BRIEFING

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How Australian light-duty vehicle CO_2 emissions compare with the rest of the world

Authors: Robin Smit,[1] Tanzila Khan, and Zifei Yang

INTRODUCTION

Road transport is a large and growing source of carbon dioxide (CO_2) emissions around the world and currently contributes about one-quarter of total annual CO_2 emissions in the European Union and the United States.[2] In Australia, CO_2 emissions from the sector increased by more than 50% between 1990 and 2020, and during that time the contribution of road transport to Australia's greenhouse gas (GHG) emissions increased from 8% to 16%.[3] Light-duty vehicles (LDVs; passenger vehicles and light commercial vehicles) are the largest share, 10%, of total GHG emissions in Australia.[4]

In its updated Nationally Determined Contribution (NDC) submitted to the U.N. Framework Convention on Climate Change in 2022, Australia set an intermediate target of reducing economy-wide CO_2 emissions by 43% (from 2005 levels) by 2030, and re-affirmed its target of net-zero emissions by 2050.[5] To meet these targets,

1 Transport Energy/Emission Research (TER), Launceston, TAS 7249, Australia; https://www.transport-e-research.com/, info@transport-e-research.com.

2 "Road Transport," European Environment Agency, accessed on Feb 15, 2024, https://www.eea.europa.eu/en/topics/in-depth/road-transport; "Fast Facts on Transportation Greenhouse Gas Emissions," United States Environmental Protection Agency, last modified October 31, 2023, https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions.

3 Robin Smit, "An Independent and Detailed Assessment of Greenhouse Gas Emissions, Fuel Use, Electricity and Energy Consumption from Australian Road Transport in 2019 and 2050," *Air Quality and Climate Change* 57, no. 2, (June 2023): 30-41. ISSN 1836-5876, https://www.transport-e-research.com/publications, publication 2023c; Climate Change Authority, "Opportunities to Reduce Light Vehicle Emissions in Australia, (Canberra, ACT: 2023), https://www.climatechangeauthority.gov.au/reviews/light-vehicle-emissions-standards-australia/opportunities-reduce-light-vehicle-emissions.

4 Climate Change Authority, Opportunities to Reduce Light Vehicle Emissions in Australia."

5 Australian Government. "Australia's Nationally Determined Contribution Communication 2022," https://unfccc.int/sites/default/files/NDC/2022-06/Australias%20NDC%20June%202022%20Update%20%283%29.pdf.

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Transport Emission Energy Research

www.transport-e-research.com

info@transport-e-research.com

THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

www.theicct.org

communications@theicct.org

@theicct

Australia needs real and rapid reductions in CO_2 emissions from the transport sector. A mandatory fuel efficiency standard (FES) is one key policy tool that has been shown to reduce fleet-average CO_2 emissions from new vehicles and help avoid the risk that countries become a dumping ground for passenger vehicles that are less fuel efficient and generate higher emissions.[6] Regions that are home to more than 85% of global LDV sales—including China, the United States, the European Union (EU), India, Brazil, and Japan—have all adopted a FES, but Australia has not yet implemented a mandatory FES or a CO_2 emission standard to regulate type-approved CO_2 emissions from its LDV fleet.[7] However, on February 4, 2024, the Australian Government released both its proposal for an LDV CO_2 emission standard, the New Vehicle Efficiency Standard (NVES), and an accompanying regulatory impact analysis of three possible policy options.[8] The Government aims to commence implementation of the NVES by January 1, 2025.[9]

This paper builds on past ICCT and TER research on Australia's GHG emission and fuel efficiency standards and compares the CO_2 emissions of Australia's LDV fleet with fleets in other countries. After a brief summary of the policy context in Australia, we present analyses of new LDV CO_2 emissions in Australia and other major markets under New European Driving Cycle (NEDC) type-approval and real-world conditions. The results indicate that to keep up with the pace of technological advancement and decarbonization in other major markets and developed countries, Australian policymakers should consider adopting a stringent, mandatory FES alongside additional policies.

HISTORY OF GHG EMISSION AND FUEL EFFICIENCY STANDARDS IN AUSTRALIA

A mandatory FES is a key component of a cost-effective strategy to reduce transport emissions.[10] Australian policymakers have debated whether to implement a mandatory FES for LDVs for more than a decade. Since 2008, the Australian Government has released six public consultation documents related to a proposed FES.[11] Figure 1 charts the history of LDV fuel efficiency standards development in Australia from 2007 to 2024 and includes major changes and decisions.

6 Jan Dornoff, Victor Valverde Morales, Uwe Tietge, "CO_2 Emissions From New Passenger Cars in Europe: Car Manufacturers' Performance in 2022," (Berlin, Germany: ICCT, 2024), https://theicct.org/publication/co2-emissions-new-pv-europe-car-manufacturers-performance-2022-feb24/; Alan Jenn et al., "Cost Implications for Automaker Compliance of Zero Emissions Vehicle Requirements," *Environmental Science & Technology* 53, no. 2 (2019): 564–574, https://doi.org/10.1021/acs.est.8b03635; Kenneth Gillingham, Alan Jenn, and Ines M.L. Azevedo, "Heterogeneity in the Response to Gasoline Prices: Evidence from Pennsylvania and Implications for the Rebound Effect," *Energy Economics* 52, (December 2015): S41–S52, https://doi.org/10.1016/j.eneco.2015.08.011.

7 "Passenger Vehicle Greenhouse Gas Emissions and Fuel Consumption," ICCT, accessed on Feb 15, 2024, https://theicct.org/pv-fuel-economy/; Robin Smit, "Vehicle CO_2 Emissions Legislation in Australia – A Brief History in an International Context," (Australia: Transport Energy/Emission Research [TER], 2019), https://www.transport-e-research.com/publications, Publication 2019f.

8 Australian Government, Department of Infrastructure, Transport, Regional Development, Communications and the Arts, "Cleaner, Cheaper to Run Cars: The Australian New Vehicle Efficiency Standard, Consultation Impact Analysis." (Canberra, ACT: 2024), https://www.infrastructure.gov.au/department/media/publications/cleaner-cheaper-run-cars-australian-new-vehicle-efficiency-standard-consultation-impact-analysis.

9 Both fuel efficiency and CO_2 emission standards are dealing with approximately the same thing: reducing fuel consumption and CO_2 emissions, as well as reducing fuel costs for consumers and improving energy security. It is noted that in its recent consultation on national EV strategy, Australia defined fuel efficiency standards as measured in grams of CO_2 released per kilometer. Hence, we refer to the fuel efficiency standard as FES or CO_2 emission standard interchangeably in the rest of this paper.

10 Tanzila Khan and Zifei Yang, Explained: Why Fuel Efficiency Standards in Australia are Expected to Reduce Costs for Car Owners," ICCT staff blog, May 26, 2023, https://theicct.org/australia-fuel-efficiency-costs-explained-may23/.

11 Smit, "Vehicle CO_2 Emissions Legislation in Australia – A Brief History in an International Context."; Robin Smit, "A Fuel Efficiency Standard for Light-Duty Vehicles in Australia," (Australia: Transport Energy/Emission Research [TER], 2023), https://www.transport-e-research.com/publications, Publication 2023b.; Australian Government, "Cleaner, Cheaper to Run Cars: The Australian New Vehicle Efficiency Standard, Consultation Impact Analysis."

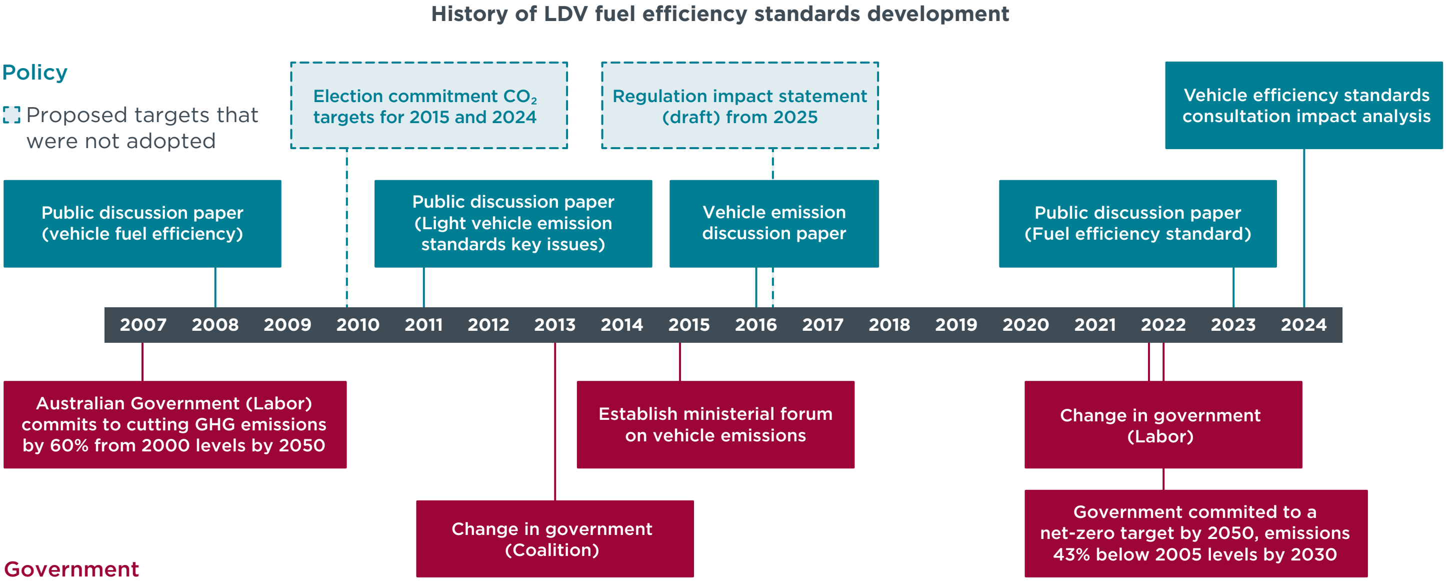

Figure 1. History of LDV fuel efficiency standards development in Australia.

In 2007, Australia's Labor Party government committed to cutting the country's GHG emissions by 60% from 2000 levels by 2050, pursuant to Australia's obligations under the Kyoto Protocol. Then-Prime Minister Kevin Rudd also instructed the Vehicle Efficiency Working Group, a government-established entity, to "develop jointly a package of vehicle fuel efficiency measures designed to move Australia towards international best practice," and this led to the 2008 public discussion paper.[12] In 2010, the Government issued an election commitment that mandatory CO_2 emission standards would apply to new light vehicles beginning in 2015 and would require a national fleet average of 190 g/km in 2015 and 155 g/km in 2024.[13] In a 2011 discussion paper, however, the Government described these targets as "starting points for the discussion."[14] After a change in government in 2013, discussion of the proposal stalled.[15]

In 2015, the Australian Government established a ministerial forum to coordinate a whole-of-government approach to addressing emissions from motor vehicles.[16] This approach was to include fuel efficiency or CO_2 emission standards. A Vehicle Emissions Discussion Paper was released in 2016 and it considered a wide range of initiatives and measures to reduce motor vehicle emissions. This was followed by a draft Regulation Impact Statement (RIS) in the same year.[17] The draft RIS considered three 2025 LDV targets: strong, medium, and mild, corresponding to 105, 119, and 135 gCO_2/km, respectively. Under all three targets, the draft RIS concluded that there would be significant net cost savings, but none of the targets were enacted.

12 Australian Government, "Vehicle Fuel Efficiency – Potential Measures to Encourage the Uptake of More Fuel Efficient, Low Carbon Emission Vehicles," Public Discussion Paper prepared by Australian Transport Council (ATC) and Environment Protection and Heritage Council (EPHC) Vehicle Fuel Efficiency Working Group, (Canberra, ACT, 2008), https://apo.org.au/node/4098.

13 Australian Government, Department of Infrastructure and Transport, "Light Vehicle CO_2 Emission Standards for Australia: Key Issues," (Canberra, ACT, 2011), https://trid.trb.org/View/1149215.

14 Ibid.

15 Smit, "Vehicle CO_2 Emissions Legislation in Australia – A Brief History in an International Context."

16 Ibid.

17 Australian Government, "Improving the Efficiency of New Light Vehicles," draft regulation impact statement, (Canberra, ACT: Department of Infrastructure and Regional Development, 2016), https://www.infrastructure.gov.au/sites/default/files/migrated/vehicles/environment/forum/files/Vehicle_Fuel_Efficiency_RIS.pdf.

A new Labor Party government took office in 2022 and subsequently initiated a new consultation process on fuel efficiency standards for LDVs.[18] That the request for comment garnered more than a thousand submissions reflects a high level of interest among advocates, experts, the general public, and other stakeholders.[19] As mentioned above, on February 4, 2024, the Government released a new RIS outlining three proposed design options and FES targets for years 2025 through 2029.[20] Option A, the most lenient of the three, would lead to CO_2 reductions of 34% for passenger vehicles (PVs) and 14% for light commercial vehicles (LCVs) from 2024–2029. Option B, the government's preferred approach, aims to align with the United States' proposed 2027–2032 LDV CO_2 emissions targets by 2028 and would lead to emissions reductions of more than 60% for PV and LCV fleets from 2024–2029. Option C, the most ambitious pathway, aims to catch up with the United States' proposed targets as early as 2026 and bring forward the United States' proposed 2029–2031 targets to 2028 and 2029; this would result in projected emissions reductions of 77% for PVs and 74% for LCVs from 2024–2029.

In the absence of a mandatory FES in Australia, the Federal Chamber of Automotive Industries (FCAI), an industry association, has periodically announced voluntary fuel-economy targets for new passenger cars, dating back to 1978. These have included, for instance, a target of 9.5 liters/100 km (corresponding to emissions of 223 g CO_2/km) in 1983, and 8.2 liters/100 km (corresponding to 193 g CO_2/km) in 2000.[21] A voluntary 2010 fuel efficiency target of 6.8 liters/100 km (corresponding to 160 g CO_2/km) was initially agreed between the Australian Government and the FCAI in 2003, but was abandoned due to a change in the test procedure from the U.S. FTP to Euro standards, which affected the ability to assess progress. In 2005, FCAI adopted a new voluntary target for 2010 of 222 g CO_2/km for all new LDVs, known as the National Average Carbon Emissions target. This higher LDV target was reportedly achieved in 2008.[22] However, improvements in fuel economy between 1978 and 2010 were not conclusively found to be greater than business-as-usual trends, and emissions testing suggested that at least some of the previous fleet-average targets were not met.[23]

In 2020, FCAI announced a new voluntary reporting system and annual targets for CO_2 emissions for the period 2020–2030.[24] It set targets for two vehicle categories: the MA category of cars and small SUVs, for which the aim is to reduce emissions from 154 to 98 g CO_2/km by 2030, and the NA+MC category of large SUVs and LCVs, for which the aim is to reduce emissions from 197 to 143 g CO_2/km by 2030. Various studies have discussed the limited nature of these targets.[25]

18 Department of Infrastructure, Transport, Regional Development, Communications and the Arts, " The Fuel Efficiency Standard—Cleaner, Cheaper to Run Cars for Australia—Consultation Paper," (Canberra, ACT, 2023), https://www.infrastructure.gov.au/department/media/publications/fuel-efficiency-standard-cleaner-cheaper-run-cars-australia-consultation-paper.

19 Department of Climate Change, Energy, the Environment, and Water, "Australians Support New Fuel Efficiency Standards," news release, August 28, 2023, https://www.dcceew.gov.au/about/news/australians-support-new-fuel-efficiency-standards.

20 Australian Government, "Cleaner, Cheaper to Run Cars: The Australian New Vehicle Efficiency Standard, Consultation Impact Analysis," (Canberra, ACT, 2024), https://www.infrastructure.gov.au/department/media/publications/cleaner-cheaper-run-cars-australian-new-vehicle-efficiency-standard-consultation-impact-analysis.

21 Smit, "Vehicle CO_2 Emissions Legislation in Australia – A Brief History in an International Context."

22 Ibid.

23 Climate Change Authority, "Light Vehicle Emission Standards for Australia - Research Report," (Canberra ACT, 2014), https://www.climatechangeauthority.gov.au/publications/light-vehicle-emissions-standards-australia; Smit, "Vehicle CO_2 Emissions Legislation in Australia – A Brief History in an International Context."

24 Federal Chamber of Automotive Industries, "Federal Chamber of Automotive Industries Announces Voluntary CO_2 Emissions Standard," news release, July 24, 2020, https://www.fcai.com.au/news/index/view/news/652.

25 InfluenceMap, "The FCAI and Australian Climate Policy, The Automotive Industry's Playbook to Weaken Australian Fuel Economy (CO2) Standards," (London, 2023), https://influencemap.org/briefing/The-FCAI-and-Australian-Climate-Policy-22253; Tanzila Khan et al., "Fuel Efficiency Standards to Decarbonize Australia's Light-Duty Vehicles," (Washington, D.C.: ICCT, 2022), https://theicct.org/publication/pv-australia-co2-standards-dec22/.

Moreover, car manufacturers in Europe adopted a voluntary CO_2 target from 1995 to 2008, but did not meet that target.[26] Other features of the current FCAI targets may further weaken their impact:

- FCAI still uses the NEDC test cycle as the basis for the standard, even though researchers have highlighted a widening gap between official type-approval emissions measured on this cycle and real-world emissions (discussed in greater detail below). [27]
- In FCAI targets, large, road-based SUVs fall into the same category as LCVs, the NA+MC category, and are thus allowed higher emissions than passenger cars. Such vehicle classification is expected to further promote the sales of heavy SUVs and utility vehicles to take the advantage of more flexible targets and, as a result, offset or increase (rather than reduce) fleet average real-world fuel consumption and associated emissions.[28] A similar vehicle classification scheme applied in the U.S. CO_2 emission standards, where more lenient targets applied to LCVs, and this encouraged higher sales of these vehicles at the expense of smaller cars.[29]
- A variety of compliance flexibilities are provided to vehicle manufacturers for each vehicle type, including off-cycle credits,[30] super credits,[31] air-conditioning credits, and the ability to carry forward the compliance credits and debits and transfer credits across vehicle types and between auto companies.[32] This creates a wider gap with real-world fuel efficiency and emissions performance.

Recent studies published by TER and by the ICCT suggested that Australia will fall short of the net-zero target in 2050 for road transport by a large margin unless emissions-mitigation policies are intensified and a portfolio of supporting policies are implemented. A brief summary of the approach and findings from those studies is provided here:

- In 2023, TER modeled the real-world well-to-wheel (WTW) emissions from Australia's on-road fleet for the period 2019–2050.[33] Two Australia-specific modeling tools were used, the Australian Fleet Model (AFM)[34] and the Net Zero

26 Peter Mock, "The Role of Standards in Reducing CO_2 Emissions of Passenger Cars in the EU," (Berlin, Germany: ICCT, 2018), https://theicct.org/wp-content/uploads/2021/06/Role_of_EU-CO2_Standard_20180212.pdf.

27 Smit, "A Fuel Efficiency Standard for Light-Duty Vehicles in Australia."

28 Ibid; Tanzila Khan and Zifei Yang, "Light-Duty Vehicle Classification for Australia's Fuel Efficiency Standards," (Washington, D.C.: ICCT, 2023), https://theicct.org/publication/pv-australia-vehicle-classification-apr23/.

29 Khan and Yang, "Light-Duty Vehicle Classification for Australia's Fuel Efficiency Standards."

30 Off-cycle credits are for any low-emitting or fuel-efficient technology not covered on the test cycle. FCAI includes all EU and U.S. off-cycle credits, allowing a maximum of 7 g CO_2/km per unit of off-cycle credits for each auto company.

31 Super credits are for sales of low-emitting and zero-emission vehicles and vary by vehicle emission level relative to their individual compliance target level. All vehicles with 0 g CO_2/km emissions are counted as three vehicles. Low-emitting vehicles are counted as two vehicles if CO_2 emissions are within one-third of the compliance target level, and as 1.5 vehicles when they emit more than one-third but less than two-thirds of the compliance target level.

32 Federal Chamber of Automotive Industries, "CO_2 Standard: Rules for Calculating Brand Targets and Assessing Brand Compliance," (Kingston, ACT, 2020), https://www.fcai.com.au/news/publication/view/publication/178.

33 Smit, "An Independent and Detailed Assessment of Greenhouse Gas Emissions."

34 The AFM simulates fleet turnover for the Australian on-road fleet out to 2060. The tool estimates on-road vehicle population and total travel activity (VKT) by considering vehicle sales and registration data, usage profiles, growth, and scrappage. AFM generates estimates for 15,200 individual vehicle classes in past, current and future years, https://www.transport-e-research.com/software.

Vehicle Emission Model (n0vem),[35] both developed and maintained by TER using Australian fleet and emissions data. The study estimated a reduction of WTW CO_2-equivalent (CO_2e) emissions from Australian transport of only 35% to 45% between 2019 and 2050. The range reflects potential variability in the dominant hydrogen production pathway. The TER study suggested that a combination of electrification and lightweighting of road transport could be the most effective way to get closer to the net-zero target in 2050.

- A 2022 ICCT study had similar findings.[36] Even when not considering the generous flexibilities offered in the FCAI approach, it was estimated that the FCAI voluntary targets would reduce real-world WTW CO_2 emissions of the Australian LDV fleet by only 35% in 2050 from 2019 levels. An alternative ambitious policy scenario was analysed that aligns with world-leading targets, and it led to fleet-average estimates of 110 g CO_2/km under NEDC by 2025, 50 g CO_2/km by 2030, and 0 g CO_2/km by 2035.[37] Only this ambitious scenario was found to nearly decarbonize Australia's LDV fleet by 2050; it resulted in a 95% WTW CO_2 reduction compared with the 2019 level.
- In 2023, another ICCT study found that for road transport to align with a global temperature pathway well below 2 °C of warming, a transition to zero-emission vehicles is needed in combination with additional measures.[38] Thus, WTW CO_2 emissions in Australia would need to be further reduced by pairing that transition with more widespread adoption of advanced internal combustion engine vehicle (ICEV) technologies and other measures, including mode shift to reduce vehicle kilometers traveled by relatively high emission transport modes, accelerated retirement of ICEVs, and decarbonized grid electricity.

TYPE-APPROVAL AND REAL-WORLD PERFORMANCE OF AUSTRALIA'S LIGHT-DUTY VEHICLE FLEET

TYPE-APPROVAL CO_2 EMISSIONS

Australian NEDC data were compiled using historic data for model years (MYs) 2005–2007,[39] previous TER research for MYs 2008–2018,[40] and processed National Transport Commission (NTC) data for MYs 2019–2021. Since 2020, NTC has aligned with the FCAI voluntary targets and no longer reports average NEDC CO_2 emissions for PVs and LCVs separately; it instead disaggregates by MA vehicles (cars and SUVs) and MC+NA vehicles (SUVs and LCVs). In addition, NTC values reflect the impacts of off-cycle

35 The n0vem tool was released in 2022 and fully incorporates the well-established COPERT Australia software (v1.3.5) for ICEV emission modelling. n0vem expands GHG emission estimation to include non-ICEV technology (i.e., HEVs, PHEVs, BEVs and FCEVs) and models emissions, fuel, and energy consumption for 9,558 current and future vehicle technology classes. It takes into account vehicle year of manufacture, weight and size, as well as expected emission and energy efficiency improvements out to 2060. Around 2 million emission factors (g/km), fuel use factors (g/km, MJ/km) and electricity/energy use factors (kWh/km) are generated for the Australian fleet, covering different operational conditions and emission types. They include vehicle speed dependencies (driving behavior and congestion level), hot running emissions, and additional GHG emissions due to engine start, air conditioning, engine oil combustion and NOx emission-control technology (selective catalytic reduction), https://www.transport-e-research.com/software.

36 Khan et al., "Fuel Efficiency Standards to Decarbonize Australia's Light-Duty Vehicles."

37 A world-class scenario represents combination of global leading ambitions including New Zealand's CO_2 emissions standards for 2025, California's ZEV mandate for 2030, and the EU standard of 0 g CO_2 per km by 2035.

38 Arijit Sen et al., "Vision 2050: Strategies to Align Global Road Transport With Well Below 2 °C," (Washington, D.C.: ICCT, 2023), https://theicct.org/publication/vision-2050-strategies-to-reduce-gap-for-global-road-transport-nov23/.

39 For historic years 2005–2007, data are based on analysis conducted by Dr David Cosgrove (pers. comm., October 1, 2023).

40 Robin Smit, "Real-World CO_2 Emissions Performance of the Australian New Passenger Vehicle Fleet 2008-2018 – Impacts of Trends in Vehicle/Engine Design," (Australia: Transport Energy/Emission Research [TER], 2019), https://www.transport-e-research.com/publications, Publication 2019a.

credits and air conditioning credits, which would artificially lower average emission rates. For this study, TER reconstructed fleet-average NEDC values for MY 2019–2021 by using underlying data published by the NTC. The ICCT provided international type-approval emissions data, normalized to the NEDC.[41] These data were combined to create an international performance envelope for comparison with Australian emissions performance.

Figure 2 shows the type-approval CO_2 emissions performance between 2005 and 2021 of Australian LDVs on the NEDC compared with four major international vehicle markets: China, the European Union, Japan, and the United States. (An expanded international performance envelope that includes Brazil, Canada, India, New Zealand, South Korea, and the United Kingdom is included in the Appendix.) The comparison in Figure 2 shows that emissions from Australian LDVs are significantly higher than emissions from LDVs in other markets. As these other major markets adopt standards that drive the transition to a low- or zero-emission fleet, Australia would be expected to lag further behind.

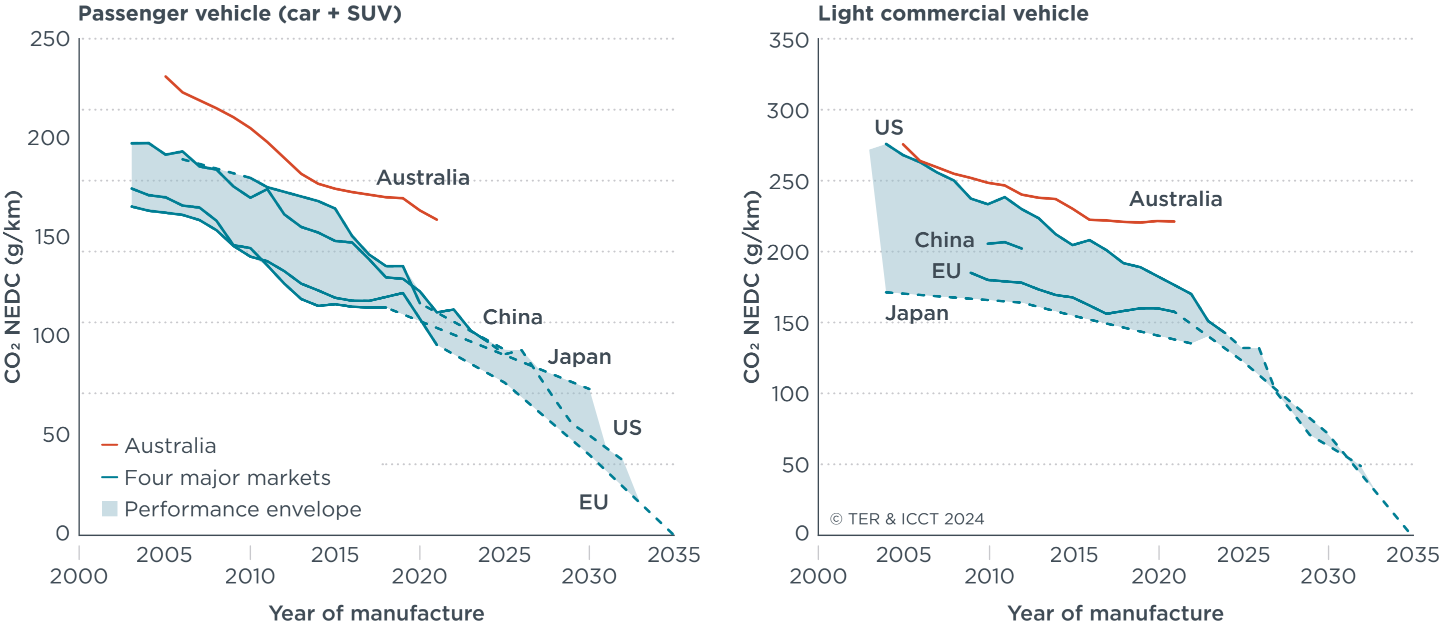

Figure 2. Australian LDV (exhaust) tailpipe CO_2 emissions normalized to the NEDC test protocol in an international context; the blue polygon shows the performance envelope with the combined results for China, the European Union, Japan, and the United States. Dotted line = interpolated values or future target values.

Figure 3 presents the same data in terms of the difference between Australian and major market NEDC emissions performance, and positive values mean that Australian NEDC emissions are higher. The red line shows the average difference between the major markets and Australian NEDC values, whereas the scatter band shows the variability and the extent of the difference. Official CO_2 emission rates for PVs in Australia were 37 g/km to 56 g/km higher than average international performance in the period 2005 to 2021, and there has been a notable increase since 2016. In 2021, CO_2 emissions of Australian PVs were 53% higher than the average of other major markets. Australian LCVs, meanwhile, had CO_2 emissions that were 41 g/km to 54 g/km higher than average major market performance between 2009 and 2021. The difference reached 32% in 2021.

41 ICCT, "Passenger Vehicle Greenhouse Gas Emissions and Fuel Consumption."

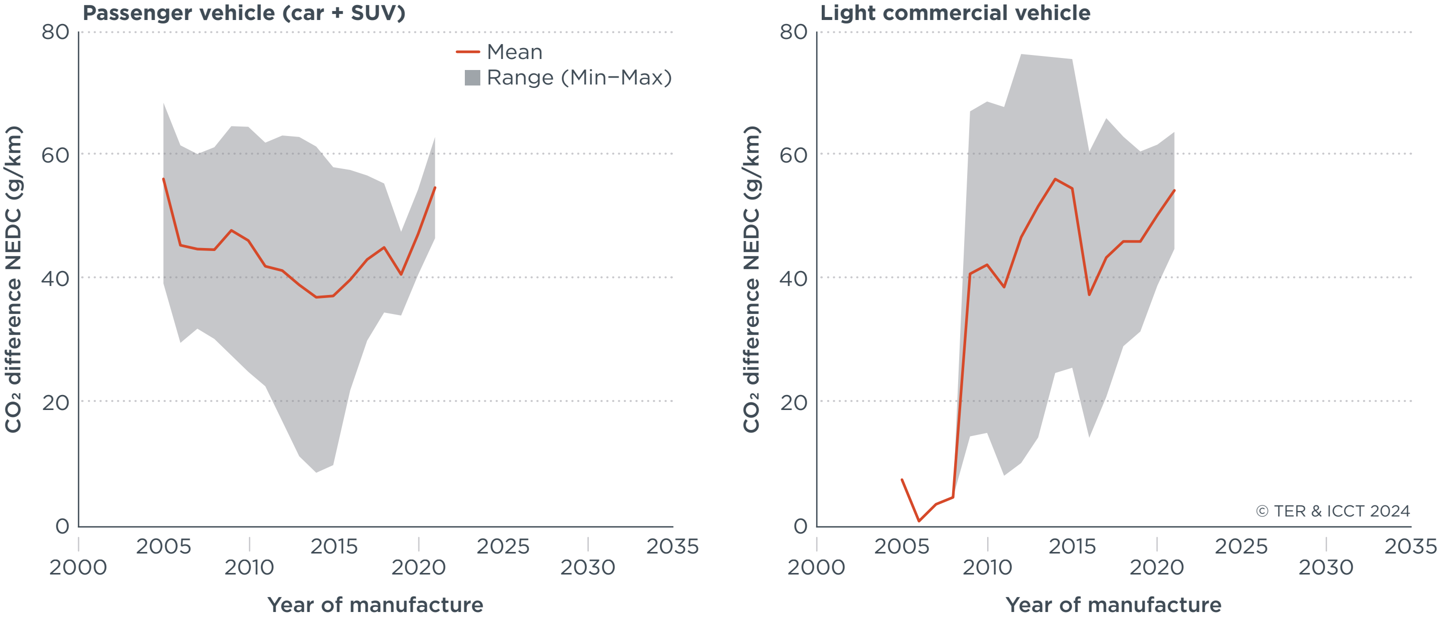

Figure 3. The absolute difference between Australian and international LDV (exhaust) CO_2 emissions performance (NEDC) for four major markets: China, the European Union, Japan, and the United States.

REAL-WORLD CO_2 EMISSIONS

For effective emissions reduction policy, it is critical that new Australian standards reflect real-world fuel consumption and emissions as closely as possible. As noted above, the NTC reports on the emissions performance of the Australian LDV fleet are based on the NEDC test cycle. The NEDC was developed in the early 1970s, when test facilities could not simulate significant changes in speed. Because this is not an issue in newer test cycles, researchers, industry, and policymakers now regard NEDC laboratory emissions testing as an out-of-date measure that underestimates CO_2 emissions in the real world.[42] For instance, prior ICCT studies demonstrated that the average gap between real-world and NEDC type-approval CO_2 emissions increased from 6% in 2001 to a peak of 40% in 2016 for cars in the European Union.[43] Due to this widening gap between NEDC and real-world emissions, the European Union replaced the NEDC test procedure with the Worldwide harmonized Light-vehicles Test Procedure (WLTP) in 2017.[44] WLTP type-approval CO_2 emissions are (on average) about 21% higher than those of the NEDC, resulting in a smaller gap with real-world emissions that was estimated to be 8% in 2018 and 14% in 2022.[45]

Figure 4 compares the official NEDC values for Australia analyzed above with estimated real-world CO_2 emissions derived from two previous TER studies. The first TER study, published in 2019, estimated the gap between NEDC and real-world CO_2 emissions in Australia between 2007 and 2018.[46] According to that study, the mean

42 National Transport Commission, "Carbon Dioxide Emissions Intensity for New Australian Light Vehicles 2021," (Canberra, ACT, 2021), https://www.ntc.gov.au/sites/default/files/assets/files/Carbon%20Dioxide%20Emissions%20Intensity%20for%20New%20Australian%20Light%20Vehicles%202021.pdf.

43 Jan Dornoff et al., "On the Way to "Real-World" CO_2 Values: The European Passenger Car Market in its First Year After Introducing the WLTP," (Berlin, Germany: ICCT, 2021), https://theicct.org/wp-content/uploads/2021/06/On-the-way-to-real-world-WLTP_May2020.pdf.

44 The WLTP not only includes the Worldwide harmonized Light vehicles Test Cycle but also removed several legal flexibilities previously used by car manufacturers in the NEDC test procedure to lower emissions. An example is the use of more representative vehicle test weights in the WLTP; weight can increase by hundreds of kilograms in the WLTP compared with the NEDC test protocol.

45 Dornoff, et al., "On the Way to 'Real-World' CO_2 Values?"

46 Smit, "Real-World CO_2 Emissions Performance of the Australian New Passenger Vehicle Fleet 2008-2018."

gap for Australian PVs registered in 2008 was estimated to be 10%, and that increased to 34% for vehicles registered in 2018. TER also found that real-world fleet-average CO_2 emissions (g/km) for new PVs had increased modestly since 2015, and attributed the trend primarily to a sustained increase in vehicle weight and a shift to the sale of more four-wheel-drive SUVs and large utility vehicles. The second TER study, published in 2023, estimated fleet average real-world emissions for all vehicle classes since 2019.[47]

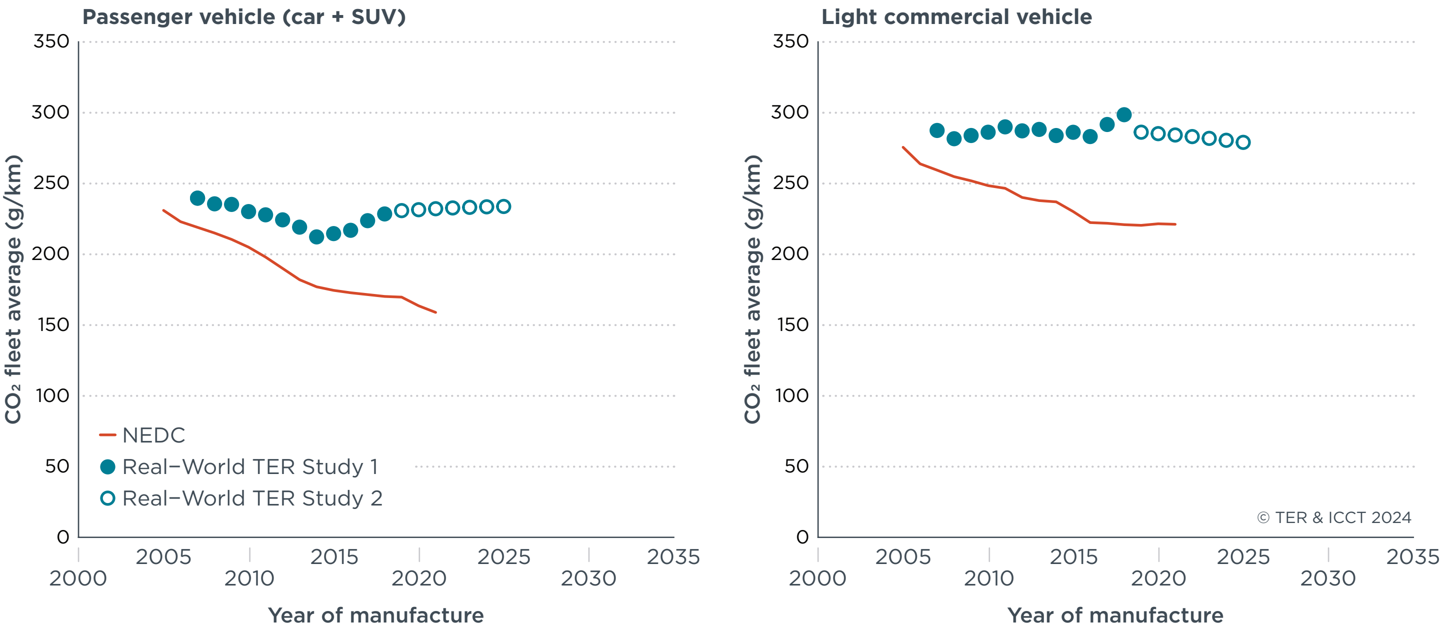

Figure 4. Australian LDV (exhaust) CO_2 emissions performance by comparing official reported NEDC and estimated fleet-average real-world emission rates from two TER studies, Study 1 (2018 and before) and Study 2 (2019 and after).

Figure 4 shows that the gap between NEDC and real-world CO_2 emissions for conventional PVs has increased from 21 g/km (9%) in 2007 to 40 g/km (23%) in 2015 and to 73 g/km (46%) in 2021. The difference for LCVs has also increased, from 28 g/km (11%) in 2007 to 56 g/km (24%) in 2015 and 63 g/km (29%) in 2021. Due to the increase of the gap, the average real-world CO_2 emissions of both PVs and LCVs in Australia have increased in recent years. The accelerated increase of such gaps is likely to continue absent efforts to develop and implement fuel efficiency standards and complementary policies.

The ICCT has estimated real-world fleet-average CO_2 emission rates for the European Union, United States, Japan, and China based on the gaps between type-approval and consumer-reported real-world fuel consumption quantified in prior work for each country. Figure 5 compares Australian (Real-world TER Studies 1 and 2, Figure 4) and international real-world fleet-average CO_2 emissions; it presents an international performance envelope in the blue shaded polygon and the mean performance for the four jurisdictions via dot points.

47 Smit, "An Independent and Detailed Assessment of Greenhouse Gas Emissions."

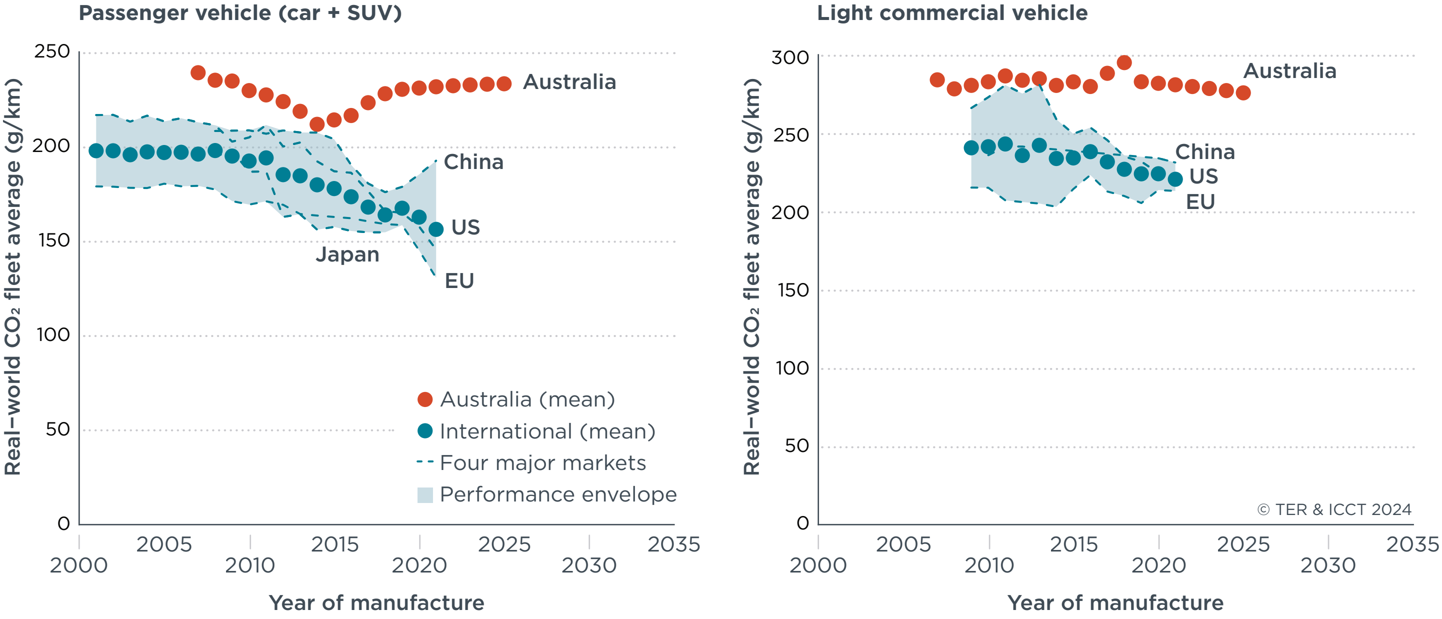

Figure 5. Australian real-world fleet average LDV (exhaust) emissions performance in an international context; the blue polygon shows the combined real-world emissions data from the ICCT for the European Union, the United States, China, and Japan.

Figure 5 shows that the real-world CO_2 emissions performance of LDVs in Australia is significantly worse than the major markets. Among PVs, the difference fluctuated around 20%—between 32 g/km and 43 g/km—before 2016 and subsequently widened to nearly 76 g/km, a 48% difference, in 2021. For LCVs, the gap was 40 g/km (17%) in 2009 and grew to 61 g/km (27%) in 2021. The lack of mandatory standards designed to monitor and limit real-world vehicle emissions is one of the main drivers of this trend in Australia.

SUMMARY

Australian policymakers have debated whether to introduce a mandatory FES or CO_2 emission standard since 2007. Our analysis indicates that existing voluntary emissions targets have not substantially reduced GHG emissions in the Australian LDV fleet. Furthermore, the gaps between type-approval and real-world emissions performance and between Australia and other international markets are growing wider. A FES could be a critical tool for achieving Australia's economy-wide net-zero emissions target for 2050, but its effectiveness would strongly depend on its design and enforcement. The following highlights are relevant for Australia:

Australian LDVs perform poorly on type-approval CO_2 emissions when put into an international context, and the available evidence suggests that in the absence of binding fuel efficiency or CO_2 standards, this gap with other markets will widen. The official fleet-average type-approval CO_2 emissions of new PVs and LCVs sold in Australia, using NEDC test procedures, are currently more than 50% (55 g/km) and more than 30% (54 g/km) higher, respectively, than the average performance among leading markets.

Comparing fleet-average type-approval CO_2 emission values for Australian LDVs with real-world estimates suggests that current test protocols increasingly underestimate on-road emissions. The gap for conventional PVs has continuously increased from 21 g/km (9%) in 2007 to 73 g/km (46%) in 2021, and the gap for LCVs has grown from 28 g/km (11%) in 2007 to 63 g/km (29%) in 2021.

The increasing gap between real-world performance and official CO_2 emissions values in Australia also contributes to the growing difference between the real-world performance of LDVs in Australia and those in other major vehicle markets. In 2021, the difference in real-world emissions performance between Australia and an average of China, the European Union, Japan, and the United States approached 76 g/km (48%) for PVs and 61 g/km (27%) for LCVs. A main driver of this trend is Australia's lack of effective standards to monitor and reduce fleet-average real-world emissions.

To catch up with major markets and put the country on the path to meeting its decarbonization targets, Australian policymakers should consider implementing ambitious and carefully designed fuel efficiency standards. Fuel efficiency or CO_2 emission standards are a cost-effective way to facilitate the transition to a low- and zero-emission vehicle fleet, and to promote higher energy efficiency, lower fuel consumption and operating costs, and reduced dependence on fossil fuels. The government-preferred Option B and stringent Option C approaches proposed in the latest FES proposal suggest an intention to catch up with the major international markets. In weighing FES proposals and evaluating public feedback, Australian policymakers should consider adopting standards that align with leading markets and with domestic climate goals, and work to ensure that standards are adopted and implemented.

New Australian standards can be designed to effectively reduce not only type-approval CO_2 emissions but also real-world emissions. For instance, an effective FES would, at a minimum, adopt the WLTP to generate type-approval values, as the WLTP is more representative of real-world conditions than the NEDC that is currently used. Effective standards would also include on-board fuel consumption monitoring to monitor the real-world fuel efficiency and emissions of new vehicles. Such monitoring is critical to ensure that the standards are performing well and are meeting their objectives.

APPENDIX. TYPE-APPROVAL CO_2 EMISSIONS PERFORMANCE OF AUSTRALIAN LDVS COMPARED WITH ADDITIONAL MARKETS.

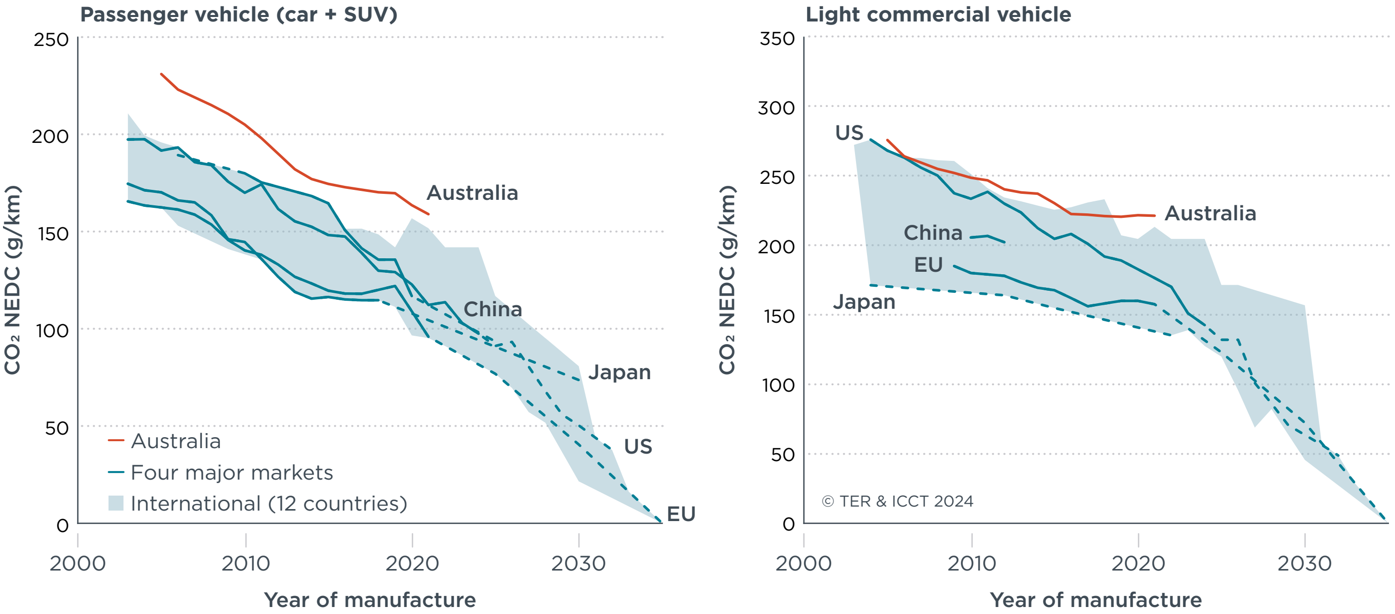

Figure A1. Australian LDV (exhaust) tailpipe CO_2 emissions performance normalized to the NEDC test protocol in an international context; the blue polygon shows the performance envelope with the combined results for Brazil, Canada, Chile, China, the European Union, India, Japan, Mexico, New Zealand, South Korea, the United Kingdom, and the United States. Dotted line = interpolated values or future target values.

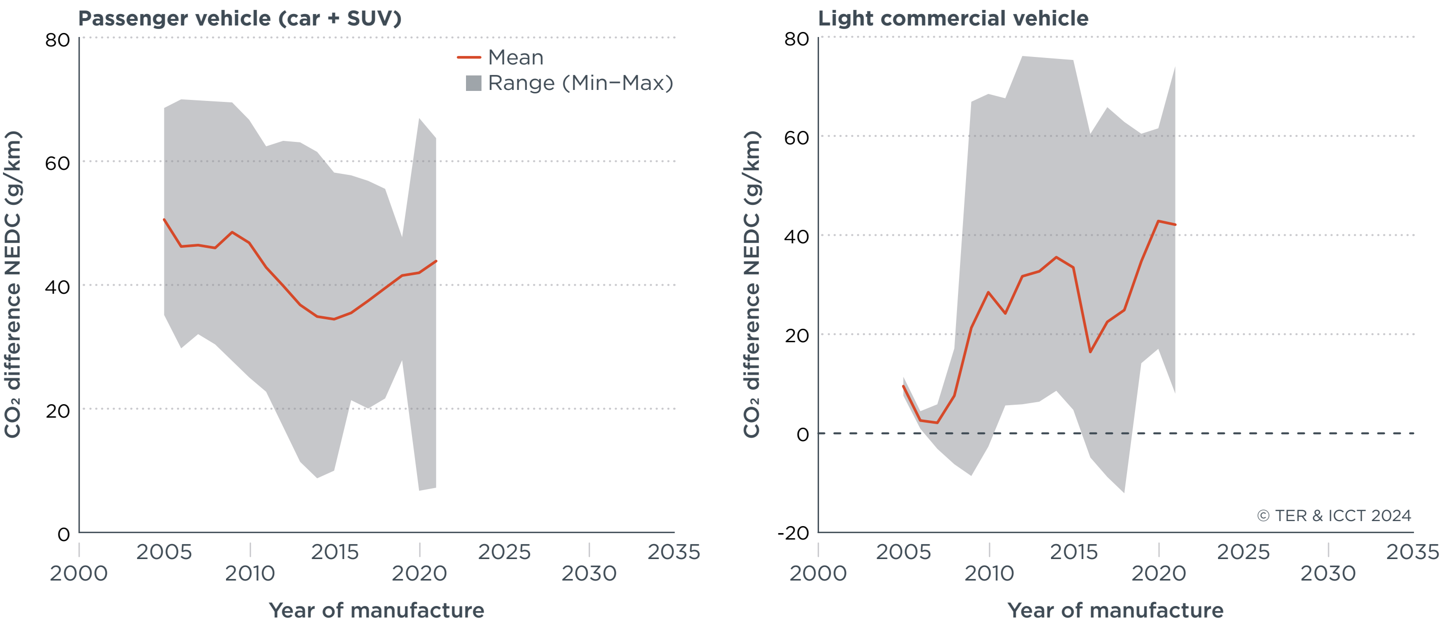

Figure A2. The absolute difference between Australian and international LDV (exhaust) CO_2 emissions performance (NEDC) for 12 countries; the grey polygon shows the full range using the combined results for Brazil, Canada, Chile, China, the European Union, India, Japan, Mexico, New Zealand, South Korea, the United Kingdom, and the United States.