Raising standards, cutting costs: *How an effective new vehicle efficiency standard can reduce vehicle emissions and save consumers money*

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Prepared by Mandala and commissioned by Electric Vehicle Council and Climate Council

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ELECTRIC VEHICLE COUNCIL

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Contents

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Note: All dollar figures are Australian dollars unless indicated otherwise.

This study examines the potential impact of introducing a new vehicle efficiency standard in Australia

- This study estimates the net benefits for Australian consumers from introducing a new vehicle efficiency standard in Australia on passenger and light commercial vehicles. This considers cost savings, upfront changes in vehicle prices and environmental benefits.
- To inform consultation on a new vehicle efficiency standard, three scenarios are used to demonstrate the range of potential outcomes.
- These scenarios were constructed based on the available data, reasonable assumptions and global approaches to new vehicle efficiency standards. Where appropriate we project forward current trends and amend them based on the expected impacts of this and other policies.
- To isolate the impact of the proposed policy, our analysis held various factors constant (e.g., kilometres travelled via vehicles). Furthermore, for consistency purposes, emissions reported in this study are standardised to NEDC measurements (CO_2 g/ km).
- Details of the methodology can be found in Appendix C.

Executive summary

In April 2023, the Australian Government committed to mandate a new vehicle efficiency standard (NVES) by the end of 2023. The Government is currently seeking input on how to design key elements of the NVES.

Australia needs a strong NVES to catch up to its global peers and cut costs for motorists

Implementing a strong NVES will reduce fuel and maintenance costs for consumers, as well as deliver substantial environmental benefits. While the NVES would have a relatively modest impact on vehicle prices, this would be more than offset by cost savings over the life of the vehicle – making cars cheaper overall for consumers.

More than 85% of vehicles sold worldwide are covered by a NVES. Australia is currently one of the few developed nations, along with Russia, without a NVES. The European Union (EU) has the strongest standard, requiring all new vehicles sold by 2035 to be zero-emissions vehicles.

Currently, the EU sells over 200 models of electric vehicles (EV) compared to just over 50 in Australia.[1] Meanwhile, new internal combustion engine (ICE) vehicles in Australia emit up to 1.5 times more carbon dioxide than those in Europe – leaving a significant market gap between Australia and our global peers.

A strong standard will improve the efficiency of new vehicles and increase the supply of electric vehicles

To assess the impact of the NVES on consumers, this study considers (a) the emissions intensity of new vehicles; (b) the supply of electric vehicles; and (c) the impact on vehicle prices.

To model how the emissions intensity of new vehicles will change, this study considers three future pathways of the NVES: (1) globally competitive case (where the NVES catches up to the US by 2027 and the EU by 2030); (2) fast follower case (where the NVES catches up to the EU by 2035 at a linear rate); and (3) slow follower case (where the NVES improves at the same rate as the US up to 2032 and catches up to the EU by 2035).

Across these pathways, the efficiency of ICE vehicles improves by 3 per cent per year. These scenarios are compared to a baseline case (where the emissions intensity of ICE vehicles improve by 1.5 per cent per year without the NVES – in line with the 5-year historical average in Australia). Meeting the NVES will require efficiency improvements in ICE vehicles to be supplemented with an increasing supply of electric vehicles. Across the three pathways, EVs will make up 6 to 21 per cent of new sales by 2025, 41 to 63 per cent by 2030, and 100 per cent by 2035.

As ICE vehicles become more efficient and the supply of EVs grows, there will be a modest but temporary relative impact on vehicle prices. Without the NVES, prices for ICE vehicles would increase by 1.1 per cent per year. The NVES would only increase this by an additional 0.3 per cent per year as ICE vehicles become more efficient. Meanwhile, the price of EVs will decrease up to 2.8 per cent per year as competitive pressures and lower battery costs drive down vehicle prices. As EVs achieve price parity, the cost of ICE vehicles will come down to stay competitive.

An effective and competitive standard can save consumers up to $10,000 over a vehicle's lifetime, and deliver up to $13.6 billion in benefits for Australians by 2035

The NVES will save consumers money, with the reduction in fuel and maintenance costs more than offsetting the modest and temporary increase in the price of new vehicles. The reduction in vehicle emissions will also have substantial environmental and economic benefits.

The NVES would see ICE vehicle prices peak in 2027 as they improve in efficiency, before prices fall as competition increases. In 2027, consumers purchasing an EV would save up to $10,000 in costs over the lifetime of the vehicle. The higher cost of an EV ($2,100) would be recovered in less than 2 years due to $1,200 of savings in running costs per year.

Catching up quickly to global peers in the globally competitive case would save Australians up to $13.6 billion by 2035. Consumers purchasing new vehicles will experience $9.2 billion in net savings, while Australians will experience $4.4 billion in environmental benefits. The fast follower case would deliver $10.3 billion in net savings for Australians up to 2035. Consumers will save $7.3 billion from lower costs, and experience $3 billion in environmental benefits. Implementing the NVES through the slow follower case will save consumers up to $8.9 billion by 2035. This is comprised of a $6.4 billion net saving for consumers purchasing a new vehicle, as well as $2.5 billion in environmental benefits.

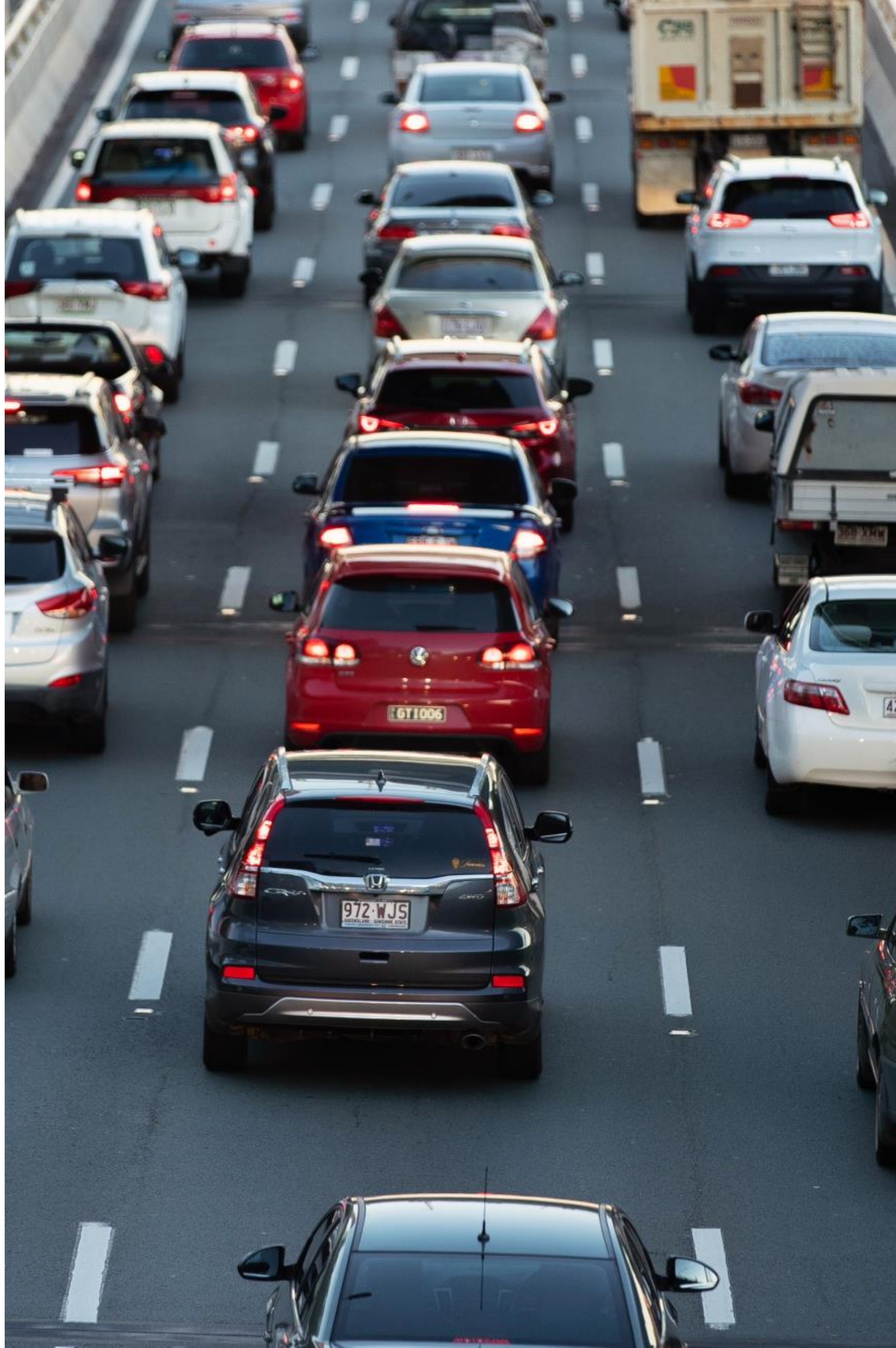
These impacts would be diluted by multiplier credits. Multiplier credits have been used by global peers to encourage innovation and improve efficiency of new vehicles. However, a mechanism with a multiplier of two for up to 4 years would dilute cost savings by up to 10 per cent and dilute the environmental benefits by up to 9 per cent.

1 **Australia needs a strong NVES to catch up to its global peers and cut costs for motorists**

2 A strong standard will improve the efficiency of new vehicles and increase the supply of electric vehicles

3 An effective and competitive standard can save consumers up to $10,000 over a vehicle's lifetime, and deliver up to $13.6 billion in benefits for Australians by 2035

Appendices



Australia has committed to introducing a new vehicle efficiency standard (NVES) by the end of 2023

A new vehicle efficiency standard (NVES), also known as a fuel efficiency standard, places obligations on vehicle manufacturers to limit the amount of carbon dioxide their vehicles emit per kilometre. These standards typically apply to light vehicle suppliers and impose an average across their fleet.[1] This allows manufacturers to supply a range of vehicles, including cars, SUVs, utes and vans.

More than 85% of vehicles sold worldwide are covered by a NVES.[2] As of early 2023, Australia remains one of the few major global economies without a NVES. Consequently, Australia has less efficient vehicles relative to global peers. The European Union currently has over 200 models of electric vehicles (EV) available, whereas Australia has just over 50.[2] However, in early 2023 the Australian Government committed $7.4 million over four years from FY24 to develop a NVES.[3] This follows various attempts to introduce a standard, as well as the introduction of various voluntary industry standards. In the interim, global peers such as the United States (US), European Union (EU) and New Zealand have adopted a mandatory NVES to curb transport related emissions and encourage vehicle manufacturers to increase their supply of low and zero emission vehicles (LZEVs) to their respective markets.

Exhibit 1: Global evolution of new vehicle efficiency standards (non-exhaustive)

1970
The US introduced a mandatory requirement for emissions for new vehicles to be reduced by 90 per cent by 1975.

1978
The Australian automotive industry adopts a voluntary fuel consumption target.

2003
The FCAI adopted a voluntary fuel consumption target for new petrol passenger vehicles to an average of 6.8 L/100 km by 2010.

2005
A voluntary target was adopted to reduce the average emissions for all new light vehicles from 245 to 222 CO_2 g/km by 2010. This target was achieved by 2008 but was not extended any further.

2009
The European Union mandated CO_2 standards for new vehicles, which were first introduced in 1999 as voluntary standards.

2020
The FCAI introduced voluntary efficiency standards for the automotive industry.
The EU mandated new standards to reduce emissions by up to 37.5% for new vehicles by 2030.[4]

2022
The US expanded their CAFE by introduced new standards for new vehicles in 2024 to 2026.[5]
New Zealand enforced their first efficiency standards for new vehicles.

2023
The EU mandated for all new vehicles supplied 2035 onwards to be zero-emission vehicles.
The Australian Government released a consultation paper to explore options for a NVES, with a commitment to mandate a new standard by the end of 2023.

1 Manufacturers that produce passenger vehicles, such as sedans, and light commercial vehicles, such as vans. 2 DITRDCA (2023) *The Fuel Efficiency Standard – Cleaner, Cheaper to Run Cars for Australia: Consultation Paper*. 3 Commonwealth of Australia (2023) *Budget Measures: Budget Paper No. 2*. 4 Based on 2021 levels. 5 The Corporate Average Fuel Economy (CAFE) standards are set by the US National Highway Traffic Safety Administration.
Source: European Parliament (2023) *Fit for 55: zero CO2 emissions for new cars and vans in 2035*; European Parliament (2022) *Deal confirms zero-emissions target for new cars and vans in 2035*; FCAI (2008) *National Average Carbon Emissions (Nace)*; Mandala analysis.

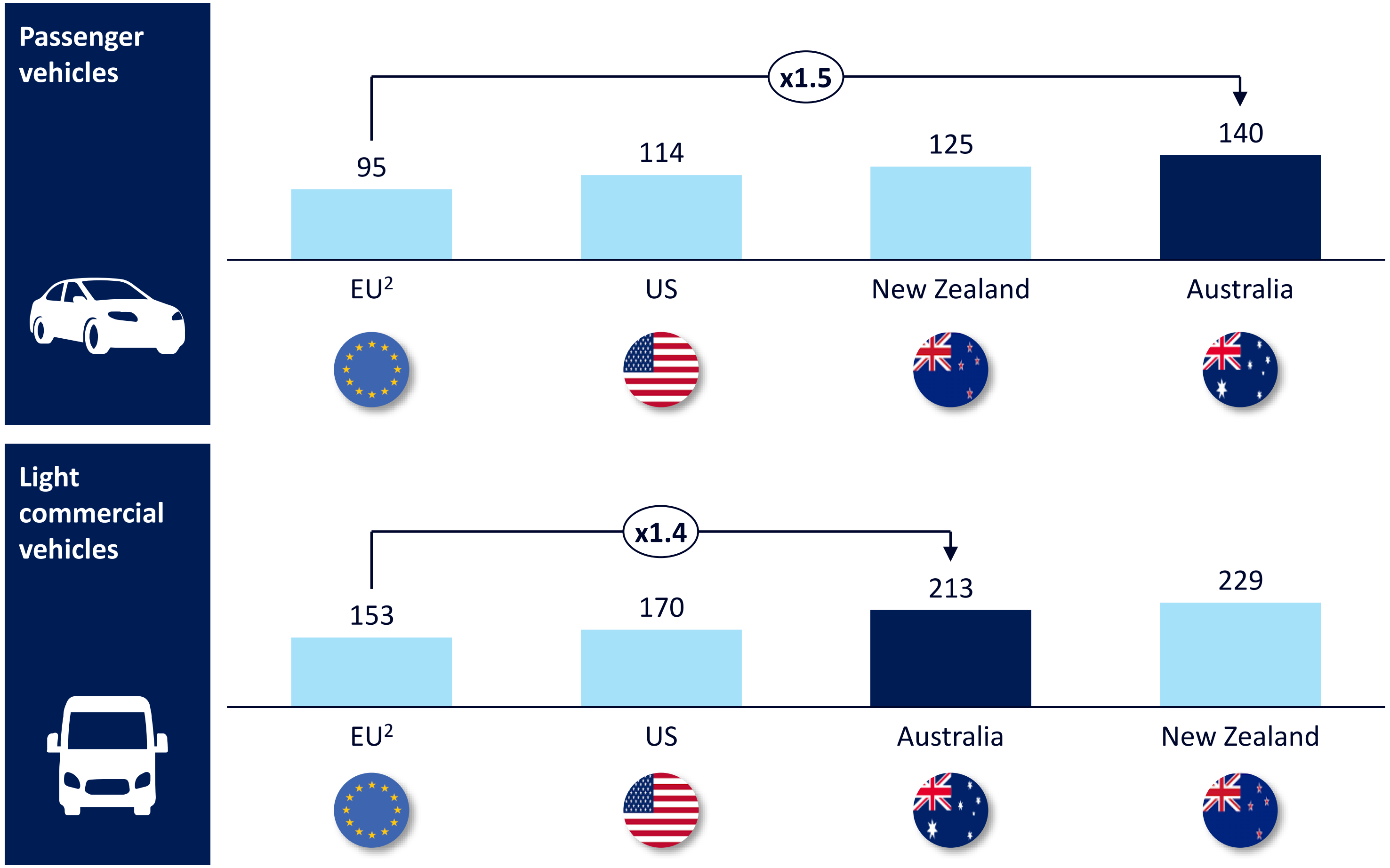
There is a significant gap to close, with Australian vehicles emitting up to 1.5x more CO_2 than global peers

General improvements in technology have reduced the emissions intensity for new vehicles in Australia. However, Australia's late move to introduce an efficiency standard has made Australia a destination for less efficient new vehicles. This has created a significant gap with global peers, with average emissions for new vehicles in Australia higher relative to global peers such as the European Union (EU), United States (US), and New Zealand (except for light commercial vehicles).

In 2022, new vehicles sold in Australia were producing up to 1.5 times more carbon dioxide relative to our global peers. This gap was largest for passenger vehicles, where new vehicles in Australia produced 1.5 times more carbon dioxide relative to the EU. For light commercial vehicles, Australia is still far behind, with new vehicles producing 1.4 times more carbon dioxide relative to the EU.

Exhibit 2: Average emissions intensity for new vehicles by country[1]

CO_2 g / km, 2022



1 Average emissions intensity for new vehicles includes internal combustion and electric vehicles.
2 Emissions intensity from the European Union is only available up to 2021 as of May 2023.
Source: BITRE (2021) *Australia's light vehicle fleet – some insights.* DITRDCA (2023) *The Fuel Efficiency Standard – Cleaner, Cheaper to Run Cars for Australia: Consultation Paper*; New Zealand Government (2021) *The Clean Car Import Standard – reducing CO_2 emissions to 105 grams per kilometre by 2025*; FCAI (2023) *Monitoring CO_2 emissions from passenger cars and light commercial vehicles in 2022*; Mandala analysis.

Globally, efficiency standards are requiring all new vehicles to be zero-emission by 2035

Global peers such as the US, the EU, and New Zealand have implemented efficiency standards for new vehicles to drive the adoption of cleaner technologies and reduce vehicle emissions. The EU stands out with the strongest standard, mandating all new vehicles sold by 2035 to be zero-emission vehicles (ZEVs). This approach set the benchmark for other countries to follow.

In April 2023, the US proposed a new, more stringent standard for light vehicles sold from 2027 onwards. This builds upon the strong standards already in place for new vehicles sold up to 2026, further reducing fleet emissions by 56 per cent.

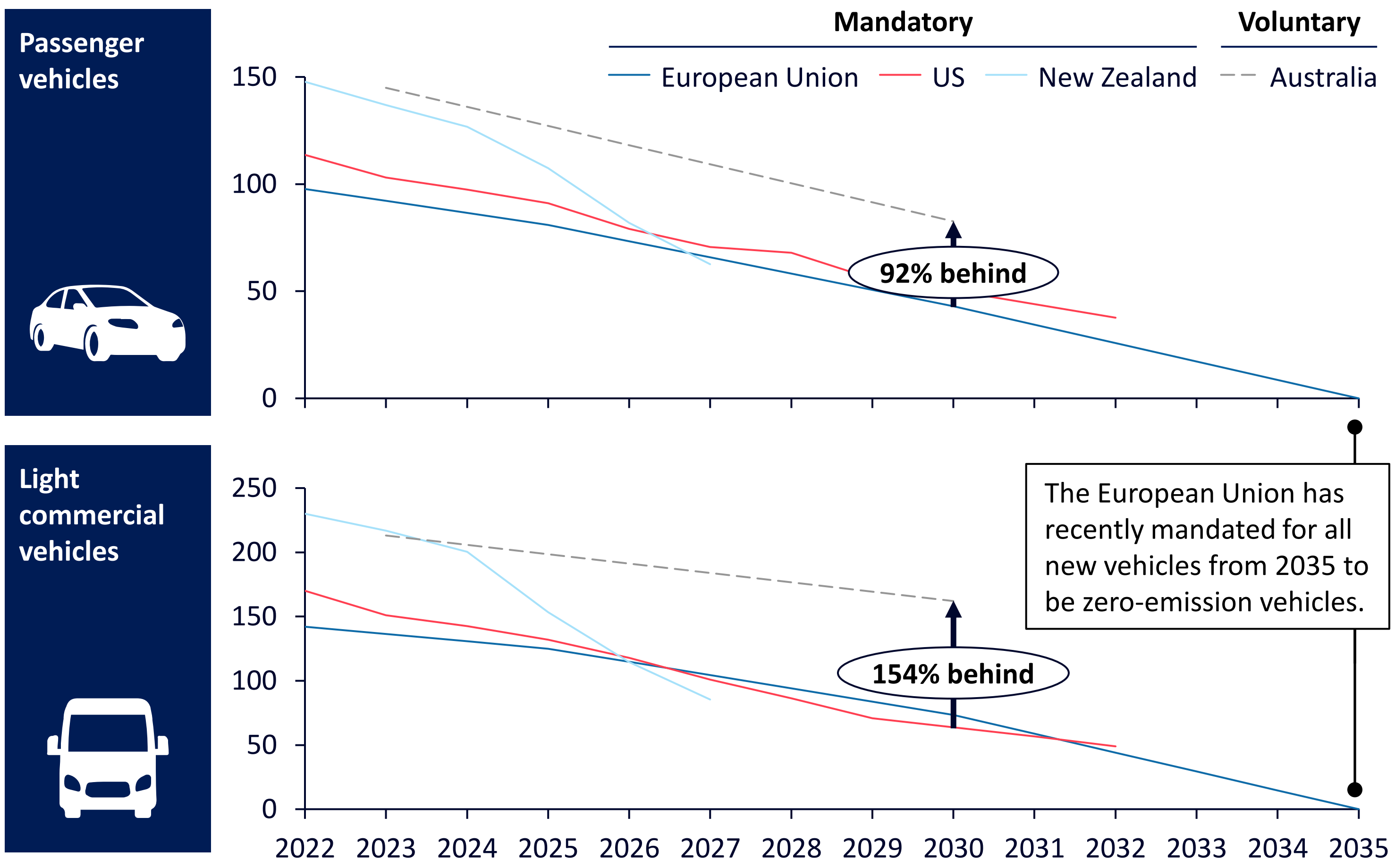
New Zealand mandated their first efficiency standard more recently in 2022. These standards have been set to catch-up with the US and EU by 2027.

In stark contrast, Australia has a voluntary standard in place. This standard falls significantly short of the progress achieved by other nations. By 2030, Australia could find itself between 92% to 154% behind global peers.

The introduction of a new vehicle efficiency standard that aligns with global peers has the potential to generate substantial benefits for Australian consumers and the environment.

Exhibit 3: New vehicle efficiency standards by country

CO_2 g / km, 2022-2035



Note: The US efficiency standards are only defined up to 2026, with new standards up to 2032 currently being considered.
Source: DITRDCA (2023) *The Fuel Efficiency Standard – Cleaner, Cheaper to Run Cars for Australia: Consultation Paper*; EPA (2023) *Final Rule to Revise Existing National GHG Emissions Standards for Passenger Cars and Light Trucks Through Model Year 2026*; EPA (2023) *Regulations for Greenhouse Gas Emissions from Passenger Cars and Trucks*; European Commission (2023) *CO_2 emission performance standards for cars and vans*; NZ Transport Agency (2023) *Clean Car Standard*; Mandala analysis.

A strong mandated NVES will alleviate price increases through fuel and maintenance cost savings, and environmental benefits

Exhibit 4: Consumer and environmental impacts			Description
Vehicle ownership impacts	Cost savings	Total consumer spend on fuel & electricity	▪ The NVES will improve the efficiency of internal combustion engine (ICE) vehicles, while also increasing the take up rate of electric vehicles. ▪ Consumers purchasing ICE vehicles will save on fuel as new vehicles become more efficient to reduce emissions. ▪ Consumers purchasing an electric vehicle will save significantly by eliminating fuel costs, and this will be marginally offset by additional expenditure on electricity for charging.
		Total consumer spend on maintenance	▪ The NVES will reduce spending on vehicle maintenance across the economy. ▪ EVs typically have substantially lower maintenance costs relative to ICE vehicles. ▪ As manufacturers increase their supply of EVs to meet efficiency standards, a greater share of new vehicles purchased will be EVs, reducing total spend on vehicle maintenance.
	Cost increase	Total consumer spend on new vehicles	▪ The NVES will change total spending by all consumers purchasing a new vehicle as prices are impacted by new technology and competition. ▪ As ICE vehicles become more efficient, their prices will increase marginally as newer and more efficient technology will be required. ▪ EVs however will become cheaper overtime from increased competition and lower battery costs.
Environmental benefits	Reduced emissions and pollutants		▪ The NVES will bring substantial environmental benefits as vehicles are required to reduce their emissions intensity. ▪ Consumers purchasing a new ICE vehicle will generate environmental benefits as car manufacturers use more efficient engines with substantially reduced emissions. ▪ Consumers purchasing an EV will also produce environmental benefits, with reduced noise and emissions, which are marginally offset by emissions generated from charging the vehicle.[1]

1 Emissions generated from charging electric vehicles will only marginally offset emission reductions during the transition to an electricity grid fully powered by renewable energy.
Source: Mandala analysis.

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Appendices

To assess the impact of the NVES, this study models the emissions intensity of new vehicles, electric vehicle uptake and vehicle prices across a range of scenarios

Exhibit 5: Approach to assess the impact of the new vehicle efficiency standard in Australia

Steps		A Emissions intensity of new vehicles in Australia	B Supply of electric vehicles in Australia	C Impact on vehicle prices
Key question		How does the emissions intensity of new vehicles in Australia change?	What share of new vehicles are required to be EVs to meet the efficiency standards?	What is the impact on vehicle prices for Australians?
Scenarios	Baseline	▪ The emissions intensity of ICE vehicles falls by 1.5% p.a. without the NVES.[1]	▪ EVs will account for 21% of new sales by 2030 and 33% by 2035 without the NVES.	▪ ICE vehicle prices increase by 1.1% p.a., while EV prices fall by 2.8% p.a. up to 2035.
	1 Globally competitive case	▪ Standards catch up to the US by 2027 and EU by 2030, and the emissions intensity of ICE vehicles falls by 3% p.a.[2]	▪ To meet efficiency standards, EVs will need to account for 54% of new sales by 2030, and 100% by 2035.	▪ ICE vehicle prices increase by 1.4% p.a. (0.3% above the baseline), to cover the costs of the technological improvement in ICEs. This technological improvement is assumed to be constant across scenarios. ▪ EV prices will continue to fall by 2.8% p.a. up to 2035. ▪ As EVs achieve price parity with ICE vehicles, we assume ICE vehicle prices will decrease with EV prices to remain cost competitive.
	2 Fast follower case	▪ Standards improve at a linear rate to catch up to the EU by 2035, and the emissions intensity of ICE vehicles falls by 3% p.a.[2]	▪ To meet efficiency standards, EVs will need to account for 36% of new sales by 2030, and 100% by 2035.	
	3 Slow follower case	▪ Standards improve at the same rate as the US to 2032, and catch-up to the EU by 2035, and the emissions intensity of ICE vehicles falls by 3% p.a.[2]	▪ To meet efficiency standards, EVs will need to account for 29% of new sales by 2030, and 100% by 2035.	
Sources of insight		▪ Fuel Efficiency Standard Consultation paper ▪ National Electric Vehicle Strategy ▪ FCAI Monitoring Emissions Reports ▪ ICCT data	▪ CSIRO Electric Vehicle Projections 2022 ▪ Australian Energy Market Operator	▪ ICCT research and papers ▪ Publicly available data

1 Improvement in ICE vehicle efficiency is based on historical 5-year average.
2 The ICCT assumes the NVES could improve the efficiency of ICE vehicles in Australia by approximately 3% per year; ICCT (2022) Fuel efficiency standards to decarbonize Australia's light-duty vehicles.
Source: Mandala analysis.

There are three pathways through which Australia can catch up to global peers and reduce new vehicle emissions

To understand the benefits of the new vehicle efficiency standard in Australia, this study considers three scenarios for Australia to catch-up to global peers and reduce new vehicle emissions. These are: (1) globally competitive case; (2) fast follower case; and (3) slow follower case. These scenarios are compared to a baseline case, where Australia continues to operate without the NVES.[1]

The globally competitive case considers a scenario where Australia closes the gap to global peers quickly. Under the globally competitive case, Australia's standards catch up to the US by 2027, followed by the EU in 2030. From 2030, Australia's standards match the EU until 2035, when all new vehicles are required to be zero-emission vehicles.

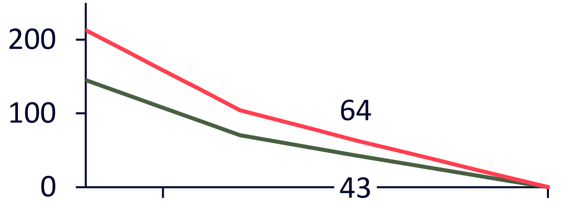
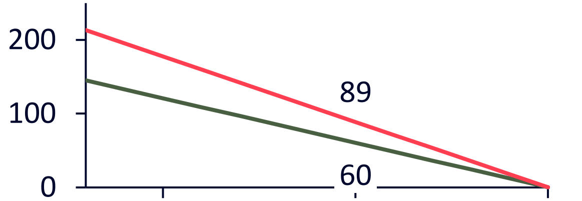
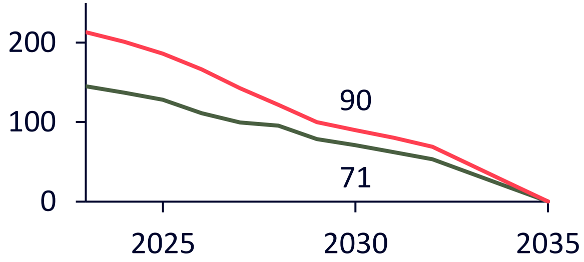
In the fast follower case, Australia's standards improves at a linear rate to catch-up to the EU by 2035. By 2030, emissions would have fallen by 58 per cent for both light commercial vehicles (89 g/km) and passenger vehicles (60 g/km).

The slow follower case considers a standard that matches the rate of reduction adopted by the US until 2032 (based on implemented and potential standards). From 2032 onwards, the standard catches up to the EU by 2035.

A Emission intensity of new vehicles in Australia

Exhibit 6: Emissions intensity of new vehicles in Australia by scenario

Passenger vehicles
Light commercial vehicles

Scenario	*CO_2 g/km targets, 2023-2035*[2]	*Rationale*
1 Globally competitive case		▪ Catching up to global peers by 2027 (US) and 2030 (EU).[3]
2 Fast follower case		▪ Targets decrease linearly from 2023 to catch up to the EU by 2035.
3 Slow follower case		▪ Matching the rate of reduction in the US from 2023 to 2032. ▪ From 2032 onwards, targets reduce linearly to catch up to the EU by 2035.

1 Under the baseline case, the average emission intensity of new vehicles in Australia will reach 92 CO_2 g/km by 2035. See Appendix C for more details on the baseline.
2 Targets for emission intensity start in 2023 based on actual / current levels. Starting points in 2023 for passenger vehicles is 145 CO_2 g/km and 213 CO_2 g/km for light commercial vehicles.
3 Assumes catching up to the US by 2027 and EU by 2030 for passenger vehicles; catching up to the EU by 2027 and US by 2030 for light commercial vehicles.
Source: Mandala analysis.

The NVES will require manufacturers to increase the supply of EVs to meet emission requirements

As the NVES improves overtime, manufacturers need to increase the supply of EVs to meet their fleet emissions targets. Across the three scenarios (globally competitive case, fast follower case and slow follow case), it was assumed the efficiency of ICE vehicles will improve by approximately 3 per cent per year.[1] The remaining reduction in the emissions intensity of the fleet would need to be met through increasing the supply of electric vehicles.

To quantify the potential uplift in the supply of EVs required, we considered modelling from CSIRO to quantify the proportion of new vehicle sales that would be EVs without the NVES or other policy interventions.[2]

In the globally competitive case, the supply of EVs increases rapidly, increasing by 43 percentage points to 45 per cent by 2027, and another 18 percentage points to 63 per cent by 2030.

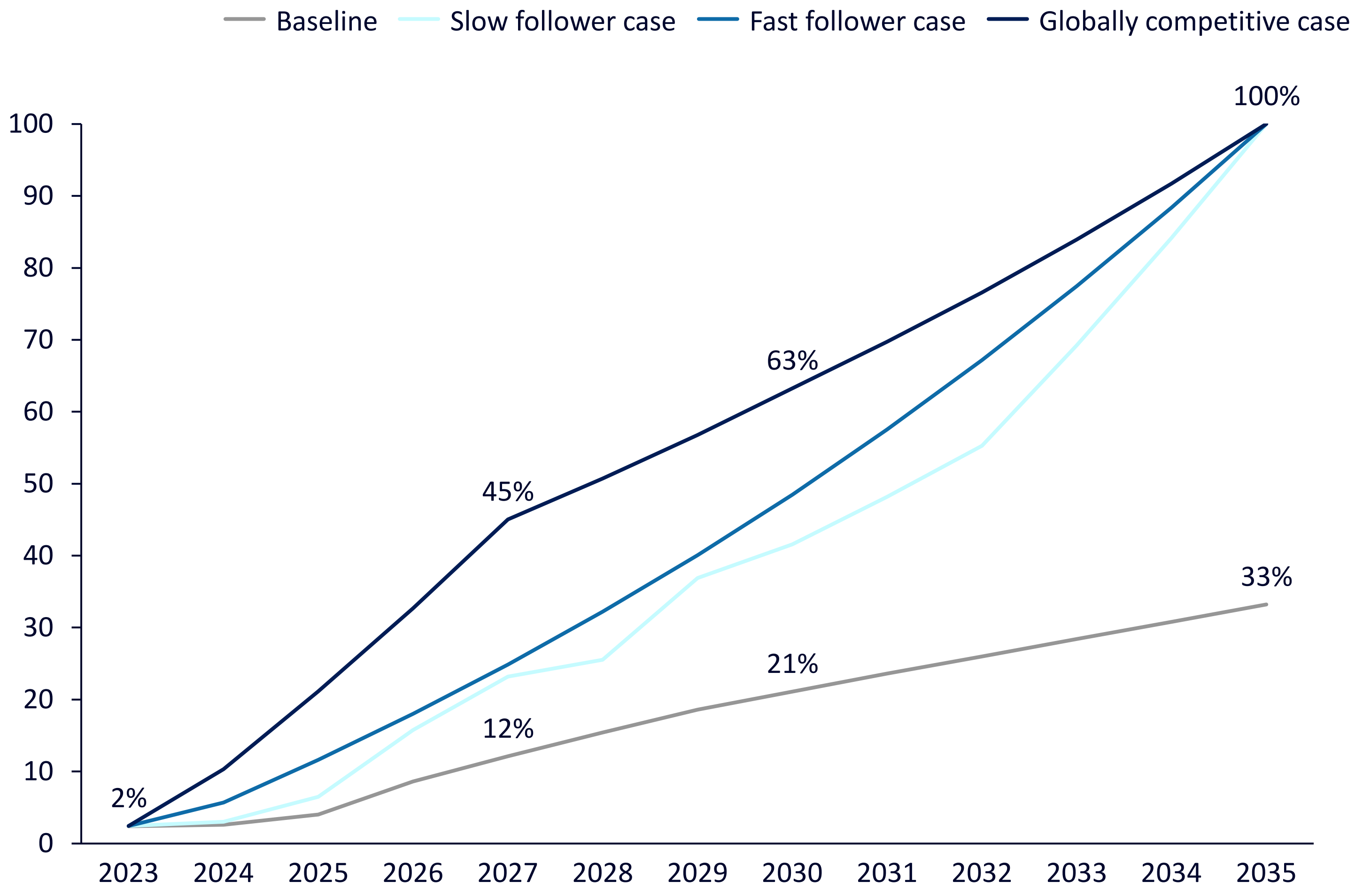
In the fast and slow follower cases, the supply of EVs will increase at a faster rate than the baseline but at a slower rate than the globally competitive case.

Across all three scenarios, EVs are assumed to make up all new vehicle sales by 2035 as the NVES requires all new vehicles to be zero-emission, similar to global standards.

B The supply of electric vehicles in Australia

Exhibit 7: Supply of electric passenger and light commercial vehicles in Australia by scenario

% of new passenger and light commercial vehicle sales, 2023-2035



1 The ICCT assumes the NVES could improve the efficiency of ICE vehicles in Australia by approximately 3% per year; ICCT (2022) *Fuel efficiency standards to decarbonize Australia's light-duty vehicles*.
2 CSIRO (2022) *Electric vehicle projections 2022*; The Baseline is underpinned by the 'Progressive Change' scenario by CSIRO.
Source: Mandala analysis.

The NVES could increase ICE vehicle prices by 0.3 per cent per year, while EV prices will fall by 2.8 per cent per year

As ICE vehicles become more efficient and the supply of EVs increase, there will be a modest but temporary impact on vehicle prices. The NVES would only increase the price of ICE vehicles by an additional 0.3 per cent per year, while the price of EVs will decrease by 2.8 per cent per year.

Without the NVES, the price of ICE vehicles will increase by 1.1 per cent per year as they become more efficient.[1] The NVES however will require ICE vehicles to become more efficient by adopting the latest technology. This would increase prices by an additional 0.3 per cent per year, a total increase of 1.4 per cent per year.[2]

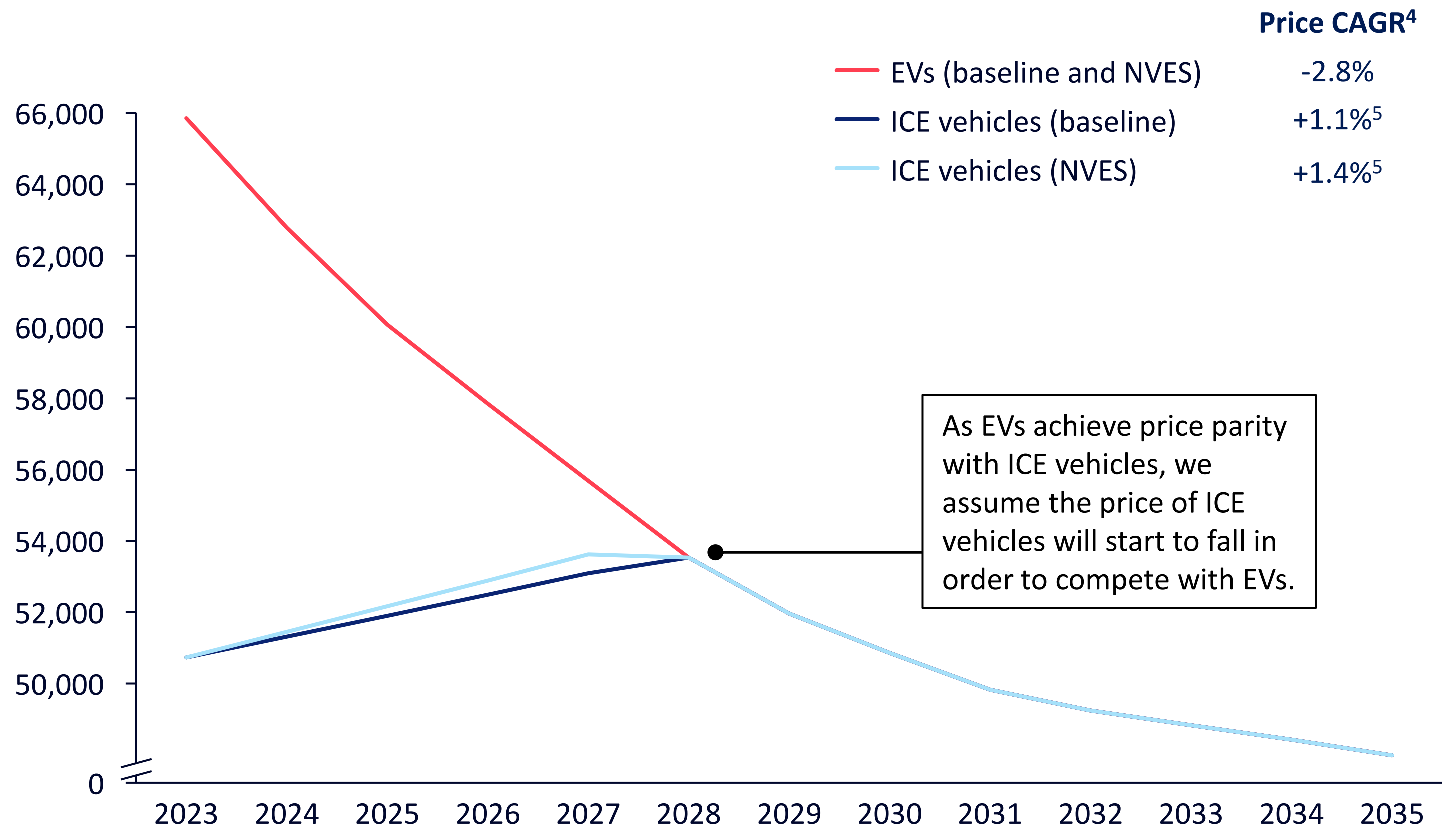
Meanwhile, the prices for EVs will fall by 2.8 per cent per year on average, driven by the falling cost of batteries. We assume this price decrease will be constant across the three scenarios, ranging from 5.3 per cent in the early years of the NVES, to 1 per cent in the latter years.

As EVs achieve price parity with ICE vehicles, the cost of ICE vehicles will come down to stay competitive. This is expected to take place around 2028.

C Impact on vehicle prices

Exhibit 8: Vehicle prices for passenger electric and ICE vehicles by scenario[3]

$AU, 2023-2035



1 The price increase of ICE vehicles under the baseline is based on the historical 5-year average change in prices.
2 This was modelled based on data from the International Council of Clean Transport that quantifies the cost increase for ICE vehicles in the US from improved efficiency; ICCT (2022) *White Paper: Assessment of light-duty electric vehicle costs and consumer benefits in the United States in the 2022–2035 time frame*.
3 Vehicle prices are modelled on the weighted average price of the top 10 selling vehicles in Australia for EVs and ICE vehicles.
4 Compound annual growth rate (CAGR) is the annualised average rate of growth.
5 Price increases are only until EV prices achieve parity with ICE vehicles.
Note: See Appendix C for detailed methodology.
Source: Mandala analysis.

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The NVES could save consumers nearly $10,000 over the lifetime of their new vehicle

As shown in Exhibit 7, the price of ICE vehicles is forecast to peak in 2027. Australian consumers purchasing a new vehicle in 2027 could be up to $10,000 better-off over the lifetime of their new vehicle.

Consumers purchasing a new ICE vehicle to replace their current ICE vehicle could benefit up to $800 over the lifetime of their vehicle. Take a hypothetical consumer, named John, who is looking to purchase a new ICE vehicle in 2027. John would face $500 in additional upfront costs to purchase the new ICE vehicle. However, John will recover this additional cost within 6 years from lower fuel costs.

Consumers who currently own an ICE vehicle and purchase a new EV will benefit the most. Take a hypothetical consumer, named Ellen, who is looking to purchase a new EV in 2027. Ellen would experience a net saving of nearly $10,000 over the lifetime of her new EV. While purchasing a new EV will cost an additional $2,100 (relative to a new ICE vehicle), Ellen will recover these costs in just under 2 years from savings on fuel and maintenance costs.

Exhibit 9: Net present value of net savings for a consumer purchasing a new vehicle with the NVES[1]

$AU, 2027

	Additional spend on a new vehicle	NPV of lifetime savings[2]	NPV net impact	Payback period[3]	
This is John. *John is looking to purchase a* ***new ICE vehicle*** *in 2027 to replace his current ICE vehicle.*	-$500	+$800	**+$300**	6.3 years	John will recover the additional spend on his new ICE vehicle within **6.3 years** through ownership savings
This is Ellen. *Ellen is looking to purchase a* ***new EV vehicle*** *in 2027 to replace her current ICE vehicle.*	-$2,100	+$12,000	**+$9,900**	1.8 years	Ellen will recover the additional spend on her new EV within **1.8 years** through ownership savings

Note: The additional spend on purchasing a new EV shown in Exhibit 8 is not driven by the NVES as our modelling makes a conservative assumption that EV prices are not impacted by the NVES. However, the NVES may decrease EV prices as more vehicle manufacturers supply EVs to the Australian market to achieve their fleet emissions targets.
1 Price impacts and cost savings for John and Ellen are constant across the three scenarios.
2 Lifetime is based on the average ownership period of a new vehicle in Australia, which is approximately 10 years. Net present value is calculated with a discount rate of 7 per cent per year.
3 Time taken to recover the additional cost of purchasing the vehicle after adjusting for discount rates.
Source: Mandala analysis.

A well-designed new vehicle efficiency standard could deliver up to $13.6 billion in savings for Australians and avoid up to 31Mt of CO_2 emissions by 2035

Exhibit 10: Consumer impact of the new vehicle efficiency standard in Australia[1]

Scenario	Key assumptions	Consumer net benefits[1]	Avoided CO_2	Consumer & environmental savings	Additional spend on vehicles
1 **Globally competitive case**	*Targets decrease to catch up to global peers by 2027 (US) and 2030 (EU).*	**$13.6 billion**	**31Mt**	$22.0 billion	$8.4 billion
2 **Fast follower case**	*Targets decrease at a linear rate to catch up to the EU by 2035.*	**$10.3 billion**	**24Mt**	$14.9 billion	$4.6 billion
3 **Slow follower case**	*Targets decrease at the same rate as the US until 2032, and then catch up to the EU by 2035.*	**$8.9 billion**	**21Mt**	$12.7 billion	$3.8 billion

1 Impacts are estimated as the net present value (discounted at 7 per cent per year) over the period of 2023 to 2035.
Source: Mandala analysis.

A NVES that catches up quickly to global peers could save Australians up to $13.6 billion by 2035

Under the globally competitive case, Australia's NVES would catch up to the US by 2027, and the EU by 2030. This could save Australians $13.6 billion by 2035.

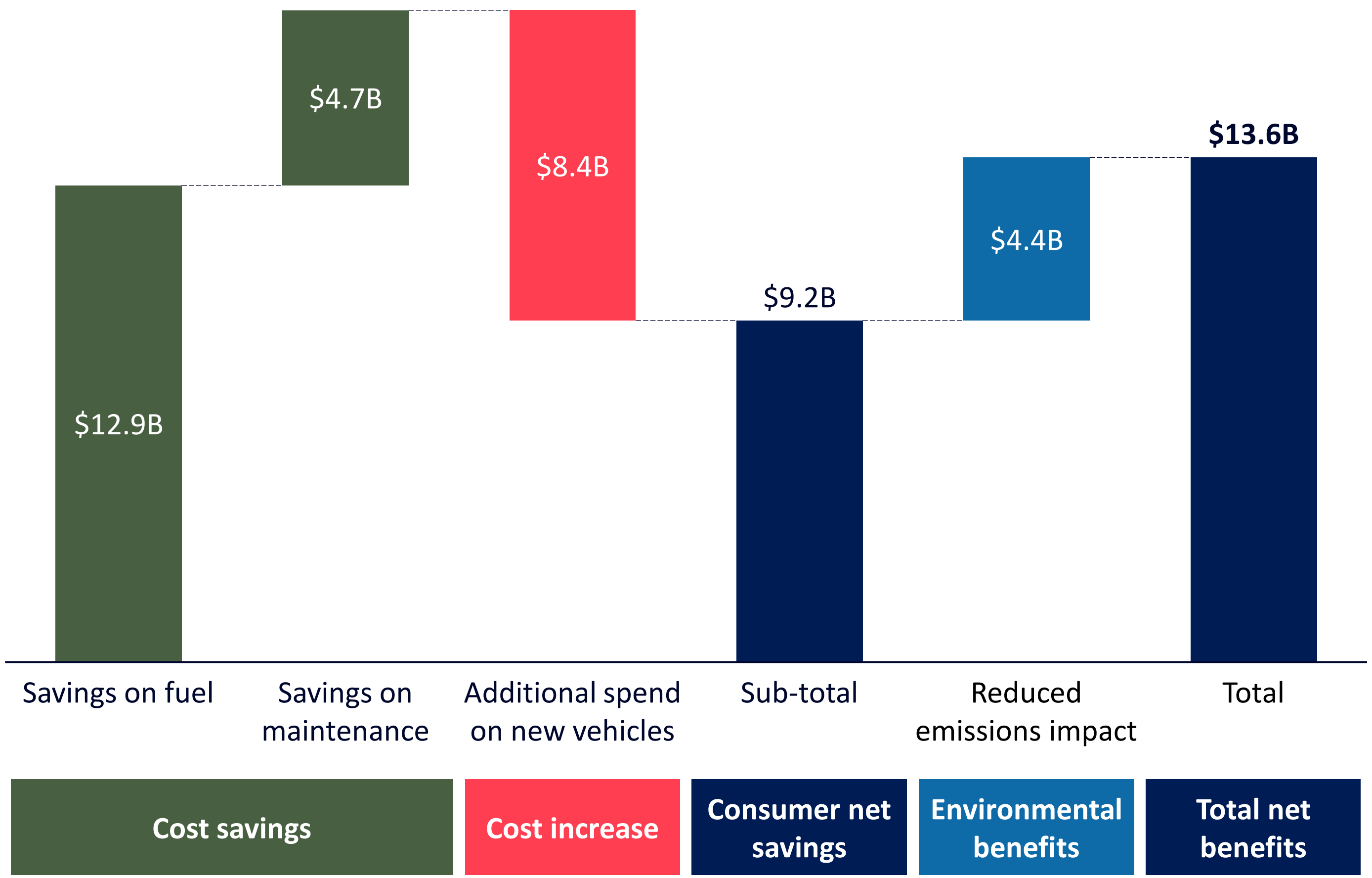
Consumers purchasing a new vehicle in the globally competitive case could experience $9.2 billion in net savings from the NVES. With access to more efficient vehicles under the NVES, consumers could save up to $12.9 billion on fuel costs. Meanwhile, consumers purchasing an EV will benefit from maintenance costs that are almost 50 per cent lower relative to ICE vehicles, generating $4.7 billion in savings for these consumers. Consumers will also spend an additional $8.4 billion on new vehicles due to price changes. The NVES will increase ICE vehicle prices and increase the supply of EVs, changing the composition of new vehicles. As this occurs, spending by all consumers on EVs will increase, and will only be partially offset by lower spending on ICE vehicles in total (as the number of new ICE vehicle sales decrease). As EV prices move closer ICE vehicle prices, this impact will be minimised, and eliminated once parity is achieved.

Australians will also benefit from reduced harm from emissions and pollutants due to the NVES. By 2035, the NVES will prevent up to 31 million tonnes of pollutants from being emitted, creating a benefit of $4.4 billion from reduced environmental and health impacts.

1 Globally competitive case

Exhibit 11: Net present value of consumer benefits from the NVES in Australia[1]

$AU billions, 2023-2035



1 Net present value is calculated with a discount rate of 7 per cent per year.
Source: Mandala analysis.

Taking a more modest approach would deliver net savings of $10.3 billion for consumers up to 2035

Total net savings for Australians could decrease by $3.2 billion to $10.3 billion by 2035 in the fast follower case. This is driven by the delay in the NVES catching up to global peers (by 2035 instead of 2030).

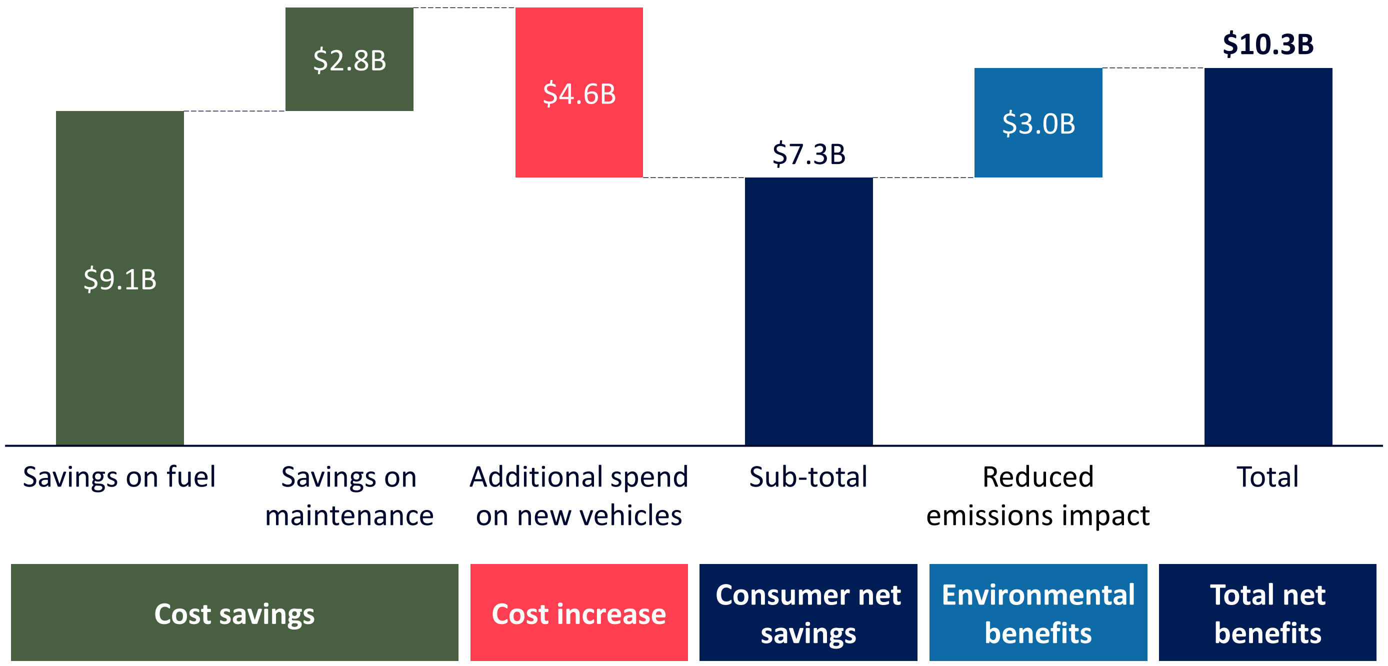
In the fast follower case, all consumers purchasing new vehicles could be $7.3 billion better off by 2035 due to the NVES. Consumers could save up to $9.1 billion on fuel as vehicles become more efficient, and $2.8 billion on cheaper maintenance costs. Consumers will spend an additional $4.6 billion on new vehicles by 2035.

In the fast follower case, Australians will benefit up to $3 billion of reduced environmental and health impacts. This is from avoiding 24 million tonnes of pollutants by 2035.

2 Fast follower case

Exhibit 12: Net present value of consumer benefits from the NVES in Australia[1]

$AU billions, 2023-2035



1 Net present value is calculated with a discount rate of 7 per cent per year.
Source: Mandala analysis.

Allowing for a longer transition will generate $8.9 billion of benefits for consumers by 2035

In the slow follower case, Australia's standards match the rate of improvement in the US up to 2032, and then improves significantly to close the gap to global peers by 2035. This requires greater effort in the latter years of the NVES. The slow follower case could generate up to $8.9 billion in total net benefits for Australians by 2035.

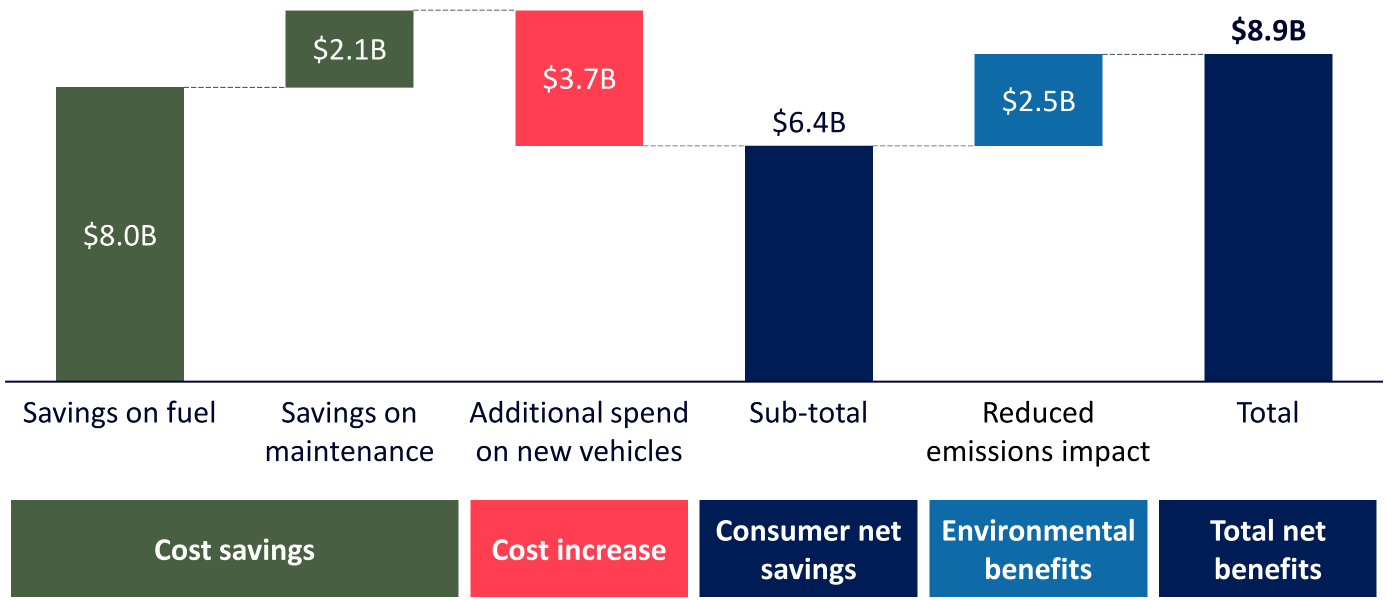
Consumers purchasing new vehicles could save a total of $6.4 billion. The NVES will improve the efficiency of existing vehicles to generate $8 billion in fuel cost savings, as well as another $2.1 billion in maintenance costs for consumers purchasing a new EV. In the slow follower case, consumers will spend in total an additional $3.7 billion to purchase new vehicles.

By 2035, the NVES will also reduce the total emissions from new vehicles by 21 million tonnes, creating a benefit of $2.5 billion for Australians due to reduced harm from emissions and pollutants.

3 Slow follower case

Exhibit 13: Net present value of consumer benefits from the NVES in Australia[1]

$AU billions, 2023-2035

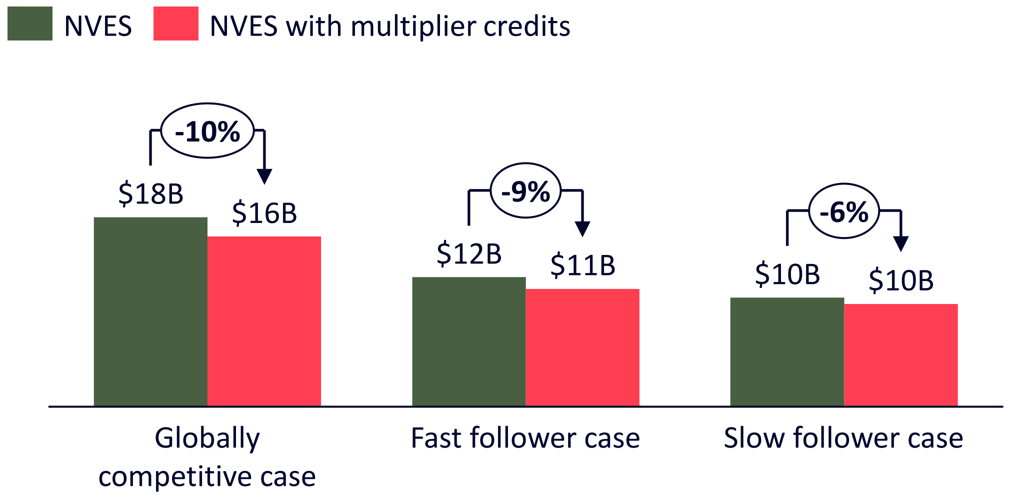


1 Net present value is calculated with a discount rate of 7 per cent per year.
Source: Mandala analysis.

Implementing concessions, such as multipliers, can dilute cost savings by 10%

Exhibit 14: Impact of multiplier credits on fuel and maintenance savings

$AU billions, 2023-2035



Multiplier credits have been used by global peers to encourage innovation and improve efficiency of new vehicles. This mechanism increases the weight attributed to low and zero emission vehicles (LZEVs) when calculating the average fleet emissions intensity. While this approach encourages vehicle suppliers to produce LZEVs, it reduces the number of efficient vehicles required to offset the emissions intensity of high polluting vehicles. This effectively dilutes the benefits of an efficiency standard over the long-term. The US and EU currently have a multiplier credit in place, but are phasing this out in 2024 and 2025 respectively.

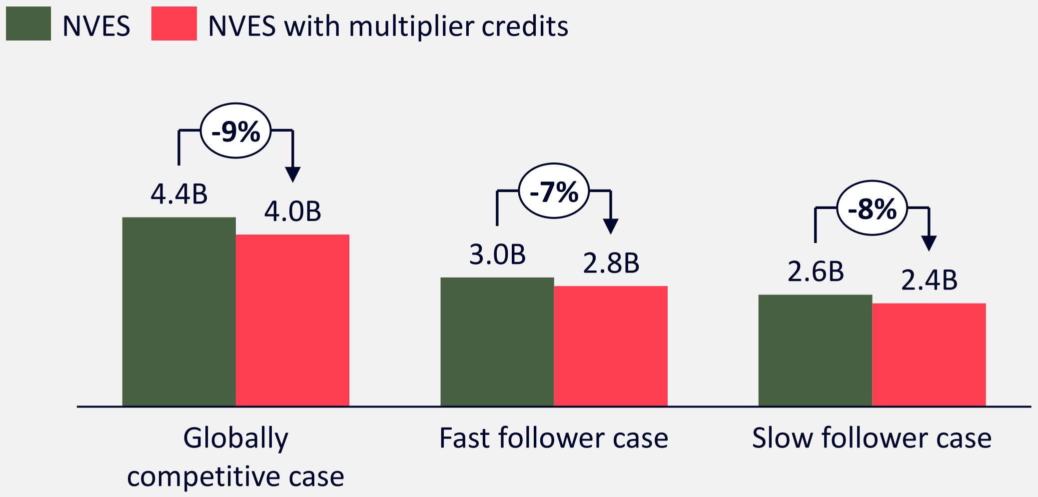
Introducing a multiplier credit on zero emission vehicles in Australia can reduce fuel and maintenance savings by $2 billion, or 10 per cent, by 2035. This also has a significant impact on environmental benefits, with $0.4 billion of environmental benefits forgone by 2035 (9 per cent).

Note: The impact of multiplier credits is modelled using a multiplier of 2 for all passenger and light commercial vehicles from 2023 until 2026. See Appendix B for more details and sensitivity analysis on alternative applications of multiplier credits.
Source: Mandala analysis.

While also diluting the environmental benefits of the NVES by up to 9%

Exhibit 15: Impact of multiplier credits on environmental benefits

$AU billions, 2023-2035



Source: Mandala analysis.

1 Australia needs a strong NVES to catch up to its global peers and cut costs for motorists

2 A strong standard will improve the efficiency of new vehicles and increase the supply of electric vehicles

3 An effective and competitive standard can save consumers up to $10,000 over a vehicle’s lifetime, and deliver up to $13.6 billion in benefits for Australians by 2035

Appendices

A: International standards

B: Supplementary analysis

C: Detailed methodology

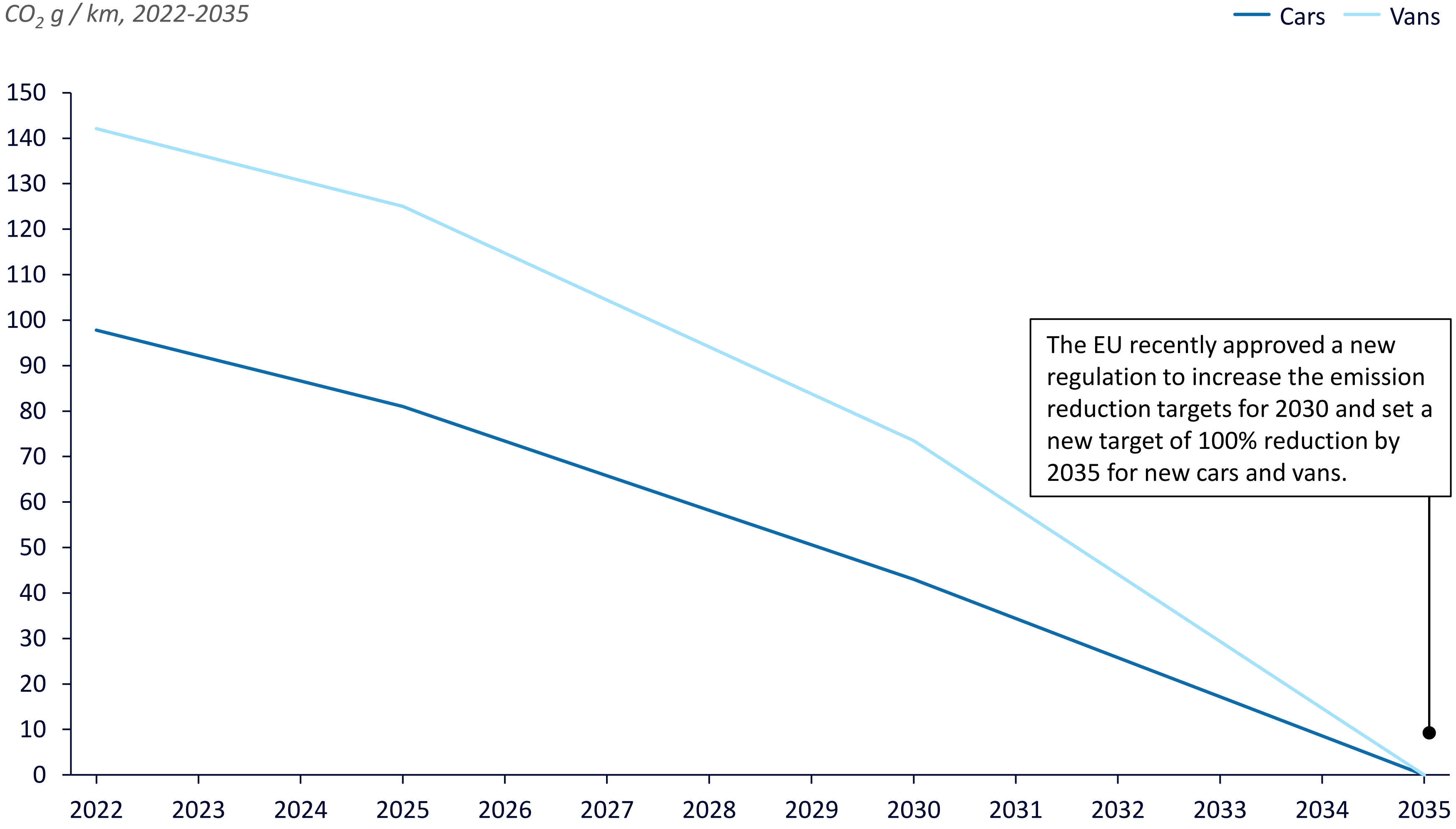
The EU has the strongest standard, with new legislative targets requiring new vehicles sold from 2035 onwards to be zero-emission vehicles

Exhibit 16: Overview of EU standard

- New vehicle efficiency standards for light vehicles were first mandated in 2012 for the EU.
- The EU standards have separate targets for passenger and light commercial vehicles.
- The targets for manufacturers are determined by limit curves based on the mass of the vehicle.
- However, in March 2023 the EU approved new legislation requiring all new cars and vans sold in 2035 onwards to be zero-emission vehicles – this was introduced in 'Fit for 55 package', a set of legislative proposals to reduce the EU's GHG emissions by at least 55% by 2030.

European Union new vehicle efficiency standard by vehicle type

CO_2 g / km, 2022-2035



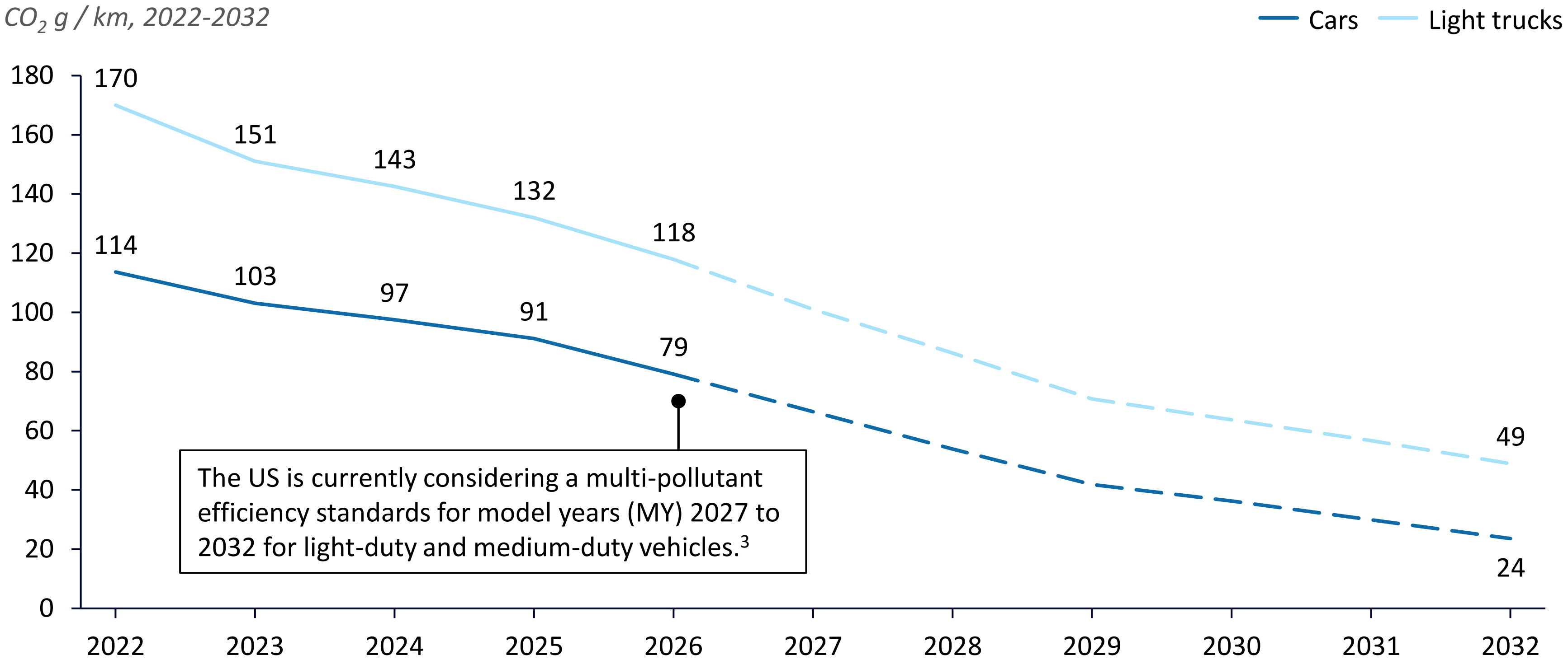
Note: New vehicle efficiency standards are standardised to NEDC measurements (CO_2 g/ km).
Source: Mandala analysis.

The US has deployed two regulations to collectively improve fuel efficiency and reduce emissions, and is currently considering new standards up to 2032

Exhibit 17: Overview of US standard

- The US regulates the efficiency standards of vehicles through two key programs:
  - The Corporate Average Fuel Efficiency (CAFE) standards set by the National Highway Traffic Safety Administration (NHTSA) for manufacturers to achieve certain fuel economy levels for their fleet.[1]
  - GHG standards set by the Environmental protection Agency to require manufacturers to meet levels of CO_2 and other emissions released by their fleet.[2]
- These standards apply two footprint-based limit curves which become more stringent each year.

US new vehicle efficiency standard by vehicle type



1 The CAFE standards were first introduced in 1975 and were subsequently updated in 1985, 2007 and most recently in 2022.
2 The GHG emission standards were first introduced in 2012 and were subsequently updated in 2020. The most recent version was announced in 2022.
3 Emission targets have only been defined up until 2026. The new emission standards being considered for 2026 onwards have been adjusted (upward) from the targets shown above by 20 g/mile for cars; 24 g/mile for trucks and 22g/mile for the fleet to normalise as a point of comparison to reflect the reduced available off-cycle and AC credits as proposed from 2027 onwards. Targets have been converted from grams per mile to grams per kilometre.
Note: New vehicle efficiency standards are standardised to NEDC measurements (CO_2 g/ km).
Source: Department of Transportation (2022) *Corporate Average Fuel Economy Standards for Model Years 2024-2026 Passenger Cars and Light Trucks*; EPA (2022) *Greenhouse Gas Emissions from a Typical Passenger Vehicle*; EPA (2023) *Final Rule to Revise Existing National GHG Emissions Standards for Passenger Cars and Light Trucks Through Model Year 2026*; EPA (2023) *Regulations for Greenhouse Gas Emissions from Passenger Cars and Trucks*; EPA (2021) *Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards*; EPA (2023) *Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light- Duty and Medium-Duty Vehicles*; NHTSA (2022) *Corporate Average Fuel Economy*; NHTSA (2022) *USDOT Announces New Vehicle Fuel Economy Standards for Model Year 2024-2026*; The International Council on Clean Transportation (2021) *US passenger vehicle CAFE and GHG regulations: The Basics*; Mandala analysis.

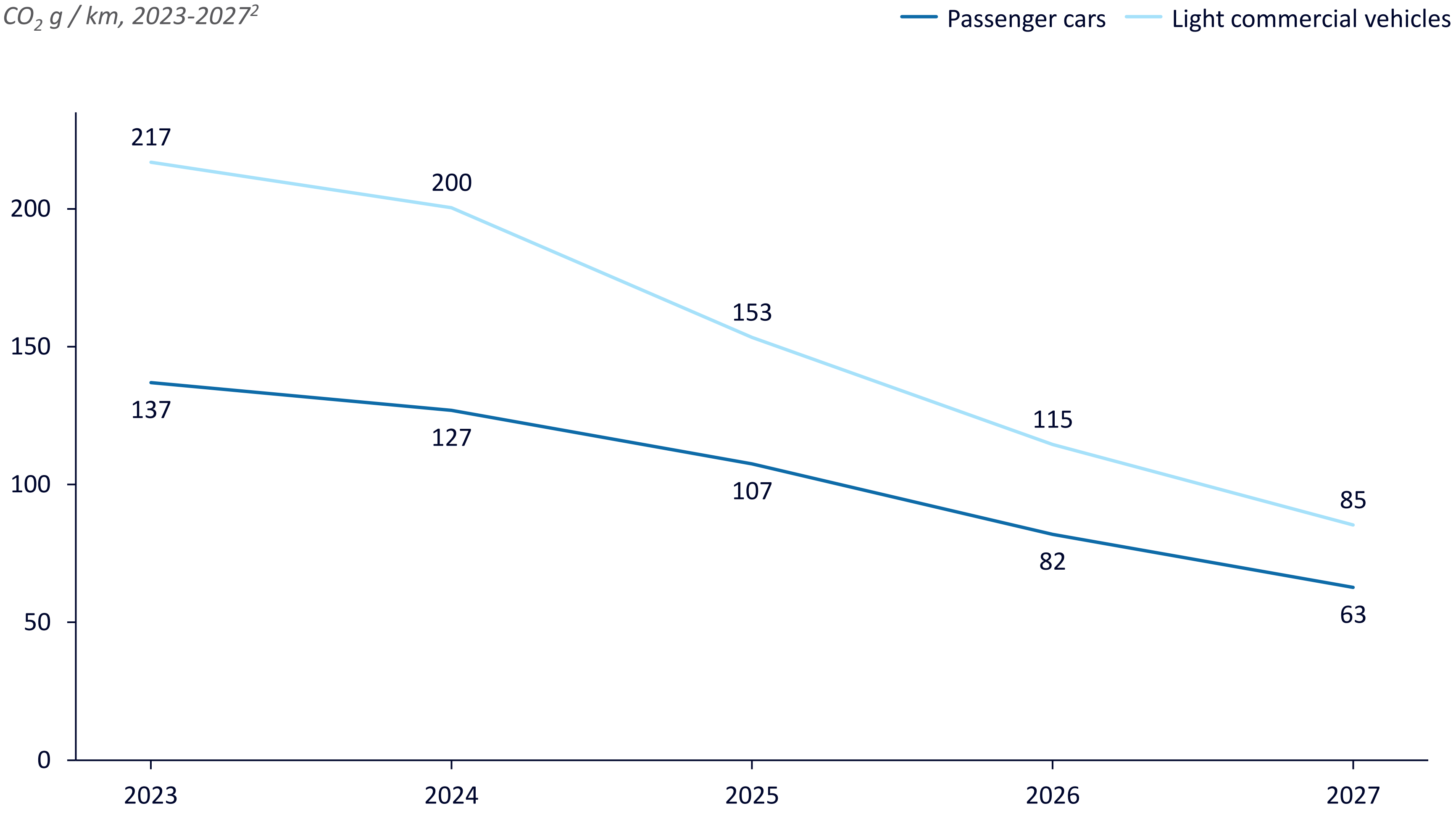
New Zealand enforced the ‘Clean Car Standards’ to take effect from 2023, requiring manufacturers to adhere to limit curves based on vehicle weight

Exhibit 18: Overview of NZ standard

- A mandatory fuel efficiency standard was legislated in 2022, due to come into effect from 2023 – the ‘Clear Car Standards’ (CCS).
- The CCS applies separate weight-based limit curves for passenger and light commercial vehicles; these standards become more stringent each year.
- These standards apply to new and second-hand vehicle imports.
- The New Zealand standard allows credits to be accrued for surpassing the standard, carried forward, carried back or traded with other manufacturers
- However, the New Zealand standard does not offer any technology (off-cycle) based credits.

New Zealand new vehicle efficiency standard by vehicle type[1]

CO_2 g / km, 2023-2027[2]



Note: As of June 2023, New Zealand emissions targets have been set up to 2027. New vehicle efficiency standards are standardised to NEDC measurements (CO_2 g/ km).
Source: Mandala analysis.

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Appendices

The NVES can reduce CO_2 emissions by 31 million tonnes and bring health benefits by reducing air pollutants

Vehicles emit a variety of emissions, such as CO_2, alongside other air pollution such as CO, NO_x and particulate matter.

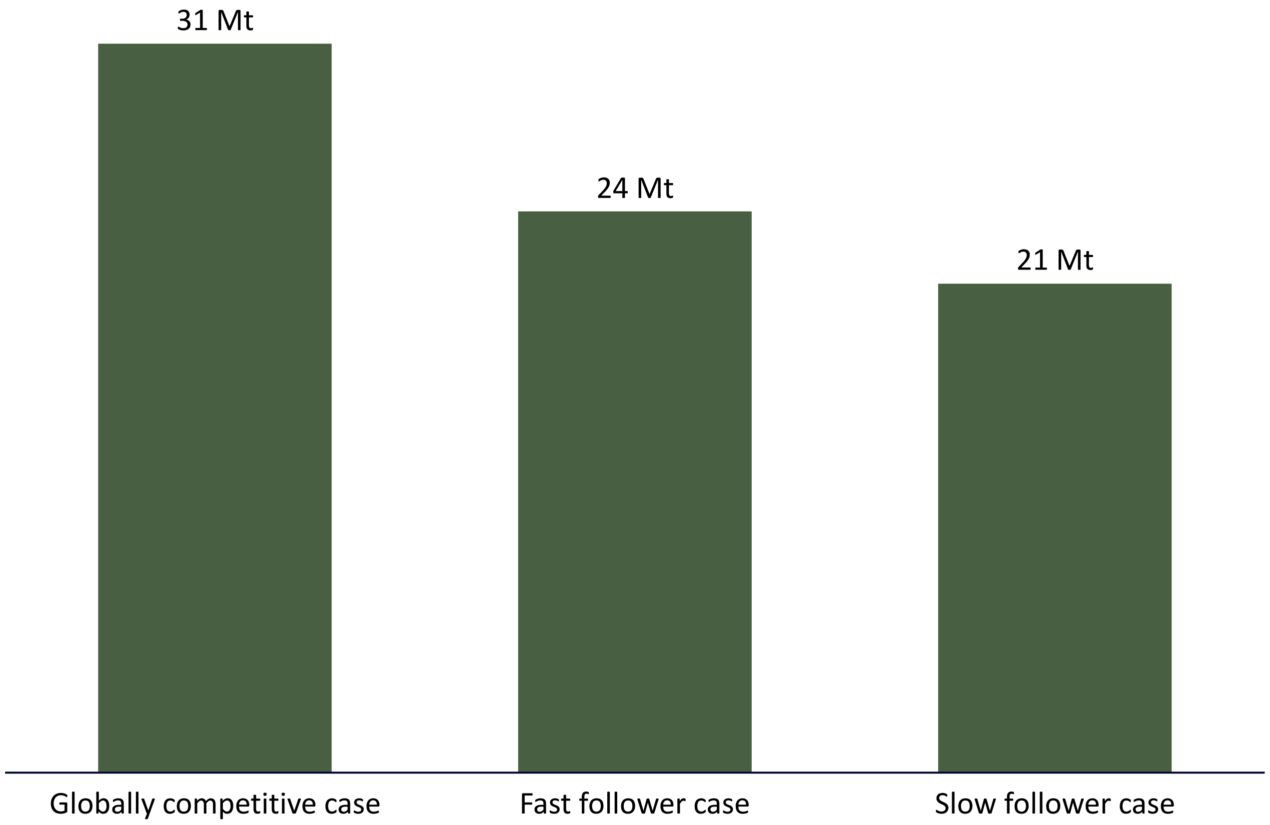
CO_2 contributes to adverse changes in agricultural productivity, human health, property damages (e.g., from increased flood risks) and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning.[1]

Under each scenario, we expect to see reductions in the amount of CO_2 emitted. In the globally competitive case, up to 31 million tonnes of CO_2 will be avoided. Meanwhile, under the fast follower and slow follower cases, up to 24 million tonnes and 21 million tonnes of CO_2 will be avoided.

These reductions in CO_2 will also be accompanied by reductions in other air pollutants emitted by passenger and light commercial vehicles.[3]

Exhibit 19: Total reduction in CO_2 emissions from the NVES by scenario

Millions of tonnes, 2023-2035

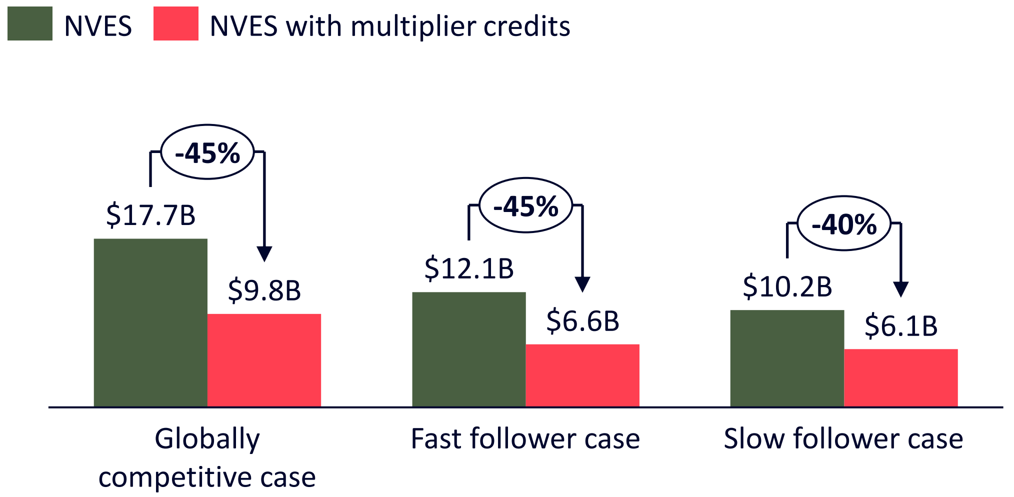


1 EPA (June 2022) *Greenhouse Gas Emissions from a Typical Passenger Vehicle*.
2 NSW Treasury (2023) *NSW Government Guide to Cost-Benefit Analysis*.
3 Ministry for the Environment (New Zealand) *Health and air pollution in New Zealand 2016*, see also Austroads (2014) *Updating Environmental Externalities Unit Values*.
Source: Mandala analysis.

An ongoing multiplier of three can dilute consumer savings by 40-45%

Exhibit 20: Impact of multiplier credits on fuel and maintenance savings

$AU billions, 2023-2035



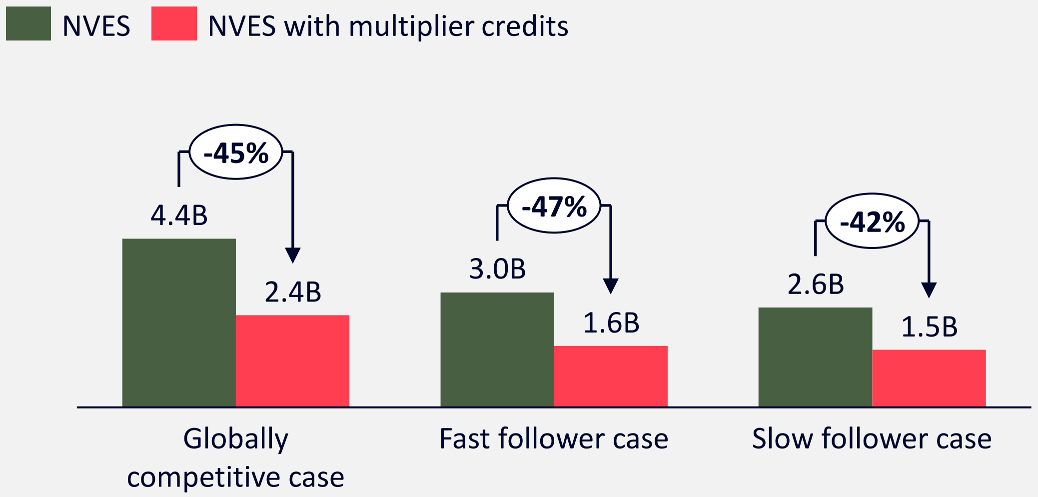
This report conducted sensitivity analysis to understand the potential impact for a range of multiplier credits. To do this, we considered a stronger multiplier of three for all zero-emission (0 CO_2 g/km) passenger and light commercial vehicles from 2023 to 2032. This reflects the current application of multiplier credits under the FCAI voluntary standard.

Note: The impact of multiplier credits is modelled based on a multiplier of 3 for all zero-emission passenger and light commercial vehicles from 2023 until 2032.
Source: FCAI (2020) *CO_2 Standard: Rules for Calculating Brand Targets and Assessing Brand Compliance*; Mandala analysis.

This also dilutes the environmental benefits by 42-47%

Exhibit 21: Impact of multiplier credits on environmental benefits

$AU billions, 2023-2035



Introducing a multiplier of three on zero-emission vehicles in Australia can reduce fuel and maintenance savings by $7.9 billion, or 45 per cent, by 2035 in the globally competitive case. This also has a significant impact on environmental benefits, with $2 billion of environmental benefits forgone by 2035 (45 per cent reduction) in the globally competitive case.

Source: FCAI (2020) *CO_2 Standard: Rules for Calculating Brand Targets and Assessing Brand Compliance*; Mandala analysis.

Australian Governments have already deployed a range of measures to improve the uptake of low and zero emission vehicles

Exhibit 22: Overview of key policies for low and zero emission vehicles

	Target	Financial incentives	Infrastructure	Key Policies
AUS	×	✓	✓	• **Financial incentives:** amendments to fringe benefits tax, import duty and CEFC green car loans • **Infrastructure**: building a national charging network on major highways
NSW	✓	✓	✓	• **Target**: 50% of new car sales being EVs by 2030-31 • **Financial incentives:** removal of stamp duty, rebates for EVs and small business incentives • **Infrastructure:** $209M for charging infrastructure
VIC	✓	✓	✓	• **Target:** 50% of light vehicle sales to be ZEVs by 2030 • **Financial incentives:** ZEV subsidy of $3,000[1] • **Infrastructure:** $19M for charging infrastructure
QLD	✓	✓	✓	• **Target:** 50% of new passenger vehicle sales to be zero emissions by 2030 and 100% by 2036 • **Financial incentives:** purchase subsidies, reduced annual and vehicle registration duty costs for EV • **Infrastructure:** $10M for charging infrastructure co-funding scheme, $12M for charging infrastructure
SA	✓	✓	✓	• **Target**: 100% new car and van sales by 2040 and by no later than 2035 in leading markets • **Financial incentives:** purchase subsidies, reducing registration costs • **Infrastructure:** funding a charging network at 52 locations
ACT	✓	✓	✓	• **Target:** 80-90% of new light vehicle sales being zero emissions vehicles in 2030 • **Financial incentives:** stamp duty exemptions, lower registration costs, zero interest loans • **Infrastructure:** build 180+ chargers by 2025, grants for building EV chargers
WA	×	✓	✓	• **Financial incentives:** rebates on EV purchases • **Infrastructure:** $22.9M to install charging stations at 49 locations, $15M grant to install chargers
TAS	×	✓	×	• **Financial incentives:** stamp duty waiver, registration cost waiver
NT	×	✓	×	• **Financial incentives:** removal of stamp duty, reducing registration costs

1 The Government of Victoria announced in early June 2023 that the ZEV subsidy will be removed at the end of FY23 instead of at the end of May 2024.

Source: DITRDCA (2023) *The Fuel Efficiency Standard – Cleaner, Cheaper to Run Cars for Australia: Consultation Paper*; Desktop research; Mandala analysis.

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Appendices

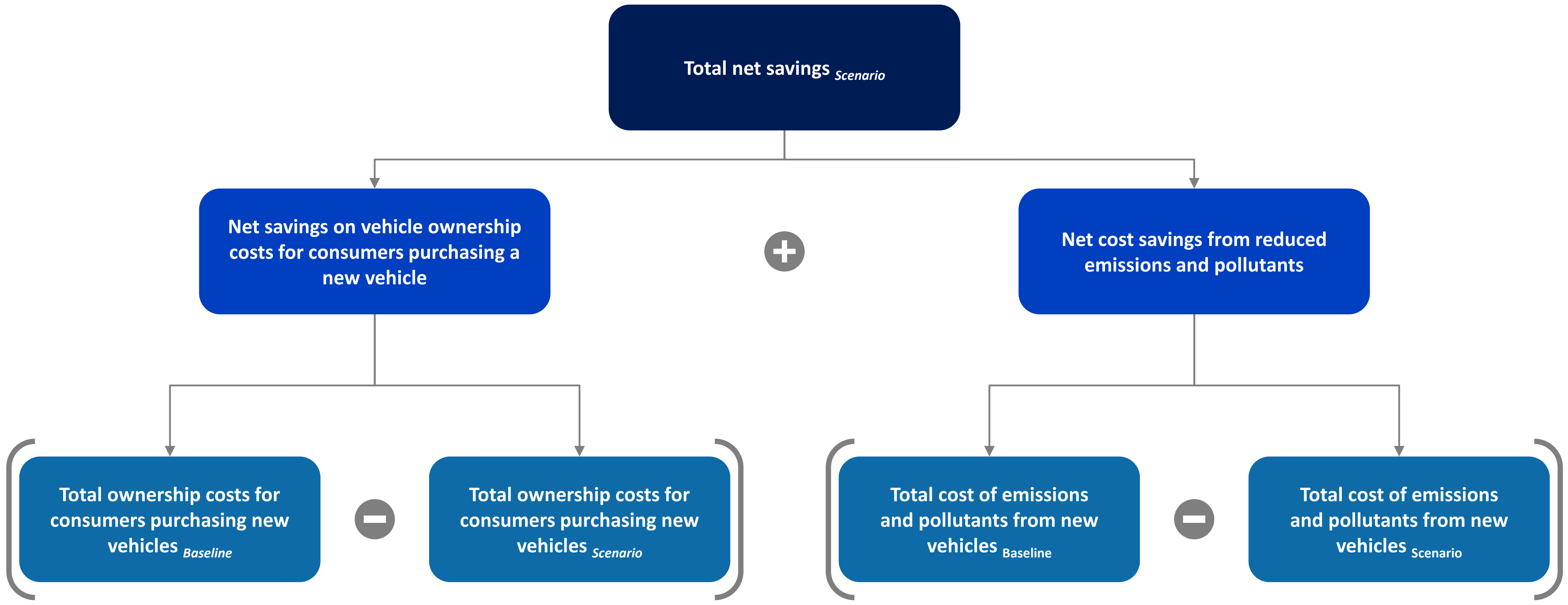
A: International standards

B: Supplementary analysis

C: Detailed methodology

The savings for each scenario were calculated as the savings on vehicle expenditure for consumers purchasing a new vehicle and the cost savings from reduced emissions

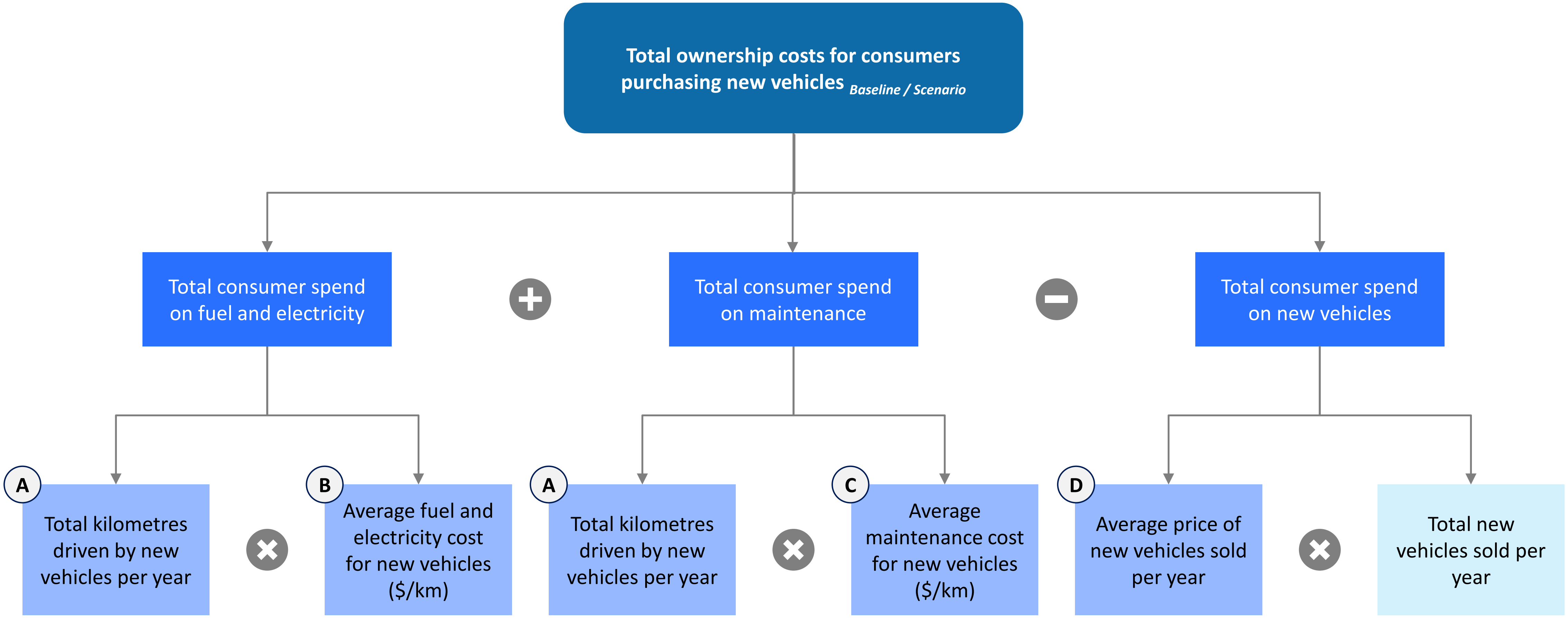
Exhibit 23: Methodology to derive the net savings of the NVES to Australian consumers



Source: Mandala analysis.

Method for calculating total expenditure by consumers purchasing new vehicles

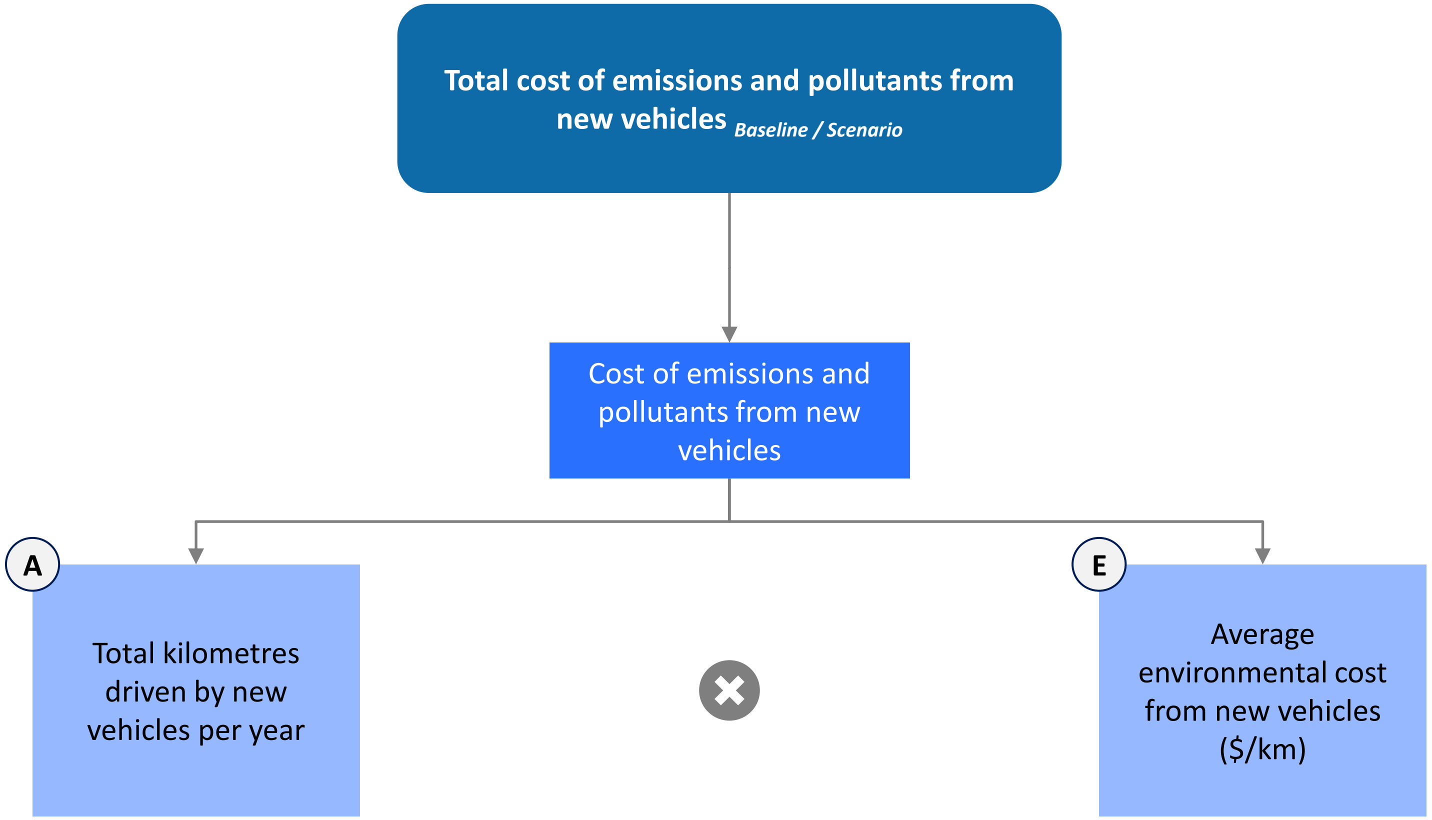
Exhibit 24: Methodology to derive total expenditure on new vehicles by Australian consumers



Source: Mandala analysis.

Method for calculating total cost of emissions and pollutants from new vehicles

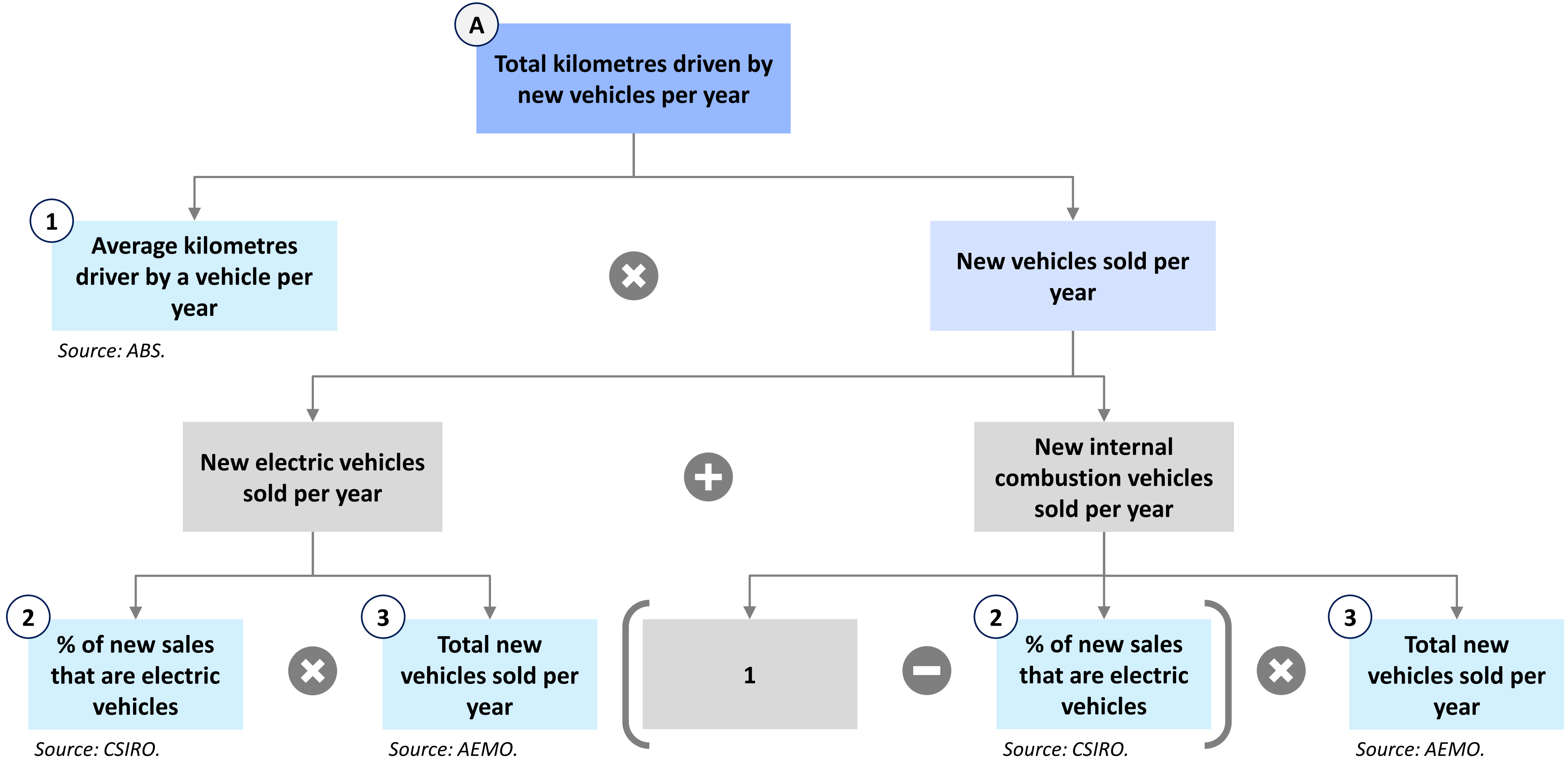
Exhibit 25: Methodology to derive total cost of emissions and pollutants from new vehicles



Source: Mandala analysis.

Method for calculating modelling inputs (I/V)

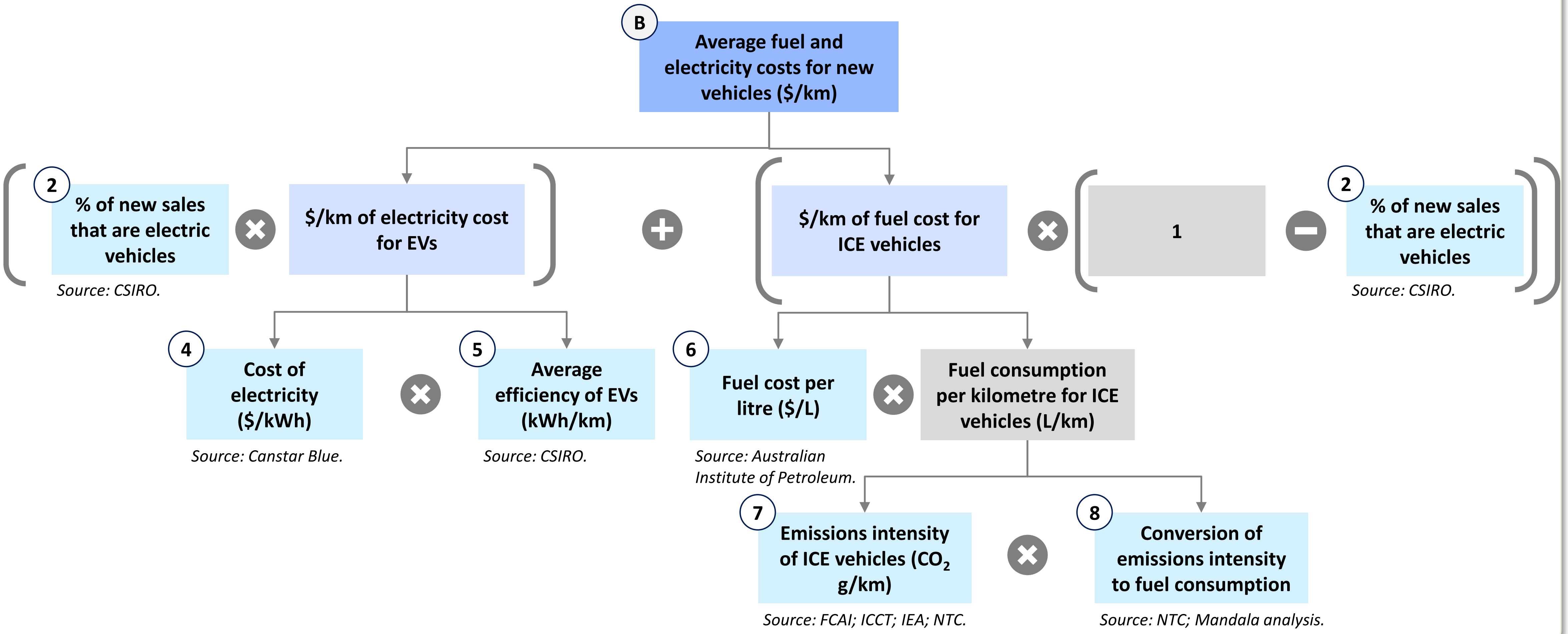
Exhibit 26: Methodology to derive total kilometres driven by new vehicles



Source: Mandala analysis.

Method for calculating modelling inputs (II/V)

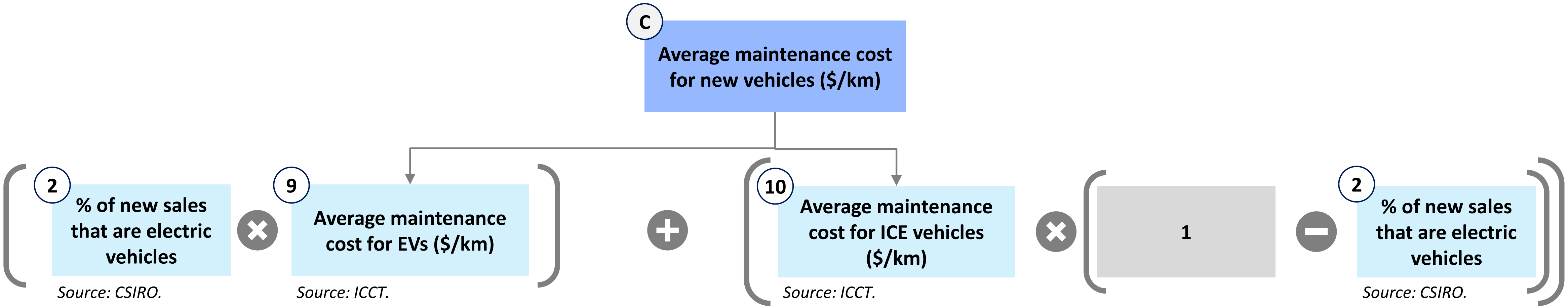
Exhibit 27: Methodology to derive average fuel and electricity costs for new vehicles



Source: Mandala analysis.

Method for calculating modelling inputs (III/V)

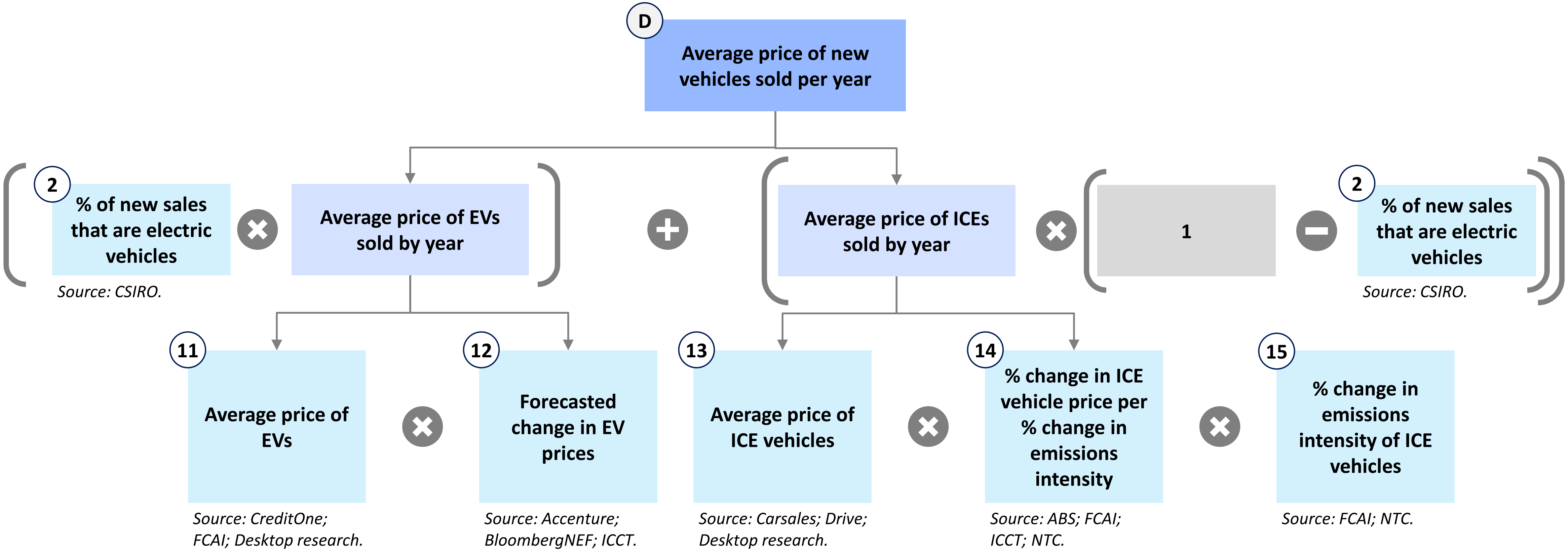
Exhibit 28: Methodology to derive average maintenance costs for new vehicles



Source: Mandala analysis.

Method for calculating modelling inputs (IV/V)

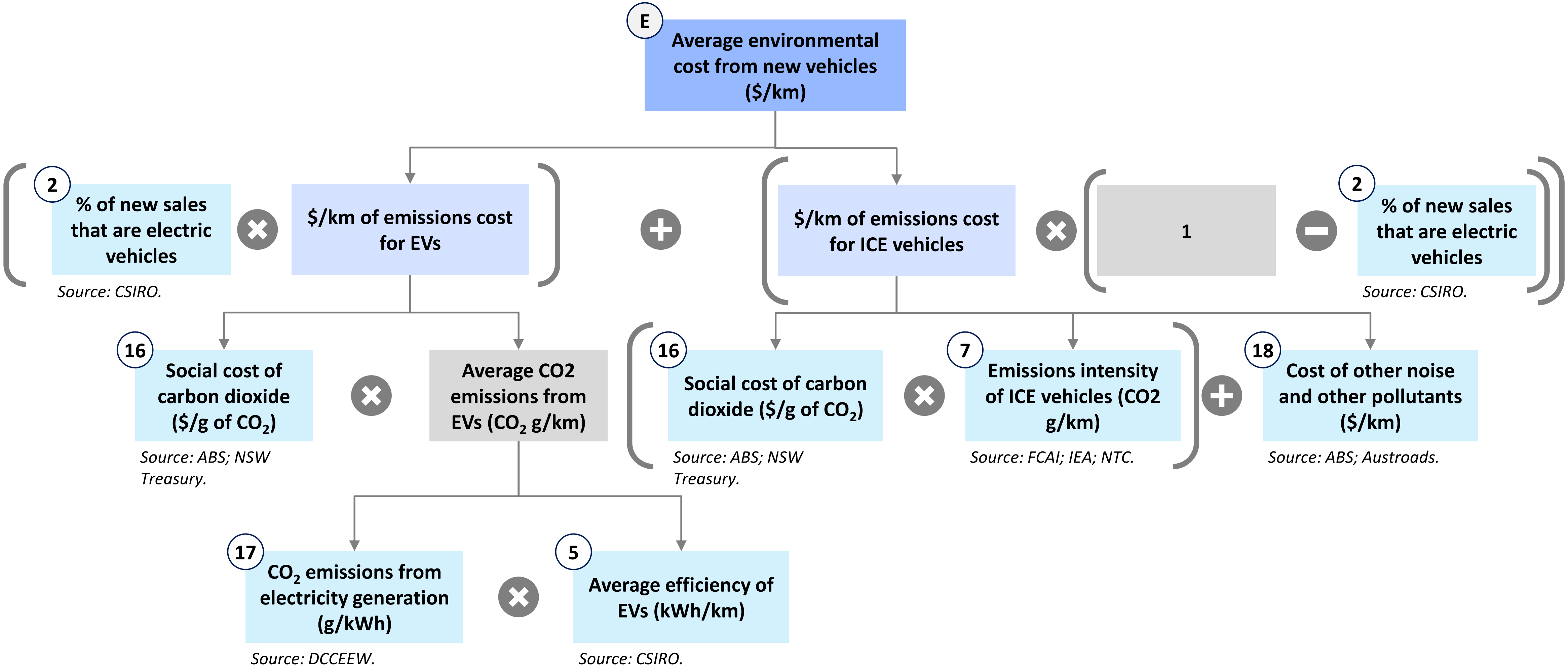
Exhibit 29: Methodology to derive average price of new vehicles



Source: Mandala analysis.

Method for calculating modelling inputs (V/V)

Exhibit 30: Methodology to derive average environmental costs from new vehicles



Source: Mandala analysis.

Key inputs, assumptions and data sources for calculating the net impact of the NVES on Australian consumers (I/VI)

Exhibit 31: Key inputs, assumptions and sources

Metric		Assumptions	Source
1	**Average kilometres driver by a vehicle per year**	**Baseline:** ▪ 12,000 kilometres travelled for passenger vehicles, and 16,000 for light commercial vehicles (for both EVs and ICE vehicles). ▪ Assumed no change year-on-year. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ ABS (2020) *Survey of Motor Vehicle Use*.
2	**Percentage of new sales that are electric vehicles**	**Baseline:** ▪ Based on the 'Progressive Change' scenario from CSIRO modelling. **NVES scenarios:** ▪ New EV sales were forecasted under each scenario by estimating the number of EVs required to be sold to ensure Australia met the emissions intensity required by the NVES. ▪ ICE vehicles were assumed to improve by 3% per year. See ***Metric 7*** for more detail.	▪ CSIRO (November 2022) *Electric vehicle projections 2022*.
3	**Total new vehicles sold per year**	**Baseline:** ▪ The total new vehicles sold per year was determined using AEMO's year-on-year forecasts of the Australian vehicle fleet. ▪ It was assumed the total number of cars sold was equal to the increase in vehicles plus the vehicle turnover calculated based on an average vehicle lifespan of approximately 22 years. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ AEMO (2021) *Detailed Electric Vehicle Databook*.
4	**Cost of electricity ($/kWh)**	**Baseline:** ▪ $0.25 per kWh ▪ Assumed no change year-or-year. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ Canstar Blue (April 2023) *Average Electricity Prices in Australia per kWh*.

Source: Mandala analysis.

Key inputs, assumptions and data sources for calculating the net impact of the NVES on Australian consumers (II/VI)

Exhibit 32: Key inputs, assumptions and sources

	Metric	Assumptions	Source
5	**Average efficiency of EVs (kWh/km)**	**Baseline:** ▪ 2020: Car 0.217 kWh/km; Light Commercial 0.235 kWh/km ▪ 2030: Car 0.204 kWh/km, Light Commercial 0.221 kWh/km **NVES scenarios:** Assumed to be the same as the Baseline.	▪ CSIRO (November 2022) *Electric vehicle projections 2022*.
6	**Fuel cost per litre ($/L)**	**Baseline:** ▪ Fuel price of $1.80 per litre. ▪ Assumed no change year-on-year. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ Australian Institute of Petroleum (May 2023) *Weekly Petrol Prices Report*.
7	**Emissions intensity of ICE vehicles (CO_2 g/km)**	**Baseline:** ▪ Emissions intensity for ICE vehicles were assumed to be 146 g/km for passenger vehicles and 213 g/km for light commercial vehicles in 2022 ▪ Historical averages from the past decade were used to forecast efficiency improvements: 1.5% p.a. reduction for passenger vehicles and 0.6% p.a. for light commercial vehicles. **NVES scenarios:** ▪ 2022 values assumed to be the same as the Baseline. ▪ Forecasts assume a 3% p.a. improvement from 2023 across all scenarios based on assumptions used by the ICCT in their modelling of a potential NVES in Australia.	▪ FCAI (2022) *Monitoring CO2 emissions from passenger cars and light commercial vehicles in 2022*. ▪ ICCT (2022) *Fuel efficiency standards to decarbonize Australia's light-duty vehicles*. ▪ International Energy Agency (2023) *Global EV Data Explorer*. ▪ National Transport Commission (2021) *Carbon Dioxide Emissions Intensity for New Australian Light Vehicles 2021*.
8	**Conversion of emissions intensity to fuel consumption**	**Baseline:** ▪ Developed a linear regression based on data from the National Transport Commission to estimate the fuel consumption of vehicles based on their emissions intensity. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ National Transport Commission (2021) *Carbon Dioxide Emissions Intensity for New Australian Light Vehicles 2021*. ▪ Mandala analysis.

Source: Mandala analysis.

Key inputs, assumptions and data sources for calculating the net impact of the NVES on Australian consumers (III/VI)

Exhibit 33: Key inputs, assumptions and sources

	Metric	Assumptions	Source
9	**Average maintenance cost for EVs ($/km)**	**Baseline:** ▪ Assumed a maintenance cost of $0.034 per kilometre for electric vehicles. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ International Council on Clean Transportation (2022) *Assessment of Light-Duty Electric Vehicle Costs and Consumer Benefits in the United States in the 2022-2035 Time Frame*.
10	**Average maintenance cost for ICE vehicles ($/km)**	**Baseline:** ▪ Assumed a maintenance cost of $0.065 per kilometre for ICE vehicles. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ International Council on Clean Transportation (2022) *Assessment of Light-Duty Electric Vehicle Costs and Consumer Benefits in the United States in the 2022-2035 Time Frame*.
11	**Average price of EVs**	**Baseline:** ▪ Current average price for a passenger EV is assumed to be $65,900 based on the weighted average price of the top 10 models sold in Australia. ▪ Current average price for a light commercial EV is assumed to be $93,000 based on the weighted average price of the top 10 models sold in Australia. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ CreditOne (2023) *Australia's Highest-Selling Electric Cars 2022*. ▪ FCAI (2023) *2022 EV Report*. ▪ Desktop research.

Source: Mandala analysis.

Key inputs, assumptions and data sources for calculating the net impact of the NVES on Australian consumers (IV/VI)

Exhibit 34: Key inputs, assumptions and sources

Metric		Assumptions	Source
12	**Forecasted change in EV prices**	**Baseline:** ▪ Forecasted change in EV prices is assumed to be approximately 2.8% reduction per year ▪ This is based on analysis conducted by the International Council of Clean Transport. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ Accenture (2021) *Future Charge: Building Australia's Battery Industries*. ▪ BloombergNEF (2020) *Battery Pack Prices Cited Below $100/kWh for the First Time in 2020, While Market Average Sits at $137/kWh*. ▪ International Council on Clean Transportation (2022) *Assessment of Light-Duty Electric Vehicle Costs and Consumer Benefits in the United States in the 2022-2035 Time Frame*.
13	**Average price of ICE vehicles**	**Baseline:** ▪ Current average price for an ICE passenger vehicle is assumed to be $50,700 based on the weighted average price of the top 10 models sold in Australia ▪ Current average price for an ICE light commercial vehicle is assumed to be $61,100 based on the weighted average price of the top 10 models sold in Australia. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ Carsales (2022) *Best Dual-Cab 4x4 Ute 2022: The verdict*. ▪ Drive (2023) *Best Utes*. ▪ Drive (2023) *VFACTS December 2022: Toyota HiLux sales highest since Holden Commodore and Ford Falcon two decades ago*. ▪ Desktop research.

Source: Mandala analysis.

Key inputs, assumptions and data sources for calculating the net impact of the NVES on Australian consumers (V/VI)

Exhibit 35: Key inputs, assumptions and sources

Metric		Assumptions	Source
14	**Percentage change in vehicle price per percentage change in efficiency (ICE vehicles only)**	**Baseline:** ▪ Assumes ICE vehicle prices increase by approximately 0.8% for every 1% increase in vehicle efficiency. This is based on historical change in emissions intensity and vehicle prices over the past decade (between 2013 and 2022). ▪ This translates to a price increase of approximately 1.1% per year on the average ICE vehicle price. **NVES scenarios:** ▪ Across all scenarios, assumes ICE vehicle prices increase by approximately 0.5% for every 1% increase in vehicle efficiency. This is based on existing modelling completed by the International Council of Clean Transport that estimates the cost of additional technology to comply with the US fuel standards, assuming ICE vehicles emissions intensity falls by 3% per year. ▪ This translates to a price increase of approximately 1.4% per year on the average ICE vehicle price – only 0.3% increase relative to the Baseline.	▪ ABS (April 2023) *Consumer Price Index, Australia*. ▪ FCAI (2022) *Monitoring CO2 emissions from passenger cars and light commercial vehicles in 2022*. ▪ International Council on Clean Transportation (2022) *Assessment of Light-Duty Electric Vehicle Costs and Consumer Benefits in the United States in the 2022-2035 Time Frame*. ▪ National Transport Commission (2021) *Carbon Dioxide Emissions Intensity for New Australian Light Vehicles 2021*.
15	**Percentage change in emissions intensity of ICE vehicles**	**Baseline:** ▪ Assumes ICE vehicle efficiencies will improve as they have historically. Based on improvements over the past decade, emissions intensity were assumed to fall 1.5% p.a. for passenger vehicles and 0.6% p.a. for light commercial vehicles. ▪ See ***Metric 7*** for more detail. **NVES scenarios:** ▪ Forecasts assume a 3% p.a. improvement from 2023 across all scenarios based on assumptions used by the ICCT in their modelling of a potential NVES in Australia. ▪ See ***Metric 7*** for more detail.	▪ FCAI (2022) *Monitoring CO2 emissions from passenger cars and light commercial vehicles in 2022*. ▪ National Transport Commission (2021) *Carbon Dioxide Emissions Intensity for New Australian Light Vehicles 2021*.

Source: Mandala analysis.

Key inputs, assumptions and data sources for calculating the net impact of the NVES on Australian consumers (VI/VI)

Exhibit 36: Key inputs, assumptions and sources

Metric		Assumptions	Source
16	**Social cost of carbon dioxide (\$/g of CO_2)**	**Baseline:** ▪ Current estimates of a social cost of carbon is approximately \$130 per tonne, adjusted for inflation, and increases to \$158 by 2033 (adjusted for inflation). ▪ Forecasts from 2033 onwards are based on an increase of approximately 2.25% per year. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ NSW Treasury (2023) *Technical note to NSW Government Guide to Cost-Benefit Analysis*.
17	**CO_2 emissions from electricity generation (g/kWh)**	**Baseline:** ▪ Emissions from electricity generate are approximately 0.68 tonnes of CO_2 per MWh as of 2022. ▪ As Australia transitions to renewable energy, this is forecasted to fall to 0.26 tonnes of CO_2 per MWh by 2030. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ DCCEEW (2022) *Australia's emissions projections 2022*.
18	**Cost of other noise and other pollutants (\$/km)**	**Baseline:** • Estimates from 2013 assume that costs from non-CO_2 pollutants are approximately \$0.01 per kilometre travelled, and costs from noise pollution are approximately \$0.002 per kilometre travelled. • These estimates have been adjusted for inflation to represent values for 2023 onwards. **NVES scenarios:** Assumed to be the same as the Baseline.	▪ ABS (April 2023) *Consumer Price Index, Australia*. ▪ Austroads (2013) *Updating Environmental Externalities Unit Values*.

Source: Mandala analysis.

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