissions intensity and production methods of LCLFs

Key initiatives: Guarantee of Origin scheme; Fuel Quality Standards (Paraffinic Diesel) Determination 2025.

3.2 Fast track support for a domestic LCLF industry, with an initial focus on SAF and renewable diesel

Key initiatives: Future Made in Australia agenda; Sustainable Aviation Fuel Funding Initiative; Australian Jet Zero Council; \$1.1 billion Cleaner Fuels Program.

3.3 Support the development of renewable hydrogen

Key initiatives: National Hydrogen Strategy; Hydrogen Production Tax Incentive; Hydrogen Headstart.



Priority Action 4: Innovate to expand cost competitive transport technology options (avoid, shift and improve)

To support the transport sector's net zero pathways, developing strategic approaches through innovation, commercialisation, pilot and demonstration projects will expand cost competitive technology options and ensure Australia is an important part of the global net zero economy.

4.1 Provide financial assistance and knowledge sharing to support improvements in the competitiveness and supply of renewable energy and the uptake of energy efficiency and electrification

Key initiatives: Future Made in Australia Innovation Fund; Driving the Nation Fund; Clean Energy Innovation Fund (CEFC); Cooperative Research Centres (CRC); Australian Renewable Energy Agency (ARENA); National Reconstruction Fund; National Battery Strategy.

4.2 Develop nationally coordinated and consistent approaches to the rollout of new transport technologies

Key initiatives: National Electric Vehicle Strategy; Aviation White Paper; National Rail Action Plan; Maritime Emissions Reduction National Action Plan; Advanced Air Mobility Strategy; National Road Transport Technology Strategy; 2024–27 National Connected and Automated Vehicle Action Plan.



Priority Action 5: Scale up efforts to reduce embodied emissions in transport infrastructure (shift and improve)

Embodied emissions are expected to form a major and increasing proportion of infrastructure-related emissions as the electricity grid transitions to decarbonised sources and operational emissions decline.

5.1 Develop end-to-end carbon management policy and guidance, beginning with a nationally consistent approach to measuring embodied carbon in infrastructure projects

Key initiatives: National Carbon Values for use in cost benefit analyses; Embodied Carbon Measurement for Infrastructure: Technical Guidance; National Sustainable Procurement in Infrastructure Guideline; National Embodied Carbon Databook.

5.2 Accelerate the commercialisation of low and zero emission construction materials

Key initiatives: Future Made in Australia Innovation Fund; Low Carbon Concrete Centre; Low emissions steel, iron and renewable hydrogen research.

5.3 Mandatory requirements on companies for reporting, assessment and emissions reduction

Key initiatives: Safeguard Mechanism; Mandatory climate-related financial disclosures.

5.4 Support infrastructure decarbonisation capability in private and public sectors, including the development of resources, training and guidance

Key initiatives: ITMM infrastructure decarbonisation capability building program and central knowledge hub.





1

Introduction

Transport connects Australians to each other and to the rest of the world. It is critical to our economy and wellbeing. It is also the third largest source of greenhouse gas emissions in Australia, amounting to 22% of national emissions in 2024. As the Transport Sector Plan, this Roadmap and Action Plan provides a clear strategy to reduce emissions across transport and transport infrastructure to contribute to economy-wide net zero by 2050.



1.

Introduction

Key points

- The Australian Government has set ambitious targets to reduce emissions by 43% on 2005 levels by 2030, 62–70% below 2005 levels by 2035 and net zero by 2050 in line with the global goal to keep warming to well below 2°C and pursue efforts to keep it to 1.5°C.
- The Australian Government's Net Zero Plan sets how Australia can transition to net zero emissions by 2050, and the steps the Australian Government is taking to achieve this.
- The six sector plans provide further detail on the pathways, opportunities for abatement and policy directions for each sector.
- The Transport and Infrastructure Net Zero Roadmap and Action Plan is the sector plan for the transport and transport infrastructure sectors. It provides a clear strategy to reduce emissions across the transport sector. It covers all transport modes and considers cross cutting issues including low carbon liquid fuels, freight and supply chains, systemwide efficiencies and transport infrastructure.

In 2022, the Australian Government legislated its commitment to reduce economy-wide net greenhouse gas emissions to 43% below 2005 levels by 2030, and to net zero by 2050. 'Net zero emissions' refers to achieving an overall balance between greenhouse gas emissions produced and greenhouse gas emissions taken out of the atmosphere. Across the economy, Australia's emissions were 447 million tonnes of carbon dioxide equivalent gases (Mt CO₂-e) in 2023–24.¹

The Australian Government's Net Zero Plan sets out and extends Australia's action on climate change. The Net Zero Plan will guide our transition to net zero greenhouse gas emissions by 2050, and the 2035 Target of a reduction of 62–70% below 2005 levels. The Plan helps ensure Australia maximises the benefits of the global transition to net zero and provides long-term policy certainty to drive investment in low emissions and renewable technologies.

To support the Net Zero Plan, the Australian Government has developed six sector plans. These plans cover electricity and energy; industry; resources; the built environment; agriculture and land; and transport. This is the Transport Sector Plan.

How the transport sector can contribute to achieving net zero

While the transport sector is critical to our economy, it is also the third largest source of greenhouse gas emissions in Australia, with direct emissions amounting to 22% of Australia's greenhouse gas emissions.² With Australia's population and economy projected to grow, transport activity is also expected to continue to increase to 2050. The challenge is to reduce emissions while the sector grows.

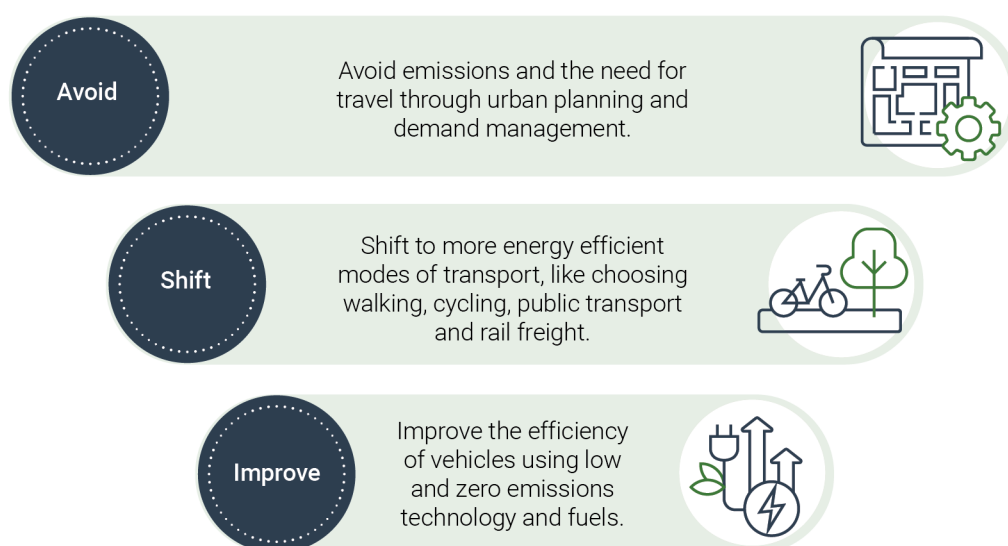
Box 1: The size and significance of transport in Australia³

- 4.6% of Australia's Gross Domestic Product was accounted for by Australia's transport, postal and warehousing industry in 2023–24.
- Total employment across transport, postal and warehousing industry was 705,000 persons in 2023–24.
- In 2023–24, there were an estimated 249.0 billion tonne kilometres of freight moved by road, 447.9 billion tonne kilometres of freight moved by rail, 88.3 billion tonne kilometres of freight moved by coastal shipping and 0.2 billion tonne kilometres moved by air freight.
- In 2023–24, 162.7 billion passenger kilometres were travelled by car, and 12.3 billion passenger kilometres were travelled on heavy rail networks in Australian capital cities.
- There were 616,361 domestic flights in 2023–24. At the height of the pandemic, domestic flights fell to 326,616, fewer than flight numbers in 1977–78.
- Transport infrastructure engineering construction work done recorded a new all-time high of \$51 billion (adjusted by chain volume index) in 2023–24. This accounted for 53 per cent of the value of infrastructure construction work done in Australia (including transport, energy, telecommunications and water).

Opportunities for reducing emissions from the transport sector have been identified through the avoid-shift-improve framework (see **Figure 3**):

- **Avoid** refers to reducing unnecessary vehicle, travel and freight movements. By improving the efficiency of the transport system through integrated land-use planning, improved supply chain logistics, transport demand management and telecommuting, the need for transport and the length of some transport may be reduced or avoided. This includes optimised future net
- zero supply chains, such as the co-location of sources of renewable energy, hydrogen production and green iron manufacturing.
- **Shift** refers to decarbonising travel by choosing to shift to more sustainable transport modes like active and public transport, or to low emission freight transport modes instead of fossil fuelled vehicles.
- **Improve** refers to improving the technology or efficiency of transport modes, such as through electrification or higher productivity vehicles.

Figure 3: Avoid-shift-improve framework



Through avoiding unnecessary transport, shifting transport to lower emissions modes, and improving the emissions profile of each transport mode and associated infrastructure, the emissions associated with the transport sector can be significantly reduced.

The benefits of taking action

Achieving net zero is essential to support global efforts to minimise the extent of climate change. Decarbonising the transport sector also brings other benefits and opportunities.

Consumer savings: Improving emissions profiles through electrification of light vehicles offers more efficient, affordable and sustainable transport for commuters. Electric vehicles (EVs) cost significantly less to power and

maintain than internal combustion engine (ICE) vehicles. This means that, while the upfront cost of electric vehicles is currently typically higher, they offer savings compared to an ICE vehicle over the lifetime of the vehicle, with running cost savings offering an EV owner a reduction in road transport costs of around \$1500 per annum compared with an ICE vehicle, averaged over 20 years of ownership.⁴

Additionally, when coupled with home solar and battery systems, EV ownership can offer substantial savings compared to owning an ICE vehicle or using grid energy. As vehicle to grid and bidirectional charging technology develops further, EV owners of vehicles with the appropriate technology enabled will have the potential to lower their electricity bills by using their EV battery to discharge back to the grid at times of peak demand. There is also potential for electricity consumers who do not own an EV to benefit

from the shared savings at a system level from EV batteries discharging into the grid. This stored electricity can be leveraged to help manage peak demand, lowering energy prices for all consumers.⁵ This will have a real benefit for consumers; for example, reducing light vehicle emissions through the New Vehicle Efficiency Standard (NVES) is estimated to deliver \$95 billion in fuel savings to Australia by 2050.⁶

Fuel security: Electrification of the transport sector and uptake of locally produced low carbon liquid fuels (LCLFs) and other fuels such as hydrogen will also reduce Australia's reliance on imported fuels. Australia is heavily reliant on imports of liquid fossil fuels, with 90% of the liquid fuel we use imported directly as refined products or indirectly as crude oil.⁷ In 2024, Australia held an average of 28 days of consumption coverage for automotive gasoline, 23 days for diesel oil and 20 days for aviation turbine fuel.⁸ Fuel security will be enhanced both by a decrease in demand for fossil fuels, and the development of a domestic LCLF production industry.

Export opportunities: Supporting domestic manufacturers to reduce the emissions intensity of key construction materials used in the transport infrastructure sector, including concrete, cement and steel, will increase the competitiveness of Australian industry in a decarbonising global economy. Increased production of low and zero carbon materials in Australia can open new market opportunities and ensure that exports are not penalised for their emissions impact.

A domestic LCLF production industry would also add value to Australian agricultural products before they are used as feedstocks in the LCLF supply chain or exported.

Health: Options to avoid, shift and improve transport emissions have efficiency and health co-benefits. It is estimated that there are more than 11,105 premature deaths of adults in Australia each year due to vehicle emissions, due to emissions of nitrogen dioxide and a range of fine particulate pollutants.⁹ People of lower socioeconomic status are disproportionately exposed to traffic and air pollution and at higher risk of adverse health outcomes;¹⁰ addressing transport emissions therefore has health equity impacts.

Increased investment in active transport infrastructure and corresponding uptake has health, community, social and safety benefits, with cities estimated to receive an almost \$5 economic benefit for every \$1 of investment.¹¹ Switching from ICE vehicles to EVs also provide health benefits across the community due to the reduction of

air and noise pollution, as does decarbonising freight transport. For example, the introduction of Euro 6d and Euro VI equivalent standards are expected to reduce the burden of disease attributable to noxious emissions from cars, SUVs, light commercial vehicles and heavy vehicles by \$13 billion.¹² The NVES is estimated to yield an additional \$5.5 billion in health savings benefits by 2050.¹³

Productivity: Decarbonising passenger and freight networks requires optimising routes and shifting to lower emissions, more efficient modes, where transport and energy infrastructure is in place. Strategic investments in infrastructure, such as multi-modal transport hubs, can support mode choice. Government facilitation of the decarbonising of transport infrastructure also offers productivity gains. Working with states and territories to produce nationally aligned infrastructure decarbonisation policies and guidance will reduce operational complexity and encourage innovation in material manufacturing.

Approach to developing this plan

This Roadmap and Action Plan has been informed by feedback, insights and analysis provided through public and industry consultations, as well as the Climate Change Authority's Sector Pathways Review and analysis and modelling from the Treasury. In response to the Transport and Infrastructure Net Zero Consultation Roadmap released in May 2024, the Australian Government received 284 written submissions, and 28 targeted consultation sessions were held, with engagement from 166 organisations and over 400 participants. Stakeholders from across industry, unions and communities broadly confirmed their support for the transport and transport infrastructure decarbonisation technology pathways.

Consultation showed broad support for the technology pathways for decarbonisation of each transport mode as set out in this Roadmap and Action Plan:

- electrification of light vehicles, as a low cost and efficient opportunity to decarbonise the sector as the electric light vehicle market continues to expand
- electrification of heavy vehicles where feasible and the use of LCLFs while electrification and hydrogen technologies develop, and for legacy vehicles
- renewable powered electrified metropolitan rail services, with more research and development required to determine the best decarbonisation pathway for non-electrified sections of the rail network for regional passenger and freight services

- a mix of technologies for maritime, including the use of low emissions fuels (LCLFs, including other fuels such as hydrogen derived fuels, and hydrogen) and battery electric small vessels
- in aviation, the use of sustainable aviation fuel (SAF) for medium to long haul aviation, with alternatives like battery electric and hydrogen propulsion aircraft having a role in decarbonising some short haul and regional flights.

There were calls for a range of measures to support the uptake of these technologies, including for:

- consistent national data on freight emissions and support for shifting more freight onto rail
- the removal of regulatory barriers to heavy vehicle decarbonisation and investment in charging infrastructure
- rail network efficiencies and investment in infrastructure
- encouraging low emissions shipping by addressing high certification costs for new low emissions vessel builds, supporting freight mode shift through intermodal terminals, and pursuing Green Shipping Corridors, along with supporting ports with bunkering and charging infrastructure
- both supply- and demand-side measures to drive the scaling-up of the LCLF industry, supported by lifecycle emissions accounting.

Consultation also covered transport infrastructure, showing support for:

- increased investment in active and public transport infrastructure
- guidance on measurement, benchmarking and reducing embodied emissions in transport infrastructure
- national infrastructure procurement guidelines which incorporate sustainability considerations in project assessments
- government support for commercialisation of low and zero emissions materials for transport infrastructure.

End notes

- 1 Department of Climate Change, Environment, Energy and Water (DCCEEW). [National Greenhouse Gas Inventory Quarterly Update: December 2024](#), DCCEEW, Australian Government, 2024.
- 2 DCCEEW, [National Greenhouse Gas Inventory Quarterly Update: December 2024](#), DCCEEW, Australian Government, 2024.
- 3 Unless separately referenced, facts and figures taken from [Bureau of Infrastructure and Transport Research Economics \(BITRE\), Australian Infrastructure and Transport Statistics—Yearbook 2024—January 2025](#) BITRE, Australian Government, 2025.
- 4 P Graham, Z Meher-Homji, L Havas and J Foster, [Consumer impacts of the energy transition: modelling report](#), Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2023.
- 5 P Graham, Z Meher-Homji, L Havas, and J Foster, [Consumer impacts of the energy transition: modelling report](#), CSIRO, 2023. Graham et al., Consumer impacts of the energy transition: modelling report.
- 6 Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA), [Cleaner, Cheaper to Run Cars: The Australian New Vehicle Efficiency Standard: Impact Analysis](#), 2024.
- 7 Carter, L., Quicke, A. and Armistead, A., [Over a barrel: Addressing Australia's Liquid Fuel Security](#), The Australia Institute, 2022.. DCCEEW, [Australia Petroleum Statistics](#), DCCEEW, Australian Government, 2025.
- 8 DCCEEW, [Australian Petroleum Statistics – Quick Stats Dashboard](#), DCCEEW, Australian Government, 2025.
- 9 W Say, W. and C. Walter, [Health impacts associated with traffic emissions in Australia](#), The University of Melbourne, 2023.
- 10 G Pratt, M Vadali, D Kvale, and K Ellickson, 'Traffic, Air Pollution, Minority and Socio-Economic Status: Addressing Inequities in Exposure and Risk', International Journal of Environmental Research and Public Health, 2015; S Cakmak, C Hebbler, JD Cakmak, J Vanos, 'The modifying effect of socioeconomic status on the relationship between traffic, air pollution, and respiratory health in elementary school children', Journal of Environmental Management, 2016.
- 11 Department of Transport and Main Roads Queensland, [Research demonstrates economic benefits of investment in cycling \(Action summary 5.5\)](#), Department of Transport and Main Roads, Queensland Government, 2023.
- 12 DITRDCA, [Heavy Vehicle Emission Standards for Cleaner Air](#), 2022.
- 13 DITRDCA, [Cleaner, Cheaper to Run Cars: The Australian New Vehicle Efficiency Standard: Impact Analysis](#), 2024.

2

Emissions outlook



With targeted action transport emissions will significantly reduce by 2050.



2.

Emissions outlook

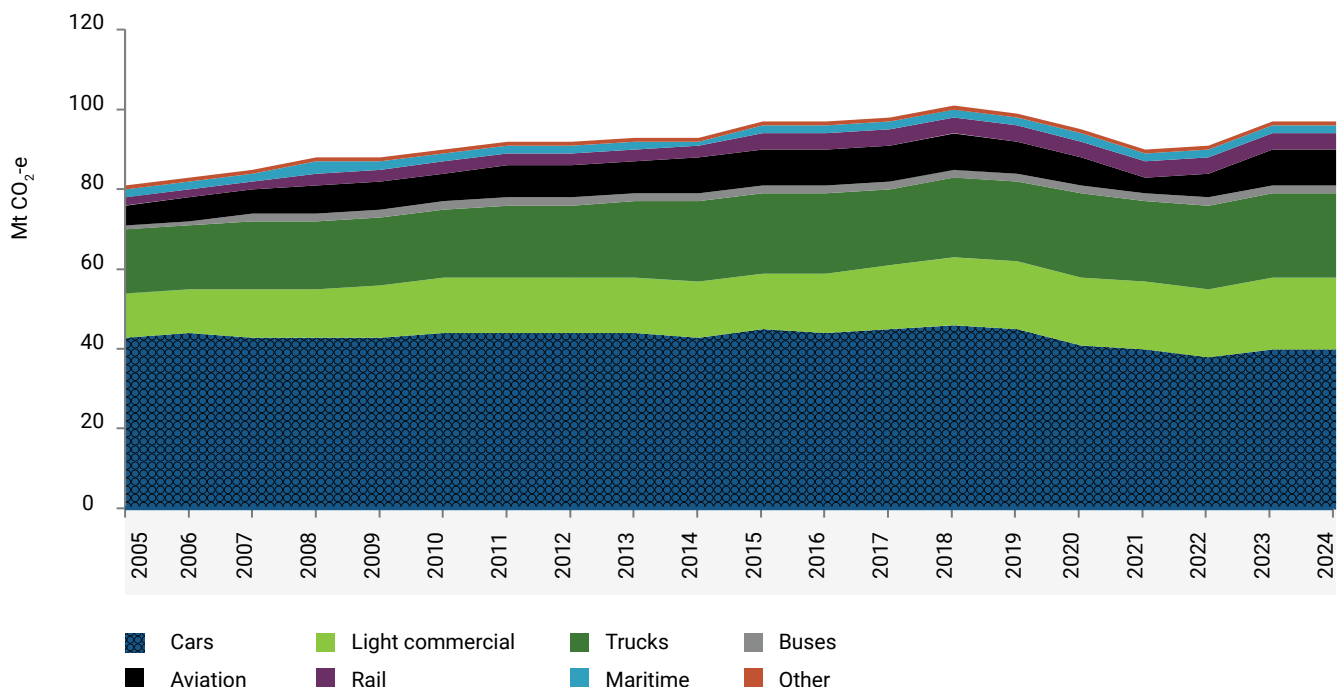
Key points

- Light vehicles (passenger and light commercial) make up 59% of all transport emissions. The switch to lower emitting vehicles facilitated by the New Vehicle Efficiency Standard (NVES) will drive significant abatement in the transport sector.
- The decarbonisation of heavy commercial vehicles, rail, maritime and aviation is expected to progress at a slower pace compared to light vehicles as the technologies are less mature.
- Treasury's modelling of the Baseline Scenario presents an efficient pathway Australia could take to reach its net zero goal. This shows it is technically and economically feasible to achieve deep cuts in transport emissions by 2050.

Transport moves people and goods across our geographically large and diverse nation. The majority of goods are moved by rail and heavy vehicles, and people move largely in cars. Road transport – cars, buses, motorcycles and trucks – is responsible for the majority of transport emissions (at around 83%).¹⁴ Of this, light vehicles (passenger cars and light commercial vehicles) are the single biggest source of emissions, contributing to 59% of Australia's transport emissions.¹⁵ In 2023–24, emissions from domestic aviation were 10% of transport emissions, rail roughly 4% and domestic maritime roughly 2%.¹⁶ **Figure 4** shows the emission trends from 2005 to 2024.

Figure 4: Road vehicles are responsible for the majority of transport emissions

Emission trends from the transport sector



Source: DCCEEW, *Australia's emissions projections 2024*, Australian Government, 2024.

Economic modelling and analysis by the Australian Treasury explores three scenarios of Australia's transition to net zero by 2050. This work has informed the development of the Australian Government's Net Zero Plan and sector plans and includes potential economy-wide and sector-specific emissions reductions pathways. The Baseline Scenario, which presents an efficient pathway Australia could take to reach its net zero goal, is referenced in this plan.

While scenario-based analysis is a powerful tool in helping inform Australia's net zero pathway, it is not possible to precisely predict how the transition will unfold. The future is uncertain and many factors will influence the net zero transition, including changes in technology, global dynamics and community responses.

Treasury modelling indicates it is technically feasible to reduce transport emissions from 100 Mt CO₂-e in 2025 to 36 Mt CO₂-e in 2050. Electrification and improved energy efficiency are projected to play a large role, aided by the implementation of policies such as the NVES. The growth in EV take-up is further enabled by reductions in EV prices, and greater public and private investment in EV charging infrastructure. In Treasury's Baseline Scenario, emissions from passenger transport in 2050 are projected to decrease from 42 Mt CO₂-e to 4 Mt CO₂-e, a 90% reduction between 2025 and 2050.

The decarbonisation of heavy vehicles, rail, maritime and aviation progresses at a slower pace compared to passenger transport in Treasury's Baseline Scenario (see **Figure 5**). In addition to electrification, alternative pathways for these transport modes include the use of low carbon liquid fuels (LCLFs), hydrogen-derived fuels and hydrogen.

By 2050, blending renewable diesel with conventional diesel and sustainable aviation fuel with jet fuel could support the reduction of the emissions associated with these fuels across the entire economy by up to 32 Mt CO₂-e and 5 Mt CO₂-e respectively (see **Figure 6**). As a result, emissions from commercial transport are projected to decline by 45% (to 32 Mt CO₂-e) from 2025 levels.

Figure 5: Emissions for commercial and private transport, Treasury's Baseline Scenario

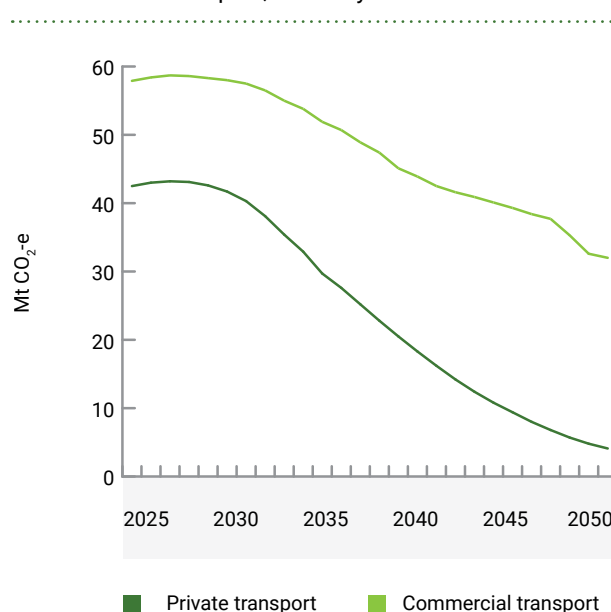
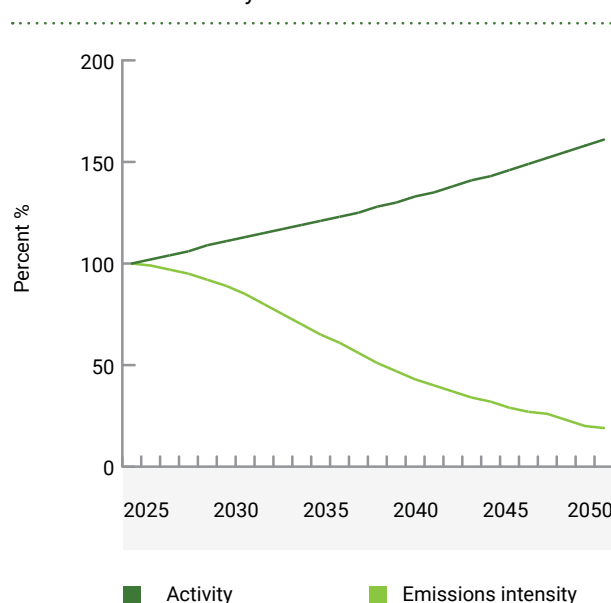


Figure 6: Transport activity and emissions intensity, Treasury's Baseline Scenario



Potential pathways for each transport mode, as well as for transport infrastructure, are set out in detail in the next chapter.

End notes

- 14 DCCEEW, [Australia's emissions projections 2024](#), DCCEEW, Australian Government, 2024.
- 15 DCCEEW, [Australia's emissions projections 2024](#), DCCEEW, Australian Government, 2024.
- 16 DCCEEW, [Australia's emissions projections 2024](#), DCCEEW, Australian Government, 2024.

An aerial photograph of a long, curved concrete bridge spanning a deep gorge. The bridge has multiple support pillars and carries a two-lane road. The gorge is filled with green vegetation, and the surrounding cliffs are rocky and layered. The ocean is visible on the left side of the bridge, with waves crashing against the shore. In the background, a city skyline is visible across the water under a clear blue sky. A large red circle is overlaid on the right side of the image, containing the number 3 and the title text.

3

Roadmap: decarbonisation pathways to 2050

The pathways to net zero will be different for each transport mode and will require a mix of technologies, policies and planning, based on evidence, market readiness and science. There are opportunities within each mode to shift to lower emission modes as well as improve the technology or efficiency of that mode. The actions the Australian Government is taking to support these decarbonisation pathways are set out in the next chapter.



3.

Roadmap: decarbonisation pathways to 2050

Key points

- Electrification and improved energy efficiency will be the primary decarbonisation pathway for light vehicles, such as cars and vans.
- The decarbonisation pathway for heavy vehicles is likely to require a range of different technologies, including electrification for buses and rigid trucks, and a mixture of low carbon liquid fuels (LCLFs) for larger vehicles that carry heavier payloads over longer distances.
- Rail is generally a lower emissions mode than road transport, so increasing the share of freight moved on rail will help reduce emissions, even with existing technologies. The decarbonisation pathway for rail will come from a mix of track electrification, battery electric trains, LCLFs and other low carbon alternatives, such as hydrogen.
- For maritime, shipping will require the use of LCLFs and other low carbon alternatives including hydrogen-derived fuels, such as methanol and ammonia, and hydrogen.
- For aviation, sustainable aviation fuel (SAF) will be the key technology. Other technologies such as battery electric and hydrogen powered aircraft are likely to be used for some short-haul flights.
- Decarbonising transport infrastructure (such as roads, railways, ports and airports) will require national standards for data collection, measurement and reporting of embodied emissions, and increased investment in low and zero carbon construction materials.

Treasury modelling provides useful insights on the potential cost-effective timing, sequencing and size of sectoral contributions to the economy-wide emissions reduction task. Treasury modelling alongside public and industry consultation have informed the potential decarbonisation pathways outlined in this chapter. The decarbonisation pathways outlined in this chapter have also been guided by the Climate Change Authority's Sector Pathways Review, the CSIRO's report *Pathways to Net Zero: Rapid decarbonisation pathways for Australia*, the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, analysis of over 130 transport emission reduction strategies from Australia and around the world, as well as public and industry consultation.

In general, the potential transport decarbonisation pathways for each transport mode involve a mix of electrification, LCLFs and alternatives, such as hydrogen-derived fuels or hydrogen, as well as productivity and efficiency improvements. A shift to sustainable, low emissions ways of moving people and goods, will further reduce transport emissions.



Box 2: Low carbon liquid fuels

- Drop in LCLFs, such as renewable diesel and sustainable aviation fuel, allow industry to use their existing fleet while lowering emissions. Drop-in fuels are LCLFs that can be used as a direct replacement for traditional fossil fuels, without the need for any modifications to the existing fuel infrastructure or engine technology. These LCLFs have a role in the decarbonisation of multiple transport modes, including heavy vehicles, rail, maritime, and aviation. See below for further details by transport mode.
- Potential LCLF feedstocks include canola seeds, tallow, sugarcane, municipal solid waste, bagasse, agricultural residues, short rotation trees, hydrogen and captured CO₂.
- LCLFs will be produced from biogenic feedstocks, such as vegetable oils, in the short-term. There is ongoing research and development into producing LCLFs from synthetic feedstocks, such as hydrogen and captured CO₂, in the medium to long term.
- This Roadmap and Action Plan (the Transport Sector Plan) focusses on the use of LCLFs in transport.
- For more detail on the production of LCLFs and hydrogen, see the Energy and Electricity Sector Plan.
- For more detail on the contribution of biogenic feedstocks to the net-zero transition, see the Agriculture and Land Sector Plan.
- More detail on the production of CO₂ for industrial uses, including LCLF production, will be provided in the upcoming Carbon Dioxide Removal (CDR) Roadmap, delivered in partnership with CSIRO.

3.1. Road – light vehicles

The main technology pathway to reduce light vehicle emissions is electrification.

Electric vehicles (EVs) have lower lifecycle emissions than petrol and diesel internal combustion engine (ICE) vehicles. EVs have zero tailpipe emissions, and even considering emissions from electricity generation the tailpipe emissions reductions more than offset the emissions associated with the supply chain and manufacturing phases.

Although EVs will be the primary technology for reducing light vehicle emissions, there are several other technologies that will also contribute to reducing light vehicle emissions:

- **Hybrid and plug-in hybrid vehicles:** Hybrid vehicles are already helping to reduce emissions within the light vehicle fleet. Plug-in hybrids can operate solely on electricity for shorter journeys – typically between 50km and 80km – and can further reduce the need for fossil fuels, especially if recharged with renewable energy. Extended range plug-in hybrids are emerging that provide a bridge towards full electrification of all light vehicle types.

- **Efficiency improvements:** Efficiency improvements in ICE and hybrid vehicles will mean less fuel is consumed, resulting in cost savings to owners and reduced emissions. For EVs, advances in battery technology are likely to result in greater electric range for plug-in hybrid vehicles, while tyres with lower rolling resistance can reduce emissions for all vehicle types.
- **Low carbon liquid fuels (LCLFs):** LCLFs may play a limited role in decarbonising light vehicles, for example in remote areas where there is limited access to charging infrastructure for EVs. For other applications electrification is expected to be the dominant technology.
- **Hydrogen fuel cell electric vehicles (FCEVs):** FCEVs can play a supportive role in decarbonising light vehicles, if hydrogen is produced from renewable energy. Hydrogen has increased range compared to current EVs, however is not currently competitive due to relatively low energy efficiency, the high cost of hydrogen production and the need to establish new refuelling infrastructure.

Voluntary alternatives to using light vehicles, especially greater use of active and public transport and home-based work, will also reduce transport emissions to 2050.

A net zero pathway for light vehicles

EVs are the key net zero pathway for light vehicles. In the short-term, this transition is being supported by incentives for purchasing EVs, along with regulation and consistent national charging standards that support the rollout of EV charging infrastructure. These actions, together with advancements in battery technology, will help ensure EVs are accessible to all Australians.

The NVES is encouraging greater availability and uptake of more efficient ICE vehicles and EVs in the Australian market by introducing progressively more stringent emissions standards for new vehicles over time. The current settings of the NVES, which improve year on year performance to 2029, are forecast to reduce emissions by 321 Mt of CO₂ emissions up to 2050.

The Australian Government is supporting and helping coordinate continued investment, including from the commercial sector, in renewable energy and network grid capacity. As take-up of vehicle-to-grid technology achieves scale, EVs will play an increasing role in consumer energy resources, helping take pressure off the grid.

As the light vehicle fleet continues to electrify, fossil fuel demand will continue to decrease until it is only used in light vehicles in very specific circumstances. Government will have a role to play in ensuring all Australians have opportunities to transition their vehicles, while maintaining transport access.

Figure 7: A net zero pathway for light vehicles



- The New Vehicle Efficiency Standard reduces new light passenger vehicle emissions intensity by over 60% and light commercial vehicles by 49%
- EVs become more affordable and accessible to all Australians
- Investments in charging infrastructure keep up with projected EV uptake
- Early steps to enable uptake of bidirectional charging and vehicle-to-grid capabilities



- Continued improvements in EV technologies and market offerings
- Charging infrastructure expands across the country
- Bi-directional charging and vehicle to grid capabilities start scaling up



- Charging infrastructure, including support for bi-directional charging and vehicle to grid capabilities, becomes widespread
- Fossil fuel demand decreases until it is only used in very specific circumstances



3.2. Road – heavy vehicles

A combination of low emission technologies and fuels will be required to decarbonise heavy vehicles.

A range of technologies and fuels will be required to decarbonise heavy vehicles, depending on payloads and distances:

- **Battery electric vehicles (BEVs):** Battery electric technology is advancing rapidly, both in increased energy density and reduced charging times. Buses and rigid trucks operating in urban areas are already able to utilise this following set routes, as they can recharge frequently at a central location. However, the additional weight of batteries has a significant impact on the total mass of BEVs, especially for trucks that operate over long distances and/or with heavier loads. The impact of this increased mass on road pavements will result in additional road maintenance being required.
- **Low carbon liquid fuels (LCLFs):** Drop-in LCLFs, such as renewable diesel, offer abatement potential and could act as a transition solution as it allows industry to continue using their existing diesel fleet, while lowering emissions. Depending on supply, LCLFs will also likely be used for larger payloads and distances, especially in regional and remote Australia, over the medium to long term.
- **Hydrogen:** Heavy and long-haul transport was identified as a priority sector in the 2024 National Hydrogen Strategy. However, the hydrogen truck market, and associated infrastructure, is currently less advanced than the market for electric trucks, with limited options currently available. This is because of emerging infrastructure required to produce and distribute hydrogen, together with its high costs and lower energy efficiency. As such, hydrogen vehicles, either hydrogen fuel cell vehicles (FCEVs) or hydrogen internal combustion engine (ICE) vehicles, may play a role in road freight transport in the long-term where electrification is less feasible due to charging infrastructure location, capacity and speed, or EV battery range to support heavy freight tasks. Greater volumes of hydrogen are required to cover the same distance, compared to diesel, due to its lower energy density by volume.
- **Battery swapping and range extending technologies:** Battery swapping vehicles are designed for batteries to be quickly removed and replaced, shortening charging times of a BEV. However, the lack of uniform standards for battery design make battery swapping less practical. A range extender is an auxiliary power unit, usually a small ICE engine, that recharges the battery in a BEV when necessary. While neither battery swapping nor range extenders are common in Australia, they have had proven success internationally, including in battery swapping in China. Demonstration projects, applying lessons from overseas could support heavy BEV uptake in regional Australia.
- **Productivity and efficiency improvements:** Higher productivity freight vehicles will move more goods more efficiently, lowering emissions. Additionally, modernising and efficiency improvements in ICE trucks and their components like tyres will mean less fuel is consumed, resulting in cost savings to owners and reduced emissions. Improvements in vehicle productivity and fuel efficiency will contribute to transport decarbonisation in the short- to medium-term but will not result in zero emissions. Optimising distribution networks (e.g. hub and spoke networks) and enhanced route planning can also increase efficiency and reduce last-kilometre transport distances.

A net zero pathway for heavy vehicles

Reflecting the technology development for heavy vehicles, the timeline for uptake of low and zero emissions vehicles will vary depending on the vehicle type and task.

In the short-term, electrification is already feasible and being used for buses, rigid and some articulated trucks (mostly through pilot programs). Roll out of charging infrastructure and establishing consistent national regulatory requirements will support electrification for heavy vehicles, with early opportunities for fixed routes and in metropolitan areas. Demonstration of this is already underway with bus, fire and rubbish truck electrification. Hub and spoke networks that deploy electric last-kilometre solutions can make greater use of these early opportunities. Decarbonisation may not necessarily involve like-for-like replacement of every route in a network.

More research and development will be needed to decarbonise articulated trucks that generally carry heavier loads longer distances. Battery and hydrogen technology innovation for articulated trucks can be progressed in near-term through addressing regulatory barriers and clarifying investment priorities. LCLFs, especially renewable diesel, could be used in conventional articulated trucks engines where electrification is not feasible. In the short-term, increasing the uptake of more efficient, modern and higher productivity freight vehicles will also contribute to emissions reduction.

In the medium-term the transition will accelerate as infrastructure for electric heavy vehicles continues to scale, along with improved technology and decreases in cost. LCLFs and other low carbon fuels such as hydrogen, with certification and accounting frameworks in place to verify emissions reductions, can complement electrification. As Australia's hydrogen industry develops, the targeted use of hydrogen for transport, either through direct use in hydrogen fuel cell vehicles or as a low-carbon feedstock for the production of LCLFs, will complement electrification. The Guarantee of Origin Scheme will be expanded to provide certification and lifecycle emissions accounting frameworks to verify the carbon intensity of LCLFs in addition to hydrogen.

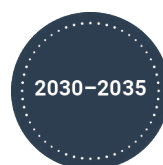
In the long-term, the widespread adoption of battery electric technologies will need to be supported by a national charging network. The use of LCLFs, where BEVs and alternatives such as hydrogen are not feasible, will also reduce emissions.

A shift of some freight transport to rail, where appropriate for the load, will complement improvements in heavy vehicle emissions intensity.

Figure 8: A net zero pathway for heavy vehicles



- Electrification of buses, rigid trucks, rubbish and fire trucks
- Continuing roll out of charging infrastructure for BEVs
- Initial use of LCLFs where electrification is not feasible, such as heavy duty articulated trucks, supported by certification
- Research and development into articulated truck emissions reduction technology
- Increased uptake of higher productivity freight vehicles



- Scale up charging infrastructure
- BEVs and FCEVs will continue to increase in efficiency and decrease in cost
- LCLFs and hydrogen, with certification and accounting frameworks in place to verify emissions reductions, complement electrification of some heavy vehicles



- National charging and refuelling networks
- Widespread use of battery and other zero emission technologies, such as hydrogen
- LCLFs where BEVs and hydrogen are still advancing/not feasible

3.3. Rail

The decarbonisation pathway for rail will involve a mix of track electrification, battery electric trains, LCLFs, including hydrogen-derived fuels and hydrogen.

Electrification of the rail network is a mature and readily available solution. However, electrifying rail track infrastructure is expensive, requiring high traffic volumes and shorter distances for financial viability. As such, the decarbonisation of Australia's rail network will likely require some mix of technologies, including:

- **Track electrification:** Electrified locomotives can take advantage of the increased level of renewable energy in the electricity mix. However, investment in rail electrification is expensive and requires high traffic use for financial viability. Track electrification is likely to be best suited for urban contexts and passenger rail.
- **Battery electric technologies:** Switching from hybrid diesel electric locomotives to battery electric locomotives is a promising solution. Battery electric locomotives can also be deployed to cover gaps between electrified rail segments and to support partial line electrification, lowering infrastructure costs. Although regenerative braking improves efficiency, the range of a battery electric locomotive is currently significantly less than a diesel electric locomotive. The technology has undergone substantial advances over recent years and will continue to develop with trials being conducted internationally and in Australia. Due to the long asset life of locomotives, retrofitting existing diesel locomotives with batteries is less expensive,

and aligns with circular economy principles. In addition to battery electric locomotives, battery electric or alternatives such as hydrogen fuel cell electric tenders (additional vehicles carrying the fuel or power needed) could be used.

- **Low carbon liquid fuels (LCLFs):** Drop-in LCLFs, such as renewable diesel, offers medium-term abatement potential, which will allow the industry to use their existing fleet while lowering emissions.
- **Hydrogen and hydrogen-derived fuels:** Low and zero emissions hydrogen and hydrogen derived fuels, especially ammonia could also become viable for rail transport. Hydrogen can be used through fuel cells or combustion. Ammonia is not a drop-in fuel, which means diesel engines need to be retrofitted to be compatible. Greater volumes of hydrogen or ammonia are required to cover the same distance, compared to diesel, due to their lower energy densities by volume.
- **Energy efficiency and network optimisation:** Higher productivity freight networks will move more goods more efficiently, lowering emissions. Additionally, efficiency improvements in diesel locomotives will mean less fuel is consumed, resulting in cost savings to operators and reduced emissions. Improvements in rail productivity and fuel efficiency will contribute to transport decarbonisation in the short- to medium-term but will not result in zero emissions.

Rail is already a low-emissions mode of transport when compared to other modes. Where feasible, increasing the share of freight and passengers moved on rail will also contribute to reducing overall transport emissions.

Current barriers to this mode shift include capacity and reliability constraints on the interstate rail network, regulatory fragmentation and a lack of standards harmonization. Eliminating these barriers will lift rail's competitiveness, facilitating its choice as an effective mode option by end users.

A net zero pathway for rail transport

The decarbonisation of rail transport will require a supply of commercially competitive zero-emission technologies with the necessary enabling infrastructure. A combination of technology improvements and pilot projects in the short-term will help determine the pathway to the medium- and long-term solutions.

Governments will play an important leadership role to test and establish future net zero pathways. Co-design of technology pathways and the enabling infrastructure investments, regulatory requirements and rolling stock standards will be needed. LCLFs, with the necessary certification and accounting frameworks to verify emissions, could start to be used in the short-term where alternative emissions reduction technology is not yet viable, while battery and hydrogen technology trials begin to establish which use-cases they suit best. Investment and regulatory requirements for low and zero emission energy and the required infrastructure should also begin across the rail network in the short-term. Where budgets allow, the Australian Government will take opportunities through the Infrastructure Investment Program (IIP) to invest in passenger rail electrification.

In the medium-term, demand for LCLFs for rail may begin to decrease as battery and alternatives such as hydrogen technology develop. As domestic production capacity of battery and hydrogen technologies grows, the refuelling and charging networks, including hydrogen refuelling infrastructure, will develop.

The long-term net zero future will require a significant reduction in fossil fuels as industry increases efficiency and adopts wide scale use of battery and alternatives such as hydrogen fuel cell technologies, supported by completed charging and refuelling networks.

Figure 9: A net zero pathway for rail



- Investment in passenger rail electrification
- Trials of battery electric and other zero emission technologies such as hydrogen
- Accelerate the build out of low and zero emission charging and refuelling infrastructure
- Initial roll out of LCLFs where electrification is not feasible, supported by certification
- Efficiency and productivity improvements



- Investment in a national charging and refuelling network
- Greater use of battery electric and other zero emission technologies such as hydrogen
- Production and investments in locomotive diesel technologies begin to scale down



- Widespread adoption of battery and other zero emission technologies such as hydrogen for new locomotives



3.4. Maritime

Shipping will require the use of low and zero emission fuels, including hydrogen derived fuels such as methanol and ammonia as well as hydrogen.

As a result of the diversity of the maritime transport sector both in Australia and internationally, a range of decarbonisation technologies are required:

- **Low carbon liquid fuels (LCLFs):** Drop-in LCLFs, such as renewable diesel, offer abatement potential and could act as a transition solution for existing diesel fleets, lowering emissions while other low emissions technologies are taken up.
- **Hydrogen and hydrogen-derived fuels:** Low and zero emissions alternatives such as hydrogen and hydrogen derived fuels, i.e. ammonia, and methanol, will play a role in the decarbonisation of long-distance shipping. Vessels require specialised internal combustion engines or fuel cells to use these fuels. Global production of ships that can run on these fuels is increasing.¹⁷ Greater volumes of hydrogen or ammonia are required to cover the same distance, compared to heavy fuel oil or marine diesel oil, due to their lower energy densities by volume.
- **Battery electric vessels:** Battery electric technology is suited for use in smaller vessels and other domestic maritime applications with shorter voyages. Battery electric technology will be highly limited by vessel size and voyage length, and will need to be matched with appropriate charging infrastructure at ferry terminals and other key locations. E-vessels, such as battery electric boats, sailing yachts, tug boats, ferries and smaller cargo ships, some of which are manufactured in Australia, are already available and in use in other countries. Hybrid electric vessels may be taken up in the short term while battery technology advances to extend the range of battery electric vessels.
- **Operational and efficiency gains:** Improved ship design and optimised vessel operations can increase efficiency and reduce emissions. This can include use of shore power (cold ironing), slow steaming, just-in-time port scheduling, hull optimisation, waste heat recovery, and advanced monitoring systems.
- **Zero emissions ports:** Ports can reduce operational emissions through the electrification of ground vehicles and equipment, including stevedoring machinery. This is in addition to using battery electric service vessels e.g. tugs.

A net zero pathway for maritime transport

To contribute to a net zero pathway, the maritime transport sector will require a combination of technology improvements and pilot projects in the short-term to determine the pathway to the medium- and long-term solutions.

In the short-term, LCLFs may be used in small vessels, as the necessary LCLF certification and accounting frameworks are developed. Newer vessels will continue to incorporate more efficient ship designs. Battery electric boats, sailing yachts, tug boats, ferries and smaller cargo ships will start to be deployed for short range voyages. The International Maritime Organization (IMO) Net Zero Framework is considering the introduction of a new set of GHG reduction measures for international shipping from 2028, including annual fuel intensity targets, a GHG emissions pricing mechanism, and a reward system for sustainable fuel adoption.

In the medium-term, the Australian Government and industry investment priorities and transition milestones will be based on evidence from trials and pilot projects. There will be greater adoption of hydrogen and hydrogen-derived low and zero carbon fuels for long distance shipping as the cost of hydrogen decreases. The use of battery electric power for small vessels (boats, sailing yachts, tug boats, ferries and smaller cargo ships) will also continue to grow. These will be supported by the expansion of refuelling and charging infrastructure, and shore power, connected to a low emissions electricity grid.

In the long-term, long-distance shipping vessels will run on low and zero emission fuels, such as hydrogen and hydrogen-derived fuels. This will be supported by low and zero-emissions port infrastructure and operations. There will be widespread adoption of battery electric boats, sailing yachts, tug boats, ferries and smaller cargo ships.

The Australian Government's Maritime Emissions Reduction National Action Plan (MERNAP) will provide more detail on the maritime decarbonisation pathway.

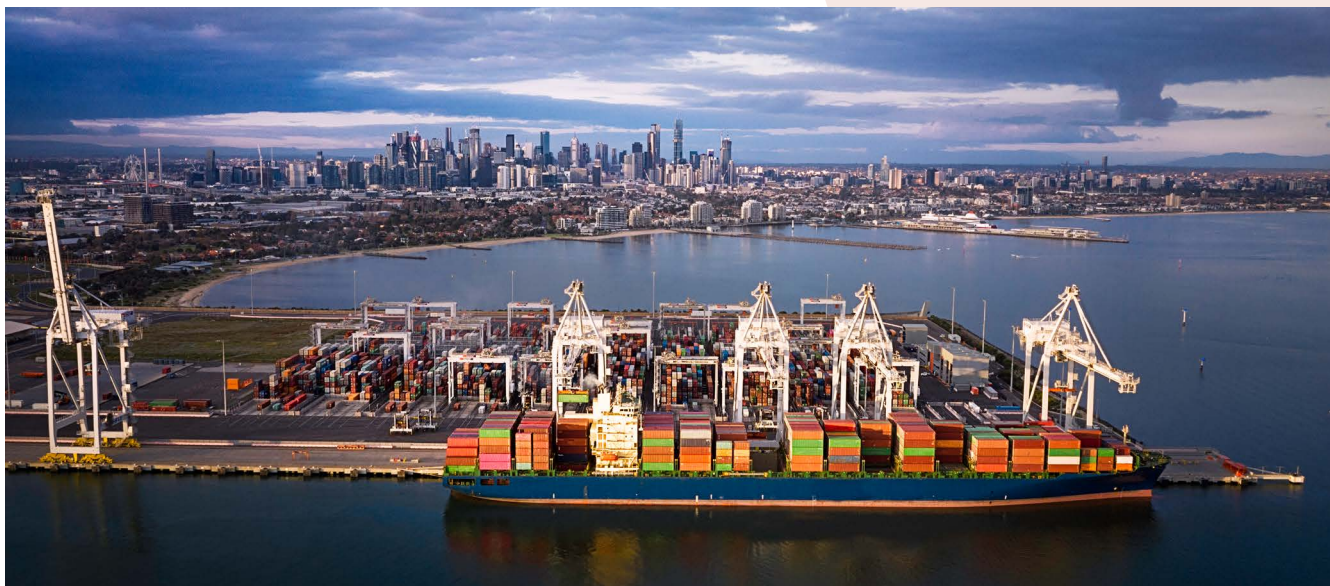


Figure 10: A net zero pathway for maritime

2025–2030

- Pilot and demonstration projects for low and zero carbon propulsion technologies
- International Maritime Organization progresses measures to reduce international shipping emissions
- Some battery electric vessels (battery electric boats, sailing yachts, tug boats, ferries and smaller cargo ships) commence deployment for short voyages
- LCLFs may be used in some small vessels as LCLF certification and accounting frameworks are developed
- Development of operating and safety standards for vessels using hydrogen and hydrogen-derived fuels
- Ongoing improvements in ship design improve efficiency of new vessels

2030–2035

- Short haul battery electric vessels continue to be deployed for short routes, including public transport
- Emerging use of hydrogen-derived fuels and hydrogen for long distance shipping, as hydrogen costs come down
- Increased deployment of charging and refuelling infrastructure at ports
- Expansion of shore power infrastructure and greater decarbonisation of port operations

2035–2050

- Widespread adoption of short haul battery electric vessels
- Significant increase in vessels powered by alternatives such as hydrogen-derived fuels and hydrogen for long distance shipping
- Ports broadly support battery recharging and refuelling of hydrogen derived fuels and hydrogen
- Zero emissions port operations widespread

3.5. Aviation

Sustainable aviation fuel is the primary pathway to decarbonise aviation.

Sustainable Aviation Fuel (SAF), a type of LCLF, will be the primary pathway to decarbonise the aviation sector, particularly for medium and long-haul flights. SAF is produced from sustainable feedstocks. It is chemically very similar to traditional fossil jet fuel and can be used in traditional jet engines without modifying them. Depending on the feedstocks, production methods and supply chains used, SAF offers an approximately 20% to 90% reduction in lifecycle emissions compared to traditional jet fuel.¹⁸ Potential feedstocks include canola seeds, tallow, sugar, agricultural and municipal solid waste, bagasse, agricultural residues, short rotation trees and hydrogen.



As a result of the diversity of the aviation transport sector both in Australia and internationally, a range of other decarbonisation technologies have potential:

- **Battery powered aircraft:** Due to range and payload limits, battery propulsion will be restricted to short haul aircraft, which are responsible for only a small percentage of the aviation sector's carbon emissions. In the longer term, battery powered aircraft may help to decarbonise short regional routes in Australia. Advances in battery technology may extend the range of these aircraft, supporting additional use cases.
- **Hydrogen:** Hydrogen propulsion shows some promise for use in medium-haul commercial flights for which battery powered aircraft are not suitable; longer domestic routes with small passenger loads that may not be viable with large aircraft; and in 'general' aviation i.e. private and recreational flying, instruction, and aerial work (agriculture, surveying, photography). Small hydrogen powered aircraft may also be well suited to regional aviation. After 2050, liquid hydrogen combustion may help decarbonise long haul domestic flights, though further testing is required to demonstrate the feasibility of this technology. Hydrogen could also play an increasing role as a feedstock for production of synthetic SAF, but this technology is at an early stage.
- **Advanced Air Mobility:** Advanced Air Mobility (AAM) involves a new generation of battery and/or hydrogen-powered aircraft with vertical take-off and landing capabilities, which can be used to move people and goods. AAM will provide opportunities to decarbonise the aviation sector and reduce surface transport emissions through mode shift.
- **Operational and efficiency gains:** Improvements in engine efficiency and aerodynamics can further improve aircraft fuel efficiency and reduce emissions. Efficient air traffic management can reduce unnecessary time aircraft spent in the air or in taxi, reducing emissions.
- **Zero emissions airports:** Airports can reduce operational emissions through the electrification of ground vehicles and equipment.

Voluntary flight alternatives, where passengers shift to other transport modes, such as High-Speed Rail, and increased use of video-conferencing could slightly reduce demand for domestic flights, lowering emissions.

A net zero pathway for aviation

The net zero pathway for aviation will rely heavily on SAF for medium and long-haul flights through to 2050 due to range and payload constraints of other technologies. Some short haul and regional flights will likely decarbonise through battery and hydrogen powered aircraft as these technologies mature.

In the short-term, SAF will be used with conventional aircraft engine technology, while investment supports battery and hydrogen propulsion development, and airport operations begin to electrify. SAF emissions intensity certification and accounting frameworks will be developed.

In the medium-term, SAF use will continue to grow, supported by increased domestic and international production. SAF production will evolve to include advanced feedstocks and production technologies, such as synthetic SAF produced from hydrogen feedstocks. Small aircraft are expected to begin to adopt hydrogen and battery propulsion technologies. Airport infrastructure will continue to upgrade to reduce operational emissions and provide recharging and hydrogen refuelling infrastructure.

In the long-term, the majority of aviation fuel used in Australia will be SAF, supported by a domestic SAF industry. Battery and hydrogen aircraft will likely be used for an increasing number of short to medium range flights. Airports will support these technologies and continue decarbonising their own operations.



Figure 11: A net zero pathway for aviation



- Nascent SAF uptake
- SAF certification and accounting frameworks are developed
- Battery and hydrogen technology and standards continue to develop with testing and demonstration in small aircraft
- Airport operations begin to electrify



- SAF uptake grows, as SAF costs reduce and production matures
- Small battery and hydrogen aircraft complete demonstration phase
- Incremental efficiency improvements in newer aircraft also reduce emissions
- Airport infrastructure continues to move towards net zero and upgrade to support electric and hydrogen aircraft recharging and refuelling



- SAF continues to reduce in cost and newer SAF technologies continue to commercialise
- Deployment of battery and hydrogen aircraft for some short to medium haul flights
- Australian airports support battery and hydrogen aircraft recharging and refuelling and have low operational emissions



3.6. Transport infrastructure

The net zero pathway for transport infrastructure requires investment in low and zero emissions construction materials supported by the implementation of design and procurement decisions which prioritise decarbonisation.

Embodied emissions from transport infrastructure are estimated to account for approximately 2.3% of Australia's net emissions, which is equivalent to 10% of transport emissions.¹⁹ These emissions are incurred during the manufacture of materials used in transport infrastructure, particularly cement, aluminium, steel and asphalt, as well as during asset construction, operation and decommission. Of these emissions, only a small proportion are scope 1 (direct) emissions for the transport sector, and are limited to emissions from on-site construction. The majority of embodied emissions are attributable as direct emissions in other sectors.

The Industrial Sector Plan covers supply-side measures which support domestic companies to decarbonise material manufacturing such as cement, steel and aluminium. In contrast, this Plan focusses on demand-side measures including the policy and regulatory environment which encourage greater production and utilisation of lower carbon construction materials. This Plan also considers opportunities to reduce emissions through optimised design and procurement, including avoided construction, using recycled materials and other circular economy practices:

- **Low emission construction materials:** In 2023, 'cradle to gate' emissions associated with the manufacturing of materials accounted for 67% of upfront embodied carbon for transport infrastructure.²⁰ Increased investment in low and zero carbon materials (steel, cement, asphalt and aluminium), including recycled materials, is needed to support the development of low carbon industries and markets.

- **Low emission design and procurement:** Public procurement can create strong, long-term demand signals for innovative materials. Procurement levers, such as purchasing with low emission materials in mind, or designing to circular economy principles (no-build or 'avoided' solutions, better maintenance, and refurbishment, or by using efficient planning, design and building techniques), promote demand-side drivers to incentivise emissions reduction in construction.²¹ Analysis by Infrastructure Australia found that up to 23% of upfront carbon from transport infrastructure construction could be abated by 2026–27 using like-for-like decarbonisation strategies. Achieving net zero aligned infrastructure by 2050 will require early and coordinated consideration of embodied carbon in planning, design and procurement.²²

The Built Environment Plan covers opportunities to reduce embodied emissions for buildings, as opposed to transport infrastructure.

Land transport infrastructure is a fundamental enabler of productive and connected communities, people, places and services, including facilitating freight movements around Australia and globally. The net zero transition will require the prioritisation of supporting infrastructure, including updates to ports and airports, building roads suitable for heavier electric vehicles, and enabling greater mode choice.

Extreme weather events will add additional strain and maintenance needs for transport infrastructure. Building resilience into the design, planning and maintenance of land transport infrastructure is an important consideration when understanding the long-term benefits these assets can provide. This includes using more long-lasting materials, not building in areas where climate impacts are likely to be severe, and ensuring redundancy in the road network to reduce single points of failure.

A net zero pathway for transport infrastructure

The Australian Government relies on state, territory and local government for the planning and delivery of most land transport infrastructure projects, and remains an informed and active co-investor on projects of national significance through the National Land Transport Act 2014, Infrastructure Policy Statement and the Federation Funding Agreement Schedule on Land Transport Infrastructure Projects (2024–2029) (FFAS). The FFAS is updated every five years to reflect changing priorities and concerns around transport infrastructure investments.²³ The FFAS will be reviewed approximately 12 months prior to its expiry to assess the degree to which its agreed objectives, outcomes and/or outputs have been achieved. These include the facilitation of efficient and effective delivery of land transport infrastructure projects, including reducing transport and infrastructure embodied emissions to support Australia's commitment to Net Zero by 2050.

Opportunities to reduce emissions from transport infrastructure need to be considered throughout the infrastructure lifecycle – the earlier the consideration in a project, the greater the influence on whole-of-lifecycle emissions. Under the FFAS, states and territories have committed to optimise their procurement practices to enable a reduction in embodied carbon in transport infrastructure in line with Australia's net zero commitments; and to increase recycled content in transport infrastructure to support Australia's transition to a circular economy. States will be required to report on progress against indicators on decarbonisation and the circular economy on an annual basis.

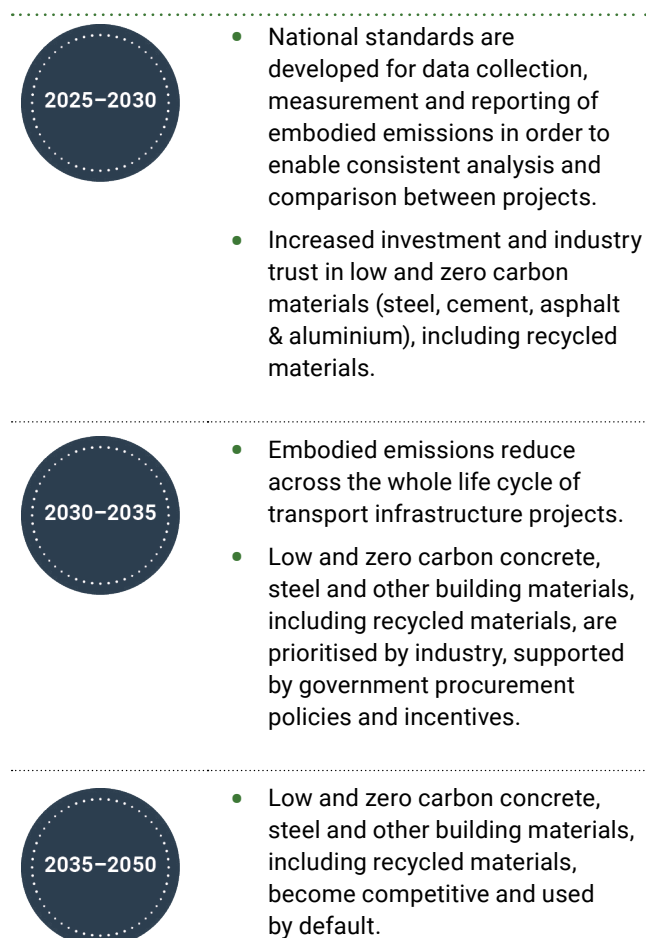
Achieving net zero will require establishing markets in low carbon and recycled materials, prioritising low or zero emissions procurement, and working to fill knowledge and skills gaps. The Safeguard Mechanism will help drive the transition to net zero for many relevant sectors, such as cement, iron and steel production.

In the short-term, national standards on data collection, measurement and reporting of embodied emissions will be required to enable accurate assessment and comparison between projects. Industry is also calling for increased investment in low and zero carbon materials production, particularly steel, cement, asphalt and aluminium, to increase their availability and accessibility on the market. Demand side drivers from areas such as transport infrastructure will support industrial decarbonisation efforts as well as future opportunities in green metals; this is further explored in the Industrial Sector Plan.

In the medium-term as industry capability grows, the Australian Government will continue to develop policy measures which incentivise significant reduction in embodied emissions, with a focus on achieving reductions across the entire sector, and embedding a strong industry preference for low and zero carbon concrete, steel and other building materials, including recycled materials. The Commonwealth's Environmentally Sustainable Procurement Policy is already reducing the environmental impact of Australian Government procurements.

In the long-term, the production of low and zero carbon concrete, steel and other materials, including recycled materials, should become price-competitive and the default choice for infrastructure projects, supported by actions to build the capacity of the sector. These measures will also support material manufacturers to innovate, increasing the competitiveness of Australian-made low carbon and recycled materials in a decarbonising global economy.

Figure 12: A net zero pathway for transport infrastructure



End notes

- 17 Bloomberg NEF, [Scaling Up Hydrogen: The Case for Low-Carbon Methanol](#), Bloomberg NEF, 2024.
- 18 CSIRO, [Sustainable Aviation Fuel Roadmap](#). CSIRO, 2023.
- 19 Infrastructure Australia, [Embodied Carbon Projections for Australian Infrastructure and Buildings](#), Infrastructure Australia, 2024.
- 20 Infrastructure Australia, [Embodied Carbon Projections for Australian Infrastructure and Buildings](#), Infrastructure Australia, 2024.
- 21 Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts (DITRDCA), [National Sustainable Procurement in Infrastructure Guideline: Technical Guidance](#), DITRDCA, 2025.
- 22 Infrastructure Australia, [Embodied Carbon Projections for Australian Infrastructure and Buildings](#), Infrastructure Australia, 2024.
- 23 Australian Government, [National Land Transport Act 2014](#), Commonwealth Consolidated Acts, AustLII, 2014, accessed 23 July 2025; Australian Government, [Infrastructure Policy Statement](#), DITRDCA, 2023; Australian Government, [Land Transport Infrastructure Projects \(2024–2029\)](#), Federal Financial Relations, 2024.





4

Action plan

This plan provides a framework for transport and transport infrastructure to support economy-wide net zero. Extensive consultation highlighted five guiding principles and five priority action areas to guide effort and investment, underpinned by the avoid-shift-improve framework.



4. Action plan

Key points

- This Roadmap and Action Plan is guided by five guiding principles: maximise emissions reduction, provide value for money, maximise economic opportunity, be inclusive and equitable and be evidence-based.
- The Plan uses the avoid-shift-improve framework to identify all opportunities for abatement.
- There are five key priority actions across our transport systems, modes and enabling inputs in this Roadmap and Action Plan.
- Priority Action 1: Invest in enabling low and zero emissions transport infrastructure.
- Priority Action 2: Electrify and increase transport's energy performance.
- Priority Action 3: Switch to low carbon alternatives (LCLFs) to power transport where electrification is not feasible.
- Priority Action 4: Innovate to expand cost competitive transport technology options.
- Priority Action 5: Scale up efforts to reduce embodied emissions in transport infrastructure.

Guiding principles

Building on the Net Zero Plan's objectives, this Roadmap and Action Plan is guided by five guiding principles that underpinned the Consultation Roadmap:

- **Maximise emissions reduction:** Emissions reduction is at the centre of the Australian Government's Net Zero Plan. We will identify and implement effective policies at the earliest opportunity that will result in the largest reductions in emissions, consistent with achieving the Australian Government's targets.
- **Value for money:** We will promote cost-effective measures to achieve the maximum abatement potential. This includes encouraging the private sector to leverage their capital, innovation and effort to achieve net zero and working with states and territories.

- **Maximise economic opportunity:** The global transformation to a net zero economy is a source of economic opportunity for Australia, its regions, industries and workers. Australia's regions and communities can take advantage of the decarbonisation of the transport sector and create new job opportunities that workers in emissions-intensive industries can be supported to transition into.
- **Inclusive and equitable:** No-one should be left behind on the journey to net zero. Inclusivity and equity, including intergenerational equity, will underpin our policy mix. By addressing the needs of a diverse range of communities and demographic groups, all Australians can benefit from decarbonisation. In particular, government support, training and close collaboration with industry will be necessary to ensure Australia has an inclusive and diverse workforce ready for net zero. Actions to decarbonise can also support liveability, health and other outcomes.
- **Evidence-based:** We have drawn on expert analysis and experience to develop a Roadmap and Action Plan that acknowledges that no one pathway or technology will suit every transport mode. The outcome is a mix of technologies, policies and planning, based on evidence and market readiness.

Avoid-shift-improve

We use the avoid-shift-improve (ASI) framework to identify all opportunities for abatement.

- **Avoid** refers to removing travel which people would prefer not to undertake. By improving the efficiency of the transport system through integrated land-use planning, transport demand management and telecommuting, the need to travel and the length of some travel may be reduced or avoided.
- **Shift** refers to decarbonising travel by choosing to shift to more sustainable transport modes like active and public transport, or to low emission freight transport modes instead of fossil fuelled vehicles.
- **Improve** refers to improving the technology or efficiency of transport modes, such as through electrification.

Transport infrastructure is critical across all three domains. See also **Figure 3**.

Priority actions

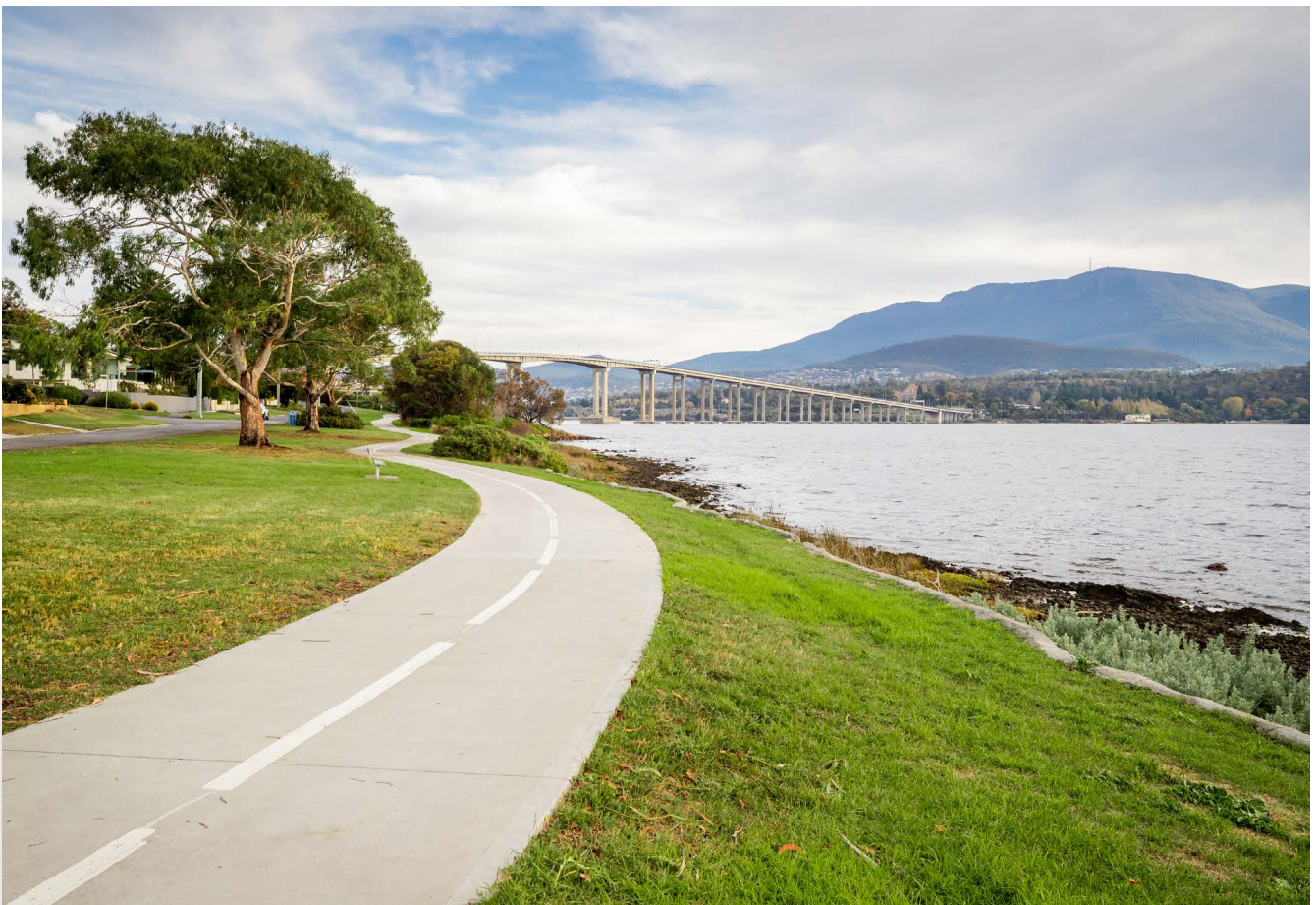
The Net Zero Plan sets out Australia's pathway to achieve our legislated target of net zero greenhouse gas emissions by 2050. The Net Zero Plan identifies 5 priority decarbonisation actions to reduce key emissions sources across the economy:

1. Decarbonise and expand the electricity network
2. Electrify and improve energy and materials performance
3. Switch to low-carbon fuels
4. Innovate to expand emissions reduction options
5. Scale up carbon removals to balance residual emissions.

This plan for transport and transport infrastructure has a particular focus on advancing priorities 2, 3 and 4, in alignment with the sector's decarbonisation pathways set out in chapters 2 and 3.

There are five priority actions that will ensure the transport sector makes its full contribution to Australia's medium and long-term emissions reductions goals. Achieving a net zero transport and transport infrastructure sector will require sustained effort and action from industry, all levels of government, the private sector and communities across these five actions:

1. Invest in enabling low and zero emissions transport infrastructure
2. Electrify and increase transport's energy performance
3. Switch to low carbon alternatives (LCLFs) to power transport where electrification is not feasible
4. Innovate to expand cost competitive technology options for transport and transport infrastructure
5. Scale up efforts to reduce embodied emissions in transport infrastructure.





Priority action 1: invest in enabling low and zero emissions transport infrastructure

Achieving a low and zero emissions transport system will require rethinking our transport networks to decarbonise how we move people and goods across our large and geographically diverse country. This links to the avoid and shift elements of the ASI framework as enabling low and zero emission transport infrastructure will improve the efficiency of our transport systems and encourage greater use of active and public transport and lower emission freight transport modes. There are five sub-actions that contribute to Priority Action 1.

1.1 Invest in transport infrastructure projects that support sustainable and decarbonised transport systems

While the design, construction and funding of transport infrastructure is a shared responsibility of Australian, state, territory and local governments, along with the private sector, the Australian Government is investing in infrastructure projects that support sustainable and decarbonised transport for both the movement of people and the movement of goods:

- The **Infrastructure Policy Statement (IPS)** guides the Australian Government's investment in land transport infrastructure to achieve economic, social, and environmental goals. Under its sustainability theme, the IPS raises the importance of decarbonising the design, construction and operation of transport infrastructure to achieve net zero by 2050; and affirms that the Australian Government will seek to invest in projects that promote integrated and more sustainable approaches to land use.
- Under the **Infrastructure Investment Program (IIP)**, 38 active projects worth a total of \$29.2 billion are dedicated to infrastructure that will support the decarbonisation of transport, such as infrastructure for active transport, public transport, or enabling freight to be moved by sea or rail rather than road.²⁴ A further 133 active projects have a component that supports decarbonisation, such as funding for a road upgrade that includes an adjacent active transport path.

- Under the **Federation Funding Agreement Schedule on Land Transport Infrastructure Projects (FFAS)**, states and territories will aim to optimise their procurement practices to enable wider outcomes including a reduction in embodied carbon in transport infrastructure in line with Australia's Net Zero commitments; and optimising recycled content in transport infrastructure to support Australia's transition to a circular economy. States will report agreed indicators relating to decarbonisation and contribution to the circular economy on an annual basis.

The **National Land Transport Act 2014 (NLTA)** provides the legislative framework that outlines the types of land transport infrastructure projects that are eligible for funding under the IIP. A future review of the NLTA provides an opportunity to consider how transport infrastructure investments can support decarbonisation, including in active and public transport.

Movement of people

A net zero transport pathway will require a substantial increase in the use of active and public transport, while providing access to transport options that are affordable and meet the needs of communities. The Australian Government is taking a range of actions to support the net zero pathway for the movement of people:

- The Australian Government's **Active Transport Fund** provides funding for bicycle and walking paths to promote active transport across Australia. The **National Health and Climate Strategy** aims to engage agencies at all government levels to promote active travel.
- Under the IIP, 26 active projects worth a total of \$27.5 billion, are dedicated to infrastructure to support the use of public transport.²⁵
- The Australian Government is planning for a future High Speed Rail network to connect communities across the east coast of Australia. **High Speed Rail** will better connect Australians and enable reduced car use.

Movement of goods

The Australian Government is also undertaking a range of actions to support the net zero pathway for the movement of goods:

- The **National Freight and Supply Chain Strategy (NFSCS)** recognises the role of supply chains in achieving net zero by 2050, highlighting decarbonisation as one of the four National Priority Action Areas.
- The Australian Government's investment in **Inland Rail** will enhance national freight and supply chain

capabilities by connecting existing routes through rail, roads, and ports and shifting more goods to rail, resulting in faster, more reliable freight; safer, less congested roads; and fewer emissions. Investments in **intermodal hubs** such as the Moorebank Intermodal Terminal Precinct will also support resilient and sustainable national supply chains.

- 10 active projects under the IIP worth a total of \$2.1 billion are dedicated to infrastructure that enables more freight to be moved by rail.²⁶
- The Australian Government's **Emerging Aviation Technology Partnership (EATP)** Program supports research into, and development of, low and zero emission propulsion systems with potential applications in conventional aviation, including freight. The EATP Program has enabled battery powered flight tests, and testing of hydrogen fuel cells that will enable hydrogen powered passenger transport flights with an estimated range of up to 3,000km in future. Under the Program, battery powered drones are also being used to deliver essential medical supplies to remote Aboriginal communities.

Using data to guide route planning and infrastructure investments will further enhance distribution strategy efficiency, thereby reducing unnecessary travel and, consequently, emissions. The CSIRO's *Transport Network Strategic Investment Tool (TraNSIT)*²⁷ can improve supply chain efficiency and help identify options for transport and logistics investment.

1.2 Support the path to net zero in the planning and development of urban areas

Considering the path to net zero in the planning and development of urban areas will be critical to supporting sustainable transport choices for the movement of people and movement of goods:

The **National Urban Policy** outlines a vision for the sustainable growth of our cities that are liveable and equitable, productive and innovative, and environmentally sustainable and resilient. Future planning for active and public transport infrastructure may be guided through the implementation of this policy, considering the distinct roles of each government level.

The NFSCS includes the **National Urban Freight Planning Principles**, which emphasise the connection between freight movement and land use planning, particularly the need to protect critical land and freight infrastructure in urban areas.

1.3 Develop place-based solutions to drive transport sustainability and decarbonisation at a local level

Place-based and local level programs are best placed to enable the identification of transport access and equity issues. Through the **Regional Investment Framework**, the Australian Government is investing in a range of programs to develop place-based solutions to drive transport sustainability and decarbonisation at a local level including:

- Growing Regions Program
- Thriving Suburbs Program
- Stronger Communities Programme
- Housing Support Program
- Safer Local Roads and Infrastructure Program
- Community Energy Upgrades Fund.

The Australian Government has also refocused programs to ensure that they support broader Australian Government priorities, including achieving net zero, through new application requirements.

1.4 Embed resilience to current and future climate change

Informed by the National Climate Risk Assessment and National Adaptation Plan, the Australian Government will seek to embed resilience to current and future climate change in our transport systems and infrastructure. For example, reflecting the importance of resilience to the future of efficient and productive freight operations, resilience has been added as a National Priority Action Area under the **National Freight and Supply Chain Strategy**.

Productivity and resilience are also strategic themes of the **IPS**. This involves investing in projects that enhance Australians' mobility in cities, towns, and regions, prioritising mass transit to develop more productive central business districts.

The Australian Government will look for opportunities to further embed resilience across transport and transport infrastructure. For example, innovative transport technologies will also play an increasingly important role in the management of extreme weather events. This will be particularly important for regional Australia, where areas with single or limited access routes can be cut off by extreme weather events. The **National Roadmap for Remotely Piloted Aircraft Systems in Bushfire Management** outlines a national pathway to implement emerging aviation technologies for bushfire management.



Priority action 2: electrify and increase transport's energy performance

Electrification and energy efficiency will be the primary decarbonisation pathway for much of the transport sector, especially light vehicles. As part of the avoid-shift-improve framework, where travel cannot be shifted away from vehicle use, decarbonising the transport sector will involve improving the fuel efficiency and carbon intensity of our vehicles and electricity.

There are five sub-actions that contribute to Priority Action 2.

2.1 Maintain, review and improve regulatory frameworks to reduce transport emissions

The Australian Government will use existing regulatory frameworks to reduce transport emissions:

- The Australian **New Vehicle Efficiency Standard** (NVES), which came into effect on 1 January 2025, encourages supply of more efficient light vehicles and will drive down emissions from new light vehicles. The Australian Government will commence a review on the operation of the NVES in 2026. The review process will offer the opportunity to assess policy effectiveness and refine the regulatory systems and mechanisms.
- The **Safeguard Mechanism** sets legislative limits on the greenhouse gas emissions of Australia's largest industrial facilities, including 11 transport facilities involving 1 in heavy vehicles, 6 in rail, 1 in maritime and 3 in aviation. As these limits decline over time, this will drive down emissions in the transport sector. In 2023–24, the Safeguard Mechanism covered 11% of transport emissions, including 82% of rail emissions and 71% of aviation emissions. The Australian Government will conduct a review of the Safeguard Mechanism policy settings in the financial year 2026–27 to ensure the scheme's design is appropriately calibrated and effectively delivering emissions reduction in line with Australia's targets.

2.2 Increase the supply of affordable and accessible EVs

The **National Electric Vehicle Strategy** establishes a consistent framework to boost EV adoption, reduce light vehicle emissions, and enhance Australians' wellbeing. Increasing the supply of affordable and accessible EVs is one of the Strategy's three key objectives, alongside encouraging increased EV demand and establishing the resources, systems and infrastructure to enable rapid EV uptake. As part of this, the NVES will also save Australians money on fuel and provide more car choices, as well as reducing greenhouse gases from cars and improving air quality.

The 2024–25 **Australian Design Rule (ADR) Harmonisation Review** is also assessing the current processes for harmonising ADRs with international vehicle standards, and seeking opportunities to improve these practices. The review is exploring how harmonisation practices influence timing and decisions about providing vehicles to the Australian market, including interactions with the NVES.

The Australian Government has also removed regulatory barriers where appropriate to accelerate the supply of heavy battery electric vehicles including:

- **Reforms to mass limits** by the National Heavy Vehicle Regulator, National Transport Commission, and states and territories ensure trucks with advanced safety and emissions features avoid productivity penalties. Steer axle mass limits have been increased from 6.5 tonnes to 7.0 tonnes for **Euro VI** and zero-emission trucks, allowing for larger battery electric models.
- The **Safer Freight Vehicles** package, to increase the overall width limit from 2.5 to 2.55 metres for new trucks that are fitted with a number of safety features and increasing the allowable space between front axles on trucks. This will increase the supply of zero-emission trucks available in Australia.

The Australian Government intends to also progress heavy vehicle reforms, including for heavy zero emissions vehicles (HZEVs), in partnership with the states and territories, and local governments. These reforms will be aimed at increasing transport productivity for all heavy vehicles and support the uptake of HZEVs.

2.3 Encourage increased uptake of more efficient vehicles, supported by energy performance improvements

To accelerate the decarbonisation of light vehicles, the Australian Government has introduced incentives and support to encourage the uptake of electric and efficient vehicles:

- Expanded the **Driving the Nation Program** (delivered through ARENA), and allocated \$100 million to support heavy BEV technologies and charging and innovation in light vehicle charging, to accelerate the uptake of both light and heavy EVs.
- The **Electric Car Discount**, introduced in 2022, provides a Fringe Benefits Tax exemption for cars made available by employers for use by employees. The fringe benefits tax exemption is complemented by the removal of a 5% import tariff, making eligible electric vehicles more affordable and accessible to Australian families. The Government will complete a statutory review into the discount by mid-2027.
- The Clean Energy Finance Corporation (CEFC) is investing in **green car loans** to accelerate EV uptake, including partnerships with auto finance companies to get more EVs onto Australia's roads and for leasing and rideshare companies to boost their EV fleet. For example, up to \$150 million has been made available to support workers earning less than \$100,000 a year and eligible essential workers to purchase an EV.
- Funding the **Real World Testing of Vehicle Efficiency program** to test the fuel consumption and emissions of vehicles in real-world conditions so consumers have clear information on how much a particular vehicle will cost to run. The Real World Testing program has been expanded to test the efficiency of EVs in 2025.
- Reviewing the carbon dioxide testing framework for light vehicles and update the sticker that is required to be placed on new vehicles when they are sold. The Australian Government will put in place a conversion framework to allow vehicle suppliers to convert between different testing frameworks.
- The **Green Vehicle Guide** is a centralised website providing data and tools to help Australians quickly compare the fuel efficiency, running costs and environmental performance of new and used vehicles.

- EV.gov.au, a **centralised website for EV education and awareness** launched in July 2025. The website provides EV education and information in a 'one-stop-shop' with tailored resources for existing EV owners and those considering an EV in the future.
- The Australian Government, in consultation with states and territories, is undertaking a cost-benefit analysis (CBA) on whether there would be merit in increasing mass limits to facilitate the adoption of low and zero emission heavy vehicles. The results of the CBA will be published in 2025.

2.4 Support the efficient rollout of electric vehicle charging infrastructure

All levels of government, individuals and the private sector will have a role to play in shaping the national EV charging ecosystem. As uptake of EVs continues to grow, it will be important to have a policy environment that supports people to enjoy the benefits of charging their EV at home alongside efficient investment in and installation of appropriate public EV charging infrastructure in the places people most need to access it.

To support the transition, the Australian Government will continue to invest in EV charging infrastructure:

- The \$475 million **Driving the Nation Fund** provides \$39.3 million to the NRMA to deliver public fast charging stations across key highway routes as part of a National EV Charging Network and \$60 million through the DRIVEN Program to support installation of EV charging infrastructure at car dealerships and repairers. Under the Fund, ARENA has also allocated \$100 million to support heavy vehicle charging and light vehicle charging innovation.
- The Australian Government will provide \$40 million to accelerate the rollout of EV kerbside and fast charging. The Government will leverage the complementary strengths of DNSPs and EV charge point operators to deliver up to 10,000 public chargers.
- Charging infrastructure will need continue to keep pace with the electrification of light road vehicles so that Australians can enjoy the benefits of charging their EV at home and access appropriate public EV charging infrastructure in the places where people need it most. Removing barriers to home charging for apartments could help reduce the reliance on public charging infrastructure. For example, governments at all levels could work together to establish a right to charge for apartments and households without off-street parking, such that owners' corporations cannot unreasonably restrict or prevent the installation of home charging.



- As part of the National Electric Vehicle Strategy, the Australian Government has developed **guides to help multi-residence (strata) buildings become 'EV ready'**. This guidance provides apartment buildings with a toolkit of resources, templates and checklists to support residents to transition to EVs when it suits them. The Strategy is also looking at how all levels of government can work together to provide a right to charge, such that bodies corporate cannot unreasonably restrict or prevent the installation of chargers in apartment buildings.
- The National **Consumer Energy Resources (CER)** Roadmap outlines the Government's vision and plan to scale CER across Australia.²⁸ It offers a national approach to reforms, to deliver the greatest benefits for Australian households, businesses and communities.
- ARENA commissioned the **National Roadmap for Bidirectional EV Charging** in partnership with the RACE for 2030 Cooperative Research Centre. The roadmap highlights the potential of bidirectional EV charging to reduce electricity costs and accelerate national emissions reduction. The V2G roadmap outlines possible pathways for commercial adoption of bidirectional charging in Australia and guides future investment.
- To ensure a consistent approach to EVs, the Australian Government, in collaboration with states and territories, has developed **minimum operating standards for EV charging infrastructure**. These standards guide the deployment of government-funded public EV charging by providing guidance on factors like uptime, accessibility, interoperability, and payment options.
- The Australian Government launched a **national mapping tool for EV charging infrastructure** in July 2025. This tool will aid in planning for infrastructure, energy, and telecommunications, provide certainty for EV drivers across borders, and guide future investments. The Australian Government is also working with states and territories to identify priority locations for regional charging infrastructure, ensuring optimal investment and certainty for all EV users in Australia.
- The Australian Government has also funded charging infrastructure for electric buses at depots in Western Australia and New South Wales. A future review of the *National Land Transport Act 2014* provides an opportunity to consider how transport infrastructure investments can further support decarbonisation, including through active and public transport.



2.5 Enhance the operations of ports, railways and airports to advance decarbonisation

Rail

The Australian Government is improving the productivity and resilience of the national rail network. This will contribute to lower emissions and increase the attractiveness of moving freight on rail. Rail freight is also captured by the Safeguard Mechanism. Actions to enhance the operations of railways that will support decarbonisation include:

- The second stage of the **National Rail Action Plan** aims to create an integrated, productive, and safe national rail network through interoperable technologies, a national approach to skills and training, and harmonised standards. The four-year program from 2024–25 to 2028–29 aims to streamline and reduce operational constraints, drive interoperability, harmonise standards and systems, and address rail's skills and labour shortages.
- The Australian Government is investing over \$15 billion in major rail projects from 2023–24 to 2032–33, including **Inland Rail** and **High Speed Rail** planning, and strategies to support the rollingstock transition, such as the **National Rail Manufacturing Plan**.

Maritime

The **Maritime Emissions Reduction National Action Plan** (MERNAP) will set the strategic direction and set out actions to decarbonise our maritime transport. This includes:

- Supporting increased green energy exports
- Encouraging investment in research and development for maritime innovation
- Enhancing port infrastructure and operations to support maritime decarbonisation
- Continuing to engage with the International Maritime Organization and expanding green and digital corridor activities
- Supporting demand aggregation through collaboration among regional operators
- Supporting first movers by reducing regulatory barriers and mitigating costs
- Ensuring timely and effective upskilling of the maritime workforce.

Further information about the MERNAP is available online.²⁹

Aviation

The Australian Government's **Aviation White Paper** sets out the vision for the aviation sector towards 2050. The Australian Government is encouraging the aviation industry to decarbonise by supporting the rollout of necessary enabling infrastructure, especially at airports:

- Amending the **Airports Regulations 2024** to require federally-leased airport master plans and major development plans to include information on how long-term planning will address decarbonisation. The new rules will allow the Minister for Infrastructure, Transport, Regional Development and Local Government to have regard to the suitability of the airport's sustainability and decarbonisation initiatives when making decisions about future master plans and major development plans.
 - \$40 million to expand the **Regional Airports Program** to improve safety and accessibility and support the transition to net zero at eligible regional airports.
 - Releasing an **Advanced Air Mobility** (AAM) Strategy outlining the Australian Government's long-term AAM policy settings to provide certainty and encourage investment in this emerging sector.
 - Developing **Advanced Air Mobility Infrastructure Planning Guidance** to ensure a nationally consistent approach to infrastructure planning to support the introduction of AAM.
 - The **Uncrewed Traffic Management** (UTM) Action Plan will develop a safe and competitive market for drone traffic management in Australia and streamline approval processes for drone operations.
 - Established the **Australian Jet Zero Council** to promote, mobilise and galvanise industry efforts on aviation and provide coordinated advice to the Australian Government.
- 



Priority action 3: switch to low carbon alternatives (LCLFs) to power transport where electrification is not feasible

To support the transport sector's net zero pathways, low carbon alternatives such as low carbon liquid fuel (LCLF), including sustainable aviation fuel (SAF) and renewable diesel, and hydrogen, will be important to decarbonise hard-to-electrify transport modes, including heavy vehicles, rail, maritime and aviation. There are three sub-actions under Priority Action 3 that are aimed at improving the emissions intensity of hard-to-electrify transport modes.

3.1 Establish frameworks to verify and track the emissions intensity and production methods of LCLFs and hydrogen

The Australian Government is extending the **Guarantee of Origin (GO) scheme** to LCLFs and hydrogen to provide a robust, internationally aligned framework for tracking and verifying the emissions intensity and production methods of LCLFs and hydrogen.

The Australian Government has also developed the new **Fuel Quality Standards (Paraffinic Diesel) Determination 2025** so that diesel users can be confident that new types of diesel, e.g. renewable diesel, operate at the same standard as conventional diesel.

3.2 Fast track support for a domestic LCLF industry, with an initial focus on SAF and renewable diesel

The Future Made in Australia agenda will see the Australian Government fast-track support for a LCLF industry, including SAF and renewable diesel, to support Australia's transition to a net zero economy:

- The **GO Scheme** supports the Australian Government's Future Made in Australia agenda to attract investment in low carbon products and renewable electricity. The scheme will empower an Australian LCLF industry to make confident, objective and credible claims about the products they make. The scheme will also help Australian producers access emerging domestic and export low-emissions markets.
- The **Future Made in Australia Innovation Fund** supports projects to commercialise net zero innovations, with \$250 million allocated to accelerate the pace of Australia's domestic LCLF industry.

ARENA's Sustainable Aviation Fuel Funding Initiative has also provided over \$30 million in grants to support development of a SAF industry.

The **Australian Jet Zero Council** was established to lead on industry efforts to achieve net zero aviation in Australia, with an initial focus on SAF.

The Australian Government has also committed to developing a **bioenergy feedstock strategy**, to support a coordinated approach to developing a feedstock industry in a way that creates opportunities for agriculture and forestry producers but does not create concern around food security.

To build a supply chain for Australian low carbon liquid fuels, the Australian Government will invest \$1.1 billion in a new **Cleaner Fuels Program**. This will help stimulate private investment in Australia's first onshore low carbon liquid fuel refineries, backing local innovators, making fuel supply more resilient and bridging the price gap for early adopters. The Government will engage with industry on how to make sure Australian liquid fuel users have a fair chance to capture the emissions reduction potential unlocked by low emission Australian fuels.

3.3 Support the development of renewable hydrogen

The **National Hydrogen Strategy** sets a growth trajectory through production and export targets with progress milestones. It identifies the most prospective hydrogen use cases that will be the focus for ongoing government economic incentives and policy support. The National Hydrogen Strategy includes a range of actions focused towards the transport sector.

The National Hydrogen Strategy builds on existing announcements like the expansion of the Hydrogen Headstart program, the Hydrogen Production Tax Incentive, funding for developing hydrogen hubs and the establishment of the Guarantee of Origin scheme to provide certification of hydrogen.





Priority action 4: innovate to expand cost competitive transport technology options

To support the transport sector's net zero pathways, developing strategic approaches through innovation, commercialisation, pilot and demonstration projects will expand cost competitive technology options and ensure Australia is an important part of the global net zero economy. The two sub-actions under Priority Action 4 will contribute to all aspects of the avoid-shift-improve framework.

4.1 Provide financial assistance and knowledge sharing to support improvements in the competitiveness and supply of renewable energy and the uptake of energy efficiency and electrification

The Australian Government is investing in financial assistance and knowledge sharing to increase energy efficient and decarbonised transport through:

- \$250 million Low Carbon Liquid Fuel component of the \$1.5 billion **Future Made in Australia Innovation Fund** to accelerate the pace of Australia's domestic LCLF industry.
- \$475 million Driving the Nation Fund.
- \$200 million CEFC **Clean Energy Innovation Fund**, the largest dedicated cleantech investor in Australia.
- **Cooperative Research Centres (CRC) Grants Program** which fosters partnerships translating research into practical applications, driving innovation, and enhancing the competitiveness of Australian industries.
- The **Australian Renewable Energy Agency (ARENA)** supports the global transition to net zero emissions by accelerating the pace of pre-commercial innovation. A key part of ARENA's work is to build knowledge that can be shared openly to help industry and governments better navigate the energy transition.
- \$15 billion **National Reconstruction Fund (NRF)** to provide finance to support, diversify and transform Australia's industry across 7 priority areas of the economy, including transport and renewables and low emission technologies.

- The **National Battery Strategy** outlines actions for Australia to create a diverse and competitive Australian battery industry, including the \$523.2 million Battery Breakthrough program. The Strategy highlights batteries for Australia's domestic equipment manufacturing (such as heavy vehicles) as a high value opportunity.
- The Australian Government has also worked with the CSIRO to highlight opportunities to build a domestic LCLF industry through the **Sustainable Aviation Fuel Roadmap** and **Opportunities and Priorities for a Low Carbon Liquid Fuel industry** research paper.

4.2 Develop nationally coordinated and consistent approaches to the rollout of new transport technologies

The Australian Government has a range of strategies to ensure the national rollout of new transport technologies is coordinated, consistent, and supports decarbonisation, including:

- National Electric Vehicle Strategy
- Heavy Vehicle National Law amendments
- Aviation White Paper
- National Rail Action Plan
- National Rail Manufacturing Plan
- Maritime Emissions Reduction National Action Plan (MERNAP)
- Advanced Air Mobility Strategy
- Advanced Air Mobility Infrastructure Planning Guidance
- UTM Action Plan
- Drone Rule Digitisation Project
- National Road Transport Technology Strategy
- 2024–27 National Connected and Automated Vehicle (CAV) Action Plan



Priority action 5: scale up efforts to reduce embodied emissions in transport infrastructure

Embodied emissions are expected to form a major and increasing proportion of infrastructure-related emissions as the electricity grid transitions to decarbonised sources and operational emissions decline. Reducing embodied emissions from transport infrastructure falls under the shift and improve sections of the ASI framework. There are four sub-actions that contribute to Priority Action 5.

5.1 Develop end-to-end carbon management policy and guidance, beginning with a nationally consistent approach to measuring embodied carbon in infrastructure projects

Through the Infrastructure and Transport Ministers' Meeting (ITMM), the Australian Government is collaborating with states and territories to deliver nationally applicable tools and guidance for the measurement, reporting and reduction of embodied carbon arising from transport infrastructure including roads, rail and bridges:

- Infrastructure Australia has developed **National Carbon Values** (NCVs) to ensure embodied emissions are considered in option selection and cost benefit analyses (CBAs) for transport infrastructure projects. All business cases submitted to Infrastructure Australia for evaluation must use the NCVs.
- Under the *Policy on the application of the National Carbon Values*, states, territories and the Commonwealth have also agreed in principle to apply the NCVs (or better) when assessing projects requesting over \$100 million in government funding.³⁰
- The **Embodied Carbon Measurement for Infrastructure: Technical Guidance** (National Measurement Guidance) promotes consistency across Australian jurisdictions by offering a common methodology, calculation assumptions, data usage approach, and reporting guidance for embodied carbon.
- The **National Sustainable Procurement in Infrastructure Guideline** offers best practice procurement and contracting approaches, including implementation options and supplier requirements to maximise emissions reductions throughout all project lifecycle stages.

- In May 2025, ITMM approved the development of a **National Embodied Carbon Databook** to provide industry and government with a reliable source of average emissions factors for materials used in transport infrastructure. The Databook will equip stakeholders to estimate embodied carbon for projects and identify opportunities to reduce emissions through material substitution or design changes.

5.2 Accelerate the commercialisation of low and zero emission construction materials

Improving access to low carbon construction materials is an important enabler for reducing embodied carbon in transport infrastructure projects. The Australian Government is funding a number of initiatives to support domestic manufacturers to accelerate production of lower carbon concrete and steel, which contribute the largest share of upfront embodied emissions in transport infrastructure projects, including:

- \$21 million for the SmartCrete Cooperative Research Centre and La Trobe University to develop a **Low Carbon Concrete Centre**, accelerating the decarbonisation of concrete and improving confidence in low carbon concrete-based products.
- \$59.1 million awarded via the Australian Renewable Energy Agency (ARENA) to support **low emissions steel, iron and renewable hydrogen research**, development and commercialisation projects.
- \$750 million of the **Future Made in Australia Innovation Fund**, administered through ARENA, to support innovative green metal projects including iron, steel, alumina and aluminium.³¹ The Australian Government is supporting the establishment of a green metals sector, including the \$1bn Green Iron Investment Fund, \$2bn Green Aluminium Production Credit, and the \$10m Green Metals Innovation Network.
- Low or no cost loans from the Clean Energy Finance Corporation for **low carbon concrete initiatives** in housing and industrial developments; the technologies and methodologies of which will also be useful for the decarbonisation of transport infrastructure.

5.3 Mandatory requirements on companies for reporting, assessment and emissions reduction

Mandatory assessment and disclosure encourage businesses to implement measures that reduce embodied emissions from materials. The Australian Government has introduced initiatives requiring companies to consider emissions from direct operations and supply chains, including:

- Under the **Safeguard Mechanism**, facilities including steelworks, iron ore mines, cement suppliers, alumina refineries and aluminium smelters are required to reduce their net emissions in line with the declining baselines.
- **Mandatory climate-related financial disclosures** require large corporate entities to disclose information about climate-related risks including emissions arising from construction or maintenance of assets. This will enable shareholders, buyers and clients to better understand – and drive action to reduce – embodied emissions.

5.4 Support infrastructure decarbonisation capability in private and public sectors, including the development of resources, training and guidance

The Australian Government is working to deliver the tools and guidance required to accurately measure and reduce embodied carbon. Targeted training and capability uplift will assist stakeholders in industry and government to implement these resources and accelerate emissions reductions. It is also important to promote awareness of net zero career paths within the infrastructure sector and to work with the private sector to increase investment in workforce capability, particularly in net zero skills, and to help attract a larger, more diverse pipeline of workers to meet current and future industry demands.

The Australian Government engages with Austroads in development of resources and guidance to improve industry familiarity with and trust in low carbon and recycled materials. For example:

- The *Carbon reduction and the use of low carbon concrete* project seeks to facilitate a widespread use of concrete with lower cement content.³²
- Circular economy guidelines provide users with information on how to improve the recycled content of roads using innovative materials.³³

In collaboration with states and territories through ITMM, the Australian Government is developing options for an **infrastructure decarbonisation capability building program and central knowledge hub**. These options may include education and training programs which target carbon literacy, platforms showcasing emissions reductions achieved through innovative construction methods, and resources demonstrating learnings and specifications for low carbon solutions.



End notes

- 24 IIP project information is as at Pre-Election Fiscal Update 2025. It includes active major construction projects (planning projects not included) and Australian Government funding contribution only.
- 25 IIP project information is as at Pre-Election Fiscal Update 2025. It includes active major construction projects (planning projects not included) and Australian Government funding contribution only.
- 26 IIP project information is as at Pre-Election Fiscal Update 2025. It includes active major construction projects (planning projects not included) and Australian Government funding contribution only.
- 27 CSIRO, [Transport logistics-TraNSIT](#), CSIRO, 2023.
- 28 Consumer energy resources (CER) include a diverse range of small to medium scale energy resources that are located behind the meter at residential, commercial and industrial premises and are owned or operated by the customer. These resources generate or store electricity and includes flexible loads that can alter demand in response to external signals. CER includes technologies such as rooftop solar small scale battery including community battery storage systems, inverters, bi-directional energy resources including electric vehicle supply equipment.
- 29 Australian Government, [Charting Australia's Maritime Emissions Reductions](#), DITRDCA, 2024.
- 30 DITRDCA, [Policy on the application of National Carbon Values](#), infrastructure.gov.au, 2024.
- 31 Australian Renewable Energy Agency (ARENA), [Future Made in Australia Innovation Fund](#), ARENA, 2024.
- 32 Austroads, [Carbon reduction and the use of low carbon concrete](#), Austroads, 2024.
- 33 Austroads, [Guide to Pavement Technology Part 4E: Recycled Materials](#), Austroads, 2022; Austroads, [National Specification for Crumb Rubber Binders in Asphalt and Seals](#), 2021; Austroads, [Crushing, Processing and Cleaning of Recycled Crushed Glass for Transport Infrastructure](#), Austroads, 2022.



5

Enabling the transition

Transport and transport infrastructure's contribution to economy wide net zero will be dependent on a number of enabling policies and resources, including access to sustainable finance and a qualified workforce. The Australian Government will continue to work collaboratively with all levels of government, the community, business and industry to deliver this Roadmap and Action Plan.



5.

Enabling the transition

Key points

- The decarbonisation of Australia's transport system will require significant public and private sector investment in emerging low and zero emissions technology and enabling infrastructure.
- Major industry shifts are needed to prepare Australia's workforce for the meet the needs of the transition, including improving Vocational Educational Training, improving age and gender diversity of the workforce and addressing training opportunities and digital literacy, especially in rural and remote areas.
- Collective action is needed between all levels of government, business, industry and the community to reduce transport emissions.
- Australia will continue to be actively engaged in international fora to reduce emissions and look to establish international partnerships to advance low emission technologies.
- More resilient transport infrastructure will be required to support Australia's transition to a net zero economy and mitigate risks to remote communities, especially First Nations people.

5.1. Sustainable finance

The ability to access sustainable finance will be critical to the success of the net zero transition.

To facilitate greater private sector investment in the transition, the Australian Government has developed a Sustainable Finance Roadmap (SFR). The SFR aims to mobilise private capital at scale to support clean, resilient growth and support financial services to align with net zero targets. Key policies in the SFR include:

- climate related financial disclosures
- sustainable investment product labelling
- the Sustainable Finance Taxonomy
- climate-related transition planning guidance
- the Australian Government Green Bond Program.

More information on these policies and the Government's role in supporting private sector investment in innovation, infrastructure and equipment to deliver the transition is set out in Chapters 10 and 11 of the Net Zero Plan.

5.2. Workforce and skills

The Australian Government is committed to supporting Australia's workforce in the transition to net zero, in conjunction with businesses, unions, state and territory governments, and regional communities.

Skills in the transport and infrastructure sector relating to digital literacy, carbon literacy and environmental, social and governance compliance will need to be a focus of training programs and workforce investment. There is also a need to upskill the workforce to use, maintain, service and repair new transport technologies, such as electric vehicles; and to provide training for use of low carbon or recycled construction materials. Occupations with strong gender imbalances are more likely to experience shortages, and the rural and remote workforce may be impacted by a lack of quality training resources and connectivity challenges. Shortages already exist for crane, hoist and lift operators, and bus and truck drivers.³⁴ In developing this Roadmap and Action Plan, the Australian Government consulted with the union movement, including the Australian Council of Trade Unions, Australian Manufacturing Workers' Union, Electrical Trades Union of Australia, Transport Workers' Union of Australia, Maritime Union of Australia and the Australian Rail, Tram and Bus Industry Union.

To prepare the transport and infrastructure workforce for the net zero transition, the following will be required:

- additional quality and quantity of Vocational Educational Training (VET) to meet current and increasing workforce needs³⁵
- responsive education and training offerings (higher education, VET, or industry continuing professional education) that allows workers to constantly upgrade their skills in line with rapidly changing industry needs and technological advancements
- a focus on improving age, gender and First Nations diversity in the workforce
- ensuring safe working environments with adequate facilities for all workers
- training that addresses emerging technologies including automation, artificial intelligence (AI), cyber security and zero-emission vehicles
- reconciling inconsistency between jurisdictions in regulations and funding opportunities.³⁶

Industry Skills Australia, the Jobs and Skills Council for the transport sector, has released four **Workforce Plans** for the aviation industry, maritime industry, rail industry and transport and logistics industry. These Workforce Plans address the transport sector's complex workforce supply and skills required to enable decarbonisation.

Infrastructure Australia, in collaboration with Australian Sustainable Built Environment Council (ASBEC) and the Infrastructure Net Zero initiative, has also released the *Delivering Net Zero Infrastructure: Workforce Report*, which analyses the workforce and skills needed to achieve net zero in the infrastructure sector. The report focuses on the occupations and skills that contribute to net zero infrastructure, identifies major skills challenges and provides recommendations for accelerating capability uplift. These recommendations include the need for collaboration across government portfolios to prioritise skills development for the shared workforce delivering construction projects across the economy.

The transition for the transport and infrastructure workforce will also be supported by a range of government programs focused on the development of a net zero economy, discussed further in the Net Zero Plan.



First Nations people in the workforce

The net zero transition, if managed correctly, could also have benefits for the First Nations workforce. Currently, a significant number of First Nations Australians are employed as construction and mining labourers, machine and stationary plant operators, and automotive and engineering trades workers, particularly in regional areas. However, data shows that while First Nations people often take up apprenticeships in similar industries to non-Indigenous apprentices, they tend to do so at a lower skill level.³⁷ Initiatives that empower First Nations people to take on apprenticeships at the same level as non-Indigenous people, and place-based approaches that focus on regional workers in the net zero transition, will be critical to ensure First Nations workers are not left behind. These employment opportunities for First Nations people will contribute to the *National Agreement on Closing the Gap*, especially target 7 (youth employment) and target 8 (economic development).

In addition to training and transition plans outlined above, targeted initiatives to address skills challenges and barriers in the First Nations workforce include:

- The **Indigenous Skills and Employment Program (ISEP)** is a First Nations-specific employment and skills program which aims to connect First Nations people to jobs, career advancement opportunities, and to new training and job-ready activities.³⁸
- The National Indigenous Australians Agency runs the Community Development Program, an employment and community development service operating in remote Australia. This is soon to be replaced by the **Remote Jobs and Economic Development program**, which will create 3000 new jobs over 3 years until 2027; and the **Remote Australia Employment Service**, which will support job seekers to build their skills and address barriers to employment.³⁹

5.3. Enabling partnerships

Close collaboration with industry, communities and governments will support the transition.

The Australian Government will closely collaborate with industry, community and all levels of government to reach net zero by 2050. In order to do this, we will align our goals nationally and consistently with our international commitments. We will work together to help regions, workers and industry to transition.

Industry

Collaborating with industry is crucial to leverage the technological expertise and resources at the necessary scale to significantly reduce emissions. By fostering partnerships, we can enhance transport efficiency and address the complex challenges associated with achieving net zero emissions. Collaborative action can make the transition to net zero faster and at a lower cost. In order to maximise these benefits, collaboration needs to be inclusive and well-coordinated. The Clean Energy Finance Corporation (CEFC) and the Australian Renewable Energy Agency (ARENA) are two critical ways the Government will continue to work with industry.



Box 3: Australian Jet Zero Council

- The Australian Government established the Australian Jet Zero Council in June 2023 to promote, mobilise and galvanise industry efforts to decarbonise aviation, and provide coordinated advice to government. The Council is modelled on the successful UK version and has a broad membership of stakeholders from across the aviation sector and its supply chains as well as a number of relevant government agencies.
- The Council has delivered on its first forward workplan, which focused on barriers and opportunities to grow a Sustainable Aviation Fuel (SAF) industry in Australia, airport infrastructure decarbonisation and progressing non-SAF decarbonisation technologies. The Council is developing a second workplan to further progress industry efforts and champion least cost decarbonisation of Australian aviation. Policy settings are critical to attract vital industry investment and support the environmental, social and governance (ESG) outcomes of businesses.
- ARENA, one of the founding members of the Council, has provided over \$30 million in grants to support development of a SAF industry through the Sustainable Aviation Fuel Funding Initiative.

States and territories

The Australian Government will continue to work with the states and territories to deliver infrastructure that shifts how people and goods move across Australia. Collaboratively we will deliver coordinated policies that reduce emissions through the Infrastructure and Transport Ministers' Meeting and collaboration on the National Electric Vehicle Strategy.

Local and regional organisations

Local and regional organisations have a key role to play in supporting the decarbonisation of transport and other economic sectors.

Local governments are responsible for the design, delivery and maintenance of local infrastructure, including roads and cycling and walking paths, and are crucial in promoting greater uptake of active and public transport options within their local community. The Australian Government supports local governments to deliver locally appropriate active transport solutions through the provision of funding for the construction of new, and the upgrade of existing, cycling and walking pathways through the **Active Transport Fund**. Local governments also have a key role to play in rolling out the charging infrastructure to support EV uptake.

Ensuring that the net zero transition addresses local concerns and that benefits are equally shared across local communities is also critical to the success of the transition and requires close collaboration with local and regional organisations. The Net Zero Plan sets out how the net zero transition is a shared responsibility and how governments will continue to work together to realise positive national outcomes.

Working internationally

Australia will continue to be an active participant in international initiatives to reduce emissions.

Australia supports **International Civil Aviation Organization** (ICAO) initiatives to reduce greenhouse gas emissions from international aviation while still facilitating growth in the industry, including ICAO's long term aspirational goal of net zero carbon emissions by 2050. In November 2023, ICAO and Member States agreed to a global framework to facilitate scaling up the development and deployment of sustainable aviation fuel (SAF), lower carbon aviation fuels (LCAF) and other cleaner energy sources, including a collective global aspirational vision to reduce CO₂ emissions in international aviation by 5% by 2030 through the use of SAF, LCAF and other cleaner energy sources.

A key global market-based measure that will help the sector reach this goal is ICAO's **Carbon Offsetting Reduction Scheme for International Aviation** (CORSIA), which aims to hold carbon emissions from international aviation at a global baseline. Australia's eligible international airlines have participated in CORSIA since 2019, and Australia continues to maintain and support the scheme through our work in ICAO.

Australia also supports a range of initiatives from the **International Maritime Organization** (IMO) to reduce emissions from international shipping. In 2023, member states of the IMO adopted the 2023 IMO Strategy on Reduction of Greenhouse Gas Emissions from Ships, with enhanced targets to tackle harmful emissions. The IMO Strategy includes an enhanced common ambition to reach net zero greenhouse gas (GHG) emissions from international shipping by or around, i.e. close to, 2050, with indicative checkpoints for 2030 and 2040, as well as a commitment to ensure a 5%, striving for 10%, uptake of alternative zero and near-zero emission fuels by 2030.

A key proposed global market-based measure that would help the sector reach this goal is the **IMO Net Zero Framework**, due for formal adoption in 2025. If adopted, the Framework would introduce new GHG reduction measures for international shipping, including annual fuel intensity targets, a GHG emissions pricing mechanism, and a reward system for sustainable fuel adoption. The proposed Framework sets CO₂ reduction targets through to 2035. Vessels will need to reduce emissions by 30–43% compared to 2008 levels to stay compliant.

The Australian Government is working closely with international partners to advance practical action on climate change and build new clean energy industries, particularly for hydrogen and its derivatives.



5.4. Building a resilient transport and infrastructure sector

The transition to net zero will require the prioritisation of new infrastructure and substantial capital investment.

Our roads will need to be prepared for the added mass of electric heavy vehicles, upgraded freight corridors will be required to deliver equipment, and new port facilities and other supporting infrastructure will be needed to support production and export low carbon liquid fuels (LCLFs) as well as hydrogen-derived fuels and hydrogen. Improving the resilience of new and existing infrastructure to a changing climate will be critical to safeguarding Australia's productivity and prosperity.

The Australian Government is working to quantify the cost of climate change on transport infrastructure and understand the opportunities arising from an increased focus on infrastructure resilience. Australia's National Climate Risk Assessment (NCRA) analyses the growing risks to transport infrastructure arising from increasingly severe natural disasters driven by a changing climate. The National Adaptation Plan (NAP) considers how these compounding risks can be managed to increase the resilience of critical freight routes and supply chains.

NCRA modelling finds that key risks to infrastructure and the built environment will increase from low-moderate (current risk rating) to high-very high by 2050 under likely global warming scenarios. Transport and supply chains will be particularly impacted by acute hazards such as flooding, bushfires and extreme winds causing widespread damage and disruptions. Supply and service chains in northern and central Australia, which is home to many remote First Nations Communities, are particularly at risk from a changing climate. Under a 3.0°C global warming scenario and in the absence of appropriate adaptation actions, increasingly severe flood events impacting Australia's East West freight corridors could result in average supply chain detours of 730 km by 2090, doubling freight costs. Health-related freight is projected to have the highest cost increase due to future climate change, further impacting First Nations people who already face greater challenges in reaching healthcare providers and receiving medicines.

Given these risks, governments' continued investments in supply and service chain resilience will have significant benefits for remote communities and First Nations people. Under the Infrastructure Investment Program, the government is investing in major infrastructure projects, such as the Bruce Highway Upgrade Program, which, by reducing the frequency and severity of road closures associated with extreme weather events experienced across Queensland, will improve supply chain resilience to support remote communities and First Nations people. The Australian Government is providing leadership to coordinate a nationally consistent approach to supply chain resilience through the National Freight and Supply Chain Strategy the supporting National Action Plan. The new National Action Plan will consider actions specifically in response to the findings of the Road and Rail Supply Chain Resilience Review and has resilience as one of four key priority areas.

Austrroads, which is the association of the Australian and New Zealand transport agencies, is also scaling up its investment in research and guidance to improve climate resilience. This guidance will support transport agencies in developing adaptation plans, embedding consideration of climate resilience into asset management, and identifying and managing critical freight routes and networks⁴⁰. Infrastructure Australia, which is the nation's independent infrastructure advisor, is also prioritising the resilience of critical infrastructure and communities in decision making and has developed *Resilience Principles* to guide its work.⁴¹

Critical infrastructure includes physical facilities, supply chains, information technologies and communication networks, which if disrupted could endanger Australia's national security. Under the NAP and the *2023 Critical Infrastructure Resilience Strategy and Plan*⁴², the Australian Government is pursuing measures to increase the resilience of critical infrastructure to increasing climate extremes. Measures proposed in the NAP include a review of the *Security of Critical Infrastructure Act 2018* to consider the operation of risk management plans, and incorporate a systems perspective into government investments in infrastructure and built environment assets.

End notes

- 34 Infrastructure Australia, *Infrastructure Net Zero Workforce Report 2025*, Infrastructure Australia, 2025.
- 35 BuildSkills Australia, *Shaping the future of the built environment*, BuildSkills Australia, 2024.
- 36 Industry Skills Australia, Transport and Logistics Industry: 2025 Draft Workforce Plan, *Transport and Logistics Industry: 2025 Workforce Plan*, Jobs and Skills Councils, 2025.
- 37 Jobs and Skills Australia, *First Nations People Workforce Analysis*, *First Nations People Workforce Analysis*, Jobs and Skills Australia, 2023.
- 38 National Indigenous Australians Agency (NIAA), *'Indigenous Skills and Employment Program (ISEP)'*, NIAA, n.d.
- 39 NIAA, *'The Community Development Program (CDP)'*, NIAA, n.d.; NIAA, *'Remote Jobs'*, NIAA, n.d.
- 40 Austroads, *Climate Change and Natural Hazards Risk Assessment and Adaptation Planning Guidelines*, Austroads, 2024, accessed 8 July 2025; Austroads, *Incorporating Climate Change Resilience in Asset Management*, Austroads, 2024, accessed 8 July 2025; Austroads, *Opportunities to Increase Freight and Supply Chain Resilience*, Austroads, 2024.
- 41 Infrastructure Australia, *Resilience principles: Infrastructure Australia's approach to resilience*, Infrastructure Australia, 2022.
- 42 The Australian Government, *Critical Infrastructure Resilience Strategy*, Department of Home Affairs, 2023.

6

Moving forward





The *Climate Change Act 2022* (Cth) sets up a strong framework to ensure Australia remains on track to reach net zero emissions. It requires the Minister for Climate Change and Energy to report progress through an Annual Climate Change Statement to Parliament, including progress towards emissions targets, and whether current policies are effective.

This regular reporting ensures transparency and accountability. It also creates a clear cycle for reviewing and improving climate policies over time.

As detailed in section 5.3, the Australian Government will closely collaborate with industry, community and all levels of government to reach net zero by 2050. The Australian Government will also continue to work closely with international partners to advance action on climate change through the International Maritime Organization and International Civil Aviation Organization.



List of abbreviations

AAM	Advanced Air Mobility
ADR	Australian Design Rule
ASI	Avoid-shift-improve
ARENA	Australian Renewable Energy Agency
ASBEC	Australian Sustainable Built Environment Council
BEV	Battery electric vehicles
BITRE	Bureau of Infrastructure and Transport Research Economics
CAV	Connected and automated vehicle
CBA	Cost Benefit Analysis
CEFC	Clean Energy Finance Corporation
CER	Consumer energy resources
CO₂	Carbon dioxide
CO₂-e	Carbon dioxide equivalent
CRC	Cooperative Research Centre
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
DCCEEW	Department of Climate Change, Energy, the Environment and Water
EATP	Emerging Aviation Technology Partnership Program
ESG	Environmental, social and governance
EVs	Electric vehicles
FBT	Fringe benefit tax
FCEVs	Hydrogen fuel cell electric vehicles
FFAS	Federation Funding Agreement Schedule on Land Transport Infrastructure Projects
GDP	Gross Domestic Product
GO Scheme	Guarantee of Origin Scheme
HVNL	Heavy Vehicle National Law
ICAO	International Civil Aviation Organization
ICE Vehicles	Internal Combustion Engine Vehicles
IIP	Infrastructure Investment Program
IMO	International Maritime Organization
IPS	Infrastructure Policy Statement
ISEP	Indigenous Skills and Employment Program
ITMM	Infrastructure and Transport Ministers' Meeting
LCLF	Low carbon liquid fuel
MERNAP	Maritime Emissions Reduction National Action Plan
Mt CO₂-e	Million tonnes of carbon dioxide equivalent
NAP	National Adaptation Plan
NCR	National Climate Risk Assessment
NCVs	National Carbon Values
NDC	Nationally Determined Contribution
NEVS	National Electric Vehicle Strategy
NVES	New Vehicle Efficiency Standard
NFSCS	National Freight and Supply Chain Strategy
NLTA	National Land Transport Act 2014
NRF	National Reconstruction Fund
SAF	Sustainable aviation fuel
SFR	Sustainable Finance Roadmap
UTM	Uncrewed Traffic Management
VET	Vocational Educational Training

Glossary

Abatement: A reduction in atmospheric greenhouse gases through emissions avoidance or removal and sequestration of carbon from the atmosphere.

Active transport: Ways of travelling including walking, cycling and other physically active modes of transport that can be undertaken alone or combined with public transport.

Adaptation: In human systems, the process of adjustment to actual or expected climate and its effects, to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.

Ammonia: Ammonia is a useful source of fertiliser, fuel and heat. Ammonia is traditionally produced by stripping hydrogen from natural gas using steam, which produces CO₂ as a by-product. Low-carbon ammonia can be produced using hydrogen from renewable energy.

Avoid-shift-improve hierarchy: The avoid-shift-improve hierarchy emphasises first avoiding unnecessary trips through telecommuting or better urban planning, then shifting to more sustainable transport modes like active and public transport, and finally improving the technology or efficiency of the transport mode, such as through electrification.

Battery electric vehicle (BEV): An electric vehicle that exclusively uses chemical energy stored in rechargeable battery packs to power at least one electric motor with no secondary source of propulsion.

Biodiesel: An older biofuel, typically made from vegetable oils, animal fats or recycled greases, which requires blending with conventional fuels for standard engines or engine modification to run. See also **renewable diesel**.

Carbon dioxide equivalent (CO₂-e): A description of, for a given mixture and amount of greenhouse gases, the amount of CO₂ that would have the same global warming ability when measured over a specified time period.

Carbon dioxide (CO₂): Carbon dioxide is a colourless, non-flammable gas at room temperature and pressure. It is also a greenhouse gas which contributes to climate change. See also **greenhouse gas**.

Carbon offset: A type of carbon credit that represents a reduction in emissions – whether prevented from entering the atmosphere or removed from the atmosphere – that is used to compensate for emissions that occur elsewhere.

Circular economy: An economic system focused on reducing waste, reusing resources and designing products for longer life, recyclability and minimal environmental impacts.

Climate change: Climate change refers to long-term shifts in temperatures and weather patterns. These shifts can be natural, but, since the 1800s, human activities have been the main driver of climate change, primary due to the burning of fossil fuels (coal, oil and gas).

Decarbonise: To stop or reduce carbon gases, especially carbon dioxide, being released into the atmosphere as the result of a process, like the burning of fossil fuels.

Direct emissions: See **scope 1 emissions**.

Electric vehicles (EVs): Plug-in vehicles powered solely by electricity. Excludes hybrid vehicles, which are powered by electricity and fossil fuels.

Electrification: Switching from energy sources, such as liquid fuels or gas, to electricity.

Embodied emissions: Emissions generated during the production and transportation of goods, from the extraction of raw materials to the manufacturing process and final delivery to the consumer. For infrastructure, embodied emissions come from the emissions embodied in the input materials, as well as the emissions generated during the construction and installation processes.

E-methanol: Chemically identical to fossil fuel-based methanol, produced by combining green hydrogen and captured carbon dioxide.

Emissions intensity: A measure of the amount of emissions associated with a unit of output – for example, emissions per unit of GDP, electricity production, or kilometre travelled.

Emissions: A quantity of greenhouse gases released into the atmosphere.

Enabled emissions: Emissions resulting from the use of infrastructure, such as from the cars on the roads.

Euro VI standards: The Euro VI standards reduce the maximum permitted emissions of nitrogen oxides by up to 80% and the maximum permitted emissions of particulates by up to 66%.

Feedstock: Raw material that can be directly used as a fuel or converted to another form of fuel or energy product.



Fossil fuels: Fossil fuels include coal, petroleum, natural gas, oil shales, bitumens, tar sands, and heavy oils. All contain carbon and were formed as a result of geologic processes acting on the remains of organic matter produced by photosynthesis, a process that began in the Archean Eon (4.0 billion to 2.5 billion years ago).

Fringe benefit tax (FBT): A fringe benefit is a payment made to an employee which is not their salary or wages. These benefits are subject to a fringe benefits tax which is separate to income tax and calculated on the taxable value of the fringe benefit.

Global warming: The long-term heating of the earth's surface observed since the pre-industrial period due to human activities, primarily fossil fuel burning (coal, oil and gas), which increases heat-trapping greenhouse gas levels in earth's atmosphere.

Global warming potential: A measure of how much infrared thermal radiation a greenhouse gas added to the atmosphere would absorb over a given time frame, in essence, how strong of a greenhouse effect a greenhouse gas will have in the atmosphere.

Greenhouse effect: Some gases in the earth's atmosphere act like the glass in a greenhouse, trapping the sun's heat and stopping it from leaking back into space. The greenhouse effect is the cause of global warming.

Greenhouse gases: Any gas (natural or produced by human activities) that absorbs infrared radiation in the atmosphere, leading to warming effects. Greenhouse gases include carbon dioxide, methane and nitrous oxide.

Heavy vehicles (road): Vehicles that have a gross vehicle mass or aggregate trailer mass of more than 4.5 tonnes. The gross vehicle mass is the maximum it can weigh when fully loaded, as specified by the manufacturer. In this Roadmap, we consider heavy vehicles to be rigid trucks, articulated trucks and buses.

Hybrid vehicle: Hybrid vehicles use an electric motor powered by a battery as a primary or supplementary power to improve vehicle fuel efficiency, in addition to an internal combustion engine. The battery is either re-charged onboard by residual braking technology (conventional hybrid) or by an external EV charger (plug-in hybrid).

Hydrogen: A substance commonly used in industrial applications, such as the production of methanol and ammonia, and can also be used as a fuel. It is traditionally produced by stripping hydrogen from natural gas using steam, which produces carbon dioxide as a by-product. Low-carbon or renewable hydrogen can be produced from water using renewable energy.

Hydrogen-derived fuel: A fuel produced using hydrogen as an input, such as ammonia or methanol. Low and zero carbon hydrogen-derived fuels can be produced using low carbon inputs including renewable hydrogen, captured carbon dioxide, and renewable energy.

Hydrogen fuel cell electric vehicle (FCEV): An electric vehicle that uses electricity from a fuel cell powered by compressed hydrogen, rather than electricity from batteries.

Indirect (secondary) emissions: See *scope 2 emissions*.

Intergenerational equity: The embodiment of care for future generations. It is the idea of fairness or justice between generations.

Intermodal terminal: Intermodal terminals play a significant role in the consolidation, storage and transfer of freight between rail and road at the beginning and end of each rail journey. Intermodal terminals provide connectivity to ports, regional networks and other capital cities and locations.

Internal combustion engine (ICE) vehicles: A conventional vehicle is a vehicle with only an internal combustion engine system – that is, a conventional vehicle powered by fossil fuel.

Lifecycle emissions: Emissions produced during a vehicle or product's production, operation and disposal.

Low carbon liquid fuels (LCLFs): Liquid fuels with lower lifecycle emissions than conventional fossil fuels. LCLFs can be sustainably produced from biomass, waste materials and/or renewable hydrogen.

Methanol: A substance used as a fuel, solvent, or as an input for other chemicals. Low carbon methanol can be produced using hydrogen, captured carbon dioxide, and renewable energy. See *e-methanol*.

Mode shift: The shift from one mode of transport to another, for example from private vehicles to public and active transport, or from road freight to lower emissions modes such as rail.

National Greenhouse Gas Inventory: Australia's National Greenhouse Gas Accounts fulfils Australia's international treaty obligations by submitting National Inventory Reports to the UNFCCC.

Net zero: An overall balance between greenhouse gas emissions produced and greenhouse gas emissions taken out of the atmosphere.

Nitrous oxide: Nitrous oxide (N₂O) is an odourless, colourless, non-flammable gas. Nitrous oxide is a greenhouse gas, and its molecules stay in the atmosphere for an average of 121 years before being removed by a sink or through chemical reactions. The global warming potential of nitrous oxide is 265 times that of carbon dioxide. Globally, 40% of total nitrous oxide emissions come from human activities.

Offsets: See *carbon offset*.

Operating emissions: Emissions from the energy use of an infrastructure asset during its use stage, for example from the energy used to operate a train station.

Paris Agreement: The Paris Agreement came into effect in 2016 and was a major step forward in international efforts to address climate change. It aims to strengthen the global response to the threat of climate change by holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit temperature increase to 1.5°C.

Particulate emissions: Emissions of particulate matter, which is a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, smoke or soot, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using a microscope. Particulate matter can be inhaled and can cause serious health problems.

Passenger kilometre: A passenger kilometre is the unit of measurement representing the transport of one passenger by a defined mode of transport over one kilometre.

Plug-in hybrid: A hybrid vehicle whose battery can be recharged by plugging it into an external source of electric power, as well as by its on-board internal combustion engine.

Pre-industrial: Pre-industrial, as defined in the Intergovernmental Panel on Climate Change, refers to the period 1850–1900.

Renewable diesel: An advanced biofuel made from a range of waste and biomass sources. Unlike first-generation biodiesel which requires blending with conventional fuels for standard engines or engine modification to run 100% biodiesel, renewable diesel can directly substitute conventional diesel and does not require blending.

Renewable energy: Energy from a source that is not depleted when used, such as wind or solar power.

Resilience: The capacity of people, communities and assets to cope with a hazardous event, trend or disturbance, responding to or reorganising in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation.

Rolling stock: Referring to railway vehicles, including both powered and unpowered vehicles – for example, locomotives, freight and passenger cars, and non-revenue cars.

Safeguard Mechanism: A legislated obligation on Australia's largest greenhouse gas emitters, or 'Safeguard facilities', to keep their net emissions below an emissions limit (a baseline).

Scope 1 emissions: The release of greenhouse gases into the atmosphere as a direct result of activities occurring within a responsible entity's control or geographic boundary.

Scope 2 emissions: The indirect release of greenhouse gases into the atmosphere from the consumption of purchased electricity, heating, cooling or steam that is generated outside of a responsible entity's control or geographic boundary.

Scope 3 emissions: All indirect emissions (not included in scope 2) that occur in the value chain of the reporting entity, including both upstream and downstream emissions.

Supply chain: The network of all the individuals, organisations, resources, activities, processes and technologies involved in the creation and sale of a product.

Sustainable aviation fuel (SAF): A liquid fuel which has the potential to reduce CO₂ emissions by up to 80% compared to traditional aviation fuel. SAF will be produced from biogenic feedstocks, such as oilseed and sugar, in the short to medium term as well as synthetic feedstocks such as hydrogen in the medium to longer term.

Tailpipe emissions: The product of fuel burning in an internal combustion engine, released through an engine exhaust. Tailpipe emissions include a number of pollutants such as carbon dioxide, carbon monoxide and nitrogen oxides.

Tonne kilometre: A unit of measurement of freight transport which represents the transport of one tonne of goods over the distance of one kilometre.

Transport infrastructure: The fixed installations, structures and networks that enable the movement of people and goods.

Whole-life emissions: See *lifecycle emissions*.



Australian Government

**Department of Infrastructure, Transport, Regional
Development, Communications, Sport and the Arts**

A GPO Box 594 Canberra ACT 2601

P 1800 075 001

infrastructure.gov.au