Climateworks CENTRE

Delivering freight decarbonisation:

Strategies for reducing Australia's transport emissions

SUMMARY REPORT

OCTOBER 2023

ACKNOWLEDGEMENT OF COUNTRY

We acknowledge and pay respect to the Traditional Custodians and Elders – past and present – of the lands and waters of the people of the Kulin nation on which the Climateworks Centre office is located, and all of the Elders of lands across which Climateworks operates nationally. We acknowledge that sovereignty was never ceded and that this was and always will be Aboriginal land. More information.

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We also acknowledge the critical insights and comments from workshop participants and industry stakeholders who gave us their perspectives on freight, logistics and transport decarbonisation.

We would like to acknowledge and thank Boundless Earth and the Limb Family Foundation for supporting Climateworks Centre's transport work. With the support of our philanthropic partners and funders, Climateworks is accelerating the transition to net zero emissions.

ABOUT US

Climateworks Centre bridges research and action, to achieve the system-level transitions required to reach net zero emissions across Australia, Southeast Asia and the Pacific. We act as trusted advisers, influencing decision-makers with the power to reduce emissions at scale.

Co-founded by The Myer Foundation and Monash University in 2009, Climateworks is an independent non-profit working within the Monash Sustainable Development Institute.

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Executive Summary

To meet national climate targets and international climate commitments, Australia is undertaking economy-wide decarbonisation. One of the critical sectors to decarbonise is transport. In 2021, the sector contributed approximately 20 per cent of Australia's domestic emissions and is likely to become the largest contributor by 2030 (Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2022).

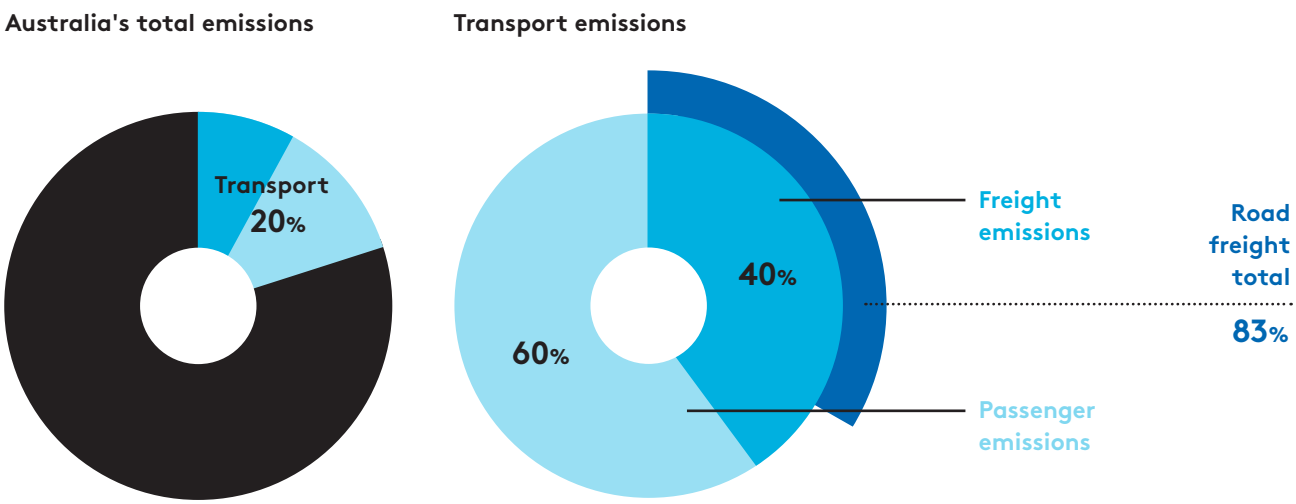
Freight makes up a considerable share of transport emissions, estimated by Climateworks to be just under 40 per cent of the transport total. This represents approximately 7 per cent of Australia's total emissions. Within freight, road transport has a dominant, 83 per cent, share of emissions, see Figure 1 below. This report focuses on opportunities to reduce emissions from road freight with solutions that span the entire freight sector.

There have been efforts to decarbonise freight in Australia for some time. Because reforms were difficult to achieve or technology solutions were not yet available, this has been challenging and freight has been characterised as 'hard to abate'. Now, given global momentum, there is an opportunity to build on past efforts and to develop a national approach to freight decarbonisation. With global shifts in manufacturer interest and increasing regulatory pressure on companies to report on value chain emissions that include freight transport, pioneering freight decarbonisation policies are being formulated in economies similar to Australia. The time is right to move beyond framing freight transport as being a 'hard to abate' sector and take action.

Undoubtedly, important decisions regarding the future of Australia's freight transport landscape will take time, and there are complex implementation hurdles yet to be overcome in some areas. Long lead times for investment decisions means that planning and action on early priorities must start now. Planning will also help a fragmented industry with a vast array of small businesses and owner–drivers achieve a just and equitable transition.

This report's recommendations take a two-pronged approach, the first to implement opportunities and solutions that are already available in short-haul road freight, and the second to enable a smoother transition towards emerging solutions and scale existing solutions in long-haul freight.

FIGURE 1: Share of total and transport emissions



The recommendations focus on reducing emissions in road freight, with solutions that go well beyond zero-emissions trucks. Across both short- and long-haul freight, there are three ways to reduce emissions: reduce the overall distance travelled; shift to lower emissions transport modes and make vehicles and trips less emissions intensive. Enlisting a suite of solutions in an integrated way can help Australia reach its climate goals in time, improve productivity, health and urban liveability, and reduce congestion.

'By implementing available solutions in short-haul freight, Australia can start reducing 51 per cent of its freight emissions immediately.'

Climateworks recommends that freight decarbonisation plans and actions, including government policy, consider the following:

Overall recommendation:

1. Set a pathway to freight transport decarbonisation with clear interim targets

Recommendations to decarbonise short-haul freight:

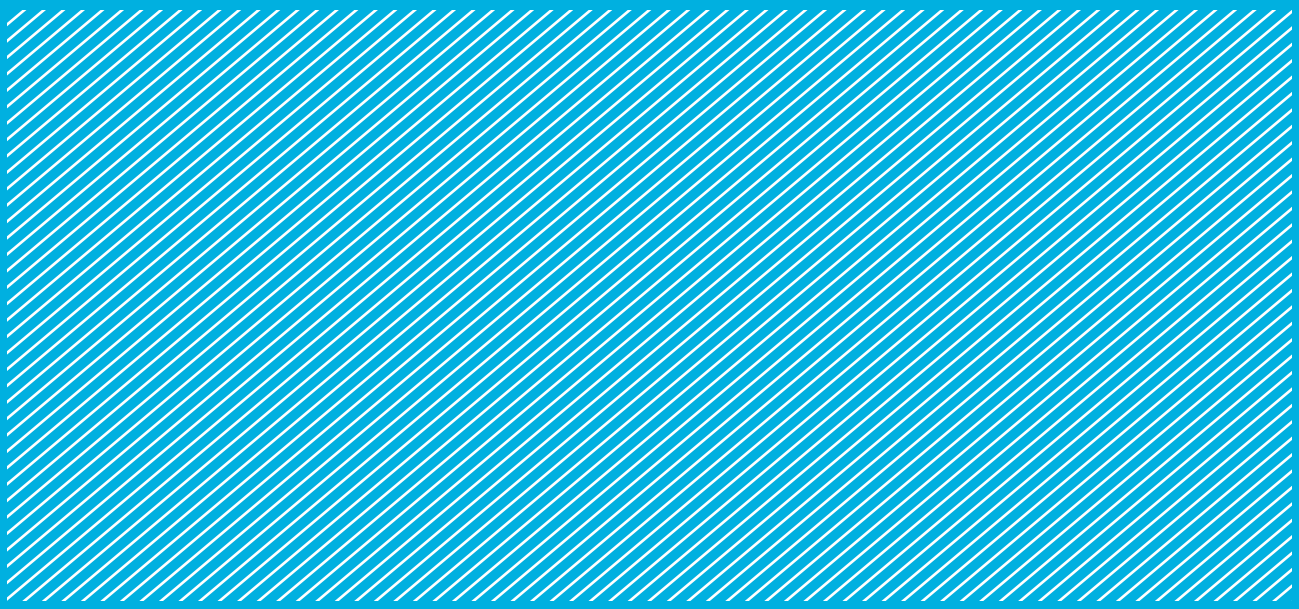
2. Unlock supply of zero-emissions trucks by revising weight limitations on heavy vehicles and formulating regulations that boost availability

3. Build demand for zero-emissions trucks and vehicles by making them competitive assets for business investment

- **3.1:** Offer tax breaks or other credits until required market share is achieved
- **3.2:** Implement emissions-based access and charges
- **3.3:** Formulate incentives to help small operators purchase zero-emissions trucks and vehicles

4. Build an environment that supports market innovations and optimisation

- **4.1:** Formulate policies and programs to support market innovations in last-mile deliveries
- **4.2:** Provide reliable data, tools and analysis to support industry decarbonisation
- **4.3:** Support training and skills development to create jobs and ancillary industries
- **4.4:** Collaborate with industry to deploy charging and refuelling infrastructure and efficiency measures



Recommendations to decarbonise long-haul freight transport:

5. Undertake a comprehensive cost-benefit analysis to determine optimal roles for different modes, fuels and technologies

6. Make rail a competitive mode-choice for long-haul freight

- **6.1:** Prioritise policies that increase operational efficiencies and reduce costs
- **6.2:** Link mode shift subsidies to clear decarbonisation targets
- **6.3:** Invest in rail, port and intermodal infrastructure to facilitate an expanded role for rail freight

7. Reduce technological uncertainty by providing guidance, supporting vehicle trials and demonstrating integrated use-cases for long-haul trucks

- **7.1:** Assess the gaps and opportunities for zero-emissions technology in long-haul road freight
- **7.2:** Demonstrate working pilots with industry

8. Set a clear role for advanced biofuels

Freight has a significant role to play in transport sector decarbonisation

In Australia, the transport sector has the third-highest share of greenhouse gas emissions, and it is likely to become the largest contributor by 2030 (DCCEEW 2022). Transport emissions comprise those related to moving people, called passenger transport emissions, and goods, called freight transport emissions.

Climateworks' analysis estimates that freight makes up just under 40 per cent of transport emissions, or approximately 7 per cent of Australia's total emissions.[1] Total freight transport emissions are estimated to be approximately 36 $MtCO_2e$ in 2021.

At the same time, in 2022, Australian freight activity amounted to 795 billion tonne kilometres (tkm),[2] transported mainly by road, rail, domestic maritime shipping and air (Bureau of Infrastructure and Transport Research Economics [BITRE] 2022a). The 'medium growth' scenario from BITRE shows this freight activity iincreasing by 26 per cent from 2020 to 2050 (BITRE 2022b). Without decarbonisation-focused interventions, growth in freight activity would lead to a commensurate rise in emissions as it continues to be heavily dependent on fossil fuels.

Within freight, the emissions share of the different transport modes is not proportional to their share of freight activity. As seen in Figure 2 below, between 2020-21 road transport had the largest share of emissions (83 per cent) but a much smaller share of freight activity (29 per cent), as it primarily moves non-bulk freight and has high vehicle kilometres travelled (BITRE 2022a; Australian Bureau of Statistics [ABS] 2020). On the other hand, rail transport had a large share of freight activity (58 per cent) because it is the primary mode for moving Australia's bulk goods like coal and iron around the country for processing and export (BITRE 2022b); yet its emissions share is very low (11 per cent).

1 This is based on historical annual emissions data-sets from Australia's National Greenhouse Gas Accounts and the ABS Motor Vehicle Census, Australia, 2020. In this analysis, 60 per cent of emissions from light commercial vehicles (LCV), all emissions from medium- and heavy-duty trucks, rail, and domestic maritime shipping are considered as freight transport emissions. Climateworks' analysis of the ABS Motor Vehicle Census, Australia, 2020 indicates that approximately 60 per cent of LCVs can be categorised as freight and 40 per cent as a passenger travel. Gas pipeline transport is also a sub-category of the transport sector emissions but has not been considered in Climateworks' analysis as there is no direct fuel combustion for mobility. See Information box 2 for more information on maritime and aviation emissions.

2 Freight activity (unit tonne kilometre or tkm) represents a tonne of goods being moved one km by a vehicle or mode of transport.

FIGURE 2: Share of freight emissions and activity

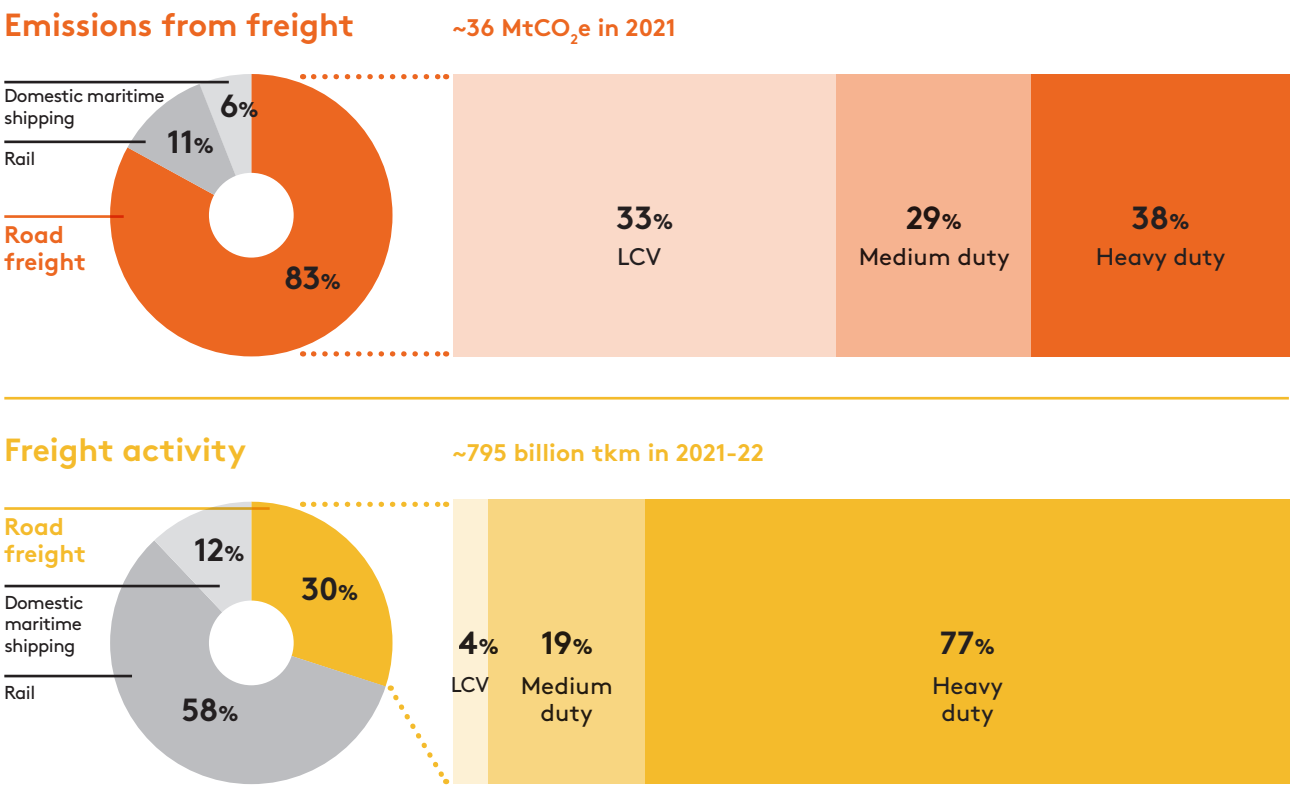


Figure based on Climateworks' analysis of 2021 emissions data (see footnote 1). Data sourced from Australia's National Greenhouse Gas Accounts as of August 2023, freight activity data from BITRE 2022a for 2021-22 and freight activity within road vehicles based on ABS 2020.

Reducing emissions from road freight should be the primary focus of freight decarbonisation, and solutions are available in short-haul freight

Climateworks' analysis estimates that road freight emissions are about five times those from rail and domestic shipping put together, despite accounting for only a third of freight activity. The high share of emissions is linked to road freight consuming more energy than any other mode (Australian Alliance for Energy Productivity [A2EP] 2017).

As seen in Figure 2, approximately 29 per cent of road freight emissions comes from medium-duty trucks, while heavy-duty trucks account for 38 per cent. Although medium-duty trucks travel more vehicle-kilometres (ABS 2020), heavy-duty trucks have a higher share of freight activity (BITRE 2022a). LCVs, such as vans, account for the remaining 33 per cent of road freight emissions.

In the last few decades, economic activity, population and urbanisation have driven overall freight growth; road freight in particular has grown on the back of advantages in average cost and productivity improvements (BITRE 2022b). Freight growth is projected to be driven in part by the kind of goods moved most frequently via road transport (i.e. mainly non-bulk, consumer goods), and the share of road freight activity is projected to rise from 29 per cent in 2020 to approximately 41 per cent by 2050 (BITRE 2022a; 2022b). If there is no change to the way road freight is carried across the country, growing freight activity will lead to an absolute increase in emissions. This would likely pose a major challenge to Australia achieving its climate targets.

Efforts to decarbonise rail and domestic maritime shipping can be undertaken in parallel with actions taken to mitigate road freight emissions. These actions will have a smaller role to play in overall freight transport decarbonisation but will support the large transport and logistics companies that are covered by the Safeguard Mechanism.[3]

This report focuses on reducing emissions in road freight through solutions that go well beyond zero-emissions trucks. Road freight can be decarbonised through a two-pronged approach: first, by implementing the opportunities and solutions that are already available in short-haul road freight; and secondly, by integrating low-carbon modes, fuels and technologies into a plan for a long-haul freight decarbonisation.

INFORMATION BOX 1:

Freight in Australia

Through moving bulk commodities, minerals, agricultural produce, consumer products, manufactured goods, machinery, motors, construction material, waste and recycling materials, freight plays a key role in the supply chains of almost all sectors (Infrastructure Australia 2019; ClimateWorks Australia 2020b).

As a sector with economy-wide linkages, the freight and logistics industry represents 8.6 per cent of Australia's gross domestic product (Department of Infrastructure, Transport, Regional Development, Communications and the Arts [DITRDCA] 2022). The overall transport and logistics sector employs over 574,000 people and in 2019-20 was valued at $101.5 billion (Australia Industry Standards [AIS] 2021). Careful planning for the sector's decarbonisation is needed so that freight can continue to play its foundational role for the economy.

INFORMATION BOX 2:

What about aviation and international maritime emissions?

Domestic aviation constitutes a very small proportion – 0.04 per cent – of Australia's total freight activity (BITRE 2022a). Most air freight is carried in the cargo hold of passenger aircraft and by a small fleet of dedicated freight aircrafts (BITRE 2022b), and it can be considered as mostly high-value and low-volume. Domestic aviation emissions as such are not focused on in this report.

The International Maritime Organization and the International Civil Aviation Organization (ICAO) legislate emissions from international aviation and maritime shipping. These emissions are excluded from national totals and are reported separately (Intergovernmental Panel on Climate Change [IPCC] 2006). Australia is currently developing a Maritime Emissions Reduction National Action Plan to reduce emissions in the maritime sector and to contribute towards reducing international shipping emissions (DITRDCA 2023a). Australia is also aligned to the ICAO's goal and has developed a State Action Plan to demonstrate the country's continued commitment to progress toward reducing carbon dioxide emissions from aviation (DITRDCA 2022).

3 Apart from a few road freight and logistics players, most road freight operators are small to medium in size and therefore do not meet the minimum threshold of emissions for the Safeguard Mechanism to apply.

Time for a national freight decarbonisation pathway with clear and ambitious targets

Australia will need to reduce its transport emissions substantially in order to reach its national climate targets and international climate commitments. The Australian Government has legislated the Climate Change Act 2022, which set a target to reduce net greenhouse gas emissions to 43 per cent below 2005 levels by 2030, and to reach net zero by 2050 (Commonwealth of Australia 2022). Australia has also committed to the Paris Agreement goals of limiting global temperature rise to well-below 2°C and striving for 1.5°C.

Achieving these goals will require a step change in the transport sector, including freight transport which makes up just under 40 per cent of the sector's emissions. This can be aided by clear sectoral targets and policies that make low- and zero-carbon modes and fuels commercially feasible.

Well-planned decarbonisation policies would enable solutions that reduce overall freight emissions as well as deliver economic outcomes, such as improving productivity, efficiency and cost-savings. There are also other far-reaching co-benefits from freight decarbonisation, such as greater resilience to energy disruptions, reduced congestion in urban areas, sustainable land use, improved liveability and health benefits, including less noise pollution and safety especially for communities that live near major roads.

Policy-makers will also need to ensure a just and equitable transition for the large workforce, as there are many small and medium businesses in the transport and logistics sector (AIS 2021). Integrated plans and policies must also ensure reviews are designed in to regularly measure and align all freight policies to the overall objective of decarbonisation.

INFORMATION BOX 3:

Pioneering policies are being formulated in freight decarbonisation

Overseas, governments with similar industrialised economies are recognising the key role of freight in transport emissions, leading to landmark transport and freight decarbonisation policies. These integrated policies set out clear emissions reduction targets for freight and provide a range of policy interventions to achieve these goals:

+ In the United States, the National Blueprint for Transport Decarbonization is a whole-of-government strategy. The blueprint aims to reduce 80–100 per cent of all transport emissions, including freight, by 2050 and includes guiding principles, plans and strategies to achieve this goal (United States Government 2023).
+ The European Union has set out similarly ambitious targets for a 90 per cent reduction in transport emissions by 2050 in their Sustainable and Smart Mobility 2021 strategy which includes freight (European Commission 2021).
+ New Zealand has a sub-sectoral target to reduce 35 per cent of freight emissions by 2035 against a base year of 2019 (New Zealand Government 2022).

+ Within the context of each region, these policies include initiatives that support a role for rail or domestic maritime shipping, as well as low carbon and sustainable alternative fuels to decarbonise freight transport. The European Union has plans to review and revise regulations on its rail freight corridors to improve operational efficiency, and meet its target of shifting 75 per cent of inland freight to rail and inland waterways (European Commission 2021). Similarly New Zealand plans to revise its national mode-shift plan in 2023 (Ministry of Transport New Zealand 2022), while the United States has well-established biofuels blending mandates (United States Government 2023).

RECOMMENDATION 1:

Set a pathway to freight transport decarbonisation with clear interim targets

1.

Sectoral targets can provide certainty in the regulatory environment and help industry make better risk-assessments of their investments and strategies. Targets are primarily in the form of emissions reductions, but also include mode share and sales targets for zero-emissions vehicles.

In 2020, Climateworks' *Decarbonisation Futures* report presented a 1.5ºC-aligned scenario that showed a 12 per cent reduction in transport emissions between 2020 and 2030, with steeper emissions reductions in the following decade. The modelling also showed zero-emissions truck sales at 25–39 per cent by 2030 in a 2ºC-aligned scenario, while the 1.5ºC-aligned scenario showed an even greater uptake of 59 per cent (ClimateWorks Australia 2020a). Climateworks is currently updating its modelling for the transport sector, and will identify a pathway to net zero and attendant targets for the entire sector, including freight.[4]

Benchmark policies:

+ In the European Union, a new proposal sets ambitious uptake targets for new zero-emissions trucks: 45 per cent by 2030 and 90 per cent by 2040 (European Commission 2023).
+ The United States has sales targets for new zero-emissions medium-heavy-duty trucks of 30 per cent by 2030 and 100 per cent by 2040 (United States Government 2023). The US is also targeting a 100 per cent zero-emissions federal fleet (medium–heavy duty) by 2035.

4 This work will be an extension of Climateworks' core whole-of-economy scenario modelling, which details the pathways to net zero in Australia across five sectors: transport, buildings, electricity, industry and agriculture. The comprehensive transport decarbonisation pathways report will be released in early 2024.

Solutions to decarbonise short-haul freight

Short-haul road freight presents a major opportunity for decarbonisation as it represents a significant proportion of freight emissions and there are solutions available now.

While these solutions focus on switching to zero-emissions vehicles and trucks, there are also opportunities to reduce emissions through mode shift and making deliveries more efficiently. Short-haul road freight accounts for 51 per cent of Australia's freight emissions, according to Climateworks' analysis, which categorises short-haul freight emissions as those associated with trips via LCVs and light—medium duty trucks that predominantly travel distances less than 300 kms.[5] Most short-haul road freight is related to tasks such as general and last-mile deliveries, parcels and couriers, waste-management and transporting construction materials (see Figure 3) and much of this occurs in urban areas.

FIGURE 3: Short-haul road freight performs a number of urban tasks

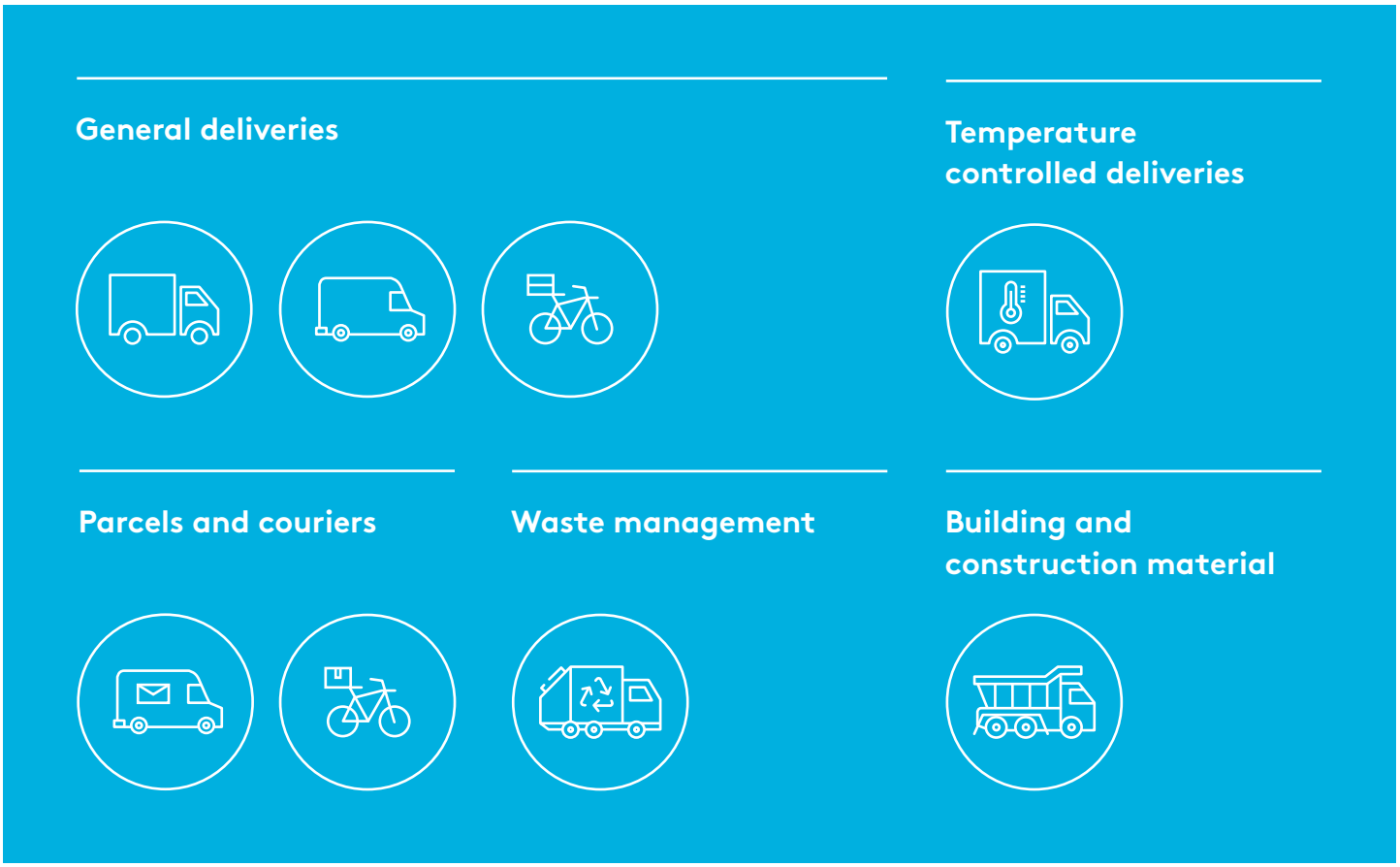


Figure adapted from a presentation by Dr. Paul Bujis 'Low carbon last-mile freight transportation'. Original from Topsector Logistiek, Outlook Stadslogistiek (2017, 2020)

5 Based on vehicle kilometres from ABS (2020) for the 12-month period ending 30 June 2020. It should also be noted that this assumption discounts the fact that some medium-duty trucks could be undertaking long-haul freight tasks, while some heavy-duty trucks could be carrying freight for short-haul tasks.

Solutions to decarbonise short-haul road freight can halve freight emissions

A range of solutions to decarbonise short-haul road freight are available and can be implemented relatively quickly. These solutions reduce emissions by replacing fossil fuel vehicles with zero-emissions technology; shifting freight to low—zero emissions modes such as e-cargo bikes; and by optimising logistics and freight transport. These solutions also offer a major opportunity for government and business to kickstart freight emissions reduction.

The shorter distances travelled and the greater access to charging and refuelling infrastructure – either at depots or along urban routes – make decarbonisation relatively easier in the short-haul (Brown, Fleming, and Safford 2020; Borlaug et al. 2021). According to manufacturer data, medium-duty trucks and vans on the market in 2022 already demonstrate median ranges of over 250 km (CALSTART 2022).

The recommendations below provide more detail on how to implement these solutions to decarbonise short-haul road freight.

RECOMMENDATION 2:

Unlock supply of zero-emissions trucks by revising weight limitations on heavy vehicles and formulating regulations that boost availability

2.

Zero-emissions vans and trucks are ready to replace diesel trucks on short-haul trips. Battery electric trucks (BET) and electric LCVs can meet the range and load requirements of most short-haul freight activity (Gray et al. 2021; CALSTART 2022).[6] Further, range-extending solutions such as 'battery-swapping' and 'depot-charging' are also viable options in urban areas. Other zero-emissions trucks like hydrogen fuel cell electric trucks (HFCET) are likely to come to market in the near future. Supportive policies such as an ambitious fuel efficiency standard, can expedite the transition in short-haul freight by encouraging manufacturers to increase supply of low- and zero-emissions vehicles, particularly light freight vehicles. To kickstart freight emissions reduction, it is critical that the fuel efficiency standard design covers light freight vehicles, such as vans, and is not restricted to passenger LCVs. Alongside a fuel efficiency standard, sales targets can play a role in boosting supply of trucks (Grattan Institute 2022).

However, Australia's current axle mass limits, and, up until recently, width limits, pose a challenge for trucks with a gross vehicular mass above 4.5 tonnes (National Heavy Vehicle Regulator 2017, 2014). In particular, the zero-emissions trucks that are currently available are wider and heavier on the steer axle[7] than similar diesel trucks, which limits the availability of these trucks in Australia. The recently announced Safer Freight Vehicles package increases the overall width from 2.5 to 2.55 metres, enhancing the safety and freight productivity of new trucks (Ministers for the Department of Infrastructure, Transport, Regional Development, Communications and the Arts 2023). Along with ongoing work to reform mass limits (DITRDCA 2023b), this sets the stage for bringing more fuel-efficient and hybrid trucks into the country.

In developing this report, Climateworks held a number of workshops with the freight sector, including from industry and government.[8] Participants who attended Climateworks' workshops identified 'revising width and steer axle mass limitations on heavy vehicles' as the highest priority policy intervention for freight decarbonisation.

6 The Gray et. al (2021) study calculated that for a 40-tonne articulated truck, a Li-Ion battery resulted in a payload decrease of 9 per cent, while the same for compressed H_2 (stored at 700 bar) was a 2 per cent reduction, and for cryogenic hydrogen the reduction was 0 per cent. These reductions were deemed acceptable ranges for haulage.

7 The steer axle is connected to the steering wheel of the vehicle.

8 See Appendix 1 for details of the Climateworks' workshops.

Discussions with stakeholders also indicated that the key task would be to increase the steer axle mass to 7 tonnes and the drive axle by an additional 1 tonne to allow a substantial ramping up of zero-emissions trucks in short-haul road freight. Climateworks recommends that in implementing new standards, priority is given to zero-emissions trucks.

One of the key concerns expressed by participants was the impact of heavier vehicles (including zero-emissions trucks) on existing roads, bridges and tunnels. While the damage from increasing the steer-axle load could be reduced by widening the tyres (Austroads 2016), a comprehensive assessment of network, road pavement and bridges would help address the concern fully. Providing network access on roads that are suitable now, while upgrading road infrastructure can also be considered as an interim solution.

In planning for the transition to zero-emissions vehicles, it is also important to address safety and other concerns of drivers and communities, especially in the early phases of using a new and unfamiliar technology. Regulatory improvements to heavy vehicle braking and stability should be prepared and implemented in line with the potential changes in design limits. Government will also need to work with industry to develop driver skills and knowledge of new technologies.

Beyond the design revisions, policies to boost the supply of zero-emissions trucks could include:

+ zero-emissions targets for government fleets, such as waste-removal trucks, and phasing-in zero-emissions vehicles in public infrastructure projects and contracts
+ binding zero-emissions sales targets for vehicle manufacturers.[9]

RECOMMENDATION 3:

Build demand for zero-emissions trucks and vehicles by making them competitive assets for business investment

3.

Policy-makers can ensure that, alongside increasing supply of zero-emissions trucks and vehicles in Australia, there is a greater demand for, and uptake of, these vehicles through targeted policies. This can be done by making zero-emissions options more cost effective for operators and owner–drivers, and as competitive as possible with diesel trucks.

Lowering the total costs of ownership (TCO) for zero-emissions trucks can be done by reducing operating expenses and upfront costs, or providing other competitive advantages such as access to road networks, as seen in the following recommendations:

3.1 Offer tax breaks or other credits until required market share is achieved

Differentiated taxes, such as tax credits and instant asset write-offs, improve the competitiveness of zero-emissions trucks as they reduce the operating expenses over the lifetime of these vehicles. Noll et al. (2022) found that operational expenditure makes up an average of 75 per cent of TCO, leading to a substantial improvement in competitiveness if such costs were reduced, even for a limited period. Such incentives can be put in place until a target market share is achieved.

9 At a minimum these targets could be aligned to those set by the Global Memorandum of Agreement on Zero Emission Medium and Heavy Duty Vehicles (i.e. 30 per cent by 2030 and 100 per cent by 2040) (EV Council 2021). Australia is not yet a signatory to this memorandum (Global Drive to Zero 2021).

Benchmark policies:

+ California's Low Carbon Fuel Standards (LCFS) offers credits that reduce the operating expenses of zero-emissions trucks. The LCFS lets users and producers of clean energy earn credits through their emissions reductions. These can then be sold to reduce the costs of charging BETs (California Air Resources Board [CARB] n.d.; International Council on Clean Transportation [ICCT] 2021).

3.2 Implement emissions-based access and charges

Emissions-based access, charges and fees can make zero-emissions trucks more competitive by giving these vehicles preferential access to freight markets.

Preferential access could include low-emissions freight delivery zones or parking space privileges. A low-emissions zone could initially provide advantageous operating hours to zero-emissions vehicles, adding more hours over time until eventually only zero-emissions vehicles are able to operate in the zone. Such a scheme would provide incentives to decarbonise trucks while also improving air quality in urban areas.

On the other hand, emissions-based charges and fees such as tolls, road user charges, stamp duties or vehicle registration fees can offer discounts to zero-emissions vehicles. Additionally fees from higher-emissions trucks can be used to subsidise purchase cost, fund tax credits and other incentives offered to zero-emissions trucks. Research has found that emissions-based tolls on vehicles with high annual mileage was the most effective policy in improving cost competitiveness of zero-emissions vehicles (Noll et al. 2022).

Benchmark policies:

+ Germany, Austria and Switzerland have 50–100 per cent exemptions for zero-emissions trucks from road tolls and charges that are otherwise applicable on heavy vehicles (ICCT 2021).
+ The city of Santa Monica in California is the first city in the United States to implement a voluntary zero-emissions freight delivery zone for participating shippers and logistics partners (Clean Technica 2021). The Low Emissions Zone in London requires heavy goods vehicles, lorries, vans or other specialist vehicles over 3.5 tonnes gross vehicle weight to pay a daily charge if they are over a certain emissions standard for particulate matter and nitrous oxide (Transport for London n.d.)

3.3 Formulate incentives to help small operators purchase zero-emissions trucks and vehicles

For small road-freight operators with a few trucks and for owner–drivers, high upfront costs mean an investment in zero-emissions trucks could be out of reach financially. Policies can help reduce these upfront costs, making it easier for smaller businesses to purchase zero-emissions trucks including through the second-hand market.

Climateworks' workshops with policy-makers and industry also identified the need for such purchase incentives to be administratively simple, such as through direct refunds based on purchase receipts. Although less common, purchase incentives could also include low-interest loans and better lease terms that reduce the cost of capital for small businesses. Scrappage, refurbish and retrofit schemes could also help replace older diesel trucks with zero-emissions vehicles. Retrofits of existing trucks provides an additional source of zero-emission trucks while avoiding the need to manufacture new vehicles.

Benchmark policies:

- Several European countries as well as the United Kingdom, China and California have provided purchase cost subsidies ranging from a few thousand dollars, to up to 80 per cent of the vehicle cost. These purchase subsidies typically vary based on vehicle type, load factor, original vehicle price, fleet sizes and technical specifications like range, battery size and energy efficiency (ICCT 2021).
- California has a Truck Loan Assistance Program that helps small businesses secure financing to upgrade their fleets with newer and cleaner trucks (CARB n.d.).

RECOMMENDATION 4:

Build an environment that supports market innovations and optimisation

4.

Industry can aid decarbonisation by planning business transition, taking up zero-emissions technology and low-carbon modes, and by optimising their operations. Government can support industry by creating policies and regulations, setting targets as well as supporting skills and capacity building, infrastructure and knowledge sharing. The following recommendations set out ways industry and government can work together to reduce emissions:

4.1 Formulate policies and programs to support market innovations in last-mile deliveries

Last-mile urban deliveries in high-density areas are relatively easy to decarbonise (International Transport Forum [ITF] 2023) by shifting to e-cargo bikes, e-three wheelers or non-motorised modes. Similar incentives used to encourage uptake of zero emissions vehicles and trucks can be applied to encourage investment in and use of these modes. Solutions can also include optimised delivery service such as distribution hubs, parcel lockers, relay-points in high-density areas and precinct delivery models that reduce motorised vehicle-kilometres.

Implementation of these modes and solutions can be supported through initiatives that bring together industry, government – including local government – and research. This can be aided by pilots and collaboration with local businesses across areas such as central cities (C40 2023).

Benchmark policies:

- E-cargo bikes are being used in many cities for freight, including through shared e-cargo bike schemes. Transport for London's 2023 Cargo Bike Action Plan, sets out a suite of actions to support cargo bikes as the leading option for last-mile freight (Transport for London 2023).
- In 2020, Germany released the first standard to specify testing methods and safety requirements for e-cargo bikes. This has already been adopted in a number of European countries (European Standards 2020).

4.2 Provide reliable data, tools and analysis to support industry decarbonisation

Companies wanting to introduce measures to reduce emissions often face challenges from lack of data and information on measures that work, and in estimating the efficacy of such measures (Miklautsch and Woschank 2022).

To improve load factors,[10] and to optimise routes as well as to plan for and monitor decarbonisation more broadly, freight operators need reliable data. They may also consider sharing data, knowledge and assets with other industry players to support greater efficiencies.

Government can act as an enabler by providing independent data, guidelines, standards and accreditations that can help industry. For instance, by providing standardised information on fuel use, emissions and energy efficiency across the value chain. While this recommendation has been included under short-haul road freight, it equally applies to all freight.

Benchmark policy:

+ The United States Environmental Protection Agency's 'SmartWay program' is a voluntary public-private program that helps companies 'advance supply chain sustainability by measuring, benchmarking, and improving freight transportation efficiency.' It provides standardised information about fuel use and freight emissions across supply chains and helps companies identify and select 'more efficient freight carriers, transport modes, equipment, and operational strategies to improve supply chain sustainability and lower costs from goods movement' (U.S. Environmental Protection Agency 2016).

4.3 Support training and skills development to create jobs and ancillary industries

In 2021, the Australian transport and logistics sector had a workforce of 574,080, of which, drivers numbered approximately 200,000[11] (AIS 2020; 2021). Policy-makers can support this workforce through training and skills-development for zero-emissions technology, and by undertaking an assessment of future skills needed in the sector. Some skills that reduce emissions, such as eco-driving, are relevant even to diesel truck drivers and could be required as part of any license.

Other capacity-building measures include energy-efficiency management, digital skills related to freight operations, safety and maintenance of zero-emissions trucks, and developing local manufacturing of vehicles parts and components. Ancillary industries, such as repair and retrofitting, as well as second-hand markets can also be developed to boost local economies.

Benchmark policy:

+ Natural Resources Canada developed an online training series called 'SmartDriver', which helps 'professional drivers of medium- and heavy-duty commercial vehicles reduce fuel consumption, operating costs and harmful vehicle emissions.' The free courses cover skills such as route optimisation, speed management and maintaining momentum. Instructor resources are also provided for in-classroom or on-road training (Government of Canada 2018).

10 The ratio of the vehicle's load to its total capacity. Higher load factor implies that a vehicle is carrying as much load as it can.

11 Machinery operators and drivers make up half the transport and logistics workforce, with approximately 74 per cent of that workforce being truck drivers as well as taxi-drivers, bus and coach drivers.

4.4 Collaborate with industry to deploy charging and refuelling infrastructure and efficiency measures

Industry and policy-makers will need to come together to consider what freight transport and operations will look like in the future and the types of infrastructure that can best support this. Policy-makers can regulate standards for charging, and support private, depot-based slow-charging infrastructure, shared facilities, end-of-trip charging amenities and battery-swapping locations, such as through support for site identification and planning, and grid upgrades. Extending this industry-government collaboration to also consider ways to optimise freight operations is another solution to reduce emissions, explored in Information box 4 below.

Benchmark policy:

+ The California Public Utilities Commission adopted a five-year, US$1 billion state-wide transport electrification program with 70 per cent of the funds going towards charging for medium-and heavy-duty vehicles (CPUC 2022).

INFORMATION BOX 4:

Industry-led measures to decarbonise freight

Government policies such as those detailed above can support industry-led measures to decarbonise freight. Typically, these industry-led measures are productivity-focused, such as increasing load factors, reducing running of empty trucks and optimising routes or distance travelled. Measures can also include using larger vehicles; although it should be noted that significant improvements in energy efficiency and emissions reductions will only take place when load-factors and vehicle utilisation are high (Miklautsch and Woschank 2022; A2EP 2017).[12] Industry-led partnerships to share warehouses (like urban consolidation centres) and vehicles are further examples of consolidating and improving load factors.

Digital and technology-based solutions can also reduce emissions by creating efficiencies, with solutions including platooning, automation and telematics.[13] Design and operational measures like low rolling resistance tyres and aerodynamic design as well as reducing practices like 'just-in-time' deliveries could improve efficiency and avoid underloading. It should be noted that for all of these measures, the amount of emissions reduction achieved will depend on the reduction of transport demand achieved (Miklautsch and Woschank 2022).

12 At the Climateworks' workshop, larger vehicles and High Productivity Freight Vehicles (HPFV) were cited by industry as options for decarbonisation.

13 A truck platoon is a unit composed of two or more trucks that travel with a reduced distance between them, connected using wireless vehicle-to-vehicle communication. The lead driver in the first vehicle is fully engaged in driving tasks (Pajqk and Cyplik 2020). Telematics is the integrated use of Information and Communication Technologies to transmit, store and receive data from remote objects. Telematics is used in many domains, including transport (TCA 2020).

Solutions to decarbonise long-haul freight

Long-haul emissions account for 49 per cent of freight emissions, according to Climateworks' analysis. This analysis defines long-haul emissions as those from heavy-duty trucks, rail[14] and domestic maritime shipping. Over half of long-haul freight emissions – 66 per cent – are from heavy-duty trucks, emphasising once again the significance of road freight.

Theoretically, long-haul road freight can be decarbonised in much the same way as short-haul road freight, i.e. by reducing distances travelled through optimisation measures, shifting freight to lower emissions modes where possible, and replacing heavy-duty diesel trucks with zero-emissions ones.

However, these solutions have relatively more complex implementation hurdles to overcome in long-haul freight. There are significant cost-differentials between diesel trucks and rail, as well as between diesel and alternative fuels (Australasian Railway Association [ARA] 2022; Clean Energy Finance Corporation and Australian Renewable Energy Agency [CEFC and ARENA] 2019). Policy-makers will need to review and address the fact that diesel trucks are currently cheaper to purchase and the fuel itself is cheaper than other lower emissions alternatives. Technological challenges in providing the high range and power requirements for long-haul freight trucks also currently limit the availability of zero-emissions options.

RECOMMENDATION 5:

Undertake a comprehensive cost-benefit analysis to determine optimal roles for different modes, fuels and technologies

5.

Decarbonising long-haul road freight would benefit from a comprehensive cost-benefit-analysis across different fuels, technologies and modes. This includes reviewing the role that can be played by rail, as well as the role of sustainable alternative fuels in decarbonising long-haul freight transport, particularly in the transition period. Based on this analysis, policies that are integrated across all freight transport modes can be formulated.

Integrated freight policies will require policy-makers to prioritise investments, make trade-offs and ensure that plans and actions across multiple modes and fuels are not running at cross-purposes or creating unintended outcomes for the overall task of freight decarbonisation. It will also require supporting the industry through a period of short-term technological uncertainty and adoption.

By integrating all possible solutions, Australia can make progress decarbonising long-haul road freight. Recommendations in the remainder of this section address current challenges in rail freight and sustainable alternative fuels, and assume that such policies will be more effectively deployed following a comprehensive review of all modes and solutions.

14 Climateworks assumes that most passenger rail is electric, hence all rail emissions reported in the National Greenhouse Accounts can be considered to be solely from freight activity. It should be noted that there are diesel passenger trains, including regional and intercity trains, whose emissions may be included within this (Bureau of Infrastructure, Transport and Regional Economics 2012).

RECOMMENDATION 6:

Make rail a competitive mode choice for long-haul freight

6.

As the country's dominant mode for transporting bulk goods, rail freight has an overall higher share of freight activity in Australia than most other countries (ITF 2022). Rail's full potential can still be considered as unrealised, despite its advantages in low emissions intensity. Over time, shifting locomotives to zero-emissions technology can further increase the advantage of freight rail.

In 2021–22, rail had a 17 per cent share of non-bulk freight, down from a high of 22 per cent in 2007–08 (BITRE 2022a). Considering that non-bulk goods are projected to drive the growth of road freight (BITRE 2022b), tapping the full potential of rail freight should be a key decarbonisation strategy for the sector. The following recommendations focus on making rail a more competitive mode choice in order to unlock this potential:

6.1 Prioritise policies that increase operational efficiencies and reduce costs

Shifting freight to rail will require multi-governmental and stakeholder alignment to remove operational inefficiencies, increase productivity,[15] fix and upgrade infrastructure, and reduce high handling costs at intermodal terminals (ITF 2022,2023; ARA 2022).

The National Rail Action Plan and the Rail Standards Harmonisation project signal the federal government's intention to increase the interoperability of rail networks in Australia (National Transport Commission n.d., 2019; National Cabinet 2022). There is also an opportunity to review rail access pricing[16] and other regulatory costs. Reducing costs, where they are a barrier to choosing rail, could help get more freight on rail and lower carbon emissions. These actions can be taken alongside strategic and decarbonisation-focused investments in transport infrastructure.

These measures are especially critical to increase rail's share of non-bulk goods. Shippers of such goods require reliability, timeliness, flexibility and accessibility (ITF 2022), parameters that are currently hampered by lack of interoperability, high costs and low productivity of rail.

Benchmark policies:

+ The 2019 European Green Deal seeks to move 75 per cent of inland freight to rail and inland waterways (International Energy Agency [IEA] 2020). The European Commission also plans to propose revised regulations governing Rail Freight Corridors and the Trans-European Transport Network[17] core network corridors. The focus here is on implementing 'quick wins' like increased train length, loading gauge, improved operational rules and the completion of key missing links in multi-modal infrastructure (European Commission 2021).
+ The United States' National Freight Strategic Plan prioritises projects that improve intermodal connectivity and enhances first- and last-mile connectors at major trade gateways (U.S. Department of Transport 2020).

15 Rail productivity can be improved through measures such as increasing rail frequencies, increasing utilisation and load factors, reducing last-mile and handling costs and facilitating quick turnarounds at terminals (ARA 2022).

16 Rail operators pay access charges that are based on the distance the operator is travelling, the mass carried and the rail infrastructure being used. As Australia has a number of Rail Infrastructure Managers (RIMs), different access prices can be charged for the freight journey. The difference in the way rail and road user charges are calculated and implemented also makes rail freight less competitive relative to road freight (Department of Infrastructure, Regional Development and Cities 2018)

17 The Trans-European Transport Network (TENT) is a multi-modal trans-European network planned as a key instrument of transport-infrastructure for the 2030s. Its multiple networks connect urban nodes, maritime and inland ports, airports and road/rail terminals across the continent (European Commission n.d.)

6.2 Link mode shift subsidies to clear decarbonisation targets

Evidence shows that for mode shift incentive schemes to be effective, they need clear decarbonisation targets rather than just mode-shift targets, and must have simple administrative processes (Takman and Gonzalez-Aregall n.d.). These schemes can also be applied to both import and export goods to incentivise short-haul rail through urban areas.

Benchmark policies:

+ Europe has a number of road to rail mode-shift policies that provide government aid in the form of grants, subsidies and funding infrastructure. Examples include Italy's Nuovo Ferrobonus and Sweden's Miljökompensation (Takman and Gonzalez-Aregall n.d.).

6.3 Invest in rail, port and intermodal infrastructure to facilitate an expanded role for rail freight

If rail is to have an expanded role in servicing Australia's growing freight sector, infrastructure investment will need to be carefully planned to support key corridors, ports and intermodal hubs. Working towards freight decarbonisation will mean these hubs become points where low-carbon mode choices can be made with minimal compromise to other factors, such as costs.

Diversified freight transport infrastructure can also provide supply chain resilience and reduce traffic congestion. Freight rail corridors and intermodal terminals near catchment areas (places where freight originates) can also increase rail productivity and reduce costs to users (ARA 2022).

RECOMMENDATION 7:

Reduce technological uncertainty by providing guidance, supporting vehicle trials and demonstrating integrated use cases

7.

Battery electric trucks and hydrogen fuel-cell electric trucks (BET and HFCET) are powertrains that both use electricity instead of fossil fuels as an energy source. However, the range and high power requirements in long-haul transport currently pose challenges to both forms of technology.

Battery electric trucks

Even though this is the more mature technology in some areas of transport, BETs face challenges in fulfilling long range requirements, have high upfront costs and take a long time to recharge (Cunanan et al. 2021). In particular, the heavier powerdrives required for long-haul can result in smaller payloads that impact both operator margins and productivity.

Hydrogen fuel cell electric trucks

HFCETs are also operated through electric motors, but can use batteries and on-board hydrogen storage to generate electricity within a fuel cell (Kluschke et al. 2019). Due to the low volumetric energy density[18] of hydrogen, large storage tanks may be required to support long-distance haulage. As with BETs, this can have an impact on payloads

18 Volumetric energy density is a measure of the energy per unit volume. In this case the volumetric density of compressed hydrogen (at 700 bar) is 5.6 MJ per per litre, and that of cryogenic hydrogen is 8.5 MJ per litre compared to diesel's energy density of over 35 MJ per litre (Gray et al. 2021)

and operator margins for long-haul freight. Being a nascent technology, HFCETs also have high upfront costs and there is not currently sufficient infrastructure to distribute and store hydrogen for refuelling and other purposes (International Council on Clean Transportation 2022 [ICCT]; Gray et al. 2021). Support for hydrogen technology has increased in recent years, yet uncertainties in the timeline for commercial-scale green hydrogen remain.

These challenges have led to uncertainty in determining the dominant technology for long-haul freight in Australia. According to participants at the Climateworks' workshops, this uncertainty in vehicle technologies is delaying investment decisions and locking in existing, high-emissions assets. While many companies want to reduce their emissions, they are uncertain about the way forward.

However, as happened in renewable energy, disruptive changes and cost-reductions are expected over the coming years (Smallbone et al. 2020). Table 1 below lays out current challenges for BETs and HFCETs as well as rapidly developing opportunities that could lift these technologies into a commercially feasible and technologically viable space.

Government can provide more confidence regarding the technological transition by assessing the gaps and pursuing opportunities to partner with industry to address them.

TABLE 1: Emerging opportunities in zero-emissions technologies for long-haul road freight

Current state of technology	Emerging opportunities	Impact
High upfront costs for both BET and HFCET	The costs of battery pack and fuel cell systems are expected to fall by 50–65 per cent respectively, over the next decade, leading to approximately 23 per cent lower overall costs for BETs and HFCETs by 2025 (International Council on Clean Transportation [ICCT] 2022).	These developments reduce total costs of operating (TCO) and improve operator margins.
High costs for blue and green hydrogen[19]	Boosting domestic use could bring down hydrogen costs. By 2050, transport – notably articulated trucks – could be a major user of hydrogen under the conditions of the 'coordinated action scenario' modelled by Climateworks for the Australian Industry Energy Transitions Initiative (Climateworks Centre 2023a).	These developments reduce TCO and improve operator margins.
Speed chargers (1 MW chargers) are not commercially available, and charging time for BETs is not currently practical for long distance trips.	Industry partnerships such as the Tesla Semis (US Class 8) being operated by Pepsico have demonstrated charging via 750 kW DC[20] chargers that enable charging within half an hour (The Driven 2023). Europe is also experimenting with innovations in range extensions such as overhead electric charging, and wireless or conductive charging in some segments of the highway (Qiu, Ribberink and Entchev, 2022). While they may not all be relevant in the Australian context, these innovations signal dynamism in the technological space.	Reducing recharging time for BETs or providing more range for the same battery capacity would reduce TCOs and operator margins.

19 The colours indicate the different ways of producing hydrogen: Grey hydrogen is produced from natural gas in a process called steam methane reforming (SMR) and produces a concentrated stream of CO_2 emissions during this process. Blue hydrogen is produced via SMR; however, CCS is used to capture the CO_2 emissions before they enter the atmosphere, making this a lower net carbon production route than if no CCS is used. Green hydrogen is produced by splitting water into hydrogen and oxygen using renewable electricity in a process known as electrolysis, which produces no greenhouse gas emissions (Climateworks Centre 2023a)

20 Direct-to-current

The key objective of government effort with regard to zero-emissions trucks in long-haul freight should be to reduce uncertainty for the industry. This can be done by assessing technologies and providing information to industry as well as by helping to demonstrate new ways of working:

7.1 Assess the gaps and opportunities for zero-emissions technology in long-haul road freight

Given the dynamic opportunities in both BETs and HFCETs (see Table 1 above) it is unclear at this point in time which will become the predominant technology for long-haul freight. This is the moment for policy-makers to support assessments of zero-emissions technologies through rigorous technical, economic and environmental evaluations.

WHAT NEEDS TO BE ASSESSED?

Government and industry partnerships are important to assess and share latest data and information on important parameters such as:

+ **Technical performance** of zero-emissions trucks so they can be compared to existing vehicles and modes. Technical performance metrics could include the range delivered under Australian driving contexts, impact of additional weight on payload, charging and refuelling time, and energy efficiency. Indicators related to driver safety are also critical.
+ **Economic performance** that feeds into business projections of TCO and investments in zero-emissions trucks.
+ **Environmental performance** that enables comparisons of well-to-wheel[21] and tank-to-wheel[22] (tailpipe emissions) across different vehicles and modes within the context of the Australian energy grid. Fuel consumption and emissions data that can be disaggregated across freight vehicle classes will also enable emissions analysis, tracking and reporting. This assessment could also include other non-emissions related environmental impacts.

Policy-makers can also build on these evaluations to understand the level of policy support required. For example, increased electrification of trucks and hydrogen production will have impacts on the grid, infrastructure and market operations that policy-makers will need to plan for. Climateworks' energy modelling recommends that energy policies evaluate a wide range of possible futures with disruptive and rapidly transforming energy demand from end-use sectors. This will also enable well-timed transmission investments (Climateworks Centre 2023b).

Modelling frameworks, tools and information provided to the industry from these assessments will also signal policy priorities, reduce uncertainties and help industry assess their long-term strategies and investments.

Benchmark policies:

+ The United States government provides industry with a TCO modelling framework that assesses all alternative powertrain vehicles within the same analytic framework (National Renewable Energy Laboratory 2021).
+ The California Air Resources Board has developed the Zero-Emission Powertrain Certification Regulation (ZEPCert) to ensure that zero-emissions technologies being deployed are able to meet the reliability and performance expectations of California fleets (California Air Resources Board 2019).

21 Well-to-wheel (WTW) emissions cover most of the life-cycle emissions of different fuels or energy carriers. The equivalent of an oil-well origination point for battery electric trucks would be mining, and for hydrogen fuel cell electric trucks it would include emissions from the production of hydrogen. Emissions under WTW do not include end-of-life emissions. WTW also includes emissions from energy sources used at various production and other stages.

22 Tank-to-wheel (TTW) emissions are synonymous with tailpipe emissions. The terminology 'zero-emissions vehicles' refers to zero TTW emissions.

7.2 Demonstrate working pilots with industry

Government–industry pilots help to evaluate new technology, assess impacts on operations and shape requirements when the technology is ready to scale. Such pilots can be important when production, storage and distribution infrastructure is in nascent stages.

By co-locating the supply of renewable energy or hydrogen at locations of likely demand from freight stakeholders,[23] pilots can provide vital place-based learnings on using zero-emissions technologies in long-haul freight. Pilots can be conducted within 'net zero precincts', 'renewable energy industry precincts' (REIPs), 'logistics hubs' or 'hydrogen hubs' where integrated supply chains and energy network solutions provide low-cost renewable energy, energy demand is flexible and the costs of new technologies are distributed across multiple users (Aurecon Australasia 2019; Climateworks Centre 2023a, [c] 2023; CSIRO and GHD Advisory 2023).

INFORMATION BOX 5:

Actions taken by the transport and logistics industry to decarbonise freight

Globally, large shippers like Amazon and DHL are leveraging engagement platforms like the Sustainable Freight Buyers Alliance to reduce emissions from their carriers (Smart Freight Centre n.d.).

Decarbonisation actions can also be taken by transport and logistics service providers (LSPs) which can help to reduce scope 3 emissions[24] for their clients:

+ AURIZON, Australia's largest rail freight operator, plans to invest $50 million over 10 years in their Future Fleet Fund, targeting adoption of low-carbon technologies for their locomotive fleet. Their approach emphasises operational efficiency, infrastructure optimisation, electrification and confidence that emerging technologies – battery, hybrid or hydrogen – will deliver a step change (Aurizon 2020).
+ LINFOX LOGISTICS is trialling electric trucks with its leading customers for urban deliveries (Linfox 2022). The first was launched in August 2022 with one of Australia's largest retailers, Coles.
+ Similarly TOLL GROUP plans to introduce five electric trucks in Australia along with two hydrogen-powered prime movers (TOLL n.d.).

23 Examples of stakeholders relevant to the freight transport industry are fuel retailers, logistics service providers and vehicle manufacturing.

24 Scope 3 emissions are a consequence of activities undertaken by a company, and occur from sources that are not owned or controlled by the company (World Business Council for Sustainable Development and World Resources Institute 2004; Clean Energy Regulator 2023). For most companies, scope 3 emissions are highly significant, typically representing at least 70 per cent of their carbon footprint (World Economic Forum 2023).

RECOMMENDATION 8:

Assess the potential of an advanced biofuels policy

8.

As BETs and HFCETs both require new vehicles to be introduced to the market, and are dependent on the retirement of existing vehicle stock, there is an important interim role for conventional biodiesel, as well as sustainable advanced biofuels.[25] These fuels have comparable energy density to fossil fuels, but lower emissions (CEFC and ARENA 2019; Gray et al. 2021).

Unlike conventional biofuels, advanced biofuels are produced from non-food feedstocks, including forest residue and some waste-streams including municipal solid wastes. Advanced biofuels can be good 'drop-in' fuels, using existing fuel distribution infrastructure and engines (ClimateWorks Australia 2020a; International Energy Association [IEA] 2022; Australia Energy Council, n.d.; Clean Energy Finance Corporation and Australian Renewable Energy Agency [CEFC and ARENA] 2019).

In Australia, these fuels face a range of challenges – difficulty getting suitable feedstock, insufficient facilities for production and existing regulatory and pricing regimes – which make them less competitive than diesel (ARENA 2021; IEA 2022). As a result, in 2019–20, biodiesel made up only 0.4 per cent of total diesel (CEFC and ARENA 2019). Although a detailed set of recommendations for sustainable advanced biofuels is outside the scope of this report, a useful starting point for Australia would be to assess biofuels and use that information to shape implementation measures. As an example of potential, the 'Targeted Deployment' scenario of ARENA (2021) modelling has biofuels at 7 per cent of the total road fuel market by the 2030s.

Recent developments such as the $30 million Sustainable Aviation Fuels (SAF) Funding Initiative (ARENA 2023) also point to a role for advanced biofuels in decarbonising aviation. Innovations in the aviation fuel space could produce beneficial spillover technology for road freight, especially as globally road transport is expected to remain a strong biofuel user for some time (Gray et al. 2021).

Benchmark policies:

+ The European Commission has proposed revisions to Renewable Energy Directive II, whereby advanced biofuels (produced from a list of sustainable wastes and residues) will comprise at least 2.2 per cent of all energy supplied to transport, with a cap on biofuels from food-and feed-based biofuels (Transport Policy 2021).
+ In the United States the Renewable Fuel Standard is the primary policy encouraging biofuel use. The standard obliges refiners or importers of petrol or diesel fuel to meet blending mandates or otherwise to obtain credits (IEA 2022).

25 Advanced biofuels also include renewable diesel, green diesel, Fischer–Tropsch (FT)-diesel, bio-jet fuel, and bio-gasoline (Clean Energy Finance Corporation and Australian Renewable Energy Agency [CEFC and ARENA] 2019).

Building on the momentum of global trends

A convergence of emissions reduction actions across industry and government over recent years, presents Australia with a unique opportunity to embed decarbonisation at the heart of freight policy. While there have been efforts in the past to implement a number of the recommendations set out in this report, three key trends are creating momentum for change now.

First, the last few years have seen rapid growth in the number of original equipment manufacturers (OEMs) who are developing medium- and heavy-duty zero-emissions trucks, signalling a growing market dynamism. This is a substantial shift from earlier innovations in zero-emissions vehicles being led primarily by passenger cars. Second, growing regulatory pressure on companies to report on indirect (scope 3) emissions is adding an increasing level of scrutiny on emissions throughout the entire value chain. Freight transport emissions generated by logistics companies are an example of scope 3 emissions for many companies. Third, numerous climate-focused policies and targets have emerged in Australia over recent years. The implementation of these provides an opportunity to embed freight decarbonisation as a core principle in transport sector decarbonisation plans as well as key freight strategies. These three trends are set out in more detail in Table 2 below.

TABLE 2: The convergence of policies and actions that support ambitious freight decarbonisation

TREND 1:

Growing OEM interest in medium-heavy duty zero-emissions trucks

Most of the market development for medium- and heavy-duty zero-emissions trucks is taking place in China, Europe and North America (CALSTART 2022).

In Australia, although the pace has been slower and scale of development smaller, there are signs of budding activity that could scale:

+ Team Global Express has partnered with ARENA to conduct the largest trial of a heavy electric logistics fleet in Australia. The fleet of 60 heavy duty trucks from Volvo and Daimler will be charged at a purpose-built depot using renewable energy (ARENA 2022).
+ Holcim Australia recently wrapped up a successful trial of a zero-emissions electric truck using a Janus Electric converted prime mover for a short base-to-base duty cycle (Rigs 2023).
+ Remondis Australia plans to trial Hyzon hydrogen fuel cell waste collection trucks (Waste Management Review 2023).
+ Volvo plans to deploy its largest battery electric trucks for on-road trials in Queensland (Brisbane Times 2023).

TREND 2:

Increasing regulatory pressure to report on scope 3 emissions

While challenging, managing scope 3 emissions also offer one of the most significant opportunities for companies to play their part in reaching global net zero before 2050 (Science Based Targets initiative 2023).

In recent years, there has been growing regulatory pressure on companies to report on scope 3 emissions:

+ The European Union's Corporate Sustainability Reporting Directive requires scope 3 disclosures from 2024 onwards for over 50,000 companies (European Parliament 2022).
+ The U.S. Securities and Exchange Commission, at the time of publishing this report, is expected to adopt and publish new climate disclosure rules by the end of October 2023, to come into effect by 2024. The rules will require disclosure of climate risks and transition plans, and scope 3 emissions for companies where they are material (U.S. Securities and Exchange Commission 2022).
+ The International Financial Reporting Standards' (IFRS) S2 Climate-related Disclosures mandate the disclosure of scope 3 emissions. Reporting entities are required to disclose information about 'climate-related risks and opportunities that could reasonably be expected to affect cash flows, its access to finance or cost of capital over the short, medium or long term' (International Sustainability Standards Board 2023).
+ In Australia, the Department of Treasury has completed second consultations on climate-related financial disclosures. The disclosures are expected to be aligned with the IFRS' S2 Climate-related Disclosures and implemented in a phased manner (Australian Government 2023; Climateworks Centre 2023f).
+ The United Kingdom, New Zealand and Singapore amongst others, have also mandated the Taskforce for Climate-related Financial Disclosures (United Kingdom Government 2021; New Zealand Government 2023; Singapore Exchange 2021).

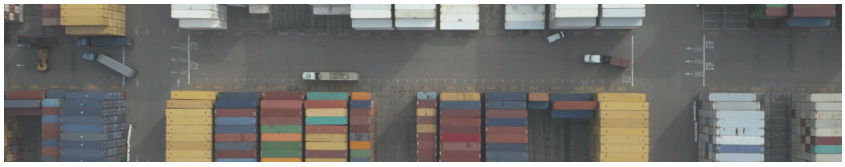
TREND 3:

Climate-focused policies in Australia that can support freight decarbonisation

- The Net Zero Unit in the Department of Infrastructure, Transport, Regional Development, Communication and the Arts, was established to identify how the transport and infrastructure portfolio could achieve net zero and improve the resilience of transport networks and supply chains (Minister for the Department of Infrastructure, Transport, Regional Development, Communication and the Arts 2022).
- The 2023 Federal Budget included $7.8 million to develop a Transport and Infrastructure Net Zero Roadmap and Action Plan (Climateworks Centre 2023d).
- In 2023, the Australian Government announced it will develop sectoral plans that include modelled decarbonisation pathways, which will be informed by the Climate Change Authority (DCCEEW 2023). These pathways will provide essential guidance for decarbonising key sectors, including transport, and will be particularly important as Australia sets its new national emissions reduction target for 2035 (Climateworks Centre 2023e).
- In 2023, the Australian Government is undertaking a review of the National Freight and Supply Chain Strategy and Action plan.
- Other transport related policies can also support freight decarbonisation. The policy priorities set out in the National Electric Vehicle Strategy 2023 can support freight vehicles such as light commercial vehicles (Commonwealth of Australia 2023). Following on from this, implementation of an ambitious fuel efficiency standard that covers light freight vehicles, can secure a better supply of smaller low-emissions freight options. The Driving the Nation Fund provides $500 million in financing to expand the charging network, including $80 million to be co-invested with state and territory governments to roll-out hydrogen refuelling stations on key freight routes (Department of Climate Change, Energy, the Environment and Water [DCCEEW] n.d.). The fund also includes $130 million to co-fund initiatives to reduce road transport emissions.
- Efforts to reduce freight emissions are also underway at state government level, including the recent NSW government Towards Net Zero Emissions Freight Policy (Transport for NSW 2023).

Australia can build on these trends by creating a sector-wide decarbonisation plan that charts a path forward for transport. As of the time of publishing this report, the 2023 review of the National Freight and Supply Chain Strategy and Action Plan offers one such opportunity.

Putting decarbonisation at the heart of national and state transport strategies would kickstart emissions reduction in freight.



Conclusion

Even though the majority of Australia's freight emissions come from road freight, an effective decarbonisation strategy brings in solutions beyond simply shifting from diesel to zero-emissions trucks.

Three types of solutions to reduce freight emissions have been set out in this report. First, solutions that make trips shorter or reduce the level of transport activity. Second, solutions that shift freight to lower-emissions modes such as rail or e-cargo-bikes; these also offer major benefits in terms of reducing congestion on Australia's roads as the freight task grows. Third, decarbonisation solutions can be achieved through improved energy intensity of vehicles and reduced carbon intensity of fuels. Enlisting a suite of solutions in an integrated way, can help Australia reach its emissions targets and also improve other outcomes, such as productivity and impacts on health and liveability.

This approach draws on the well-known Avoid-Shift-Improve framework which is often used to frame transport decarbonisation strategies (SLOCAT 2023; Intergovernmental Panel on Climate Change 2022). While 'improve' strategies will be critical, emissions reduced through integrating avoid-shift strategies will generate more benefits in terms of costs and efficiency.[26]

By drawing on the recommendations in this report and putting freight decarbonisation efforts at the heart of transport sector decarbonisation plans and freight strategies, Australia's policy-makers can support industry to make the transition to net zero and stay on track with achieving its emissions reduction goals.

26 A scan of global transport decarbonisation efforts highlights that strategies which reduce unnecessary trips and shift to lower emissions modes could reduce up to 40–60 per cent of transport emissions and at a lower cost than 'improve' strategies alone (SLOCAT 2022).

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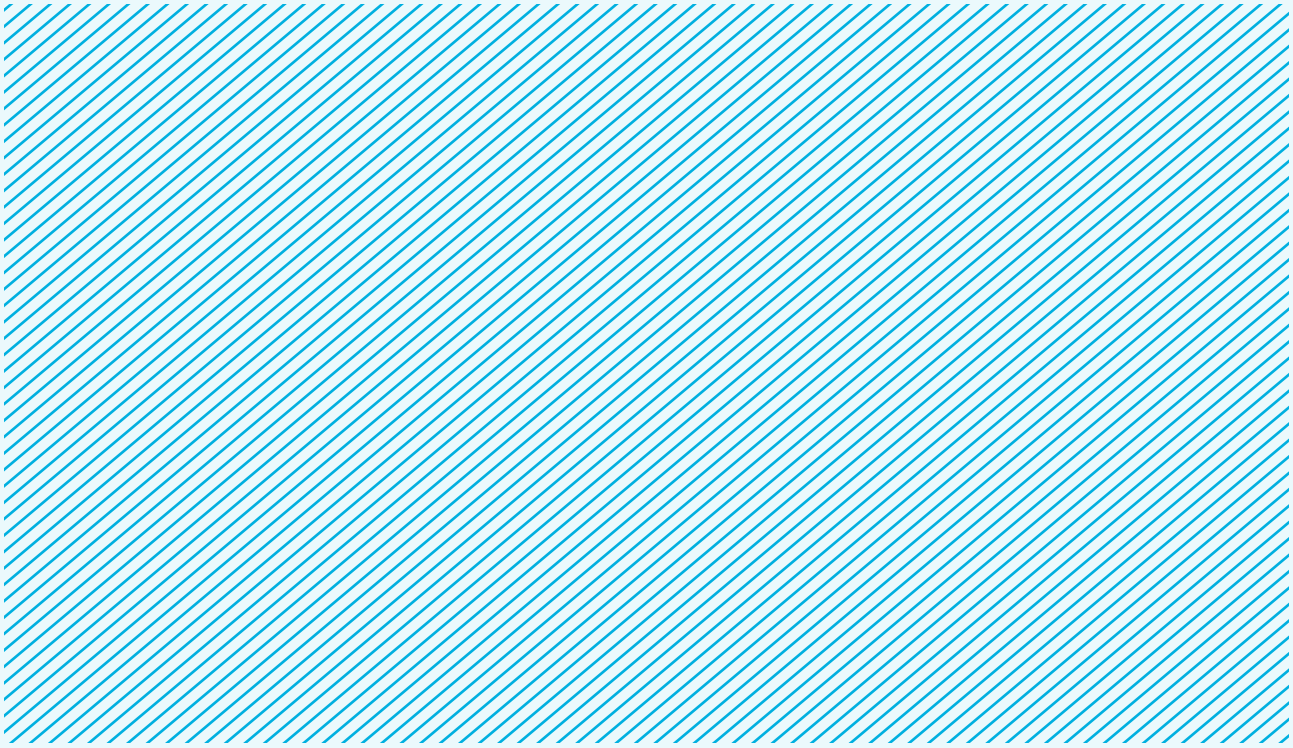


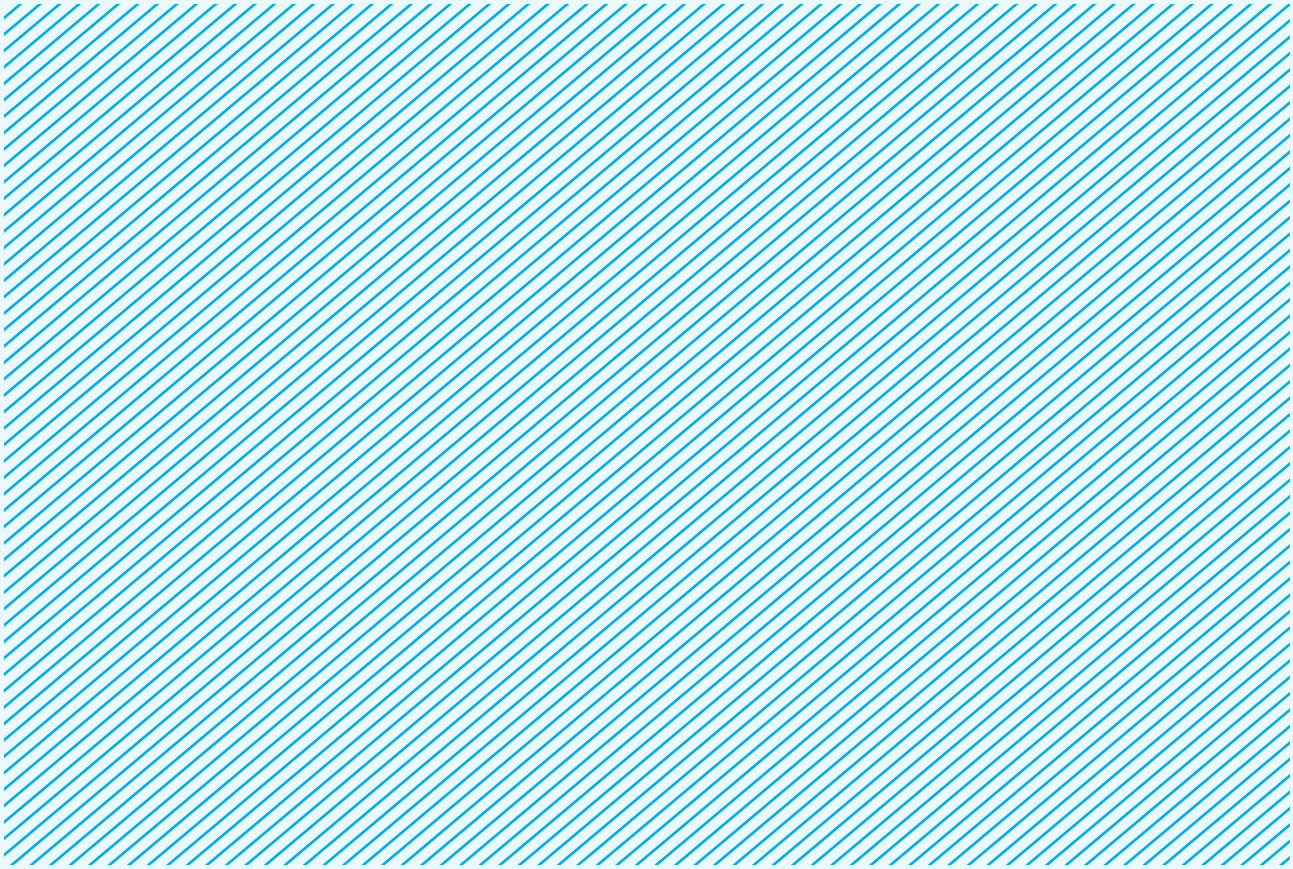
Appendix 1

The recommendations set out in this report have been identified through desktop research, industry and expert interviews and two workshops that Climateworks held with industry and policy-makers in May 2023.

The desktop research gathered transport decarbonisation policies and analysed the emissions reduction potential of various solutions, both from Australia and internationally. As far as possible, this report focuses on meta-studies and reports from similar economies. It should be noted that the emissions reduction potential of various solutions depends on the context and the assumptions of a study/trial. Therefore, Climateworks recommends that any policy be implemented based on Australia-relevant evaluation.

The desktop research was further enriched through interviews with subject-matter experts in government and industry. Climateworks also held two workshops with representatives from freight industry, government departments and agencies at the federal and state level. During the workshops, participants ranked policy interventions (identified through the desktop research) on a multi-criteria assessment. The criteria used were participant-assessed performance on emissions reduction, cost-effectiveness, ease-of-implementation and productivity. The top 10–15 priorities were then discussed further to identify the challenges and opportunities in implementation. This provided us valuable insights into freight sector decarbonisation, however it should be noted that our recommendations are based on Climateworks' comprehensive analysis and not views endorsed by these stakeholders.

These insights have played a key role in recognising that freight policies need to straddle economic and environmental objectives and need to be tested for the Australian context.

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For further information please contact:

HELEN ROWE
Transport Program Impact Manager
helen.rowe@climateworkscentre.org

DECHEN DOLKER
Project Manager
dechen.dolker@climateworkscentre.org

Climateworks Centre
Level 27, 35 Collins Street
Melbourne Victoria 3000
Wurundjeri Country

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