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The case for action – the economy-wide benefits of strong yet realistic vehicle emission standards for Australia

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Abstract

In July 2010, the Australian Government committed to introduce CO_2e emissions standards for passenger and light commercial vehicles. If Australia is to meet its target for greenhouse gas emissions reductions by 2020 and 2050, the transport sector – the second fastest growing source of domestic emissions – will need to make a significant contribution. The Australian new light vehicle fleet has improved its efficiency by 20% since 2002 while new car prices have fallen relatively in this time. However, at 199 gCO_2e/km the Australian new light vehicle fleet is still far less efficient than the majority of other markets in developed countries.

ClimateWorks Australia partnered with Rare Consulting to analyse the opportunities to improve the fuel efficiency of light vehicles in Australia. Our analysis found that strong vehicle emissions standards, coupled with targeted complementary measures, has the potential to deliver a broad range of benefits; financial savings for vehicle owners, improved energy security, and least cost emissions reductions.

By choosing a strong trajectory for improving vehicle emissions,, equivalent to European standards with a 4 year lag, our analysis finds that motorists derive substantial benefit, with total fuel savings of $7.9 billion per year by 2024, or $850 per year for the average driver. Improving the efficiency of cars and light commercial vehicles also represents the lowest cost opportunity to reduce emissions available across our economy, while delivering substantial abatement – 8.7 MtCO_2e in 2024. Reducing fuel use also reduces Australia's dependence on imported oil, improving energy security. To achieve this in Australia, a partnership approach is considered necessary to ensure robust solutions are developed to overcome current inertia in the industry.

1. Introduction

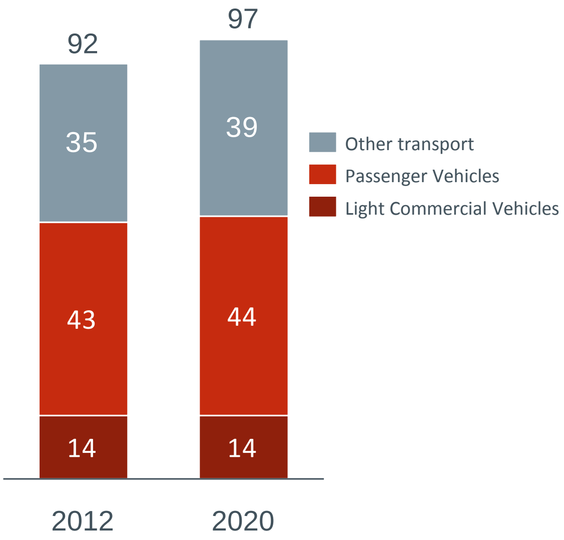
This paper seeks to provide a further evidence base of the economic, financial and environmental benefits of improving the fuel efficiency of Australia's light vehicle fleet, building off the significant amount of work already undertaken on this issue by government, industry, consumer groups and others. In order to capture the broad range of benefits, a suite of measures needs to be developed and implemented. This approach is best developed in collaboration with all stakeholders. Strong light vehicle CO_2e emission standards and relevant complementary measures should be designed with a focus on maximising a range of positive outcomes - financial savings for vehicle owners, improved energy security, revitalisation of the automotive industry, and least cost emissions reductions.

2. Main body

2.1 Australia's transport emissions

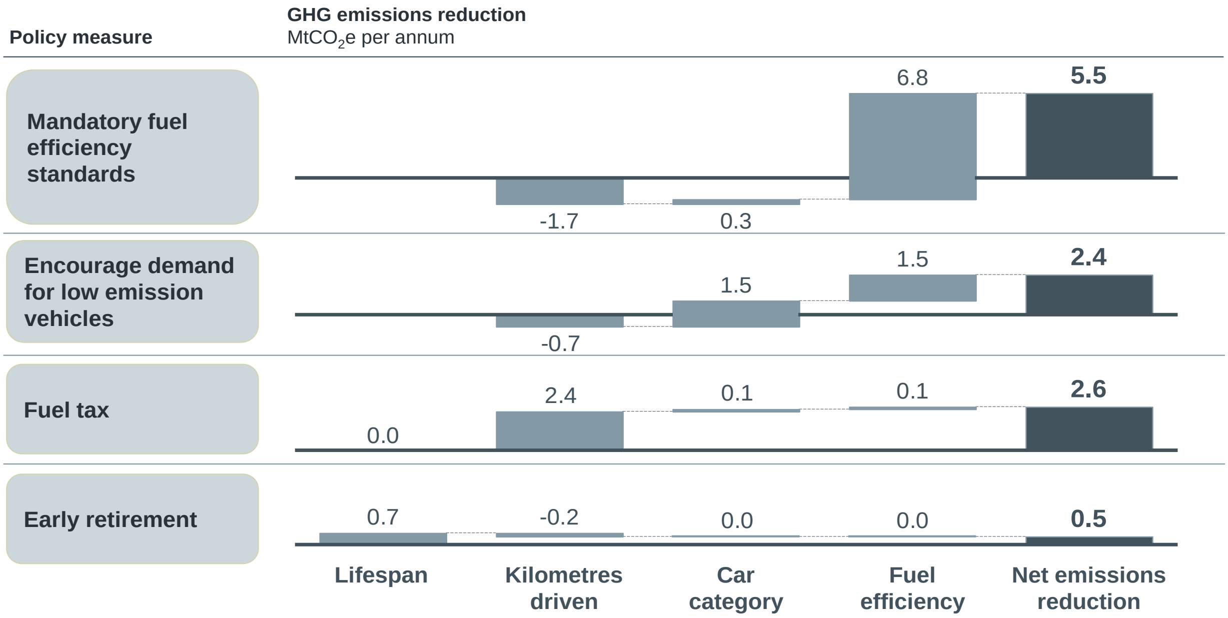
In 2012, the transport sector accounted for 17% (92 MtCO_2e) of Australia's emissions, with passenger and light commercial vehicles contributing 62% of the sector's emissions (DIICCSTE, 2013). The transport sector is one of the fastest growing sources of emissions within Australia, increasing by 47.5% between 1990 and 2012 (DIICCSTE, 2013). Emissions from the sector are projected to reach 97 MtCO_2e by 2020, a further 5% increase on 2012 levels (DCCEE, 2010). This continued increase to 2020 is driven primarily by population and income growth leading to an increase in passenger vehicles on roads and kilometres travelled, and economic growth resulting in increased freight transport (DCCEE, 2010).

Figure 1: Australia's transport emissions 2012 and 2020 (MTC0_2e) (DICCSRTE, 2013, DCCEE, 2010)



The *Low Carbon Growth Plan for Australia* (ClimateWorks 2010) identified that the transport sector can contribute 6 MtCO_2e of the least cost emission reductions available in 2020, equivalent to taking 1.5 million cars off the road. The largest opportunity within this sector – and the most financially attractive opportunity identified across the economy – is achieved through improving the fuel efficiency of conventional internal combustion engine (ICE) vehicles; the vehicles most commonly seen on Australia's roads. A range of policy approaches were compared (Figure 2), and our analysis shows that mandatory fuel efficiency standards has the largest impact on reducing emissions, even after taking account of the 'rebound effect', or the increase in kilometres travelled when fuel savings are achieved.

Figure 2: Comparison of policy measures to reduce emissions in cars and light commercial vehicles (ClimateWorks 2010)



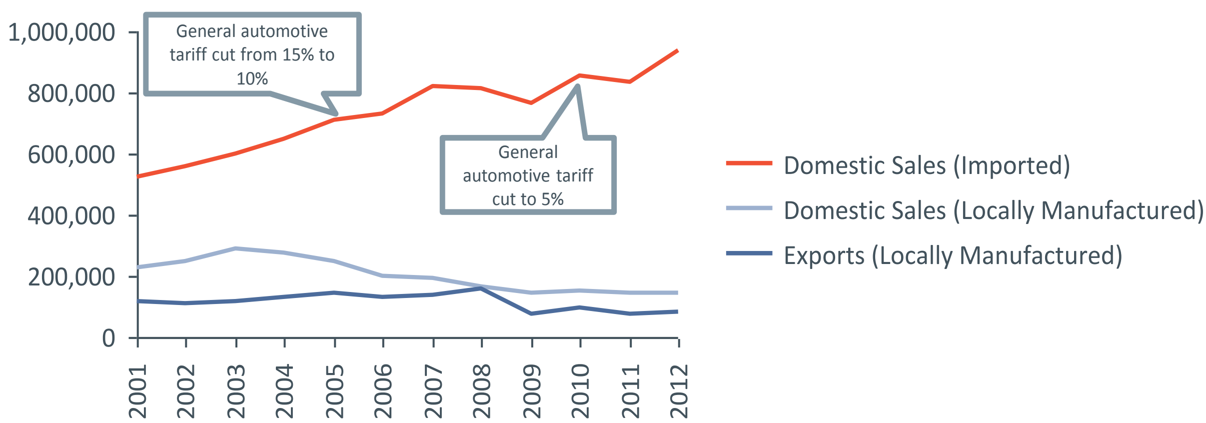
2.2 Local context

Over 1 million new vehicles were sold in Australia in 2012, making ours the 11th largest vehicle market globally (Bandivadekar 2013). Australia's market is characterised by its highly competitive nature (DIISRTE 2011), due to low barriers to entry such as favourable tariffs (CoA 2008).

Australia's domestic automotive manufacturing sector, comprised of vehicle manufacturers and component manufacturers, contributes over $8 billion annually to the Australian economy, and supports over 50,000 jobs (DIISRTE 2011), or more than 5% of all manufacturing employment.

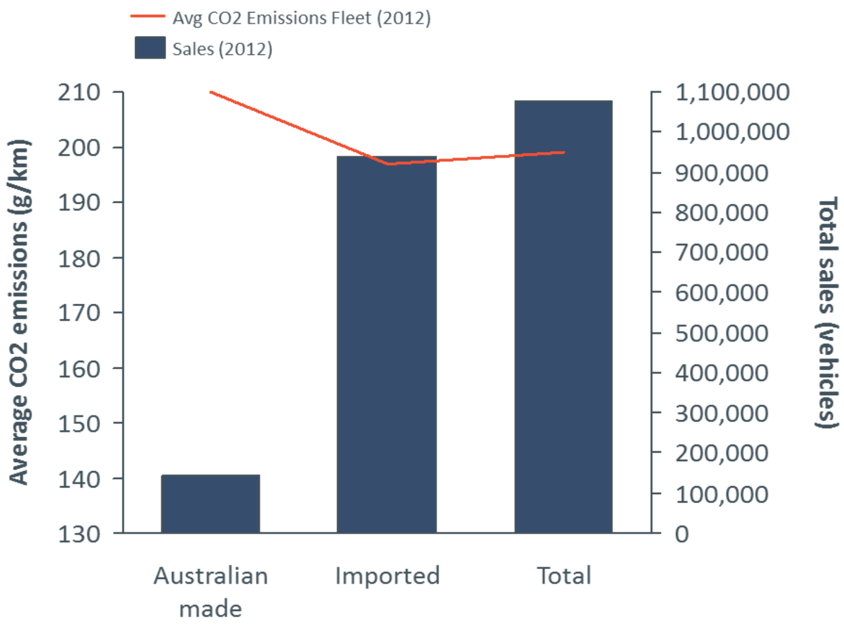
Currently there are three foreign-owned vehicle manufacturers operating in Australia; Holden, Ford and Toyota, producing 10 models for domestic and export markets. In 2012 these manufacturers had a production volume of approximately 220,000 vehicles (NTC 2013), worth approximately $5 billion in 2011 (DIISTRE 2011). There are also a range of component manufacturers supplying local and export markets, with a production value of approximately $2.5 billion in 2011 (DIISTRE 2011).

Figure 3: Breakdown of Australian new vehicle domestic sales 2011-2012 (NTC, 2013)



In recent times there has been a decline in sales from local vehicle manufacturers (Figure 3), driven by the high Australian dollar (which has both reduced export demand and made imported vehicles cheaper), reduced import tariffs (resulting in an increased range of brands available), and a shift in consumer preferences towards smaller vehicles and SUVs (sports utility vehicles), benefiting the import market. These factors have contributed to a significant increase in imported vehicles, and a decline in local vehicle manufacturing, contributing to the job losses witnessed in recent years. In 2012 approximately 85% of new vehicles sold in Australia were manufactured overseas, and this is likely to increase to 90% following the planned 2016 closure of Ford's Australian based manufacturing facilities. In 2012, vehicles manufactured in Australia had average emissions of 210 g CO_2e /km, and imported vehicles averaged 197 g CO_2e /km, resulting in a national average of 199 g CO_2e /km (NTC, 2013).

Figure 4: Australian average light vehicle fleet emissions and sales 2012 (NTC, 2013)

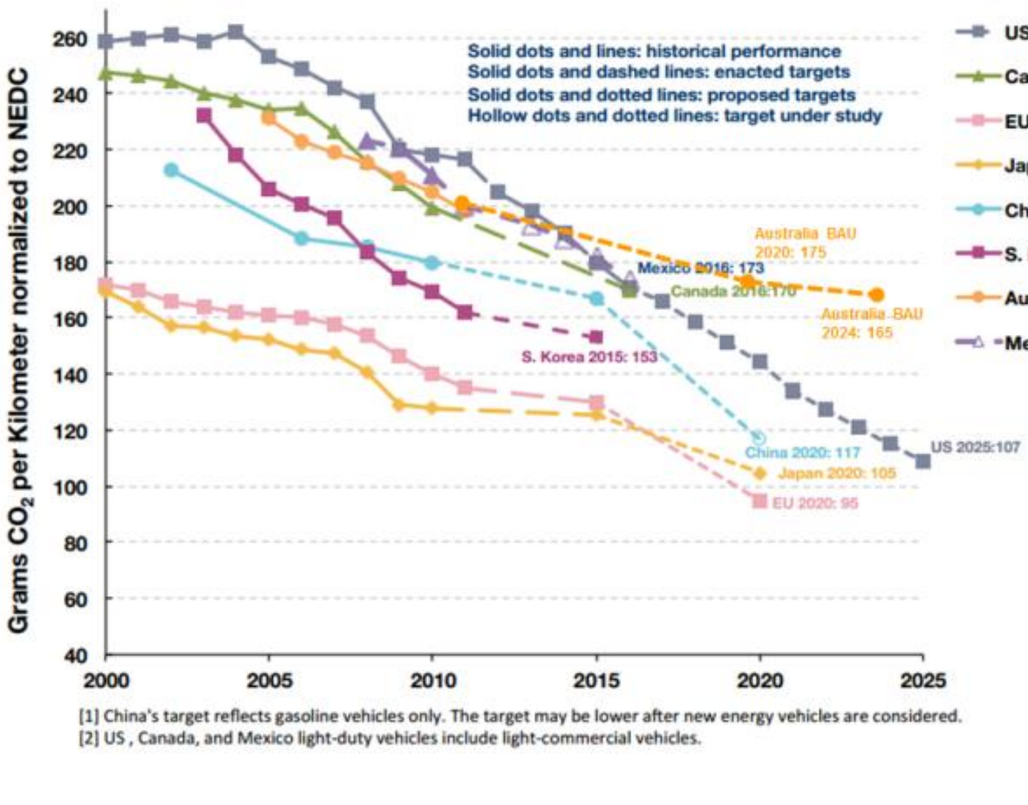


2.3 International perspective

The national average carbon dioxide emissions for new passenger and light commercial vehicles in Australia has fallen by over 20% between 2002 and 2012 (NTC 2013). In 2012 alone, average emissions fell by almost 4%, to reach 199 g CO_2e/km (NTC 2013). This improvement, which has occurred without an Australian regulatory driver in place, has been driven by the presence of international CO_2e standards, an increase in the share of imported vehicles with better emissions performance, improved vehicle technologies, and shifting consumer preferences away from large sedans to smaller cars and compact sports utility vehicles (SUVs).

Despite strong efficiency gains, Australia still lags behind other developed nations, both in terms of the emissions performance of vehicles driven, and the required regulatory structure to encourage efficiency improvements. Figure 5 compares Australia to other key international markets. It demonstrates that whilst, at present, average fleet emissions in markets with similar consumer preferences for larger vehicles (such as the United States and Canada) are comparable to those in Australia, within the next few years the fleet average emissions performance of Australia's new passenger vehicle fleet is projected to fall considerably behind these markets, and even further behind current leading markets in the EU and Asia, as rates of efficiency gains increase in those markets. It is of note that all of these markets have light vehicle emission standards in place. This demonstrates that for Australia, significant efficiency gains over business as usual (BAU) could be achieved through the adoption of technologies that are already available in international markets.

Figure 5: Comparison of new passenger vehicle fleet average emissions, actual and forescast (ICCT 2011)



2.4 The opportunity

The Australian Government has committed to developing mandatory carbon dioxide emissions standards for new light vehicles, to be introduced from 2015 (DIT, 2011). Following the release of a discussion paper in September 2011, a Regulatory Impact Statement (RIS) is currently under development, which will outline options for the standards and the framework for implementation. The development and implementation of these standards – if designed well and supported with suitable complementary measures – presents a significant opportunity to reduce emissions from the transport sector whilst providing broader benefits. The status of this process is currently unknown.

ClimateWorks Australia and Rare Consulting (a division of pitt&sherry) collaborated to model the costs and benefits of various scenarios for emissions standards based on the Government's discussion paper and international best practice. Four scenarios taken from the Government's discussion paper (BAU, Scenarios 1, 3 and 6) have been modelled. Further, our analysis shows that the technology exists for Australia to achieve more ambitious standards than has been considered in the scenarios included in the Government's discussion paper. Scenario 7 was created to reflect the uptake of standards equivalent to those in the EU, with a four year delay. This delay is an estimate of the additional time required for local automotive manufacturers to adjust to these standards, and for technologies to flow from EU and other markets to the Australian market.. Most importantly, the trajectory detailed in Scenario 7 would still deliver a net financial benefit to new car owners, even factoring in a higher upfront cost

With the recent approval of light vehicle standards in the United States to 2025, and European Union target discussions to 2025, it was deemed necessary to project ten full years to 2024. In the short term (until 2015), Scenarios 1 and 3 assume a continuation of historical trends. Scenarios 6 and 7 assume a higher rate of improvement of 3.0% to 2015. This higher rate is consistent with the annual change of 2.8% observed from 2009 to 2011, possibly driven by early moves by car manufacturers in response to the announcement of emission standards in July 2010.

In the longer term (from 2015), higher rates are achievable based on the increased flexibility of car manufacturers and the current efforts occurring in both European and United States markets to meet tighter standards. Scenarios 3 and 6 adopt an annual improvement rate of 4% and 5% respectively, which is consistent with achievements of European new passenger car standards (4%) since their introduction in 2009 and the expected rate of improvement required by United States standards from 2017 to 2025 (4.5%).

Scenario 7 takes a more aggressive approach that recognises the ability to adopt targets similar to overseas standards but with a 4 year delay on introduction into Australia. This assumes better access to overseas vehicle models that are used to achieve their current standards, as well as the next generation models that may be used to achieve even tighter standards from 2015 (e.g. the European Union has a proposed target of 70 g/km for new passenger cars in 2025).

Based on the assumptions in Table 1, average emission standards in the new light vehicle fleet could improve between 17% and 50% from 2014 to 2024 depending on the scenario adopted. This outlook was constructed from 2014 (based on the first full year after the standards are expected to be legislated).

Table 1: Light vehicles CO_2e emission standards modelled

	Standard Levels		Average Annual Improvement			Total Improvement
Scenario	**2020 (g CO_2e/km)**	**2024 (g CO_2e/km)**	**2011-2015 (%)**	**2015-2024 (%)**	**2011-2024 (%)**	**2015-2024 (%)**
BAU[a]	175	165	1.80	1.80	1.80	17
1 (less stringent)[a]	170	155	2.25	2.25	2.25	20
3[a]	155	130	2.10	4.2	3.5	35
6[a]	140	110	3.00	5.5	4.7	41
7 (stronger)[b]	**130**	**95**	**3.00**	**7**	**5.8**	**48**
EU[c]	95	~70 (2025 tbc)	2	6 (2015-2025)	4.6 (2011 - 2025)	46 (to 2025)
US[c]	155 (2016)	101 (2025)	5.15 (2011-2016)	4.6 (2016-2025)	~5 (2011 - 2025)	35 (2016-2025)

Notes: a) DIT 2011 Discussion Paper, b) Rare modelling, c) Existing standards for comparison

2.5 The benefits

Analysis reveals that stronger standards can provide significant benefits to consumers and the broader economy by reducing emissions, providing financial savings for businesses and households, and increasing energy security.

Figure 6: Benefits of fuel efficiency achieved under Scenario 7 vs. BAU

Emission Reductions

- 8.7 Mt CO_2e in 2024
- 33.4 Mt CO_2e 2014-2024

Cost Savings

- Average annual fuel savings of $852 per vehicle (based on 14,000 km/yr)
- Additional up front cost of approximately $2,500 paid off in 3 years for average vehicle

Increased Energy Security

- Up to 3.7 billion litres of fuel saved by 2024

Compared with the current average fuel consumption for new light vehicles (9 L per 100 km, or 199g CO_2e/km), the most aggressive emissions standard modelled in this report (Scenario 7) could achieve more than a 50% fuel improvement by 2024, equating to 4.2 L per 100 km (95 g/km).

Compared to a BAU scenario of 7.1 L per 100 km (165 g/km) in 2024, this represents a 41% reduction. Assuming fuel prices increase by 50% by 2024, a new vehicle owner could be saving $852 a year on fuel costs in comparison to a new vehicle in the BAU scenario. Compared to current fuel expenditure, a new vehicle owner would pay 20% more for fuel in 2024 in the BAU scenario or 30% less under Scenario 7. These savings will be significant for fleet buyers who will travel higher annual kilometres.

Table 2: Cost saving calculations

Period	2011	2024 BAU	2024 Scenario 7
Average annual kilometres (km/yr)	14,000	14,000	14,000
Average new vehicle fuel consumption (litres per 100 km)	9.0	7.1	4.2
Fuel consumption (L)	1260	994	588
Estimated price of unleaded petrol ($/L)	$1.40	$2.10	$2.10
Cost of annual fuel expenditure ($)	$1,764	$2,087	$1,235

The IEA estimates that within the EU, achieving a 50% improvement in fuel efficiency will cost in the range of $2,500 per vehicle by 2020, and will decrease further over time (IEA, 2012). Given that Australia will be adopting these technologies from the EU and other leading markets where technological innovation is required to achieve new standards in these countries, this cost is expected to be conservative for the Australian market. Given the strong efficiency gains that can be achieved in Australia to 2024, for a vehicle owner driving average kilometres (14,000 km/yr), these additional upfront costs will be recouped within 3 years. For fleet owners with higher annual kilometres, this is likely to deliver even more substantial savings and shorter payback periods (assuming a fuel price of $2.10 / litre in 2024). Strong emissions standards can therefore play a key role in reducing cost of living pressures for all Australians.

Scenario 7 would also deliver increased energy security to Australia, reducing demand for fuel by up to 3.7 billion litres per annum by 2024. As domestic production of vehicle fuels declines and Australia becomes increasingly reliant on imports, improving our energy security may well become a key priority in future years (see section 2.6.1 for further details).

2.5.1 Approach to constructing Scenario 7

Scenario 7 could reduce CO_2e emissions by 8.7 Mt in 2024 compared to the BAU scenario. In order to model the costs and benefits on the wider community, the outlook for the Australian light vehicle fleet was based on the introduction of successive tranches of new light vehicles with incremental improvements in emissions performance according to the proposed standards. The impact of new vehicles and attrition of pre-2014 vehicle models within the fleet composition is shown in Figure 7 on page 11. Appendix A provides a summary of the assumptions adopted to construct this outlook.

The outlook was constructed from 2014, as that is the first full year after standards are expected to be legislated. The overall vehicle fleet is expected to grow by 28%, from approximately 15 million vehicles in 2011 to 19.7 million in 2024. This is based on a range of assumptions derived from the Australian Bureau of Statistics (ABS 2010, 2012) for the historical purchase and attrition of light vehicles.

It is anticipated that new vehicles introduced after the imposition of emission standards in 2013 will have an increasing impact on average fleet emissions, with new post-2013 new vehicles accounting for two-thirds of the fleet in 2024. Apart from the total number of vehicles, the impact of lower emissions from successive vehicle models will also be amplified by higher than average utilisation of new vehicles in the fleet. Based on evidence gathered from the Victorian and New South Wales FleetWise programs, a large proportion of corporate and government fleet vehicles travelled between 20,000 and 30,000 km in the first three years of operation. This compares to a whole-of-fleet average of approximately 15,000 km (ABS 2010).

As a result, new vehicles introduced after the imposition of emission standards in 2013 could account for over 30% of kilometres driven by 2016 and over 70% in 2024. Total vehicle kilometres are expected to increase from approximately 210 to 270 million kilometres (28%). In order to determine the CO_2 savings under each scenario, the average expected emissions performance of each vehicle was applied to the number of kilometres travelled in each year. While the amount of CO_2 emitted by an average new car can be related to the various targets under each scenario, the amount of fuel consumed (or saved) is not as simple. The derivation of litres of fuel saved is complicated by the different emissions intensities (grams of CO_2 per litre of fuel) of diesel, petrol and LPG. The National Transport Commission (NTC, 2012) describes the relationship between litres of diesel and petrol with grams of CO_2.

Although the reduction in GHG emissions from 2011 to 2024 is significant, in the context of Australia's commitment to reduce national emissions the contribution of the light vehicle fleet should be evaluated relative to 2000 levels.

In 2000, the annual GHG emissions of the light vehicle fleet were 50.4 Mt CO2-e (BITRE 2005). Over the last decade the increase in fleet size has offset improvements in fuel consumption leading to approximately a 10% increase in annual GHG emissions over this period. Based on the scenarios evaluated, light vehicle fleet emissions are likely to peak by 2015 at around 56 Mt CO2-e under all scenarios. This will provide only approximately 5 years to reverse the increases observed since 2000. The ability to achieve a reduction is highly sensitive to the standards adopted. Under a BAU scenario, annual GHG emissions of the light vehicle fleet will still be 3% above 2000 levels in 2020 at 52.1 Mt CO2-e. For light vehicles to contribute effectively, Scenario 7 will be needed to achieve an expected 4.6% reduction relative to 2000 levels and in line with the 5% target set nationally.

Avoided fuel use will depend on the proportion of diesel or alternative fuels used, but Australia could be saving around 3.7 billion litres of fuel, worth $7.9 billion every year, by 2024 (based on a 50% increase in fuel prices).

2.6 The risks of inaction

By not taking advantage of this opportunity, Australia faces several key risks.

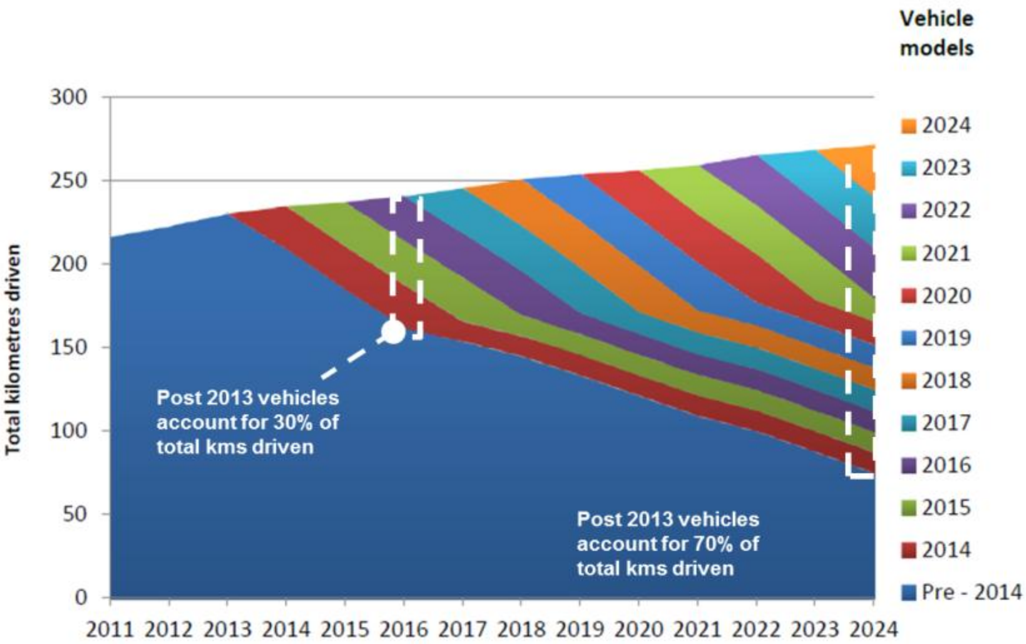
2.6.1 Energy security

Australia's oil self-sufficiency has been declining rapidly over the past decade and is expected to continue to decline over the next 20 years, increasing reliance on imported oil for transport fuels. Projections suggest that Australia's annual demand for transport energy could rise by as much as 35% by 2030 to 470 million barrels of oil equivalent (ACIL Tasman, 2008). This prediction coincides with a projected fall in Australian crude oil production to less than 85 million barrels of oil equivalent by 2030 (ACIL Tasman, EnergyQuest, Purvin & Gertz and Rare, 2009). The impact of achieving fuel efficiency associated with stronger emissions standards (Scenario 7) in 2024 could be equivalent to reducing oil imports by between 40 and 66 million barrels per annum.

2.6.2 Lock-in of higher levels of emissions

Australia has a lower than global average rate of turnover of vehicles – the average age of vehicles on our roads is 10 years, which is higher than similar overseas markets (ABS 2010, ABS 2012). Figure 7 shows that in 2024, 30% of all cars and light commercial vehicles on the road will have been built prior to 2014. This means that any delay in improving vehicle emissions standards will lead to a level of emissions lock-in, and increase the costs of 'catching up' in future.

Figure 7: Proportion of new light vehicles by total vehicle kilometres driven (2011-2024)



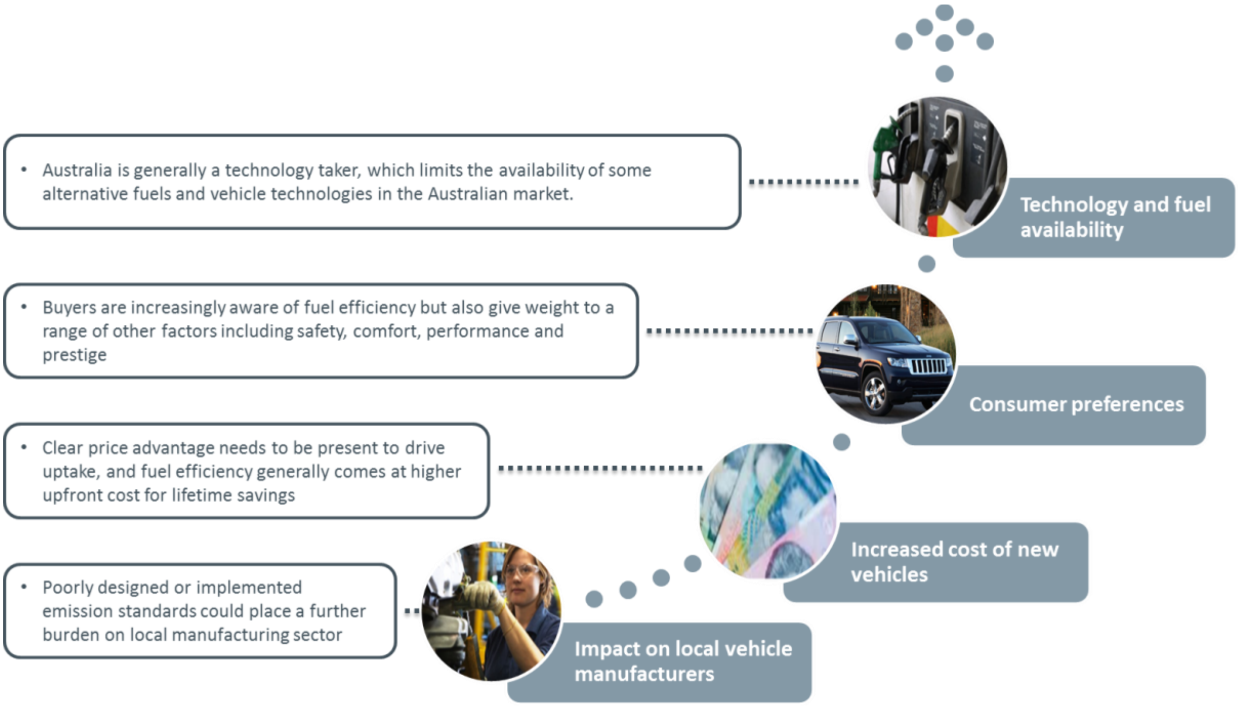
2.6.3 Increasing redundancy of Australian-made vehicles

Finally, the Australian automotive industry is already experiencing a significant decline in market share, resulting in job losses and flow-through impacts on related industries. Without intervention this trend is expected to continue, placing further pressure on the industry. This is highlighted by the recent announcement by Ford to cease Australian manufacturing by 2016, with only one car manufacturer has committed to manufacturing in Australia until 2022. Australians are increasingly choosing different cars than those manufactured domestically, and the ability to access export markets is increasingly limited, as many of Australia's trade partners already have stronger vehicle emissions standards in place and protectionist policies that inhibit imports. Further, many Australian-made vehicles are manufactured specifically for the Australian market, yet global trends are seeing most car manufacturers moving to global manufacturing platforms, which reduces the unit cost of production.

2.7 The barriers to action

Whilst achieving strong standards is technically feasible and delivers significant benefits to consumers and the broader economy, there are a number of barriers that must first be overcome (Figure 8). These barriers relate not only to technical issues, but also to the broader political, economic and institutional issues, and cover a broad range of stakeholders.

Figure 8: Barriers to increased fuel efficiency within Australia



2.8 Solutions

2.8.1 Technology and Fuel

There are a range of current and emerging technologies (DIT, 2011) that can be (and some that already have been) implemented by manufacturers to improve vehicle fuel efficiency, with the majority of these technologies developed in response to existing and forthcoming legislative requirements in international markets. For Australia, this means that local manufacturers can adopt these technologies at lower cost and faster rates, and importers can sell existing, more efficient vehicles into the Australian market. In many cases, less efficient versions of these cars are already sold here. (However there are factors that differentiate the Australian market – such as lower fuel quality and unique driving conditions – that mean that not all technologies available overseas will suit the Australian market).In addition to technology improvements to traditional internal combustion engines, emission reductions for the light vehicle fleet could also be achieved through a range of alternative fuels (e.g. biofuels) and technologies (e.g. electric or hybrid vehicles). Widespread penetration of these fuels and technologies depends on a variety of factors, including cost, the time required to optimise production scales and build confidence amongst fleet operators.

2.8.2 Standard Design

To be effective, fuel efficiency targets should achieve reductions well beyond the rate expected under a BAU scenario. In Europe, new passenger car standards have achieved a 4% annual improvement since introduction in 2009 (European Commission, 2013). The

United States expects an annual rate of improvement of 4.5% over the period 2017-2025 when standards are in place (US DoT, 2013).

There is considerable scope to improve the fuel efficiency of Australia's light vehicle fleet. The National Transport Commission calculated that if best-in-class vehicles were purchased in each segment in 2012, the Australian fleet average today would be 40% lower (119 g CO_2e /km) (NTC, 2013), surpassing current performance in the EU and Japan and exceeding Scenario 7's 2020 target.

Based on the large scope for improvements in Australia's new vehicle fleet using currently available technology, Scenario 7 was constructed to converge towards United States and European standards in the period to 2024. Scenario 7 provides an approach that is reflective of the US commitment to halve average emissions, and the European commitment to move from 130 g CO_2e /km in 2015 to 95 g CO_2e /km by 2020. It essentially mirrors European standards with a 4-year lag, allowing for the domestic manufacturing industry to make required infrastructure upgrades.

This is considered realistic as the target recognises a higher proportion of light commercial vehicles and larger passenger vehicles in the Australian fleet in comparison to the EU, but the convergence also acknowledges three important issues: an easier starting point (low hanging fruit) in the Australian fleet, the potential to adopt vehicle technologies from other markets, and the changing preferences of Australian buyers (with a notable trend towards smaller, diesel-powered and European vehicles).

The global trend to greater efficiency, the availability of suitable technologies and vehicles, and the need for the local industry to become globally competitive if it is to survive, all argue convincingly for strong standards. A range of features of strong standard design are presented in Table 3.

Table 3: Potential features of strong vehicle emission standards

Element	Potential features
Coverage of standards	There are pros and cons of having a single standard for all light vehicles versus separate standards for passenger cars and light commercial vehicles. A single standard allows manufacturers more flexibility in meeting targets by changing their model mix, it avoids the complexity of separate standards, and minimises leakage of passenger models into a less stringent light commercial vehicle standard. This approach may advantage manufacturers who only sell passenger cars, but this bias could be offset through the application of attribute weightings (e.g. mass, footprint). Separate standards may reduce the compliance burden on local manufacturers who produce a higher mix of LCVs, which comes at a higher administrative effort.
Attribute based targets	Vehicle footprint is the preferred attribute for its greater fairness and its recognition of light weighting opportunities as opposed to vehicle mass which may incentivise a shift to larger vehicles.
Test cycle	New vehicles are tested in laboratory conditions using a representative test cycle that aims to simulate real-world driving. Different countries use different cycles. It is suggested that the NEDC should continue to be used as the fuel consumption test drive cycle. This is also supported by key countries where many of Australia's new vehicles originate (e.g. European Union and China).
Banking	Permitting the transfer of credits between years encourages early effort and allows manufacturers to surpass their targets if consumer preferences do not meet the required model mix.

Element	Potential features
Trading	Transfer between manufacturers of large brands enables advanced technologies to be provided by the manufacturer with least cost (e.g. Toyota hybrid drive train development).
Super credits	Multiplication factors for electric vehicles and alternative fuels are not recommended beyond a short transition period because these can undermine the total emissions benefit achievable. They may also unnaturally favour more expensive technologies and increase the cost of meeting standards.
Penalties	Penalties should be high enough so that manufacturers invest in improving fuel economy rather than pay a fine, but reasonable enough to not make the Australian market an unattractive place to sell vehicles.
Opportunity to adjust targets	As in the United States, a review should be conducted to understand the cost and accessibility of technology improvements (i.e. if the target is too low or high based on experience of compliance).
Target setting	At least a 10-year outlook is necessary. This is consistent with longer term targets established in other markets (United States) and provides a lead time for model planning and technology transfer.
Eco-innovations	These are non-engine technologies that can still contribute to fuel savings (e.g. low-resistance tyres, gear shift messages). Their effect can be difficult to measure and can have a higher administrative cost. It may be better to support case studies that show the impact of additional fuel saving features to encourage purchase of these vehicles.
Exemptions for low volumes	In the European Union, manufacturers registering fewer than 10,000 new vehicles a year can apply for an exemption. If adopted, a much lower threshold would be appropriate for Australia because the European threshold would exempt all but the top 15 car brands in Australia.

2.8.3 Complementary measures

Overseas experience shows that while mandatory fuel efficiency standards are key to achieving emissions reductions in passenger and light commercial vehicles, they should be developed as a package of solutions including strong complementary measures (ICCT & ClimateWorks Foundation, 2012). These may include information measures and incentives to build consumer awareness and guide behaviour, road use pricing to minimise the ‘rebound effect’, and transitional assistance for the vehicle manufacturing sector.

The ‘rebound effect’ refers to the phenomenon where energy savings from increased efficiency can result in rebounding energy consumption. For the transport sector, the rebound effect comes into play where savings from reduced fuel consumption results in additional kilometres travelled. The European Commission found direct rebound of 30 to 80 per cent for fuel efficiency in commercial transport (Breakthrough Institute, 2013). Complementary measures are required in addition to standards to ensure that the rebound effect can be minimised, if not eliminated

All countries that have enacted standards have supportive complementary measures. Examples of complementary measures are presented in Table 3, for a range of government levels (Federal to local).

Table 4: Range and example of complementary measures

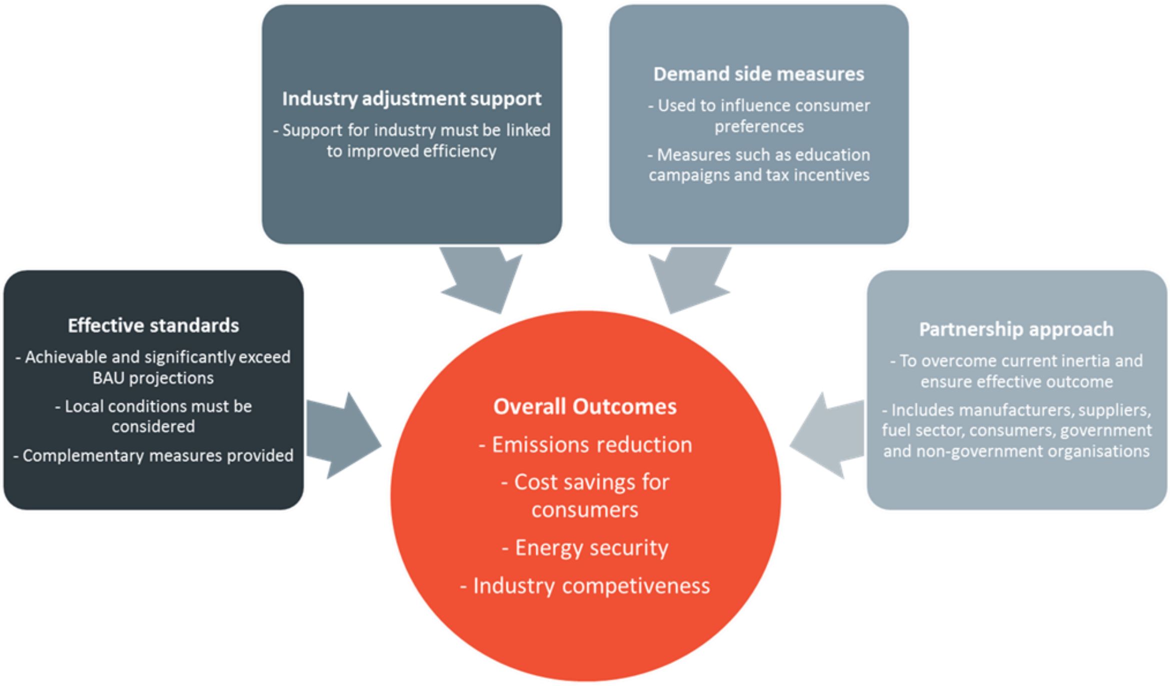
Complementary Measure	Example
Consumer education Labelling, promoting eco-driving and car sharing, low emissions vehicle demonstrations etc.	The UK Fuel Economy Label shows car buyers the running costs and fuel efficiency of new cars, clearly demonstrating that choosing a car with lower CO_2e emissions means lower running costs (UKLCVP, 2013).
Transitional assistance for industry Transitional assistance for local vehicle and component manufacturing could link future government support to leverage local adoption of fuel saving technologies used overseas	The UK's Carbon Plan released in December 2011 provided over £400 million (~AU$600M) funding for the development, supply and use of ultra-low emission vehicles – through consumer incentives and support for research, development and demonstration (UKLCVP, 2013).
Road access pricing Users charged based on distance travelled on certain roadways to reduce number of 'low value' kilometers driven.	Congestion plays a significant role in increasing vehicle carbon emissions. Road access pricing strategies could significantly reduce (or even eliminate) congestion on urban freeways (and reduce congestion elsewhere), which would provide an additional benefit in reducing vehicle carbon emissions. Such measures have been implemented in Singapore and in parts of the EU and US, at the city and national scale.
Fuel and vehicle fees Fees encourage consumers to buy the most efficient models available and drive automakers to go beyond compliance of the minimum mandated levels. Alone they do not guarantee improvement, and consumers can discount fuel savings when purchasing a vehicle. 'Feebates', which combine fees on high-emitting vehicles with rebates for buyers of low-emissions vehicles, can address this market failure (ICCT & ClimateWorks Foundation, 2012).	Annual registration fees based on CO_2e emissions have been adopted in France, Germany and the UK. The US has had a 'gas-guzzler' tax on cars with a fuel economy rating below 22.5 mpg since 1991. A study in 1997 found that these fuel fees have significantly more impact on fuel economy than purchase-registration fees (ICCT & ClimateWorks Foundation, 2012). The UK has found that progressive CO_2e taxation of company cars has been very powerful in driving consumer choice (UKLCVP, 2013).
Partnership approach Develop an interactive, multi-stakeholder forum to assist with facilitating the transition to lower emission vehicles.	The Low Carbon Vehicle Partnership was established in the UK in 2003, as a public-private partnership to accelerate a shift to lower carbon vehicles and fuels and create opportunities for UK business. The partnership has engaged almost 200 organisations from sectors including automotive and fuel supply chains, vehicle users, academics, environment groups and others (UKLCVP, 2013).
Fuel quality A review of Australian fuel quality standards with a view to mandating fuels compatible with the Euro 5/6 emissions standards.	Australia may require a tightening of petrol standards as many European vehicles require 10 ppm sulphur content to meet air quality standards. Without harmonisation of fuel quality standards there may be some impediment for importing fuel-efficient vehicles or transferring engine technology.

3. Conclusions

Analysis undertaken for the development of this paper provides further evidence of the economic, financial and environmental benefits of improving the fuel efficiency of Australia's light vehicle fleet, building off the significant amount of work already undertaken on this issue by government, industry, consumer groups and others. The following presents a summary of the key issues covered:

- The Australian new light vehicle fleet has improved its efficiency by 20% since 2002 and car prices have fallen relatively in this time;
- However, at 199 gCO_2e/km the Australian new light vehicle fleet is still far less efficient than new fleets overseas;
- The technology exists for Australia to adopt European standards with a four year lag, which would increase fuel efficiency by over 50% by 2024 compared with BAU, easing cost of living pressures and improving energy security;
- By pursuing stronger emissions standards (targeting 130 $MtCO_2e$ in 2020 and 95 $MtCO_2e$ in 2024), there is an opportunity for significant emissions reductions of 8.7 $MtCO_2e$ in 2024, equivalent to 15% of current passenger and light commercial emissions;
- Average car owners would recover the increased upfront vehicle purchase costs within 3 years;
- A partnership approach is required to overcome current inertia and address this issue.

Figure 9: Summary of measures required to improve fuel efficiency of Australia's new light vehicle fleet



3.1 Outstanding gaps in knowledge and avenues for further research

- Analysis of transition costs (e.g. the cost to retool) for the Australian vehicle manufacturing industry to meet strong standards
- More detailed economic assessment of the benefits of strong standards, including the benefit for different vehicle drivers (e.g. fleet, private etc), the flow through benefits and risks to the broader economy (e.g. jobs, impact on different segments of the vehicle industry, potential impact on government revenues as a substantial fleet owner etc), flow through impacts to the second hand market
- Further research into the impact of fuel quality issues on the adoption of more efficient technologies, and costs associated with improving fuel quality in line with international standards
- Further investigation into how best to design a partnership approach that considers all relevant stakeholders, the risks and benefits for each, and the optimal mix of complementary measures to support the adoption of strong yet realistic vehicle emissions standards for the Australian market.

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5.1 Reference acronyms

DIICCSRTE - The Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education

DCCEE - The Department of Climate Change and Energy Efficiency

NTC - National Transport Commission

DIISRTE - The Department of Industry, Innovation, Science, Research and Tertiary Education

CoA - Commonwealth of Australia

ICCT - The International Council on Clean Transportation

USDot - U.S. Department of Transport

DIT - The Department of Infrastructure and Transport

IEA - International Energy Agency

ABS - Australian Bureau of Statistics

UKLCVP - UK Low Carbon Vehicle Partnership

Appendix A - Light vehicle fleet assumptions

Table 5 summarises the assumptions adopted to estimate total GHG emissions and fuel consumption associated with each emission standards scenario.

Table 5: Light vehicle fleet assumptions

Assumption	Value	Comments
Review period	2014 to 2024	Period between the first year when standard is enacted and the last year of proposed target. Benefits will continue beyond this period with greater uncertainty and discounting to present value.
Application of standard	Single standard (i.e. no separate targets) for light commercial vehicles and passenger vehicles	Based on light vehicle discussion paper (DIT 2011).
New vehicle sales	New vehicle sales increase by 2% per year	Approximately 980,000 in 2011 and 1 million in last 12 months as a base year.
Attrition rate	4.5%	Based on ABS census data (ABS 2010)
Existing fleet fuel consumption	11.5 L per 100 km (262 g/km)	Weighted average light vehicle fleet fuel consumption in 2010 (ABS 2010).
Forecast pre-2014 model emissions performance	Improves 1.8% per year based on 13-year lag to reach 2011 new vehicle average.	Pre-2014 fleet emissions performance improves due to attrition of older vehicles (1.8% per year to 210 g/km in 2024, and forecast to equal the 2010 new vehicle average in 2024 (indicating a 14-year lag)
Vehicle fleet growth	Increase at 2% per year	Historically, vehicle growth has been strongly correlated to the rate of growth in the Australian economy (BITRE 2009). However, increasing congestion and financial costs of private travel could result in reduced growth. The actual growth is affected by vehicle prices, fuel costs and demographic trends. Anecdotal evidence suggests that the long-term trend in passenger vehicle growth will follow an S-shape curve, with a saturation period when vehicle population growth stabilises on a per capita basis. However, this is not assumed to be realised prior to 2024.

Assumption	Value	Comments
Average annual vehicle kilometres	New vehicles achieve an average of 25,000 km per year for three years before declining to 12,000 km per year over remaining vehicle life (ABS 2010)	For the purposes of modelling total fleet kilometres driven, it was assumed that average annual kilometres were higher for new vehicles in the first 3 years due to the high proportion operated by fleets. After 3 years the resale of these vehicles or relegation into weekends of occasional motoring reduces annual average distance to 12,000 km. Future changes in congestion or demographic trends could potentially reduce vehicle use at some point but equally improvements in fuel economy could also drive a rebound in demand. Without confidence in the interplay of these factors, the trend is assumed to continue to 2024.
Real-world emission performance and fuel consumption	No difference	An average translation factor of 1.195 can be been derived based on the outcomes of past studies into differences between reported and real world fuel consumption. This suggest that fuel consumption is 20% higher on average than reported. The accuracy of how standards will impact vehicle operation is therefore best seen in the relative terms of improvement compared to BAU.
Fuel mix	Dieselisation increases from 14% to 20% of light duty vehicle fleet. Assume LPG use is unchanged and EV adoption is limited.	Actual fuel consumption will decline more rapidly than GHG as a consequence of dieselisation (2695 g/L) and switch to alternative fuels. The average emissions per litre of fuel consumed is expected to 2330 g/L in 2011 and 2370 g/L in 2024.
Use of ABS *Survey of motor vehicle use* (ABS 2010)	Adopted	The ABS warns that caution should be used when interpreting the *Survey of motor vehicle use* (ABS 2010) to measure changes over time (e.g. annual vehicle kilometres). While this limitation is acknowledged, the survey is also one of the only sources of historic measures of vehicle data available. Discussions with the ABS have identified that registration information for LPG vehicles may be underestimated. Some state registration authorities do not have a reliable mechanism in place for approving conversions of petrol engines with LPG systems, and rely on the owner to notify the authority of the change before it appeared in registration statistics. As LPG (and CNG) vehicles account for a small and declining proportion of light vehicles, their impact on fuel use and emissions is negligible.