FCAI Response to Improving the efficiency of new light vehicles Draft Regulatory Impact Statement

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KEY MESSAGES

The widespread availability of EN standard fuels is a key enabler for globally consistent vehicle emissions standards and proposed Australian CO_2 targets. As such, Australian fuel standards and availability must be first defined before CO_2 targets can be properly contemplated.

Overview:

- The FCAI welcomes the establishment of the Ministerial Forum on Vehicle Emissions as vehicle pollutant emission standards, CO_2 emissions and fuel quality standards are interrelated and must be considered as a single system to deliver the environmental and health benefits from reductions in light vehicle CO_2 emissions and vehicle pollutant emissions.
- The Australian automotive industry is committed to continuing to make a strong contribution to national efforts to reduce the impact of global climate change and improve air quality.
- Australia is a small market comprising only 1.5% of global production. For the industry to be able to offer vehicles with world-class fuel consumption and pollutant emission technology, Australia must harmonise pollutant emission and fuel standards with leading overseas markets.
- CO_2 standards or targets need to be considered together with pollutant emission standards and fuel quality standards as they are all interrelated. This position is shared by many governments, research organisations and the global automotive industry.
- The FCAI/industry supports introduction of a mandated 2030 CO_2 standard that is realistic, achievable and relevant to the Australian market conditions and contributes to the Government's overall post-2020 GHG reduction targets.
- Consideration of the introduction timing of CO_2 targets (and Euro 6 pollution emission standards for new vehicles) cannot be undertaken until a detailed consideration of changes to Australian fuel quality standards has been completed. Of central concern is how the Government is planning to transition to the European fuel standards (EN228 for Petrol and EN590 for Diesel) to support the introduction of both Euro 6 and CO_2 targets.
- The timeframe for the required fuel to be available to the market will then determine the timeline for new vehicle models and the timeline for the introduction of regulatory standards. Moving ahead with new emission regulations without resolving fuel quality questions could increase the purchase and operating costs of new vehicles and adversely affect the operability of new emission technologies without delivering the anticipated environment and health benefits.

Integrated approach:

- A whole of government approach that includes on-road operation of light vehicles must be taken to achieve real world CO_2 and pollutant emission reductions:
    - Fuel quality standards, which must match the emission technology in our vehicles and how to encourage/ensure consumers use the correct fuel grade.
    - The Australian consumer preference for heavier vehicles with larger and more powerful engines and automatic transmissions.
    - The use of light vehicles in Australia; in particular, how to relieve congestion in our major cities. There is significant potential benefit, a reduction of up to 10% of fuel use, from vehicle-to-infrastructure (V2I) technology.

    - Driver behaviour and how eco-driving can reduce fuel use.
    - Vehicle technology and the refueling infrastructure required to support new technologies such as electric vehicles, hybrid electric vehicles and hydrogen fuel cell vehicles.
    - Increasing consumer demand through raising awareness and creating incentives for people to adopt new technology.
    - Steps to reduce the age of the vehicle fleet, as newer vehicles are more fuel efficient.
- To focus on only one area will increase the overall cost to the community without delivering the expected environmental and health benefits from CO_2 and pollutant emission reductions.

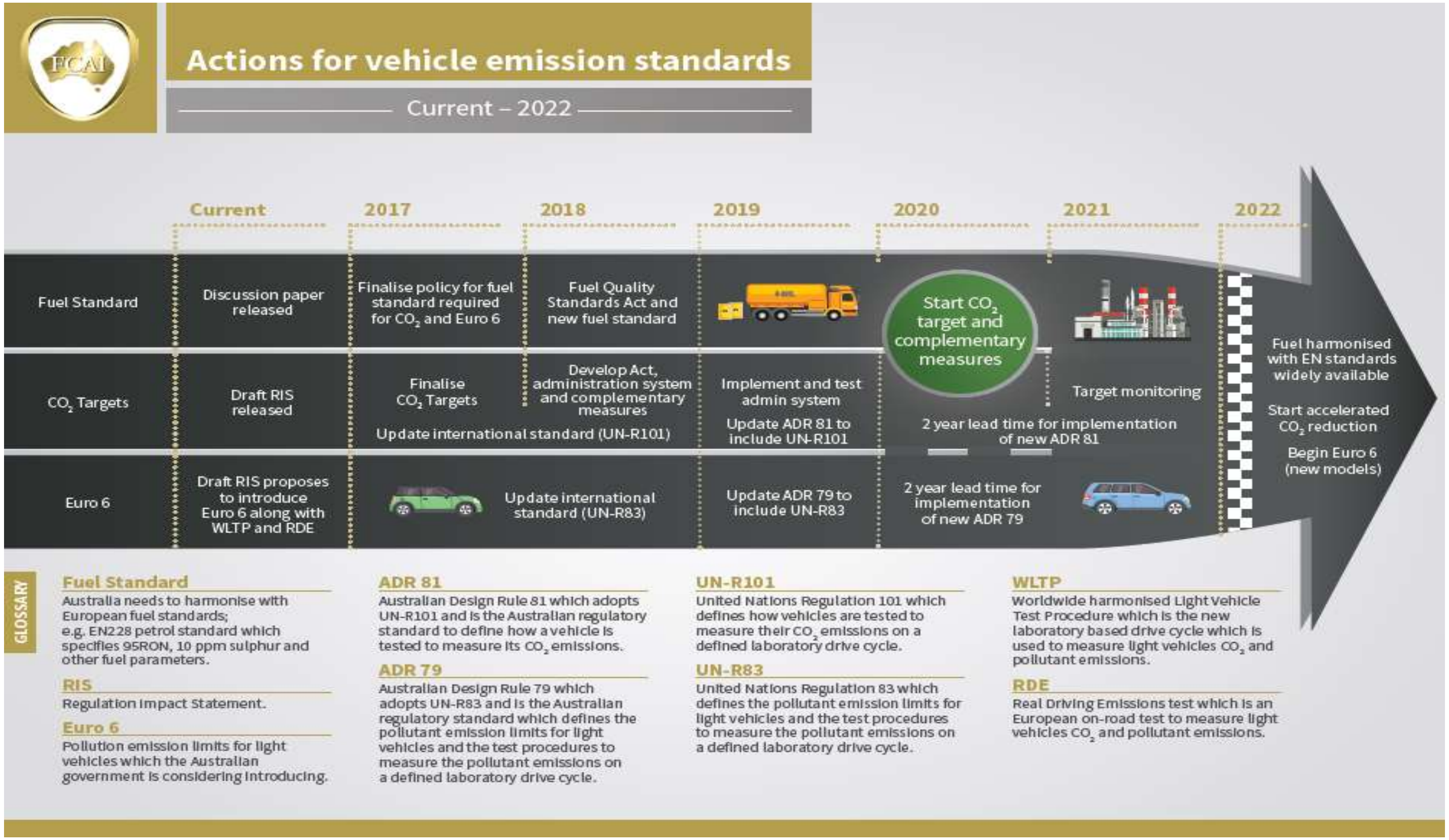
CO2 standard:

Before a mandated CO2 standard is established, the standards for market fuels and vehicle noxious emissions first need to be determined. These standards in turn, set the vehicle technology capability for fuel efficiency improvements. The following comments assume widespread availability of European standard fuels for petrol (EN228) and diesel (EN590):

- The FCAI/industry supports the introduction of a mandated 2030 CO_2 standard that is realistic, achievable and relevant to the Australian market conditions, and contributes to the Government's economy-wide post-2020 GHG reduction targets.
- The FCAI would support a mandated 2030 CO_2 standard that commenced in 2020, with interim targets and a mid-term review. The target would be based on a 2% annual reduction from 2017 to 2022 and then a change in rate of annual reduction out to 2030.
- A long term target is necessary to allow for FCAI member brands to develop future plans with certainty and taking into consideration the model life and replacement cycle.
- Introduction of an accelerated rate of reduction must be linked with introduction of Euro 6 (for new models) and widespread availability of petrol meeting the European standard EN228 (i.e. 95 RON, 10 ppm sulphur, 35% v/v max aromatics, etc.) and diesel meeting European standard EN590 (as well as other applicable fuel standards, e.g. biodiesel and ethanol blends).
- Reducing aromatics in petrol has been shown to reduce vehicle CO_2 emissions. The EN228 limit on Aromatics (35% v/v max) is critical in delivering future annual reductions in CO_2 emissions.
- Increasing ethanol in petrol has been shown to reduce vehicle fuel efficiency. EN228 limits for ethanol (10% max) must not be exceeded.
- A mid-term review is necessary as it is impossible to accurately project the circumstances (e.g. market conditions, consumer choice, technology changes, market segment shifts, etc.) impacting the feasibility of a CO_2 standard over such a long time period.
- Targets for individual vehicle categories should be aligned with the US/Canadian approach of separate targets for passenger cars (MA Category) and LCVs (NA Category), with off-road passenger SUVs (MC category) included with LCVs.
- Extensive modelling is required by the Government to determine the level and type of complementary measures required to change consumer behaviour to achieve an accelerated (over BAU) rate of annual reduction.
- The UN Regulation 101 needs to be updated with the new laboratory test cycle (WLTP) and this is expected be completed in 2018. ADR 81 will then need to be updated to reflect the new UN R101.

Implementation Timing

- Petrol meeting EN228 (i.e. 95 RON, 10 ppm sulphur, 35% v/v max aromatics, etc.) and diesel meeting EN590 must be widely available in time for implementation of both a CO_2 standard and Euro 6 pollutant emission standards.
- The infographic below provides an overview of the major government actions that need to be undertaken between 2017 and 2022 to provide for the start of an accelerated CO_2 reduction and implementation Euro 6 for new models.



Conclusion:

- A real and sustained reduction in vehicle emissions (both CO_2 and pollutants) will only be achieved through an integrated approach that takes a whole-of-government approach to CO_2 standards, vehicle pollutant emission standards, fuel quality standards and on-road vehicle operation.
- Consideration of the introduction timing of CO_2 targets and Euro 6 for new vehicles cannot be undertaken until a detailed consideration of changes to Australian fuel quality standards has been completed. Of central concern is how the Government is planning to transition to the European fuel standards (EN228 for Petrol and EN590 for Diesel) to support the introduction of both Euro 6 and CO_2 targets.

The timeframe for the required fuel to be available to the market will then determine the timeline for new vehicle models and the timeline for the introduction of regulatory standards. Moving ahead with new emission regulations without resolving fuel quality questions could increase the cost of new vehicles and adversely affect the operability of new emission technologies without delivering the anticipated environment and health benefits.

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1.0 INTRODUCTION

The FCAI welcomes the opportunity to respond to the Federal Government's "Improving the efficiency of new light vehicles" Draft Regulatory Impact Statement[1]. The Federal Chamber of Automotive Industries (FCAI) is the peak industry organisation representing the manufacturers and importers of passenger vehicles, light commercial vehicles and motorcycles in Australia.

The Australian automotive industry is committed to continuing to make a strong contribution to national efforts to reduce the impact of global climate change and to improve air quality. To achieve a reduction in CO_2 emissions from private road transport an "Integrated Approach" is required. The Integrated Approach includes vehicle technology, alternative fuels, driver behaviour, infrastructure measures and price signals.

The FCAI/industry supports introduction of a mandated CO_2 standard that is realistic, achievable and relevant to the Australian market conditions, and contributes to the Government's economy-widepost-2020 GHG reduction targets.

With continual significant investment in product development, the automotive industry has reduced average CO_2 emissions of new light vehicles by more than 27 per cent since 2000, at an average annual reduction of 2.4 per cent. This means that the on-road light vehicle fleet is now more than 25 per cent more fuel efficient than it was in 2000. When comparing on a like-for-like basis (i.e. using results of drive cycle tests across the same market segments) the annual reduction in Australia is comparable to the annual improvements in the EU and also the OECD average.[2]

The FCAI welcomes the establishment of the Ministerial Forum on Vehicle Emissions as vehicle pollutant emission standards, CO_2 emissions and fuel quality standards are interrelated and must be considered as a single system to deliver improvements in both CO_2 emissions and vehicle pollutant emissions.

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[1] Australian Government, Department of Infrastructure and Regional Development, "Improving the efficiency of new light vehicles", Draft Regulatory Impact Statement, December 2016 (DIRDa)

[2] FCAI Response to Vehicle Emissions Discussion Paper, 8 April 2016

2.0 CO2, POLLUTANT EMISSIONS AND FUEL QUALITY STANDARDS

Main Points from Section 2.0 CO_2, Pollutant Emissions and Fuel Quality Standards:

- CO_2 standards or targets, pollutant emission standards and fuel quality standards all need to be considered together, as they are all interrelated.
- This position is not unique and is shared by the global automotive industry, regulators and research organisations alike.
- The Government has recognised the inter-relationship between fuel consumption, pollutant emissions and fuel quality standards by the formation of the Ministerial Forum on Vehicle Emissions.
- On-road operation of light vehicles must be considered to achieve CO_2 and pollutant emission reductions and an "Integrated Approach" that covers the following aspects is required:
    - Vehicle technology
    - Fuel quality standards
    - Alternative fuels and energy platforms
    - Driver behaviour
    - Infrastructure measures
    - Price signals
    - Average fleet age

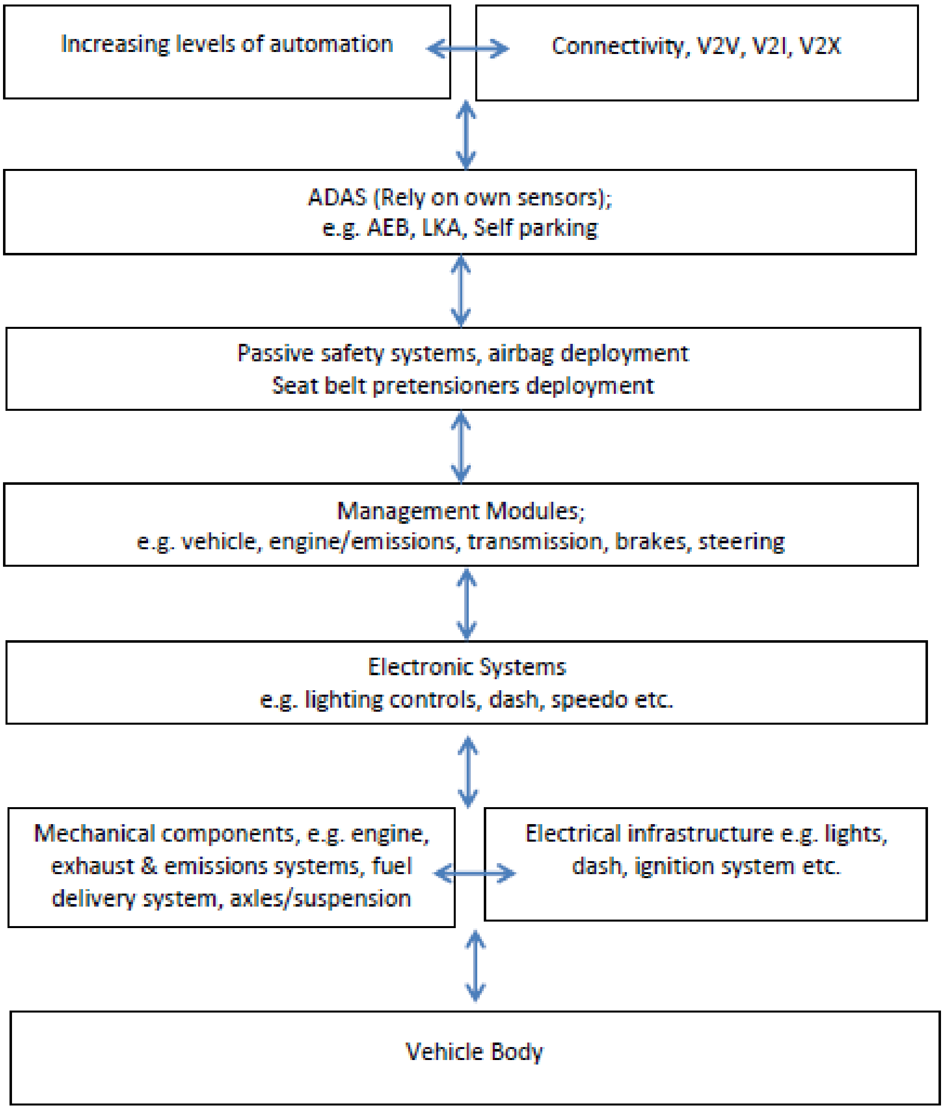
2.1 Inter-operability of Vehicle Systems

Modern vehicles are very complex with a range of sophisticated mechanical and electrical components and electronic modules that are integrated to deliver the performance, safety and emissions expected by customers and government. Figure 2.1 (below) represents how the various systems are integrated and need to be inter-operable to operate correctly.

Vehicles are designed and developed to meet GHG emissions (CO_2) targets and air pollutant emission standards with an expectation of fuel quality in a particular market. To continue to deliver reduced CO_2 emissions and corresponding expected air quality benefits (i.e. reduction in pollutant emissions) with the introduction of advanced vehicle emission standards, market fuel of the relevant standard (i.e. consistent with the EN fuel standards[3]) must be available. If market fuel of the necessary standard is not utilised, higher exhaust emissions (both CO_2 and pollutants) will be generated during a vehicles' operation with lower than expected environmental and health benefits.

[3] EN are European Standards published by the European Committee for Standardisation (CEN)

Figure 2.1 Block Diagram showing Inter-operability of Vehicle Systems



2.2 Whole-of-Government Approach

The FCAI's longstanding position is that CO_2 standards or targets, pollutant emission standards and fuel quality standards all need to be considered together, as they are all interrelated. This position is not unique and is shared by the global automotive industry, regulators and research organisations alike.

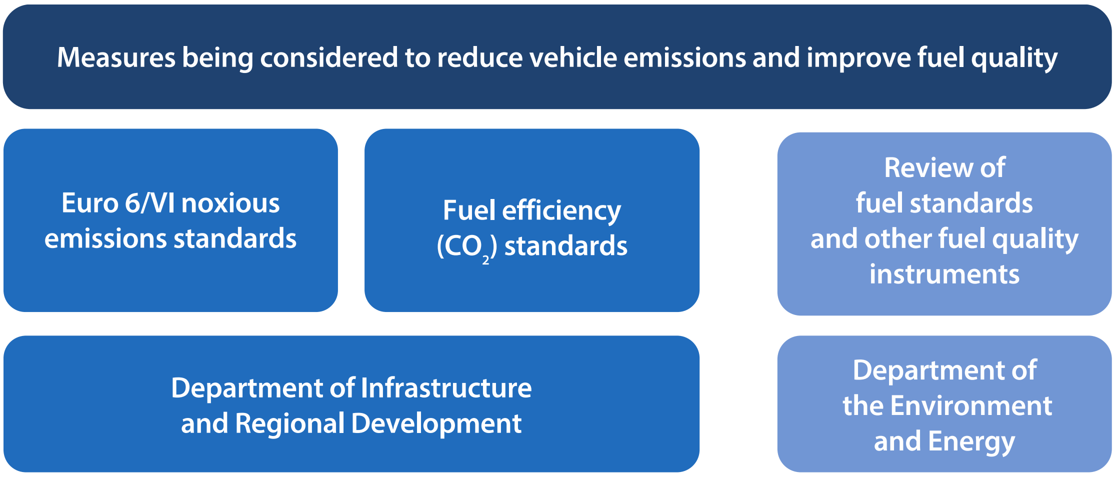
A whole-of-Government approach is required to incorporate all associated issues, including fuel quality standards, which have a significant impact on vehicles' ability to meet both GHG (CO_2) and air pollution emission standards. In the absence of such an approach, Australians will not receive the full benefit of the additional cost for improved emission technology in new light vehicles.

The Government has recognised the inter-relationship between fuel consumption (CO_2), pollutant emissions and fuel quality standards by the formation of the Ministerial Forum on Vehicle Emissions. The comprehensive package of activities being undertaken by the Ministerial Forum on Vehicle Emissions includes the release of three papers (Figure 2.2):

- *Improving the efficiency of new light vehicles*, Draft Regulation Impact Statement (December 2016).

- *Vehicle Emission standards for cleaner air*, Draft Regulation Impact Statement (December 2016).
- *Better fuel for cleaner air,* Discussion Paper (December 2016).

Figure 2.2 Ministerial Forum on Vehicle Emissions Activities[4]



Separately, the FCAI will outline in more detail our positions on fuel quality standards, in our response to *Better fuel for cleaner air*, Discussion Paper, and the implementation and standards for pollutant emissions in response to the *Vehicle Emission standards for cleaner air*, Draft Regulation Impact Statement.

2.3 Integrated Approach

In addition to a whole-of-Government approach to vehicle emissions and fuel standards, consumer purchasing choice, vehicle use, road infrastructure and fuel quality will continue to be major influences on the rate of growth of private road transport related CO_2 and pollutant emissions.

To achieve a reduction in both CO_2 and pollutant emissions from private road transport an "Integrated Approach" is needed that includes:

- Vehicle Technology – Improve the performance of new light vehicles (passenger cars, SUVs and light commercial vehicles) to reduce their average CO_2 emissions.
- Fuel Quality Standards – Compatible market fuel must be available to support the vehicle technology and deliver the expected CO_2 (and pollutant) emission reductions.
- Alternative Fuels and Energy Platforms – Support of alternative fuels and energy platforms and the infrastructure to deliver them.
- Driver Behaviour – Educate drivers on techniques to reduce fuel consumption and CO_2 emissions, which can also improve road safety (see the golden rules of eco-driving at www.ecodrive.org).
- Infrastructure Measures – Improve traffic flow and avoid wasteful congestion. Emerging Cooperative Intelligent Transport Systems (C-ITS) technology has the potential to deliver significant reductions in traffic congestion.

[4] Australian Government, Department of the Environment and Energy, "Better fuel for cleaner air", Discussion paper, December 2016 (DEE)

- Price signals (including incentives) – Influence consumer choice to produce changes in driving behaviour, and purchase and operating decisions for lower CO_2 emissions.
- Average fleet age – Incentives to increase the uptake of newer light vehicles and reduce the average age of the in-service fleet.

Focusing on just a single area, (e.g. vehicle technology) could increase overall cost to the community without delivering the expected benefits in the real world.

3.0 VEHICLE INDUSTRY

Main Points from Section 3.0: Vehicle Industry:

- The Australian automotive industry is committed to making a strong contribution to national efforts to reduce the impact of global climate change.
- The internal combustion engine (ICE) will remain the dominant type of engine for vehicles out to 2030 and it is expected the majority of light vehicles introduced into Australia during this period will have gasoline direct injection (GDI) engines.
- Complementary measures such as incentivising the purchase of electric vehicles will be required to encourage a change in consumer choice and increase the uptake of electric vehicles and other advanced technology powertrains.

3.1 Background

The Australian automotive industry is committed to making a strong contribution to national efforts to reduce the impact of global climate change and improve air quality. But it must be recognised that the on-road operation of light vehicles[5] also needs to be considered. For example, due to increasing congestion in our major cities owners of passenger cars, SUVs and light commercial vehicles are experiencing increasing travel times and consequently are using more fuel, and emitting more CO_2 and pollutant emissions year-on-year without corresponding increases in travel distance.

As at 31 January 2016 there were (approx.) 18 million motor vehicles registered in Australia, of which (approx.) 16.8 million were light vehicles[6]. In 2016, more than 1.14 million new passenger cars, SUVs and light commercial vehicles were sold.[7] Annual sales of new light vehicles are equivalent to (approx.) 1/16th or 6.75% of the light vehicle in-service fleet.

The predominant powertrain of light vehicles in Australia is a petrol engine. Almost 79% of light vehicles registered in 2016 had petrol engines, while just under 19% had diesel engines (predominantly light commercials) and the remaining 2% were "other fuel types" that included LPG, dual fuel and electric vehicles.[8]

3.2 Fuel Consumption and GHG Emissions

The Australian Government's, *Australia's emissions projections 2014-2015*[9], states (pp.19-20) that transport emissions[10] were 17 per cent of the National Greenhouse Gas Inventory in 2013-14 and that private road transport accounted for 46 per cent of transport emissions in 2013-14. Light vehicles accounted for 10.4 per cent of the National Greenhouse Gas (GHG) Inventory in 2013-14. However, as outlined above, sales of new passenger cars, SUVs and light commercial vehicles are equal to only (approx.) 1/16th of the current light vehicle in-service fleet. Therefore, new light vehicle sales can influence only around 1/16th of the private road transport annual GHG emissions. This equates to less than one per cent (i.e. 1/16th of 10.4 per cent) of the National Greenhouse Gas Inventory.

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[5] Light vehicles in this submission refers to passenger cars, sport utility vehicles (SUVs) and light commercial vehicles up to 3.5 tonne GVM (LCVs)

[6] Australian Bureau of Statistics, 9309.0 – Motor Vehicle Census, Australia, 31 Jan 2016.

[7] Vfacts National Report, New Vehicle Sales, December 2016.

[8] Australian Bureau of Statistics, 9309.0 – Motor Vehicle Census, Australia, 31 Jan 2016.

[9] Commonwealth of Australian (Department of Environment) 2015, Australia's emissions projections 2014-15, p. 19.

[10] Transport emissions includes rail, domestic shipping, domestic air and road transport.

In 2014 the Bureau of Infrastructure, Transport and Regional Economics (BITRE) released a study on the fuel consumption trends of new passenger vehicles sold from 1979 to 2013.[11] The BITRE found that before 2005, the improvements in vehicle technology that produced improved fuel consumption were somewhat offset by a change in the market to increases in power, weight and four wheel drive vehicles. The BITRE also reviewed the performance of the entire light vehicle fleet and found that since 1980;

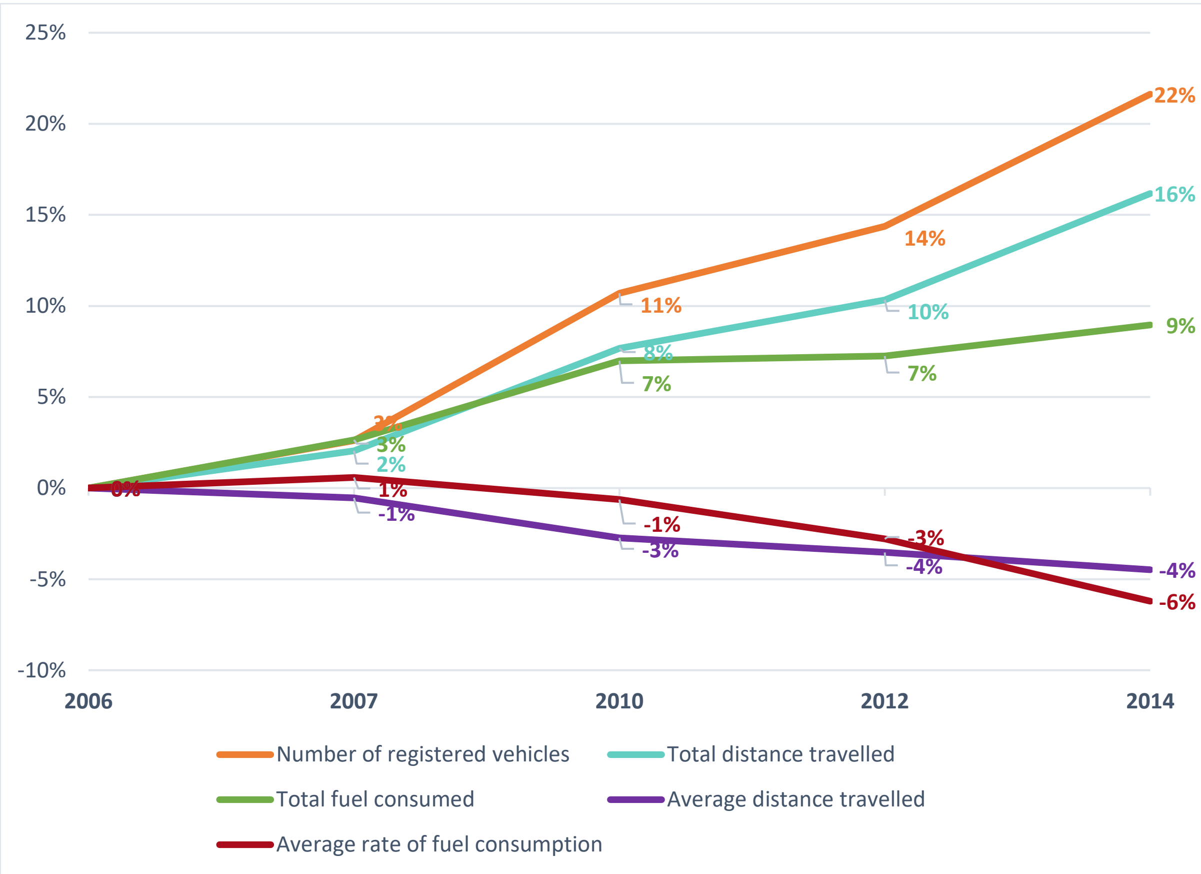
> *"…the fuel intensity of the entire light vehicle fleet has decreased a total of about 12.8 per cent"*

This is supported by the ABS Survey of Motor Vehicle Use.[12] When considering the percentage change in use of light vehicles over the period 2006 to 2014 (see Figure 3.1):

- The numbers of registered light vehicles increased by 22%.
- The total distance travelled by light vehicles increased by 16% and the average distance travelled by each light vehicle decreased by 4%.
- The total fuel consumed increased by 9% while the average fuel consumption of a light vehicle improved by 6%.

The yearly improvements in fuel consumption of new light vehicles lead directly to a reduction in both CO_2 and pollutant emissions.

Figure 3.1 – Changes in Light Vehicle Use: 2006-2016



[11] Australian Government, Bureau of Infrastructure and Regional Economics (BITRE), 2014, *New passenger vehicle fuel consumption trends, 1979 to 2013, Information* Sheet 66, BITE, Canberra.

[12] Australian Bureau of Statistics (ABS), 9208.0 – Survey of Motor Vehicle Use, Australia, 12 months ended 31 October 2014, 15 October 2015, ww.abs.gov.au

3.3 Pollution Emissions Standards (ADR 79)

Through the Australian Design Rules, the Government has introduced successively more stringent pollutant emission standards for vehicles. New light vehicles (passenger cars, SUVs and light commercial vehicles) introduced into Australia must meet the Euro 5 standards (ADR 79/03 introduced from 1 November 2013 and ADR 79/04 introduced from 1 November 2016).[13]

The progressive tightening of vehicle emissions standards, especially over the last 10+ years as Australia has progressed from Euro 2, through Euro 3 to Euro 4 and now Euro 5 standards, has contributed to improvements in air quality in Australian cities. For example, a 2013 study by the CSIRO for the Victorian EPA found that by 2030 total motor vehicle exhaust emissions will have significantly reduced and that improved technology is entering the vehicle fleet at a faster rate than growth of vehicle use.[14]

Adoption of Euro 6 standards has been efficiently achieved through the government's decision to "apply"[15] United Nations Regulation 83 (UN R83). This will allow those brands whose vehicles can operate effectively on the current market fuel (including diesel engine vehicles) to be offered to the market. Advice from some member brands is that some of their models that meet the initial Euro 6b standards are able to operate on Australian market PULP (which commonly has less than 30 ppm sulphur[16]). However, the long term impact on the durability of the engine and emissions systems of these vehicles is unknown.

The successful introduction of the next step in light vehicle pollutant emission standards, Euro 6, is dependent on suitable fuel quality standards, i.e. Petrol meeting EN228 (i.e. 95 RON, 10 ppm sulphur, 35% v/v max aromatics, etc.) and diesel meeting EN590.

3.4 Australian Light Vehicle Market

The consumer preferences in the new Australian light vehicle market have changed significantly from 2000 to 2016 (see Table 3.1 and Figure 3.2) with a significant growth in the SUV and light commercial vehicle (LCV) segments, a large proportion of which were diesel vehicles (33% of SUVs and 89% of LCVs)[17] in 2016.

In 2016, Australian new car buyers had a diverse range of choice of models across all market segments. This is demonstrated by the top ten sellers in 2016 (see Table 3.2) comprising three LCVs, one SUV, four small cars and two large/medium cars. Table 3.2 demonstrates the significant change in the light vehicle market in terms of both segment shift from passenger cars (in 2005, eight out of the top ten sellers were passenger cars) and also the significant fragmentation of the market.

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[13] Vehicle Emissions Standards, www.infrastructure.gov.au [accessed 5 January 2017]

[14] EPA Victoria, Future air quality in Victoria-Final Report, Publication 1535 July 2013

[15] Once a UN Regulation has been "applied" Australia has an obligation (under the "Mutual Recognition" provisions of the 1958 Agreement) to accept UN Approvals issued by any other Contracting Party (CP). The basic principle is that when a CP agrees to "apply" a UN Regulation, the Regulation is regarded as being consistent with that country's national legislation. Therefore a vehicle that conforms to an "applied" Regulation must be allowed free access to that country's market, without the imposition of additional mandatory requirements.
The benefit of Australia "applying" a UN Regulation is that Australia will have access to vehicles that comply with later (than specified in the ADR "Alternative Standards" clause) versions of UN Regulations without the need for additional certification approval. That is, vehicles meeting later safety or environmental standards will be certified without additional administrative workload for either the Government or industry.

[16] AIP, 2016, *Submission to the Vehicle Emissions Working Group on the Vehicle Emissions Discussion Paper February 2016*, 8 April 2016.

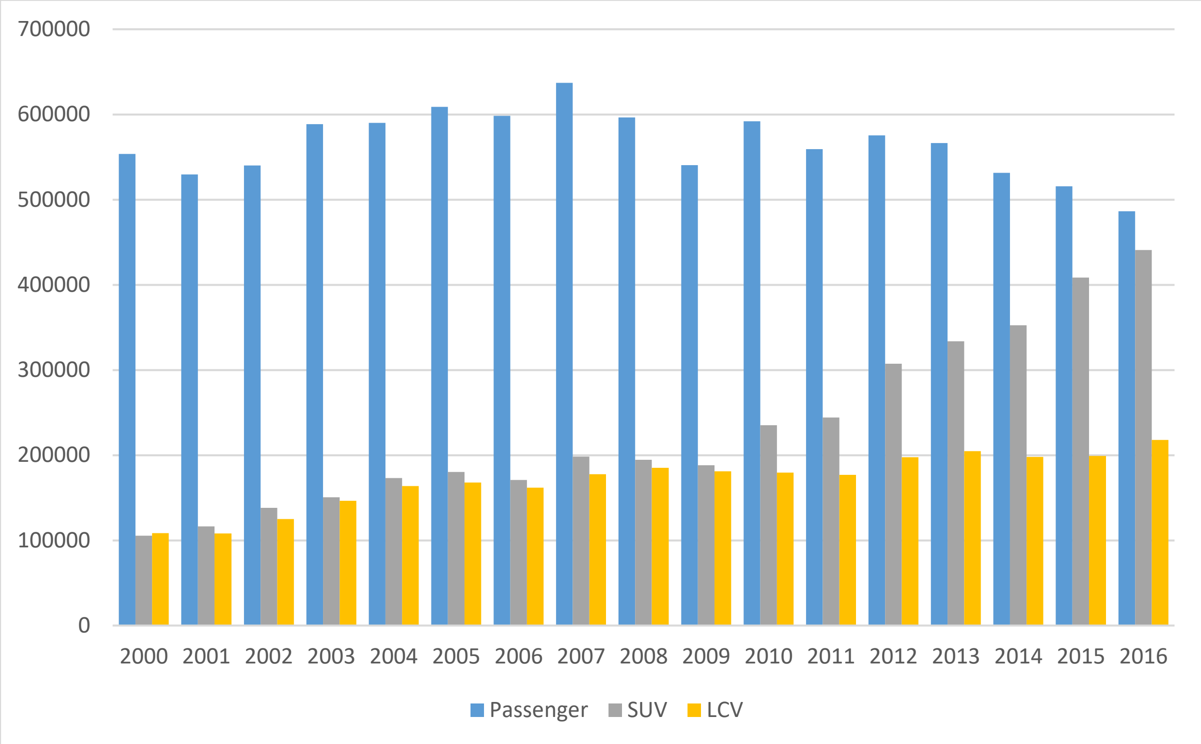
[17] Vfacts National Report, New Car Sales, 2000 to 2016

Table 3.1 Light Vehicle Sales 2000-2016[18]

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Passenger																	
Light & Micro	90298	66942	66235	76716	83944	90731	116086	127891	126600	116460	137916	132442	137606	130757	124374	122671	105228
Small	154079	162046	164943	175651	181160	215325	219358	232388	228463	213988	239098	244090	252171	266413	250536	233122	224450
Medium	41956	38293	38951	47164	49983	51833	87707	92579	86819	76638	82622	75984	89235	77985	71405	78123	74573
Large	198766	190303	188348	203524	181678	153244	136523	139677	119339	101701	98583	78077	61531	52482	47387	43940	39392
Upp large							7334	9346	5467	3592	3753	3042	3235	4238	3869	2976	2286
People movers	11736	12140	12791	11852	15232	15738	15442	16202	12646	11032	12655	11109	10212	9242	10220	11946	12864
Sports	7866	8820	13988	10175	8903	9744	15944	18936	17211	17151	17495	14570	21437	25337	23805	22905	27464
Prestige	29717	27234	24830	29167	37079	40605											
Luxury	19255	23674	30154	34262	32006	31585											
Total pass	**553673**	**529452**	**540240**	**588511**	**589985**	**608805**	**598394**	**637019**	**596545**	**540562**	**592122**	**559314**	**575427**	**566454**	**531596**	**515683**	**486257**
SUV																	
SUV-Compact/Small	39321	38683	73235	75062	75240	74659	75675	90330	85597	84598	114761	121387	60683	74809	87237	108353	110414
SUV-Medium	40227	51600	33269	38220	60160	71941	61361	74434	75485	72501	83811	80485	110044	119464	125222	147859	172194
SUV-Large	25962	25953	23021	25375	23940	19083	15469	13370	14874	11013	12256	12336	121791	126530	127820	152259	158409
SUV - Luxury			8539	11921	13747	14609	18342	20042	18722	20041	24457	29928	14735	12708	12068		
Total SUV	**105510**	**116236**	**138064**	**150578**	**173087**	**180292**	**170847**	**198176**	**194678**	**188153**	**235285**	**244136**	**307253**	**333511**	**352347**	**408471**	**441017**
LCV																	
Light buses	1890	1277	1615	1787	1544	2298	2622	2465	3417	2259	2434	2888	3857	3030	3375	3417	3166
Vans	19006	16870	18270	21598	22353	21571	20453	20300	24299	24557	23003	21033	20078	18621	19208	20993	23816
PU/CC 4x2	47276	53817	60057	70966	79298	79534	69545	70606	72812	67393	59052	52179	49233	44831	41807	40,657	43,948
PU/cc 4x4	39533	35371	43978	50670	58692	62728	67639	82691	83308	85813	93956	99850	124536	138084	133566	134,003	146,820
LCV 2.5-3.5 GVM	627	699	953	1568	1789	1747	1532	1494	1180	1036	1108	990					
Total LCV	**108332**	**108034**	**124873**	**146589**	**163676**	**167878**	**161791**	**177556**	**185016**	**181058**	**179553**	**176940**	**197704**	**204566**	**197956**	**199070**	**217750**
Total	**767515**	**753722**	**803177**	**885678**	**926748**	**956975**	**931032**	**1012751**	**976239**	**909773**	**1006960**	**980390**	**1080384**	**1104531**	**1081899**	**1123224**	**1145024**

[18] Vfacts National Reports, New Vehicle Sales, 2000 through to 2016

Figure 3.2 Light Vehicle Sales 2000-2016[19]



The change in the market is demonstrated by a comparison of the top ten selling models in 2005 and 2016. In 2005 (see Table 3.2) the top ten sellers accounted for approx. 1/3rd of all new vehicle sales with the top selling Holden Commodore selling more than 66,000 units which was 6.8% of the market.[20] While in 2016 the top ten models represented only 26.5% of the (almost) 20% larger new vehicle market with the top selling Toyota Hi-Lux selling less than 2/3rd of the 2005 Commodore volume (at 43,735) and accounting for less 3.6% of the total market.

Table 3.2 Top Ten Light Vehicle Sales in 2005 and 2016[21]

Rank	2005		2016	
	Model	Sales	Model	Sales
1.	Holden Commodore	66,794	Toyota Hi-Lux	42,104
2.	Ford Falcon	53,080	Toyota Corolla	40,330
3.	Toyota Corolla	46,415	Hyundai i30	37,772
4.	Holden Astra	33,070	Ford Ranger	36,934
5.	Mazda3	32,570	Mazda3	36,107
6.	Toyota Camry (4 cyl)	24,446	Toyota Camry	26,485
7.	Holden Utility (4x2)	20,813	Holden Commodore	25,860
8.	Ford Falcon Ute	20,123	Mazda CX-5	24,564
9.	Nissan Pulsar	17,643	Mitsubishi Triton	21,897
10.	Honda Accord	17,579	Volkswagen Golf	20,367
	33.6% to total market of 988,268		26.5% of total market of 1,178,133	

[19] Vfacts National Reports, New Vehicle Sales, 2000 through to 2016
[20] In 2002 the Holden Commodore sold 102,269 units and accounted for 12.4% of the total new vehicle market.
[21] Vfacts National Reports, New Vehicle Sales, 2005 and 2016

Over the five year period from 2011 to 2016, there was a significant change in the number of diesel engine passenger vehicles (cars and SUVs) and light commercial vehicles (LCVs) registered, increasing by 92 per cent and 63 per cent, respectively. However, diesel engine light vehicles are still a relatively small part of the in-service light vehicle fleet. In 2016, diesel engine passenger vehicles comprised (approx.) 7 per cent of all registered light vehicles, while diesel engine light commercials were (approx.) 10 per cent of all registered light vehicles.[22]

Growth in the particulate intensive diesel segment has implications for air quality. For many years Europe has focused on CO_2 reductions with policies including fuel taxation that made diesel cheaper than petrol. These policies led to an increase in diesel passenger cars in many European countries and resulted in air quality and health related problems created by the emission of particulate matter from old technology diesel powered vehicles. In response, there are a number of European cities (and other congested cities around the world with air quality and particulate matter issues) that have announced they will ban, or are considering banning, diesel cars from their city centres by 2025.

This is a key learning in relation to consideration of a CO_2 target. Any Government policy aimed at influencing light vehicle CO_2 emissions, must also consider if there are any adverse implications for vehicle pollutant emissions. E.g. if a CO_2 target and associated complementary measures encourage a greater uptake of diesel engine light vehicles, there may be a negative health and air quality impact.

3.5 Future Light Vehicle Powertrains

The internal combustion engine (ICE) will remain the predominate powertrain for Australian light vehicles out to 2030. Research conducted for the FCAI by IHS Advisory Services,[23] and presented to the Government, in 2016 concluded that;

> *"The internal combustion engine (ICE) will be the dominant source of power in passenger cars through to 2030. Hybrids will expand significantly (but they still have ICE's in them). Pure EV's will be niche."*

The BP Energy Outlook 2017 edition[24] supports this view and estimates that the global car fleet will double from 0.9 billion cars in 2015 to 1.8 billion in 2035. While the number of electric cars will increase from 1.2 million in 2015 to around 100 million in 2035 it will only be 6% of the global fleet. BP considers the key drivers for the uptake of electric vehicles (including PHEVs and BEVs) are:

- Fuel economy standards.
- Pace at which battery costs continue to fall.
- Size and durability of subsidies and other government policies supporting EV ownership.
- Improvements in fuel efficiency of ICE.
- Consumer preferences.

One of the expected drivers of development of PHEVs, especially for light commercial vehicles and large SUVs, is the US 2017-2025 vehicle fuel consumption and CO_2 (GHG standards) targets. The advice from IHS Advisory Services was that significant levels of hybridization of light commercial vehicles and large SUVs would be required in the US to meet their 2025 targets.

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[22] Australian Bureau of Statistics, 9309.0 Motor Vehicle Census, Australia, 31 Jan 2016. http://www.abs.gov.au/ausstats/abs%40.nsf/mf/9309.0 [accessed 17 April 2015]

[23] Paul Haelterman, IHS Advisory Services, Global Automotive Regulatory Requirements: Regulatory Environment and Technology Roadmaps, February 2016

[24] BP Energy Outlook 2017 edition, www.bp.com/energyoutlook [downloaded 27 February 2017]

To inform the draft RIS on *Improving the efficiency of new light vehicles*[25], the government engaged ABMARC to undertake a study on the costs that may be incurred and the technologies that are likely to be required to achieve the range of CO_2 targets for 2020 and 2025 that were developed by the Climate Change Authority (CCA) in 2014.[26,27]

In their study, ABMARC concluded that significant shifts in powertrain mix will be necessary to meet any of the CO_2 targets considered. ABMARC modelled a mix of petrol, diesel, hybrid, electric and LPG powertrains for each of the CCA proposed targets. To meet the most stringent CO_2 target, ABMARC estimated that in 2025 electric vehicles must constitute at least 9.5% of all light duty vehicle sales, along with diesel powertrains at 9.5% and an increase in hybrid powertrains to 17.8% of the market. This is far in excess of the estimates of increase in EVs (both pure battery EVs and PHEVs) from both BP and IHS. ABMARC did acknowledge that these levels were very high and unlikely to be achieved without strategies such as incentivizing the purchase of EVs.[28]

The draft RIS, Table 2[29] includes estimated costs of CO_2 enablers from the ABMARC study. The benefits of each technology may be accurate when based purely on improvements from the base vehicle (medium sized car with 4-cylinder petrol engine with Single Overhead Cam (SOHC), fixed valve timing with port fuel injection and 4 speed automatic transmission). It must be noted that these are ideal improvements, and cannot be necessarily cumulated together for the overall improvement. Also, the base vehicle for this study would now be at least a 10 year old vehicle and many of the technology enablers listed have already been incorporated into current models.

3.6 Summary

A whole-of-Government approach is required that incorporates all associated issues, including fuel quality standards, that have a significant impact on vehicles' ability to meet both CO_2 targets and air pollution emission standards. The FCAI and member brands are committed to continue to work with the Government to develop an approach that efficiently meets government policy objectives while taking into account industry key requirements.

[25] DIRDa (2016), *op. cit*.
[26] ABMARC, Analysis of the Australian 2015 New Light Vehicle Fleet and Review of Technology to Improve Light Vehicle Efficiency: Study for Department of Infrastructure and Regional Development, December 2016, (ABMARCa)
[27] Australian Government Climate Change Authority, Light Vehicle Emissions Standards for Australia Research Report, June 2014
[28] ABMARCa, *op. cit*., p.7
[29] DIRDa (2016), *op. cit*., p.22

4.0 FUEL QUALITY STANDARDS FOR CO2 TARGETS

Main Points from Section 4.0: Fuel Quality Standards for CO_2 Targets

- Fuel quality standards, CO_2 standards and pollutant emission standards all need to be considered together, as they are all interrelated.
- Consideration of the introduction timing of Euro 6 and CO_2 targets for new vehicles cannot be undertaken until a detailed consideration of changes to Australian fuel quality standards has been completed. Of central concern is how the Government is planning to transition to the European fuel standards (EN228 for Petrol and EN590 for Diesel) to support the introduction of both Euro 6 and CO_2 targets.
- The timeframe for the required fuel to be available to the market will then determine the timeline for new vehicle models and the timeline for the introduction of regulatory standards. Moving ahead with new emission regulations without resolving fuel quality questions could increase the cost of new vehicles and adversely affect the operability of new emission technologies without delivering the anticipated environment and health benefits.
- The European fuel standards for petrol (EN228) and diesel (EN590) are required to deliver CO_2 reductions in-service.
- Vehicles are designed and developed to meet air pollutant emission standards and/or CO_2 targets with an expectation of suitable/appropriate fuel quality in a particular market.

4.1 Introduction

Vehicles are designed and developed to meet air pollutant emission standards and/or CO_2 targets with an expectation of compatible fuel quality in a particular market. While the Government has mandated Euro 5 (through ADR 79/03 and ADR 79/04), the Government has not mandated the associated European fuel quality standard (EN228[30] for petrol and EN590[31] for diesel).

If Australia does not adopt EN228 for the petrol standard and EN590 for the diesel standard, vehicles will be unable to comply with Euro 6 in-service requirements and will be unable to deliver the anticipated fuel efficiency improvements. It also risks the possibility of future vehicle models shifting Australia's vehicle fleet towards lower grade offerings than other advanced markets. This potentially degrades Australia's progress towards more technologically advanced and efficient vehicles.

Improving the quality of Australian market fuel will deliver improvements for the entire motor vehicle fleet, not just for new motor vehicles.

To continue to deliver reduced CO_2 emissions (i.e. reduction in fuel consumption) and corresponding expected air quality benefits (i.e. reduction in pollutant emissions) with the introduction of advanced vehicle emission standards, market fuel of the relevant standard (i.e. consistent with the European EN fuel standards) must be employed. If market fuel of the necessary standard is not utilised, higher exhausts emissions (both CO_2 and pollutants) will be generated during a vehicles' operation with lower than expected improvements to air quality and health outcomes.

[30] EN228 is the European gasoline (petrol) fuel quality standard and specifies a range of fuel parameters including RON and maximum sulphur levels. Throughout this response the FCAI refers to RON and sulphur as these are the main parameters that affect fuel consumption and pollution emissions (see ABMARC report in Appendix D), however, there are other fuel parameters (e.g. aromatics) that also impact indirectly on vehicle emissions and operability and need to be considered.

[31] EN 590 is the European diesel fuel quality standard and specifies a range of fuel parameters.

4.2 Better fuel for cleaner air Discussion Paper

In our response to the Government's "Better fuel for cleaner air" Discussion paper, the FCAI strongly supported Policy Alternative B: **Revisions to the fuel standards to align with the recommendations of the Hart Report and to harmonise with European standards**.

The FCAI's response to the Government's *Better fuel for cleaner air* Discussion paper, outlined the need to harmonise with EN standard fuels to deliver the governments objectives with introducing a CO_2 target and Euro 6 pollutant emission standards.

This has been the FCAI's longstanding position that fuel quality standards, CO_2 standards and pollutant emission standards all need to be considered together, as they are all interrelated. This is not a unique position and is shared by the global automotive industry, regulators and research organisations alike. Appendix C contains a list of references and quotes from leading international regulators, the automotive industry, research organisations and the Australian Government that demonstrate this position is universally acknowledged.

4.3 Interaction of CO_2 targets, pollutant emission standards (Euro 6) and fuel quality standards

The interaction of CO_2 targets, pollutant emission standards and fuel quality standards is a complex issue. Recognising the benefit to all stakeholders, from an understanding of the operation of engine and emission system technology, in 2016, the FCAI commissioned a Melbourne based firm, ABMARC, to prepare a technical report to explain how a spark ignition petrol engine works with a focus on designs for light duty vehicles and the technologies required to meet future emission standards (contained in Appendix E).[32]

ABMARC summarised its key findings into a two page infographic (Figures 4.1 and 4.2) covering:

1. Fuel, engine technology and exhaust after treatment must be considered as a system to reduce both CO_2 and pollutant emissions
2. The types of engine technology along with the benefits and downsides, e.g. gasoline direct injection (GDI) engines have improved fuel efficiency (compared to multi-point fuel injection), but the combustion process produces particulate matter that must be treated by an exhaust after treatment system with a particulate filter.
3. The main components of the exhaust after treatment system, i.e. catalytic convertor and particulate filter (required by GDI engines to meet Euro 6c and 6d particulate requirements).
4. The importance of fuel standards and in particular the impact of sulphur on the catalyst and how higher RON provides for higher engine efficiency and reduces CO_2.

The conclusions from the ABMARC study included:

- Achieving low vehicle emissions with spark ignition engines requires a compromise between pollutants and CO_2.
- Low vehicle emission can only be achieved using engine and exhaust after-treatment technology that is complemented by high quality fuel.

[32] ABMARC, 2016, Technical Report: Engine and Emission System Technology, Spark Ignition Petrol Euro 5 & Beyond, Light Duty Vehicle, August 2016 (ABMARCb)

Figure 4.1 Petrol Engine and Emissions System Technology (1)

PETROL ENGINE AND EMISSIONS SYSTEM TECHNOLOGY
Spark Ignition Petrol: Euro 5 & Beyond

ABMARC

INTRODUCTION

Advanced engine technology, exhaust after treatment and high quality fuel are all required to deliver low CO_2 and pollutant emissions. Modern petrol engines are highly complex and provide a compact, economical power plant that is capable of meeting the customer requirements of light duty vehicles while satisfying stringent global standards which limit CO_2 and pollutant emissions.

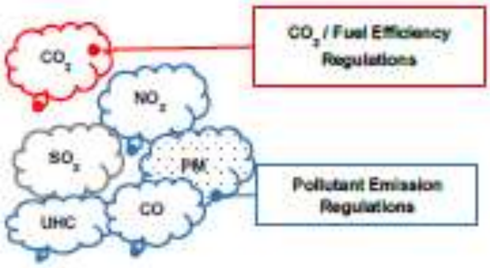
In order to ensure performance and durability for the designed vehicle service life, careful consideration must be made to meet the needs and limitations of the engine and emission reduction technologies.

01 OVERVIEW

Low vehicle tailpipe emissions require advanced engine technology, exhaust after treatment and high quality fuel.

Pollutants from Combustion

Pollutants are produced during combustion due to the engine design and operation combined with impurities in the fuel

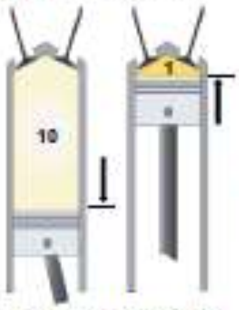


02 ENGINE

Petrol Combustion

Fuel, air, compression and a source of ignition are required for combustion within an engine.

Compression Ratio



10:1 Compression Ratio

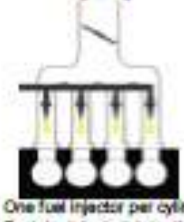
Compression ratio is the ratio of the volume of air and fuel that enters the engine divided by the final, compressed volume prior to combustion. This is presented as 10:1, for example.

Increasing compression ratio increases efficiency and reduces CO_2 emissions, but makes an engine more prone to knocking.

Fuel Injection Types

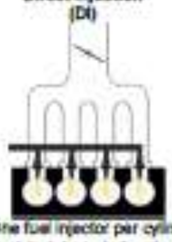
Current vehicles use either Multi Point Fuel Injection (MPFI) or Direct Injection (DI). The proportion of petrol engines using DI has increased over the last ten years due to the reduction in CO_2 emissions and increased power that is offered over MPFI. This helps vehicle manufacturers meet increasingly stringent global CO_2 and greenhouse gas standards.

Multi-Point Fuel Injection (MPFI)



- One fuel injector per cylinder
- Fuel is injected into the air intake
- Good fuel mixing

Direct Injection (DI)



- One fuel injector per cylinder
- Fuel is injected directly into the cylinders
- Improved combustion

Particulate Formation

- DI engines are more prone to particulate production than MPFI as fuel is sprayed directly into the combustion chamber.
- Fuel that hits relatively cold surfaces like pistons, valves and cylinder walls leads to particulate formation, through a mechanism known as wall wetting.

Figure 4.2 Petrol Engine and Emissions System Technology (2)

PETROL ENGINE AND EMISSIONS SYSTEM TECHNOLOGY
Spark Ignition Petrol: Euro 5 & Beyond

ABMARC

03 EXHAUST EMISSIONS REDUCTION

Catalytic Converter

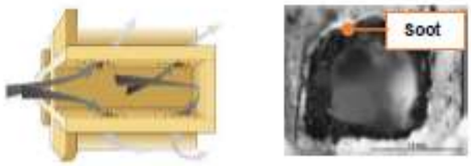
All petrol vehicles are fitted with a catalytic converter in order to meet stringent emission standards.

Source: AECC

- It encourages reactions between the pollutants and oxygen in the exhaust gas, forming CO_2 as a by-product.
- Pollutant conversion efficiency is sensitive to exhaust gas air: fuel ratio, temperature and deactivation (poisoning) from sulfur compounds.
- The efficiency of catalytic converters tends to reduce over time due to detrimental conditions, however, they are rarely replaced or renewed.

Particulate Filter

In order to meet European Euro 6c and 6d emission standards, all vehicles with direct injection petrol engines will require particulate filters.



Sources: Corning & Argonne National Laboratory

- A particulate filter is fitted in the exhaust system to trap soot particles in microscopic pores of a ceramic or metallic honeycomb.
- Pore size is around 11 times thinner than a human hair.
- Up to 90% of the mass of particles produced by the engine can be trapped, reducing tailpipe particulate emissions.

04 AUSTRALIAN FUEL

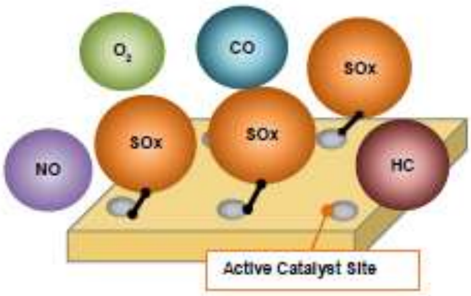
Fuel Sulfur Content

Sulfur in fuel forms compounds during combustion which inhibit the performance and durability of catalytic converters, increasing pollutant emissions. Other advanced markets have lower maximum sulfur content.

Petrol Type	Minimum Octane Rating	Maximum Sulfur Content
ULP	91 RON (Lower Octane)	150 ppm
PULP	95 RON (Higher Octane)	50 ppm
	(From 2017)	10 ppm

RON = Research Octane Number
ppm = parts per million

Impact on Pollutants

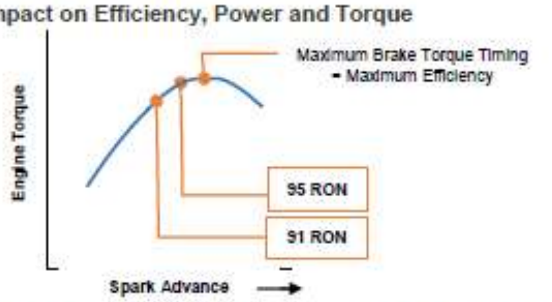


- The higher sulfur content of 91 RON ULP leads to higher levels of sulfur oxides (SO_X) in the exhaust gas.
- SO_X inhibits catalytic converter performance by bonding with the catalyst sites, reducing the reactions between other pollutants.
- 91 RON ULP leads to increased CO, UHC and NO_X emissions compared with 95 RON PULP due to its higher sulfur content.

Fuel Octane Rating

Higher octane fuel resists engine knock and enables high compression ratio engines to improve fuel efficiency and reduce CO_2 production. The European fuel standard requires a minimum octane rating of 95 RON.

Impact on Efficiency, Power and Torque



- For modern engines designed to use 95 RON fuel, using 91 RON will likely result in engine knock.
- To reduce engine knock, spark advance is retarded. This reduces the engine torque and decreases engine efficiency.
- Using 95 RON enables the engine spark timing to operate closer to the point of Maximum Brake Torque Timing (MBT)
- 95 RON enables higher engine efficiency, reducing CO_2

CONCLUSION

Achieving low vehicle emissions with spark ignition engines requires a compromise between pollutants and CO_2.

Low vehicle emissions can only be achieved by using engine and exhaust after treatment technology that is complemented by high quality fuel. 95 RON fuel offers a reduction in real world CO_2 and pollutant emissions over 91 RON.

From 2017, Europe, Japan and the USA will all have fuel standards with a maximum sulfur content of 10 ppm, enabling advanced engine and exhaust emission reduction technologies to meet stringent pollutant emission regulations in both the real world and in the laboratory.

4.4 Fuel Quality Standards for CO_2 targets: Summary

Consideration of the introduction timing of CO_2 targets (and Euro 6) for new vehicles cannot be undertaken until a detailed consideration of changes to Australian fuel quality standards has been completed. Of central concern is how the Government is planning to transition to the European fuel standards (EN228 for petrol and EN 590 for diesel) to support the introduction of both Euro 6 and CO_2 targets.

The timeframe for the required fuel to be available to the market will then determine the timeline for new vehicle models and the timeline for the introduction of regulatory standards. Moving ahead with new CO_2 (and pollutant) emission regulations without resolving fuel quality questions could increase the purchase and operating costs of new vehicles and adversely affect the operability of new emission technologies without delivering the anticipated environment and health benefits.

5.0 LIGHT VEHICLE CO2 TARGETS

Main Points from Section 5.0: Light Vehicle CO_2 Targets

- The FCAI supports teh introduction of a mandated CO_2 Light Vehicle Emissions standard that is realistic, achievable and relevant to the Australian market conditions, and contributes to the Government's economy-wide post-2020 GHG reduction targets.
- The standard must account for Australian market characteristics such as fuel quality, consumer requirements and fleet mix.
- Australia cannot simply adopt an overseas CO_2 standard. Australia is different to Europe and the US as we have our own unique market.
- The FCAI supports a mandated 2030 CO_2 target to commence in 2020, with interim targets or measurement points and a mid-term review.
- Extensive modelling is required by the Government to:
    - Determine appropriate CO_2 value for 2020 start date.
    - Annual rate of reduction.
    - What level of intervention will the government introduce in terms of credits, incentives and other complementary measures?
    - Mechanisms for measuring and reporting CO_2 values including individual company/brand targets.
    - Vehicle categories and corresponding targets (Note: Europe and the US have different definitions and separate targets for passenger cars and light commercial vehicles).
- The FCAI offers to work with the government to develop a CO_2 standard that is relevant to Australia and delivers the Government's objective of reducing CO_2 from light vehicles without constraining consumer choice.

5.1 CO_2 Targets

The FCAI supports a mandated CO_2 standard that is realistic, achievable and relevant to the Australian market conditions, and contributes to the Government's economy-wide post-2020 GHG reduction targets. This has been a long-standing FCAI position and the industry cooperated with the (previous) government during 2011-2013 to consider mandatory CO_2 targets.

Australia cannot simply adopt an overseas CO_2 standard. Australia is different to Europe and the US as we have our own unique market (fleet mix), consumer and driving needs, environmental conditions as well as an inferior quality market fuel. There are different operating and economic factors in Australia than in other major markets.[33]

Similarly, there are significantly different operating and economic factors in Europe. Table 5.1, taken from the National Transport Commissions' publication, *Carbon Dioxide Emissions Intensity for New Australian Vehicles Light Vehicles 2015,* summarises many of the European government initiatives and the resulting effect on the market.

[33] IHS Consulting, Feb 2016, Global Automotive Regulatory Requirements: Regulatory Environment and Technology Roadmaps

Table 5.1: European Measures that have reduced carbon dioxide emissions intensity from motor vehicles[34]

European Measure	Effect of Measure
Higher fuel prices through higher fuel taxes.	Encourages consumers to purchase fuel-efficient vehicles to lower running costs. European consumers purchase more small vehicles compared with Australian consumers. European consumers prefer manual transmission vehicles, whereas Australian consumers prefer automatic transmissions.
Low diesel taxes compared with petrol taxes.	Encourages consumers to purchase diesel vehicles to reduce running costs.
Regulating carbon dioxide emissions from motor vehicles (passenger vehicle standards were phased in from 2012, with full implementation from 2015).	Provides manufacturers with targets for emissions reductions.
Vehicle excise duties.	Encourages consumers to purchase low carbon dioxide– emitting vehicles.
Direct cash incentives for consumers to purchase low carbon dioxide vehicles.	Encourages consumers to purchase low carbon dioxide vehicles as it lowers the purchase price of the vehicle.
Consumer information on vehicles.	Provides information to consumers about relative carbon dioxide efficiency and the annual running costs of new vehicles.
Consumer information in printed advertisements.	Provides information to consumers about relative carbon dioxide efficiency and the annual running costs of new vehicles.

The U.S. new vehicle fleet mix is more similar to Australia in terms of:

- Approximately half of all light vehicle sales are SUVs or LCVs.
- Australians and Americans tend to favour light vehicles with automatic transmissions and petrol engines over diesel engines.

However, there are significant market differences including:

- Market fuel quality.
- Demand-side financial incentives for EVs, PHEVs and HEVs. This has resulted in a significantly higher uptake of EVs, PHEVs and HEVS in the U.S. than in Australia; e.g. hybrid vehicles account for 2.8% of the U.S. market while less than half of that (1.1%[35]) of the Australian market.
- Off-cycle credits (e.g. CO_2 credits for use of low GWP air conditioning gas) in the U.S. vehicle CO_2 targets that encourage early introduction of new technology into the market.

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[34] National Transport Commission, March 2015 Information Paper, "Carbon Dioxide Emissions Intensity for New Australian Vehicles Light Vehicles 2015".
[35] Vfacts, 2016

5.2 Proposed Approach for Australia

The FCAI supports the introduction of a mandated CO_2 Light Vehicle Emissions standard for Australia. The standard must be realistic, achievable and relevant to the Australian market conditions and contribute to the Government's economy-wide post-2020 GHG reduction targets.

5.2.1 Parameters of a Mandated CO2 Target

The FCAI proposes that the parameters of a mandated CO_2 target would include:

- To commence in 2020 with starting target(s) to be determined:
    - A 2020 start date to align with the Government's current timetable for the Vehicle Emissions Ministerial Forum.
    - Current trend (as defined by the CCA) of 2.0%[36] out to 2022 and then an accelerated rate of reduction from 2022 through to 2030.
- 2030 target:
    - A 2030 target will align with the Government's post-2020 GHG target of 26-28% reduction on 2005 levels by 2030.
    - A 2025 target does not provide for the long term planning certainty required by the industry.
- Interim targets or measurement points at regular intervals between 2020 and 2030 that will provide a continuing assessment of the industry's ability (and changes in consumer preference that contributes) to achieve the 2030 target.
- A mid-term review (i.e. 2025) is required to assess if changes to the market requires the targets to be adjusted.
- Adoption of vehicle grouping similar to the US/Canada, i.e. separate targets for passenger cars (MA Category) and LCV/SUVs (NA and MC Categories).[37,38]
- Use of a mass-based parameter and limit curve to develop both fleet-wide and individual brand targets.

If the government's intention is to create a transformed light vehicle fleet (in terms of fleet mix and/or powertrain technology) a long-term target (2030) is required. With a long-term target a mid-term review is required as it is exceedingly difficult to accurately predict the circumstances (e.g. market conditions, consumer choice, technology changes) so far into the future, impacting the feasibility and relevance of a fixed CO_2 standard.

The mid-term review will need to review the assumptions made during the development of the targets including rate of change of technology developments, consumer choice and market conditions and then evaluate the appropriateness of the original targets.

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[36] Climate Change Authority, June 2014, *Light Vehicle Emission Standards for Australia, Research Report*, p.45, Table 4.1 modelled BAU as 2% for 2013-20 and 1.6% for 2021-25.

[37] Note: In addition to vehicles that fall within the ADR definitions for MC and NA categories, the US also include vehicles meeting the following two criteria into the Light Truck group:

1. Vehicles with off road ground clearance with 2WD if GVM > 2.7 t; or
2. Vehicles with three (3) or more rows of seats where seats can be folded/pivoted/removed to then allow the vehicle to carry cargo.

This was done to:

- Not penalise vehicles designed to carry or tow heavy loads.
- Prevent manufacturers "gaming" the system by replacing their large 2WD SUVs with 4WD to take advantage of the lower targets.

[38] 49 CFR 523.5 - Non-passenger automobile

A 2022 start date for accelerated rate of reduction is required due to:

- FCAI member brands will require up to 60 months to make significant changes to products offered for sale. Therefore, a lead-in period of up to 5 years (from finalisation of standard) with CO_2 reductions at current trends will be required.
- The government has recommended to introduce Euro 6 along with the new laboratory test cycle (WLTP) for both CO_2 (UN R101[39] and ADR 81) and pollutant emissions (UN R83[40] and ADR 79). Both UN R101 and R83 are yet to be updated to include the WLTP. Taking into consideration the steps required to introduce Euro 6 into Australia leads to an earliest implementation timing of 2022 for new models.

5.2.2 Options for Consideration

The FCAI considers that there are two broad options for consideration based on the CCA 2014 report:[41]

1. Annual reduction of 1.6%.
2. Annual reduction of 3.5%.

Each of these options are further outlined below using the following baseline assumptions:

- 2015 as the base year.
- 2% annual reduction (i.e. CCA BAU for 2013-20) from 2015 to 2022.
- Finalisation and introduction of a CO_2 standard/target from 2017 with a 5 year lead-in period.
- Modelling is only on a sales weighted average and does not adopt a parameter (vehicle footprint or vehicle mass) approach.

Important notes on the FCAI broad options are as follows:

- The following options are put forward as possible scenarios for illustrative purposes.
- Each of the scenarios are only based on sales weighted average CO_2 based solely on results of the laboratory (ADR 81/02) certification test that uses the NEDC drive cycle.
- When the government adopts the new WLTP (as part of an updated UN R101), the CO_2 emissions will be higher due to the different performance of technologies in the test cycle. It is expected that the CO_2 emissions from passenger cars tested on the WLTP will be at least 20% more than the same car tested using the NEDC drive cycle. The discrepancy will be larger for SUVs and LCVs.
- Additional work would be required to develop individual brand targets once parameters (i.e. mass or footprint), midpoint, slope of attribute curve and annual reductions are all determined.
- Additional modelling on the impact of the various complementary measures (e.g. incentives and credits) will also need to be undertaken to estimate change in consumer preference in purchasing.

[39] United Nations Regulation No. 101 (UN R101) Uniform provisions concerning the approval of passenger cars powered by an internal combustion engine only, or powered by a hybrid electric power train with regard to the measurement of the emission of carbon dioxide and fuel consumption and/or the measurement of electric energy consumption and electric range, and of categories M1 and N1 vehicles powered by an electric power train only with regard to the measurement of electric energy consumption and electric range

[40] United Nations Regulation No. 83 (UN R83) Uniform provisions concerning the approval of vehicles with regard to the emission of pollutants according to engine fuel requirements

[41] Australian Government, Climate Change Authority, Light Vehicle Emissions Standards for Australia Research Report, June 2014

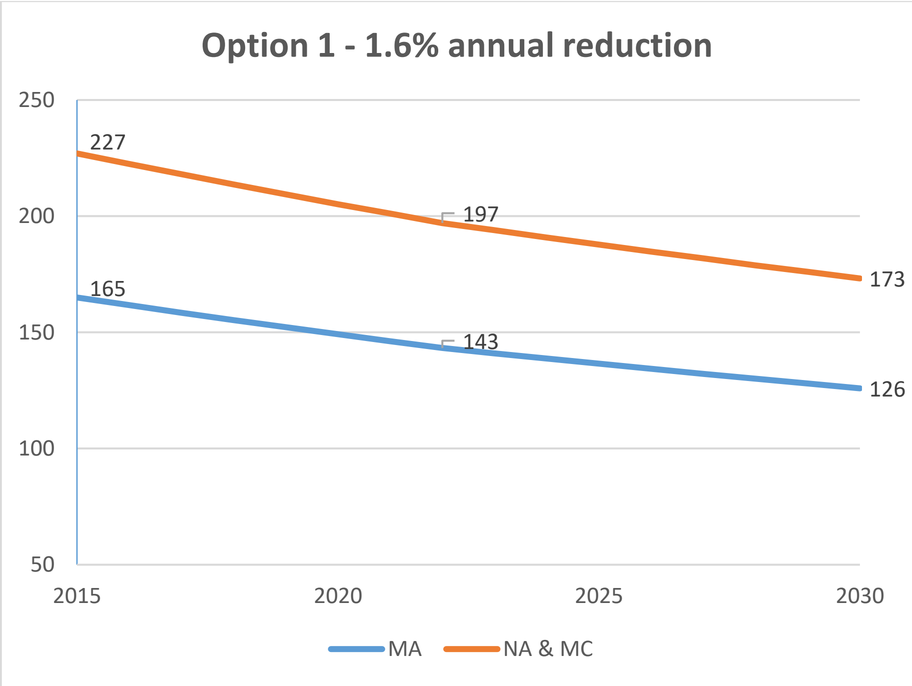
5.2.3 *Option 1 – Annual reduction of 1.6%*

Option 1 is based on the CCA BAU scenario and has 2% annual reduction from 2015 to 2022 and then 1.6% annual reduction out to 2030.[42] This option would produce the following targets (Table 5.2 and Figure 5.1) using only a sales weighted average:

Table 5.2: Option 1 – Annual reduction of 1.6%[43]

Year	MA	NA & MC
2015	165	227
2022	143	197
2025	136	188
2030	126	173

Figure 5.1: Option 1 – Annual reduction of 1.6%[43]



To achieve this level of ongoing annual reduction a minimum level of complementary measures are required:

- Fuel quality:
  - Widespread availability of market fuel harmonised with European standards (i.e. EN228 for petrol and EN590 for diesel).
  - If current ULP (91 RON 150 ppm sulphur) continues to be available, there must be price parity between 91 RON and 95 RON fuel to encourage vehicle owners to use the higher grade fuel, in order to deliver the emission benefit in-service.
- Financial incentives: financial incentives offered by the government such as the (no longer operational) Green Car Innovation Fund will need to continue throughout this time frame.

[42] Climate Change Authority, June 2014, *Light Vehicle Emission Standards for Australia, Research Report*, p.45, Table 4.1 modelled BAU as 2% for 2013-20 and 1.6% for 2021-25.
[43] Modelling using a sales weighted average and tested using the NEDC drive cycle

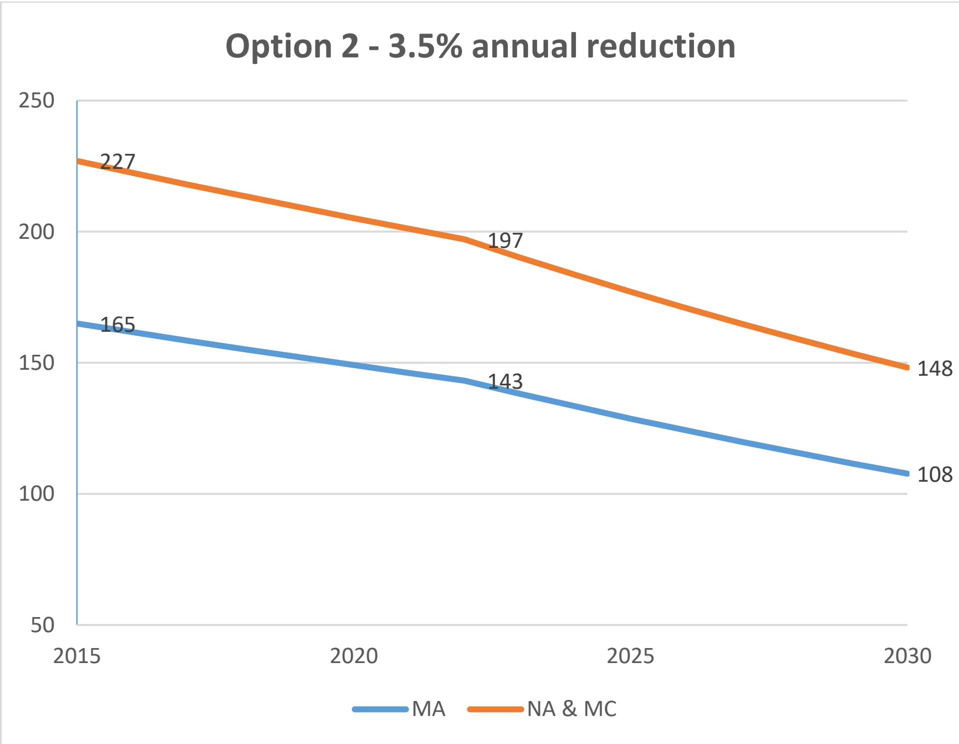
5.2.4 Option 2 – Annual reduction of 3.5%

Option 2 has 2% annual reduction from 2015 to 2022 and then 3.5% annual reduction out to 2030. This achieves the following targets (Table 5.3 and Figure 5.2):

Table 5.3: Option 2 – Annual reduction of 3.5%[44]

Year	MA	NA & MC
2015	165	227
2022	143	197
2025	129	177
2030	108	148

Figure 5.2: Option 2 – Annual reduction of 3.5%[44]



To achieve an accelerated rate of reduction, an extensive package of complementary measures will be required.

5.2.5 Complementary Measures

Table 5.4 has a list of the types of complementary measures and some suggested trigger points for both Options 1 and 2.

While these complementary measures are based on the existing measures used throughout the world (and some already exist in Australia) they will need to be tailored for the Australian market and CO_2 targets.

[44] Modelling using a sales weighted average and tested using the NEDC drive cycle

Table 5.4 List of Complementary Measures Required for CO_2 Targets[45]

		Option 1 - 1.6% annual reduction		Option 2 - 3.5% annual reduction	
		MA Category	NA & MC Categories	MA Category	NA & MC Categories
Federal Government					
Off cycle credits:	Air Cond gas (low GWP)	-		✓	✓
	High efficiency A/C			✓	✓
	Eco Innovations (or US White List)	-		✓	✓
Super Credits:	Factor 3.5: <2% mkt pen.	-		<100g/km ✓	<150g/km ✓
	Factor 2.5: 2-5% mkt pen.	-		<100g/km ✓	<150g/km ✓
	Factor 1.5: 5-10% mkt pen.	-		<100g/km ✓	<150g/km ✓
	Factor 1.0: >10% mkt pen.	-		<100g/km ✓	<150g/km ✓
Fuel Quality:	PULP	95RON / 10ppm sulphur	95RON / 10ppm sulphur	95RON / 10ppm sulphur	95RON / 10ppm sulphur
Fuel Pricing	Price partiy between ULP and PULP	✓	✓	✓	✓
	Increse fuel price to change behaviour			✓	✓
Program Flexibilities:	Data collection & pooling			✓	✓
	Banking & make good provisions			✓	✓
	Trading			✓	✓
Penalties:				Non-financial	Non-financial
Finanical incentives:	Import duty relief	-		Waive <100g/km	Waive <150g/km
	LCT relief	-		Waive <100g/km	Waive <150g/km
	GST discount	-	-	75% <75g/km	75% <112.5g/km
		-	-	100% <50g/km	100% <75g/km
	Income Tax Rebates	-	-	✓	✓
	Green Car Innvoation Fund	✓	✓	✓	✓
Non-financial incentives:	Primary Industry exemptions	-	-	✓	✓
	Building standards to include EV recharging and other infrastructure such as hydrogen refuelling	-		✓	✓
	Govt fleet purchasing			50% <75g/km	50% <112.5g/km
State Government					
Finanical incentives:	Registration Cost discount (across all states)	-		75% <75 g/km	75% <112.5 g/km
				100% <50 g/km	100% <75 g/km
	Stamp Duty discount (across all states)			50% <75g/km	100% <75 g/km
				100% <25g/km	
Non-financial incentives:	Home EV recharging			✓	✓
	Building standards to include EV recharging and other infrastructure such as hydrogen refuelling			✓	✓
	Transit lane access			<50g/km	<75g/km
	Exempt from tolls			<50g/km	<75g/km
	Govt fleet purchasing			50% <75g/km	50% <112.5g/km
Local Government					
	Transit lane access			<50g/km	<75g/km
	Free charging for Evs & PHEVs			EV/PHEV	EV/PHEV
	Building standards to include EV recharging and other infrastructure such as hydrogen refuelling			✓	✓
	Govt fleet purchasing			50% <75g/km	50% <112.5g/km
	Free CBD parking			<75g/km	<112.5g/km

[45] The levels of incentives and credits in Table 4.5 are indicative and provided as a starting point for discussion and modelling

5.3 Next Steps

The above options are designed to demonstrate how a 2030 CO_2 target may work based on the FCAI's preferred approach including:

- Annual reduction of 2% (CCA estimate of BAU for 2013-2020) from 2017 to 2022 and then a change in rate of annual reduction out to 2030.
- Targets for individual vehicle categories aligned with the US/Canadian approach of separate targets for passenger cars (MA Category) and LCVs (NA Category), with off-road passenger SUVs (MC category) included with LCVs.

These options are all based on sales weighted average with CO_2 as measured in accordance with ADR 81/02 (i.e. on the NEDC drive cycle). As part of developing a mandated CO_2 target, the government will need to review the targets in terms of an attribute (i.e. vehicle mass or vehicle footprint).

If the CO_2 standard is to be based on the new laboratory test cycle, the Worldwide harmonised Light Vehicle Test Procedure (WLTP) that will be introduced with Euro 6d), the starting point and targets will need to be reviewed and adjusted. The WLTP is quite different to and more stringent than the NEDC test cycle, and will provide a higher CO_2 figure for the same vehicle.

6.0 COMMENTS ON DRAFT RIS AND RESPONSES TO QUESTIONS

Main Points from Section 6.0: Comments on Draft RIS and Responses to Questions

- The FCAI supports adopting or harmonising with other major markets as much as is practical to reduce the level of uniqueness in any Australian vehicle efficiency standard.
- The costs in the draft RIS need to be revised.
- The Australian consumer choice for larger vehicles with automatic transmissions and towing capacity needs to be recognised in any CO_2 standard.
- Complementary measures that include off-cycle credits such as for low GWP air conditioning gas and improved efficiency of air conditioning systems must be taken into consideration for a mandated CO_2 target.

6.1 Comments on the Draft RIS

In this section, the FCAI will provide comments and additional information on sections of the draft RIS that are not captured in the FCAI Answers to Questions contained in Appendix A (Section 6.2 of this response).

6.1.1 Costs and CO_2 Reduction

The draft RIS acknowledges that it is important to consider how to improve the fuel consumption of all light vehicles and there are many proven technologies (e.g. reducing mass and more efficient powertrains) that are currently available.[46] Table 2[47] contains a detailed list of the benefits and costs of a range of technologies that could be adopted to improve the fuel efficiency of a medium sized car with a 4-cylinder engine (from the study undertaken by ABMARC).

Whilst the benefits of each technology may be accurate when based purely on improvements from the base vehicle (medium sized car with 4-cylinder petrol engine with Single Overhead Cam (SOHC), fixed valve timing with port fuel injection and 4 speed automatic transmission), it must be noted that these are ideal improvements, and cannot be necessarily cumulated together for the overall improvement or will be relevant to all models and market segments. Also of note is that the base vehicle would be considered by most OEMs to be at least a 10 year old model, where many of the technology enablers listed have already been incorporated.

To further substantiate the above statement, it is useful to study an example vehicle which has undergone significant fuel consumption improvements through the adoption of technology, while maintaining comparable acceleration and towing capability. The Chevrolet Tahoe Hybrid from 2008 is used as an example, as it was sold alongside the base vehicle which did not include the same technology.

The fuel consumption data for these vehicles (see Figure 6.1) can be found on the US Government website: http://www.fueleconomy.gov/feg/Find.do?action=sbs&id=25122&id=24572

The key technology included on the Hybrid variant:

- Two Mode Hybrid transmission with 2 electric motors and High Voltage battery.
- Engine was "larger" but it was changed to LIVC (late intake valve closing).
- Engine was intentionally oversized to allow it to operate overall more efficiently including additional Active Fuel Management (AFM).

[46] DIRDa, 2016, *op. cit.*, p.21
[47] DIRDa, 2016, *op. cit.*, p.23

- Hybrid system added mass so the fuel tank was downsized, and GM added aluminium to the hood, tailgate, wheels, and some of the seats.
- Front air dam was lowered and rear spoiler was changed for aero improvements.
- Tyres had improved rolling resistance.

Figure 6.1 Fuel Economy data for 2008 Chevrolet Tahoe[48]

All of the above yielded a 22.5% improvement to fuel consumption (i.e. from 6.2 gal/100mi to 4.8 gal/100mi) with a corresponding 23.8% reduction in CO_2 emissions (i.e. from 555 to 423 grams CO_2 per mile), for a vehicle with comparable performance and towing capability.

[48] US EPA, http://www.fueleconomy.gov/feg/Find.do?action=sbs&id=25122&id=24572 [downloaded 11 March 2017]

Based on the data from Table 2,[49] GM should have achieved 45% improvement from the hybrid system alone.

In Table 2[49] there is a summary of the cost and benefits associated with mass reduction, under 'Body Technology'. Looking at CO_2 reduction and cost separately:

- CO_2 Reduction:
  - The CO_2 reduction due to mass reduction alone is less than the 6.5% per 10% mass change shown in Table 2.[49]
  - Taking a single vehicle and simply reducing mass by 10% will actually reduce CO_2 output between 3.3 and 4.3% on the NEDC cycle.
  - If the assumption is that a 10% mass reduction allows for downsizing of engine, transmission, brakes, etc., then the 6.5% may be valid. However, if a 10% mass reduction would allow for some engine downsizing, the benefit of downsizing cannot be scaled infinitely, as there are not an infinite number of engines available.
  - In that case, we would propose the mass reduction value in Table 2[49] be updated accordingly, and be limited to purely the benefit of mass reduction itself, being 3.8% reduction in CO_2 per 10% mass reduction, as engine downsizing is listed separately.

- Cost
  - In reality, the cost for light weighting grows exponentially, due to the need to go from optimisation, to higher strength steels and manufacturing techniques, to premium materials including aluminium, magnesium and composites. This exponential trend is not shown in the table.
  - Application of premium materials, aluminium hoods, doors and lift gates (tail gates) for example, range in cost from $8-18/kg saved.
    - In contrast, the cost stated by the ABMARC report for an average vehicle ranges from $2-5/kg saved.
  - Many new vehicles on the market in Australia today are already significantly optimized, albeit generally using conventional steel structural bodies.
  - To reduce the mass of an already optimized 1300kg vehicle by 5% (65kg), it would cost approximately $650 even at $10/kg.
  - Diving into this further, a study completed by the Centre for Automotive Research ran a survey of U.S. OEMs to understand what changes would be necessary for future mass reductions.
  - The chart below (Figure 6.2) shows that for today, a 5% mass reduction could be achieved on some vehicles by optimizing the steel BIW (body in whites, or sheet metal). To achieve a 10% or 15% reduction, there is a large shift towards carbon fibre and other composites.
  - Recommended values for 2020 and 2025:
    - $10/kg for 5% = $650
    - $12/kg for 10% = $1560
    - $15/kg for 15% = $2925
  - Further info can be found from the source 'Assessing the Fleet-wide Material Technology and Costs to Lightweight Vehicles by CAR' (Centre for Automotive Research).[50]

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49 DIRDa, 2016, *op. cit.*, p.23

50 Centre for Automotive Research (CAR), Assessing the Fleet-wide Material Technology and Costs to Lightweight Vehicles, September 2016, www.cargroup.org

Figure 6.2 Technology Pathway and Relative Cost[51]

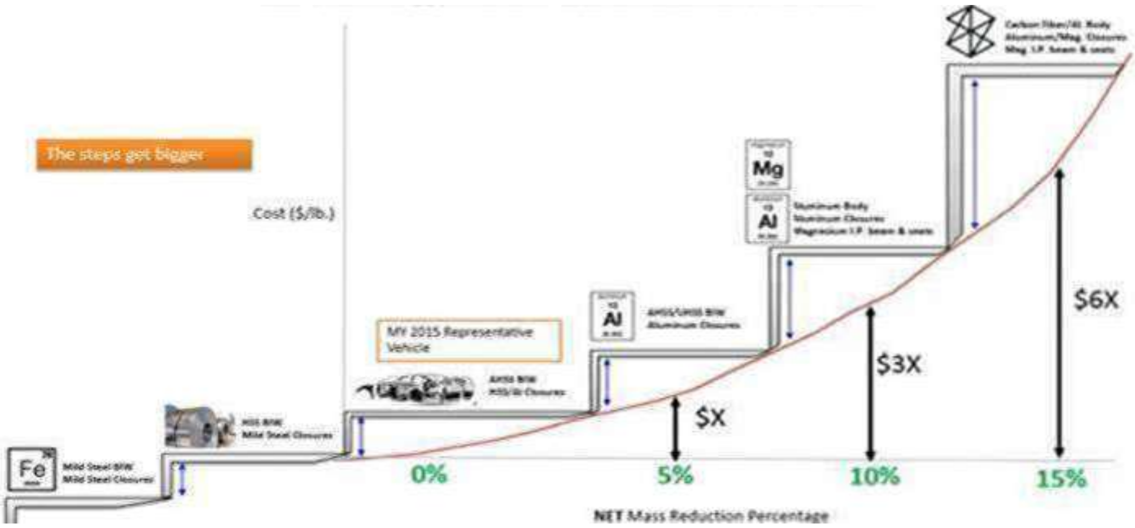
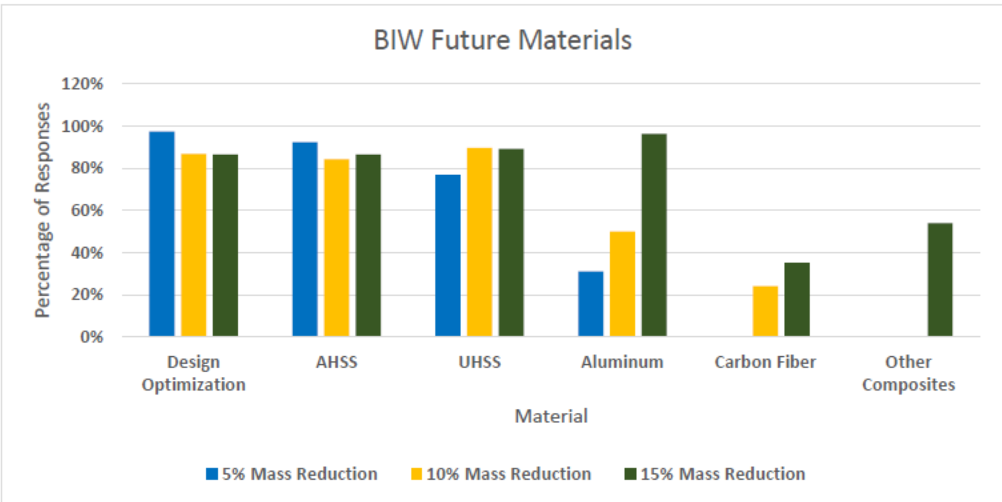


Figure 6.3 BIW Future Materials[52]



6.1.2 Vehicle Specifications

Section 3.4 of the draft RIS claims that the fuel efficiency of the Australian light vehicle fleet is not improving to the *"same extent as countries that have adopted standard to improve vehicle efficiency."* The draft RIS notes that while there are differences due to consumer choice it also claims that the *"most efficient variants of vehicle models offered in Australia are considerably less efficient that the most efficient variants of the same model offered in other markets."*[53]

[51] CAR, *Op. Cit.,* Figure 7, p.16 overlaid with a brand's generic Net Mass Reduction Percentage
[52] CAR, *Op. Cit.,* Figure 5, p.10
[53] DIRDa, 2016, *op. cit*., p.23-24

For example, in Table 3,[54] a 2WD 6 speed Nissan X-Trail variant sold in the UK (with a 6 speed manual gearbox) is compared to an Australian Nissan X-Trail variant sold with a CVT. The Australian variant has a CVT in instead of the manual transmission in the UK variant due to Australian consumers' preference for CVT/auto transmissions.

The FCAI considers that the draft RIS does not sufficiently acknowledge that the difference in specifications of variants offered in Australia compared to overseas (e.g. UK) markets are due to consumer choice and preference of Australian new car buyers.

The cost to new car buyers from loss of vehicle attributes that are preferred due to imposition of fuel efficiency standards is outlined in the report prepared by the CIE that identified that due to lifestyle choices or work activities, some Australian consumers have a need for higher towing capacity large vehicles, and this need takes preference in their choice over fuel consumption or CO_2.[55]

An example of this is the Nissan Pathfinder where Nissan offers two powertrains: 3.5 litre V6 and 2.5 litre 4cyl hybrid. Whilst the hybrid has a lower CO_2 value (203g/km vs. 240g/km) it also has a lower towing capacity (1650kg vs. 2700kg). If Nissan (and other brands) were only able offer the hybrid variant to meet stringent CO_2 standards, there would be a reduction in consumer choice due to lower towing capacity.

To encourage change to consumer behaviour to purchase vehicle emitting less CO_2, and in some cases reduced operational capability, the government will need to consider complementary measures such as those outlined in Section 5.2.

6.1.3 Mobile Air Conditioning

On May 10, 2010, the United States Environmental Protection Agency (EPA) established an incentive program of pre-approved credits for improvements to the environmental performance of vehicle Mobile Air Conditioners (MACs). The MAC credit program has been a great success in accelerating real-world greenhouse gas improvements and was acknowledged by EPA in its recent mid-term evaluation of its light duty vehicle GHG program[56] as a "significant source of real-world benefit" and an "important contributor to industry compliance plans".

In the 2015 model year (the most recent year in EPA public reports), 17 automobile manufacturers were participating in the MAC credit programs (essentially the entire industry), producing a fleet average improvement of 9 grams of CO_2 per mile for those automakers. Of this, 65% is related to reductions in emissions of the high-GWP refrigerant gas R-134a (direct credits), and 35% is related to improvements in vehicle air conditioner efficiency (indirect credits).

6.1.3.1 Refrigerants

In the early years of the program, alternative refrigerants were not available, and direct credits could only be earned through tightened air conditioner systems that reduced leakage of the existing refrigerant, R-134a. This happened quickly, as industry average leakage credits climbed from approximately 3.5 grams per mile of CO_2 per vehicle in 2010 to approximately five grams per mile in 2015.

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[54] DIRDa, 2016, *op. cit*., p.24

[55] The CIE, Reducing greenhouse emissions from light vehicles, Compulsory standards and other policy options, Prepared for the Australian Automobile Association, August 2016

[56] United States, Environmental Protection Agency (US EPA), Greenhouse Gas Emission Standards for Light-Duty Vehicles, Manufacturer Performance Report for the 2015 Model Year

Meanwhile, a new low global warming potential (GWP) air conditioner refrigerant was developed, R-1234yf, which was introduced on new vehicles in the U.S. beginning in the 2013 model year. R-1234yf has a GWP approximately equal to CO_2, meaning its GWP is 1. Since there is a range of only 0.5 to 1.5 kilograms of refrigerant in typical light-duty vehicle air conditioner systems, and this refrigerant charge provides for operation over many years, the use of a refrigerant with a GWP as low as that of R-1234yf essentially removes vehicle air conditioner refrigerants from the list of meaningful contributors to GHG emissions. Refrigerant emissions become a *de minimis* category, equating to close to zero grams per year per vehicle of CO_2-equivalent. By the 2015 model year, EPA reports that approximately 10% of new U.S. light-duty vehicles were sold with R-1234yf, or 1.8 million vehicles, resulting in a reduction of approximately 3 million tons of CO_2-equivalent.

Looking forward, the benefits from implementation of R-1234yf are continuing to grow much larger, as global production capacity for R-1234yf has increased steadily. As a result of the incentive program, EPA estimated that all manufacturers would fully implement R-1234yf across their U.S. new vehicles by 2021. Due to the groundwork laid by the incentive program, in 2015 EPA was able to establish requirements for an eventual phase-down of high GWP automotive refrigerants under the EPA SNAP[57] program, such that R-134a will no longer be allowed on new light-duty vehicles in the U.S. beginning in the 2021 model year. Fully implemented, in 2021 the transition to R-1234yf will generate fleet average benefits of approximately 15 grams of CO_2 per mile per vehicle in greenhouse gas reductions annually across the entire U.S. new vehicle fleet. Over time, the vehicles produced prior to 2021 which use R-134a as their refrigerant will be retired, thereby allowing the large national phase-down in total U.S. HFC usage now planned for 2030 and beyond, since the requirement for R-134a to service vehicles will be gradually eliminated as the vehicles reach their end of life.

It should be noted that the regulatory actions under the SNAP program to phase out R-134a, as well as the national plan to phase-down total HFC emissions, were done with the support of the automobile industry, since the incentive credit program had already moved the industry to implement R-1234yf. The automobile industry was only concerned with "how" the transition was made – through incentive credits – and did not oppose the transition.

The U.S. plans for a national phase-down in HFC usage were enabled by the incentive program for low-GWP vehicle air conditioner refrigerants, and would not have been possible without the success of the automobile incentive credit program. The incentive credit approach encouraged automobile manufacturers to move quickly to overcome barriers to R-1234yf implementation.

The operating environment for vehicle air conditioners is much harsher than the environment for other air conditioning and refrigeration equipment, and refrigerant leakage rates are therefore much higher. As a result, automobile R-134a accounted for over 50% of the U.S. national inventory of HFC emissions, based on global warming impact.

With the successful development and implementation of R-1234yf, that large portion of the national HFC emissions inventory, over 50%, is now expected to be brought over time to near zero. In terms of the total national greenhouse gas emissions inventory for all regulated greenhouse gases (the "Kyoto" gases), eliminating the light-duty vehicle refrigerant global warming impact from R-134a will yield a reduction of over one percent.

6.1.3.2 Air Conditioner Efficiency

Because vehicle air conditioners consume the most energy of any vehicle accessory, in the 2012-2016 Light-Duty GHG regulation, EPA created a list of efficiency technologies which could earn pre-defined and pre-approved incentive credits in grams per mile of CO_2. These were termed "indirect"

[57] SNAP is the Significant New Alternatives Policy program.

mobile air conditioner (MAC) credits, since the emissions reduction did not result within the air conditioner system itself, but rather from the savings in fuel ultimately used to power the MAC system. The baseline for these credits was EPA's estimate of the total fuel usage (and hence indirect emissions) from light-duty mobile air conditioner usage in the U.S., which EPA estimated to be 14.3 grams CO_2 per mile, or 3.9% of total national light-duty vehicle fuel usage.

6.1.3.3 Credits available in U.S.

The technologies identified for pre-approved credits and the percentage efficiency improvement estimates for these technologies came primarily from the Improved Mobile Air Conditioner (IMAC) industry-government Cooperative Research Program conducted through SAE International. IMAC was a partnership between EPA, the U.S. Department of Energy (DOE) and 28 corporate sponsors, which published its final report in 2007. The IMAC program demonstrated an improvement of 36.4% in MAC efficiency using best-of-the best designs for these technologies on a test vehicle, compared to a baseline MAC system using a defined list of typical technologies in production at that time, such as a fixed displacement compressor. Based primarily on the IMAC report, EPA estimated that a 40% MAC indirect emissions reduction was possible using the technologies on the pre-approved list, and set a cap on these credits based on a 40% improvement level, equating to a cap of 5.7 grams CO_2 per mile [the cap was modified beginning in 2017 to 5.0 grams CO_2 per mile for cars and 7.2 grams CO2 per mile for light trucks to more accurately align the improvements based on the physics of the vehicles].

The pre-defined and pre-approved MAC indirect credit menu has proven to be a highly successful approach for gaining rapid implementation of air conditioner efficiency technologies. Air conditioner efficiency technologies were not heavily used among vehicles sold in the U.S. at the beginning of the greenhouse gas regulatory period, with the total industry claiming only an average of 1.0 gCO_2/mile in CO_2 credits in 2009. Since then, manufacturers have claimed credits significantly faster than assumed by EPA when the Agency drafted the 2012-2016 standards, rising to an average industry credit of over 3.4 gCO_2/mile in 2014, or about 60% of the way to the maximum capped credit level of 5.7 gCO_2/mile. For 2015, these credits were reported to reduce about 12 million tons of CO_2 from the total U.S. fleet of new vehicles sold in that year. MAC indirect credits are playing a critical role in industry compliance with the light-duty vehicle greenhouse gas regulation, achieving emission reductions that would not otherwise have been possible using the previous fuel economy regulatory framework.

In its mid-term review of the program, EPA noted:[58]

> *Additional information that has become available, as well as changes in the overall regulatory environment affecting the A/C technology developments in the light-duty vehicle industry, reinforces our earlier conclusions that these technologies will continue to expand and play an increasing role in overall vehicle GHG reductions and regulatory compliance.*

EPA based its MAC efficiency credits on estimates of each technology's percentage impact on the total fuel usage by vehicle air conditioner systems in the U.S. However, EPA's estimate of baseline air conditioner energy usage (3.9% of total light-duty fuel consumption) was well below the estimates of others, such as researchers from the National Renewable Energy Laboratory (over 6%) and Oak Ridge National Laboratory, as well as longstanding benchmarks used by industry.

The FCAI considers that this low baseline used by EPA, which was approximately half the baseline MAC energy usage estimated by the other major sources, resulted in MAC efficiency credits and an associated credit cap which are far below the actual real-world fuel savings and CO_2 reductions that

[58] United States, Environmental Protection Agency (US EPA), Greenhouse Gas Emission Standards for Light-Duty Vehicles, Manufacturer Performance Report for the 2015 Model Year

are resulting from these technologies. At a minimum, the existing MAC indirect credit system cannot be viewed as excessive. Instead, as a result of the EPA methodology, these credit amounts were set at very conservative levels for the U.S. national average climatic conditions.

Tables 6.1 and 6.2 following provide a summary of the US MAC Credits. In Australian conditions, with higher overall air conditioner usage, these technologies would be expect to provide greater greenhouse gas benefits.

Table 6.1 U.S. MAC Credits:

	2009-2016 gCO2/mile	2017-2025 gCO2/mile
Max. Car Leakage	6.3	6.3
Max. Car Alternate Refrigerant	13.8	13.8
Max. Truck Leakage	7.8	7.8
Max. Truck Alternate Refrigerant	17.2	17.2
Max. Car Efficiency	5.7	5.0
Max. Truck Efficiency	5.7	7.2

Table 6.2 U.S. MAC Efficiency Technologies and Credits for 2017-2025:

Technology:	Car gCO2/mile	Truck gCO2/mile
Reduced reheat with externally controlled variable compressor	1.5	2.2
Reduced reheat with externally controlled fixed compressor	1.0	1.4
Default to recirculation above 75F closed loop with interior air sensor	1.5	2.2
Default to recirculation above 75F open loop with no sensor	1.0	1.4
Blower motor controls which limit waste energy (e.g., pulsewidth modulated blower)	0.8	1.1
Internal Heat Exchanger	1.0	1.4
Improved evaporators and/or condensers (10% COP)	1.0	1.4
Oil separator	0.5	0.7

6.2 Responses to Questions

Following are the FCAI's responses to the questions in Appendix A of the draft RIS.

6.2.1 What could be regulated?

Question:

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

The FCAI supports a fuel efficiency standard based on CO_2 tailpipe emissions.

As noted in the draft RIS, this would align with the Government's objective of reducing greenhouse gas emissions (GHG) and would treat all fuel types equitably.

Using a CO_2 based standard will also allow the government to develop a standard that encourages technologies that reduce CO_2 in-service but may not be measured during the fuel consumption laboratory drive cycle (i.e. off-cycle technologies).

This approach has been adopted in many overseas standards. For example, the U.S. provide credits of between 10 and 20 gCO_2/mil (see Section 6.1.3) for the introduction of low GWP air conditioning gas and more efficient air conditions systems. This credit accounts for approx. 50% of the difference between the CO_2 measured on the 2-cycle laboratory tests and the CO_2 targets.[59]

6.2.2 How could efficiency be measured?

Question:

2. *How should a vehicle's efficiency for the purpose of an Australian fuel efficiency standard be assessed and why?*

The draft RIS states that the use of a standardized laboratory test provides "robust, uniformly collected, verifiable and comparable data for the least cost and is currently the only such data available at individual model/variant level for all light vehicles."[60]

The FCAI supports the use of a standardized laboratory test to measure a vehicle model's CO_2 emissions. A standardized laboratory test is repeatable, verifiable and provides a baseline measurement for motor vehicle manufacturers and consumers alike to compare vehicles on a like-for-like basis.

Australia is a signatory to the United Nations 1958 Agreement[61] and the Australian government's policy is to harmonise vehicle standards with the international United Nations Regulations (UN Regs).

Currently Australia specifies the NEDC test cycle in ADR 81/02[62] (by adopting UN R101). The United Nations Working Party 29 (WP.29) is undertaking the necessary work to update UN R101 to use the new WLTP drive cycle. The same drive cycle will be used to measure pollutant emissions when it is

[59] US Federal Register, Vol. 77 No, 199, Monday October 15, 2012, *2017 and Later Model Year Light Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards: Final Rule*, Tables III-1, III-2 and III-3

[60] DIRDa (2016), *Op. Cit*., p.43

[61] United Nations Economic Commission for Europe, Inland Transport Committee, Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be fitted and/or be used on Wheeled Vehicles and the Conditions of Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions.

[62] Vehicle Standard (Australian Design Rule 81/02-Fuel Consumption Labelling for Light Vehicles) 2008

adopted into UN R83 (which the Government is proposing to adopt in ADR 79[63] to mandate Euro 6 pollutant emission standards)

While this work is underway, it is expected that the earliest it will be completed is during 2018 and ADR 81/02 to be updated during 2019. This timing would then lead to an earliest introduction time of 2022[64] (taking into account a two year lead time for introduction of a new ADR to allow the administration systems to be updated and vehicles to be certified to a new ADR). It is important that an updated ADR 81/02 is introduced in parallel with Euro 6 (new models).

However, consideration of the introduction timing of Euro 6 and CO_2 targets for new vehicles cannot be undertaken until a detailed consideration of changes to Australian fuel quality standards has been completed. Of central concern is how the Government is planning to transition to the European fuel standards (EN228 for petrol and EN590 for diesel) to support the introduction of both Euro 6 and CO_2 targets.

The timeframe for the required fuel to be available to the market will then determine the timeline for new vehicle models and the timeline for the introduction of regulatory standards. Moving ahead with new emission regulations without resolving fuel quality questions could increase the cost of new vehicles and adversely affect the operability of new emission technologies without delivering the anticipated environment and health benefits.

Continuing to use the international United Nations test procedure will deliver this benefit and it will mean that new car buyers will be able to accurately compare the CO_2 output of new models on a like for like basis.

6.2.3 How could a sales weighted average target be applied?

Question:

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

The FCAI supports the use of an attribute to develop sales weighted targets for Australia.

In the past, the FCAI has only produced a simple sales weighted average in the reporting of the annual NACE (national average carbon emissions) for light vehicles. While this is suitable for a single 'whole of fleet' CO_2 average, it is not suitable for regulated targets where individual brands will have individual targets. Use of an appropriate attribute is required to ensure that individual brands are not disadvantaged and consumer choice is maintained by vehicle brands being able to continue to offer a wide range of vehicle models across all market segments.

If a CO_2 target is too stringent and forces brands to offer only smaller (or lighter) vehicles, some brands may be forced to remove from sale those larger models in the SUV and/or LCV market segments with larger towing or carrying capacity (see Section 6.1.2). This will severely impact on consumer choice and may even have the perverse outcome of vehicle owners delaying (or changing) the decision to purchase a new vehicle, thereby keeping older vehicles in-service for longer periods with adverse impacts on the government's environmental and safety policies.

[63] Current level is ADR 79/04, i.e. Vehicle Standard (Australian Design Rule 79/04-Emission Control for Light Vehicles) 2011

[64] See Infographic "Actions for Vehicle Emission Standards – Current to 2022" included in "Key Messages" of this paper.

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

Question:

4. If an attribute standard is adopted, which attribute should be adopted in Australia and why?

The draft RIS recognises that while both the EU and US have adopted a sales or production weighted attribute based standard based on a continuous function, each have taken different approaches to their CO_2 standards using mass and footprint respectively.

The ABMARC report prepared for the draft RIS[65] notes that the Australian light vehicle fleet aligns with the use of a mass based attribute. While recognising there are advantages with the use of either a mass or footprint approach, the FCAI supports a mass based approach as the ABMARC study showed there is a better correlation for Australian new light vehicles.

Whichever attribute selected needs to recognise the differences in the Australian light vehicle fleet, namely the strong presence of light commercial vehicles and SUVs. Accordingly, any attribute standard will need to consider two distinct vehicle groups, i.e. passenger motor vehicles (MA) and light commercial/SUVs (NA/MC). While each vehicle group would use the same attribute (e.g. mass) the attribute curve (slope of line) for each vehicle category will need to be different in terms of slope and average vehicle mass.[66]

Use of a mass based attribute (similar to that used in the EU) needs to recognise that the EU targets and attribute curves cannot be directly adopted due to the different vehicle markets in the EU and Australia that result in very different average mass. For example, the average mass of a passenger vehicle used in the EU target is 1372 kg, while the average mass (in running order) of passenger vehicles in Australia in 2015 was 1444 kg, and passenger cars and SUVs combined had an average mass of 1613 kg.[67]

6.2.5 How could targets be applied to different vehicle types?

Questions:

5. How should a fuel efficiency standard be applied to each light vehicle category and why?
6. If SUVs are subject to a different target to passenger cars, how should SUVs be defined and why?

The FCAI supports separate targets for passenger cars (ADR category MA) and light commercial vehicles (ADR category NA). SUVs that are categorized as MC category vehicles (off-road passenger vehicles) should also be included with the light commercial vehicle target.

The ADR vehicle categories should be used for defining SUVs. Some will be MA category and some will be MC category.

MC category[68] vehicles are “off-road passenger vehicles” with additional features for off-road operation including:

- has 4 wheel drive; and
- has at least 4 of the following 5 characteristics
    - Approach Angle of not less than 28 degrees;
    - Breakover Angle of not less than 14 degrees;
    - Departure Angle of not less than 20 degrees;
    - Running Clearance of not less than 200 mm;

[65] ABMARCa (2016)
[66] Mass used in the EU and also in the ABMARC analysis is “mass in running order”
[67] ABMARCa, (2016), *op. cit.*, p74
[68] Vehicle Standard (Australian Design Rule-Definitions and Vehicle Categories) 2005, Section 4.3.3 (p.39)

- Front Axle Clearance, Rear Axle Clearance or Suspension Clearance of not less than 175 mm each.

This is the same definition used by the U.S. for SUVs that are included in their Light Truck target.

The ADR definition also recognises the definition of off-road vehicles used in UN Regulations as an alternative to classify off-road passenger vehicles (MC category). The UN definition has similar criteria:[69]

- At least one front axle and at least one rear axle designed to be driven simultaneously including vehicles where the drive to one axle can be disengaged;
- At least one differential locking mechanism or at least one mechanism having a similar effect; and
- If they can climb a 30 per cent gradient calculated for a solo vehicle;
- In addition, they shall satisfy a least five of the following six requirements:
    - (i) The approach angle shall be at least 25°;
    - (ii) The departure angle shall be at least 20°;
    - (iii) The ramp angle shall be at least 20°;
    - (iv) The ground clearance under the front axle shall be at least 180 mm;
    - (v) The ground clearance under the rear axle shall be at least 180 mm;
    - (vi) The ground clearance between the axles shall be at least 200 mm.

Using this approach will adopt the internationally recognised definitions used in vehicle certification and regulatory standards applied elsewhere in the world. Importantly, all entities involved in administrating the CO_2 standard will be able to understand the vehicle category definitions and the existing certification processes will be able to be used.

In addition to vehicles that fall within the ADR definitions for MC and NA categories, the US also include vehicles meeting the following two criteria into the Light Truck group:

- Vehicles with off road ground clearance with 2WD if GVM > 2.7 t; or
- Vehicles with three (3) or more rows of seats where seats can be folded/pivoted/removed to then allow the vehicle to carry cargo.

The U.S. included vehicles meeting these additional criteria to:

- Not penalise vehicles designed to carry or tow heavy loads.
- Prevent manufacturers "gaming" the system by replacing their large 2WD SUVs with 4WD to take advantage of the lower targets.

6.2.6 How could targets be phased in from 2020 to 2025?

Questions:

7. *How should targets for a fuel efficiency standard be phased in and why?*
8. *If annual targets are adopted, what targets should apply in each year for each segment and why?*
9. *If a percentage phase in is adopted, what percentage should apply in each year and each segment and why?*
10. *What flexibility arrangements should be allowed under an Australian fuel efficiency standard and why?*

[69] United Nations Economic Commission For Europe, Consolidated Resolution on the Construction of Vehicles (R.E.3) Section 2.8 (p.10)

The FCAI does not support a CO_2 target phased in from 2020 to 2025. This short timeframe does not provide the long term planning certainty required by FCAI member brands, who need to develop their product plans at least 5 years in advance of the vehicle being launched in the local market.

As outlined in our repose to the 2016 Vehicle Emissions Discussion Paper, and in Section 5.2 of this response, the FCAI supports a mandated 2030 CO_2 target that commenced in 2020, with interim measurement points and a mid-term review. This timing aligns with the Australian government's GHG reduction commitment to reduce national emissions by 26-28 per cent below 2005 levels by 2030[70].

The widespread availability of EN standard fuels is a key enabler for globally consistent vehicle emissions standards and proposed Australian CO_2 targets. As such, Australian fuel standards and availability must be first defined before vehicle emission standards and CO_2 targets can be properly contemplated or implemented.

The earliest that any accelerated CO_2 reduction could start is from 2022. This is based on:

- The Government's own expected timeframe for the vehicle emissions forum to report in mid-2017.
- The timeframe required to develop the necessary legislation (end of 2018).
- The need to develop, test and implement the necessary administration systems (2018-2019).
- Providing a 2 year lead time (2020-2021) for monitoring of the new system to allow both the government and industry to implement systems required to meet the legislation (assuming a 2022 start).
- Allowing up to 5 years for the vehicle industry to adjust model plans.
- Providing lead-time for the widespread availability of EN standard fuels.

The infographic provided in the Key Messages section of this response provides an overview of the actions required prior to introduction of any CO_2 emissions target.

It is necessary to point out that to coincide with any type of accelerated (i.e. beyond current trend) rate of reduction the Government must introduce a range of complementary measures to encourage change in consumers buying preference. As new technology is the result of research and development undertaken by motor vehicle brands, it often comes at significant price premium over existing technology.

[70] Australian Government, Australia's 2030 Emissions Reduction Target: Strong, credible, responsible, www.environment.gov.au [accessed 6 January 207]

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

Question:

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

More fuel efficient vehicles require complex and expensive technology creating a higher initial purchase price which may be a dis-incentive to purchase. International experience has demonstrated that a range of complementary measures are required to address the price premium and provide supply-side incentives. Table 6.1 following includes a list of possible incentives and credits that are in use in Australia and around the world to encourage purchase of more fuel efficient, and more expensive vehicles.

In Section 5.2 of this response, the FCAI provided two different options for CO_2 reductions along with the introduction of the complementary measures that have the potential to encourage change in consumer behaviour. The FCAI would welcome additional modelling to determine the level of change in consumer behaviour from a comprehensive package of complementary measures to form part of the government's CO_2 targets.

One of the least cost methods of reducing CO_2 is the introduction of low GWP air conditioning gas. Improvements in a/c efficiency and use of low GWP a/c gas provides up to 50% of the CO_2 reductions in the U.S. standard out to 2025. A detailed discussion of the air conditioning credits provided in the U.S. is contained in Section 6.1.3 (above).

Many governments around the world have recognised the importance of complementary measures to encourage the uptake of these lower emission vehicles including:[71]

- Japan: Government-led consumer incentives and infrastructure investment played significant roles in the uptake of vehicles with these technologies. Japan has an official government target to deploy 2 million slow charging and 5,000 fast charging points for EVs by 2020.
- U.S.: The mandated CO_2 targets include CO_2 credits towards individual brand targets for hybrid, electric and hydrogen fuel cell vehicles ranging from 4.3% (in 2015) to 12.2% (in 2025). Additionally, there are a range of financial incentives for buyers, from the U.S. Government (up to $7500 electric car tax credit) and many U.S. states.
- Canada: Some Canadian Provinces have rebates for purchasing EVs or PHEVs and also for installing home recharging.
- Norway: Owners of EVs and PHEVs have been exempt from paying road tax. This has helped Norway become the largest EV fleet per capita in the world with around 55,000 EVs in 2015. Incentives are being wound back with owners of EVs needing to pay half of the road tax from 2018 and the full road tax from 2020.
- Netherlands: Had financial incentives for purchasing PHEVs. The incentive expired in January 2014 and sales dropped from 9,000 in December 2013 to a little more than 500 in January 2014. This demonstrates the need for long term financial incentives to create price parity of EVs, PHEVs and HEVs with conventional engine vehicles.
- China: The Chinese government offer a nationwide subsidy of RMB 3,000 to consumers who purchase any passenger vehicle with an engine capacity of under 1.6 litre and that consume 20% or less fuel than government standards.

[71] IHS Consulting, Feb 2016, Global Automotive Regulatory Requirements: Regulatory Environment and Technology Roadmaps

Table 6.1 Example of Incentives and Credits for CO2 Targets available in overseas markets

Level of Government	Credit/Incentive	Details
Federal Government	Off cycle credits:	Air Cond gas (low GWP) Eco Innovations (or US White List)
	Super Credits[72]:	Factor 3.5: <2% mkt pen. Factor 2.5: 2-5% mkt pen. Factor 1.5: 5-10% mkt pen. Factor 1.0: >10% mkt pen.
	Fuel Quality:	PULP; 95 RON 10 ppm sulphur
	Fuel Pricing:	Increase price of fuel to change behaviour Price parity between ULP and PULP
	Program Flexibilities:	Data collection & pooling Banking & make good provisions Trading
	Financial incentives:	Import duty relief LCT relief GST discount Income Tax Rebates
	Non-financial incentives:	Primary Industry exemptions Government Funded EV Fast Charging and other Infrastructure such as hydrogen refueling Govt fleet purchasing
State Government[73]	Financial incentives:	Registration Cost discount[74] Stamp Duty discount[75]
	Non-financial incentives:	Home EV recharging Transit lane access Building standards to include EV recharging and other infrastructure such as hydrogen refueling. Govt fleet purchasing
Local Government	Non-financial incentives:	Transit lane access Free charging for EVs & PHEVs Building standards to include EV recharging and other infrastructure such as hydrogen refueling. Govt fleet purchasing Free CBD parking

[72] Credits could be linked to various CO_2 thresholds
[73] Some Australian State/Territory and local government incentives currently exist for hybrids and EVs such as transit lane access and registration discount
[74] Vic provides $100 reduction from registration for hybrid vehicles
[75] ACT provides stamp duty saving of up to 100% for low emission vehicles

Section 3.5 of the draft RIS discusses fleet purchasing as a Policy option for increasing vehicle efficiency. Whilst the FCAI recognises that Fleet Purchasing as a standalone policy may not meet the government's objectives of improving the efficiency of light vehicles, it should be adopted along with the necessary demand-side incentives to encourage change in consumer choice to purchase zero/low emission vehicles.

History has shown (e.g. ANCAP) that Federal Government Fleet Purchasing policies are followed by state governments and then in turn by large fleets, and does have a significant impact on consumer choice.

It is highly likely that a suitable fleet purchasing policy (supported by appropriate complementary measures) would have a significant supply-side pull on lower emission vehicles as fuel use is a significant operational cost for many fleet operators. In a report prepared for AT&T the U.S. Centre for Automotive Research on "The Economic and Environmental Impacts of a Corporate Fleet Vehicle Purchase Program"[76] found that:

> *"If half of US corporate fleets were to emulate a green fleet plan similar to AT&T's over the next ten years, CAR estimates annual CO_2 emissions could be cut by the equivalent of 1.2 million vehicles."*

6.2.8 Which entities could be required to comply?

Question:

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

The FCAI acknowledges that any legislation will require a legal entity to be responsible and there are a range of examples in various legislation including tax law and consumer law.

The FCAI does not support the MVSA "licensee" as the legal entity for a CO_2 standard. The "licensee" is responsible for ensuring each vehicle (make/model) supplied to Australia meets its type approval, while the CO_2 target applies to all sales each calendar year. These are very different approaches to vehicle regulation.

Additionally, there are examples where the IPA holder (or "licensee") are not employed by the brand that supplies the vehicle to the market.

FCAI recommends the company that supplies the vehicle to the market is the responsible entity such as under Australian Consumer Law.

6.2.9 Should all entities be subject to the same requirements?

Question:

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

The FCAI considers that in the interests of equity all vehicle suppliers should be subject to the same requirements. However, the FCAI also recognises that this may be impractical and/or impose a significant cost burden on some sections of the industry, in particular:

- The Registered Automotive Workshop Scheme (RAWS) and the Specialist and Enthusiasts Vehicles Scheme (SEVS), and
- Small Volume Manufactures (SVM).

[76] Centre for Automotive Research (CAR), The Economic and Environmental Impacts of a Corporate Fleet Vehicle Purchase Program, Prepared for AT"&T, October 2009.

6.2.9.1 RAWS/SEVS:

The current proposal (as part of the Review of the Motor Vehicle Standards Act) is to remove the annual limit on the number of vehicles that a Registered Automotive Workshop (RAW)[77] can supply (this proposal is opposed by the FCAI). If this proposal proceeds, RAW workshops (as part of the Specialist and Enthusiasts Vehicles Scheme (SEVS)) must be part of a CO_2 standard to eliminate the possibility of a backdoor (i.e. allowing RAW workshops to supply) entry to the market of models with high fuel consumption that have been removed from sale by a brand as part of their sales strategy to meet their mandated CO_2 target.

There are two options that could be considered;

- Including all vehicles imported under SEVS in the same CO_2 target.
- Introducing a CO_2 target for each RAW workshop.

If there is no limit on the number of used imported vehicles that can be supplied to Australia, combined with a mandated CO_2 target, the Australian car market is at risk of changing to a car market similar to New Zealand where more than half of ‘new’ light vehicles introduced each year are used (8-10 year old) Japanese domestic product vehicles. While this will take a number of years to occur, significant changes can occur within the 10 year timeframe that the Australian industry requires for a mandated CO_2 target.

6.2.9.2 Small Volume Manufacturers (SEVS):

The FCAI proposes that the government include the definition of Small Volume Manufacturer (SVM) and special provisions with regard to local annual sales and operational independence as already used in many other overseas CO_2 standards including both in the Europe and US.

Many of the SVMs are key contributors to innovation and energy-saving technological development through their research and development of high performance sports cars targeted for niche markets. This can include applying innovative design concepts, new materials and implementing state of the art engineering technologies into the automotive industry. Many of these technologies, such as lightweight materials, turbocharging and aerodynamic improvements are then introduced into the broader automotive industry and provide significant contributions to CO_2 reductions.

In recognition of the active contribution of SVMs to high technology and innovation, and their negligible impact on the whole market CO_2 emissions, many countries have developed alternative standards for SVM compliance to CO_2 standards. In particular, both Europe and the US have defined SVM based on their annual sales/production volumes and their operational independence. Manufactures who obtain SVM qualifications may, as an alternative to application of the CO_2 standard targets, submit a (up to) 5 year plan to reduce their CO_2 emissions and improve fuel consumption in line with their technological potential.

In addition to Europe and the US, SVM regulations are in place in many other countries including Canada, Saudi Arabia and Taiwan.

Conversely, the absence of any SVM approach would result in a significant market disadvantage to small volume manufacturers.

The FCAI would support the government including a SMV approach in the CO_2 standard. The definition of SMV would require careful consideration to reach an appropriate volume limit, due to the relatively small size of the Australian market and large number of brands. An approach that could be initially considered is leveraging off the existing SMV definitions and allowing any brand

[77] Australian Government, Department of Infrastructure and Regional Development, Info Sheet 3, Reform of the Motor Vehicle Standards Act 1989, Registered Automotive Workshop Scheme, www.infrastructure.gov.au [downloaded 17 March 2017]

that is accepted as a SVM in one of the major markets (e.g. Europe or the US) would also be accepted as an SVM for Australia.

6.2.10 What penalties could be applied if entities failed to comply?

Question:

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

The FCAI considers that no financial penalties should apply, at least in the initial phases of any program.

Both the government and industry will need to understand how the program and the accompanying administrative system operates prior to being able to consider what (if any) regulatory punitive measures (e.g. fines or need to withdraw vehicle models from sale) would be appropriate.

It is recommended that in the early years of any mandated CO_2 target there could be public reporting of each brand's compliance status.

7.0 CONCLUSION

The Australian automotive industry is committed to making a strong contribution to national efforts to reduce the impact of global climate change, even though light vehicle sales are only a relatively minor influence on Australia's annual GHG emissions as they equate to less than one per cent of the annual National Greenhouse Gas Inventory.

The FCAI supports improvement of fuel efficiency of motor vehicles through the consistent application of measures at technological, behavioral and regulatory levels. To achieve the Government's policy objective to reduce emissions from road transport an Integrated Approach that includes a combination of measures such as the increasing use of alternative fuels, improved fuel quality, better infrastructure and traffic management, adopting an eco-driving style, using price signals and reducing the average age of the in-service fleet is required.

If the Government chooses to introduce light vehicle CO_2 standards and encourage the purchase and supply of light vehicles that meet Euro 6 emissions standards, petrol meeting the European standard EN228 (i.e. 95 RON, 10 ppm sulphur, 35% aromatics, etc.) and diesel meeting the European standard EN590 must be widely availability at price parity to any other base grade market fuel. Otherwise, the benefits estimated using the results of the regulation certification laboratory testing will not be delivered.

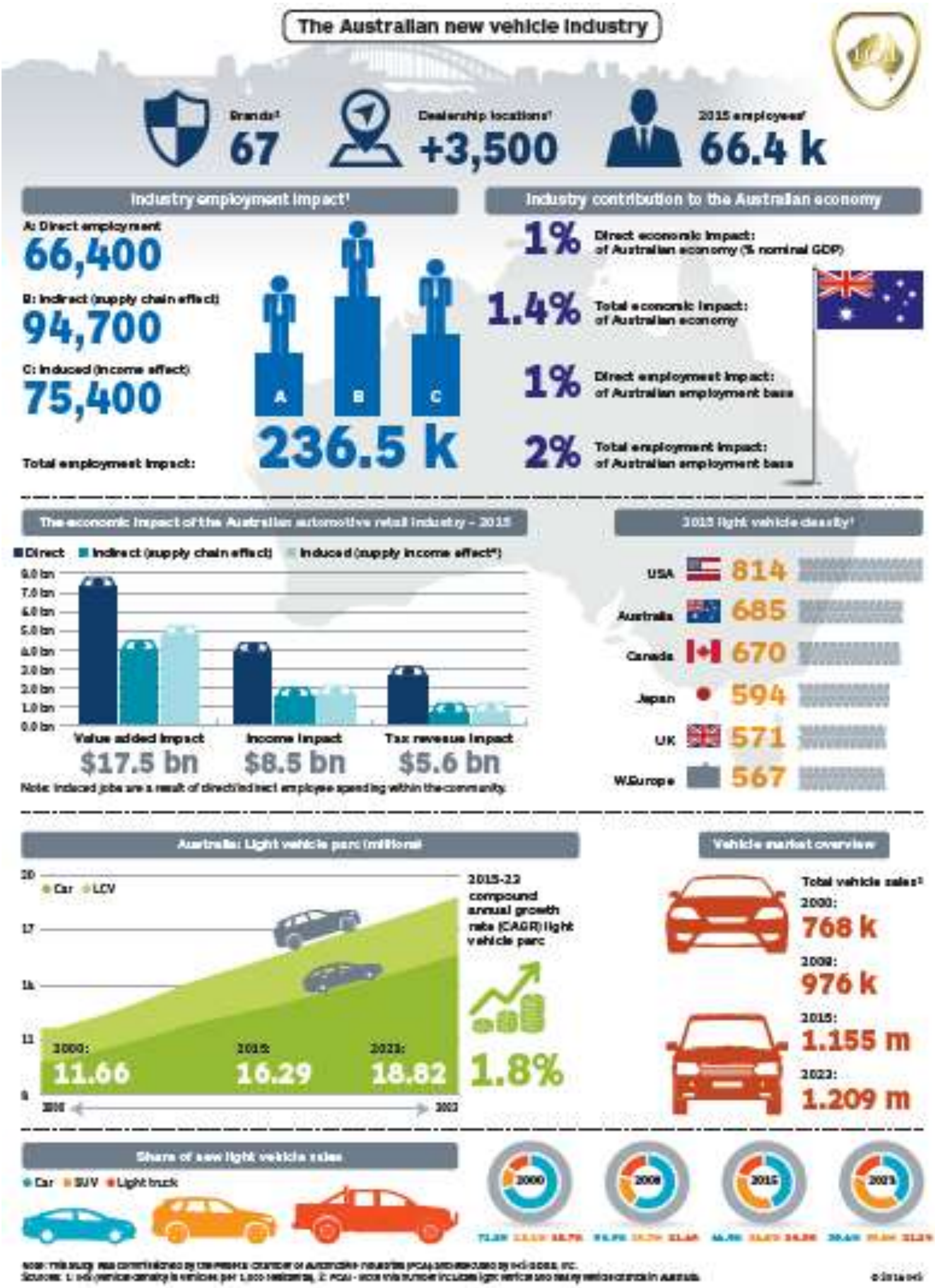
A real and sustained reduction in vehicle emissions (both CO_2 and pollutants) will only be achieved through an Integrated Approach that takes a whole-of-government approach to CO_2 standards, vehicle pollutant emission standards, fuel quality standards and on-road vehicle operation.

Consideration of the introduction timing of CO_2 targets (and pollutant emission standards, i.e. Euro 6) for new vehicles cannot be undertaken until a detailed consideration of changes to Australian fuel quality standards has been completed. Of central concern is how the Government is planning to transition to the European fuel standards (EN228 for petrol and EN590 for diesel) to support the introduction of both Euro 6 and CO_2 targets.

If the CO_2 standard is to be based on the WLTP (to be introduced with Euro 6d), the starting point and targets will need to be reviewed and adjusted. The WLTP is quite different to and more stringent than the NEDC test cycle, and will provide a higher CO_2 figure for the same vehicle.

The timeframe for the required fuel to be available to the market will then determine the timeline for new vehicle models and the timeline for the introduction of regulatory standards. Moving ahead with new emission regulations without resolving fuel quality questions could increase the cost of new vehicles and adversely affect the operability of new emission technologies without delivering the anticipated environment and health benefits.

APPENDIX A THE AUSTRALIAN AUTOMOTIVE INDUSTRY



APPENDIX B INTEGRATED APPROACH

The "Integrated Approach" includes;

- Vehicle Technology – Improve the performance of new light vehicles (passenger cars, SUVs and light commercial vehicles) to reduce their average CO_2 emissions.
- Fuel Quality Standards – Compatible market fuel must be available to support the vehicle technology and deliver the expected CO_2 (and pollutant) emission reductions.
- Alternative Fuels and Energy Platforms – Support of alternative fuels and energy platforms and the infrastructure to deliver them.
- Driver Behaviour – Educate drivers on techniques to reduce fuel consumption and CO_2 emissions, which can also improve road safety (see the golden rules of eco-driving at www.ecodrive.org).
- Infrastructure Measures – Improve traffic flow and avoid wasteful congestion. Emerging Cooperative Intelligent Transport Systems (C-ITS) technology has the potential to deliver significant reductions in traffic congestion.
- Price signals – Influence consumer choice to produce driving behaviour and purchase decisions for lower CO_2 emissions.
- Average fleet age – Incentives to increase the uptake of newer light vehicles and reduce the average age of the in-service fleet.

Focusing on just a single area, (e.g. vehicle technology) could increase overall cost to the community without delivering the expected benefits in the real world.

B.1 Vehicle Technology

The industry will continue to deliver new vehicle technology to reduce the CO_2 and pollutant emissions of new light vehicles (passenger cars, SUVs and light commercial vehicles).

B.2 Fuel Quality Standards.

To deliver the expected CO_2 and pollutant emission reductions, market fuel that meets European Fuel Standards EN228 (petrol) and EN590 (diesel) must be widely available in Australia.

While 95 RON, Premium Unleaded Petrol (PULP) is widely available it comes at a price premium over Unleaded Petrol (ULP). To encourage consumers to use PULP and consequently receive the CO_2 benefits from advanced vehicle technologies the price of PULP will need to be comparable to ULP and ideally there would be no price difference.

Another significant issue with Australia's market fuel is the level of sulphur in petrol. Many new engine and emission technologies require a maximum of 10 ppm sulphur for full utilisation and to deliver the anticipated environmental benefits. However, Australia's fuel quality standard for petrol still allows up to 150 ppm sulphur for 91 RON petrol and up to 50 ppm sulphur for 95 RON petrol. [78]

In contrast, the diesel fuel quality standard has specified a maximum of 10 ppm sulphur since 2009.[79] Diesel fuel refined in Australia meets this standard.

[78] Department of Environment, Petrol Fuel Quality Standard, www.environment.gov.au [accessed 4 April 2016]
[79] Department of Environment, Diesel Fuel Quality Standard, www.environment.gov.au [accessed 4 April 2016]

The EN228 limit on aromatics (35% v/v max) is critical to meet Euro 6c and Euro 6d Particulate Number (PN) limits for gasoline direct injection engines.

The high sulphur content and high aromatics content in petrol currently supplied to the Australian market limits the adoption/import of some existing petrol engines that meets Euro 6. The situation will continue until such time that 10 ppm sulphur petrol is widely available in the Australian market.

It should also be noted that the Indian Government's recent rulemaking process recognised that petrol meeting EN228 is a pre-requisite to mandating Euro 6.

B.3 Alternative Fuels and Energy Platforms

An important part of an Integrated Approach is support of alternative fuel sources and the infrastructure required to deliver vehicles with alternative energy platforms, e.g. electric vehicles (EVs), plug-in hybrid electric vehicles (PHEV), hybrid electric vehicles (HEV) and hydrogen fuel cell vehicles (HFCV).

Australia needs to be aware of all these technologies and facilitate the entry into the market of all technologies, rather than locking the country into one approach.

EVs, PHEVs, HEVs and also HFCVs can potentially have significant impact on energy saving and deliver light vehicle CO_2 reduction. However, there are still a number of issues that need to be addressed[80]:

- HFCV: System cost reduction and development of hydrogen infrastructure are required.
- EV:
    - Recharging infrastructure is necessary for expansion.
    - Improved battery performance and cost reduction.
    - Consumers are still concerned about range, performance, recharge time and return on investment (i.e. resale value of car).
- PHEVs: Additional models, including light commercial vehicles, are likely to be introduced in the US post 2020/25 to meet the US CO_2 targets.

The Australian Government needs to consider what role it will play in this area. Approaches that are used in other countries to encourage the uptake of these alternative energy platform vehicles include:[81]

- Japan: Government-led consumer incentives and infrastructure investment played significant roles in the uptake of vehicles with these technologies. Japan has an official government target to deploy 2 million slow charging and 5,000 fast charging points for EVs by 2020.
- US: The mandated CO_2 targets include credits for hybrid, electric and hydrogen fuel cell vehicles ranging from 4.3% (in 2015) to 12.2% (in 2025). The US Government provided up to $7500 electric car tax credit and many US states also provide financial incentives.
- Canada: Some Canadian Provinces have rebates for purchasing EVs or PHEVs and also for installing home recharging.
- Norway: Owners of EVs and PHEVs have been exempt from paying road tax. This has helped Norway become the largest EV fleet per capita in the world with around 55,000 EVs in 2015. Incentives are being wound back with owners of EVs needing to pay half of the road tax from 2018 and the full road tax from 2020.

[80] IHS Consulting, Feb 2016, Global Automotive Regulatory Requirements: Regulatory Environment and Technology Roadmaps
[81] IHS Consulting, Feb 2016, Global Automotive Regulatory Requirements: Regulatory Environment and Technology Roadmaps

- Netherlands: Had financial incentives for purchasing PHEVs. The incentive expired in January 2014 and sales dropped from 9,000 in December 2013 to a little more than 500 in January 2014. This demonstrates the need for long term financial incentives to create price parity of EVs, PHEVs and HEVs with conventional engine vehicles.
- China: The Chinese government offer a nationwide subsidy of RMB 3,000 to consumers who purchase any passenger vehicle with an engine capacity of under 1.6 litre and that consume 20% or less fuel than government standards.

B.4 Driver Behaviour

Vehicle engine technology and performance has improved rapidly, while most drivers have not adapted their driving style. Educating drivers on techniques to reduce fuel consumption and CO_2 emissions (which can also improve road safety) can reduce fuel consumption from road transport so that less fuel is used to travel the same distance.

Ecodriving[82] is a term used to describe energy efficient use of vehicles and represents a driving culture to makes best use of advanced vehicle technologies. Ecodriving offers numerous benefits, including GHG emissions reductions, fuel cost savings, as well as greater safety and comfort.

Many organisations, including some Australian motoring clubs, promote "eco-driving."

Following are the "Golden Rules of Eco-driving" as promoted by Ecodrive.org:

1. Anticipate Traffic Flow: Read the road as far ahead as possible and anticipate the flow of traffic. Act instead of react – increase your scope of action with an appropriate distance between vehicles to use momentum (an increased safety distance equivalent of about 3 seconds to the car in front optimises the options to balance speed fluctuations in traffic flow – enabling steady driving with constant speed).
2. Maintain a steady speed at low RPM: Drive smoothly, using the highest possible gear at low RPM.
3. Shift up early: Shift to higher gear at approximately 2,000 RPM. Consider the traffic situation, safety needs and vehicle specifics.
4. Check tyre pressures frequently (at least once a month) and before driving at high speed. Keep tyres properly inflated as low tyre pressure is a safety risk and wastes fuel. For correct tyre pressure (acc. To loading, highest pressure and speed driven), check the car's manual or tyre placard.
5. Any extra energy used costs fuel and money: Use air conditioning and electrical equipment wisely and switch it off if not needed. Electrical energy is converted from extra fuel burnt in a combustion engine, so electrical equipment doesn't work "for free" – it always costs extra energy and money. Avoid unnecessary weight and aerodynamic drag.

B.5 Infrastructure Measures

Improvements to infrastructure to improve traffic flow and avoid wasteful congestion.

Emerging Cooperative Intelligent Transport Systems (C-ITS) technology has the potential to deliver significant reductions in traffic congestion. In 2008 Austroads estimated the use of C-ITS systems to improve traffic management systems and reduce congestion could reduce GHG emissions by 5.5 million tonnes in 2020, which is approximately 5 per cent of the estimated annual transport related GHG emissions[83].

[82] Ecodriving.org, What is Ecodriving?, www.ecodriving.org [downloaded 25 March 2016]
[83] Austroads, 2008, Intelligent Vehicles and Infrastructure: The Case for Securing 5.9 GHz

During the 2015 ITS World Congress, papers presented in the Technical Sessions estimated up to 10% of fuel savings through vehicle-to-infrastructure (V2I) C-ITS through technology such as 'green-wave' traffic signals. Similar data was presented to the Driverless Vehicle Conference held in Adelaide in November 2015.

While the vehicle industry can (and will) supply C-ITS equipped vehicles there is a significant role for Federal and State/Territory governments including;

- A standardised interface harmonised with the European standards as Australian vehicle safety and environmental regulatory standards are harmonised with the European standards.
- A regulatory model that ensures vehicles fitted with C-ITS being delivered to Australia meet the European standards and will operate within the specified spectrum.
- Roll out of infrastructure to enable vehicle-to-infrastructure (V2I) communications.

B.6 Price Signals (including incentives)

Price signals can influence consumer choice to change driving behaviour and purchase decisions resulting in lower CO_2 emissions. For example, the BITRE found that when petrol prices are relatively high buyers shifted to more fuel efficient vehicles.[84]

An existing Government policy that is an example of providing a price signal to increase the rate of CO_2 emission reductions is the Government's Emission Reduction Fund (ERF). However, light vehicles have effectively been excluded from the Government's signature climate change policy, the Emissions Reduction Fund (ERF), at this stage.

The proposal that initially appeared to be most likely to be taken up by FCAI members and subsequently allow light vehicles to be part of the ERF is not open to light vehicles. The proposal was being able to aggregate sales of low emission vehicles (e.g. electric vehicles, hybrids or alternative fuel vehicles) across many owners for the purpose of calculating emission reductions. The Government advised the proposal is no longer open to light vehicles due to:

- Concerns over how to establish a baseline rate of improvement and light vehicle turnover.
- Acknowledgment that light vehicles currently have a rate of improvement that is among the highest of any sectors.
- CO_2 reductions in light vehicles is high-cost (i.e. doesn't meet the Government's objective of lowest cost abatement).

B.7 Average Fleet Age

The average age of registered passenger vehicles in Australia (as at 31 January 2015) is 9.8 years and has slightly increased from 9.7 years in 2010. The average age of light commercial vehicles is slightly older at 10.4 years and has remained steady since 2010 while the average age of the entire Australian registered vehicle fleet is 10.1 years.[85]

It is widely acknowledged that newer vehicles are more environmentally friendly in terms of both reduced CO_2 and pollutant emissions as demonstrated by the National Average Fuel Consumption (NACE) figures.

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[84] Australian Government, Bureau of Infrastructure and Regional Economics (BITRE), 2014, *New passenger vehicle fuel consumption trends, 1979 to 2013,* Information Sheet 66, (p. 7) BITRE, Canberra.

[85] Australian Bureau of Statistics (ABS), 9309.0 - Motor Vehicle Census, Australia, 31 Jan 2015

An important consideration of improving the fleet environmental performance is to continue to reduce the average fleet age. Recognising that due to the large number of vehicles already in-service policies to reduce the fleet age will require a number of years to be effective.

The government also needs to be aware of policies or legislative changes which have the unintended effect of increasing the average age of the national fleet that will put at risk the broader policy objective of improved environmental outcomes. For example, if CO_2 targets results in brands withdrawing lager model SUVs and/or LCVs from sale, buyers who have a lifestyle and/or business that requires these vehicles may decide to keep an older model on the road.

APPENDIX C SUMMARY OF FUEL STANARDS REFERENCES

The FCAI's longstanding position that fuel quality standards, CO_2 standards and pollutant emission standards all need to be considered together, as they are all interrelated, is not a unique one. It is shared by the global automotive industry, regulators and research organisations alike.

Following is a list of references and quotes from leading international regulators, the automotive industry, research organisations and the Australian Government that demonstrate this position is universally acknowledged.

C.1 US EPA

The US EPA stated in their Tier 3 Motor Vehicle Emission and Fuel Standards:[86]

> *"This program includes new standards for both vehicle emissions and the sulfur content of gasoline, considering the vehicle and its fuel as an integrated system."*

and

> *"The systems approach enables emission reductions that are both technologically feasible and cost-effective beyond what would be possible looking at vehicle and fuel standards in isolation."*

and

> *"EPA is not the first regulatory agency to recognize the need for lower-sulfur gasoline. Agencies in Europe and Japan have already imposed gasoline sulfur caps of 10 ppm, and the State of California is already averaging 10 ppm sulfur with a per gallon cap of 20 ppm."*

The US EPA Tier 3 Gasoline Sulfur program sets an in-service gasoline standard of 10ppm sulphur from 1 January 2017:[87]

> *"The final Tier 3 Gasoline Sulfur program is part of a systems approach to addressing the impacts of motor vehicles on air quality and public health, by considering the vehicle and its fuel as an integrated system. The program sets new vehicle emissions standards to reduce both tailpipe and evaporative emissions, and lowers the sulfur content of gasoline to a 10 ppm average sulfur level."*

C.2 European Commission

The European Commission (EC) also recognises fuel quality standards are linked to both pollutant and CO_2 standards. On their website page, "Road transport: Reducing CO2 emission from vehicles[88]" the EC state:

> *"Fuel quality is an important element in reducing greenhouse gas emissions from transport."*

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[86] US Federal Register Vol. 79 No. 81, 28 April 2014, Part II Environmental Protection Agency 40 CFR Parts 79, 80, 85, et al. Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards: Final Rule

[87] United States Environmental Protection Agency, Gasoline, www.epa.gov/otaq/fuels/gasolinefuels/index.htm [accessed 7 July 2015]

[88] European Commission (EC), Climate Action, Road transport: Reducing CO2 emissions from vehicles, http://ec.europa.eu/clima/policies/transport/vehicles/index_en.htm [accessed 21 November 2014]

C.3 International Council on Clean Transportation

The non-profit research organisation, the International Council on Clean Transportation (ICCT), also recognises the importance of fuel quality standards.

In their inaugural *State of Clean Transport Policy*[89] report, released in 2014, the ICCT states:

> *"A key requirement to world-class vehicle standards, and thus cleaner vehicles, is the availability of ultralow-sulfur fuels."* (Page 4)

and

> *"Fuel quality, most notably the sulfur content of gasoline and diesel, is key to the implementation of advances emission controls. For optimal function of emission controls, … Euro 6/VI-equivalent vehicles require fuel as low as 10 ppm sulphur."* (Page 18)

C.4 World Wide Fuel Charter

The global auto industry position is based on the World Wide Fuel Charter[90] (WWFC) which is an extensive and comprehensive compilation of research and testing of engine, fuel and control systems by a wide group of expert contributors. The objective of the WWFC is to promote global harmonisation of fuel to:

- Reduce the impact of motor vehicles on the environment by enabling reduced vehicle fleet emissions;
- Facilitate the delivery of optimised fuels for each emission control category, which will minimize vehicle equipment complexities and help reduce customer costs (purchase and operation); and,
- Increase customer satisfaction by maintaining vehicle performance for a longer period of time.

The WWFC contains both minimum specifications of necessary fuel quality parameters and a summary of the impact of the various fuel parameters on vehicle operation. In the "Technical Background" section there is an excellent overview of the research conducted on the effects of octane and sulphur, in gasoline. The WWFC includes the following statements on octane:[91]

> *"Vehicles are designed and calibrated for a certain octane rating."*
>
> *"Engines equipped with knock sensors can handle lower octane ratings by retarding the spark timing, but this will increase fuel consumption, impair drivability and reduce power; and knock may still occur."*
>
> *"Increasing the minimum octane rating available in the marketplace has the potential to help vehicles significantly improve fuel economy and, consequently, reduce vehicle CO2 emissions. While the improvement will vary by powertrain design, load factor and calibration strategy, among other factors, vehicles currently designed for 91 RON gasoline could improve their efficiency by up to three percent if manufacturers could design them for 95 RON instead."*

In Technical Background section, in relation to Sulphur, the WWFC[92] states:

> *"Sulphur has a significant impact on vehicle emissions by reducing the efficiency of catalysts."*

[89] Miller, Joshua D., Facanha, Cristiano, The International Council on Clean Transportation (ICCT), the State of Clean Transport Policy: A 2014 synthesis of vehicle and fuel policy development, 2014.
[90] ACEA, Auto Alliance, EMA and JAMA, World Wide Fuel Charter, September 2013, 5th Edition, www.acea.be [accessed 9 October 2010]
[91] WWFC 5th Edition, p.17
[92] WWFC, 5th edition, pp.17-19

> *"Sulphur also adversely affect heated exhaust gas oxygen sensors"*
>
> *"Reductions in Sulphur will provide immediate reductions of emission from all catalyst-equipped vehicles on the road."*
>
> *"Sulphur removal requires prolonged rich operating conditions…"*

And, in relation to aromatics, the WWFC[93] states:

> *"Fuel aromatic content can increase engine deposits and increase tailpipe emissions, including CO_2."*
>
> *"Heavy aromatics … have been linked to engine deposit formation, particularly combustion chamber deposits… these deposits increase tailpipe emissions, including HC and NOx."*

Relevant to the consideration of a gasoline octane rating and level of sulphur for Australia, the WWFC outlines the required parameters for various fuel categories. The ones of specific relevance to Australia are (Page 1):

> **Category 4:**
>
> Markets with advanced requirements for emission control, for example, markets requiring US Tier 2, US Tier 3 (pending), US 2007 / 2010 Heavy Duty On-Highway, US Non-Road Tier 4, California LEV II, EURO 4/IV, EURO 5/V, EURO 6/VI, JP 2009 or equivalent emission standards. Category 4 fuels enable sophisticated NOx and particulate matter after-treatment technologies.
>
> **Category 5:**
>
> Markets with highly advanced requirements for emission control and fuel efficiency, for example, those markets that require US 2017 light duty fuel economy, US heavy duty fuel economy, California LEV III or equivalent emission

For both Category 4 and Category 5 gasoline the WWFC specifies a maximum sulphur of 10 ppm and aromatics of 35% v/v. While Category 5 gasoline has a minimum octane of 95 RON (pp. 6-7).

Cetane is a measure of the compression ignition of a diesel fuel and as such is a significant fuel quality parameter in diesel. In the Technical Background (page 41), the WWFC outlines:

> *"Higher cetane generally enables improved control of ignition delay and combustion stability, especially with modern diesels which use high amounts of exhaust gas recirculation (EGR)."*

and

> *"Cetane influence on NOx is very significant … particularly at low speeds where reductions of up to 9% are achieved"*

and

> *"The cetane increase also reduced HC emissions by 30-40%."*

The WWFC specifies a minimum Cetane Index of 55.0 for both Category 4 and Category 5 diesel.

C.5 Department of Environment

The Department of Environment is currently reviewing the Fuel Quality Standards Act 2000. As part of the review two reports were released:

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93 WWFC, 5th edition, pp.28-29

- A report prepared by Orbital Australia in 2013, “Review of Sulphur Limits in Petrol.” [94]
- A 2014 report by Hart Energy, International Fuel Quality Standards and Their Implications for Australian Standards.[95]

Orbital Australia reviewed existing standards and research on the impacts of sulphur levels in petrol and reached similar conclusions to the extracts above;

- Fuel standards work in partnership with vehicle emission standards to reduce emissions.
- Exhaust emissions will be higher with existing Australia market fuels (150 ppm or 50 ppm sulphur) than if low sulphur (10 ppm) petrol is introduced.
- Reducing sulphur levels (to 10 ppm) would allow use of some specific technologies and also reduce fuel consumption through the reduction of frequency of catalyst regeneration.

The Orbital report also acknowledges the potential for degraded performance, operability and durability of some vehicle technologies due to low quality market fuel.

The 2014 Hart Energy report, *International Fuel Quality Standards and Their Implications for Australian Standards*, demonstrates where Australian fuel quality standards are behind international levels and provides a series of recommendations where Australian fuel quality specifications need to be reviewed and upgraded in line with international standards. In the Section 1.2 Key Findings,[96] Hart stated:

> *“In Hart Energy Research and Consulting’s view, there are a number of specifications in Australian gasoline, diesel and E85 that may require changes.”*

Hart then recommended that for sulphur in gasoline (petrol):

> *“Align with the EU, Japan and South Korea by reducing the limit from the current 150 ppm for all grades and 50 ppm for premium-grade (PULP) to 10 ppm max for all grades to enable advanced emission controls on the vehicles that are being produced and driven in markets such as Australia today.”*

In relation to aromatics (in gasoline) Hart recommended:

> *“Align with the EU by reducing the limit from the current cap 45vol% (42% pool average over 6 months) to 35 vol% max to help further reduce NOx, benzene and PM in Australia;”*

(Note: in their 2015/16 rulemaking process to introduce Euro 6 vehicle pollutant emission standards, the Indian Government has recognised that availability petrol (gasoline) with a limit of 10 ppm sulphur and a maximum aromatics content of 35 %volume was necessary.[97])

C.6 Climate Change Authority

The FCAI considers that the analysis undertaken by the Climate Change Authority when developing its cost/benefit analysis of mandatory CO_2 targets[98] did not address the implications of in-service fuel and subsequent in-field vehicle performance. In particular, the Climate Change Authority paper uses certification results to develop its benefit analysis. The certification fuel is 95 RON 10 ppm sulphur petrol.

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[94] Orbital Australia Pty Ltd, 2013, Review of Sulphur Limits in Petrol, Produced for Fuel Policy Section, Department of Sustainability, Environment, Water, Population and Communities, 10 Jun 2013.

[95] Hart Energy Research and Consulting, October 2014, International Fuel Quality Standards and Their Implications for Australian Standards, Final Report (Hart)

[96] Hart, (2014), *op. cit*., p.2

[97] Shakun & Company (Services) Private Limited, Copy of Notification, Motor Vehicles Act, G.S.R 18(E), (published in the Gazette of India on 22nd February 2016).

[98] Australian Government Climate Change Authority (CCA), Light Vehicle Emission Standards for Australia: Research Report, June 2014

If the equivalent fuel is not available in the market, it cannot be guaranteed that the same result will be delivered in service, especially if a vehicle owner is likely to use ULP which, in Australia, is currently regulated to be 91 RON 150 ppm (max) sulphur. Therefore, the FCAI questions whether the full benefit as calculated will be delivered and considers that this cost/benefit analysis cannot form the basis for any rigorous regulatory analysis without additional testing to confirm in-service operation on market fuel will deliver the same result. Otherwise, to deliver the estimated benefits, the market fuel would have to be consistent with the certification fuel (i.e. 10 ppm sulphur, 95RON) to fully deliver a continued reduction in CO_2 emissions.

C.7 Australian Institute of Petroleum

In their 2013 publication, *Downstream Petroleum 2013*,[99] the Australian Institute of Petroleum acknowledged the benefits of cleaner fuels in reducing vehicle pollutant emissions (p.12):

> *"Government regulated fuel quality standards facilitate the introduction of advanced engine technologies. Benefits include improved urban quality (through reduced smog and particulates from motor vehicles), reduced greenhouse gas emissions, and improved fuel efficiency."*

C.8 FCAI Position

The FCAI has been consistent in its call for concomitant market fuel since 2010 in the FCAI's submission to the 2010 Regulatory Impact Statement (RIS) considering the introduction of Euro 5/6 emission standards. The Australian Design Rules for mandating Euro 5 vehicle emission standards (ADR 79/03 and ADR 79/04) specifies 95 RON, max 10 ppm sulphur, 35% max aromatics petrol as the test fuel.

Euro 6 pollutant emission standards for light vehicles cannot be mandated in Australia until such time as petrol meeting the European standard EN228 (i.e. 95 RON, 10 ppm sulphur, 35% v/v max aromatics, etc.) and diesel meeting European standard EN590 (as well as other applicable fuel standards, e.g. biodiesel and ethanol blends) is widely available in Australia.

The EN228 limit on Aromatics (35% v/v max) is critical to meet Euro 6c and Euro 6d Particulate Number (PN) limits for gasoline direct injection (GDI) engines.

[99] Australian Institute of Petroleum (AIP), Downstream Petroleum 2013, www.aip.com.au [downloaded 25 March 2016]

APPENDIX D ABMARC REPORT

(Supplied as separate file)