Austroads

Issues Paper
AP-C110-20

Decarbonisation of Road Transport Network Operations in Australia and New Zealand

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Abstract

There is a considerable focus on vehicle electrification as the primary driver of reducing greenhouse gas emissions in the roads sector.

Austroads has commissioned the development of this Issues Paper to assess the specific relevance of the greenhouse gas emissions issue from the point of view of road transport network operations, to frame the role that road network transport operations play in supporting the state and national ambitions for emissions reduction, and identify network management levers for consideration by decision makers.

The paper has been developed to help direct the Network Task Force's knowledge sharing and future research program.

The paper identifies the global climate trajectories and the Paris Agreement goal to limit temperature increase to no more than 1.5°C. It explores the Australia and New Zealand policy landscape and level of ambition.

It analyses the contribution of transport and the road sector to greenhouse gas emissions in Australia and New Zealand and reviews opportunities for contributing to net zero emissions in the context of electric vehicle take-up.

The paper highlights the need for a strategic rebalancing of priorities to include greenhouse gas emissions reduction as a key consideration in all road network transport operations thinking and decision, alongside road safety and transport network efficiency and productivity.

Keywords

Greenhouse Gas Emissions, Climate Change, Decarbonisation, Electric Vehicles, Mobility as a Service, Road Pricing, Mode Shift, IPCC, Paris Agreement

About Austroads

Austroads is the peak organisation of Australasian road transport and traffic agencies.

Austroads' purpose is to support our member organisations to deliver an improved Australasian road transport network. To succeed in this task, we undertake leading-edge road and transport research which underpins our input to policy development and published guidance on the design, construction and management of the road network and its associated infrastructure.

Austroads provides a collective approach that delivers value for money, encourages shared knowledge and drives consistency for road users.

Austroads is governed by a Board consisting of senior executive representatives from each of its eleven member organisations:

- Transport for NSW
- Department of Transport Victoria
- Queensland Department of Transport and Main Roads
- Main Roads Western Australia
- Department of Planning, Transport and Infrastructure South Australia
- Department of State Growth Tasmania
- Department of Infrastructure, Planning and Logistics Northern Territory
- Transport Canberra and City Services Directorate, Australian Capital Territory
- Department of Infrastructure, Transport, Regional Development and Communications
- Australian Local Government Association
- New Zealand Transport Agency.

ISBN 978-1-922382-01-6

Austroads Publication No. AP-C11-20

Publication date May 2020

Pages 34

Summary

The roads sector in Australia and New Zealand has an important role to play in supporting the transition to net zero emissions by 2050.

A policy review of the global and national climate change ambition leads to three important conclusions:

1. There is a convincing case to limit global temperature increase to less than 1.5°C above pre-industrial levels.
2. There is a substantial gap between current global ambition and the emissions reduction trajectory required to achieve global temperature increase to less than 1.5°C above pre-industrial levels.
3. The Australian Commonwealth and New Zealand national governments have identified emissions reduction targets under the Paris Agreement and New Zealand and each of the states and territories in Australia have identified the ambition to achieve net zero emissions by 2050.

There is a considerable focus on vehicle electrification as the primary driver of emissions reduction in the roads sector. This paper presents scenarios for vehicle electrification, and allowing for a transitioning electricity grid, how that may impact roads sector emissions in Australia. There are two important insights to draw from the emissions scenario analysis:

1. Accelerated support for new electric vehicle sales is insufficient on its own to bring roads sector emissions in line with a net zero emissions outcome in 2050.
2. Incentives to accelerate the retirement of inefficient internal combustion engine vehicles are also needed to transition the national fleet more in line with net zero emissions by 2050.

This paper suggests that road transport network managers have real opportunities to affect emissions reduction by supporting the transition to electric vehicles, but that the vehicle transition alone is insufficient to be achieve net zero emissions in the sector.

Beyond the adoption of low and zero emission vehicles, the business functions of road network transport operations (e.g. integrated transport planning, road traffic management, real-time traffic and transport operations, road network operations planning, network performance reporting) need to contribute to decarbonisation.

A range of levers are available to policy makers and road transport network operators to support a trajectory to lower emissions:

1. reduction in vehicle kilometres travelled
2. improvement in the emissions efficiency of road vehicles, and
3. shift of transport tasks to other modes with lower emissions intensity.

This paper highlights network management options to give effect to these levers, many of which also have co-benefits – road pricing, mobility as a service, travel demand management, freight network innovation and parking controls. These go alongside a range of licensing and economics incentives in support of vehicle electrification.

Importantly for network managers and agency leaders with many options for emissions reduction, the priority must be to include greenhouse gas emissions as a strategic priority for decision-making alongside safety and network efficiency, as each of these aspects of future mobility is addressed in policy and network management.

Contents

Tables

Figures

1. Introduction

1.1 Purpose of this Report

There is a considerable focus on vehicle electrification as the primary driver of greenhouse gas emissions reduction in the roads sector.

Austroads has commissioned the development of this Issues Paper to assess the specific relevance of the greenhouse gas emissions issue from the point of view of the road transport network operations and to frame the role that road network transport operations play in supporting the state and national ambitions for emissions reduction and identify network management levers for consideration by decision makers.

This Issues Paper provides an initial problem definition with the aim to drive more targeted knowledge sharing and research by the Network Task Force in relation to actions towards greenhouse gas emissions reduction required alongside the expected uptake in low and zero emission vehicle.

1.2 Methodology

The key approaches within this research are to:

1. identify the Global Climate Trajectories and the Paris Agreement goal to limit temperature increase to no more than 1.5°C
2. explore the Australia and New Zealand policy landscape and identify our level of ambition
3. identify the role of transportation and the roads sector in driving greenhouse gas emissions in Australia and New Zealand
4. review decarbonisation opportunities for net zero emissions in the context of electric vehicle take-up scenarios
5. identify practical levers for decarbonisation in the management of the road network.

As the road transport network is a substantial contributor to greenhouse gas emissions in Australia and New Zealand, it is important to align climate and emissions policy with the broader network management policy and practices.

This paper considers a range of drivers, policies, technical options and risks. It is a response to a framework of policy drivers that include the imperative to achieve global net zero emissions by 2050 and provide an implementation pathway in the road network sector for Australia and New Zealand's state and national emissions reduction ambitions.

1.3 Limitations

This report is based on a high-level review of global, federal and state emissions reduction policy and opportunities in the transportation sector.

The pathways for emissions reduction and future trajectory scenarios are necessarily simplifications and provide insight into the likely trends rather than specific benchmarks or goals for policy makers. Further analysis is required to support investment in any initiatives in pursuit of low-emissions outcomes in the road network.

2. Global Emissions Commitments and Trajectories

2.1 Commitments of the Paris Agreement

In 2015, at the United Nations (UN) Climate Change Conference, COP 21, the world's leaders committed to limit the global average temperature rise caused by anthropogenic climate change to less than 2°C above pre-industrial levels in the mid 18th century, and pledged substantial efforts to achieve 1.5°C.

Each participating country committed a nationally determined contribution to support the limitation of carbon dioxide equivalent (CO_2) emissions. Australia's commitment is a 26-28% reduction by 2030 and New Zealand's commitment is a 30% reduction by 2030.

2.2 The Case for 1.5°C

Further to the commitments made at COP 21, in 2018 the Intergovernmental Panel on Climate Change (IPCC) produced a *Special Report on the impacts of global warming above 1.5°C* (IPCC, 2018) to inform the Paris Agreement.

The report identifies modelled mitigation pathways consistent with limiting global warming to 1.5°C above pre-industrial levels and assesses the quantified impact which CO_2 and non-CO_2 emissions have on these pathways. The results demonstrate a higher likelihood of achieving a limitation in global average temperature rise corresponded with more aggressive reductions in emissions over a shorter timeline and sooner rather than later in time.

The research presented in the report shows that limiting a global average temperature increase to 1.5°C minimises the likelihood of the most impactful consequences of climate change occurring. These include, but are not limited to, extreme weather events such as droughts and heatwaves, exceeding a one-meter rise in sea level by 2100, increased rainfall and hurricanes associated storm intensity, continued temperature increase and melting of the polar ice caps.

The report concludes that there is a very strong case for implementing policy to keep global temperature rise to no more than 1.5°C above pre-industrial levels.

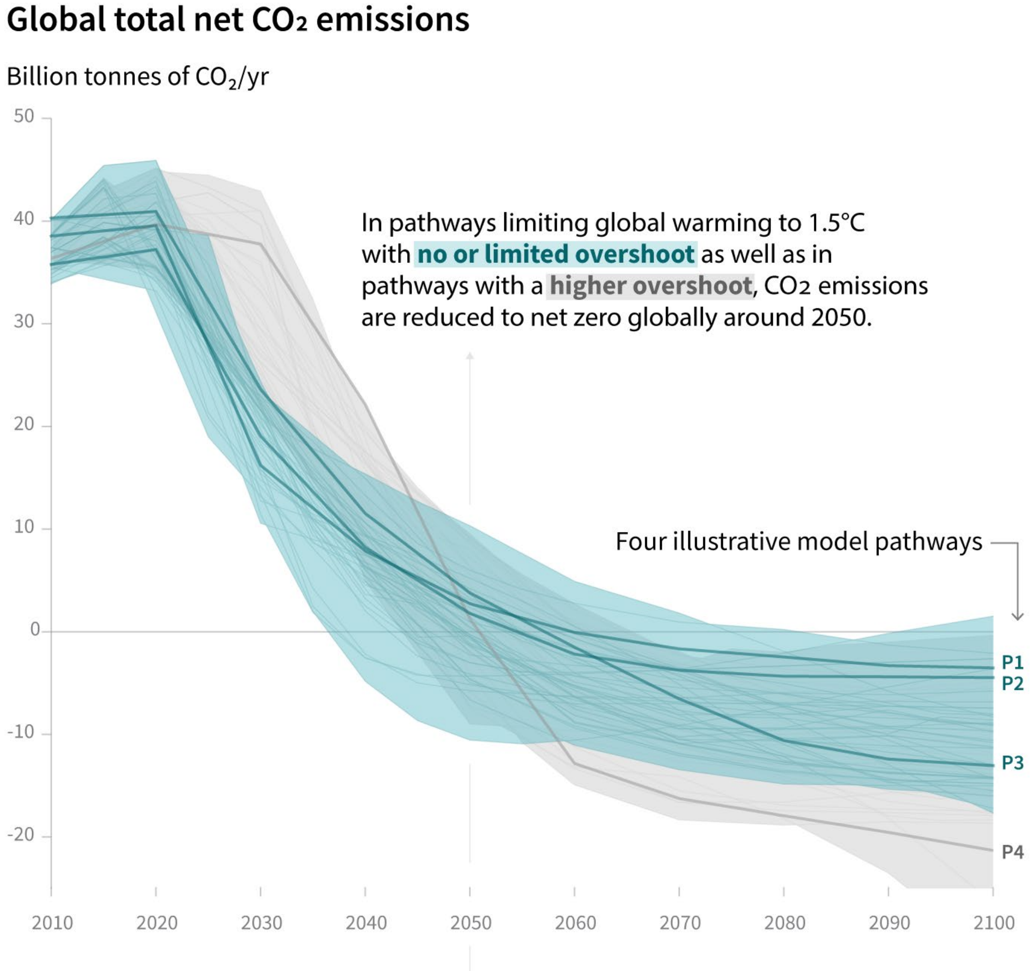
2.3 Emissions Scenarios for 1.5°C

The IPPC ambition for the global climate trajectory is to limit the rise in average global surface temperature to as close to 1.5°C as possible, aspiring to reach net zero emissions by 2050.

The International Energy Agency (IEA) in conjunction with the IPCC, produced the *World Energy Outlook* (IEA 2018). This publication includes greenhouse gas emissions curve scenarios, predicted as necessary to limit the average global temperature increase. Figure 2.1 models predicted pathways for limiting global warming with confidence, with little or no overshoot versus high overshoot, to achieving the 1.5°C temperature increase limit.

According to the UN*'s Emissions Gap Report 2019* (UNEP 2019), the total greenhouse gas emissions in 2018 reached a record high of 55.3 $GtCO_2e$.

Figure 2.1: Global emissions reduction pathways to limit warming to 1.5°C



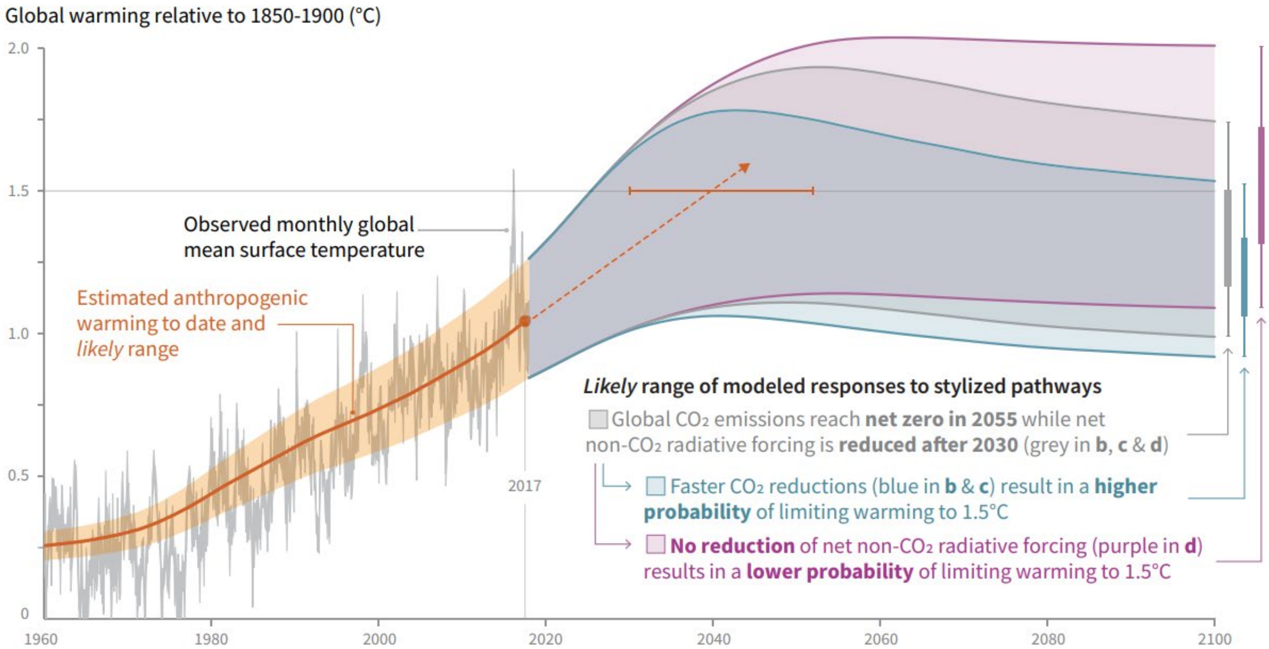
Source: Timings of net zero for CO2 for meeting the 1.5°C limit under "no or limited overshoot" (blue) and "high overshoot" (grey) scenarios (Figure SPM.3a: Summary for Policymakers in IPCC 2018).

The pathway to achieve a global average temperature rise of less than 1.5°C requires global emissions to be reduced by:

- 2030: at least 50% reduction from 2018 levels
- 2050: 100% reduction from 2018 levels
- 2050+: Negative emissions

Figure 2.2 below, drawn from the *IPCC Special Report* (IPCC 2018) which makes the case for a 1.5°C trajectory, shows the different temperature increase pathways as predicted by reducing global CO_2 emissions. The blue region represents a greater emissions reduction, corresponding to a higher probability of limiting global warming to less than 1.5°C.

Figure 2.2: Cumulative emissions pathways to limit warming to 1.5°C

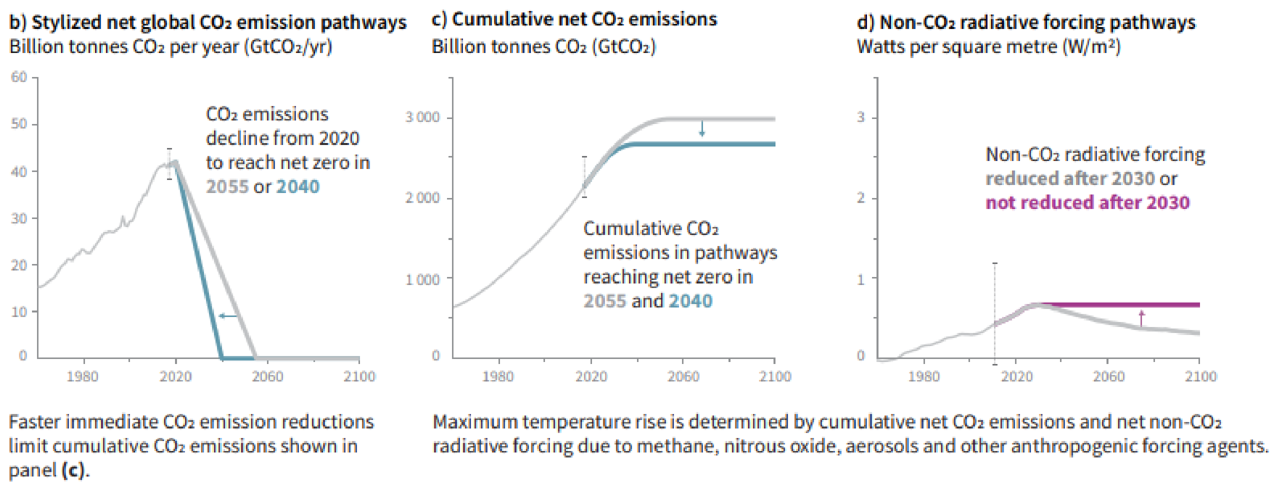


Source: 'Cumulative emissions of CO2 and future non-CO2 radiative forcing determine the probability of limiting warming to 1.5°C, (Figure SPM.1: Summary for Policymakers in IPCC 2018)

The emissions reduction timelines to reach the corresponding predicted average rise in global temperature are shown in the following figure, providing an indication of sensitivity to the rate of emissions reduction on temperature increase. It shows how a decline in emissions over a shorter time period demonstrates a higher likelihood of limiting the temperature increase to 1.5°C.

The pathways modelled include net zero emissions by 2040 and 2055.

Figure 2.3: Cumulative emissions pathways to improve the probability of limiting warming to 1.5°C



Source: Cumulative emissions of CO2 and future non-CO2 radiative forcing determine the probability of limiting warming to 1.5°C (Figure SPM.1: Summary for Policymakers in IPCC 2018)

2.4 Nationally Determined Contributions Shortfall

The global emissions requirements point to a need for deeper cuts than are currently reflected in the nationally determined contributions.

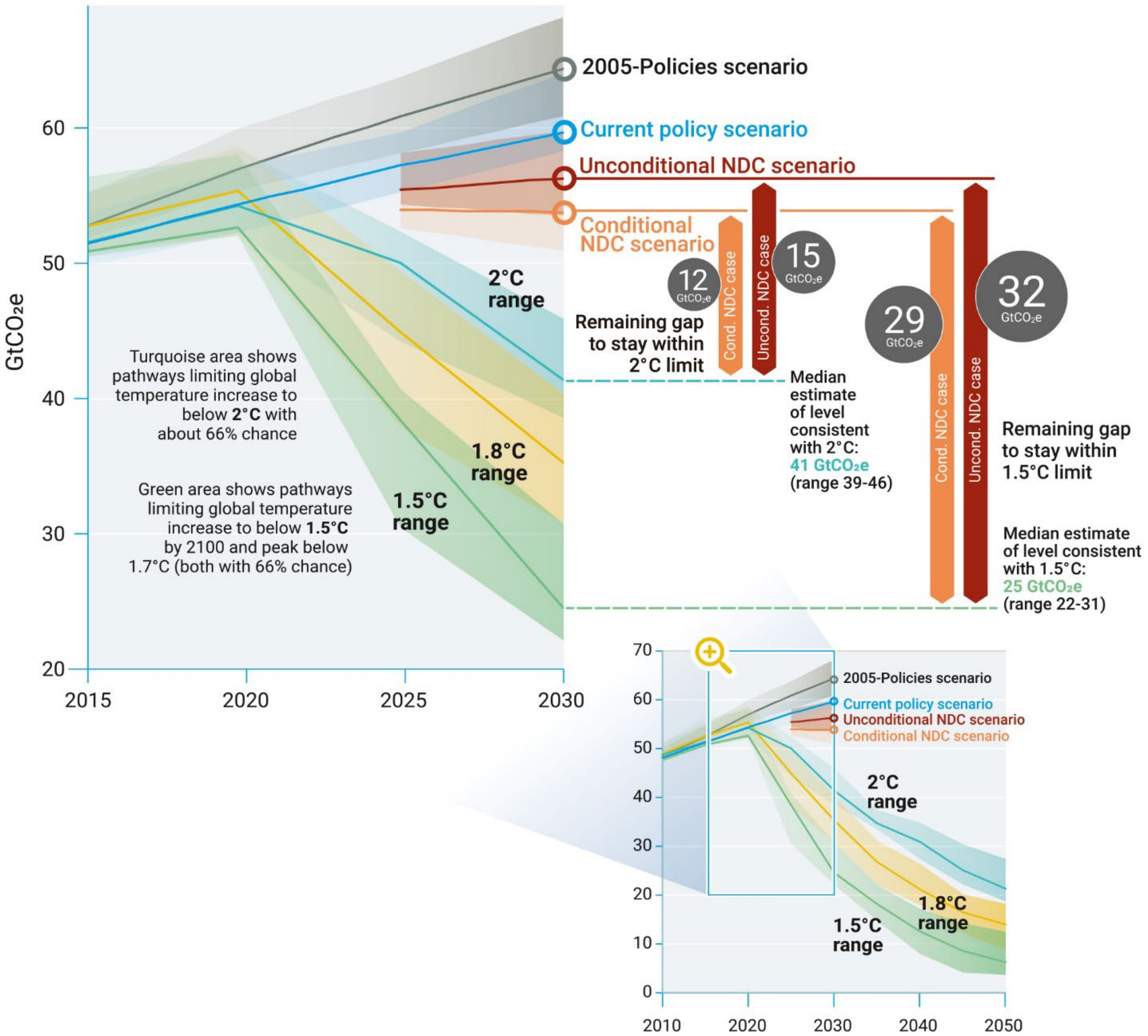
The modelled scenarios developed for the *World Energy Outlook* (IEA 2018) by the IEA to achieve a 1.5-2°C temperature increase require a 25-55% reduction in emissions globally by 2030. However, greenhouse gas emissions have risen at a rate of 1.5% per year in the last decade and in the absence of emissions reduction policy will likely continue to rise.

This presents a disconnect between the ambitions of the Paris Agreement and the current reality of increasing global emissions, not only in total but in key sectors including energy, transport and agriculture.

Figure 2.4, taken from the *2019 Emissions Gap Report* (UNEP 2019), shows the gap between the unconditional nationally determined contribution scenario and the 1.5°C temperature increase to be 32 $GtCO_2e$.

The emissions gap between the unconditional nationally determined contribution scenario and the 2°C temperature increase is 15 $GtCO_2e$, demonstrating that global emissions requirements point to deeper cuts than are currently reflected in the nationally determined contributions.

Figure 2.4: Nationally determined contribution shortfall compared to the 1.5°c emissions pathways



Source: Global greenhouse gas emissions under different scenarios and the emissions gap in 2030, (Figure ES.4 UNEP 2019)

2.5 Conclusions

The global climate negotiations under the auspices of the IPCC have described the emissions reduction trajectories that provide the best chance of avoiding the worst impacts of climate change; a trajectory that achieves:

- at least 50% reduction in emissions by 2030
- net zero emissions by 2050
- net negative emissions from 2050-2100.

However there remains a gap between voluntary emissions reduction commitments by individual nations under the Paris Agreement and the trajectory to maintain temperate rise of less than 1.5°C.

This paper explores opportunities in the roads sector that align to the global emissions reduction task.

3. Australia and New Zealand Policy Review

3.1 Introduction

The ambitions and commitments of Australia, New Zealand and the states and territories are noted below.

Table 3.1: Emissions reduction ambitions by nation and state

State/ Nation	Commitment
Australia	• 26-28% emissions reduction by 2030 as per nationally determined contribution
New Zealand	• 30% emission reduction from 2005 levels by 2030 • 100% renewable target by 2035 • **Net zero emissions by 2050**
New South Wales	• **Net zero emissions by 2050**
Victoria	• 25% renewable energy target by 2020 • 40% renewable energy target by 2025 • 15-20% emissions reduction below 2005 levels by 2020 • 30% emissions reduction from government operations from 2015 by 2020 • **Net zero emissions by 2050**
Queensland	• 50% renewable energy target by 2030 • 30% reduction below 2005 levels by 2030 • **Net zero emissions by 2050**
South Australia	• Achieved 20% reduction from 1990 levels • 50% emissions reduction from 2005 levels by 2030 • **Net zero emissions by 2050**
Australian Capital Territory	• 100% renewable energy target by 2020 • 40% emissions reduction from 1990 levels by 2020 • 50-60% emissions reduction from 1990 levels by 2025 • 65-75% emissions reduction from 1990 levels by 2030 • 90-95% emissions reduction from 1990 levels by 2040 • **Net zero emissions by 2045**
Western Australia	• **Net zero emissions by 2050**
Northern Territory	• 50% renewable target by 2030 • **Net zero emissions by 2050**
Tasmania	• 100% renewable energy target by 2022 • Achieved 95% emissions reduction from 1990 levels in 2017 • **Net zero emissions by 2050**

Australia's nationally determined contribution pledges a 26-28% emissions reduction by 2030 and New Zealand's contribution commits a 30% emissions reduction from 2005 levels by 2030. The Australian states and territories governments have made emissions reductions targets towards net zero by 2050.

While New Zealand's current nationally determined contribution commits a 30% emissions reduction from 2005 levels by 2030, New Zealand has recently passed a bill to reduce carbon emissions to net zero by 2050 to better align with the motivations of the Paris Agreement and global peers such as the United Kingdom, which passed net zero emissions legislation in June 2019. In November 2019, New Zealand passed the *Climate Change Response (Zero Carbon) Amendment Bill* (NZ) (Ministry for the Environment 2019). The bill sets new greenhouse gas emissions reductions targets to align more closely with the Paris Agreement, as follows:

- reduce all greenhouse gases (except biogenic methane) to net zero by 2050
- reduce emissions of biogenic methane within the range of 24–47 per cent below 2017 levels by 2050 including to 10 per cent below 2017 levels by 2030.

3.2 New South Wales

In 2016, New South Wales released the *NSW Climate Change Policy Framework* (Office of Environment and Heritage (OEH) 2016a). This document outlines the state's ambition and framework to meet net zero emissions by 2050. Additionally, the OEH published the *Emissions in NSW fact sheet* (OEH 2016b), which quantifies trends in greenhouse gas emissions in New South Wales by sector and includes a linear pathway to achieving net zero emissions by 2050.

3.3 Victoria

Victoria's *Climate Change Act 2017* (Vic) sets out emissions reduction targets; with the principal target of net zero emissions by 2050. Additionally, Victoria has identified dates to establish six interim targets – which have not yet been defined but will be developed based on the state's emissions reduction performance within a predetermined period.

To support Victoria's emissions reductions targets, the state has released its interim targets for emissions reductions which are not currently legislated. They are as follows:

- reduce Victoria's emissions 15 to 20 per cent below 2005 levels by 2020
- reduce emissions from Victoria's government operations by 30 per cent below 2015 levels by 2020.

Additionally, Victoria has published *Interim Emissions Reduction Targets for Victoria 2021-2030* (Independent Expert Panel on Interim Emissions Reduction Targets for Victoria2019). This document comprehensively outlines emissions budgets, reduction opportunities and interim targets and identifies opportunities for decarbonisation within the key sectors of electricity, land use and transport..

3.4 Queensland

Queensland has documented the ambition for emissions reductions in line with the Paris Agreement, towards net zero emissions by 2050, although these targets are yet to be legislated. To support this commitment, the Queensland government has made three key climate change commitments:

- powering Queensland with 50% renewable energy by 2030
- net zero emissions by 2050
- interim emissions reductions target of at least 30% below 2005 levels by 2030.

Additionally, Queensland has released *Pathways to a Clean Growth Economy – Queensland Climate Transition Strategy* (Department of Environment and Heritage Protection 2017a) and the *Queensland Climate Adaptation Strategy* (Department of Environment and Heritage Protection 2017b). The strategy presents a framework for the state's ambitions and the trajectory planned for achieving net zero emissions by 2050 by identifying various drivers (global, national, state-wide), pathways and interim targets. It also identifies the need for low emission infrastructure and transport systems and the intent of developing a net-zero transport emissions roadmap.

3.5 South Australia

South Australia passed the *Climate Change and Greenhouse Emissions Reduction Act 2007* (SA). The principal target under this act is to reduce greenhouse gas emissions by at least 60% to an amount that is equal to or less than 40% of 1990 levels. Interim targets are provided:

- increase the proportion of renewable electricity generated so that it comprises at least 20% of electricity generated in South Australia by 31st December 2014 – achieved
- increase the proportion of renewable electricity consumed so that it comprises at least 20% of electricity consumed in South Australia by 31 December 2014 – achieved.

Additionally, South Australia released the *Carbon Neutral Adelaide Action Plan 2016-2021* (Government of South Australia and Adelaide City Council 2016). This document presents a framework for the state's ambitions and the trajectory planned for achieving net zero emissions by 2050. The pathways consider how carbon emissions can be offset in emissions-heavy sectors such as the built environment, transport, energy and waste.

South Australia has adopted five policy directions for a Climate Smart South Australia, a new across-agency climate change strategy due for completion in early 2020. It will support implementation through a range of new and expanded actions that are already in place to:

- engage business and industry to reduce emissions, manage climate risk and harness new economic opportunities
- help grow low emissions and climate resilient jobs
- build business, community and environmental resilience
- manage climate-related risks and reduce emissions in government.

The strategy will compliment other plans which are already in place or soon to be released, including *South Australia's Hydrogen Action Plan* (Government of South Australia 2019) and Electric Vehicle Strategy.

3.6 Australian Capital Territory

In 2018, the Australian Capital Territory passed the *Climate Change and Greenhouse Gas Reduction (Principle Target) Amendment Bill 2018* (ACT). The bill brings forward the Australian Capital Territory's net zero emissions target date from 30 June 2050 to 30 June 2045. Additionally, it identifies additional interim targets to set pathways towards the principal target. These interim targets are as follows:

- 50-60% below 1990 levels by 2025
- 65-75% below 1990 levels by 2030
- 90-95% below 1990 levels by 2040.

As of 1 October 2019, the Australian Capital Territory is powered 100% by renewable energy, via South Australia's Horndale wind farm. While the Australian Capital Territory will still run on energy generated by coal and gas plants, for every watt of power the Australian Capital Territory consumes it generates a watt through its renewable energy investments across Australia.

Additionally, the Australian Capital Territory has published the *ACT's Climate Strategy to a Net Zero Emissions Territory* (ACT Government 2017). This document presents a framework for the state's ambitions and the trajectory planned for achieving net zero emissions by 2045. It outlines key sectors and pathways for emissions reduction within these sectors, including energy, transport, waste and land use.

3.7 Western Australia

In August 2019, Western Australia released its greenhouse gas emissions reduction aspirations to achieve net zero emissions by 2050 (Department of Water and Environmental Regulation 2019).

3.8 Northern Territory

In October 2019, the Northern Territory Government released *Northern Territory Climate Change Response Towards 2050* (Northern Territory Government 2019) which states the ambition to achieve net zero emissions by 2050.

While no interim emissions reductions targets have been established, there are some existing initiatives that will assist in supporting the net zero emissions 2050 pathway:

- 50% renewable energy target by 2030
- construction of the Northern Territories first large-scale solar project, a 25 MW plant near Katherine
- successful installation 10 MW of solar energy in 25 remote communities.

3.9 Tasmania

Tasmania's *Climate Change (State Action) Act 2008* (Tas), last amended in 2017sets the emissions reduction legislation framework for Tasmania. It identifies the state's principal target; to reduce greenhouse gas emissions in Tasmania to at least 60% below 1990 levels by 31 December 2050.

While Tasmania has not released any policy framework documentation, the Climate Change Office has published the *Tasmanian Greenhouse Gas Emissions Report 2019* (Tasmanian Climate Change Office 2019). This document quantifies emissions by sector, providing transparency as to where the state has improved.

Additionally, Tasmania has committed to achieving a 100% renewable energy target by 2022 and in 2017 achieved 95% emissions reduction from 1990 levels.

3.10 Other Decarbonisation Considerations

Beyond public policy, the increasing reflection of climate change externalities in the real economy is having an impact on both private and public sector decision-making and risk management.

Several notable interventions by regulators and business leaders are worth noting with a view to the potential impact on transportation agencies:

- Global financial regulators, *Network for Greening the Financial System* (NGFS 2019), at which the Reserve Bank of Australia has observer status (see Figure 3.1), has forecast the role that financial regulation may play in responding to the challenge of decarbonising the global economy and the systemic financial risk posed by climate change.
- The Bank of England Prudential Regulation Authority (PRA) included explicit climate scenarios for their 2019 stress testing guidance for insurers, with prescribed write-downs for equity holdings in a range of impacted sectors and regions (PRA 2019).
- In a number of speeches over 2017-2019, leaders at the Australian Prudential Regulatory Authority (APRA) have signalled the inclusion of climate scenarios in Australian financial regulation and APRA published an information paper in March 2019 on climate change awareness (APRA 2019).
- In March 2019 the Australian Centre for Policy Development published an update to the landmark 2016 legal opinion by Noel Huntley SC identifying how directors who do not properly manage climate risk could be held liable for breaching their legal duty of due care and diligence (Boll 2019).
- In November 2019, Fairfax media reported on the potential inclusion of climate change progress in the trade negotiations between Australia and the EU (.SMH 2019) to provide a foretaste of potential broader policy impacts of progress against the Paris Agreement commitments.

These initiatives point to a growing appreciation in government and the private sector of the risks posed to the Australian and New Zealand economies by a changing climate and the global response to climate change. The transportation sector in Australia and New Zealand will face transitional pressure as a result of this.

Figure 3.1: Members of the Network for Greening the Financial System

Source: NGFS 2019.

3.11 Conclusions

Each state and territory in Australia and New Zealand at a national level has set the aspiration to achieve net zero emissions by 2050 or sooner.

Many states supplement these aspirations with interim targets to demonstrate a pathway or trajectory towards achieving these emissions reductions or produce policy framework documents to outline strategies utilised.

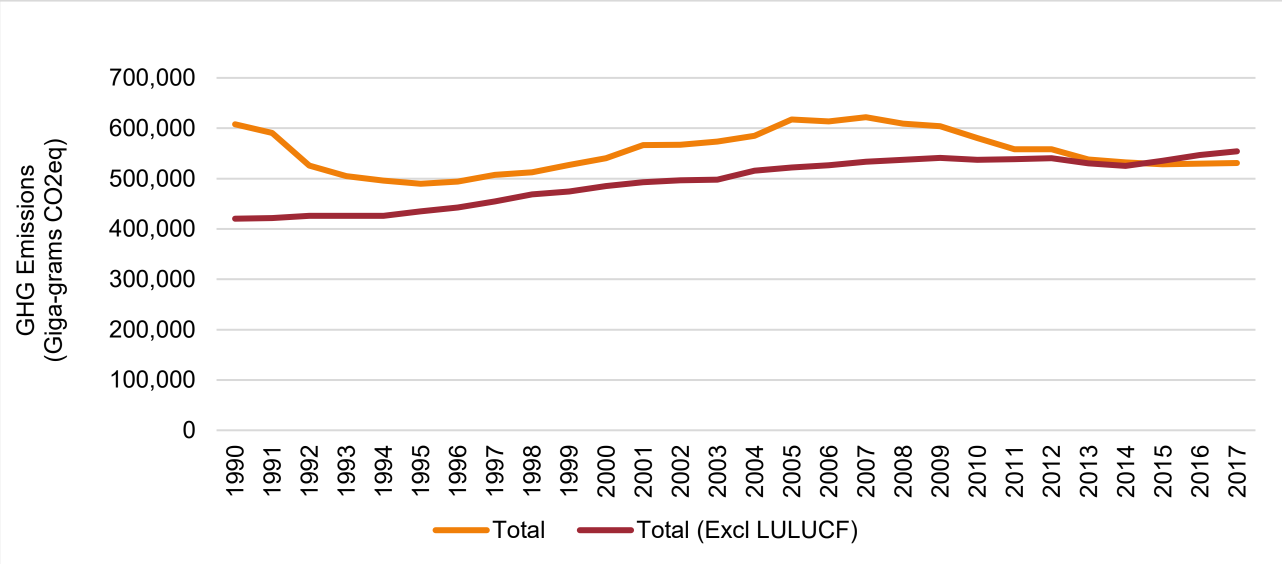
While not all jurisdictions have detailed decarbonisation pathways and sector specific policy it is reasonable to suppose that transportation, and roads in particular, are an important consideration in achieving these policy ambitions.

4. Greenhouse Gas Emissions in Australia and New Zealand

4.1 National Emissions

Australia is an industrialised country and contributes in the order of 1% to global greenhouse gas emissions. Australia's greenhouse gas emissions have varied over the past 30 years, peaking in 2007 before gradually declining until 2013 and then flattening. Emissions excluding Land Use, Land Use Change and Forestry (LULUCF) have climbed annually since 1990.

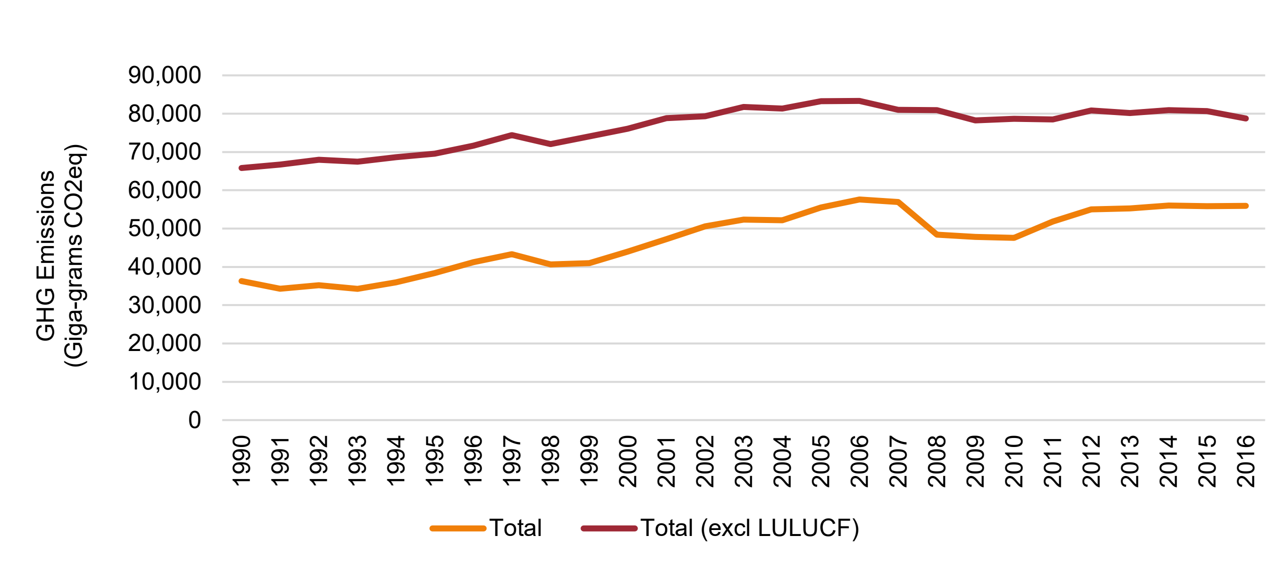
Figure 4.1: Australian greenhouse gas emissions including and excluding LULUCF (1990-2017)



Source: Data obtained from the Australian Greenhouse Emissions Information System, Department of the Environment and Energy. Accessed 25 Oct 2019.

New Zealand emissions grew from 1990 until 2007 and have plateaued over the past decade. A notable difference for New Zealand compared to Australia is that including LULUCF results in lower emissions and also that emissions excluding LULUCF (i.e. the operating emissions of the economy, including transportation) have declined since 2007.

Figure 4.2: New Zealand greenhouse gas emissions including and excluding LULUCF (1990-2016)



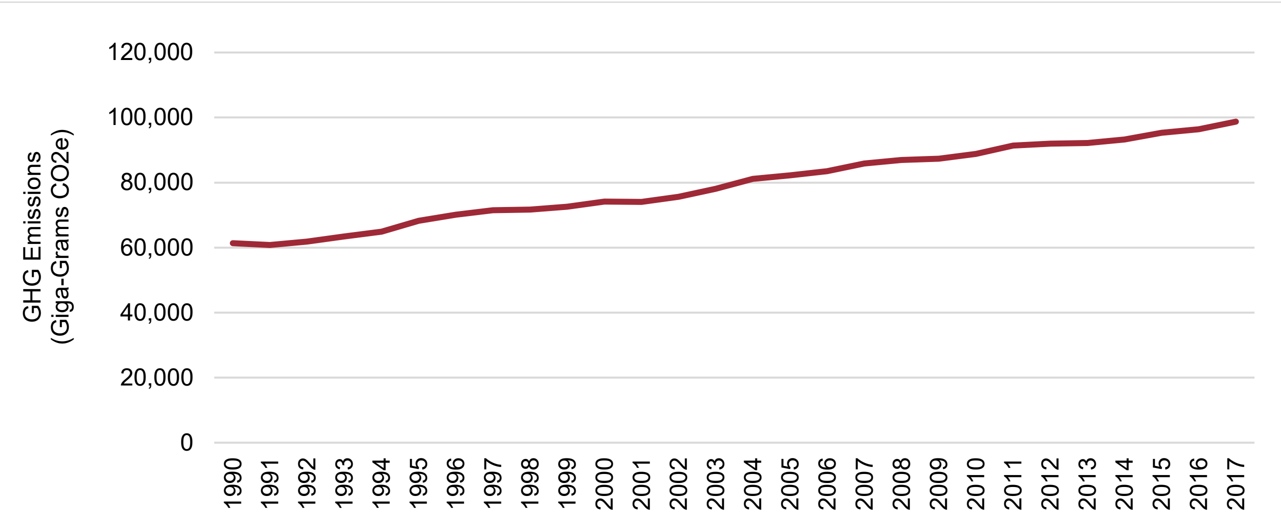
Source: Data obtained from the New Zealand Greenhouse Emissions Inventory, Ministry for the Environment. Accessed 10 January 2020.

4.2 Transport Emissions

Currently, the transport sector accounts for approximately 20% of Australian emissions of which road transportation contributes the majority. In New Zealand road transportation account for over 39% of total emissions.

The continuing increase in transport emissions and their relative contribution toward the national emissions make-up of both Australia and New Zealand reveal a challenge in aligning transport policy and the state/national emissions reduction ambitions. For those jurisdictions with an ambition of net zero emissions, the current increasing emissions trajectory for the transport sector appears at odds with that ambition.

Figure 4.3: Australian transportation sector emissions (1990-2017)

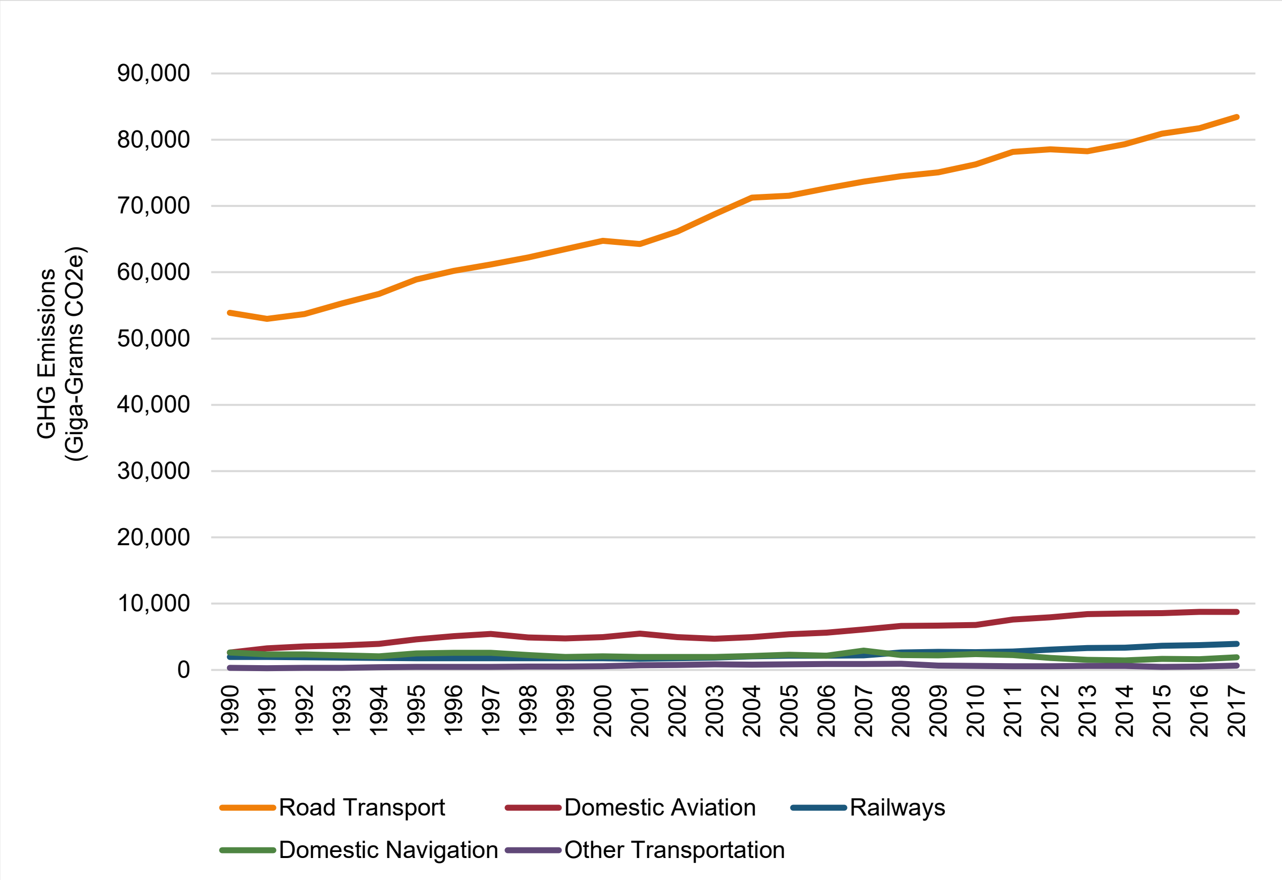


Source: Data obtained from the Australian Greenhouse Emissions Information System, Department of the Environment and Energy. Accessed 25 Oct 2019.

4.3 Road Transport Emissions

Road transport is the dominant emissions source within the transport sector in both Australia and New Zealand. Figure 4.4 shows the transportation emissions breakdown by sector.

Figure 4.4: Transport emissions breakdown by sector (Australia, 1990-2017)

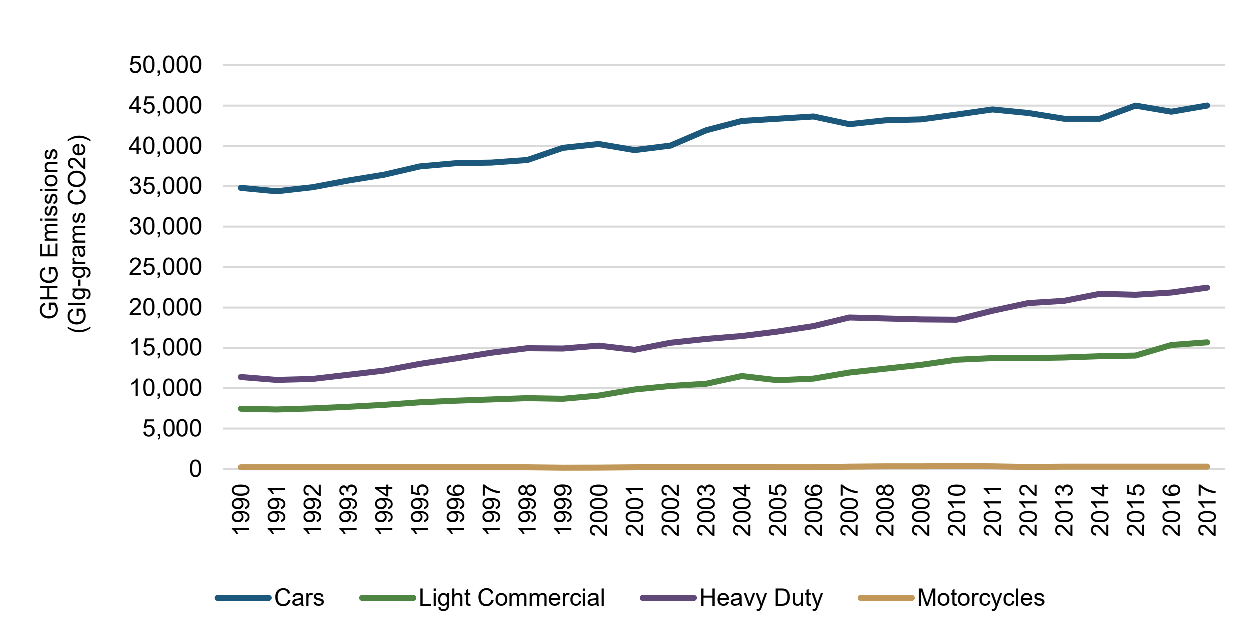


Source: Data obtained from the Australian Greenhouse Emissions Information System, Department of the Environment and Energy. Accessed 25 Oct 2019.

This suggests that the roads sector, dominated by vehicles with internal combustion engines, plays a material role in contributing to greenhouse gas emissions in Australia. It also suggests that efforts to reduce emissions across the economy consistent with a pathway to net zero emissions will require a change in trajectory in the roads sector. Within road transportation emissions, the usage split between different vehicle types can also provide insights for network managers seeking to reduce emissions.

Figure 4.5 indicates the contributors to road emissions, in order of emissions share are: cars, heavy duty vehicles, light commercial vehicles and motorcycles.

Figure 4.5: Breakdown of road transport emissions by vehicle type (Australia, 1990-2017)

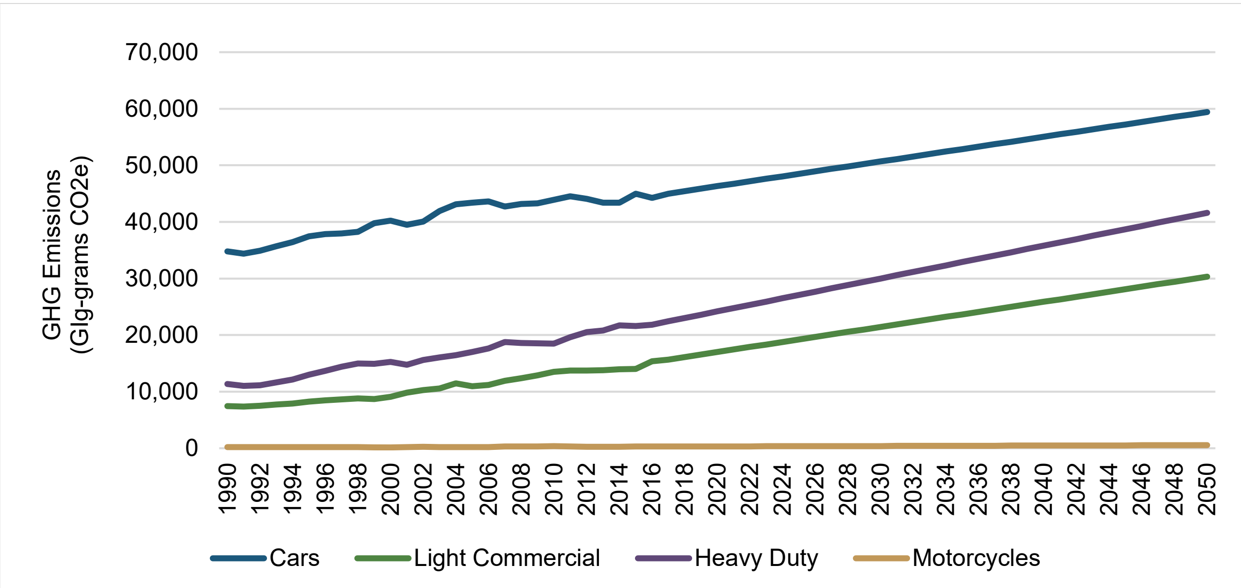


Source: Data obtained from the Australian Greenhouse Emissions Information System, Department of the Environment and Energy. Accessed 25 Oct 2019.

This paper has undertaken a linear emissions projection to provide a business-as-usual benchmark against which emissions reduction scenarios can be tested.

The resulting projection of road transportation emissions forecast to 2050 is provided in the figure below. This does not account for any electric vehicle penetration in the fleet and provides the baseline against which to consider electric vehicle policy and other opportunities for emissions reduction through the management of the network.

Figure 4.6: Projected business as usual emissions contribution of road transport by vehicle type (Australia, 1990-2050)



Source: Integral Group Analysis of Data obtained from the Australian Greenhouse Emissions Information System, Department of the Environment and Energy. Accessed 25 Oct 2019.

4.4 Conclusions

The transport sector is a significant and growing source of emissions, particularly within Australia, and transport emissions are primarily from the road network with a balance of passenger travel and freight.

Road use and the road network management are substantial contributors to emissions and a critical sector for reform in the transition for those jurisdictions with ambitions to achieve net zero emissions.

Addressing road network levers for decarbonisation are an important consideration in efforts to achieve the emissions reduction ambitions of the states and territories.

Roads agencies may need further policy levers for driving low carbon outcomes through network management.

5. Vehicle Electrification Emissions Considerations

5.1 Supporting the Electric Vehicle Transition

The transition to electric vehicles (EVs) is an important contributor to decarbonisation of the transport sector, and this importance is reflected in the policy direction supporting EV sales in Australia and New Zealand.

The supporting considerations and market forecasts for EVs are addressed in other Austroads reports (*Assessment of Key Road Operator Actions to Support Electric Vehicles* (Austroads 2020) and *Future Vehicles 2030* (Austroads in press)).

This paper presents several factors contributing to greenhouse gas emissions reduction as a result of electric vehicle policy and market trends in order to provide context for other emissions reduction opportunities in networks management.

5.2 Electric Vehicle Take-up Scenarios

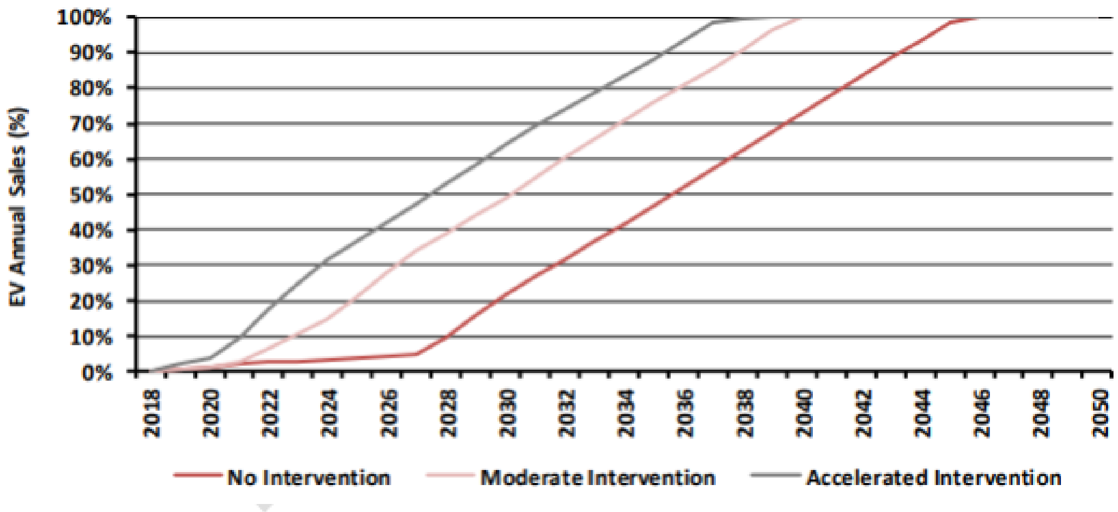
The two Austroads reports provide insight into the future sales and fleet penetration of EVs into the Australian and New Zealand markets.

Assessment of Key Road Operator Actions to Support Electric Vehicles (Austroads 2020) provides several scenarios for EV take-up in Australia and New Zealand, referencing a recent report by Energeia.

Three scenarios are presented for passenger vehicles:

- no intervention: EVs progress to 100% of new sales by 2044 (~22% by 2030)
- moderate intervention: EVs progress to 100% of new sales by 2040 (~55% by 2030)
- accelerated intervention: EVs progress to 100% of new sales by 2036 (~65% by 2030).

Figure 5.1: Electric vehicle take-up scenarios for Australia (2018-2050)



Source: Austroads 2020 and Energeia 2018

The take-up of electric drivetrains in freight and public transit have not been addressed in *Assessment of Key Road Operator Actions to Support Electric Vehicles* (Austroads 2020). This is an area that warrants further investigation as the supporting policy environment that supports accelerated sales for different vehicle types will vary greatly.

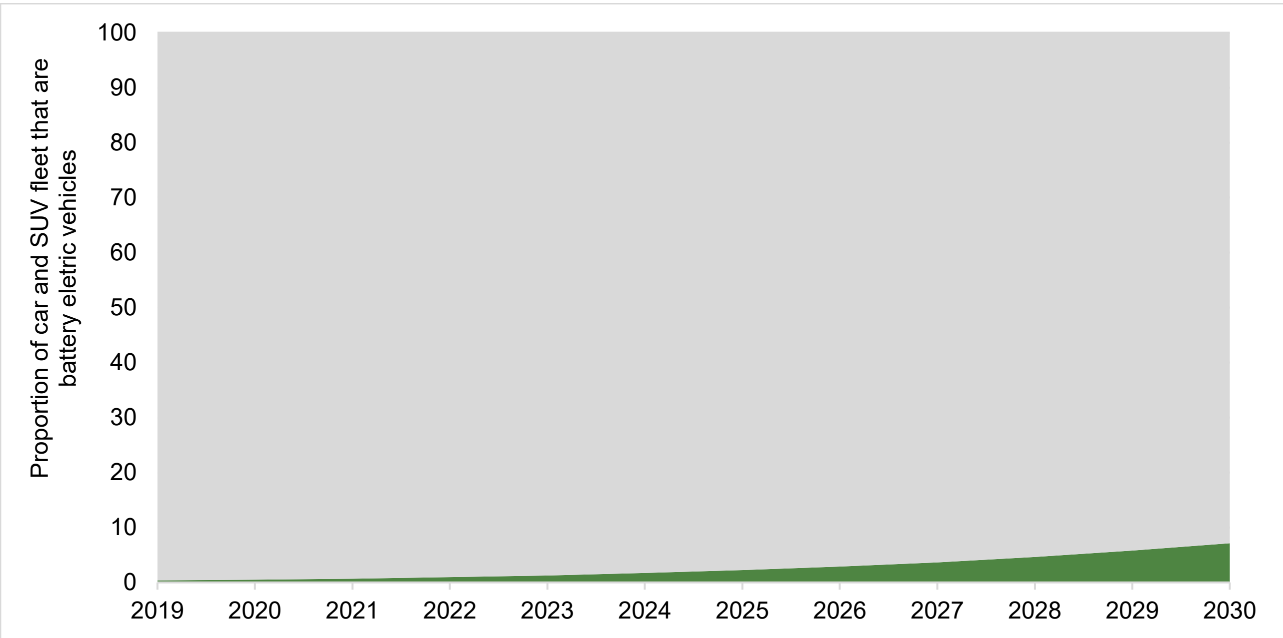
The EV take-up scenarios reflect new sales and the overall transformation of the fleet will lag behind new sales as it takes time for older vehicles to be retired. A more detailed analysis of the national fleet make-up across different vehicle types and different policy environments is recommended to provide authoritative forecasts for emissions reduction, in concert with the grid transformation trajectory for stationary energy generation.

Future Vehicles 2030 (Austroads in press) identifies the EV sales and fleet penetration forecasts based on continuity of the current policy environment in Australia and New Zealand.

The sales forecasts for EV passenger vehicles are approximately 2% of new sales in 2019, increasing to around 23% of new sales by 2030.

This provides for a fleet penetration of EV passenger vehicles of approximately 7% by 2030. Fleet transition forecasts beyond 2030 are not currently available.

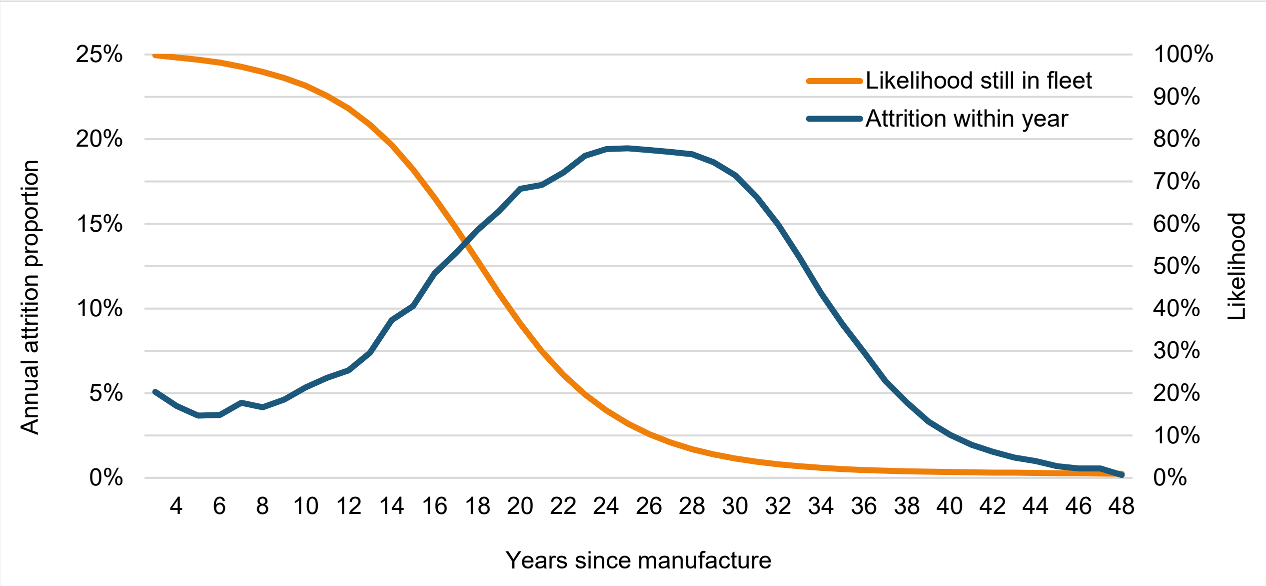
Figure 5.2: Electric energy source: fleet penetration over the period 2019-2030



Source: Austroads in press.

The fleet penetration model for different vehicle types presented in *Future Vehicles 2030 (Austroads in press)* is supported by data for the likelihood that a vehicle of a certain age remains in the fleet. This model provides an indication of how likely vehicles sold in a particular year are to remain in service into the future.

Figure 5.3: Likelihood that a passenger car of this age is still in the fleet

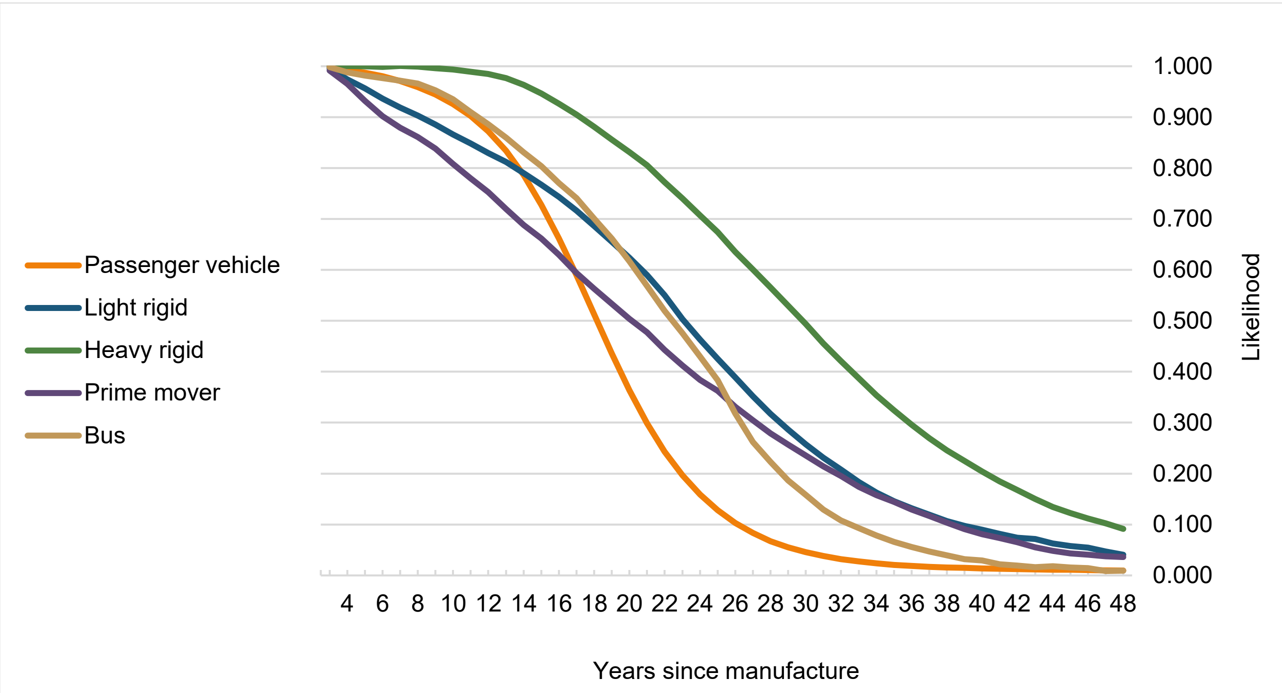


Source: Austroads in press

The likelihood of different vehicle types still being in service in the future has also been considered in *Future Vehicles 2030*(Austroads in press), which indicates a higher likelihood that older vehicles of other types (light rigid, heavy rigid, prime mover and bus) are more likely to be in the fleet at any one time.

This suggests that the transition of these other vehicle types to electric drive trains is unlikely to be faster than the trajectory of change for passenger vehicles.

Figure 5.4: Likelihood that a vehicle of this age is still in the fleet



Source: Austroads in press

This analysis indicates several things in the electric vehicle market that will impact emissions in the roads sector:

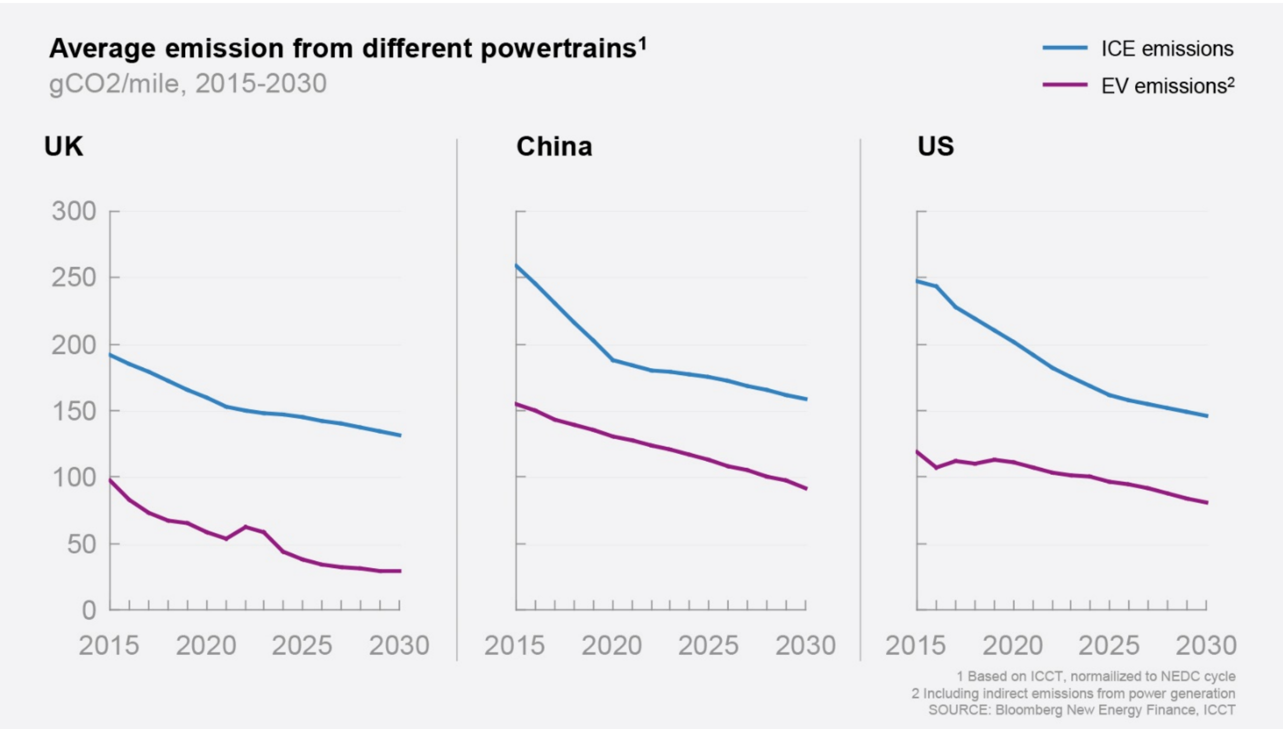
- Electric vehicles will continue to grow their presence in the fleet.
- The attrition rate of vehicles exiting the fleet grows rapidly at 12-14 years after manufacture and peaks approximately 25 years after manufacture.
- The likelihood that a vehicle will remain in the fleet drops below 10% as follows:
  - Passenger vehicles – 26 years
  - Busses – 33 years
  - Light rigid vehicles – 39 years
  - Prime mover vehicles – 39 years
  - Heavy rigid vehicles - >50 years.

5.3 Electric Vehicle Greenhouse Gas Emissions

Electric vehicle emissions are a factor of drive-drain efficiency and the emissions intensity of the electricity grid. While EV drivetrains are inherently more efficient than internal combustion engine equivalents, there remains a relatively high sensitivity to electrical grid emissions intensity from stationary generation technology.

As shown in Figure 5.5, the projected emissions intensity of internal combustion engine and electric vehicles in three jurisdictions was presented in *An Integrated Perspective on the Future of Mobility (McKinsey& Company and Bloomberg 2016)*.

Figure 5.5: Electric vehicles vs internal combustion engine emissions profiles in the UK, China and USA



Source: EV vs ICE Emissions profiles in the UK, China and USA (McKinsey& Company and Bloomberg 2016)

The predicted emissions impact of EVs compared to internal combustion engine vehicles in Australia is not addressed in the McKinsey & Company and Bloomberg report. However, the Australian grid transition is likely to be closer to that of China or the USA rather than the UK, where coal has largely exited the stationary energy generation mix in 2020.

The USA and Chinese markets show predicted EV emissions to be 50-60% of the equivalent internal combustion engine emissions per km travelled by 2030, whereas in the UK it is closer to 75%.

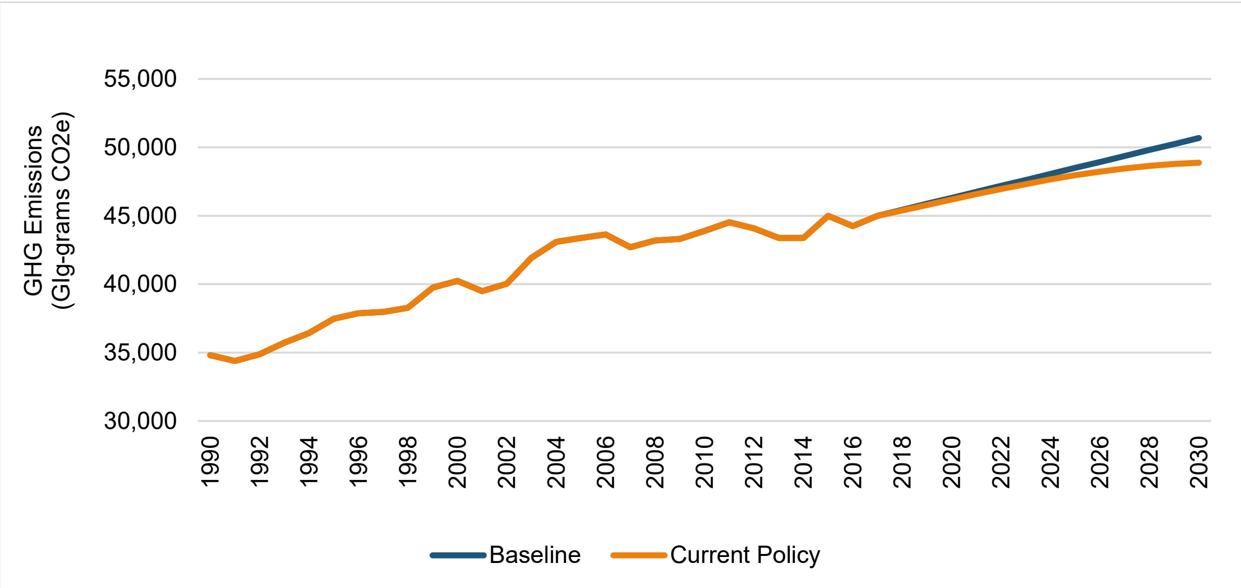
This analysis identifies that electric vehicles have a material role to play in reducing emissions. However, two important considerations will impact the rate of emissions reduction, the rate at which:

- electric vehicles grow within the fleet make-up
- the energy grid reduces its greenhouse gas emissions coefficient.

5.4 Road Sector Emissions Considerations

The analysis for this issues paper has considered how the forecast EV fleet representation to 2030 could impact greenhouse gas emissions compared to business as usual. From 2030 to 2050, the forecast models do not have enough certainty to make fleet penetration predictions and the fleet penetration model assumptions cannot be extended.

Figure 5.6: Passenger vehicle emissions (baseline vs current policy, Australia, 1990-2030)



The emissions analysis considers a baseline trend, that represents the projection of emissions growth at historical rates to 2050, as presented in Figure 5.6. The current policy trend is based on the projected EV fleet penetration by 2030 and estimated energy grid emissions factor improvements to 2030.

The analysis in Figure 5.6shows that passenger vehicle emissions are projected to continue to grow above 2018 levels (an increase of 8%) to 2030, and only moderately reduce emissions compared to the business as usual growth trajectories by 2030 (an increase of 12% compared to 2018).

The emissions reduction goals that align to the global net zero across the economy are in the order of 50% below 2018 levels by 2030. For the roads sector to address emissions in line with this milestone, additional initiatives in addition to the current EV policy framework will be required.

5.5 Accelerating Retirement of Internal Combustion Engine Vehicles

Much of the focus on accelerating electric vehicle take-up has been on the support for new vehicle sales through preferential licensing, other concessions and improved charging infrastructure. This is reflected in the EV scenarios in the Austroads EV report (Austroads 2020) which focuses on new sales trajectories.

When viewed in terms of emissions though, another important driver for the roads sector is accelerating the retirement of inefficient internal combustion engine vehicles from the national fleet at the same time as supporting new EV sales.

Considering the statistical vehicle age by which most vehicle stock will have been retired, it is possible to identify the latest possible dates by which sales of new vehicles with internal combustion engine must end in order for the transition of most of the fleet to electric vehicles.

Under current vehicle attrition patterns, for 90% of current vehicles to be replaced by 2050, the last vehicles of each type must be sold by:

- 2024 for passenger vehicles
- 2017 for busses
- 2011 for light rigid vehicles and prime mover vehicles
- 2000 for heavy rigid vehicles.

Most of these threshold dates are in the past, suggesting that 90% retirement of these vehicles by 2050 is unlikely. This further suggests that the pattern of existing vehicle retirement from the fleet will need to change for a fleet transition more in line with deeper penetration of electric vehicles in the fleet and corresponding higher ambitions for emissions reduction by 2050.

Network managers can consider mechanisms for restricting the use of inefficient internal combustion engine vehicles; reducing their desirability as EV options become more viable and increasing the likelihood of early retirement.

In considering a policy framework for retiring inefficient vehicles early, mechanisms for addressing the loss in residual value of vehicles within their economic life is an important consideration. Social equity is one of the important considerations in accelerating early retirement of vehicles with internal combustion engines from the fleet. There is a risk that a loss of residual value in vehicles with an internal combustion engine due to policy changes could negatively impact vulnerable communities or demographics. The social and economic impacts of policy toward this end should be carefully considered to moderate impacts by more targeted support to low/socio economic demographics.

5.6 Conclusions

The electrification of the vehicle fleet in concert with the transition of the stationary energy sector towards renewable energy is a critical component in the long-term decarbonisation of the roads sector.

The emissions trajectory analysis in this report points to several conclusions for road network managers:

- Moderate or accelerated policy interventions in support of EV sales in both passenger and freight sectors are required to address medium- and long-term road transport emissions.
- The retirement of older vehicles from the fleet is a strong driver of emissions reduction in partnership with the support for new EV sales.

It is complex to draw direct links between the national sector-specific policy and closing the global gap between current Nationally Developed Contributions and the emissions reduction trajectories consistent with the 1.5°C pathway. However, as a contribution to net zero emissions by 2050, conclusions at a national sector level can be drawn.

The transportation sector needs to position itself to transition away from liquid fossil fuels and take advantage of the transition of the electricity grid to renewable energy. Furthermore, the roads sector needs to drive behaviour change in reducing the reliance of passengers and freight on the road network as well as encouraging other modal alternatives.

Supporting emissions reduction in line with the policy ambitions for net zero emissions by 2050 requires both an accelerated policy intervention in support of new EV sales and a policy intervention to accelerate the retirement of inefficient internal combustion engine vehicles from the national fleet. Network managers can support both outcomes through a range of levers, explored in following sections of this report.

6. Levers for Decarbonisation in Road Network Transport Operations

6.1 Reducing Road Sector Emissions

In considering road network emissions, there are three primary levers for changing the emissions trajectory of any transport task, and by extension for the sector:

1. reduce the vehicle kilometres travelled (VKT) in delivering the transport task
2. improve the vehicle emissions efficiency in delivering the transport task (including engine efficiency and fuel selection)
3. reallocate the task to a different mode with a lower emissions footprint.

Each of the network management opportunities discussed in this paper have the capacity to create incentives or regulatory responses that move one of these emissions levers.

6.2 Network Management Priorities

There are several technical levers available to road network managers to support emissions reduction. However, at the heart of the challenge is the recognition that emissions reduction should be a priority for the management of roads in Australia.

6.2.1 Safety and Efficiency

The guiding lights of network management over the past decades have been the dual goals of safety and network efficiency: getting passengers and goods safely conveyed through our cities and across our country as efficiently as possible with minimal disruption has been our primary goal.

Unfortunately, the dual prioritisation of safety and network efficiency has led to a sector with consistently growing emissions, emissions that are now contributing to Australia’s difficulty in meeting its international obligations under the Paris Agreement.

6.2.2 A Third Priority

The combination of international obligations, current decarbonisation trajectories for the Australian economy and the relative impact of the roads sector on slowing decarbonisation support a substantial shift in approach to network management priorities.

This paper demonstrates the need for strategic rebalancing of network priorities to include greenhouse gas emissions reduction alongside safety and network efficiency at the most fundamental thinking in our policy, planning and management of network operations.

It is acknowledged that there are several practical initiatives for addressing emissions reduction through the road network. For example: traffic signal optimisation and prioritisation to public transport; estimation of costs of congestion with consideration of environmental and health costs; public transport price modelling; increased development of on-demand public transport solutions; and a focus on liveability in street design, which incorporates cycling and walking infrastructure with the Movement and Place framework.

However, these initiatives are not primarily focused on emissions reduction, and the emissions opportunities may be lost if the goal of decarbonisation is not held at a strategic level for network managers.

Finally, planning and assessment guidelines can be developed to consistently demonstrate how to consider climate change across jurisdictions.

6.3 Road Pricing

Road pricing provides an opportunity to target emissions reduction most effectively across the road network. There are several aspects to road pricing which make it a desirable mechanism for incentivising emissions reduction.

Road pricing, whether for congestion zones or along corridors, provides a high level of user discretion in optimising the transport network for different outcomes. While it has primarily been used globally as a congestion management tool, it provides a strong mechanism for influencing and enabling emission reductions.

- **Assigning the costs of emissions at source -** road pricing could allow for the pricing of the greenhouse gas emissions externality, and put the cost of emissions at the source, introducing real costs at the point of emission.
- **Incentivising efficient or electric vehicles** – road pricing can implement discretionary pricing between vehicle types to incentivise the transition of the national fleet to increasingly efficient and electric vehicles.
- **Incentivising mode shift** – road pricing can provide a discretionary pricing mechanism between modes within the same corridor that incentivise mode shift to a lower emissions option.

Both a mode shift to lower emissions options and the transition to electric vehicles offer road safety benefits, while the assigning of emissions costs to source and mode shift incentives offer opportunities to improve the efficiency of the road network and sweat existing infrastructure assets harder.

6.4 Mobility as a Service

Mobility as a Service (MaaS) can also be a substantial driver of decarbonisation, addressed in the Austroads paper *Opportunities in Mobility as a Service (Maas)* (Austroads 2019).

Services which take the place of private car ownership have several characteristics that can support decarbonisation:

- MaaS providers can potentially respond to vehicle emissions regulation more effectively across the whole network than the many thousands of individual car owners.
- MaaS may provide a market mechanism that allows older, inefficient vehicles to exit the national fleet without causing undue disruption to vehicle owners.
- The economics of MaaS solutions lend themselves to low-emissions vehicles, and notably so if emissions costs are applied at source through a road/mobility pricing framework.
- MaaS is commonly agreed as being focused on increasing vehicle occupancy by placing public transport at the core of urban mobility.
- MaaS utilises micro-transit, public transport and active travel modes which further contribute to emissions reductions as well as requiring associated infrastructure and supporting services.
- MaaS supports and encourages the uptake of new mobility solutions by combining and offering a variety of mobility options, for example: car sharing, ride sharing, and micro-mobility options such as e-scooters, bike sharing schemes and e-skateboards.

- MaaS has the ability to support an extensive public transport network by providing first and last mile transport solutions, this is highly advantageous as transport infrastructure agencies will not have public transport spline services replaced with four seat cars.

6.5 Travel Demand Management

Increasingly and more dynamically using Travel Demand Management (TDM) as a tool in shaping consumer behaviour can also support emissions reduction in the road network.

There are many road trips where the transport task could be completed more safely, efficiently and affordably by other means than a car. Given the dominance of car-based emissions in the greenhouse gas accounts, TDM can support emissions reduction by reducing VKT on the network and encourage mode shift towards low-emission public transport options.

Within a broader TDM framework that includes digital wayfinding, effective communication and potential incentives to customers (for example, the Frenzy app: https://www.frenzy.co.nz/), opportunities for low-emissions transport can be communicated to passengers to support decisions in favour of low-emissions transport options.

Due to a still-growing population, most Australian and New Zealand cities are experiencing urban sprawl. This results in limited access to efficient and relevant public transport networks and cities that are not centred around mobility and access.

Transit oriented development designed for higher density, mix of use and with robust pedestrian environments, bicycle lane infrastructure and electrified public transport options such as the metro is a further consideration in a broader TDM approach to decarbonisation.

6.6 Freight Network Considerations

Road freight is a substantial contributor to road-based emissions. It is not clear in the EV take-up scenarios presented in Section 5.2. how trucks are represented in vehicle sales, although for the purposes of this analysis they have been considered to mirror passenger vehicles.

The freight sector has already achieved some success in removing the dirtiest trucks from the network based on managing air quality, and there may be lessons in these policy levers for broader greenhouse gas emissions reduction efforts. Austroads project NEF6184 will quantify the contribution of aged trucks to greenhouse gas emissions and health costs, and review policy measures and other initiatives designed to improve the quality and renewal rate of heavy vehicles specifically considering freight tasks that most rely on end-of-life heavy vehicles.

Improvement in logistics efficiency and supporting modal shift are a critical considerations for road network managers seeking emissions reduction. Emissions are an important lens through which to view inter-modal design and location as well as the road-rail interface for Inland Rail in Australia. Efficiency examples include green freight digital platforms to minimise empty trucks or inefficient route planning, use of rail networks where accessible and potentially even incentivised rail freight schemes for the transport of goods long distances.

In New Zealand, the *Green Freight Project* (Ministry of Transport 2019) has been established to identify how zero emissions fuels such as electricity, hydrogen and biofuels can support emissions reduction in road freight.

Other more opportunistic solutions include e-highways, currently being trailed by Volvo and Scania in multiple European countries, and inclusion of low/zero emissions zones which would affect both light and heavy vehicle freight operations whilst potentially being broadened to all vehicle types. Co-benefits of these options include pollution and noise improvements.

6.7 Vehicle Parking Considerations

Parking availability is one of the network levers that can influence road use behaviour. Parking restrictions can act in a similar way to congestion pricing for commuter traffic.

Parking restrictions for inefficient vehicles can support the take-up of EVs and can also drive behaviour change towards improved modal diversity.

Co-benefits to parking restrictions include supporting better pedestrian infrastructure and land use optimisation in urban areas. As well as penalties, incentives could also be considered such as reduced parking costs which also potentially limiting additional kilometres travelled.

It is acknowledged that parking management may not be within the direct responsibility of state road transport agencies but network managers can work with planning authorities and local government to use parking assets to support emissions reduction across the road network.

6.8 Co-Benefits of Emissions Reduction in Transport

A low-emissions trajectory in the transportation sector brings co-benefits to cities and communities beyond the reduced contribution to climate change.

The largest co-benefit to emissions reduction is the attendant air quality benefits of low-emissions transportation systems. Poor air quality from vehicle emissions – particulate emissions, CO, SOx and NOx – all contribute to a range of respiratory health risks for communities and broadly impact poorly on amenity in cities.

Many cities have achieved success in vehicle efficiency based on the health benefits, where the greenhouse gas emissions reductions are a co-benefit of public health strategies.

Where emissions reduction is achieved through modal shift towards active transportation, the health benefits are further improved by encouraging more healthy lifestyles for city residents.

Examples of other co-benefits to emissions reduction include:

- opportunities to improve freight productivity due to quieter operations of low-emissions vehicles and ability to operate at night
- perception of increased innovation for cities at large, in the global competition for investment and talent
- fuel security benefits of reduced reliance on imported fossil fuels
- road safety benefits of reduced vehicle risks through fuel combustion and engine failure – many low-emissions vehicles are also structurally safer than conventional equivalents
- increased modal diversity and the land use benefits that accrue to cities, land owners and other commuters through reduced congestion.

Additionally, there are financial co-benefits of emissions reduction in transport. These include:

- reduced dollars spent on imported fuels and instead spent in locally generated fuels
- reduced operating costs for individuals and businesses
- operational savings that can be spent elsewhere in the economy.

The affordability of transportation services is a critical consideration in the broader transportation system, and with a focus on emissions, the importance of the social accessibility of the transport system must not be lost.

While there are certainly mechanisms for incentivising emissions reductions that further support affordable transportation solutions, there are also cases where there is a natural tension as some emerging technology is not fully mature.

However, due to the global urgency for emissions reduction, where decarbonisation does incur a cost on road users, opportunities for these costs to be socialised should be explored and considered in the development of new transport business models, for example; business model for ridesharing services.

7. Conclusions

Climate change represents a substantial challenge for governments of all types, in all places. The emissions reduction trajectories aligned to a stable future climate less than 1.5°C warmer than pre-industrial times will test the vision and governance of all public and private instructions.

This Issues Paper presents the drivers and opportunities for emissions reduction within the roads sector in Australia and New Zealand, assesses the specific relevance of the greenhouse gas emissions issue to the road transport network operations, and highlights key levers for decarbonisation available to roads network managers.

The case for emissions reduction in the road network has been presented based on the global, national and state policy framework for emissions reduction to which road network managers may need to respond.

The priority insights from the policy review can be summarised as follows:

1. There is a global economic case for keeping temperature increases due to climate change below 1.5°C above pre-industrial levels.
2. The Nationally Developed Contributions of all countries under the Paris Agreement are insufficient to meet the emissions trajectory associated with this temperature rise – greater ambition is required to have a chance of maintain temperature rise to less than 1.5°C.
3. The global emissions reduction targets consistent with a 1.5°C trajectory are:
   - 2030: at least 50% reduction from 2018 levels
   - 2050: 100% reduction from 2018 levels
   - 2050+: negative emissions
4. Each of the states and territories in Australia and the New Zealand National Government have established emissions reduction policies with the ambition to achieve net zero emissions by 2050.

The transportation sector is a substantial contributor to emissions and emissions growth in both Australia and New Zealand. The road network is the dominant contributor to transportation emissions, with a balance of passenger and freight contributing to road network emissions.

The priority insights from the emissions analysis can be summarised as follows:

1. Left unabated, the transportation sector will continue to drive emissions growth in Australia and New Zealand.
2. Business as usual in road network emissions is inconsistent with the stated ambition for net zero emissions by 2050 across Australia and New Zealand jurisdictions.

The transition to electric vehicles across the road network is an important initiative in reducing greenhouse gas emissions in transportation. Substantial analysis has been undertaken in other reports for Austroads and by other parties, documenting mechanisms to support EV take-up in the network.

This assessment has considered how the projected EV make-up of the fleet by 2030, and estimated energy grid emissions factor changes can support emissions reduction in the roads sector.

Further consideration of vehicle attrition patterns from the fleet have been considered to assess the impact of policy aimed at early retirement of inefficient internal combustion engine vehicles from the network.

The priority insights from the emissions analysis can be summarised as follows:

1. Moderate or accelerated policy interventions in support of EV sales in both passenger and freight sectors are likely required to reduce road sector emissions from 2018 levels.
2. Moderate or accelerated policy intervention in support of EV sales as well as the early retirement of inefficient internal combustion engine vehicles from the fleet are required to substantially reduce road transport emissions by 2050.

Beyond supporting the transition to electric vehicles, other levers are available and to be considered by road transport network managers to support emissions reduction in line with levels agreed at global, national and state scale:

1. Reduce the vehicle kilometres travelled (VKT) in delivering the transport task
2. Improve the vehicle emissions efficiency in delivering the transport task (including engine efficiency and fuel selection)
3. Reallocate the task to a different mode with a lower emissions footprint.

Network management options to achieve these outcomes include road pricing, Mobility as a Service (MaaS), Travel Demand Management (TDM), freight network considerations and vehicle parking considerations.

Important insights from the assessment of decarbonisation levers can be summarised as follows:

1. There are several practical opportunities for supporting emissions reduction in the roads sector: supporting the adoption of EVs, supporting the retirement of inefficient vehicles from the fleet, encouraging behaviour change with respect to modal choice, supporting strategic planning for efficient freight networks and supporting active transportation.
2. There are co-benefits to the consideration of emissions reduction in the road network, which may support policy reform to reduce emissions: health benefits, competitiveness benefits and broader economic benefits.
3. To achieve substantial emissions reduction in the road network, operators and agencies will need to consider emissions reduction alongside safety and network efficiency as a strategic priority in the future.

8. Next Steps

It is acknowledged that this Issues Paper only constitutes an initial problem definition focused on defining and sizing the issue of greenhouse gas emissions from the point of view of road transport network operations and for the specific purpose of the Austroads Network Program and the Austroads Network Task Force.

More targeted research is required to explore how the opportunities highlighted in this paper may contribute to the level of ambition for roads sector emissions reduction over the coming decades.

At the time of development and publication of this paper, the immediate next steps being taken by the Austroads Network Program (being rebranded Transport Network Operations Program as of 1 July 2020 in line with the 2020-2024 Austroads Strategic Plan) include the consideration of the issues raised into current and planned projects to assist with framing the discussion on greenhouse gas emissions reduction in road transport network operations:

- Austroads project NEG6185 is currently reviewing the strategic objectives stated by the member agencies and will then facilitate the definition of commonly agreed performance indicators and metrics for consideration and use by all Austroads members in their urban road-based transport performance measurement. This Issues Paper will encourage further discussions as part of this project with regards to performance indicators relating to greenhouse gas emissions.
- In relation to Section 6.6, Austroads project NEF6184 is already identifying the policy measures and other initiatives that can drive improvements in the quality and renewal rate of heavy vehicles specifically considering the freight tasks that most rely on aged heavy vehicles.
- The planned strategic review of the Austroads *Guide to Traffic Management* will assess how network operations planning currently considers greenhouse gas emissions through the Movement and Place framework, Network Operations Plans and other processes, and it will research how this focus could be reinforced in practice.

References

ACT Government 2017, *ACT's Climate Strategy to a Net Zero Emissions Territory: Discussion Paper,* Environment, Planning and Sustainable Development Directorate, ACT Government, Canberra.

APRA 2019, *Climate Change: Awareness to Action,* Australian Prudential Regulatory Authority, Sydney, NSW.

Austroads 2019, *Opportunities in Mobility as a Service (MaaS)*, AP-R601-19, Austroads, Sydney NSW.

Austroads in press, *Future Vehicles 2030,* Project FCA6239, Austroads, Sydney NSW.

Boll, L. 29 March 2019, *Updated Huntley opinion on directors' duties and Climate Risk*, Centre for Policy Development [https://cpd.org.au/2019/03/directors-duties-2019/ accessed 29 November 2019].

Climate Change Act 2017 (Vic). Retrieved from https://www.legislation.vic.gov.au/

Climate Change and Greenhouse Emissions Reduction Act 2007 (SA). Retrieved from https://www.legislation.sa.gov.au/

Climate Change and Greenhouse Gas Reduction (Principal Target) Amendment Bill 2018, (ACT), Retrieved from https://www.legislation.act.gov.au/

Climate Change (State Action) Act 2008 (Tas) Retrieved from https://www.legislation.tas.gov.au/.

Department of Environment and Heritage Protection 2017a, *Pathways to a Clean Growth Economy – Queensland Climate Transition Strategy,* Department of Environment and Heritage Protection, Queensland Government.

Department of Environment and Heritage Protection 2017b, *Pathways to a Climate Resilient Queensland – Queensland Climate Transition Strategy,* Department of Environment and Heritage Protection, Queensland Government.

Department of Water and Environmental Regulation 2019, *Greenhouse Gas Emissions Policy for Major Projects,* Department of Water and Environmental Regulation, Western Australian Government

Energeia 2018, *Australian electric vehicle market study*, Energeia, Sydney, NSW.

Government of South Australia 2019, *South Australia's Hydrogen Action Plan,* Department for Energy and Mining, Government of South Australia.

Government of South Australia & Adelaide City Council 2016, *Carbon Neutral Adelaide: Action Plan 2016-2021*, Government of South Australia & Adelaide City Council

Boll, L. 29 March 2019, *Updated Huntley opinion on directors' duties and climate risk*, Centre for Policy Development [https://cpd.org.au/2019/03/directors-duties-2019/ accessed 29 November 2019].

Independent Expert Panel on Interim Emissions Reduction Targets for Victoria2019, *Interim Emissions Reduction Targets for Victoria (2021-2030),* Independent Expert Panel on Interim Emissions Reduction Targets for Victoria, Department of Environment, Land, Water and Planning.

IPCC 2018, *Global warming of 1.5°C, An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*, [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

McKinsey & Company and Bloomberg 2016, *An Integrated Perspective on the Future of Mobility*, McKinsey & Company, Inc. and Bloomberg New Energy Finance..

Ministry for the Environment 2019, *Climate Change Response (Zero Carbon) Amendment Bill: Summary*, Ministry for the Environment, Wellington.

Ministry of Transport 2019, *The Green Freight Project: Background paper on reducing greenhouse gas emissions from road freight in New Zealand through the use of alternative fuels,* Ministry of Transport.

NGFS 2019, *A call for action: Climate change as a source of financial risk.* Central Bank and Supervisors Network for Greening the Financial System].,

Northern Territory Government 2019, *Northern Territory Climate Change Response Towards 2050* [https://apo.org.au/sites/default/files/resource-files/2019-09/apo-nid259766.pdf]

Office of Environment and Heritage 2016a, *NSW Climate Change Policy Framework*, Office of Environment and Heritage, New South Wales Government, Sydney.

Office of Environment and Heritage 2016b, *Fact Sheet: Emissions in NSW*, Office of Environment and Heritage, New South Wales Government, Sydney.

PRA 2019, *Insurance Stress Test 2019*, Prudential Regulation Authority, London.

SMH 2019, *Trade Deals may be an Effective Method of Enforcing Climate Action*, Sydney Morning Herald editorial [accessed 29 November 2019].

Tasmanian Climate Change Office 2019, *Tasmanian Greenhouse Gas Emissions Report 2019*, Tasmanian Climate Change Office, Department of Premier and Cabinet, Hobart.

UNEP 2019, *Emission Gap Report 2019*, United Nations Environment Programme, Nairobi.

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