INTERNATIONAL IMPLEMENTATION OF VEHICLE EMISSIONS STANDARDS

A

Mandatory vehicle emissions or fuel economy standards have been operating for at least a decade in the US, Japan and China. Many countries are accelerating their rate of emissions intensity improvement with successive standards.

All countries allow varied targets across the light vehicle fleet that are based on an attribute such as vehicle mass or size. None applies a flat standard to which all vehicles must comply regardless of size or weight. In addition, soon all four major markets (the US, the EU, China and Japan) will take a flexible, corporate-average approach to standards, with Japan switching to fleet averaging for its 2020 target.

The detail of standard design varies across developed and emerging markets. The US and EU have more flexible yet more administratively complex designs, including trading or pooling arrangements, and have financial penalties for non-compliance. All major markets have at least some flexibility mechanisms (such as banking and borrowing arrangements) that lower the costs to suppliers of meeting targets.

A.1 INTRODUCTION

This appendix provides an overview of the implementation of vehicle emissions standards in other jurisdictions, including the approaches other countries have taken to each of the key design issues for standards. Understanding how standards have been implemented elsewhere provides a useful input into standard design for Australia.

Over 70 per cent of light vehicles sold in the world today are subject to vehicle emissions standards (CCA 2014a, p. 164). In several cases, including the US, Japan and China, mandatory standards have been operating for at least a decade. The share of vehicles covered by standards is expected to grow, with standards currently under investigation in emerging markets such as Indonesia and Thailand (ICCT 2014).

Standards have been introduced around the world to contribute to energy affordability, energy security and emissions reduction objectives. The US first introduced light vehicle fuel economy standards in the 1970s as part of its response to oil price shocks. After an initial period of improvement, the standards were static for decades, but were reinvigorated in 2012 with the joint objectives of improving fuel economy and reducing CO_2 emissions. The EU has focused on reducing emissions as part of a broader climate change strategy and introduced mandatory targets in 2009 after previous voluntary targets were not met (EC 2009, L 140/2).

The countries analysed in this appendix account for the majority of the global vehicle market and have implemented, or committed to implement, mandatory vehicle emissions standards. The analysis focuses on the top four markets—the EU, the US, Japan and China—which together make up about 68 per cent of global vehicle sales (OICA 2014). Other countries are discussed where relevant.

The rest of this appendix:

- provides an overview of standards in other countries
- discusses the design choices other countries have made and the reasons for their choices.

A.2 OVERVIEW OF STANDARD DESIGN AND AMBITION IN OTHER COUNTRIES

Table A.1 and Figure A.1 summarise passenger vehicle emissions standards in major countries. They show:

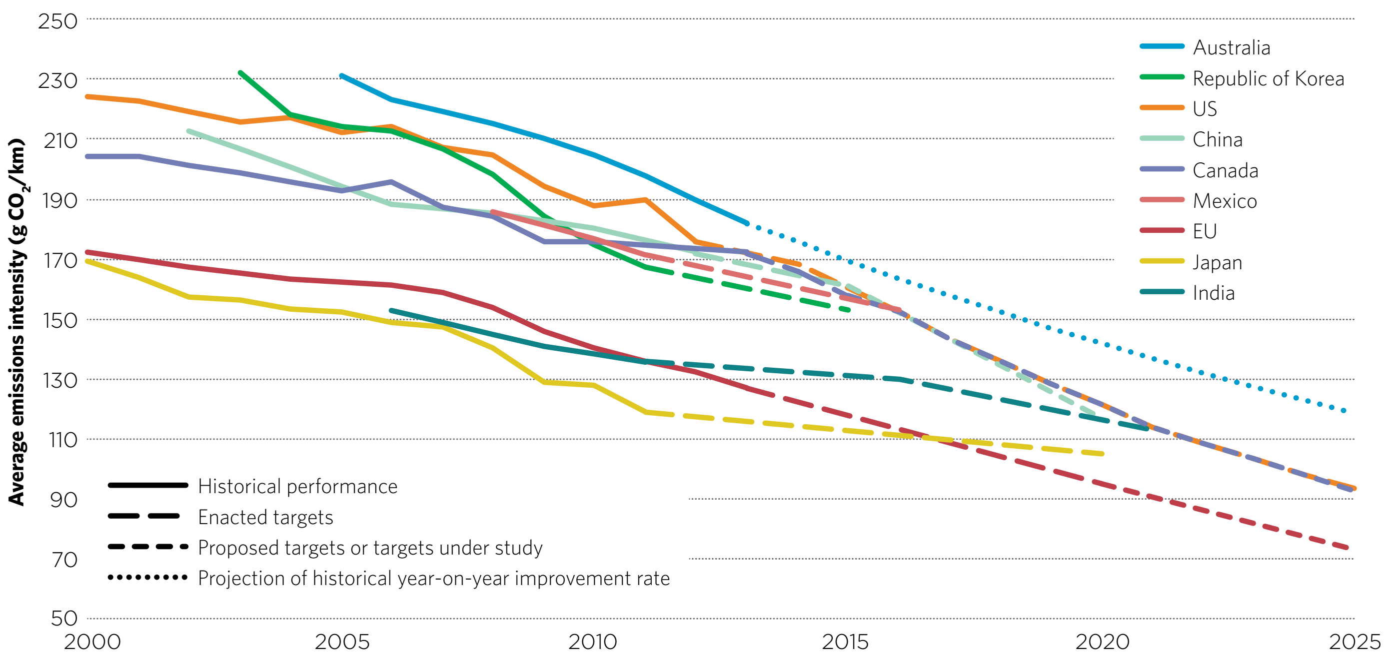
- The EU, the US, Japan and India have targets to at least 2020, with the US and EU having legislated and proposed targets to 2025, respectively. China has legislated targets to 2015 and proposed a 2020 target. Canada has a target for 2016 and has proposed regulations that more or less mirror the US's 2025 target, although they have not yet been adopted.
- The legislated basis of the standard differs between countries. Standards are applied in two forms—as a limit on either greenhouse gas emissions (GHGs) per distanced travelled or fuel consumption per distanced travelled. Some countries are motivated to implement standards to reduce fuel use, some CO_2 emissions, and some both. The direct physical relationship between the two means that both will be achieved regardless.
- Over the period to 2020, the EU and Japan have the most ambitious standards in absolute terms. Standards in China and the US capitalise on the faster rates of reduction possible when starting with a less efficient fleet; their 2020 standards are expected to take these nations from efficiency levels similar to Australia's to levels much closer to the global leaders.
- Countries with the largest vehicle markets, including the US and China, will have to accelerate their average improvement to meet their 2020 targets. The US will need to more than double its historical rate of improvement of 1.9 per cent per year to meet its 2020 target, and China will have to almost triple its historical rate of 2.1 per cent to meet its proposed 2020 target. The EU achieved its 2015 target two years early (EC 2014a); it will still have to improve by 4.1 per cent per year to meet its 2020 target, stepping up to 6.5 per cent per year to meet its proposed 2025 goal. Japan achieved its 2015 target four years early and thus requires a much lower annual reduction rate of 1.4 per cent to meet its 2020 target.
- This general increase in global ambition means that the gap between Australia and others could widen. Between 2009 and 2013, Australia's new passenger vehicle emissions fell at an annualised rate of 3.5 per cent per year—faster than some other major countries. As discussed in Chapter 3, it is difficult to project the extent to which more ambitious standards elsewhere will raise the rate of improvement of Australia's new light vehicle emissions in the absence of standards here. It is reasonable to expect Australia will benefit to some extent, given it already imports almost all its light vehicles, and will become a full importer after 2017. However in the absence of standards, Australia could continue to miss out on the most efficient models and not keep pace with improvements elsewhere. Even if Australia's new passenger vehicle efficiency continued to improve at the rate of the past five years, it would still lag behind other major countries (Figure A.1).

TABLE A.1: GLOBAL COMPARISON OF STANDARDS FOR PASSENGER VEHICLES

JURISDICTION AND FIRST COMPLIANCE YEAR	BASIS FOR STANDARD	FUTURE TARGET YEAR/S	EQUIVALENT CO_2 TARGET (g CO_2/km)	EQUIVALENT FUEL ECONOMY TARGET (L/100km)	ANNUALISED PERCENTAGE REDUCTION (DURING EACH COMPLIANCE PERIOD)^	ANNUALISED PERCENTAGE REDUCTIONS (VARIOUS HISTORICAL PERIODS)
EU 2009	CO_2 emissions	2015 2020* 2025**	130 95 68-78**	5.6 4.1 2.9-3.3	Achieved in 2013 4.1 3.9-6.5	2000-09: 1.8 2009-13: 3.4
United States 1975	Fuel economy and GHG	2020 2025	121 93	5.2 4.0	5.1 5.1	2000-13: 1.9
Japan 1985	Fuel economy	2015 2020	125 105	5.3 4.5	Achieved in 2011 1.4	2000-11: 3.2
Republic of Korea 2006	Fuel economy and GHG	2015	153	6.5	2.2	2003-11: 4.0
China 2004	Fuel economy	2015 2020**	161 117**	6.9 5.0	2.3 6.2	2002-12: 2.1
India 2016	CO_2 emissions	2016 2021	130 113	5.6 4.8	1.2 2.8	2006-12: 1.9
Canada 2011	GHG	2016 2025**	147 93**	6.3 4.0	5.2 5.0	2000-13: 1.3
Mexico 2012	Fuel economy and GHG	2016	153	6.5	3.8	2008-11: 2.6

Note: CO_2 emissions and fuel economy for all standards normalised to European test cycle (NEDC). The coverage of 'passenger vehicles' differs by country—SUVs are included in the EU, Japan, Korea, China and India, and covered under 'light trucks' in North America. All countries except Korea and India also have targets for light commercial vehicles (or light trucks). ^For current compliance periods, annualised rate of reduction is calculated from 2013; EU 2020 target is calculated from 2013; Japan 2020 target is calculated from 2011; India 2016 target is calculated from 2012. *This target has a one-year phase-in period; 95 per cent of vehicles must comply by 2020 and 100 per cent by 2021. **Denotes target proposed or in development; Canada follows the US 2025 target in its proposal, but the final target value would be based on the projected fleet footprints. GHG is greenhouse gases.
Source: Adapted from ICCT 2014 and official sources listed under References

FIGURE A.1: PASSENGER VEHICLE CO_2 EMISSIONS INTENSITY, SELECTED COUNTRIES, 2000–25



Note: CO_2 emissions and fuel economy for all standards normalised to European test cycle (NEDC). The coverage of 'passenger vehicles' differs by country; SUVs are included in the EU, Japan, Republic of Korea, China and India, and covered under 'light trucks' in North America and Mexico. The EU met its 2015 target in 2013, so the EU trajectory to its next target year (2020) is a straight line from actual 2013 new passenger vehicle emissions intensity to the 2020 target; Japan, which met its 2015 target in 2011, has a similar approach. EU 2025 target is a mid-point between proposed targets of between 68 and 78 g CO_2/km. The BAU projection for Australia is the rate of passenger vehicle improvement recorded from 2009–13 (3.5 per cent).
Source: Adapted from ICCT 2014 and, for Australia, NTC 2014

A.3 DESIGN FEATURES FOR VEHICLE EMISSIONS STANDARDS—INTERNATIONAL PRACTICE

Chapter 5 set out the design choices that Australia must make to implement a standard. This section summarises the practices in other jurisdictions to help inform Australia's choices. There is some variation in the design of vehicle emissions standards in other countries, and both the similarities and differences between countries are informative for Australia. As standards are implemented in both developed and emerging markets, much of the variation reflects different appetites for more flexible but potentially more administratively complex designs; there is also evidence of convergence across countries on some major issues such as a fleet-average approach to standards. Table A.2 at the end of this appendix provides a detailed comparison between the top four light vehicle markets of each of these design choices.

A.3.1 COVERAGE AND LIABILITY

A.3.1.1 COVERAGE

All light vehicle emissions standards applied in other countries cover passenger vehicles at a minimum; most also cover light commercial vehicles. Upper weight limits are usually set to differentiate passenger vehicles and light commercial vehicles from heavy trucks and coaches. The classification and delineation of vehicle boundaries differs between countries. For example, larger vehicles such as four-wheel drive and sports utility vehicles (SUVs) are classified as passenger vehicles in some countries and as light trucks or light commercial vehicles in others.

All countries analysed that have targets for both passenger vehicles and light commercial vehicles (or light duty trucks) have 'split' targets. Under split targets, the light commercial vehicle category, which is usually larger and/or heavier, has a higher emissions intensity level target than passenger vehicles. Other countries regulate passenger vehicles only and have an upper weight limit. While split targets recognise the practical differences between different vehicles, the same outcome can be achieved under a single target (see Chapter 5 for further discussion).

A.3.1.2 LIABILITY AND EXEMPTIONS

Vehicle manufacturers are generally vertically integrated global businesses and, in each of the schemes analysed, liability rests with the domestic parent company, or manufacturer's agent, rather than (say) distributors, individual factories or sales offices. The EU permits suppliers to 'pool' their fleets to meet a combined target. Many countries have exemptions for small manufacturers and some exempt particular types of low-emissions vehicles.

In the EU and US, weaker targets are available for manufacturers producing small volumes of cars, which are applied upon application. In addition, in the US, those with fewer than 1,000 employees are automatically exempt from liability.

A.3.2 STANDARD DESIGN AND MEASUREMENT

A.3.2.1 ATTRIBUTE OPTIONS

All countries analysed have adopted an attribute-based approach, where the target for a vehicle is defined relative to a vehicle attribute. The two types of attribute used are vehicle mass (the weight of the vehicle) or vehicle size (usually measured as 'footprint'). While mass is more strongly correlated to fuel consumption, footprint is considered to better relate to consumer utility, and facilitates a more technology-neutral approach to compliance (see Chapter 5).

The EU, the US and China have implemented corporate average targets, so a manufacturer can produce new vehicles that fall short of the standard if they also produce models that surpass it. Japan will move to a corporate average approach for its 2020 target.

- The EU uses a mass-based corporate average target for each supplier. The EU did consider a footprint approach for its 2020 targets, but continued with the mass attribute due to limited availability of footprint data at the time the standard was set. It recommended that the footprint attribute should be considered in a future review (EC 2014b, L 103/15).
- North American countries have adopted a footprint-based approach to corporate average targets.
- Japan currently uses an approach that sets mass targets by class, but is shifting to mass-based corporate average targets for its 2020 target (Government of Japan 2011). The current system identifies the most fuel-efficient automobile in each weight class and designates it the 'top runner'. Fuel consumption targets are then set at the level of the top runner. All other vehicles are required to surpass the new target values for their weight class within three to 10 years.
- China has corporate average mass-based targets. It adopted a corporate average approach in 2012 for its Phase III standards to 2015, and is expected to use the same approach for its 2020 target. The IEA has reported concerns that a shift to heavier vehicles is occurring under the current approach (IEA 2012b, p. 26). As discussed in Chapter 5, mass-based standards can remove the incentive to reduce vehicle weight to comply with standards.

A.3.2.2 BASIS OF STANDARD AND CO_2 EMISSIONS AND FUEL CONSUMPTION TESTING

The major countries with standards in place use the data from laboratory testing of CO_2 emissions and fuel consumption to underpin the standards. Varying types of laboratory testing are used around the world, but in each country a single test is used for CO_2 emissions and fuel economy standards, as well as for testing compliance with air quality standards. The two main test types are the New European Drive Cycle (NEDC) and the US Federal Test Procedure (FTP-75). The EU, Australia, China and India use the EU test; the US, Korea, Canada and Mexico use the US test. Both are 'combined cycle' tests; that is, CO_2 emissions and fuel consumption of each model are measured under simulated urban and non-urban conditions and the results are combined.

A.3.3 TIMING AND COMPLIANCE

A.3.3.1 TIMING

There are a number of different options for compliance, with a spectrum ranging from annual to periodic compliance; other variations, such as cumulative compliance over a number of years, are also possible. The US requires annual compliance with its targets, and China set specific interim targets between 2012 and 2015 under its Phase III standards. The EU and Japan do not have interim targets for their 2015 and 2020 targets, although the EU recently announced a one-year phase-in period for its 2020 target (EC 2014b). The periodic approach does not mandate an annual rate of improvement. The US approach has provisions for banking and trading (see below) that assist in allowing annual targets to be met at least cost.

A.3.3.2 FLEXIBILITY MECHANISMS—BANKING, BORROWING AND TRADING

All major markets have some flexibility mechanisms that lower the costs to suppliers of meeting targets:

- The US permits liable parties to bank previously accrued credits and trade excess credits with other parties (within specified time frames). It also allows liable parties to borrow from future years to meet compliance obligations.
- The EU standards allow manufacturers to 'pool' their emissions under certain conditions, which in effect is like a trading system.
- Under its Phase III standards, China allows banking of excess credits achieved in a compliance year and they can be used within the phase period (2012–15).
- Japan currently allows manufacturers to 'pass' credits between their own models in different weight classes. For example, credit given for a model that surpasses its weight-class target can be passed to a model in another weight class to help meet its target.

Additional incentives are used in other countries to encourage the supply of more efficient vehicles.

'Multipliers' are awarded to vehicles that satisfy low-emissions benchmarks or use specific technologies or fuels claimed to reduce CO_2 emissions relative to conventional vehicles. Technology or fuel-specific adjustments apply in the US, China and the EU. In the US, multipliers for specified alternative drivetrains start at 2.0 in 2017 and decline to 1.5 by 2021. In the EU, the target for vehicles capable of using 85 per cent ethanol (E85) is reduced by 5 per cent. Multipliers for vehicles below a specific low-emissions benchmark are given to vehicles in the EU and China. For example, the EU awards 'super-credits' for sub-50 g CO_2/km vehicles. These started at 3.5 in 2012 and decline each year to zero additional credit by 2016; they will start again at 2.0 in 2020, declining to zero additional credit in 2023.

'Off-cycle' credits are awarded for emissions-reducing technologies whose contributions are measurable but not covered by test cycles. The EU and US award off-cycle credits for technologies such as efficient lights, solar panel charging and active aerodynamics. The US also awards credits for improvements to air-conditioning systems. The emissions intensity of eligible models is effectively reduced by the number of credits they receive, making the standard easier to achieve. Limits are applied in both the EU and US, largely because of limited data about, and difficulties in testing, the emissions performance of these technologies.

A.3.3.3 PENALTIES

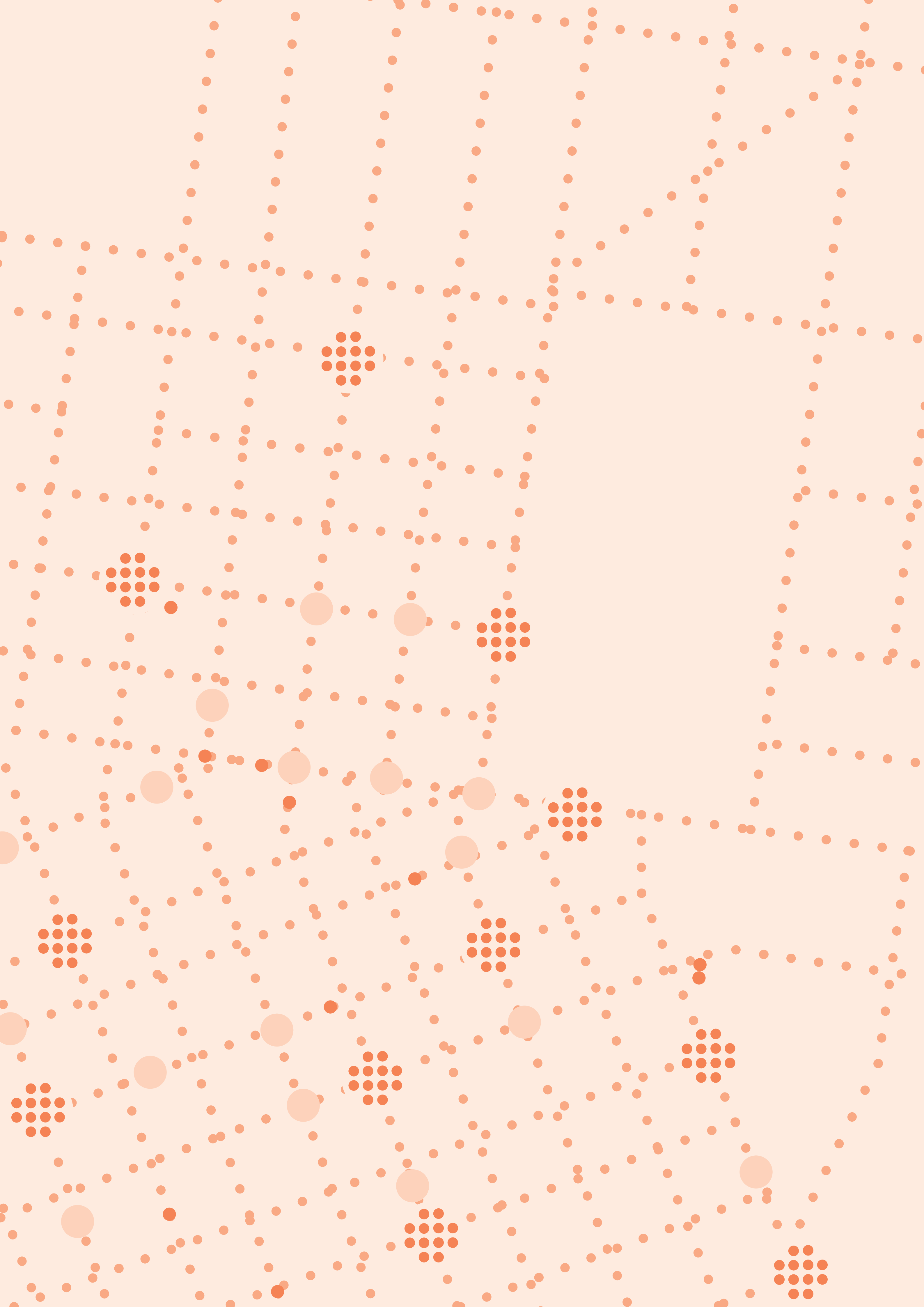
All countries with standards employ some type of penalty for non-compliance, with the form and stringency of penalties varying across countries.

- In the US and EU, a financial penalty applies and is based on each unit (g CO_2 per km or mile) over the target, multiplied by every non-compliant model sold by a manufacturer (in the US) or all models sold by a manufacturer (in the EU).
- Financial penalties are lower in Japan with a penalty of ¥1 million (about AUD$10,800), which is not tied to the extent of non-compliance. Suppliers are also required to announce publicly that they have failed to meet the target.
- There are no financial penalties in China; manufacturers are punished through a large loss of flexibility in future compliance. If a manufacturer does not achieve its corporate-average target in a given year, models that do not meet their individual weight-based target cannot be sold the next year. In addition, as in Japan, suppliers are required to publicly announce non-compliance.

TABLE A.2: COMPARISON OF VEHICLE EMISSIONS STANDARD DESIGN FEATURES IN TOP FOUR MARKETS

COUNTRY	BASIS OF STANDARD	COVERAGE	LIABILITY	TARGET; APPROACH	TEST PROCEDURE	TIMING	FLEXIBILITY—BANKING, BORROWING AND TRADING	PENALTIES	ADDITIONAL CREDITS AND OTHER INCENTIVES
EU	CO_2	Passenger (includes SUVs), light commercial vehicles	• <10,000 vehicles produced can apply for a derogation (partial or full exemption) • 5% higher target for E85 vehicles • Manufacturer pooling allowed	Split; vehicle mass	NEDC	Periodic	Manufacturers are allowed to pool together to meet a combined target	€95 for each gram above target multiplied by all models sold. Called 'excess emissions premium'	• Multipliers for vehicles under 50 g CO_2/km of 3.5 down to 1 between 2012 and 2016, and 2 down to 1 between 2020 and 2023 • Can apply for 'eco-innovations' up to 7 g CO_2/km—e.g., LEDs, advanced alternators, improved battery systems
United States	Fuel economy and GHG	Passenger, Light-duty trucks (includes SUVs)	• <50,000 vehicles can apply for less stringent targets until 2016, and transitional leniency until 2021 • <5,000 vehicles produced can be exempt at least until 2017 • <1,000 employees default exemption	Split; vehicle footprint	US combined	Annual	Credits may be carried forward or banked up to 5 years, or carried back 3 years to cover a deficit (see 'penalties')	US$5.50 for each 10th of a mpg of each new vehicle sold above target. The ability to 'carry back' credits (see 'banking') effectively means penalties can be avoided if deficits are made up within 3 years	• Plug-in hybrid electric vehicles (PHEVs) zero carbon-rated • Multiplier for alternative drivetrain vehicles of 2 down to 1.5 between 2017 and 2021 • Additional credit for improvements to AC systems • Off-cycle credits given for solar panel charging, engine start-stop or active aerodynamics. Pre-approved list for 2014 and later
Japan	Fuel economy	Passenger		Split; vehicle mass	JC08	Periodic	Suppliers can 'pass' credits between their own models in different weight classes	Public announcement and single penalty of up to ¥1 million	• PHEVs zero carbon rated
China	Fuel economy	Passenger and SUVs		Fleet-wide, vehicle mass	NEDC	Annual	Banking: excess credits achieved in a compliance year can be used within the phase period (2012–15)	Models that do not meet their category target cannot be sold the following year. Public announcement also required	• Electric vehicles (EVs), PHEVs and fuel cell vehicles (FCVs) with at least 50 km electric range are zero fuel consumption-rated and counted 5 times • Multiplier of 3 for 'super-efficient vehicles' (not including EVs and FCVs) less than 2.8L/100 km fuel consumption

Source: Adapted from ICCT 2014 and official sources listed under References



B

MODELLING AND APPROACH TO COSTS AND BENEFITS OF STANDARDS

B.1 INTRODUCTION

This appendix outlines the Authority's approach to assessing the benefits and costs of implementing fleet-average CO_2 emission standards for light vehicles in Australia. It includes an overview of the modelling commissioned from the CSIRO to investigate the impacts of standards. The results are used in Chapter 4.

The Authority has conducted an indicative assessment of the net private and net social benefits of these standards using a combination of commissioned modelling and additional economic evidence. This work aims to provide a good starting point for a full cost-benefit analysis required for any regulatory impact statement.

The Authority has not developed an Australia-specific estimate of the incremental cost of different standards. Instead, the cost estimate is based on international studies of the costs of fuel-saving technologies necessary to meet similar standards. These international estimates isolate the incremental costs of fuel-saving technologies from other vehicle features that contribute to driver utility. The estimates of fuel savings and emissions reductions from the standards have been calculated directly by the Authority using the modelling discussed here. These estimates necessarily involve making assumptions about a range of inputs, informed by the available evidence. Where a clear central estimate is not available, the Authority has attempted to err on the side of choices that would underestimate the benefits available from standards.

This appendix outlines:

- the modelling commissioned to analyse standards, and the BAU and standards scenarios analysed (B.2)
- details of the approach to estimating fuel savings and the impact on vehicle costs (B.3)
- details of the approach to estimating the cost of emissions reductions from standards (B.4).

B.2 CSIRO MODELLING AND SCENARIOS

The Authority commissioned modelling from the CSIRO (Reedman and Graham 2013b) to explore the potential benefits of standards; in particular, fuel savings and emissions reductions. The starting point for the modelling is the BAU projection describing what would happen in the absence of standards. Six different standards scenarios are then modelled—a lenient, medium and strong standard starting in either 2018 or 2025. The results are compared with BAU to identify the benefit of each standard.

B.2.1 CSIRO MODELLING OF LIGHT VEHICLE EMISSIONS STANDARDS

Reedman and Graham use the CSIRO's Energy Sector Model (ESM) to investigate the impacts of standards. The ESM (see Box B.1) determines the least-cost fuel and vehicle mix to meet a given transport demand, subject to constraints such as policy, vehicle class preferences and vehicle stock turnover.

The analysis of standards forms part of a larger transport emissions projections exercise (Reedman and Graham 2013a) conducted for the Authority's Targets and Progress Review, the assumptions for which were subject to public consultation at the start of 2013.

When interpreting the modelling results, the Authority has taken into account the difference between actual and 'tested' new light vehicle emissions intensity, which make the CSIRO projections for new light vehicle emissions intensity appear higher than in some other sources.

The CSIRO model estimates actual new light vehicle emissions intensity, calculated from public data on fuel consumption, vehicle sales and emissions intensity of fuels (Graham 2014). In contrast, 'test cycle' readings of new light vehicle emissions intensity, such as those published by the National Transport Commission, are the result of laboratory testing of new vehicles' emissions intensity. The CSIRO's analysis of the difference between its estimates and those measured by the test cycle over the last decade indicates the CSIRO's estimates are, on average, about 5 per cent higher than test cycle intensity.

Because a mandatory standard would set a target level for test cycle rather than actual emissions intensity, the Authority has incorporated this adjustment when making findings on the level of a light vehicle emissions standard for Australia (Chapter 4). Throughout the report, the unadjusted CSIRO estimates of actual new light vehicle emissions intensity are described as 'measured,' and projections for new light vehicle emissions intensity intended to correspond to the results of vehicle testing are described as 'tested'.

In this analysis, the Authority focuses on the projected impacts of standards to 2030. The CSIRO modelling contains projections of the impacts of standards commencing in 2018 and 2025 over the period to 2050. Over longer time horizons, it is increasingly difficult to project what technologies might exist, their rate of deployment in new vehicles, the relative cost and emissions performance of those technologies, and fuel prices that may influence fuel consumption and emissions outcomes.

For a full account of the modelling, see Reedman and Graham (2013b).

BOX B.1: THE CSIRO'S ENERGY SECTOR MODEL

To model the emissions reduction potential of light vehicle emissions standards, the CSIRO uses its Energy Sector Model (ESM). The ESM assumes vehicle owners make the least-cost vehicle choices to meet a given transport task. Consumers are assumed to purchase alternative fuel or engine vehicle technology if the discounted payback from the fuel savings offsets any additional upfront costs within five years. Inputs include projected rates of improvement in the fuel efficiency of internal combustion engines and consumer preferences about vehicle sizes. Outputs include the fuels consumed (such as petrol, diesel and LPG, and their associated spark or compression ignition engines types), and the drivetrains chosen, including internal combustion engine, hybrid, electric and fuel cell drive. In addition to the cost of alternative fuels and vehicles, ESM incorporates detailed fuel and vehicle technical performance characterisations such as fuel efficiencies and emission factors by vehicle type, engine type and age.

For this exercise, demand for road transport in the BAU scenario was determined in the Monash Multi-Regional Forecasting Model, taking into account population growth, projected output of industries and changes in the cost structure of road transport.

Demand in the standards cases was determined in the ESM by allowing changes in the overall cost of travel due to standards to affect the level of travel demand (that is, by incorporating a 'rebound effect'). The value of the rebound in the ESM is 0.2, meaning that there is a 0.2 per cent increase in demand for every 1 per cent fall in the overall cost of travel. Estimates of the value of the rebound effect in road transport vary; the value used in the ESM is broadly equivalent to the mean of international estimates (NHTSA 2012, p. 853).

Fuel prices are the same across the BAU and standards scenarios. Australian retail prices are projected by applying a method for translating oil and gas paths into retail fuel prices, which includes assumptions about future excise rates by fuel (see Reedman and Graham 2013a, pp. 28–31). The oil price path is based on the IEA's *2012 World Energy Outlook,* which grows in real terms by 61 per cent over 2013–30 (Treasury and DIICCSRTE 2013, p. 59). Consistent with this outlook for oil prices, retail petrol prices are projected to increase by 24 per cent in real terms over the same period (Reedman and Graham 2013a, p. 30), taking into account the outlook for other components of the retail price, including fuel excise. The excise rates do not reflect the increases announced in the 2014–15 Budget. With higher real excise, fuel prices would be higher in all scenarios, and the fuel savings for consumers from standards would most likely be larger than the estimates provided here.

The ESM assumes a linear change in fuel consumption in response to changes in activity. There is an assumption that average activity per vehicle plateaus after 2030, after which demand for passenger transport grows in response to population growth. This approach implicitly accounts for a typical vehicle in Australian traffic conditions over time.

As with all models, there are limitations, including to assumptions for parameters that are in reality uncertain and in some cases evolving rapidly (for example, advanced biofuels and the cost and driving range of future electric vehicles). As the ESM considers cost as the only driver of consumer choice, it cannot capture behaviour driven by other factors. This could result in either underestimating or overestimating rates of adoption of some new technologies or fuels, depending on whether these non-price factors encourage or discourage adoption.

The way in which standards are introduced in the ESM is described in B.3.3. Further information on the ESM is provided in Reedman and Graham (2013a).

B.2.2 ASSUMPTIONS ABOUT BAU REDUCTIONS IN EMISSIONS INTENSITY

Projected emissions under BAU depend on the rate of improvement in new light vehicle fuel efficiency that would occur without standards. As discussed in Chapter 3, two factors complicate the projection of BAU improvements in new Australian light vehicles:

- Recent rates of improvement have been rapid relative to Australia's earlier history, but it is unclear whether these rates will be sustained.
- Mandatory vehicle emissions standards in other countries will become increasingly ambitious over the period to 2025; this will likely make new light Australian vehicles more efficient but the extent of this influence is unclear.

The modelling assumes the BAU rate of reduction in the average emissions intensity of new light vehicles slows from the 2.8 per cent per year observed over the last eight years to 2.0 per cent per year over the period to 2020, and reduces further to 1.6 per cent per year to 2025. This results in average measured emissions intensity of approximately 197 g CO_2/km in 2015, 178 g CO_2/km in 2020 and 164 g CO_2/km in 2025 (Graham 2014).

This projected annual improvement rate is similar to other recent estimates of BAU.

- In 2010, the FCAI commissioned estimates of the BAU of the light vehicle fleet (PWC 2010). The work was based on confidential consultations with vehicle manufacturers operating in Australia to assess both the rate of technology uptake and consumer preferences. It projected that the change in average light vehicle CO_2 emissions intensity would slow from the average of 2.1 per cent (4.3 g CO_2/km per year) achieved from 2002–10 to about 1.9 per cent per year (2.3 g CO_2/km per year) from 2010–20. The average tested emissions intensity of the new light vehicle fleet was projected to be about 195 g CO_2/km in 2015 and 176 g CO_2/km in 2020 under BAU.
- More recently, ClimateWorks's 2014 Briefing Paper *Improving Australia's Light Vehicle Fuel Efficiency* drew on unpublished analysis by Rare Consulting. This used the same path for improvement as the FCAI/PWC analysis, and extended its projection to 2024. With the inclusion of 2011 data, a slightly higher historical rate of improvement of 2.2 per cent was assumed by Rare, and it projected this would slow to about 1.8 per cent per year from 2011–24. The average tested emissions intensity of the new light vehicle fleet was projected to be about 175 g CO_2/km in 2020 and 165 g CO_2/km in 2024 under BAU.
- In its 2011 discussion paper on light vehicle standards, the Department of Infrastructure and Transport proposed a BAU annual improvement of 2.1 per cent or 2.5 per cent over the period to 2015 as a basis for analysing the effects of standards starting in that year.

Table B.1 and Figure B.1 compare the CSIRO, PWC and ClimateWorks projections. The rate of emissions intensity improvement in the CSIRO modelling is similar to the other sources, and all projections are slower than the rate achieved in the past decade.

In this analysis, the Authority has estimated the benefits of standards relative to the BAU rates of reduction in the CSIRO modelling. If BAU rates of improvement are faster than 2 per cent per year, the modelling will overestimate emissions and fuel savings from standards, but will also overstate the effort necessary to achieve any given standard. If BAU rates of improvement are slower than projected, the opposite will be true.

B.2.3 STANDARDS MODELLED FOR THE AUTHORITY

The CSIRO modelled a total of six standards scenarios with three different stringencies—lenient, medium and strong—and two different start years—2018 and 2025 (Reedman and Graham 2013b). These standard scenarios are implemented in the ESM by:

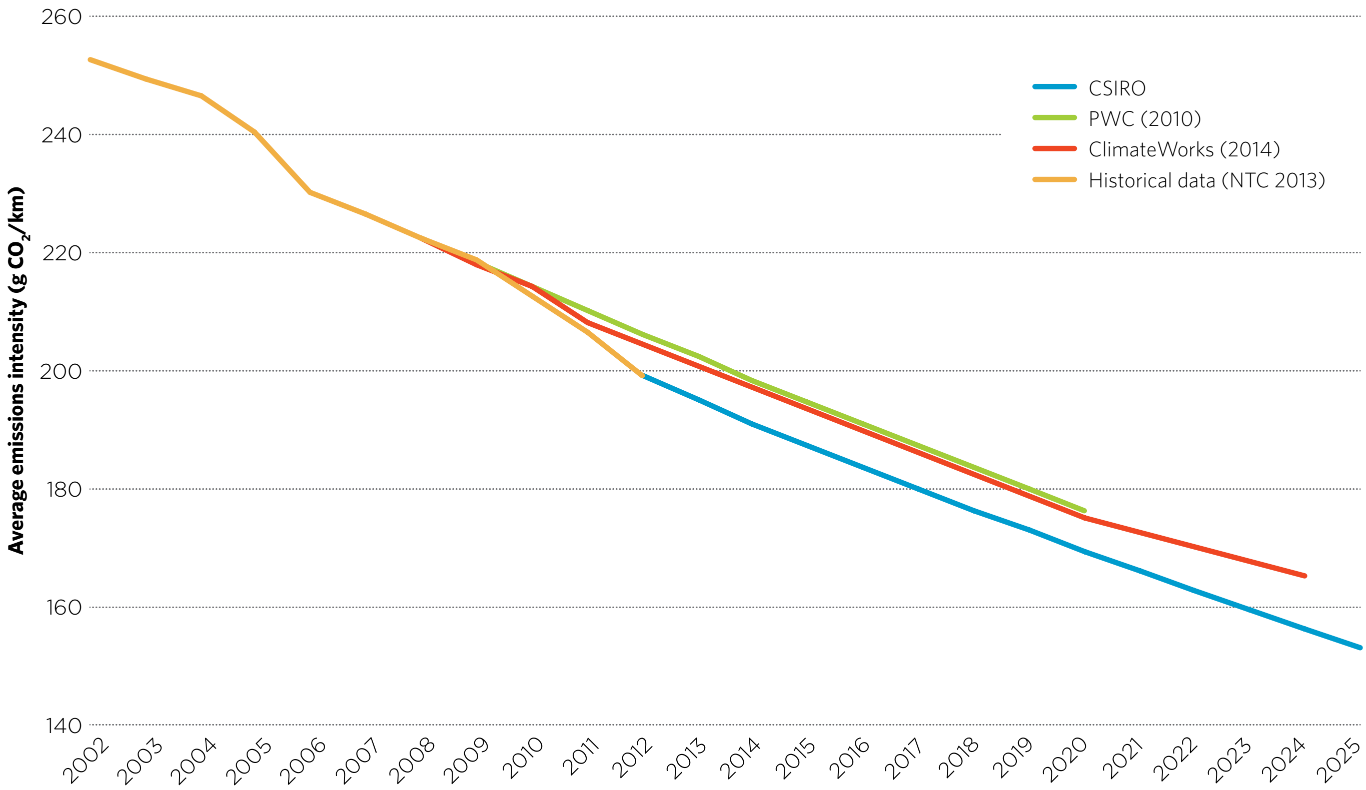
1. Imposing an additional, fixed amount of improvement in the efficiency of petrol internal combustion engine efficiency (3.3 per cent a year, up from 1.3 per cent under BAU). This is assumed to be available with no additional upfront cost to vehicles. Reedman and Graham (2013b, p. 6) draw on analysis in the *2007 King Review* for their assumption that there is a set of fuel-saving changes available to the mass market in the range of $150 to $1,000 for new vehicles using internal combustion engines. Assuming these lower cost fuel savings innovations are introduced in a gradual manner and as a priority over other product features, they conclude that real vehicle prices are not likely to be significantly changed.

TABLE B.1: COMPARISON OF PROJECTED RATES OF LIGHT VEHICLE EMISSIONS INTENSITY IMPROVEMENT, THREE BAU SCENARIOS

SOURCE (YEAR)	ANNUALISED RATE OF CHANGE	TIME PERIOD	RATIONALE
PWC (2010)	–1.9%	2010–20	Industry consultation on technology uptake and consumer preferences
ClimateWorks (2014)	–1.8%	2011–24	Builds on the PWC estimate with updated 2011 data and extended to 2024
CSIRO (2013)	–1.8%	2013–25	Driven by projected improvements in petrol internal combustion engines; some projected changes in preferences

Source: Climate Change Authority based on sources listed in table

FIGURE B.1: HISTORICAL AND PROJECTED RATES OF IMPROVEMENT IN LIGHT VEHICLE EMISSIONS INTENSITY, THREE BAU SCENARIOS



Note: CSIRO-projected BAU levels are converted to test cycle from measured emissions; other sources project test cycle emissions intensity. See Section B.2.1 for further discussion.
Source: Climate Change Authority (from sources listed in legend)

2. Allowing the most cost-effective deployment of alternative drivetrains and use of diesel vehicles to achieve the remainder of the emissions standard. To meet the required standards, the model ensures consumers adopt vehicles, even if the payback period is longer than the five years typically specified in the model as the basis for consumer choice.

The modelling assumes that standards have no effect on consumer preferences for vehicle size. Under both BAU and standards scenarios, smaller vehicles increase their share of the passenger vehicle market at the expense of larger and, to a lesser extent, medium vehicles (Reedman and Graham 2013b, p. 5).

Table B.2 shows average annual light vehicle emissions intensity associated with the BAU scenario and standards starting in 2018, along with the approximate corresponding test cycle level of emissions intensity.

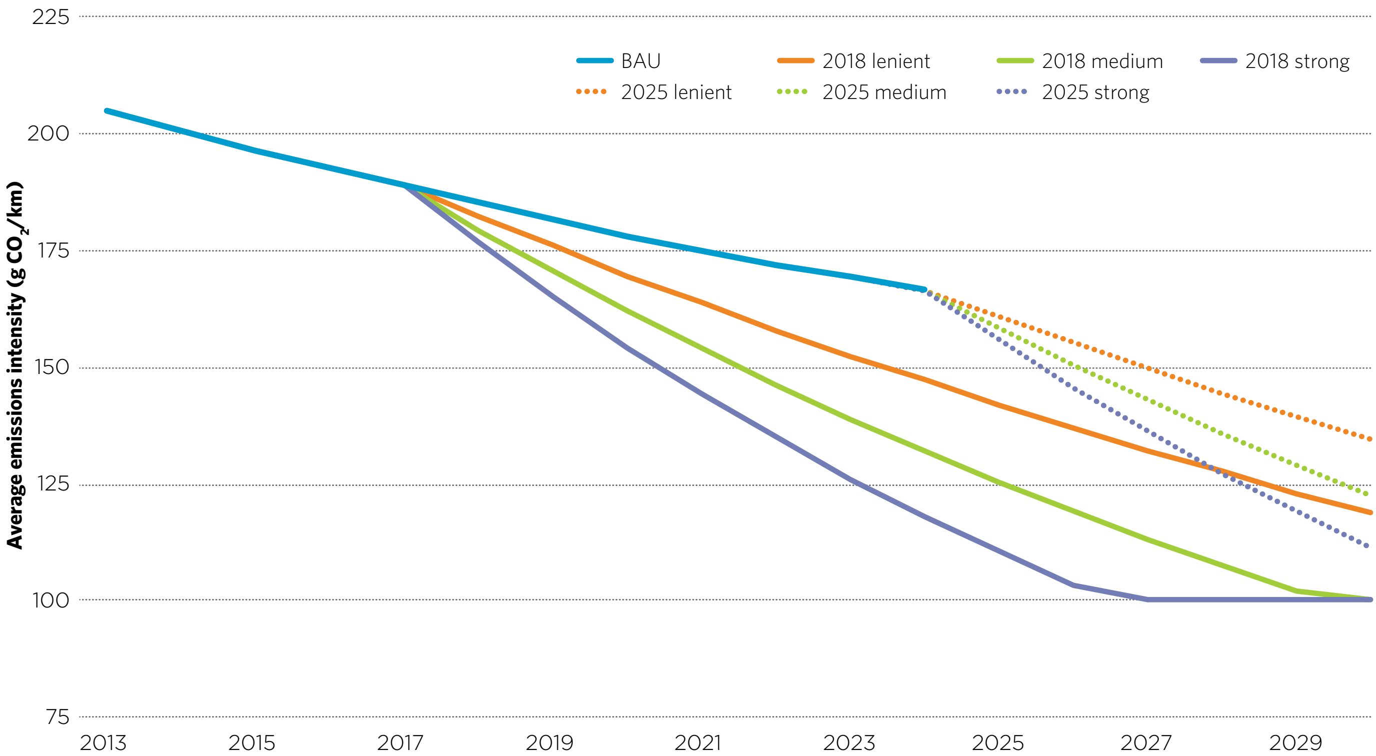
All standards modelled by the CSIRO are illustrated in Figure B.2. The figure shows that all of the standards assume sustained improvement until the average measured emissions intensity of new light vehicles reaches 100 g CO_2/km, after which no further reductions in emissions intensity occur. While it has no practical impact on the modelling, this may be a conservative limit—it is equivalent to a tested target of around 95 g CO_2/km, which is the 2020 EU target for passenger vehicles. While it would be more difficult to meet this target for all light vehicles (rather than just passenger vehicles), the EU is considering a 2025 passenger vehicle target of between 68 and 78 g CO_2/km (ICCT 2013c), suggesting average new light vehicle limits below 100 g CO_2/km are feasible.

TABLE B.2: STANDARDS MODELLED STARTING IN 2018—AVERAGE MEASURED (AND APPROXIMATE TEST CYCLE) EMISSIONS INTENSITY LEVELS, NEW LIGHT VEHICLES, SELECTED YEARS

SCENARIO	2018	2020	2025
BAU (2 per cent 2013–20; 1.6 per cent 2021–25)	185 (176)	178 (169)	164 (156)
Lenient (3.5 per cent from 2018)	182 (174)	170 (162)	142 (135)
Medium (5 per cent from 2018)	179 (171)	162 (154)	125 (119)
Strong (6.5 per cent from 2018)	177 (168)	154 (147)	110 (105)

Note: Measured new light vehicle emissions intensities are estimated to be about 5 per cent higher than test cycle emissions intensities. See Section B.2.1 for further details.
Source: Reedman and Graham 2013b

FIGURE B.2: STANDARDS MODELLED—AVERAGE MEASURED EMISSIONS INTENSITY LEVELS FROM NEW LIGHT VEHICLES, STANDARDS STARTING IN 2018 OR 2025



Note: This graph differs from Figure 2.2 in Reedman and Graham 2013b; this version corrects the BAU rate of new light vehicle emissions intensity and levels for the standards cases. This figure shows measured new light vehicle emissions intensities that are estimated to be about 5 per cent higher than test cycle emissions intensities. See Section B.2.1 for further details.
Source: Climate Change Authority based on Reedman and Graham 2013b and Graham 2014

B.3 ESTIMATING THE NET IMPACTS OF STANDARDS

B.3.1 FUEL SAVINGS FROM LIGHT VEHICLE EMISSIONS STANDARDS

The estimates of fuel savings in Chapter 4 for each standards scenario are calculated as follows:

1. Determine total fuel savings each year by calculating the difference between the modelled total fuel spend under standards and BAU.
2. Calculate the amount of total fuel savings in (1) that come from new vehicles of each model year subject to standards, by subtracting total fuel savings in the current year from the previous year. Note that if vehicles have an average life of 15 years in the stock, the first vehicles subject to standards would exit the fleet in 2033 on average, which is beyond the end of the first phase of standards. This means that it is acceptable to ascribe all of the annual change in fuel savings to the new vehicles subject to standards that entered the fleet that year, rather than to a combination of entry and exit.
3. Calculate the average annual savings from the first year of ownership for vehicles from each model year by dividing the results in (2) by the number of new light vehicles purchased in each year.
4. Calculate the present value of fuel savings for the first owner and the vehicle's life for a vehicle bought in each year under standards, by:
    a. Growing average annual savings in (3) by the rate of real fuel price growth in each scenario (to adjust the fuel savings for rising real fuel prices over time).
    b. Taking the present value by discounting the stream of annual fuel savings in (a), and summing the discounted savings over three or five years (for the first vehicle owner) or 15 years (for the vehicle's life).

For private net benefits, the calculations use the full retail fuel prices including excise; for social net benefits, these calculations exclude excise because this is a transfer at the economy-wide level (from consumers to government).

While vehicles may spend longer in the stock, the assumption of 15 years provides a conservative estimate of the fuel savings from standards; longer vehicle lives would mean higher fuel savings, if other things were equal. The discount rate of 7 per cent per year is the default discount rate for discounting private benefits in Commonwealth assessments of regulatory impacts (OBPR 2013).

The fuel spending in Reedman and Graham is in 2010 Australian dollars (Graham 2014). Along with all other monetary values in this report, fuel savings are in real 2012 Australian dollars unless indicated. The fuel savings were inflated to 2012 values using the RBA's inflation calculator (inflation over the two years of 5.1 per cent (RBA 2014)).

B.3.2 IMPACT OF STANDARDS ON VEHICLE COSTS

The estimates of the incremental costs of US standards in Table 4.2 are the estimated incremental costs for passenger vehicles and light trucks (NHSTA 2012), weighted by the Authority to create an estimate of incremental costs for all light vehicles.

In the US, SUVs are classified as 'light trucks' (light commercial vehicles) while in Australia they are classified as passenger vehicles. Because the US incremental costs are used as an estimate of the incremental cost of meeting a similar standard in Australia, they are combined using weights that make some adjustment for this difference in classification—passenger vehicles receive a weight of 70 per cent, rather than their share of the Australian market according to Australian classifications (about 80 per cent). While SUVs make up about 30 per cent of the Australian market (Chapter 2), NHSTA estimates indicate costs for light trucks are lower than for passenger vehicles, so the Authority's weights err on the side of overestimating the incremental costs.

The additional vehicle costs for the US and EU in Table 4.2 were converted to Australian dollars in two steps:

1. Both the EU and US sources reported incremental costs in 2010 units of their respective currencies. These costs were converted to 2010 AUD using the average annual exchange rate for 2010 reported by the RBA: AUD$1=US$0.92 and AUD$1=€0.70.
2. The converted figures were inflated to 2012 values using RBA 2014, and rounded to the nearest $10.

These US costs were then weighted as described above to generate the estimated incremental cost for all light vehicles. These costs are estimates of the incremental production costs associated with meeting standards and do not include smaller components of the overall cost of owning a new vehicle that might rise with higher vehicle purchase prices, such as insurance premiums.

As mentioned in Chapter 4, the increase in retail prices may be lower if not all of the cost of the increase in vehicle production costs resulting from production changes to meet the standard is passed through to consumers. Vehicle suppliers might absorb some of the increase over the short term to gain market share, or over the longer term if competition in vehicle markets was imperfect and suppliers could 'price to market' by adjusting vehicle prices in separate geographical markets to maximise overall profits. The proportion passed through to consumers in Australia would depend on a range of factors, including competition in the market and the extent to which a rise in vehicle prices will affect consumers' purchasing decisions. In this context, it is worth noting that by international standards, the Australian new vehicle market offers a large number of models to consumers, increasing competitive pressure on suppliers. The RBA's analysis of cost pass-through following changes in the exchange rate provides some evidence of pricing to market for Australian imports as a whole. While the proposition of full pass-through was not always rejected in statistical tests, the analysis suggests that exchange rate changes are passed through rapidly and, to a large but incomplete extent, into import prices. An estimated 80 per cent of a change in exchange rates is passed through, with the total effect occurring within one quarter (Cheung et al. 2011, pp. 10–11).

B.4 EMISSIONS REDUCTIONS FROM STANDARDS

B.4.1 EMISSIONS REDUCTIONS FROM 2018–25 STANDARDS

The cumulative emissions reductions in Figure 4.8 are for reductions from vehicles subject to the first phase of standards proposed by the Authority (2018–25). They are reported in carbon dioxide equivalent (Mt CO_2-e) and include CO_2, methane and nitrous oxide emissions. The CSIRO modelling assumes that standards continue past 2025 (see Figure B.2). The Authority has therefore calculated cumulative emissions reductions to 2030 from the first phase of standards by summing the cumulative emissions reductions from standards over 2018–25 and the average annual emissions reductions that vehicles from those model years would deliver over the period 2026–30.

B.4.2 APPROACH TO ESTIMATING THE VALUE OF EMISSIONS REDUCTIONS

The cost per tonne of emissions reductions from standards discussed in Chapter 4 were determined using the Authority's general approach to calculating the cost per tonne of emissions reductions—dividing the net present value of the incremental resource cost by the stream of resulting emissions reductions. In the case of vehicle standards this becomes:

> Cost per tonne of emissions reductions for each model year ($/t) =
>
> net present value of incremental costs from standards for model year ($) / stream of (undiscounted) emissions reductions from vehicles of model year over their life (t)

The net present value of the incremental costs from standards are equal to the incremental capital costs minus the present value of the fuel savings (excluding excise); these are taken from international evidence and the Authority's calculations as described in B.3.1 and B.3.2, respectively. The incremental costs and fuel savings per vehicle calculated above are multiplied by the number of vehicles sold in each model year to obtain economy-wide costs for each year per model year.

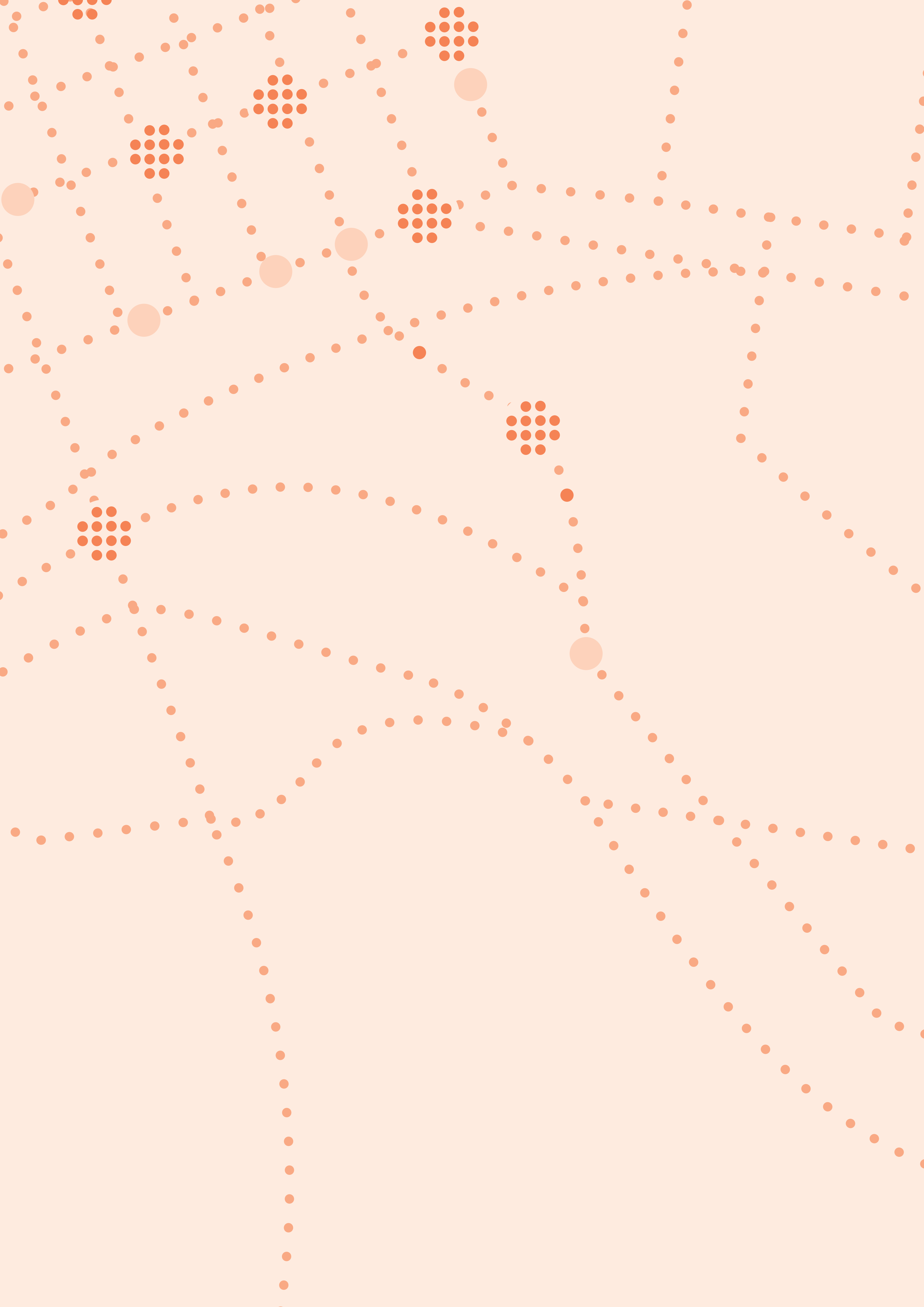
The stream of undiscounted emissions reductions are Authority calculations from the CSIRO modelling. These are the product of:

- the difference in new light vehicle emissions intensity between standards and BAU for each model year (g CO_2/km)
- the weighted average distance travelled per vehicle per year (vehicle kilometres per year)
- vehicle life (assumed to be 15 years)
- the number of vehicles sold each year.

The resulting estimate of –$580 per tonne of avoided emissions is the average of the cost per tonne over the model years 2020–25. Model years 2018 and 2019 are excluded from this average because the incremental capital costs are sourced from the US, and the Authority's strong standard starting in 2018 is most similar to the US standard from 2020 onwards (see Figure 4.1.)

The Authority's approach is conceptually similar to that of ClimateWorks in its cost curve analysis, with the difference that ClimateWorks looks at a particular year rather than computing net present values of the stream of costs and benefits. Its estimate of a –$350 per tonne private cost provides a 'snapshot' of the cost of emissions reductions in 2020 by dividing the net cost in 2020 by the emissions reductions in 2020 (ClimateWorks 2014).

There are some published estimates of higher positive costs of emissions reductions from standards. These are generally not estimates of the cost-effectiveness for society as a whole. For example, Frondel, Schmidt and Vance (2008, pp .8–9; cited by FCAI 2011c, p. 14) calculate the cost per tonne of emissions reductions from the EU standard as €100 to €200 per tonne for the standards to 2015, and €475 to €900 per tonne after 2015. The approach attempts to calculate the cost-effectiveness of standards for society as a whole from the cost per tonne to liable parties for non-compliance. In fact, the result is neither an upper bound on the compliance cost per tonne for liable parties, nor an estimate of the net benefit per tonne to society as a whole. It is therefore not informative about the potential costs of emissions reductions from vehicle standards in Australia.



C

DESIGN CHOICES

Chapter 5 sets out the Authority's analysis of the design of a light vehicle emissions standard for Australia. This appendix outlines the underlying analysis and evaluation of the policy design options:

- C.1—Coverage and liability
- C.2—Standard design and measurement
- C.3—Timing and compliance.

As outlined in Section 5.1, the Authority used a simple framework to evaluate the design options:

Environmental effectiveness—the standard should ensure that the emissions intensity of new light and commercial vehicles is reduced. The standard should contribute to the overall reduction of transport emissions intensity.

Administrative and regulatory burden—the standard should be low cost, and simple for government to administer and for industry to comply with. It should draw on existing governance and regulatory structures where possible.

Equity—the standard should ensure, to the extent possible, equity in the compliance burden placed on manufacturers with a diverse product mix.

Policy stability and credibility—the standard should minimise opportunities for gaming, avoidance and market distortions. Participants and the wider public should have confidence in the standard.

C.1 COVERAGE AND LIABILITY

C.1.1 COVERAGE

There are three key design questions about the application of the emissions standard to the light vehicles class:

- Will the standard apply to all light vehicles or only passenger vehicles?
- If it applies to all light vehicles, will there be a single standard or split standards for passenger vehicles and light commercial vehicles?
- Will the standard cover second-hand vehicles imported into Australia?

C.1.1.1 TYPE OF LIGHT VEHICLES

As discussed in Section 2.3, the light vehicles class includes both passenger vehicles (cars, sports utility vehicles, light buses) and light commercial (goods-carrying) vehicles (utilities, light trucks, vans).

Passenger vehicles account for 80 per cent of new light vehicles in Australia and are responsible for the majority of CO_2 emissions (see Chapter 2). Light commercial vehicles comprise the remaining 20 per cent of new vehicle sales. Light commercial vehicles travel greater distances than passenger vehicles, estimated to be 28 per cent more on average (ABS 2013), with vehicle kilometres travelled projected to grow more than twice as fast as passenger vehicles to 2020 (BITRE 2009).

Light commercial vehicles typically represent a larger, heavier and more powerful segment of the vehicle market and have, on average, higher rates of fuel consumption than passenger vehicles. In some circumstances, light commercial vehicles may face greater challenges to deliver better fuel economy and lower emissions than passenger vehicles. For example, the functional requirements of light commercial vehicles (particularly light trucks) may limit the incorporation of fuel-saving technologies such as drag reduction. Converting vehicles to diesel is an emissions reduction opportunity but most light commercial vehicles already use diesel—82 per cent of light commercial vehicles sold in Australia in 2012 were diesel (FCAI 2013).

All light vehicle emissions standards applied in other countries cover passenger vehicles at the minimum, and most also cover light commercial vehicles. International evidence suggests that the most effective vehicle emissions standards have broad coverage (ICCT 2011a).

Limiting standards to passenger vehicles alone would reduce environmental effectiveness, compared to a standard with wider coverage. While light commercial vehicles comprise a significantly smaller proportion of new vehicle sales, their higher emissions profile and travel distances suggest that they should be covered by a standard.

There are no obvious barriers to implementing a light vehicle emissions standard for both passenger and light commercial vehicles. Emissions data on all new light vehicles—passenger and light commercial—is currently collected under the Australian Design Rule (ADR) 81/02 *Fuel Consumption Labelling for Light Vehicles.*

CONCLUSION
The standard should cover both passenger and light commercial vehicles.

C.1.1.2 SINGLE OR SPLIT STANDARD

If all light vehicles are covered, a secondary question is whether to set a single standard encompassing all light vehicles, or to split the standard into two parts, with separate levels applying to passenger and light commercial vehicles.

In the EU, the US, China, Japan, Mexico and Canada, separate standards apply to passenger vehicles and light commercial vehicles, with the latter category having a higher (less stringent) numerical standard to meet than passenger vehicles. In part, this split is due to the history of the introduction of standards in these jurisdictions, where standards were initially applied to the largest group (passenger vehicles) and only later applied to light commercial vehicles.

The strongest argument for setting split standards for passenger and light commercial vehicles is to avoid a disproportionate burden on light commercial vehicle manufacturers. The weight of this burden largely depends on the product mix provided by the manufacturer, as the standard is for the average level of performance across all of a manufacturer's sales mix of new vehicles.

- The manufacturers of the 10 highest-selling Australian pick-up truck models in 2012, and of the five van or light truck models selling over 1,000 vehicles a year, all produce a significant number of passenger vehicles (NTC 2014). They can therefore meet a single standard by varying the relative mix of passenger and light commercial vehicles sold, as well as by improving performance of their light commercial vehicles.
- The choice of size thresholds for the application of the standard will also have an influence (see C.1.2.2). In 2013, there was only one specialised light commercial vehicle manufacturer that sold over 2,500 vehicles that did not also manufacture passenger vehicles (NTC 2014).

This suggests that, with the proposed standard, light commercial vehicle manufacturers in the current Australian market would not be unduly burdened.

On the other hand, split standards increase administrative complexity (especially as the majority of manufacturers would have to meet two separate standards, rather than one), and potentially create an incentive for manufacturers to market light commercial vehicles (subject to a less stringent standard) into the passenger vehicle market.

A 2012 analysis recommended the continued separation of standards for passenger vehicles and light commercial vehicles in Europe for a range of reasons, but acknowledged that the split does increase the risk of manufacturers 'gaming' the system by marketing certain light commercial vehicles as passenger vehicle substitutes (TNO et al. 2012).

In responses to the 2011 DIT discussion paper, most respondents (including the vehicle industry) favoured a single standard covering all vehicles (DIT 2011b). The FCAI (2011a) noted that there is some substitution between commercial and passenger vehicles, that a single standard provides a consistent policy objective for both and that separate standards could increase the regulatory burden.

CONCLUSION
A single standard for both passenger and light commercial vehicles should apply.

C.1.1.3 SECOND-HAND IMPORTS

A third question is whether standards should extend to imports of second-hand vehicles.

Second-hand imports are currently a very small segment of the Australian 'new' vehicle market, estimated to be less than three per cent of new vehicle sales (DIRD 2014d). Situations in which vehicles may be imported into Australia are tightly prescribed to ensure that vehicles meet safety and environmental standards, and current legislation appears to prevent large-scale imports. The *Motor Vehicle Standards Act* provides that applications for licence plates, or to supply an imported vehicle without licence plates, can only be made for a single used imported vehicle (sections 13C(2), 16(3)). Importers of second-hand vehicles thus tend to be individuals and small businesses, licensed automotive workshops restricted to fewer than 100 cars annually, and immigrants and returning expatriates importing personal vehicles.

No other vehicle efficiency standards currently apply to second-hand imports. This may reflect relatively limited importation of second hand cars in most jurisdictions. New Zealand includes second-hand imports in its fuel efficiency-labelling scheme.

Applying vehicle emissions standards to second-hand imports would marginally increase environmental effectiveness through increased coverage but could also significantly increase administration and compliance costs. In part, this is because existing fuel efficiency values for those imported cars that are derived from non-European test cycles could not simply be adopted into an Australian standard. Calculated fuel efficiency per kilometre differs between standards in separate jurisdictions, reflecting the different testing methodologies used. In New Zealand, where a significant proportion of imported vehicles are second-hand, a conversion formula is applied to second-hand Japanese imports that are pre-2008 models for the purpose of vehicle fuel efficiency labelling.

Even if second-hand imports were covered under the standard, it is very unlikely that individual suppliers would be liable due to low numbers of annual sales under the current import restrictions (see C.1.2.2 on threshold for liability).

The Productivity Commission has suggested that restrictions on large-scale second-hand imports be removed (PC 2014, pp. 100–102). If adopted, this change could potentially lead to a large increase in second-hand vehicle imports. In that case, both equity across suppliers and environmental effectiveness would suggest second-hand vehicles should be covered.

On balance, the very small increase in coverage from including second-hand imports does not appear to warrant the extra administrative costs of including them in the scheme at this stage. In the event that circumstances change and there is a significant increase in the quantity of vehicles imported, this issue should be reconsidered. Coverage could also be reassessed as part of the proposed 2021 review (section 5.3), taking account of market developments.

CONCLUSION

Second-hand imports should not be covered under the standard at this stage.

C.1.2 LIABILITY

The liable entity is responsible for compliance with the light vehicle emissions standard, including reporting performance and paying any penalties for non-compliance.

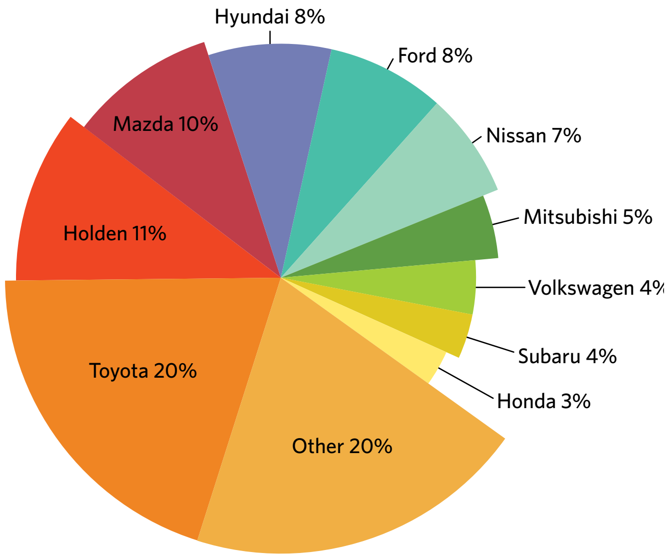
The key design questions for determining the point of liability are:

- Where in the vehicle supply chain (from manufacturer to retailer) should liability be placed?
- What size threshold (defined by annual sales) for imposing liability should be applied?

C.1.2.1 CHOICE OF LIABLE ENTITY

The Australian new vehicle market is dominated by a relatively small number of large vehicle manufacturers, with the top 10 manufacturers responsible for approximately 80 per cent of new vehicle sales in 2012. A further 37 manufacturers accounted for the remaining 20 per cent of vehicle sales (see Figure C.1). As noted in Chapter 3, it is expected that there will be no vehicle manufacturing operations in Australia by 2018, with all new cars imported. As only around 10 per cent of vehicles sold are currently domestically manufactured, there is no reason to expect that this will fundamentally alter the broad market structure.

FIGURE C.1: LIGHT MOTOR VEHICLE SALES BY MANUFACTURER 2012



Source: Climate Change Authority based on NTC 2013

The larger vehicle manufacturers responsible for the bulk of vehicle sales use integrated supply chains, which encompass manufacture, import and retail sale. Business models for other vehicle suppliers are more varied. In some instances, authorised importers supply independent retailers; in others, independent retailers directly import vehicles. All importers must comply with government requirements under the *Motor Vehicle Standards Act.*

Practical considerations are important. The liable entity should be able to comply with the standard reporting requirements (and be penalised in the case of non-compliance) and be the entity able to respond to standards by altering its vehicle mix. For this reason, retailers are clearly not an appropriate point of liability—they are far more numerous and varied in structure than large manufacturers and, importantly, less able to respond to the standard by controlling product mix. Accordingly, manufacturers (or their importing agents) are likely to be a better choice for point of liability.

Several submissions to the 2011 DIT discussion paper suggested the entity responsible for certifying new vehicles for the Australian market under the *Motor Vehicle Standards Act* (the MVSA certifying entity) should be the point of liability (see, for instance, the Australian Automobile Association 2011, Ford Australia 2011 and Honda Australia 2011). This is broadly consistent with US and EU standards, which both hold either the domestic manufacturer or a licensed importer responsible for ensuring compliance with relevant environmental and safety regulations.

The MVSA certifying entity already has a legal relationship with the Commonwealth, and is required to submit detailed technical information on vehicle design and safety as part of the approval process for new vehicles entering the Australian market. In the case of larger manufacturers, the certifying entity is likely to be either the manufacturer or closely related to the manufacturer, so obligations could be effectively passed through by contractual or other arrangements.

Smaller manufacturers may contract independent agents for certification, and have less of a business presence in Australia, making it less clear that the licensing entity will be able to influence the vehicle sales mix. These arrangements could be considered further as part of a RIS process.

At this stage, the MVSA certifying entity appears to be an appropriate point of liability for vehicle emissions standards. This should lead to a relatively small number of liable entities, which in most cases will be closely related to the vehicle manufacturer and have the technical capacity to comply with reporting obligations.

CONCLUSION

Subject to further consultation with industry, the liable entity under the standard should be the same entity responsible for Australian certification of a vehicle under the *Motor Vehicle Standards Act 1989* (Cth).

C.1.2.2 THRESHOLD FOR LIABILITY

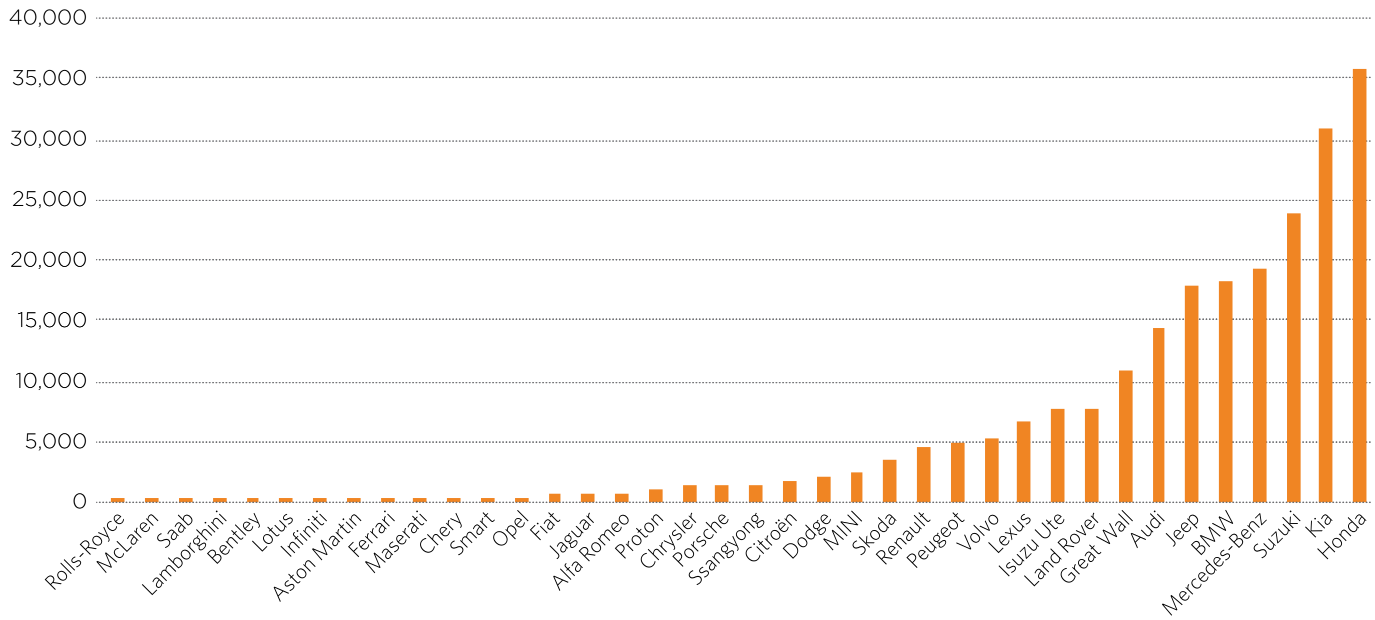
A threshold for liability is an important design feature to reduce compliance and administration costs. Some form of size threshold is used in all overseas schemes; direct comparisons are complicated by differences in the overall size of new vehicle markets. The US applies less stringent transitional standards to manufacturers with fewer than 50,000 annual sales, and manufacturers with fewer than 5,000 sales worldwide can apply for firm-specific standards. The EU also applies several threshold levels, with those with under 1,000 annual sales exempted altogether, and those between 1,000 and 10,000 able to apply for firm-specific standards.

Selecting a size threshold requires balancing the improved environmental effectiveness and improved equity of a lower threshold against the increased regulatory burden of imposing liability on more and smaller entities. Any threshold will invariably raise boundary issues, with the potential for entities near the threshold to alter activity levels to avoid liability. A more limited liability could be imposed on smaller entities to reduce costs and risks of gaming, although this would increase regulatory complexity.

An important consideration is the market structure of liable entities and how the point of liability is determined (discussed in C.1.2.1). Many vehicle brands may be linked into a larger corporate group, and may or may not operate as distinct legal entities. The practical implications of the threshold level therefore interact with selection of the point of liability.

Figure C.2 sets out the distribution of Australian car sales by make under 40,000 annual vehicle sales and Table C.1 sets out the implications of different thresholds, based on 2012 sales volumes.

FIGURE C.2: LIGHT VEHICLE SALES UNDER 40,000 VEHICLES BY MAKE IN 2012



Source: Climate Change Authority based on NTC 2013

TABLE C.1: IMPLICATIONS OF SELECTED THRESHOLDS (BASED ON 2012 LIGHT VEHICLE SALES)

THRESHOLD (VEHICLES SOLD)	NUMBER OF VEHICLES NOT COVERED	PERCENTAGE OF VEHICLES NOT COVERED	NUMBER OF UNCOVERED MAKES (OUT OF 47 TOTAL)
100	524	>0.01	9
500	923	0.09	12
1,000	3,784	0.4	16
2,500	7,521	1.2	23
5,000	23,317	2.1	25
10,000	56,313	5.2	30

Note: This assumes each make operates as a separate liable entity. In practice, some small makes may be part of a larger corporate group; this would reduce the number and percentage of vehicles excluded by the threshold.
Source: Climate Change Authority based on NTC 2013

Figure C.2 shows that there is a long 'tail' of smaller makes that account for a very small proportion of sales. As set out in Table C.1, thresholds could be set to eliminate a large number of makes with minimal effect on coverage. A 500-vehicle threshold would exclude about a quarter of makes from liability while diminishing coverage by less than a 10th of one per cent; a 1,000 vehicle threshold would exclude about one-third of makes at the expense of 0.4 per cent of coverage; a 2,500 vehicle threshold would exclude about half of the makes and reduce coverage by 1.2 per cent.

Ideally, the threshold would be set at a level that minimises the number of makes near to the threshold (which might offer an incentive to 'game' it to avoid liability, including through disaggregating brands covered by a corporate group that might otherwise operate as a single entity for the purposes of the standards). The distribution of sales is, however, relatively uniform with no obvious gaps.

On balance, a threshold of 2,500 vehicles would appear to provide an appropriate balance between compliance costs and coverage. Based on current sales, this threshold would exclude about half of the makes but only reduce coverage by about 1.2 per cent. This threshold could be reviewed when considering the second phase of the standard, to address any distortionary market responses if they emerge.

CONCLUSION

Subject to further consultation and consideration of how the point of liability will be determined, the threshold for liability should be annual sales of 2,500 vehicles.

C.2 STANDARD DESIGN AND MEASUREMENT

Determining how the standard applies to manufacturers of new light vehicles raises two related design choices:

- Should a flat or attribute-based standard be applied?
- If an attribute-based standard is favoured, which is the most appropriate attribute to adopt?

This section also discusses a number of measurement and scope issues for how emissions will be measured under the standard:

- whether the standard should be based on fuel consumption or CO_2 emissions
- what test procedure should be used
- whether multipliers, which recognise specific low-emissions technologies or fuels, should be part of the scheme
- whether off-cycle credits, which recognise emissions reductions not captured by the standard test, should be part of the scheme.

C.2.1 FORM OF STANDARD

The most common forms of light vehicle emissions standards that have been evaluated internationally are:

- a flat standard for the fleet (or sections of it), usually an absolute cap or uniform percentage reduction of emissions intensity, which applies to every manufacturer
- an attribute-based fleet-average standard, where the level of the standard varies with an attribute of the vehicle (typically vehicle mass or size).

In determining the best option, a reasonable starting point is to consider the simplest model possible that delivers significant emissions reductions, is cost-effective to administer and is equitable across manufacturers. The selected approach also needs to be objective and transparent so that liable entities clearly understand their obligations.

The simplest approach—to set a flat (absolute) target(s) for the fleet, or categories of the fleet, or to apply a uniform percentage reduction on emissions—imposes the same requirements on every manufacturer, regardless of their mix of vehicles. While this may appear fair, a 'one-size-fits-all' approach can disadvantage manufacturers at both ends of the emissions spectrum and reduce consumer choice. Different manufacturers produce a heterogeneous mix of models and have different starting positions linked to previous investments in fuel economy and reducing emissions. Applying a uniform percentage reduction target to a manufacturer who has already invested heavily in emissions or fuel consumption reductions will put it at a competitive disadvantage relative to a company that has not previously focused on this aspect. Conversely, applying the same flat standard to all manufacturers could force one with larger vehicles sitting above the standard to remove certain models from its range (even if such models are relatively efficient for their size or are important for their commercial viability and are strongly favoured by consumers).

The alternative approach is to implement a sales-weighted fleet-average standard. The target emission level varies across manufacturers, in light of their product mix. The standard is defined by the relationship between the CO_2 emissions or fuel consumption of a vehicle and an objective attribute of the vehicle such as mass or size. Attribute-based standards enable manufacturers to supply vehicles above the target level of the standard, provided they are offset by sufficient sales of vehicles that are below the target. The International Council on Clean Transportation (ICCT) notes that such standards enable a manufacturer to market vehicles that '... remain diverse in terms of vehicle shape, size and functionality and to improve efficiency without compromising vehicle functionality' (Mock 2011).

International assessments in both the US and EU have strongly favoured attribute-based standards. Benefits include encouraging emissions improvements across the full range of vehicle types, spreading the regulatory burden across all manufacturers and respecting consumer choice (US EPA and NHSTA 2011b). A useful overview of the EU's assessment of the various approaches is summarised in the 2011 DIT discussion paper (DIT 2011a). Similarly, a US EPA and NHTSA evaluation in support of the US 2017–25 standards also identified multiple benefits from attribute-based standards (compared to class-based caps or uniform percentage reductions).

All countries that have adopted mandatory fuel consumption or CO_2 standards have included an attribute adjustment, but not all have included fleet-averaging. For example, China applies the averaging across specified categories of vehicles, not the fleet as a whole. However, soon all four major markets (the US, the EU, China and Japan) will take a flexible corporate-average approach to standards, with Japan switching to fleet-averaging for its 2020 target. In submissions to the 2011 DIT discussion paper, there was overwhelming support for attribute-based fleet-average standards, including from the vehicle industry.

If an attribute-based standard is favoured, a decision needs to be made on the most appropriate attribute to adopt. To date, the attributes used internationally are mass or vehicle size, usually measured as the 'footprint' of the vehicle (the size of the vehicle determined by the product of the vehicle track width and the wheelbase—which is the distance between the two axles).

Footprint is used in the US, Canada and Mexico, with mass adopted in the EU, China, Japan and Korea. International assessments conclude both can work effectively and impose similar costs but, on balance, the evidence favours footprint as the best option (TNO 2011; German & Lutsey 2011; US EPA and NHSTA 2011b).

The key advantage of footprint is that it encourages manufacturers to improve efficiency by reducing vehicle mass ('light weighting'). Light weighting is a major emissions reduction strategy in new vehicle design, and vehicles can be light-weighted without compromising vehicle functionality from the consumer's perspective. Mass-based standards discourage light weighting, as they require lighter vehicles to meet more stringent average emissions targets. A recent ICCT assessment (2011a) argues strongly against mass-based standards, which typically shift fleets towards bigger or heavier models. In addition, size-based standards tend to encourage better safety design than weight-based standards. This was one of the key factors in NHTSA's decision to adopt footprint-based standards instead of weight-based standards for the US 2008–11 light truck Corporate Average Fuel Economy rule (US EPA and NHTSA 2011a).

In submissions to the 2011 DIT discussion paper, there was broad support for footprint-based standards. However, vehicle manufacturers at the time were split on the issue, with most favouring mass-based standards because they were used more frequently in the standards applying in source countries.

There is good evidence, and widespread support, for the adoption of attribute-based fleet-average standards compared to any alternative approach. Such standards maximise equity and flexibility for manufacturers and preserve consumer choice. While attribute-based standards using either mass or footprint can be effective, the balance of the evidence supports a footprint-based standard. There is no evidence to indicate that this would disadvantage suppliers from markets where mass-based standards (including the EU, Japan, Korea and China) are in place.

CONCLUSION

The standard should apply to fleet-average emissions and be based on vehicle footprint.

C.2.2 MEASUREMENT AND SCOPE

C.2.2.1 BASIS FOR MEASUREMENT—FUEL CONSUMPTION OR EMISSIONS

Standards can be based on fuel consumption per kilometre travelled or on CO_2 emissions per kilometre travelled. These metrics are directly related; combustion of fuel leads to emissions of CO_2 (noting that different types of fuel have different emissions profiles). Reducing consumption of fuel per kilometre will therefore lead to corresponding decreases in emissions per kilometre.

Internationally, the US and Republic of Korea use both fuel economy and CO_2 emissions standards. The EU uses CO_2 emissions standards. Japan and China use fuel economy. In Australia, the existing ADR81/02 collects both CO_2 emissions and fuel consumption data at a model-specific level (see C.2.2.2).

An emissions-based standard is preferable where the primary objective is to reduce emissions. Fuel economy improvements do not always give an equal emissions intensity improvement, as emissions rates from different fuels vary. For instance, depending on driving conditions and engine performance, diesel engine vehicles can be up to 30 per cent more fuel-efficient than comparable petrol vehicles. However, diesel consumption results in about 15 per cent more CO_2 being emitted per litre of fuel (calculated based on NTC 2012, p. 3). Overall, a shift to diesel reduces emissions by about 15 per cent relative to petrol.

However, consumers could more easily understand a fuel economy standard than an emissions-based standard, and it provides a better basis for aiding consumer purchasing decisions. Vehicle fuel economy labelling schemes, including in both the US and EU, tend to include both emissions and fuel economy data.

A further question is whether to base the standard on CO_2 emissions only or to include emissions of other greenhouse gases from vehicles. These could include nitrous oxide exhaust emissions from the combustion of fuel and emissions of hydrofluorocarbons (HFCs) from vehicle air conditioning systems. Overseas schemes do not generally include these emissions directly, although they may be considered in the calculation of off-cycle credits (see C.2.2.4).

The primary objective of the standard suggests that it should be based on CO_2 emissions rather than fuel economy. Emissions of other greenhouse gases are very small compared with CO_2 emissions from a vehicle over its lifetime, and are unlikely to warrant the extra effort and complexity of inclusion. In addition, the inclusion of other gases would require every vehicle model to undergo additional Australia-specific testing (CO_2 is the only greenhouse gas directly measured in the standard emissions test that underpins ADR81/02).

CONCLUSION
The standard should be based on CO_2 emissions. Other greenhouse gases should not be included in the standard.

C.2.2.2 TEST PROCEDURE

To minimise administrative complexity and reduce compliance costs, existing testing procedures, if appropriate, should be used wherever possible. In Australia, the CO_2 emissions value for each vehicle model (and its variants) is already collected under ADR81/02 as part of the vehicle type approval certification process under the *Motor Vehicle Standards Act*. This applies to all new vehicles to be sold in the Australian market. This test can supply the basic data for calculating the CO_2 emissions targets under vehicle emissions standards—the tailpipe CO_2 emissions produced by the vehicle (in grams of CO_2 per kilometre travelled) is combined with annual sales data to determine the liable entity's compliance requirement.

The ADR81/02 data does not represent all 'real-world' driving and does not take into account the non-road CO_2 emissions from the production and supply of various transport fuels (including electricity for electric vehicles). International research on testing procedures that provide robust data for life-cycle emissions for all fuel types is currently underway, but remains at an early stage.

The data currently collected under ADR81/02 is robust, verifiable and comparable, and is the only such data available at the individual model or variant level for all light vehicles. It is internationally recognised and already used for Australia's CO_2 labelling requirements. The CO_2 standard would not require any additional vehicle testing if ADR81/02 is accepted as the data source.

There was broad support for this approach in submissions to the 2011 DIT discussion paper (DIT 2011a).

Australia is committed to matching United Nations regulations, through which a new harmonised testing procedure is being developed. This test may help to reduce the gap between real-world and tested performance, and is likely to be adopted in the EU from 2020 onwards (ICCT 2013a). Developments in the adoption of this procedure will need to be monitored and any transition arrangements considered in setting the first phase of the standard.

CONCLUSION
The standard should use the CO_2 emissions value collected under ADR81/02 *Fuel Consumption Labelling for Light Vehicles*.

C.2.2.3 MULTIPLIERS

Many countries allow manufacturers to reduce their reported average emissions by using 'multipliers'. Multipliers can be awarded to vehicles that satisfy low-emissions benchmarks or utilise specific technologies or fuels claimed to reduce CO_2 emissions relative to conventional vehicles.

The principal rationale for multipliers is to encourage innovation and early deployment of advanced (often high-cost) low-emissions technologies such as electric vehicles (EVs). Multipliers can act as an additional incentive to innovate and outperform standards.

Crediting arrangements such as multipliers can contribute to the environmental effectiveness of the scheme over the medium term. While multipliers will lead to an increase in overall fleet CO_2 emissions in the short term (as more credits are awarded for the same amount of emissions reductions), if carefully designed they may have beneficial effects in the longer term as lower emissions technologies are more rapidly deployed. Multipliers are likely to involve a minor increase in administrative effort to design as an element of the scheme and, on an ongoing basis, to assess for each liable entity choosing to utilise them.

Multipliers can be implemented in two ways. The first is to provide multipliers for specific technologies or fuels that are claimed to reduce CO_2 emissions relative to conventional vehicles. This requires governments to choose particular technologies or fuels for eligibility at a certain point in time.

The second approach provides for more equitable treatment of technologies by setting an emissions performance benchmark. This provides multipliers for vehicles below a specific emissions intensity level, regardless of the technology or fuel used. Benchmarks of 50 g/km and 100 g/km were raised by industry in response to the 2011 DIT discussion paper (DIT 2011a).

On balance, multipliers are not considered a necessary option to pursue at this stage. A fleet-average standard already creates a direct incentive for innovation—producing very low-emissions vehicles makes it easier for manufacturers to meet the fleet average. Other options to encourage innovation and performance beyond the standard are discussed in C.3. This could be considered for later phases of the standard.

CONCLUSION
Multipliers are not necessary to the functioning of a vehicle emissions standard and are not proposed at this time.

C.2.2.4 OFF-CYCLE CREDITS

Off-cycle credits are primarily designed to recognise technologies that can deliver actual on-road CO_2 emissions reductions but are not 'captured' by the standard tailpipe emissions test used for compliance. Such credits may include, for example, measures for the more efficient operation of vehicle air conditioners, which are standard on most new vehicles but turned off during the standard test cycle.

Off-cycle credits could contribute to the overall reduction of transport emissions by providing additional incentives to reduce all emissions associated with real-world vehicle use. If credited, they may also provide a more cost-effective way for manufacturers to reduce emissions than measures that are directly assessed through standard tailpipe emissions testing. However, off-cycle credits would increase the administrative and regulatory complexity of the scheme.

A central issue with off-cycle credits is the design of objective, repeatable methodologies and processes to determine and validate the claimed additional CO_2 benefits. Internationally, both the US and EU have attempted to recognise and quantify the CO_2 benefits from off-cycle technologies within their standards. Both place the burden for demonstrating off-cycle credits with the liable entities.

The EU provides procedures for approving and certifying 'innovative technologies' not captured by the standard test cycle and assessing their CO_2 emissions benefits. In the US, the EPA and NHTSA have undertaken an extensive analysis covering air conditioners and a broad range of off-cycle technologies including high-efficiency lighting and engine heat recovery.

The US work has developed a 'menu' of technologies assessed as providing real-world CO_2 benefits, which assigns default CO_2/mile credit values for each. This approach reduces the need for extensive testing, and uses analysis and simulations rather than full vehicle testing as much as possible. Both the US and EU apply a cap on the maximum overall fleet benefit a manufacturer can claim for innovative or off-cycle technologies. This recognises, in part, the inherent uncertainty of a general assessment of off-cycle performance as opposed to testing the individual vehicle models (US EPA and NHTSA 2011a) (EU Regulation 725/2011).

The EU adopts a stricter approach in only considering off-cycle technologies that are deemed innovative and are intrinsic to the transport function of the vehicle (excluding accessory functions) (EU Regulation 725/2011). In practice, while a small number of eco-innovations have been approved, feedback from stakeholders indicates that implementation has proven difficult.

The FCAI submission to the 2011 DIT discussion paper (FCAI 2011c) acknowledges the fundamental burden of demonstrating additional off-cycle benefits should rest with individual manufacturers and that there is a need for a system of rigorous assessment and validation. While pre-existing international methods could be adapted for the Australian context, the emissions reductions recognised by off-cycle credits vary as a function of driving behaviour, congestion, road infrastructure, speed limits and ambient temperature, and therefore differ significantly from country to country. Adapting methods would require significant effort and involve a considerable administrative burden in both design and ongoing assessment for the standards.

On balance, off-cycle credits are not considered a necessary option to pursue at this stage, due to the significant administrative and regulatory burden they would impose to design and implement. However, there may be merit to off-cycle credits and their inclusion in later phases of the scheme could be considered as part of the proposed 2021 review.

CONCLUSION
Off-cycle credits are not necessary to the functioning of a vehicle emissions standard and are not proposed at this time.

C.3 TIMING AND COMPLIANCE

C.3.1 TIMING

Introducing a light vehicle emissions standard to Australia will require time for detailed policy development, stakeholder consultation, and the establishment of monitoring and reporting processes. The key timing decisions are:

- start year
- length of first phase.

C.3.1.1 START YEAR

The first timing decision is the appropriate start year for standards. Greater environmental and economic benefits will be achieved by introducing light vehicle emissions standards early. This needs to be balanced against providing an appropriate lead time to allow for industry consultation, the consideration and development (if required) of an appropriate legislative framework, and the establishment of monitoring and reporting processes.

Early introduction of vehicle standards would increase the fuel savings and emission reductions available to Australia. Results of the modelling conducted by the CSIRO for the Authority (discussed in Appendix B) show timing is a key determinant of benefits. Over the period to 2050, lenient standards introduced in 2018 are projected to deliver greater emission reductions than stringent standards introduced in 2025 (CCA 2014a). Early adoption of a standard maximises the benefits—it takes time for changes to new vehicles to improve the fleet overall. A strong standard starting in 2018 generates the greatest emissions reductions and the greatest financial benefits to Australian motorists.

As discussed in Chapter 1, the introduction of a light vehicles emissions standard is not a new concept in the Australian context, and significant work has already been done to both explore an appropriate design and consult with industry. In addition, as discussed in Chapter 4, the proposed target for Australia will not be more stringent than in other key economies. Australia will import all its new vehicles by 2018, and currently lags behind other major markets (including most of our major suppliers). This means that the required adjustment for manufacturers will be a choice about which models and model variants are supplied to the Australian market, rather than necessitating fundamental design and product changes. It suggests that lead times for a standard could be relatively short.

Internationally, lead times of about three years for the initial introduction of vehicle emissions standards are common. The EU 2012–15 standards and target for 2020 were announced in April 2009 (European Council 2009), while the US 2012–16 vehicle standards were announced in May 2009. Both have large domestic car manufacturing industries that would need to have made adjustments to comply with the new standards.

Best practice would suggest that two years is sufficient for policy planning and development (IEA 2012b). As outlined below, Australia has much of the required measurement and reporting in place already, so is well placed for rapid implementation.

A start year of no later than 2018 should therefore provide for adequate consultation and an orderly phase-in of new light vehicle emission standards in Australia. This provides a three-year lead time if a policy decision is taken in 2015.

CONCLUSION

The new light vehicle emissions standard should commence no later than 2018.

C.3.1.2 LENGTH OF FIRST PHASE

The second timing decision is the length of the first phase of standards (phase one). The period needs to be long enough to allow liable entities to adjust their business operations, but short enough to avoid 'locking in' standards that prove inappropriate due to technology developments, market changes or other factors.

Internationally, compliance periods have tended to range between four and seven years. The EU and US currently have targets out to 2020 and 2025 in place under their emissions standards, and China has proposed a target to 2020.

Aligning the first Australian standards to major jurisdictions could assist with future global harmonisation, possibly simplifying the compliance process for manufacturers. With a proposed start year of 2018, ending phase one in 2020 would appear too short. A 2025 end date, however, provides a reasonable first phase (2018–25) of eight years.

This would not set a binding precedent for future phases. For example, the time span for phase two could be shorter (such as 2026–30).

CONCLUSION

The first phase for the new light vehicle emissions standard should be 2018 to 2025.

C.3.2 COMPLIANCE OPTIONS

The key design options for compliance with the standard are:

- whether compliance is required on an annual or a periodic basis
- what flexibility mechanisms should be allowed to enable liable entities to cost-effectively comply with the standard
- the frequency and start date for reporting obligations
- what form of penalties should apply for non-compliance.

C.3.2.1 ANNUAL OR PERIODIC COMPLIANCE

Standards can require annual (frequent) or periodic (infrequent) compliance. The choice of approach has a strong relationship to what flexibility mechanisms, such as banking, borrowing or trading, are allowed within the scheme (discussed in C.3.2.2).

Annual compliance requires manufacturers to meet a set target each year, and thus drives early and progressive efforts to reduce emissions. Internationally, the US is the only major market that has mandatory annual targets. While this may increase compliance costs, mechanisms such as banking and borrowing that allow for normal business ebbs and flows can enhance flexibility for manufacturers and minimise any costs. The US allows for banking, borrowing and trading.

Periodic compliance entails manufacturers meeting a set target by a fixed future year and does not mandate an annual rate of improvement. Internationally, the EU and Japan have targets for 2015 and 2020 with no interim targets (ICCT 2014).

Annual compliance is likely to drive greater environmental effectiveness as it ensures fleet performance improves each year. Periodic compliance will have a lower administrative burden, but runs the risk of liable entities only striving to improve the emissions of vehicles sold in the final year of the period. Further concerns with periodic compliance include a risk of suppliers lobbying for target revisions, which, if successful, would unfairly disadvantage competitors who have already taken action to meet the standard; and the possibility of 'fringing' effects of new entrants and suppliers leaving the market and avoiding compliance altogether. Either of these could compromise policy stability and credibility and environmental effectiveness.

The extent of the administrative burden posed by annual compliance depends on the new reporting obligations introduced by the standard. As discussed in C.3.2.3, the proposed standard involves only a modest additional reporting obligation.

On balance, annual compliance is the preferred approach. It would encourage progressive improvement in fleet performance, and guard against lobbying and fringing effects. The additional administrative burden is likely to be very small.

CONCLUSION

The standard should set annual compliance obligations for liable entities.

C.3.2.2 FLEXIBLE COMPLIANCE MECHANISMS—BANKING, BORROWING AND TRADING

Flexible compliance mechanisms provide liable entities with a range of options to cost-effectively comply with a given standard. They can improve the pace of progress in meeting given standards and assist in driving emissions improvements, while allowing flexibility in year-to-year performance.

Banking allows liable entities to save credits generated by overachieving against their targets and use them for future compliance, either within a compliance period (for example, phase one) or between periods (for example, between phase one and phase two). Similarly, borrowing allows liable entities to use credits from future periods to meet current compliance obligations. Trading allows for the movement of credits between liable parties.

In determining whether to allow one or more of these options, the starting point, as outlined in Chapter 5, has been to consider the vehicle emissions standard design for Australia that maximises emissions reductions while ensuring the cost-effectiveness, equity and credibility of the scheme for consumers and manufacturers.

As discussed in C.3.2.1, decisions on banking, borrowing and trading are closely linked with decisions on the type of compliance and the compliance period. For example, banking and borrowing can reduce the costs of annual compliance by allowing year-on-year flexibility to account for normal business ebbs and flows. They are less relevant in a scheme with periodic compliance.

Flexibility mechanisms operating within a compliance period; for example, phase one (2018–25), and between phases (pre- and post-2025) may have different impacts on the integrity of the scheme. If the Australian standard was set at a level significantly less stringent than other markets, especially in the first phase, and banking or trading across phases was allowed, liable entities could potentially establish large volumes of credits in the early years with relatively little effort. This would significantly reduce the need to act in later phases as the standards get tighter, thereby diluting the environmental effectiveness of future standards. If, however, Australian standards are on par with international standards, this is less of a concern.

Flexibility within phase one does not create the same risks to environmental effectiveness, as entities would be obliged to meet the given standard within the time frame specified.

Borrowing within phase one increases flexibility but could create risks of non-compliance in future years, or incentives to lobby to weaken the standard. This would reduce the credibility of the scheme. Borrowing from future phases could exacerbate credibility concerns. These risks can be managed by imposing limits on borrowing and restricting it to within the phase.

Trading increases flexibility and provides an incentive for performance beyond the standard. While it is difficult to predict the likely market for trade of excess credits between liable entities in the Australian context, international experience and feedback from domestic stakeholders suggests uptake may be limited. This suggests the benefits of a bespoke trading mechanism within the standard are unlikely to justify the associated administrative complexity and cost.

There may be scope to encourage performance beyond the standard through other mechanisms. For example, if a methodology could be developed to estimate and credit emissions reductions achieved through superior performance by a supplier, the ERF may be a suitable vehicle.

On balance, to give liable entities flexibility to meet their compliance requirements, banking and limited borrowing should be allowed within phase one. While trading could improve the cost-effectiveness of a standard, it does not appear warranted at this time.

CONCLUSIONS

Banking and limited borrowing should be allowed within phase one of the standard.

Trading is not necessary to the functioning of a vehicle emissions standard.

C.3.2.3 TIMING OF REPORTING OBLIGATIONS

Key considerations for reporting obligations are the start date and frequency of reporting.

Early introduction of reporting obligations (prior to the commencement of the standard) is likely to bring benefits. It will help liable entities track their position prior to facing formal compliance obligations, and make any necessary changes to their business operations. It also allows entities and administrators to test and refine reporting and monitoring systems.

Overall, with a proposed start date of no later than 2018, it would be worthwhile for reporting to begin two years prior, in 2016. In the event of delay, a one-year lead time for reporting would still be beneficial. Testing and refining reporting and monitoring systems could be prioritised in the policy development process, if necessary, to enable reporting to commence in 2016.

Annual compliance would clearly require annual reporting. Even if periodic compliance was preferred, annual reporting from 2016 would still be desirable as it would help identify suppliers above and below the minimum threshold for liability. Annual reporting would enable regulators, industry and policy makers to monitor performance against the standard and provide the necessary data to underpin any banking and borrowing provisions.

As discussed in Box 5.1, CO_2 emissions, fuel consumption and other data is already legally required for all new vehicles entering the Australian market under the ADR81/02. The government does not, however, currently collect annual vehicle sales or footprint data, which will be required to determine individual emissions targets for liable entities. As vehicle suppliers already hold this data, requiring this to be reported to government is only likely to be a small additional burden for industry. It will also help policy makers to monitor the target and assess compliance.

In the interest of policy credibility and transparency, the government should consider making non-commercially sensitive data collected to assess compliance with the standards publicly available. This is recommended by the IEA and is currently undertaken by the EU (IEA 2012a, p. 71) and US.

CONCLUSION

By 2016, liable entities should be required to report annually on sales and vehicle data needed to underpin the standard.

C.3.2.4 PENALTIES

Penalties are a critical component of any regulatory scheme. The form and level of a penalty for non-compliance must be sufficient to encourage manufacturers to meet the required standard.

Financial penalties are commonly used, including in both the US and EU. In the US, a US$5.50 fine applies for each 10th of a mile per gallon of each new vehicle sold above the target. In the EU, a €95 fine for every gram of emissions of each new vehicle sold above the target is charged. In Japan, a smaller financial penalty applies and firms must make a public announcement of their non-compliance.

Non-compliance over a period can also be accounted for through a make-good provision at the end of a phase. Make-good provisions are easier to administer if trading is allowed.

Financial penalties seem appropriate for Australia. Further analysis by government would be required to determine the appropriate penalty level.

CONCLUSION
A financial penalty should apply to liable entities who do not comply with the standard.