March 2017

Ministerial Forum on Vehicle Emissions

Regulation Impact Statement

ClimateWorks Australia, in collaboration with Future Climate Australia, welcomes the opportunity to make this submission in response to the three consultation papers - 'Draft Regulation Impact Statement Improving the Efficiency of New Light Vehicles'; 'Draft Regulation Impact Statement on Noxious Emissions Standards for Light and Heavy Vehicles'; and 'Discussion Paper on Improving Fuel Quality Standards'.

We congratulate the Ministerial Forum on Vehicle Emissions, the Department of Infrastructure and Regional Development, and the Department of the Environment and Energy for their work in addressing light vehicle emissions in Australia. We hope that this submission can assist the Forum and the Department's in designing standards which maximize benefits to the Australian economy and environment.

We welcome the opportunity to discuss any of the points raised in this submission further.

ClimateWorks Australia is a leading independent organisation acting as a bridge between research and action to identify, model and enable end-to-end solutions to climate change. Since our launch in 2009, ClimateWorks has made significant progress and earned a reputation as a genuine and impartial adviser to key decision makers from all sides of politics and business. Our collaborative approach to solutions that will deliver the greatest impact encompasses a thorough understanding of the constraints of governments and the practical needs of business. We do this by looking for innovative opportunities to reduce greenhouse gas emissions, analysing their potential, resolving obstacles and helping to facilitate conditions for our transition to a prosperous, net zero emissions future by 2050. ClimateWorks was co-founded by The Myer Foundation and Monash University and works within the Monash Sustainable Development Institute.

Future Climate Australia (FCA), a not-for-profit organisation established in 2007, has been integral in the development and implementation of a wide range of practical initiatives contributing to the improvement of fuel efficiency measures in passenger vehicles, and an active contributor in the development of policy in the automotive sector.

The submission has had input and draws on current evidence from International Council for Clean Transportation (ICCT) and Global Fuel Economy Initiative (GFEI).

1. Introduction

As a signatory to the Paris Agreement to limit global warming to less than 2°C above pre-industrial levels, and striving to limit warming to 1.5°C, Australia has now committed to the global transition to net zero emissions. Australia has proposed an economy-wide target to reduce greenhouse gas emissions by 26 to 28 per cent below 2005 levels by 2030. This includes the investigation of opportunities to improve the efficiency of light vehicles.

The transport sector is one of the fastest growing sources of emissions within Australia, increasing by 47.5 per cent since 1990[1], however it also represents the most financially attractive emissions reduction opportunity across the Australian economy.[2] The transport sector accounts for 17 per cent or 92 $MtCO_2e$[3] of Australia's emissions in 2013 to 14, with Passenger and Light Commercial vehicles contributing 62 per cent of the sector's total emissions.[4] The sector's emissions have been projected to rise by a further 6 per cent to 2020, to reach 97 $MtCO_2e$, driven primarily by population and income growth for passenger travel and economic growth for freight transport.[5]

As it stands however, Australia is one of the few remaining developed countries without light vehicle CO_2 emission standards in place, with standards covering over 80 per cent of the global automotive market.[6] This has meant that in comparison to our global peers, Australia has scored poorly in the energy efficiency of its land transport sector. The recent American Council for an Energy-Efficient Economy (ACEEE) International Scorecard ranked Australia last out of 16 major OECD countries for the energy efficiency of our transport sector.[7]

Over 1.1 million new light vehicles were sold in Australia in 2014[8], making it the 11th largest vehicle market globally.[9] These new sales were comprised of approximately 80 per cent passenger vehicles and 20 per cent light commercial vehicles.[10] Light vehicles include all motor vehicles under 3.5 tonnes gross vehicle mass, including passenger vehicles, sports utility vehicles (SUVs) and light commercial vehicles, but excluding motorcycles.[11] A fuel efficient or low emissions vehicle is considered to be a vehicle with the lowest practicable impact on the environment and in general, can be classified in terms of net CO_2 emissions and tailpipe air-pollutant emissions.

Best practice light vehicle CO_2 emissions standards and relevant complementary measures must be designed with a focus on maximising a range of positive outcomes - financial savings for vehicle owners, improved energy security, and least cost emissions reductions. The conditions are now optimal for Australia to set the policy and program framework for the improvement of light vehicle fuel economy and to set us on the path towards lower and ultimately zero emissions light vehicles in Australia.

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[1] DIICCSRTE (2013)
[2] ClimateWorks Australia (2010)
[3] CO_2e or carbon dioxide equivalent, used to describe how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of carbon dioxide as the reference.
[4] DIICCSRTE (2013)
[5] DCCEE (2010)
[6] International Council on Clean Transportation (2015)
[7] American Council for an Energy-Efficient Economy (ACEEE) (2014)
[8] Federal Chamber of Automotive Industries (FCAI) (2015)
[9] Bandivadekar (2013)
[10] National Transport Commission (2013)
[11] ClimateWorks Australia (2014)

ClimateWorks and FCA supports the implementation of Target A (105 gCO_2e/km) to be phased in from 2020 to 2025. The draft Regulation Impact Statement shows that Target A provides the opportunity to deliver approximately over 6 per cent of Australia's 2030 emissions reduction target at the lowest cost of abatement across the economy, whilst delivering the greatest net benefit of all Targets of AUD$13.9 billion to 2040. It provides an additional 19 Mt of abatement to 2030 and 67 Mt to 2040 over Target B, whilst delivering an additional AUD$3.5 billion in net benefit to 2040. Compared with Target C, it provides an additional 41 Mt of abatement to 2030 and 140 Mt to 2040, whilst delivering an additional $8.1 billion in net benefit to 2040.

These are significant benefits as Australia looks to achieve its emissions reduction objectives at least cost, while reducing cost of living expenses to Australian households and operating costs to Australian businesses. We also recommend that the Ministerial Forum conduct a cost benefit analysis of an even more ambitious target of 95gCO_2/km by 2025, as we believe it will deliver greater net benefits and is technically feasible based on achievements in other markets.

Table 1: Estimated benefits of draft RIS Target stringencies and additional benefit of Target A (Draft RIS and ClimateWorks analysis)

Target Stringency	Cumulative Abatement to 2030 (Mt)	Cumulative Abatement to 2040 (Mt)	Net benefit to 2040 ($ billion)
Target A (105 gCO_2/km)	65	231	13.9
Target B (119 gCO_2/km)	46	164	10.4
Target C (135 gCO_2/km)	25	91	5.8
Additional benefit of Target A vs B (Target A-B)	19	67	3.5
Additional benefit of Target A vs C (Target A-C)	41	140	8.1

A summary of key comments and positions in this submission are outlined below:

1. The introduction of CO_2 emissions standards can be achieved without immediately improving fuel quality.
2. A short lead-time (less than two years) provides ample time to prepare for the introduction of the standard.
3. A more stringent standard beyond Target A is achievable and likely to provide greater net benefit due to technology advancements and cost reductions.
4. There are significant implications of implementing less stringent standards or delaying implementation of standards from an economic, social and environmental perspective.
5. Complementary measures are important to drive consumer uptake.
6. Whilst discrepancies exist between on-road and in-lab performance, a standard will still provide significant savings to consumers and the environment.

2. Summary of key comments and positions

The introduction of CO_2 emissions standards can be achieved without immediately improving fuel quality

Australia's fuel quality standards do not provide any impediment to immediately implementing CO_2 emissions standards. Claims to the contrary appear to conflate or confuse fuel quality requirements to meet Euro 5/6 standards, which aim to limit noxious emissions - NOx, HC, CO and particulates, with fuel requirements to meet CO_2 emissions standards. Largely, these two objectives can be considered independently, except in the specific circumstance where fuel efficient 'lean-burn' engine technology is used for which low-sulfur fuel is required. The evidence shows that vehicle manufacturers are not turning to lean burn technologies even in markets where low sulfur fuel is available.[12]

ClimateWorks and FCA supports the introduction of more stringent noxious emissions standards and the improvement of fuel quality to deliver on these. Consideration also needs to be given to the design of CO_2 emission standards to ensure they do not have perverse outcomes in terms of noxious emissions.

However, we do not support delaying the introduction of light vehicle CO_2 emission standards due to Australia's present fuel quality. Contrary to the evidence linking fuel quality and noxious emissions, there is no corresponding evidence base suggesting ultra-low sulfur fuel is a prerequisite to meet fuel economy (CO_2) standards. In fact, there is evidence that Australia's current fuel quality standards do not inhibit deployment of fuel efficient vehicle technologies. ClimateWorks and FCA have previously supplied evidence from the ICCT which concludes that the present quality of fuel available for road transport across Australia does not present any impediment to reducing vehicle CO_2 emissions in line with levels outlined in the draft Regulation Impact Statement.[13]

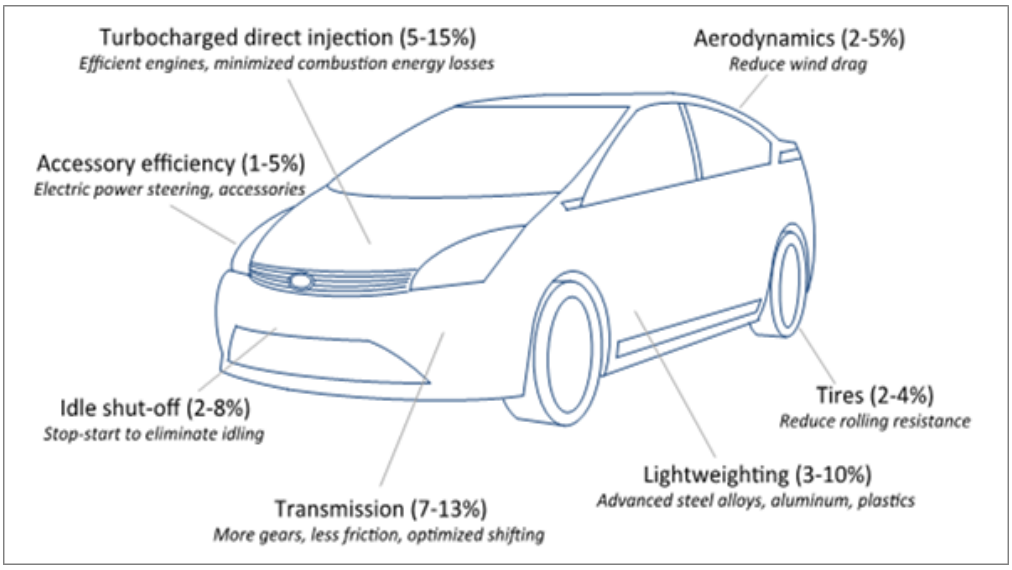
The ICCT, citing the US Environmental Protection Agency findings[14], goes on to state that 'low sulfur fuel … might be important for future long-term low-GHG combustion technologies that are in development stages'. Specifically, 'lean-burn Gasoline Direct Injection (GDI)' engines fitted with advanced after-treatment systems are identified as a technology that would require ultra-low sulfur fuel. The current evidence is that lean-burn technologies have not enjoyed significant uptake, even in countries where 10 ppm fuel is available. A 2011 study 'Lean GDI Technology Cost and Adoption Forecast: The Impact of Ultra-Low Sulfur Gasoline Standards[15]' found that:

> *… the market penetration of lean gasoline direct injection (GDI) engines in Europe will peak at about two per cent (2%) in 2010, the same maximum penetration level the technology reached in Japan 10 years ago. As in Japan, lean GDI will not be a meaningful technology path for European fleet average CO_2 compliance beyond 2013. In North America, the opportunity for lean GDI will be limited to a narrow number of naturally-aspirated engines that cannot accommodate advanced variable valve timing, a building-block technology necessary for HCCI functionality. Between 2015 and 2020, the maximum potential share for lean-burn engines in the U.S. is projected to reach three per cent (3%), and decline thereafter as observed in Japan and Europe.*

[12] McMahon, K., Selecman, C., Botzem, F., and Stablein, B. (2011)
[13] International Council on Clean Transportation (2014)
[14] Environmental Protection Agency (EPA) (2000)
[15] McMahon, K., et al. (2011)

Automotive manufacturers have a wide range of technologies with which to respond to fuel economy (CO_2) standards, as shown in Figure 1 below, of which only the lean burn technology noted above is adversely affected by sulfur content in fuels. Fuel quality is also not an issue for electric and other zero emissions vehicles which will contribute to achievement of advancements in light vehicle CO_2 emissions performance.

Figure 1: Range of technologies used for fuel economy (CO_2) standards (ICCT, 2014)



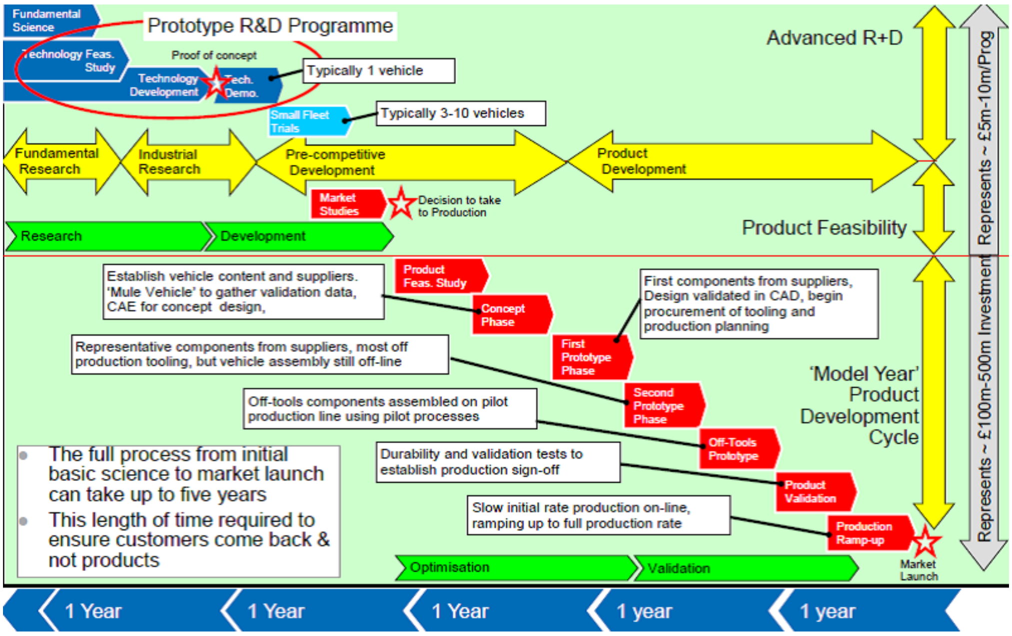
A short lead-time (less than two years) provides ample time to prepare for the introduction of the standard

ClimateWorks strongly supports the proposed Target A of 105 gCO_2/km with a short phase in period where a calculated percentage reduction in emissions can be applied each year to each yearly fleet. With a starting fleet efficiency of 184 gCO_2/km (NEDC) in 2015, Target A corresponds to a 5.5% annual reduction.[16]

It is recognised that the US 2017 to 2025 standards require about a 4.1 per cent annual reduction, however it is important to note that the US is a 'technology forcing' market, where high volume automotive technology development and implementation follows robust processes, which from initial concept to market launch can take up to five years. With that said, the U.S. CAFE standards were announced 18 months prior to enforcement. Australia is starting from a different baseline, where the development of new vehicles is not required but rather revised production schedules for variants of existing models that are currently manufactured to meet current standards in the US, EU and Japan. Figure 2 below illustrates typical technology development timelines.[17]

[16] Based on the ICCT tool to convert these NEDC values to WLTP (Kühlwein et al. 2014) and assuming Australian fleet diesel share of around 30 per cent, leads to Target A stringency of about 120 gCO_2/km while the 2015 fleet averages about 190 gCO_2/km, or a 4.5 per cent annual reduction.
[17] Ricardo (2016)

Figure 2: Technology Development Timelines



As outlined by the ICCT:

> *The average level of technology currently installed on vehicles in Australia lags that for vehicles in the US, Europe, and Japan by many years. Thus, Australia is a 'technology taker', meaning that the standards are designed to bring technology to Australia that is already in widespread use in much of the world. This is much easier, requires much less lead time than technology forcing standards, and allows for larger annual reductions.*

The ICCT also notes that the draft Regulation Impact Statement and supporting documentation has been published well in advance of potential implementation dates of either 2018 or 2020. As such the standards can be flexible enough that if there are changes in circumstances that result in insufficient lead time, they can be phased in more slowly at the beginning of the compliance period and faster towards the end.

An interesting international comparison is Saudi Arabia, which has a similar vehicle fleet to Australia's and is also a 'technology taker'. Saudi Arabia introduced standards, applicable to all new and used passenger vehicles and light trucks whether imported from outside or manufactured in country, which were effective as of 1 January 2016 and will be fully phased in by 31 December 2020. A review of the targets will be carried by December 2018, at which time targets for 2021 to 2025 will be set[18].

Like Target A proposed in the draft Regulation Impact Statement, Saudi Arabia's target required the same level of technology on vehicles as in the US, with a three year lag time, thereby harmonising the standards and simplifying manufacturer compliance.

[18] International Council for Clean Transportation (2014)

A more stringent standard beyond Target A is achievable and likely to provide greater net benefit due to technology advancements and cost reductions

The draft Regulation Impact Statement considers three different levels of standard stringency, based on the 'strong', 'medium' and 'mild' standards analysed by the Climate Change Authority in 2014.[19] In determining the appropriate level for a standard, the Climate Change Authority suggested two main considerations:

- maximising the net benefits from standards; and
- seeking to align Australia's standards with comparable markets if there are opportunities to do so.

In order to assess the first consideration, the Climate Change Authority undertook analysis to identify which target delivers the largest net benefit based on modelling undertaken by the CSIRO in 2013, and international evidence of the costs of technologies to meet the standards, again undertaken in 2014. It was also noted that 'if it was so inclined, however, the government might wish to consider whether stronger standards in phase one would deliver even larger net social benefits'.

Whilst the draft Regulation Impact Statement has considered updated analysis to inform its cost benefit analysis (further commentary on this below), it has not revisited the stringency of the standards modelled by the Climate Change Authority. We believe that by not looking at a more stringent standard, the possible standard which could deliver the maximum net benefit has not been assessed. This does not allow for a discussion of the technical feasibility to implement such a standard, if it were to deliver maximum net benefit. ClimateWorks and FCA recommends that the Ministerial Forum run a cost benefit analysis on a standard which reflects adopting the EU 2020 standard with a five year delay (i.e. 95 gCO_2e/km).

In regards to the analysis used to inform the cost benefit analysis, we support the ICCT's position that:

> *Costs of efficiency technologies have decreased, and a greater variety of technologies have become available, since the studies used in BITRE's cost-benefit analysis were completed.*

The draft Regulation Impact Statement also rightly emphasises the uncertainty with technology cost forecasts, citing the European Consumer Organisation[20] (BEUC) who 'emphasise that in ex-ante estimates, production costs are often largely overestimated', and Ricardo-AEA[21] who also state that the 'costs of deploying technologies for new vehicles have been lower than anticipated' in regards to progress under the EU's light vehicle CO_2 regulation. The draft Regulation Impact Statement also cites the recent US EPA[22] assessment of progress towards the US light vehicle CO_2 standards, which finds 'a wider range of technologies exist for manufacturers to use to meet the MY [Model Year] 2022-2025 standards, and at costs that are similar or lower, than those projected in the 2012 rule'. This is an important consideration when making long range cost forecasts, and is similar in other rapidly developing technology fields such as solar PV, where deployment rates and decreases in costs of technology often far exceed projections.

[19] Climate Change Authority (2014)
[20] BEUC (2013)
[21] Ricardo-AEA (2014)
[22] United States Environmental Protection Agency (2016)

Developments in zero emissions vehicles, particularly electric vehicles given the standards timeframe, have advanced significantly in recent years. The cost of electric vehicles has been falling faster than previous forecast and Bloomberg New Energy Finance estimated that they could reach parity with conventional internal combustion vehicles as early as 2025[23], meaning that costs to achieve the standard will be lower than anticipated. It is unclear as to whether the draft Regulation Impact Statement considered the role of electric vehicles in meeting a standard, as Table B7 specifically looks at estimated additional capital and compliance costs for 'non-electric' fleet only. If so, then it is possible that electric vehicles may drive down average additional capital costs for standard compliance during the 2020 to 2025 timeframe.

As Australia is a 'technology taker' with an increasingly large proportion of our fleet sourced from markets with standards already in place, Australia can expect to replicate the rate of improvement in a shorter timeframe than previously seen in markets such as the United States and Europe.[24]

Based on this, we would argue that technology costs used in the draft Regulation Impact Statement are overly conservative, and hence underestimate the net benefit to the Australian economy. The sensitivity analysis run in the draft Regulation Impact Statement in Table B12 provides an example of the impact of lower capital costs, and shows that Net Present Value increases by almost AUD$2 billion over the assessment period compared to standard values used in the base case.

ClimateWorks and FCA recommends that the Ministerial Forum work with the ICCT to review the capital costs used in the cost benefit analysis to greater reflect:

1. The latest research in terms of technology costs to meet the standards in other markets;
2. The implications of Australia being a technology taker and relative laggard in vehicle efficiency on technology costs; and
3. The impact of electric vehicles on standard additional costs be further investigated by the Ministerial Forum.

ClimateWorks and FCA also encourages the Ministerial Forum to consider the implications of different ownership models emerging in the light vehicle space, especially on passenger vehicles. These models, such as car share, and increase of Uber etc, will have implications for kilometres travelled per vehicle, and will reduce capital expenditure for broader consumers. We welcome discussing this with the Ministerial Forum in more detail.

There are significant implications of implementing less stringent standards or delaying implementation of standards from an economic, social and environmental perspective

Apart from the technical design aspects of light vehicle CO_2 emissions standards, the stringency of the standard and the timing for implementation are key elements. These two issues carry major implications for the cost and benefits to the Australian economy, society and environment, and should be based on what is realistically achievable by industry and delivers the greatest net benefit.

[23] Bloomberg New Energy Finance (2016)
[24] ClimateWorks Australia (2016)

This section provides a summary of further analysis undertaken by ClimateWorks, drawing off analysis provided by MOV3MENT, to assess the implications of standard stringency and timing.

Standard Stringency

The first piece of analysis assesses impact of stringency of the targets. It presents the benefit of these standards against BAU as provided in the draft Regulation Impact Statement, and contrasts the most stringent target (A) with least stringent (C) over two different timeframes: to 2030 (Figure 3), and to 2040 (Figure 4). Results are presented in terms of emission reductions (cumulative abatement and against the Government's 2030 target[25]), cumulative fuel savings and net benefit (net benefit to 2040 only). This analysis draws on the data presented in the draft Regulation Impact Statement.

Figure 3: Comparison of RIS Target stringency levels on emission reductions (Draft RIS and ClimateWorks analysis)

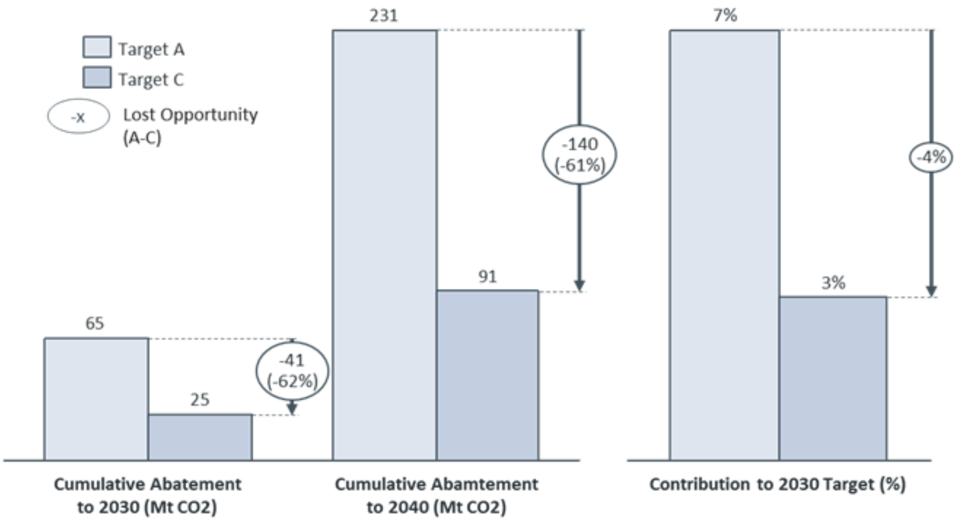
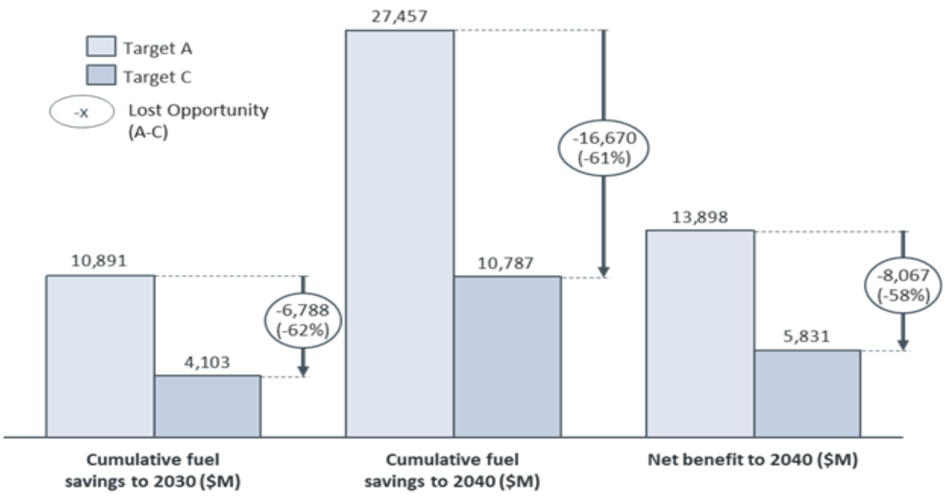


Figure 4: Comparison of RIS Target stringency levels on fuel savings and net benefit (Draft RIS and ClimateWorks analysis)



[25] Department of the Environment and Energy (2016)

Standard Implementation Timing

The second piece of analysis assesses the impact of the timing for standard implementation. It contrasts Target A as presented in the draft Regulation Impact Statement (2020 to 2025 implementation) with a delayed scenario (2022 to 2027 implementation, two years later than draft Regulation Impact Statement). The analysis is completed for two different timeframes to 2030 and to 2040 (Table 2). Results are presented in terms of emission reductions (cumulative abatement and against the Government's 2030 target[26]), cumulative fuel savings, net benefit (to 2040 only) and number of additional vehicles covered[27] by the standard.

The analysis draws off modelling provided by MOV3MENT, where a simple linear model has been used which assumes a parallel rate of improvement to Target A in the draft Regulation Impact Statement over a five year period, using a different start date and a flat average of 17,000 km/year driven by each vehicle. While this modelling is illustrative, it demonstrates the need for further analysis based the implications of this using the Government's own CBA model.

Table 2: Impact of timing of implementation of Target A to 2030 and 2040 (MOV3MENT and ClimateWorks analysis)

Target implementation timing	**Cumulative Abatement (Mt)**	**% contribution to 2030 target (26%=990MT)**	**% contribution to 2030 target (28%=1055 Mt)**	**Cumulative fuel savings ($M, 7% discount)**	**No. additional vehicles covered (M)**
Delayed vs draft RIS (2 years later) to 2030	-17.6	-1.8%	-1.7%	$4,920	-2.2
Delayed vs draft RIS (2 years later) to 2040	-40.0	-1.8%	-1.7%	$8,321	-2.2

Any delay in implementing vehicle emissions standards will result in emissions and fuel use lock-in, where a larger proportion of vehicles on our roads will be less efficient than they would be with a standard in place. This reduces the potential by which vehicle emissions standards can contribute to Australia's 2030 emissions reduction target, and reduces the potential fuel savings these vehicles will have over their lifetime.

The analysis presented above shows that by delaying implementation by two years compared to the timing in the draft Regulation Impact Statement, from 2020 to 2022, would result in an additional 2.2 million vehicles being sold without a standard in place. As Australian light vehicles have a long lifespan of approximately 20 years, this has significant implications for their lifetime emissions and fuel use, as discussed in the following sections.

Implications for CO_2 Emissions

The stringency and implementation timing of a standard has a significant impact on the emissions reduction potential which can be achieved in the light vehicle sector, and the contribution this sector can make to meeting Australia's 2030 emissions reduction target. The most stringent standard analysed in the draft Regulation Impact Statement (Target A) will deliver 41 Mt CO_2e additional cumulative abatement from 2018 to 2030 than the least stringent (Target C). To 2030, Target A will deliver a further 3.9 to 4.1 per cent of the Government's emissions reduction target than Target C, and between 6.2 to 6.6 per cent of the target in total. The difference between the targets is even more profound to 2040, with Target A delivering 140 Mt CO_2e of additional cumulative abatement from 2018 to 2040 than Target C.

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[26] Department of the Environment and Energy (2016)
[27] Assumes 1.1 million new light vehicle sales per year.

From a timing perspective, delaying implementation of the standard by 2 years will result in 17.6 Mt CO_2e of cumulative abatement being lost to 2030; a loss of 1.7 to 1.8 per cent of the Government's emission reduction target. The impacts of timing are even more significant to 2040, a two year delayed target would lose 40 Mt CO_2e cumulative abatement over this period.

The difference between this abatement potential has significant implications for other sectors of the Australian economy and the community more broadly. The Australian Government has a 2030 emissions reduction target that has been committed to through the UNFCCC process; any abatement not achieved in the light vehicle sector will need to be made up for in other sectors or purchased through international carbon permits. Research conducted by a number of organisations, including ClimateWorks, RepuTex[28] and Energetics[29], has shown that abatement in the light vehicle sector is the cheapest across the economy and provides a net return, as demonstrated by the draft RIS own estimates of -AUD$47/t$CO_2$ cost of abatement. Hence any other form of abatement pursued to achieve the 2030 target will come at a greater net cost. Ultimately, this cost is passed on to the Australian economy and consumers.

The draft Regulation Impact Statement, specifically Table 9, estimates that this cost difference is in the range of AUD$700 million, for the discrepancy between Target A and Target C to 2030 and based on a cost of abatement of AUD$35 per tonne CO_2e.

If the abatement was to be achieved through a mechanism such as the Emissions Reduction Fund, which had an average cost of abatement across the first three auctions of AUD$12.10 per tonne CO_2e, to achieve a further 17.6 to 41 Mt CO_2e of cumulative abatement to 2030 (the range presented in the analysis above), would cost approximately an additional AUD$212 to AUD$492 million.

It should be noted that ClimateWorks views the Emissions Reduction Fund results to be a conservative estimate of the cost of abatement, as abatement costs to 2030 are likely to be significantly higher than early results of the Emissions Reduction Fund where low cost abatement opportunities have been funded. This is demonstrated by the assumption used in the draft RIS of AUD$35/t$CO_2e$. Even this figure is likely to be conservative, as the International Energy Agency[30] estimates a carbon price in the range of US$100/t$CO_2e$ by 2030 in OECD countries to achieve emission reductions in line with limiting global warming to 2 degrees, let alone well below 2 degrees as stipulated in the Paris Agreement.

Implications for Fuel Savings

The implications for potential fuel savings related to the stringency and timing of a light vehicle CO_2 emissions standard are also quite significant. Based on the draft Regulation Impact Statement analysis to 2030, Target A delivers an additional AUD$6.8 billion in cumulative fuel savings than Target C, and to 2040 Target A delivers AUD$16.7 billion more in cumulative fuel savings. The draft Regulation Impact Statement highlights that for an average performing petrol vehicle, the difference between Target A and Target C results in an annual additional fuel saving of between AUD$197 to AUD$295[31] per year (AUD$3.80-AUD$5.70 per week) for a driver doing 15,000 km per year, and between AUD$328 to AUD$493[32] per year (AUD$6.30-AUD$9.50 per week) for a driver doing 25,000 km per year.

[28] RepuTex (2015)
[29] Energetics (2016)
[30] IEA (2016)
[31] Range based on petrol price range of $1.00/L to $1.50/L.
[32] Range based on petrol price range of $1.00/L to $1.50/L.

Table 3: Comparison of RIS Target stringency levels on fuel savings and expenditure (Draft RIS and ClimateWorks analysis)

Target Stringency	Annual additional fuel savings over BAU ($)[33]	Reduction in average low income household fuel spend (%)[34]	Reduction in average middle income household fuel spend (%)[35]
Target A vs BAU (15,000 km/yr)	$362-543	9.7-14.5%	7.2-10.9%
Target C vs BAU (15,000 km/yr)	$165-248	4.4-6.6%	3.3-5.0%
Lost opportunity (A-C, 15,000 km/yr)	$197-295	5.3-7.9%	3.9-5.9%
Target A vs BAU (25,000 km/yr)	$604-906	16.1-24.2%	12.1-18.1%
Target C vs BAU (25,000 km/yr)	$276-413	7.4-11.0%	5.5-8.3%
Lost opportunity (A-C, 25,000 km/yr)	$328-493	8.8-13.2%	6.6-9.9%

To put this into context, in 2012 the average Australian middle income household spent AUD$96 per week on household energy, of which fuel for vehicles was AUD$59, or 61 per cent.[36] By adopting the most stringent target (Target A) compared to the most lenient (Target C), this could deliver an approximate further 4 per cent to 10 per cent reduction in total household energy cost.

The cost implications for low income households is even more significant, as low income households spent on average approximately three times the amount of their gross household weekly income on total household energy costs compared to high income households (in 2012, 10 per cent of low income household gross weekly income was spent on household energy costs). In 2012 low income households spent an average of AUD$72 per week on energy, with AUD$42 per week, or 58 per cent, spent on fuel for vehicles. By adopting the most stringent target (Target A) compared to the most lenient (Target C), this could deliver an approximate five per cent to 13 per cent reduction in total household energy cost for low income households. This is a significant cost saving given current issues with increasing household energy costs37 and pressures on cost of living. The Climate Change Authority states that "*over time, the substantial fuel savings from standards are likely to benefit low income households, particularly as more efficient vehicles are resold into the second hand market*".[38]

The impact that timing has on fuel savings shows that by delaying implementation of a light vehicle CO_2 emission standard by 2 years (Target A implemented in 2022 to 2027), new light vehicle owners would face an additional AUD$4.9 billion in cumulative fuel costs to 2030, and an additional AUD$8.3 billion to 2040, compared to the timing presented in the draft Regulation Impact Statement (2020 to 2025).[39]

Implications for Health

The draft Regulation Impact Statement does not provide an assessment of the estimated health benefits from the implementation of light vehicle CO_2 emission

[33] Range based on petrol price range of $1.00/L to $1.50/L.
[34] Based on ABS 2012 Household energy consumption
[35] Based on ABS 2012 Household energy consumption
[36] Australian Bureau of Statistics (2012)
[37] http://www.abc.net.au/news/2016-02-10/abs-energy-stats-show-61-per-cent-increase/7153660
[38] Climate Change Authority (2014)
[39] Data was not available from this analysis to calculate average saving per driver.

standards. When considering the stringency of a standard, Target A delivers over 2.6 times more fuel savings than Target C to 2030, and over 2.5 more savings to 2040. In terms of target timing, if the target is delayed by two years, then it increases fuel use by 7,000 ML to 2030, and 16,000 ML to 2040.

Reduced fuel use of this magnitude could have flow on effects to reduce noxious emissions, resulting in reduced health impacts, noting that standards would need to be designed which don't encourage dieselisation without appropriate noxious emission standards in place. The reduction in health costs will broadly correspond to the reduction in fuel use if this were the case. Given that Target A will deliver 2.6 times more fuel savings than Target C, it should reduce health costs by a similar proportion. ClimateWorks and Future Climate Australia recommends that the Ministerial Forum consider the health benefits of light vehicle CO_2 emission standards in their cost benefit analysis, utilising a similar methodology as applied in the draft Regulation Impact Statement '*Vehicle Emissions Standards for Cleaner Air*'.

We know that vehicles are significant contributors to levels of hydrocarbons, oxides of nitrogen, carbon monoxide and particulate matter in the air, which can adversely affect acute and chronic health conditions[40], including respiratory illness, cardiovascular diseases and cancer. It has been estimated that road vehicles are the second and third largest source of PM2.5 in the Sydney greater metro area, and the second and fourth largest source of NOx.[41]

The World Health Organization estimates that globally in 2012, approximately 3.7 million deaths were attributable to ambient (outdoor air pollution).[42] While in general the air quality in Australia compares favourably to a range of other countries, our monitoring and reporting systems are not expansive or sufficiently geared to provide an accurate account of the actual air quality experience in Australia.

In its *Clean Air for NSW Consultation Paper*[43], the NSW EPA states the following in regards to the public health impacts and costs of air pollution:

> *Each year, air pollution leads to:*
> - *520 premature deaths and 6,300 cumulative years of life lost in Sydney (Morgan et al. 2013);*
> - *1,180 hospital admissions in Sydney (Broome et al. 2015); and*
> - *an estimated AUD$6.4 billion (2015 AUD) in health costs in the NSW Greater Metropolitan Region (GMR) (DEC 2005).*

Air pollution from road vehicles is a negative externality, the health costs are not borne directly by the vehicle manufacturers nor owners, but shared by the community. The draft Regulation Impact Statement acknowledges that there are considerable uncertainties in the analysis around the actual health costs of various pollutants, most notably NOx, given the wide range of figure in current literature. As such, the health costs used for this analysis were conservative estimates.

Implications for Net Benefit

Looking at the impact of standard stringency[44] on net benefit to 2040 shows that there is a significant difference between the most stringent target (Target A) and the least stringent (Target C) as presented in the draft Regulation Impact Statement. This shows that Target A delivers an additional AUD$8 billion in net benefit to the Australian economy beyond Target C over this 22 year timeframe, whilst delivering a further 140 Mt CO_2e of abatement. This results in an average cost of additional abatement over this period of -AUD$58/$tCO_2e$.

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[40] Climate Change Authority (2014)
[41] NSW Environment Protection Authority and Office of Environment and Heritage (2016)
[42] World Health Organization (2014)
[43] NSW Environment Protection Authority and Office of Environment and Heritage (2016)
[44] Analysis was not available for the implication of standard implementation timing.

To put this in context, by adopting the most stringent standard as opposed to the least stringent, this alone is estimated to deliver approximately 12 times the estimated net benefit of implementing both Euro 6 and Euro VI noxious emissions standards for light and heavy vehicles[45] - noting that health benefits have been excluded from the light vehicle CO_2 standard net benefit calculation, but included in the noxious emissions calculation. This highlights the significance of implementing the most stringent standard which is technically feasible at the earliest implementation date, as the benefits to Australian society are larger than other opportunities in this area.

Complementary measures are important to drive consumer uptake

As has been consistently shown in other markets, implementing light vehicle CO_2 emissions standards should not happen in isolation. Best practice light vehicle CO_2 emission standards and relevant complementary measures must be designed with a focus on maximising a range of positive outcomes - financial savings for vehicle owners, addressing technical and infrastructure issues, improved energy security, and achieving least cost emissions reductions. They must also be designed to support the marketing of low emissions vehicles, to assist consumer choice.

While complementary measures are outside the scope for the draft Regulation Impact Statement of light vehicle CO_2 emissions standards, their importance to overall policy developments warrants inclusion and discussion. It is hard to assess some of the technical features of standard design (such as super credits etc), without fully understanding the complementary measures that will be introduced.

ClimateWorks and FCA have previously outlined key complementary measures required to support the introduction of a light vehicle CO_2 emissions standards, in its response the Ministerial Forum on Vehicle Emissions Discussion Paper.[46] A summary of these measures is provided under five broad categories below. We are happy to have further dialogue with the Ministerial Forum on these measures as it works to implement standards.

Information and Education

Education and awareness activities should include providing information about fuel savings, total cost of ownership and relevant purchasing incentives at dealerships, on consumer labels, websites, and through advertising campaigns.

Public events, including ride-and-drive with expert panels for fleet managers and decision makers and increased placement of low emissions vehicles in government fleets, increase awareness of new technologies. Finally, the placement of vehicles in taxi, company, rental, and car-sharing fleets can also help to overcome the basic foundational lack of awareness and acceptance regarding available low emissions vehicle models.

In addition, an overarching vision for improving the fuel economy of Australia's new light vehicle fleet would be a major driver for supportive policy. The establishment of supportive institutional and policy frameworks consisting of the creation of an agenda setting organisation for lower emissions vehicles would ensure a coordinated approach in terms of policies and complementary measures.

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[45] The benefit-cost analysis of option 6–mandating both Euro 6 and Euro VI for light and heavy vehicles–estimated a net benefit of $675 million over the period 2016 to 2040, as per the draft Regulation Impact Statement *Vehicle Emissions Standards for Cleaner Air*.

[46] ClimateWorks Australia and Future Climate Australia (2016)

Fleet Purchasing Policy

The importance of fleet purchasing policies is crucial in the support and uptake of low and zero emission vehicles. The opportunity now exists for the Australian Government to lead by example through fleet policies designed to promote adoption of radically lower emissions vehicles.

In 2015, approximately 46 per cent of new vehicle purchases in Australia were by fleets47 with fleets typically turning vehicles over in three to five years, and in doing so providing a significant proportion of vehicles into the second-hand market. Fleet operators also generally have a good understanding of the total cost of ownership, duty cycle and are more understanding of issues stemming from the deployment of new technology. A high proportion of fleet purchases are novated or 'user chooser' leases where an individual nominates the make and model of car that they wish to obtain. Fleet managers, with their level of knowledge, can potentially be great advocates for efficient vehicles.[48]

Taxation and other policy measures

Several basic design principles appear important in policy implementation. Consumer interest could be motivated by setting incentives for the purchase of fuel efficient and lower emissions vehicles including both financial and nonfinancial mechanisms. Financial incentives could be in the form of annual (including tax rebates, registration and stamp duty reductions, parking fee deductions and vehicle emission taxes) or punctual incentives (including differential road tolls and pricing, free or reduced parking fees, higher fuel prices).[49] Non-financial incentives can include benefits such as priority lanes and reserved parking spaces.

Other taxation policies measures include: exemption of low or zero emissions vehicles from Luxury Car Tax (LCT) or the replacement of this scheme with an Emissions Tax for Luxury Vehicles; exemption of low or zero emissions vehicles from Fringe Benefits Tax (FBT) to account for their higher capital costs in the period through to their expected pricing parity with internal combustion engine vehicles; and consideration for the extension of the FBT exemption to novated leasing arrangements and beyond the sunset period for the business fleet vehicle exemption.

Alternative fuels and electric vehicles

The deployment of alternative fuelled vehicles requires both the right infrastructure and developed supply chains.

To develop the right infrastructure for alternative fuels federal, state and local governments could utilise urban planning powers coupled with grant programs towards businesses to stimulate the installation of infrastructure dedicated to lower emissions vehicles.

Supply chains for lower emissions vehicles can be stimulated by policy intervention in a variety of ways. Government procurement is a powerful policy tool that can be considered at all levels of government. Government procurement could represent a major demand in the lower emission vehicle market, consequently developing supply chains. Federal and State governments could also establish voluntary agreements or set binding targets on manufacturers or suppliers to increase model availability in Australia and contribute to the development of specific supply chains.

[47] Federal Chamber of Automotive Industries (FCAI) (2015)
[48] Wikstrom (2014)
[49] ClimateWorks Australia (2015)

Advancement of emerging technologies and practices which can improve efficiency

The broad-scale advancement of new and emerging technologies can bring significant changes in the technologies utilised for personal transportation, and also in moving economies away from petroleum and reducing the environmental footprint of transportation. With standards or targets in place, industry can be incentivised to promote advanced technologies to achieve reductions in CO_2 emissions.

The development of intelligent transportation systems (ITS) provide advanced and innovative applications relating to different modes of transport and traffic management. If ITS becomes accessible to ten per cent of the Australian fleet, the benefits in terms of improved traffic management and safety would flow onto the entire fleet.

Whilst discrepancies exist between on-road and in-lab performance, a standard will still provide significant savings to consumers and the environment

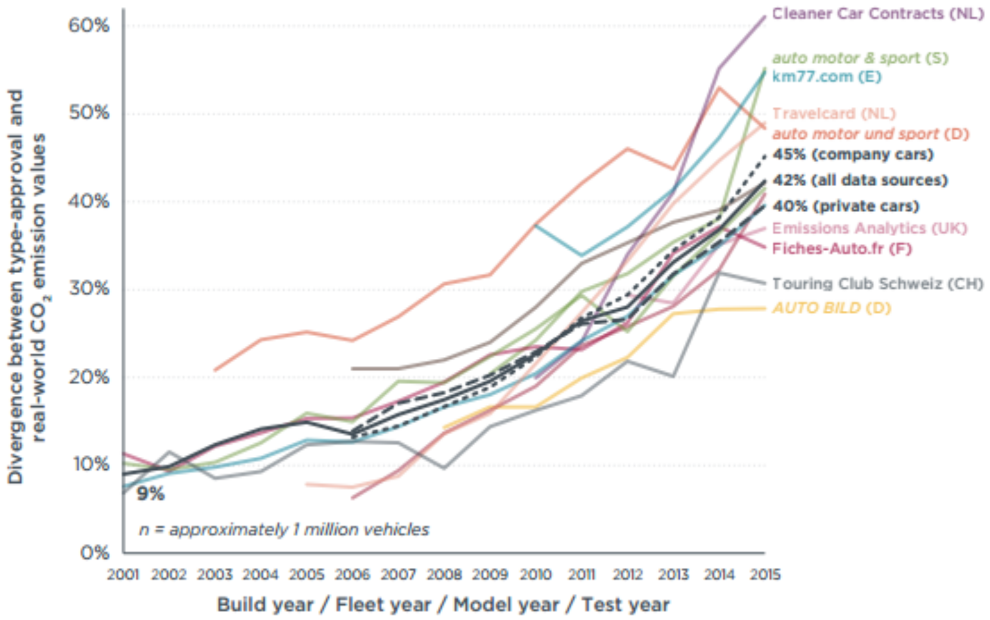
An Australian light vehicle CO_2 emissions standard should be implemented using accepted, widely-used test procedures to minimise regulatory burden. Australia presently uses the New European Drive Cycle (NEDC) for fuel economy and CO_2 emission ratings. NEDC is the CO_2 emission standard in Europe and many other markets, while other standards (eg US CAFE standard) are often expressed as ‘normalised to NEDC’ for comparative purposes. In the period 2017 to 2020, the NEDC will be phased out to be replaced with the Worldwide Harmonized Light Vehicles Test Procedure (WLTP).

ClimateWorks and FCA supports efforts to improve the correlation of test results to real world experience and for that reason it would seem logical to implement an Australian CO_2 standard using the WLTP to coincide with the international implementation of that standard in 2020.

The WLTP is being introduced to address the growing disparity between emissions recorded under test conditions and so-called ‘real-world’ emissions. The ICCT has demonstrated that this divergence has grown from around nine per cent of greater emissions in the ‘real world’ in 2001 to over 40 per cent in 2015.[50]

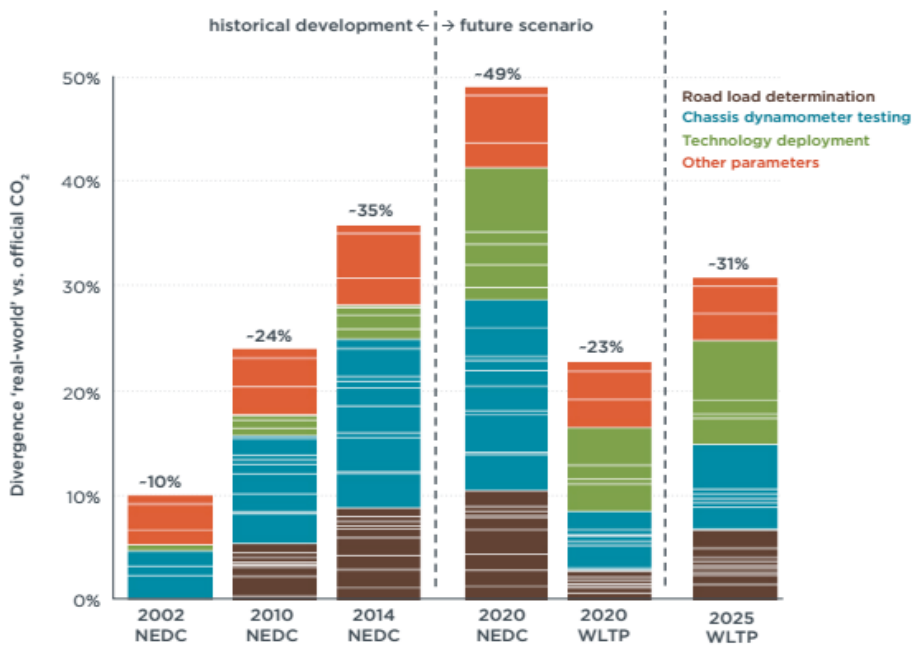
[50] International Council on Clean Transportation (2016)

Figure 5: Divergence between real-world and manufacturers' type-approval CO_2 emissions values for various real-world data sources, including average estimates for private cars, company cars, and all data sources[51]



The ICCT projects that this divergence will grow further to almost 50 per cent by 2020, as shown in Figure 6. The reasons for divergence are varied but technology deployment is projected to represent the greatest increase between now and 2020. That is, deployment of increasingly advanced technology distorts the test results further from real world outcomes.

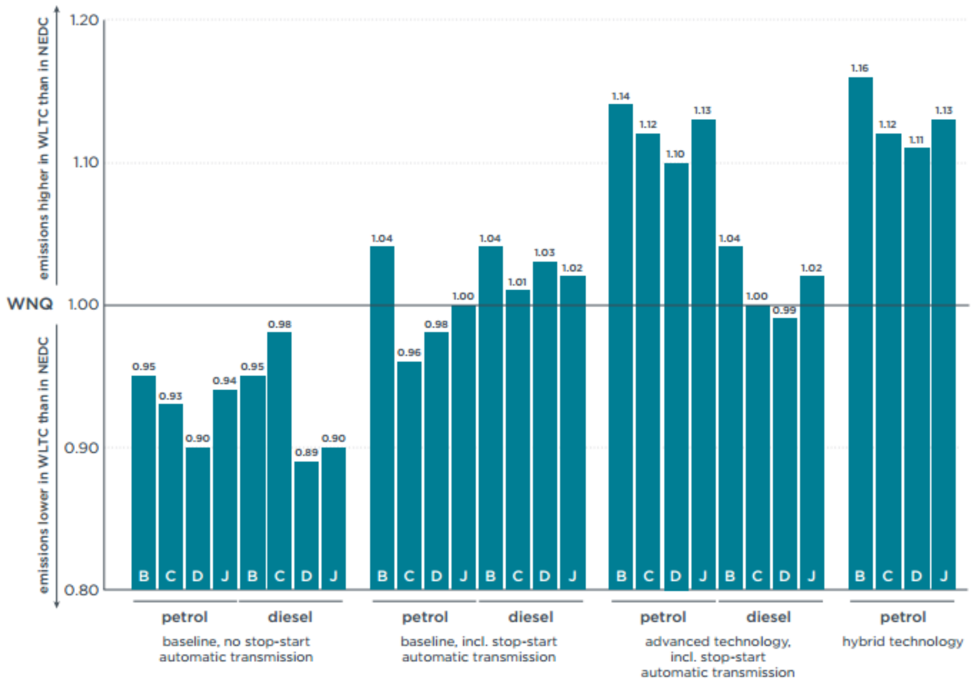
Figure 6: Estimate of the reasons for the discrepancy between type-approval and real-world CO_2 emission levels for new passenger cars in the past as well as in the future, with and without introduction of the WLTP[52]



[51] International Council on Clean Transportation (2016)
[52] International Council on Clean Transportation (2016)

This effect is further seen in a simulation of WLTP vs NEDC results for a range of technologies in Figure 7. If the WLTP is accepted as a closer representation of 'real world' than NEDC, then it is clear that increasing levels of technology sophistication result in greater levels of test result distortion.

Figure 7: Ricardo vehicle simulations runs and resulting NEDC-WLTC conversion factors[53]



Some commentators have argued this effect may negate any benefits of a CO_2 standard. That is, that perceived benefits or test results will not be matched by real world outcomes. Perhaps counterintuitively, the benefits obtained in the real world can be expected to at least equal and perhaps exceed the notional benefits calculated using test results.

The following example demonstrates this. The draft Regulation Impact Statement assumes 2025 BAU and Target A emissions of 145 g CO_2/km (NEDC) and 95 g CO_2/km (NEDC) respectively, with a real world adjustment factor of 10 per cent and target savings of 55.7 g CO_2/km.

These calculations have been repeated in Figure 8 below as Example 2. Example 1 provides the same calculation using notional test results without any real world adjustment. Example 3 and 4 use the test divergence figures reported by ICCT in Figure 6 above. Example 3 uses the figure for 2014 and assumes no further technological deployment. This is an unlikely scenario but is included for comparison purposes. Example 4 is considered the most realistic scenario. This uses the ICCT adjustment factor for 2020 (the latest available using the NEDC test cycle) and show a very similar result to the RIS outcome.

[53] International Council on Clean Transportation (2014)

In summary, even after allowing for deployment of increasingly sophisticated technology and assuming that this results in test results increasingly divergent from 'real world' the RIS estimate of projected savings under the Target A scenario appears sound. Of course, should the WLTP be adopted as the basis of the CO_2 standard, the test results and real world results would be expected to align even more closely.

Figure 8: Estimated reduction in passenger vehicle gCO_2/km emissions using different test divergence assumptions

		g CO2/km
2025 passenger vehicle average emissions (projected BAU - NEDC)		145
RIS Real world adjustment factor	10%	
ICCT Real world adjustment factor (2014)	35%	
ICCT Real world adjustment factor (2020)	49%	
Projected Target A (RIS)		95
1. No "real world adjustment factor"		
Projected BAU - NEDC		145
Projected Target A - NEDC		95
Projected Reduction - NEDC		***50***
2. Assuming constant RIS real world adjustment factor		
Projected BAU		160
Projected Target A		105
Projected Reduction - RIS real world adjustment factor		***55***
3. Assuming ICCT "real world adjustment factor" & 2014 technology mix		
Projected BAU		196
Projected Target A		128
Projected Reduction - ICCT real world factor and 2014 technology mix		***68***
4. Assuming ICCT "real world adjustment factor" & increasing technology mix		
Projected BAU (held at 2014 technology mix)		196
Projected Target A		142
Projected Reduction - ICCT real world factor and increasing technology mix		***54***

3. Response to Improving the Efficiency of New Light Vehicle

The draft Regulation Impact Statement 'Improving the Efficiency of New Light Vehicles' takes a considerable step forward in terms of aligning Australia with best practice vehicle efficiency standards in the US, EU, Japan, Mexico, Saudi Arabia, and other markets. Australia has a significant opportunity to reduce emissions from the transport sector, which will be crucial in meeting both international and national targets.

ClimateWorks and FCA strongly supports the proposed Target A stringency and responses to key issues outlined in the draft Regulation Impact Statement are detailed below, and are based on the technical response submitted by the ICCT.[54]

What could be regulated?

What parameter (CO_2 emissions or fuel consumption) should be used for an Australian fuel efficiency standard and why?

ClimateWorks and FCA support the ICCT's submission responding to the key questions raised in Appendix A of the draft Regulation Impact Statement Improving the 'Efficiency of New Light Vehicles'. In relation to what parameters should be used for an Australian fuel efficiency standard, that submission states:

> *Since the Government primarily seeks to reduce CO_2 emissions through improved vehicle efficiency, a CO_2 emissions-based standard is preferable. In contrast to a fuel consumption-based standard, a CO_2 emissions parameter is independent of type of fuel burned. Thus, alternative, low carbon fuels are equally encouraged.*
>
> *Furthermore, Australia's Green Vehicle Guide already uses CO_2 as a metric for vehicle efficiency. Evidenced by Australia's fuel consumption labelling program, measuring efficiency in terms of CO_2 emissions easily translates into fuel consumption. Thus, using CO_2 as the efficiency parameter is both administratively easier and more straightforward, as well as more technology neutral than using fuel consumption to measure efficiency.*

Internationally and as a point of comparison, the US and Republic of Korea use both fuel economy and CO_2 emissions standards. The EU and India use 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.[55]

An additional question to consider is whether to structure the standard to include emissions of other greenhouse gases beyond CO_2 emissions. These other greenhouse gases could include nitrous oxide exhaust emissions from the combustion of fuel and emissions of hydrofluorocarbons (HFCs) from vehicle air conditioning systems. In general, emissions of these other greenhouse gases are relatively small compared with the CO_2 emissions from a vehicle over its lifetime, and are unlikely to warrant the extra effort and complexity of inclusion. International standards have also not generally included these emissions directly, although some consider them in the calculation of off-cycle credits.[56]

[54] International Council on Clean Transportation (2017)
[55] Climate Change Authority (2014)
[56] Climate Change Authority (2014)

How could efficiency be measured?

How should a vehicle's efficiency for the purposes of an Australian fuel efficiency standard be assessed and why?

The ICCT submission responding to the draft Regulation Impact Statement, states that for the purposes of an Australian fuel efficiency standard, vehicle efficiency should be assessed by the follow method:

> *Australian Design Rule (ADR) 81/02 currently uses the NEDC test as the standardized laboratory test applied to all new light duty vehicles.*
>
> *The UN Economic Commission for Europe (UNECE) World Forum for Harmonization of Vehicle Regulations (WP.29) has formally adopted the Worldwide harmonized Light vehicles Test Procedure (WLTP).*[57] *The test cycle does more than simply harmonize global testing procedures: it improves the test procedure and closes loopholes, thus providing more realistic results that are closer to real world emissions.*[58]
>
> *The more realistic emissions data delivered by the WLTP leads to the adjustment of the EU target of 95 gCO_2/km (based upon the NEDC) in 2020 to 100-102 gCO_2/km on the WLTP.*[59] *Thus, adoption of WLTP in ADR 81/02 will not greatly affect the necessary targets under the proposed fuel efficiency standard. Several markets are already preparing to adopt the WLTP: the EU is set to adopt WLTP in 2017-18, Japan will adopt in 2018-19. The test cycles in the US show similar results to the WLTP.*
>
> *The proposed Target A for MY2025 essentially matches the stringency of the US 2025 standards, and the European 2020/21 standards when all standards are converted to their NEDC equivalent.*[60]
>
> *Converting the Target A standard to WLTP, assuming diesel market share stays relatively constant at 30%*[61]*, using the ICCT's test cycle conversion factors*[62]*, leads to a modified target of 120 gCO_2/km. Again, this is very similar to the stringency of the US standards for 2025. Because the stringency of the standards is broadly the same, numerous possible technologies to meet Target A are already available in the US and EU markets (among others).*

How could a sales weighted average target be applied?

How should a sales weighted average target be applied in Australia and why?

Internationally, the most common forms of light vehicle emissions standards that have been evaluated are either a flat standard or an attribute-based fleet-average standard. A flat standard is applied to sections of the fleet or the fleet as a whole, and usually as an absolute cap or uniform percentage reduction of emissions intensity which applies to every manufacturer. On the other hand, an attribute-based fleet-average standard is where the level of the standard varies with an attribute of the vehicle, typically vehicle mass or size.[63]

---

[57] Mock (2013)
[58] Mock, P., Kühlwein, J., Tietge, U., Franco, V., Bandivadekar, A., German, J. (2014)
[59] Mock, P., et al (2014)
[60] Climate Change Authority (2014)
[61] National Transport Commission (2016)
[62] Kühlwein (2014)
[63] Climate Change Authority (2014)

ClimateWorks and FCA support the ICCT's response regarding how a sales weighted average target could be applied in Australia:

> *As acknowledged in the draft Regulation Impact Statement, attribute-based standards equitably spread the regulatory burden across all manufacturers while respecting consumer choice. Attribute-based standards provide a variety of ways for manufacturers to comply by linking the target to the fleet mix, which may change over time.*
>
> *In contrast, flat standards, while administratively simple, are not nearly as equitable as attribute-based standards, as they disproportionately disadvantage manufacturers at both ends of the emissions spectrum. The draft Regulation Impact Statement acknowledges that absolute limits/caps could reduce consumer choice by forcing manufacturers to stop offering larger vehicle models.[64] And uniform percentage improvements set a terrible precedent, as they penalize manufacturers that have already improved vehicle efficiency and reward technology laggards with a less stringent standard.*

If an attribute based standard is adopted, what attributes could be used to determine manufacturer targets?

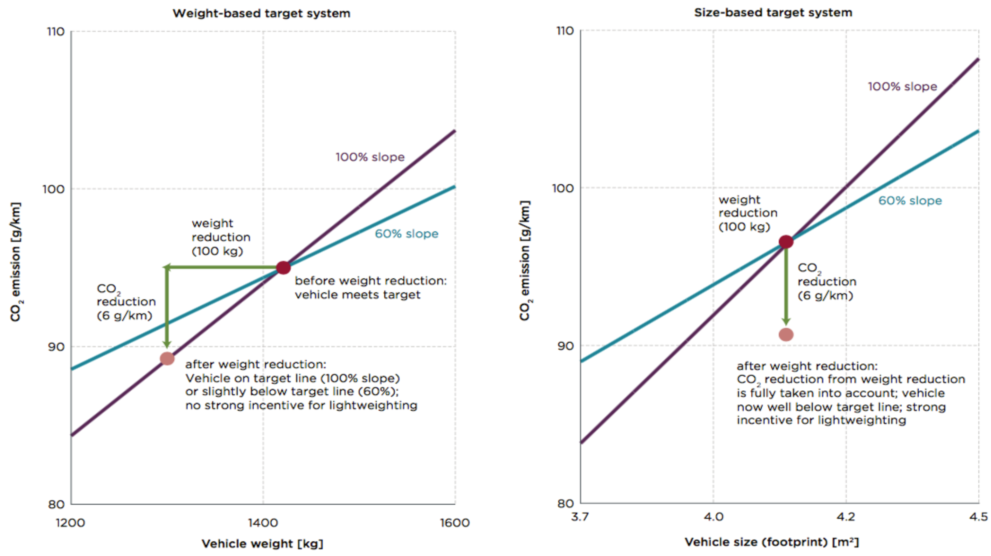
If an attribute based standard is adopted, which attribute should be adopted in Australiaand why?

If an attribute-based standard is the preferred option, a decision needs to be made on the most appropriate attribute to adopt. To date, the two attributes used internationally are either mass or vehicle size, usually measured as the 'footprint' of the vehicle. ClimateWorks and FCA supports the ICCT's submission in relation to what attributes could be used to determine manufacturer targets, stating that:

> *Footprint-indexed standards more directly and efficiently encourage mass reduction (lightweighting), which is the primary means for reducing vehicle load, than mass-indexed standards. Since lightweighting promises to be one of the least cost ways to increase efficiency[65] and thereby comply with the standards, footprint-based standards reduce compliance costs. Furthermore, footprint-based standards encourage better safety design than mass-based standards.[66] Weight-based standards can encourage smaller vehicles, which has negative safety impacts for the vehicle fleet. Size-based standards encourage lighter vehicles while maintaining vehicle size. As long as size is maintained, safety impacts are negligible, or even positive.[67]*
>
> *Powertrain efficiency improvements generate the same benefit under a mass- and footprint-based standard. Under a footprint-based standard, the same efficiency improvement derived from weight reduction moves a manufacturer closer to the target emission level by the same amount. In contrast, a mass-based standard does not reduce the distance to compliance given the same efficiency benefit due solely to weight reduction (refer to Figure 9 below). Thus, weight-reducing technologies are not treated equally under the two separate standards.[68]*

[64] Climate Change Authority (2014)
[65] Environmental Protection Agency (EPA) (2016) and International Council for Clean Transportation (2017)
[66] National Highway Traffic Safety Administration (US) (2006)
[67] International Council for Clean Transportation (2009)
[68] German and Lutsey (2011)

Figure 9: Two different incentives for vehicle load reduction via lightweighting under standards based on mass or footprint as utility parameter[69]



In 2014, Ricardo-AEA completed a study for the European Commission comparing footprint- and mass-based standards.[70] *It was found that overall compliance costs are 16 per cent lower under a footprint standard than a mass standard. All but one manufacturer showed reduced costs using footprint as the utility parameter. The study also found that mass as the utility parameter may result in other, rival manufacturers benefitting from weight reduction efforts by an individual manufacturer, providing a competitive disincentive to reduce weight. Finally, the study reinforces independent findings that weight reduction can be achieved at lower costs than originally anticipated, due to improved materials and design options.*

Although the evidence supports more cost-effective footprint-indexed standards, suddenly switching from the design of EU CO_2 standards to a footprint-based standard may provide some manufacturers with a competitive advantage. Utilising footprint from the beginning provides uniform accounting for all methods of improving vehicle efficiency, costs less overall for the vast majority of manufacturers, and avoids possible administrative and competitive problems if a switch is deemed necessary later. Finally, the objective of attribute-based standards is to preserve consumer choice. Size is a utility desired by consumers, while weight is invisible to customers and is not directly valued.

Footprint as the utility parameter preserves size and more efficiently encourages lightweighting, which improves vehicle handling and performance. As explained above, footprint also results in lower overall costs of compliance, and technology costs continue to fall while new advancements routinely come to market. Thus consumer choice is not limited. In fact, numerous efficiency technologies also improve performance.

[69] Mock (2011)
[70] Kollamthodi (2014)

How could targets be applied to different vehicle types?

How should a fuel efficiency standard be applied to each light vehicle category and why?

ClimateWorks and FCA supports the ICCT's response regarding how an attribute-based fleet-average standard should be applied to each light vehicle category in Australia:

> *The US footprint system is ideal and should be applied by Australia to each light duty vehicle category. The system applies a 'target' to each vehicle, based upon its footprint. The overall standard for each manufacturer is the sales-weighted average of the targets for each of the vehicles it actually produces. Note that this generates different standards for each manufacturer, based upon their unique mix of vehicles actually produced.*
>
> *Compliance with the individual manufacturer's standard is also a sales weighted average, this time based on the actual efficiency or CO_2 of each vehicle actually produced. Note that this means that not every vehicle has to meet its individual target – many vehicles can be below their targets as long as they are offset by other vehicles that exceed their targets. This system allows maximum flexibility to manufacturers, to minimize the cost of compliance, and treats every vehicle equally, regardless of size.*

If SUVs are subject to a different target to passenger cars, how should SUVs be defined, and why?

All light vehicle emissions standards applied internationally cover passenger vehicles at a minimum, and the majority also cover light commercial vehicles. The classification and delineation of vehicle boundaries differs between countries; for example, larger vehicles such as four-wheel drive and SUVs are classified as passenger vehicles in some markets and as light trucks or light commercial vehicles in others.[71] We support the ICCT submission which outlines how different vehicle types should be categorised in Australia:

> *The technologies available to improve efficiency of both M1 vehicles (cars & SUVs) and N1 vehicles (LCVs, comprising light trucks such as pickups and vans) are very similar. Hence, the best practice is to regulate all vehicles (M1 and N1) together, under the same target curve. Currently, no country regulates all M1 and N1 vehicles under the same standard. Thus, Australia could be a pioneer as the first country to regulate all light duty vehicles together.*
>
> *While some people use LCVs as a personal transport vehicle just like a car or an SUV, there are many legitimate users of LCVs who need the fundamental load carrying/towing capacity provided by LCVs, and which affects overall CO_2 emissions of those vehicles. Combining the standards into one may provide a disadvantage to some of these vehicles, especially if the standard is not attribute based. Under an attribute-based standard, however, consideration can be given to the larger size/mass of the LCVs while maintaining one set of standards for all light vehicles. Indeed, LCVs generally have a lot of empty space inside, and do not carry the extra seats and other consumer features of cars/SUVs. Therefore, LCVs are typically much lighter for their size than a similar sized passenger vehicle, and consequently have better fuel efficiency. In this way, a single footprint-based standard can apply to all light vehicles, whereas a mass-based standard (which penalizes LCVs for their light weight relative to their size) will likely require a separate standard for cars & SUVs and another for LCVs (as is the case in Europe, the split standards in the US is explained below).*

[71] Climate Change Authority (2014)

If two curves are deemed necessary, they should be separated into M1 (again, cars and SUVs) and N1 (LCVs). Since M1 vehicles are based on car platforms, having a curve for cars & SUVs, rather than cars only, would provide a consistent target for vehicles based on car platforms and for which similar methods of improving efficiency apply. However, the following explains some of the historical drawbacks of separate target curves.

Separate car/SUV standards and LCV standards creates an incentive for manufacturers to reclassify some of the larger/heavier/less efficient cars and SUVs as LCVs through simple design changes, without affecting the underlying engine/transmission or overall utility of the vehicle – or its purchase by customers for non-commercial use.

Globally, N1 vehicles are typically restricted to vehicles designed to carry cargo, such as pickups and boxed vans (Ford Transit, e.g.). SUVs and minivans under 3500kg are classified as M1 vehicles. Only in the US are minivans and SUVs under 3500kg considered N1 vehicles. Since some manufacturers have more N1 sales than M1, a split standard may impact relative competitiveness among manufacturers. Additionally, N1 vehicles tend to have less efficiency technology applied (although there is no technical reason why the same amount of efficiency cannot be applied). As the N1 standards in Europe reflect the lower level of technology on the baseline vehicles, the EU standards for N1 are relatively lenient, resulting in manufacturers meeting their future targets well in advance.[72] When US fuel economy standards were initially formulated under the 1975 Energy Policy and Conservation Act, light trucks were only 20% of the market and minivans and car-based SUVs did not exist. Thus, the initial focus was on car standards, with the establishment of light-truck standards delegated to NHTSA. When the larger car-based minivans and SUVs began developing, NHTSA included them in trucks. Acknowledging some of the issues with this classification, EPA and NHTSA subsequently reclassified all 2wd SUVs less than 6,000 lbs GVWR as cars, but left 4wd SUVs, larger 2wd SUVs, and minivans as trucks.

Unfortunately, the less stringent standard for trucks strongly incentivizes manufacturers to reclassify cars as trucks, by increasing the ground clearance of cars so that they can be classified as SUVs and eliminating 2wd versions of small SUVs. Less efficient 4wd versions remain, along with the addition of vehicles with higher ground clearance, which directly increase fleet fuel consumption. Additionally, this eases manufacturer compliance, so that they need not install available technology on other vehicles. Most light trucks (except for certain SUVs and pickups) are based on car platforms; and pickups are much lighter than truck-based SUVs of the same size (due to empty bed). These two facts, plus the applicability of similar technologies to all vehicles regardless of platform, indicate that there is no technical reason to have separate curves for M1 and N1 vehicles.

It is time to also end the artificial distinction between M1 and N1 vehicles for fuel efficiency and greenhouse gas emissions. A single footprint function will still give larger trucks a less stringent target to meet, while avoiding vehicle classification games and helping to ensure fuel consumption and GHG emission goals are actually met.

[72] Mork (2013)

How could targets be phased in from 2020 to 2025?

How should targets for a fuel efficiency standard be phased in and why?

There are a range of different options for compliance, from annual to periodic compliance; other variations, such as cumulative compliance over a number of years, are also possible. The ICCT response regarding how targets for a fuel efficiency standard should be phased in are supported by ClimateWorks and FCA.

> *Annual targets encourage annual rates of efficiency improvements, which have greater environmental benefits than a periodic phase-in. Annual targets also set interim goals for manufacturers, ensuring they do not wait until the last minute to comply. Two other important benefits are that flexibility mechanisms are not implementable without annual targets and adoption of annual targets would harmonize with other international standards. The combination of interim goals and flexibility mechanisms allows regulators to judge whether manufacturers are putting forth their best efforts, and, if falling short of the standards, provides the capacity to relax the mandates.*

If annual targets are adopted, what targets should apply in each year for each segment and why?

If annual targets are adopted, a decision on the timing of an appropriate start year for a standard is required. While there needs to be consideration for appropriate lead time to allow for industry developments, it is important to note that greater environmental and economic benefits will be achieved by introducing light vehicle emissions standards early. We support the ICCT's comments in relation to what targets should apply in each year and for each segment.

> *After setting the initial fleetwide goal under Target A (105 gCO_2/km, NEDC), the calculated percentage reduction in emissions can be applied each year to each yearly fleet. With a starting fleet efficiency of 184 gCO_2/km (NEDC) in 2015, Target A corresponds to a 5.5 per cent annual reduction; using the ICCT tool to convert these NEDC values to WLTP[73] and assuming Australian fleet diesel share of around 30 per cent, leads to Target A stringency of about 120 gCO_2/km while the 2015 fleet averages about 190 gCO_2/km, or a 4.5 per cent annual reduction.*
>
> *While this might be a bit aggressive if the standards were technology forcing, for example the US 2017 to2025 standards require about a 4.1 per cent annual reduction, it is important to understand that Australia is starting from a different baseline. The average level of technology currently installed on vehicles in Australia lags that for vehicles in the US, Europe and Japan by many years. Therefore, Australia is a 'technology taker, meaning that the standards are designed to bring technology to Australia that is already in widespread use in much of the world. This approach is considerably easier, requires much less lead time than technology forcing standards, and allows for larger annual reductions. Given the comparable standards in other vehicle markets and the availability of existing technology to comply with those standards, a 5.5 per cent annual reduction for a technology taker is quite feasible. Using a percentage based target also allows for flexibility in the standard based on changing fleet mix. .*
>
> *The publication of the draft Regulation Impact Statement and supporting documents come far in advance of either 2018 or 2020 when the standards would be implemented. Thus, finalizing the standards this year (2017) provides ample lead-time for implementation in 2020. Furthermore, the sooner the standards are finalized, the greater stability and regulatory certainty they offer for the future. The stringency of the standard could be ramped up over time, as necessary, but this would delay implementation.*

[73] Kühlwein et al. (2014)

The U.S. CAFE standards were announced 18 months prior to enforcement. Saudi Arabia, which has a vehicle fleet very similar to Australia's and is also a technology taker, gave even less lead time.[74] *Like Target A proposed in the draft Regulation Impact Statement, Saudi Arabia's target requires the same level of technology on vehicles as in the US (albeit lagging by three years), thereby harmonising the standards and simplifying manufacturer compliance. Manufacturers are already anticipating efficiency standards globally, thus extended lead time is not critical for technology takers.*

If a percentage phase in is adopted, what percentage should apply in each year and each segment, and why?

ClimateWorks and FCA support the ICCT's response regarding what percentage should apply in each year and each segment:

5.5 per cent per year (or 4.5 per cent per year using WLTP) would place Australia roughly in line with the US at the end of the phase-in in 2025, combining less stringent initial requirements with a faster rate of efficiency improvement. This ensures that the technologies put on vehicles sold in Australia will be on par with the best technologies used in the US and EU by 2025.[75] *Since all vehicles are imported beginning in 2018, little extra burden will be placed on manufacturers to meet these standards, as they only need to export the same vehicles to Australia that they are already planning to sell in the US, Europe, and Japan.*

The relatively low burden is further supported by reduced technology costs and greater variety of available technologies. Although several new studies and publications regarding technology cost are referenced in the draft Regulation Impact Statement, there is still newer information and data that should be taken into account, and which will reduce the costs of the fuel efficiency program.

For example, the technical support document to US Environmental Protection Agency's Proposed Determination[76] *updates cost and efficiency values for numerous technologies compared to the draft Technical Assessment Report.*[77] *In that report, costs/vehicle for bringing the MY2021 fleet to MY2025 standards is $986 for passenger cars (US$749) and $1339 for light trucks (US$1018), see Table IV.4.*

In the draft Regulation Impact Statement in Table 10, the costs for bringing the Australian FY2021 fleet to FY2025 Target A standards is $1158 for passenger cars and $2344 for LCVs - these numbers were determined by subtracting the 2021 costs from the 2025 costs. The draft Regulation Impact Statement predicted costs per vehicle are approximately 1.2x and 1.75x the costs estimated by the US Environmental Protection Agency.

The Australian and US baseline fleets are different in share of passenger cars and LCVs, as well as share of diesel and gasoline. However, diesel technology costs are expected to continue to decrease, below even the costs presented by the US Environmental Protection Agency.[78] *Lightweighting costs are expected to decrease as well, with a 15% reduction in light truck mass costing less than $733 (US$557) in 2025. Thus, despite the differences between the Australian and American baseline fleets, the technologies that show the greatest benefit for the Australian fleet have significantly decreased costs than those used in the BITRE*

[74] Bandivadekar and Posada (2014)
[75] Climate Change Authority (2014)
[76] US Environmental Protection Agency (2016)
[77] US Environmental Protection Agency (2016)
[78] International Council for Clean Transportation (2009), Martec Group (2016) and Meszler, D., German, J., Mock, P., Bandivadekar, A (2016)

benefit-cost analysis. Thus, based solely on updated technology costs, cost per vehicle will likely be 1.2x-1.75x less (that is 57%-85% of the costs in the draft Regulation Impact Statement in Table 10). This would increase the Target A net benefits to $16,330m-$20,870m and the benefit-cost ratio up from 1.86 to 2.18-3.26. ICCT is even more optimistic about the technologies available for compliance.[79]

Finally, ICCT's comments on US Environmental Protection Agency's Proposed Determination[80] *demonstrate that even EPA's Proposed Determination did not consider or incorporate the latest available technology developments. For example, Atkinson and Miller cycle engines improve conventional gasoline vehicle efficiency, e-boosting and 48V mild hybrid systems greatly improve gasoline and diesel efficiency, electric vehicle battery costs have fallen dramatically, and lightweighting continues to advance. Updating BITRE's cost analysis with this data is important, as only the most recent technology studies can provide accurate starting points for future projections.*

We note here that, while regulatory design is crucial, stringency is equally important. The stringency of Target A effectively brings technology to Australia that is already in widespread use in much of the world, including in the world's most stringent economies. As discussed, these technologies are available at decreasing costs and wider applicability. However, updated costs and benefits cannot be addressed without asking questions of stringency.

What flexibility arrangements should be allowed under an Australian fuel efficiency standard and why?

The majority of international markets have some flexibility mechanisms that lower the costs to suppliers of meeting targets. The details of flexibility mechanisms used by key international markets were outlined by the Climate Change Authority[81] and included:

- United States, permits liable parties to bank previously accrued credits and trade excess credits with other parties within stated timeframes. The ability for liable parties to borrow from future years to meet compliance obligations is also allowed.
- European Union, standards specify that manufacturers are able to 'pool' emissions under certain conditions, which in effect acts as a trading system.
- China, under its Phase III standards allows for the banking of excess credits that are achieved in a compliance year, which could then be used within the phase period (2012 to 2015).
- Japan, the standard 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.

We support the ICCT's comments in relation to what flexibility arrangements should be allowed under an Australian fuel efficiency standard.

In theory, we support all flexibility mechanisms provided that they are properly implemented. Specific flexibility mechanisms we support include: credit trading among vehicle categories, credit trading between years, credit trading between companies (pooling), derogations (concessional arrangements, exemptions, or relaxations of the rule), and fiscal and non-fiscal fines.

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[79] International Council for Clean Transportation (2009) and Meszler, D., et. al (2016)
[80] International Council for Clean Transportation (2016)
[81] Climate Change Authority (2014)

Banking, borrowing and trading should be allowed within a compliance period, assuming the standards are phased in annually. There is no point in banking credits for a periodically phased in standard.

Carry-forward credits are given to over-compliant manufacturers for use in future model years. Carry-backward credits, on the other hand, would be applied to past model years.

Allowing manufacturers to bank, borrow, and trade carry-forward credits between compliance periods encourages over-compliance, which improves the energy security and global warming benefits of the standards and establishes a more efficient baseline, effectively allowing more stringent standards to be set in the next phase.

However, banking, borrowing and trading carry-backward credits between compliance periods would compromise the effectiveness of the standard to reduce emissions. Furthermore, standards for each successive phase typically aren't known until only a few years in advance, thus manufacturers should not rely on borrowing and trading for these unknowns.

In summary, banking, trading, and borrowing both styles of credits within a compliance period, and banking, borrowing, and trading carry-forward credits between periods, incentivize manufacturers to over-perform within a compliance period, if the standards are relatively lenient. Conversely, disallowing inter-period banking would only encourage a minimum amount of improvement. Furthermore, banking between periods allows manufacturers to comply even if product development timelines do not match up with the start (or end) of a new compliance period.

Applying an expiration date for banked credits, for example three years rather than five years as used in the US, prevents excess credits from being carried forward.

What other incentives could a standard adopt to encourage supply of more efficient vehicles under a standard?

What, if any, credits should an Australian fuel efficiency standard adopt to further encourage the supply of more efficient vehicles, and why?

ClimateWorks and FCA believe that super credits should be applied for ultra-low emissions vehicles with the aim of encouraging vehicle availability and supply in Australia, whilst minimising any effect on overall increases in emissions. Whilst we appreciate that super-credits may in fact reduce efficiency gains in non-electric vehicles, we believe the benefit of early uptake of electric vehicles, which are ultimately required to decarbonise the passenger vehicle transport sector, outweighs this.

In the EU and the US, the introduction of ultra-low emissions vehicles is encouraged by the adoption of super credits; they are also supported by a much larger market, federal and state complementary measures and localised efficiencies in logistics, marketing and regulatory compliance.

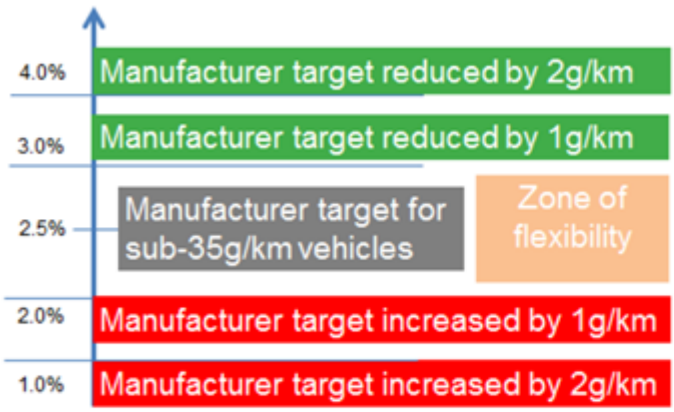
In Australia with a relatively modest market by world standards, there are minimal complementary measures and country specific regulatory compliance requirements. As a result, automotive manufacturers need to justify the supply of ultra-low emissions vehicles to Australia in the short term and the introduction of super-credits for these vehicles could support this justification.

A traditional super-credit structure has proven to be relatively ineffective at driving overall supply into the market. However, due to the factors stated above, this conclusion may not be replicated in Australia to the same extent.

Regardless of its forecast efficacy in Australia, we believe that a Flexible Ultra-Low Carbon Vehicle mandate would be more effective at increasing model availability in Australia, as well as reduce the impact on overall fleet emissions outcomes.

The flexible mandate was introduced by MEP Fiona Hall, rapporteur of the European Parliament's Industry Committee, as part of the discussion around the EU emissions standards. This system, illustrated below, encourages all car makers to make available a range of ultra-low emissions vehicles, and rewards those that do more.[82]

Figure 10: Flexible Ultra-Low Carbon Vehicle mandate



Modelling has been done of the effective weakening of the overall fleet emissions standards through the use of super-credits, and has shown that the Flexible super credits approach in fact strengthen the overall fleet emissions target, and only affects its effectiveness when electric vehicle market share reaches 5%, at which point the system can be reviewed or phased out.

Importantly, the flexible mandate is technology neutral. So automakers can choose to invest in the supply of ultra-low emissions vehicles (whether it be battery electric vehicles or otherwise), and thereby achieve an advantage in overall required emissions targets, or they can invest more in overall fleet emissions reductions, taking into account the 'penalties' for not supplying enough, or not having available, ultra-low emissions vehicles in the market.

As more ultra-low emissions vehicles are sold in the market, the business case becomes easier to justify due to the cost efficiencies that come with higher volumes.

> *The draft Regulatory Impact Statement even-handedly considers the variety of credits available. The ICCT supports off-cycle and air-conditioning credits, as long as they are verifiable and do not weaken the stringency of the standard by duplicating on-cycle benefits. Validation procedures, performed by the government, can serve as a means for verifying off-cycle benefits before granting credits. For examples of such procedures, see the US Environmental Protection Agency and National Highway Traffic Safety Administration83 and the eco-innovations requirements in the EU 2020 standards.*[84]

[82] Transport and Environment (2013)
[83] United States Environmental Protection Agency and US EPA and National Highway Traffic Safety Administration (US) (2010)
[84] European Commission (2011)

The process granting off-cycle credits in the US does suffer some problems, which have an interesting solution. In the US, granting off-cycle credits is a very contentious issue, primarily because real world data on nationwide travel behavior and conditions does not exist. Manufacturers and the US Environmental Protection Agency are frustrated because every application for a new credit requires the manufacturer to generate data, followed by a lengthy and time consuming process where Environmental Protection Agency tries to resolve issues and obtain more information from the manufacturer before granting the approval. The solution to this issue is to conduct a joint program with manufacturers and other invested entities to gather comprehensive data on nationwide, year-round travel behavior and conditions. This will allow the government to establish standardized procedures for granting off-cycle credits, streamlining the approval process and providing known credits equally to all manufacturers.

Super credits are extremely important to the Australian market because it will encourage model availability and supply in a relatively low volume market. With a lack of complementary measures and financial incentives, we must help auto manufacturers improve their business case for the introduction of low emissions vehicles, and super credits will help them do that.

Implemented badly however, and super credits can have a negative effect on overall fleet emissions standards, which ClimateWorks and FCA does not support. With a Flexible super credits scheme, the overall fleet emissions profile strengthens in the medium term, before needing review when electric vehicle penetration is higher.

Which entities could be required to comply?

Which entities should be required to comply with a fuel efficiency standard, and why?

In relation to which entities should be required to comply with a fuel efficiency standard, ClimateWorks and FCA agree with statements included in the ICCT submission:

All entities responsible for Australian certification of a vehicle under the Motor Vehicle Standards Act 1989 should also be the entities required to comply with the fuel efficiency standard. From a practical view, this eliminates any disputes between entities of who is responsible for the different requirements and this is consistent with EU and US standards (under which domestic manufacturers or licensed importers are responsible for compliance).

Should all entities be subject to the same requirements?

What concessional arrangements should be offered to low volume suppliers under an Australian fuel efficiency standard and why

ClimateWorks and FCA support the ICCT's response regarding concessional arrangements, and whether these should be offered to low volume suppliers:

Special provisions for small volume manufacturers could be considered. However, an attribute-based standard does not put manufacturers of a limited product line at a competitive disadvantage, as the standard adjusts the stringency for each vehicle such that the amount of technology required for all vehicles is relatively consistent. In addition, any concessional arrangements need not rely on volume in Australia. Many low-volume manufacturers produce the same vehicles globally, which are subject to various standards world-wide.

Thus, any small volume manufacturer provisions should be limited to manufacturers with limited engineering capacity, i.e. manufacturers with worldwide sales of less than 3,000 vehicles per year.

Another alternative is to allow a temporary lead time allowance. That is, low volume manufacturers are not subject to lower standards, but receive slightly more lead time. For example, a low volume manufacturer may be allowed to meet 2020 standards in 2021, but must meet 2025 standards in 2025.

What penalties could be applied if entities failed to comply?

What penalties should be applied to entities that failed to comply with a fuel efficiency standard and why?

All countries that have a standard in place employ some form of penalty for non-compliance, with the type and stringency of penalties varying across countries. In relation to what penalties should be applied to entities that failed to comply with a fuel efficiency standard, ClimateWorks and FCA supports comments made by the ICCT, stating that:

It is important to set financial penalties at a level high enough to provide a strong incentive to comply with the standard rather than simply pay the penalty. In other words, the penalties should be higher than the cost of technology required to reduce CO_2 emissions in order to make compliance the more cost-effective option.

Recent technology studies have found that most conventional technologies cost less than AUD$50 per percent improvement, with full hybrids and diesels close to AUD$100 per percent improvement.85 Therefore, the financial penalty should be at least AUD$75 per percent improvement and preferably, close to AUD$100 per percent improvement.

The European Commission penalty of €95/gCO_2/km is acceptable, as it is almost exactly AUD$100 per percent improvement and ensures widespread compliance. To put that figure into context, the expected cost of compliance with future 2025 standards of 70 gCO_2/km (NEDC), is estimated to be between €1000 and €2150. Starting with a 2014 baseline fleet at around 120 gCO_2/km (NEDC), this corresponds to a compliance cost of €20-€43/gCO_2/km, or less than $50 per percent improvement.86 Thus the penalty of €95/gCO_2/km is more than two times the cost of compliance.

In the US, CAFE penalties have been low historically. Until MY2019, the penalty corresponds to AUD$55/mpg shortfall, or less than AUD$30 per percent improvement in 2025. But these penalties are increasing dramatically, to AUD$145/mpg shortfall beginning in 2019, or close to AUD$75 per percent improvement. Starting with a 2014 fleet at 31.5mpg, the costs to reach an estimated 51.4mpg is less than AUD$1,61087 or around AUD$81/mpg reduction, which is more than the current CAFE penalties, but less than the increased penalties.

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[85] International Council for Clean Transportation (2016)
[86] Mock (2016) and Meszler, D., German, J., Mock, P., Bandivadekar, A. (2016)
[87] Environmental Protection Agency (EPA) (2016)

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