Light vehicle CO₂ emission standards for Australia

KEY ISSUES — DISCUSSION PAPER — 2011
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Key Issues — Discussion Paper — 2011
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1 Introduction

The Australian Government has decided that mandatory carbon dioxide (CO₂) emissions standards will apply to new light vehicles from 2015 (see Appendix A for a copy of the election commitment of 24 July 2010). The mandatory standards will form an important part of the Government’s Clean Energy Future plan. The standards will complement the carbon price and help reduce emissions from the light vehicle fleet, making an important contribution to reducing Australia’s overall emissions.

The Department of Infrastructure and Transport has been given primary responsibility for the detailed work to develop the standards, in consultation with industry and other key stakeholders. The Department will present a set of recommendations on the standards for later consideration by the Government.

This discussion paper has been prepared by the Department of Infrastructure and Transport to elicit views from interested parties on the key issues that will need to be addressed in the development of the standards. These issues fall into two broad categories:

- the emissions target(s) to be established under the standards (section 3.1); and
- the most appropriate regulatory framework for implementing the standards (section 3.2).

The paper does not purport to present a set of final positions on these key issues, rather it aims to present possible approaches for consideration and comment.

The views received in response to the discussion paper will help inform the Department of Infrastructure and Transport in its development of an implementation Regulatory Impact Statement (RIS) which will set out options for the standards and the framework for implementing the new standards. The RIS will also include a formal benefit-cost analysis, and will itself be formally released for public scrutiny and comment, prior to the presentation of a final RIS for consideration by the Government. This discussion paper seeks input from stakeholders on potential costs and benefits, but does not include a benefit-cost analysis.

All comments on this discussion paper must be provided in writing (hard copy or email) to the following address no later than 30 November 2011:

CO₂ Emissions Standards  
Vehicle Emissions and Environment Section  
Surface Transport Policy  
Department of Infrastructure and Transport  
GPO Box 594  
CANBERRA ACT 2601

OR

CO2standards@infrastructure.gov.au

In the interest of transparency, all submissions will be treated as public documents and will be posted on the Department’s website.
2 Context

2.1 Australian Government Climate Change Policy

The Australian Government is committed to addressing climate change and has stated that a fair and effective global agreement to stabilise greenhouse gas concentrations, at or below 450 parts per million carbon dioxide (CO₂) equivalent, is in Australia’s national interest. In responding to this challenge, the Government has committed to near-term targets of reducing economy wide emissions by at least 5% on 2000 emissions levels by 2020 (a bipartisan agreement in the absence of any action by other nations), and between 15% and 25% depending on the actions of other nations. In July 2011, the Government announced its Clean Energy Future plan to reduce CO₂ emissions across all sectors of the Australian economy. The Government will achieve this through introducing a carbon price into the Australian economy and through implementing a range of complementary measures.

Transport produces around 15% of Australia’s CO₂-e emissions and 18% of global emissions¹. Light vehicles — which comprise passenger vehicles, sports utility vehicles and light commercial vehicles — make up 64% of Australia’s transport emissions, and 9–10% of total emissions². As emissions reductions are achieved in other sectors, particularly electricity generation, transport’s share of Australia’s total emissions will become significantly larger.

2.2 Reducing Transport Emissions

In addressing CO₂ emissions from the transport sector, the International Energy Agency’s (IEA) modelling indicates that, if all modes of transport in every region of the world do not reduce their emissions significantly by 2050, stabilising the concentration of greenhouse gases in the atmosphere at 450 parts per million will be ‘very difficult’, even with deep emissions cuts from all other energy sectors³.

It is in this context that the Government has also committed to the introduction of mandatory CO₂ emissions standards for light vehicles (see Appendix A). The Government considers that these vehicle based standards are complementary to a carbon price and represent the single most important measure with the potential to deliver the largest reductions in transport emissions. The Government has also decided that transport fuels for light vehicles will be permanently excluded from the carbon pricing scheme. The mandatory CO₂ standards will help reduce carbon emissions from the light vehicle fleet and will make an important contribution to reducing Australia’s overall emissions.

Mandatory CO₂ standards (or the equivalent fuel economy standards) are internationally recognised as one of the most cost effective strategies to reduce transport emissions. To quote from a recent International Transport Forum (ITF) report: “a fuel economy standard is a key component of a policy package that stimulates the use of technology to improve fuel economy”⁴. The IEA also concluded that mandatory fuel efficiency standards for light vehicles are a “necessary condition” for delivering significant energy savings in the transport sector⁵. It needs to be noted however, that as such standards only apply to new vehicles, realising significant reductions in total CO₂ emissions from the light vehicle fleet overall will take some years, as older vehicles are replaced by the new, lower emission vehicles.

A large body of international and Australian evidence suggests that improvements in light vehicle fuel efficiency (which is directly correlated to CO₂ emissions) can be made at low overall cost or net financial benefit to motorists (from lower fuel costs) and society, even before the value of emissions reductions is taken into account⁶. For example, the IEA estimates that if strong measures (such as mandatory standards) were implemented globally, the fuel consumption of new light vehicles could be halved by about 2030 at low or possibly negative cost to consumers, while cutting emissions and improving energy security⁷. ClimateWorks finds similar results for Australia⁸.
2.3 CO₂ Emissions Trends in the Australian Light Vehicle Fleet

The Australian light vehicle fleet comprises both locally manufactured vehicles (from three manufacturers — Ford, GM Holden and Toyota) and a large range of importers, with imports currently accounting for about 85% of sales. The majority of imports are sourced from Japan, Thailand, Korea, Germany and South Africa, with these five countries accounting for 75% of all sales.

The average level of CO₂ emissions of the new light vehicle fleet in 2010 was just under 213g/km. The average for the passenger car segment (which includes SUVs) was 205g/km, with light commercials averaging 250g/km.

A 2011 analysis of 2010 vehicle sales data by the National Transport Commission (NTC)⁹ indicates that across the 15 largest manufacturers which supply around 94% of vehicles to the Australian market, the corporate average CO₂ emissions ranged from 175g/km to 237g/km (see Figure 1). Refer to Appendix A of the NTC report for a full listing of manufacturers.

![Figure 1 Corporate Average CO₂ Emissions for Light Vehicles (2010) in Australia](source: NTC (2011))

The NTC analysis also compared the relative performance of the Australian and EU new passenger car fleets, based on 2009 data (Figure 2).
Given the different nature of the fleets in Australia and the EU, it is not surprising that the average emissions levels of the EU fleet are significantly lower than that in Australia (146g/km compared to 210g/km in 2009) and as discussed later in this section, there are a wide range of factors which influence the relative performance of fleets in different countries.

In the absence of emissions standards, annual emissions reductions in the new vehicle fleet are being achieved by manufacturers using available technologies. A 2.1% annual rate of reduction in average CO₂ emissions of new vehicles in Australia was achieved from the combined impact of changes in consumer behaviour and improvements in vehicle fuel consumption performance over the 2003–10 period, but as indicated in Table 1, the annual rate has varied considerably over that period. While the absolute CO₂ emissions values in the EU are much lower, the European average rate of improvement over the 2003–10 period (also without CO₂ emissions regulation) was also around 2.1%, again with considerable year on year variability. There is also considerable variability in the rates within various vehicle segments — the NTC analysis (Table 13 of NTC report) indicates that between 2009 and 2010, the percentage change in CO₂ emissions by segment ranged from an increase of 1.4% to a reduction of 7.2%, with for example, small cars improving by 0.8%, medium by 5.2% and large by 3.6%.
Table 1  

<table>
<thead>
<tr>
<th>Year</th>
<th>Average CO₂ Emissions (g/km)</th>
<th>Annual Reduction (%)</th>
<th>Average CO₂ Emissions (g/km)</th>
<th>Annual Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>250</td>
<td>1.1</td>
<td>166</td>
<td>1.0</td>
</tr>
<tr>
<td>2004</td>
<td>247</td>
<td>1.2</td>
<td>163</td>
<td>1.3</td>
</tr>
<tr>
<td>2005</td>
<td>241</td>
<td>2.4</td>
<td>162</td>
<td>0.6</td>
</tr>
<tr>
<td>2006</td>
<td>230</td>
<td>4.2</td>
<td>161</td>
<td>0.7</td>
</tr>
<tr>
<td>2007</td>
<td>226</td>
<td>1.7</td>
<td>159</td>
<td>1.6</td>
</tr>
<tr>
<td>2008</td>
<td>222</td>
<td>1.8</td>
<td>154</td>
<td>3.2</td>
</tr>
<tr>
<td>2009</td>
<td>219</td>
<td>1.7</td>
<td>146</td>
<td>5.1</td>
</tr>
<tr>
<td>2010</td>
<td>213</td>
<td>2.7</td>
<td>140</td>
<td>3.7</td>
</tr>
</tbody>
</table>

As illustrated in Figure 3, the Federal Chamber of Automotive Industries (FCAI – representing both local manufacturers and importers) anticipates that under market influences alone (i.e. the combined effect of technology uptake and consumer led changes in market segmentation, but with no mandatory emissions standards in place) the emissions reductions to 2020 in Australia would average around 1.8% per year over the 2008–2020 period10.

Figure 3  

Note: Percentage changes shown on chart are relative to base year of 2008 (222.4 g/km)

Source: FCAI Presentation to Improving Fuel Economy Conference (March 2011)
2.4 International Developments

While as noted above, annual emissions reductions in the new vehicle fleet are being achieved by manufacturers without regulatory intervention, it is clear that the significant levels of reduction required by regulation planned or in place in major economies such as the EU and US are unlikely to be delivered in a non-regulatory environment. The EU, US, China, Japan and Korea are among the countries which are implementing mandatory standards in order to realise the higher emissions reductions and associated financial benefits from lower fuel costs. Standards currently cover 75% of the world light vehicle market and are also in progress or have been proposed in India, Mexico and Brazil, amongst others.

As illustrated in Figure 4, mandatory vehicle emissions standards in major overseas vehicle markets are anticipated to deliver reductions significantly beyond the market based expectations of around 2% outlined above.

Figure 4 Comparison of CO₂ Emissions Reductions from Passenger Cars in Australia and Various Countries – Actual and Proposed

When considered in annual percentage reduction terms, the US standards for example, require an average reduction of 5.15% pa between 2011 and 2016 to achieve the standard and the US EPA modelled reduction rates of 3–6% pa in its consideration of standards for 2025.

In the EU, the rates of reduction required to achieve the agreed standards are:

Passenger cars

- 2.0% pa to 2015
- 6.0% pa from 2016–2020
Vans

- 0.7% pa to 2017
- 5.7% pa from 2018-2020.

The ICCT also reports that Japan’s standards are targeting an annual reduction rate of 4.1% between 2010–2015, and South Korea a rate of 4.5% between 2012–2015.14

In considering international comparisons such as those illustrated in Figure 4 it is important to recognise that the relative performance of light vehicle fleets in particular countries or regions is not related to the presence of standards alone, but is a reflection of the complex interaction of consumer preferences for particular categories or types of vehicles, the degree to which lower emission technologies and fuels are adopted in the vehicles offered for sale in the market, and the information and policies which influence both consumers and manufacturers. Figure 5 illustrates the current proportion of different vehicle categories in the Australian light vehicle fleet.

Figure 5 Australian Light Vehicle Fleet (2010) by Category

![Pie chart showing the proportion of different vehicle categories in the Australian light vehicle fleet.](chart.png)

Source: VFACTS (2010)

Of particular relevance from a technology/fuel context is the relative use of diesel engines in light vehicles in passenger cars in Australia and other countries. In Australia, around 15% of passenger cars and 70% of light commercial vehicles are diesel engined (leading to a 25% diesel share overall in the total light vehicle fleet). In contrast, an average of 50% of new passenger cars in the EU are diesel, with France, Belgium and Spain having 70% or more of their cars running on diesel. At the other end of the spectrum, less than 1% of cars in the US are diesel.15

Regardless of these national and regional differences, the clear trend in Figure 4 is that all major vehicle producing countries are seeking significant reductions in CO₂ emissions from the introduction of their mandatory standards over the short-medium term — and the level of these reductions is significantly greater than that expected under a non-regulatory environment.

The Australian Government’s decision to implement mandatory carbon emissions standards for light vehicles from 2015 is consistent with these international trends. Although Australia imports some 85% of its light vehicles, in the absence of mandatory standards in Australia it is likely that sourcing decisions by global vehicle manufacturers will see the most fuel efficient vehicles and components being allocated to markets with mandatory standards in place.
3 Key Issues

As noted in the introduction, the key issues in the development of mandatory CO₂ emissions standards for light vehicles are to determine the target(s) and to design and implement the regulatory framework. Section 3 of this paper explores those issues that the Department of Infrastructure and Transport has identified as significant for the standards development process. Stakeholders are encouraged to provide their views on these issues and any other matters considered to be significant, and a range of questions are included for your consideration. We would also welcome comments on any other issues you consider relevant (while noting that broader policy issues such as carbon prices and vehicle taxation are outside the scope of this process).

3.1 Targets

While the Government’s election commitment clearly sets out a requirement for mandatory CO₂ emissions standards, it did not specify the target CO₂ emissions that would be required under the standard. The figures for 2015 and 2024 quoted in the election commitment (190g CO₂/km and 155g CO₂/km, respectively), have been presented as a starting point for discussion and do not represent a pre-determined target. This paper presents a range of potential targets for discussion and these are set out in section 3.1.3 (Table 4). There are a range of issues to consider in the setting of targets and these are also discussed below.

3.1.1 Single or Staged Targets?

The election commitment specifies that the standards will commence from 2015, leaving open the question of whether to set one or more targets. The Department of Infrastructure and Transport recognises that the capacity for major change by 2015 is limited, due to vehicle manufacturing planning timelines which are typically around 3–5 years and because achieving an ambitious target at lowest possible cost requires a longer lead time to enable emissions improvements mandated by standards to be factored into the planning process.

A possible approach would involve setting two staged targets — the first in 2015 as required by the Government’s election commitment, followed by a more stringent target for 2020. Setting a 2020 date at the same time as the 2015 date provides a degree of certainty for manufacturers and will ensure that they have the capacity to factor the emissions target into their vehicle design and technology choices as part of their normal product planning.

There are difficulties in setting firm targets for later years (beyond 2020) given the uncertainties around the pace and nature of technology developments, their cost effectiveness and their uptake in the new vehicle fleet. A possible approach is to monitor compliance with the 2015 target and the trends towards the 2020 target and formally review progress in (say) 2016–17 to consider the need and nature of targets beyond 2020.

Q1 Do you support the setting of staged short and medium term targets?

Q2 If yes, do you consider 2020 is the logical date for a firm second stage target?

Q3 Do you consider it is appropriate to set a target beyond 2020 at this stage?
3.1.2 What is the Appropriate Reference (Base) Year?

At a fleet wide level, the consideration of a target is, in part at least, determined by an assessment of the potential for improvement relative to the current fleet. Thus a decision needs to be made on the base year against which any such assessment is made.

Prima facie, an appropriate approach would be to use the most recent full year data for the new vehicle fleet (2010) as the base year, unless there is evidence to suggest that 2010 represents a significant departure from the trend in recent years. The Department of Infrastructure and Transport understands that the 2009 new vehicle sales profile was significantly affected by the global financial crisis and the responses to it, and thus would not be appropriate. However, indications are that the 2010 fleet profile represents expected trends and thus would seem appropriate.

Q4 Do you consider 2010 is the appropriate base year for determining the targets?

3.1.3 What is a Reasonable Target for Australia?

To warrant regulatory intervention, targets need to be significantly tighter than the outcomes expected to occur under a “business as usual” (BAU) scenario — regulating to achieve outcomes only marginally better than BAU would increase costs without commensurate benefits. As indicated in section 2 of this paper, the average annual rate of emissions reduction in the 2003–2010 period in Australia was 2.1%, and in the future any BAU scenario would be expected to deliver some level of emissions reduction in response to market forces. For example, the previous FCAI projections in Figure 3 estimate emissions reductions in 2015 and 2020 (relative to 2010) of 8% and 15% respectively without regulatory intervention. These emissions reductions are delivered by a combination of the technology improvements which a manufacturer judges to be in their marketing interest and by changes in consumer preferences for different types of vehicles. Thus BAU should not be considered a static “no action” scenario, but the scenario which describes what is expected to occur in the absence of new regulations or other major Government intervention.

The international literature (UK King Review, OECD/ITF papers, US research) suggests a 30% reduction on the average current CO₂ emission levels should be achievable in most countries by 2020, using proven, cost-effective and available technology and without any significant change in the model or fuel mix. As an indication, Table 2 shows the expected fuel efficiency improvements from a range of existing technologies as assessed by the King Review. Similar estimates have been developed for the determination of the EU and US standards (see Table 3).

Table 2 Estimated Efficiency Savings from Existing Technologies (King Review)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Efficiency Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct injection and lean burn</td>
<td>10 – 13%</td>
</tr>
<tr>
<td>Variable valve actuation</td>
<td>5 – 7%</td>
</tr>
<tr>
<td>Downsizing engine capacity with turbo-charging or supercharging</td>
<td>10 – 15%</td>
</tr>
<tr>
<td>Dual clutch transmission</td>
<td>4 – 5%</td>
</tr>
<tr>
<td>Electric motor assist</td>
<td>7%</td>
</tr>
<tr>
<td>Lightweighting</td>
<td>10%</td>
</tr>
<tr>
<td>Low rolling resistance tyres</td>
<td>2 – 4%</td>
</tr>
<tr>
<td>Improved aerodynamics</td>
<td>2 – 4%</td>
</tr>
</tbody>
</table>

Source: King Review of Low Carbon Cars
Table 3  Estimated Efficiency Savings from Existing Fuel Saving Technologies and Associated Costs

<table>
<thead>
<tr>
<th>Category</th>
<th>Fuel Saving Technologies</th>
<th>$\text{CO}_2$ Emissions Reduction (%)</th>
<th>Incremental Price per Vehicle ($US)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engine</strong></td>
<td>Low Friction Lubricants</td>
<td>0.5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Gasoline Direct Injection</td>
<td>1–2</td>
<td>209–346</td>
</tr>
<tr>
<td></td>
<td>Engine Friction Reduction</td>
<td>1–3</td>
<td>50–100</td>
</tr>
<tr>
<td></td>
<td>Variable Valve Timing and Lift</td>
<td>3–4</td>
<td>125–259</td>
</tr>
<tr>
<td></td>
<td>Turbocharged Downsized Engine</td>
<td>5–7</td>
<td>149–1099</td>
</tr>
<tr>
<td></td>
<td>Camless Valve Actuation</td>
<td>5–15</td>
<td>501</td>
</tr>
<tr>
<td></td>
<td>Cylinder Deactivation</td>
<td>6</td>
<td>150–169</td>
</tr>
<tr>
<td><strong>Transmission</strong></td>
<td>Six Speed Automatic</td>
<td>4.5–6.5</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>Six Speed Dual Clutch</td>
<td>5.5–13</td>
<td>47–92</td>
</tr>
<tr>
<td></td>
<td>Continuously Variable Transmission</td>
<td>6</td>
<td>192–224</td>
</tr>
<tr>
<td><strong>Vehicle</strong></td>
<td>Reduced Rolling Resistance of Tyres (10%)</td>
<td>1–2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>High Efficiency Alternator and Electrified Accessories</td>
<td>1–2</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>Electric Power Steering</td>
<td>1.5–2</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>Aerodynamic Drag Reduction (20%)</td>
<td>2–3</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Lightweighting (10% Reduction)</td>
<td>6.5</td>
<td>518–666</td>
</tr>
<tr>
<td></td>
<td>Integrated Stop–Start</td>
<td>7.5</td>
<td>351–437</td>
</tr>
<tr>
<td></td>
<td>Hybrid Motor Assist</td>
<td>20–30</td>
<td>2854–4431</td>
</tr>
</tbody>
</table>


In 2010, the FCAI commissioned a survey of its members (both local manufacturers and importers) for their views on likely technology uptake in the fuel consumption/$\text{CO}_2$ emissions context in the medium term — and their assessment on the expected percentage reductions in emissions from the various technologies. The companies’ collective views are summarised in Figure 621.
In developing its technology roadmap, the Automotive Australia 2020 project\textsuperscript{22} developed by the Co-operative Research Centre for Advanced Automotive Technology (Auto CRC) and others also identified a range of emissions reduction technologies amongst its six priority areas for ensuring the domestic vehicle and components industry continues to play a role in the future of the global vehicle industry. These are lightweighting, gaseous fuels (LPG, CNG) and vehicle electrification.

The Global Fuel Economy Initiative, a collaboration of the UK-based charity, FIA Foundation, the International Transport Forum (ITF), International Energy Agency and United Nations Environmental Program, which is advocating a 50\% reduction in vehicle fuel consumption by the global light vehicle fleet by 2050, notes that average fuel economy of new vehicles could be improved by 30\% by 2020 and 50\% by 2030 at low or negative cost taking into account fuel savings\textsuperscript{23}. In the context of current international standards the EU target for 2015 represents a 19\% reduction on 2008 figures and the US target for 2016 is around 30\%. However, the EU fleet already has much lower CO\textsubscript{2} levels and it is harder and more costly to deliver CO\textsubscript{2} emissions reductions from already efficient vehicles.

The fuel efficiency improvements necessary to meet such standards can be generally made without impinging on consumer preferences for other vehicle attributes (such as acceleration and safety features) in each main vehicle class. Even within the existing vehicle fleet, there are often lower emission variants of the same model. Figure 7 illustrates comparisons between pairs of model variants currently available in Australia with the same features but with different levels of CO\textsubscript{2} emissions.
Percentage Reduction Approach for Setting Fleet Targets

One approach to considering options — in addition to the ‘starting point’ identified in the election commitment — would be to base the fleet wide new vehicle target(s) for Australia on achievable percentage reductions relative to the current fleet.

As noted above, the international evidence suggests an achievable target under such an approach could be in the order of 30% or more over the next 10 years (i.e. by 2020). While this would not be as ambitious as the US (in its timeframe), it would be consistent with what the literature suggests could be achieved at relatively low cost, and is greater than would be expected under a current business as usual scenario. Achieving a 30% reduction by 2020 (relative to 2010) would require an average annual reduction in emissions of around 3.5% over 2011-2020, and would lead to an average CO₂ emissions value of just under 150g/km for the 2020 new vehicle fleet in Australia. Based on unpublished analysis conducted for the Department of Infrastructure and Transport, such a reduction would deliver emission rates around 18% lower than would have been expected under BAU in 2020 (this analysis assumes a 1.5% average annual reduction under BAU). A 40% reduction by 2020 would require average annual reductions of around 5% over 2011-2020 and would deliver a target just under 130g/km by 2020.

More ambitious targets could also be considered, and while they would deliver greater emission reductions, they may also lead to higher vehicle costs or require significant model shifts. As Australia currently imports around 85% of its vehicles (and this figure is showing signs of increasing), it will however, benefit from the more stringent standards being introduced in Europe and elsewhere if manufacturers choose to send vehicles and components designed for these markets to Australia after the introduction of mandatory standards, and this will to some extent moderate cost increases. In this context, the ATC/EPHC Vehicle Fuel Efficiency report also noted that diesel penetration in the passenger car fleet in Australia was still very low, and that diesel engines produce considerably lower CO₂ emissions than equivalent petrol engines — for example, CO₂ emissions from the diesel Mazda 6 are 20% lower than the petrol model, and in the Toyota Hilux 4x2, the diesel variant is 20–30% lower than the petrol versions.
Scenarios for Discussion

For the purposes of discussion, Table 4 sets out some possible scenarios for targets in 2015 and 2020. All scenarios in Table 4 have a relatively modest target for 2015 (reflecting the short timeframe to meet this target) and set progressively more stringent targets for the later years.

Scenario 1 reflects the starting point set out in the Government’s election commitment. Scenarios 2–6 have been developed by the Department of Infrastructure and Transport for the purpose of public discussion and assisting with the assessment of the implications of varying degrees of target stringency. They do not represent a Government position.

Scenarios 2 and 3 assume the average annual reduction rate in CO₂ emissions from the new light vehicle fleet from the past eight years (2.1%) will continue up until 2015, while Scenarios 4 and 5 assume a slightly higher rate (2.5%), and Scenario 6 a rate of 3%. Scenarios 2–6 then apply either a 4% or 5% rate for the second period to 2020. These rates for the second period are consistent with the range of rates of improvement being applied in both the US and EU. The US EPA for example, assessed rates of 3–6% for its 2020–2025 standards setting process, after requiring a 5.1% rate for the 2011–2016 period. In his recent announcement, the US President, with the support of the vehicle industry, set a target for 2025 which, at around 100g/km (as measured on the US test procedure), will require annual reductions in the order of 4.5% from 2017 onwards.

The stepped approach in Scenarios 2–6 is also consistent with the ICCT assessment that annual reduction rates of 2–3% in the short term, and 4–5% in the longer term, are achievable under a standards regime.

Table 4  Scenarios using Steady Annual Rate (Scenario 1 only) and Stepped Rates

<table>
<thead>
<tr>
<th>Year</th>
<th>New Vehicle Fleet Average CO₂ Emissions (g/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scenario 1 (Starting Point – steady 2.25%)</td>
</tr>
<tr>
<td>2015</td>
<td>190</td>
</tr>
<tr>
<td>2020</td>
<td>-</td>
</tr>
<tr>
<td>2024</td>
<td>155</td>
</tr>
</tbody>
</table>

† All scenarios use 2010 as the base year (except Scenario 1, which is based on 2008). 2.1% is the average annual rate of reduction in CO₂ emissions from new vehicle fleet in Australia (in the absence of mandatory standards) over last 8 years.

If considered in terms of a uniform rate across 2011–2020, achieving the 2020 targets for each of the stepped scenarios (Scenarios 2–6) represent average annual reductions from 2011 of:

- just over 3% for Scenarios 2 and 4;
- around 3.5% for Scenario 3;
- almost 4% for Scenario 5; and
- 4% for Scenario 6.

On the evidence to date, achieving even more stringent standards than the most stringent scenarios set out in Table 4 would make adjustment to the standards significantly more difficult for manufacturers for a relatively small increase in near-term abatement.
Some have argued that Australia should meet the EU Standards for CO₂ emissions on the same timeframe as the EU because, as noted above, around 85% of light vehicles sold in Australia are imported. While such a target may be technically feasible, relevant considerations would appear to be:

- the different starting points in Europe and Australia;
- the different profile of the vehicle fleet and consumer preferences in Australia;
- that the majority of vehicles imported into Australia do not come from Europe; and
- that meeting the 2020 EU CO₂ target of 95 g/km in 2020 in Australia would require Australia’s light vehicle CO₂ emissions to fall around 7.5% per year over 2011-2020, a rate which is unprecedented internationally²⁵.

### Q5 What rate of CO₂ emissions reduction do you consider is achievable by 2015 and 2020 in Australia?

### Q6 What do you think is a reasonable CO₂ target for the Australian new light vehicle fleet in 2015 and 2020?

### Q7 Are there any impediments to Australia achieving the more ambitious rates of reduction embodied in Scenarios 5 and 6 above?

#### 3.1.4 What are the Costs and Benefits?

The introduction of any mandatory standards will deliver benefits, and may also increase costs. A full analysis of the costs and benefits of options for implementing mandatory standards will be presented in the implementation RIS to be prepared after comments are received on this consultation paper. Preparation of the implementation RIS will include seeking comments from stakeholders on the draft RIS.

However, in broad terms the principal cost associated with standards are the incremental costs per vehicle of meeting the regulation, which would be passed on (to varying extents) to consumers in the form of higher prices in a competitive vehicle market. As indicated in Table 3, estimates of these costs can vary widely depending on the technology adopted. There would also be a loss in Government revenue (excise and GST) from the reductions in the volume of fuel sold.

In economic terms, the principal benefit of the standards arise from the monetary value of the fuel savings, which are clearly linked to the type, quantity and price of saved fuel. As fuel economy improvements lower the relative cost of driving, the evidence suggests this can lead to increases in kilometres driven relative to the baseline (the ‘rebound effect’), which offsets the fuel savings to a limited extent. The US EPA’s cost-benefit analysis of mandatory standards for 2016 for example, used a rebound effect of 10%, meaning that in a cost benefit analysis, 10% of the fuel savings from standards would be offset by additional driving.

In environmental terms of course, the benefits arise from the additional reductions in greenhouse gas emissions and noxious gas emissions from reduced fuel use. These will be assessed in the RIS using an agreed value.

In a range of international studies and regulatory analyses examining mandatory standards the results indicate that the value of fuel savings to consumers is expected to more than offset the value of increased vehicle costs over a reasonable time frame, and that overall, mandatory standards can be expected to deliver significant net financial benefits for motorists and for society, even without including the environmental benefits from CO₂ emissions reductions.

### Q8 Do stakeholders have any information on costs and benefits of standards which would assist the Department of Infrastructure and Transport in the preparation of the cost benefit analysis for the implementation RIS?
3.1.5 Should the Targets be Split?

The discussion above is based on a single target for the whole new light vehicle fleet in a given year, which includes passenger cars, sports utility vehicles (SUVs) and light commercial vehicles (LCVs – utes and vans). Consideration could be given to setting separate targets for passenger vehicles (cars and SUVs) and LCVs as has been done in Europe and the US.

Some manufacturers are active in both sectors of the light vehicle fleet, while others only manufacture passenger cars. In Australia there is a preponderance of light truck/utility type vehicles in the LCV segment, but there is also a considerable blurring of the boundaries between the passenger and commercial segments, with many dual cab utility type vehicles also being used as substitutes for “normal” passenger cars. In Europe the LCV market is dominated by enclosed vans, whereas the US is somewhat similar to Australia, albeit with much larger vehicles.

Prima facie, without evidence of clear benefits in the Australian context, splitting the standard and developing separate targets would complicate the regulatory framework and could potentially reduce flexibility for manufacturers.

Q9 Should Australia set a single set of CO₂ targets for all light vehicles, or is there merit in establishing separate targets for passenger vehicles (cars and SUVs) and for LCVs (utes and vans)?

3.1.6 How should the Target be Calculated?

Consistent with international practice, the Department of Infrastructure and Transport considers that the CO₂ emissions value for each model (and its variants) that is recorded on the standard emissions test under ADR81/02 – Fuel Consumption Labelling for Light Vehicles, should be the basic data element for calculating the CO₂ emissions targets under the standard. ADR81/02 adopts the test used in UNECE Regulation 101.

This CO₂ data is provided to the Department of Infrastructure and Transport via the vehicle type approval certification process which operates under the auspices of the Motor Vehicle Standards Act 1989 and as such, is subject to audit by Department of Infrastructure and Transport. It is acknowledged that the ADR81/02 test result may not always represent “real world” driving, but it does provide a robust and uniform source of data, and it is the only such data available at the individual model level for all light vehicles.

Overseas CO₂ emissions standards also use certification data as the primary data for their CO₂ standards. Some, including those in the US and EU, provide bonus credits for “advanced technology” vehicles such as fully electric vehicles (EVs) and flex fuel vehicles. Support is also provided for other vehicle based technologies which may lower emissions but these emissions reductions are not “captured” in the standard test regime under ADR81/02 (such as tyre pressure monitors, gear shift indicators and efficient air conditioners). It is not proposed to list all the various concessional treatments in this discussion paper, but some examples are given below.

In the EU case for example:

- E85 capable vehicles can have their CO₂ emissions value reduced by 5% for a limited period (until 2015) provided the fuel meets legislated sustainability criteria and at least 30% of the fuel outlets in the country where the vehicle is registered provide E85 for sale;
- manufacturers can seek reductions in emissions targets for particular vehicles through the use of “eco-innovations” – up to a maximum 7g CO₂/km – with the onus on the manufacturer to verify the actual benefits; and
- each vehicle supplied to the market with CO₂ emissions below 50g/km (currently only achievable by EVs) count as 3.5 vehicles in 2012-13, gradually reducing to one vehicle in 2016.

The US, inter alia, provides credits for vehicle air conditioning units that meet certain low energy benchmarks.
Inclusion of such provisions in mandatory CO₂ emissions standards broaden the policy intent of the standards beyond the primary purpose of CO₂ emissions reduction. Policies to include credits such as those outlined above are designed to support/encourage manufacturers to move early to introduce advanced (often expensive) technologies such as hybrids and EVs, and in the case of certain fuels, to provide recognition of claimed life cycle CO₂ benefits not captured in the standard test. Such credit arrangements need to be treated with caution as their merits can in some cases be difficult to quantify accurately (particularly where the claimed benefits are based on estimates of life cycle emissions). Their inclusion is also inconsistent with the general principle of a performance based standard (where every gram of CO₂ saved is treated equally, regardless of the technology). It can also be argued that where such measures have clear merit, they could better be addressed through separate, but complementary, policies outside of the CO₂ standard itself.

Q10 Do you support the idea of bonus credits for new technology vehicles (such as EVs), flex fuel vehicles and other technologies, or should the CO₂ standard be purely performance based, treating all vehicles on the same basis (using the CO₂ emissions result on the standard ADR test)?

Q11 If you support credits, what vehicle types do you consider qualify for a credit and why?

3.2 Regulatory Models

Once targets are agreed, an equally important task is to design an appropriate regulatory model for implementing the new standards. There are a number of issues that will need to be considered in developing a suitable regulatory model for Australia. Key among these are:

1. Determining the methodology for setting targets for individual manufacturers.
2. Identifying the data requirements for:
   a. calculating the emissions targets overall;
   b. measuring the emissions performance of individual legal entities against their defined target; and
   c. providing annual reports to track compliance and, in the target years, measure compliance against overall targets.
3. Assessing whether current data sets are adequate and sufficiently robust for legal enforcement purposes, and if not, consider how best to establish new data sets.
4. Determining whether new primary legislation is required or amending existing legislation is sufficient.
5. Preparing suitable subordinate legislation (regulations).
6. Defining the legal entities which will be subject to the regulations, including questions of enabling manufacturers to “pool” and trade for the purposes of the standards.
7. Determining penalties for non-compliance.

These issues are discussed in more detail below.
3.2.1 Methodology for Setting Targets – What are the Options?

In broad terms, a mandatory standard would set a fleet wide average CO₂ emissions target for a given year(s), which is based on average CO₂ emissions value (in g/km) across all new light vehicle sales for that year(s).

Unless every manufacturer is subject to the same target, the fleet wide CO₂ target declared by the Government would not be the legally binding target applied to individual manufacturers – the fleet target is in essence the Government’s policy goal, which will be achieved if every manufacturer achieves their legally binding individual targets.

In developing a mandatory standard, a mechanism to precisely determine each manufacturer’s targets will need to be determined. There are a number of approaches that could be considered.

The starting point should be to find the simplest model possible that is both cost-effective to administer and equitable for all mainstream manufacturers. However, the differences in product mix between manufacturers supplying the Australian market (and the international experience) suggest that a regulatory approach that is both simple and equitable is not readily apparent.

The EU standards process, for example, considered 3 broad approaches:

- Uniform limits;
- Percentage reductions; and
- Utility based functions (mass and footprint).

All these options should be considered, together with any other viable options that stakeholders may propose. An ICCT assessment of the pros and cons of these various approaches to standards are summarised in Table 5.

Table 5 ICCT Assessment of Advantages (+) / Disadvantages (-) of Various Approaches to Mandatory Emissions/Fuel Economy Standards

<table>
<thead>
<tr>
<th>Factors to Consider</th>
<th>Underpinning Attribute for Mandatory Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flat</td>
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<tr>
<td>Potential for Benefits from:</td>
<td>Powertain Efficiency</td>
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<tr>
<td></td>
<td>Engine Downsizing</td>
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<td>Lightweighting</td>
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<td></td>
<td>Downsizing Sales Shift</td>
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<tr>
<td>Risk of Backsliding Reducing</td>
<td>Category Sales Shift</td>
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<tr>
<td>Benefits from:</td>
<td>Vehicle Sales Shift</td>
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<tr>
<td></td>
<td>Vehicle Weight Creep</td>
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<tr>
<td>Equity Across Manufacturers</td>
<td>–</td>
</tr>
<tr>
<td>Simplicity, Transparency,</td>
<td>+</td>
</tr>
<tr>
<td>Certainty</td>
<td></td>
</tr>
</tbody>
</table>

Source: ICCT Presentation to Improving Fuel Economy Conference (March 2011)
It is worthy of note that in both the US and EU, uniform or percentage based reduction approaches were rejected as inequitable because of the heterogeneous nature of the vehicle model mix produced by different manufacturers (as in Australia), and the relative position and emphasis on fuel consumption improvements across different manufacturers. A summary table of the EU’s assessment of the pros and cons of these approaches is at Appendix B.

The international evidence appears to favour the development of “attribute” or “utility” based standards linked to a target based on the average emissions level of vehicles produced or sold in a given year. Both the EU and US have adopted this approach, albeit using different attributes. These standards set CO₂ emissions targets for each manufacturer linked to a vehicle attribute and with the relationship of the attribute and the CO₂ emissions being defined by a “limit value curve” which ultimately sets the target. In the EU, the limit value curve was established after detailed analysis of the EU fleet by the European Commission (EC) in the reference year 2006 and evaluation of expected trends (see Figure 8)²⁷.

Figure 8  EU 2006 Average CO₂ Emissions per Manufacturer by Mass, Illustrating the Final Limit Value Curve

In the EU system, individual manufacturers must ensure that the average of all their new cars in the target year is below the average of the permitted emissions for those cars as defined by the curve. Under this approach, heavier cars are allowed a higher absolute level of emissions, but to meet the target they will have to improve more than lighter cars. The limit value curve for passenger cars is illustrated in Figure 9.
Figure 9  EU Vehicle Mass Limit Value Curve for Passenger Cars

Source: European Commission (2007)

Figure 10 sets out the US equivalent limit curve, based on footprint rather than mass. The flat lines set upper and lower bounds at either end of the curve.
As part of the work commissioned by the Department of Infrastructure and Transport for the earlier COAG RIS process, the consultant (ACIL Tasman) assessed a range of international models for implementing standards and also concluded in favour of attribute based standards, pointing to a range of difficulties with both uniform and percentage based targets (see Appendix C for more detail from the consultant’s assessment). The EU has chosen vehicle weight as the relevant attribute (see Appendix B for the EU’s summary reasons).

The US has chosen vehicle “footprint” (which is a measure of the area between the wheels of the vehicle). As recently noted by the US National Highway Traffic Safety Administration (NHTSA), while mass is more strongly correlated to fuel consumption, NHTSA considers footprint is a better parameter for mandatory standards in all other respects. NHTSA concluded that footprint better relates to consumer utility (whether for carrying goods or people), is more technology neutral, better from a safety perspective and does not discourage smart design or the use of lightweight materials.

A recent paper by the ICCT also makes a strong case for a footprint approach, particularly for countries which have yet to implement a mandatory standard. A 2008 TNO/IEEP study came to a similar conclusion and the ACIL Tasman analysis of Australian fleet data also concluded that footprint was a more appropriate parameter than mass.
While appearing to be the most practical approach, it is clear the development of an attribute based regulation system would be complex and time consuming. In broad terms, the development of the EU and US standards relied first on the quantification of the current fleet mix for each manufacturer against the specified attribute, followed by the application of the relevant attribute based target values for each model in that mix and ultimately the calculation of the target for that specific manufacturer based on their expected model mix in the target year. It is only this final target figure which is regulated, thus providing manufacturers with the flexibility to produce models above or below their target value, provided that the average value of all of their models sold in the target year meets the specified target.

Q12 Do you support an attribute based standard?

Q13 If so, do you have a preference for mass or footprint?

Q14 If you do not favour an attribute based standard, what is your preferred approach and why?

3.2.2 What are the Specific Data Requirements?

For standards to work, data is required at an individual vehicle (model/variant) level. Department of Infrastructure and Transport considers the key data elements for the CO₂ standards include:

- make, model, variant;
- the CO₂ emissions value(s) and the fuel consumption (L/100km) for the vehicle as per ADR81/02 Fuel Consumption Labelling for Light Vehicles 32;
- any parameters required to measure the “utility” function that may be used in a standard (such as mass, pan area, wheelbase etc);
- other vehicle descriptors which may not be required for the standard, but may assist analysis of trends (e.g. body style, engine size, fuel type); and
- accurate sales volumes at the variant level.

Q15 Do you consider there are any other data elements which might also be required for the standards to be effective and enforceable?

3.2.3 Is the Current Data Set Adequate and Appropriate?

The current voluntary standards and the annual Federal Chamber of Automotive Industries (FCAI) reporting on fleet CO₂ emissions performance are based on the data collected by a private company (POLK) for the FCAI and published as “VFACTS”. The data collected is quite comprehensive - however there are some gaps which would need to be addressed if certain design approaches were adopted. Most notable of these are gaps in vehicle mass data for some passenger vehicles (including locally manufactured vehicles) and an absence of data required to measure vehicle “footprint”, a measure based on wheelbase. Work by the NTC in 2009 also identified gaps (albeit small) in some of the CO₂ data. From discussions with the FCAI, the Department of Infrastructure and Transport understands that there should be no difficulty in supplementing and improving the VFACTS database to address all relevant gaps.

A broader question is whether it is appropriate for the Government to use data collected by a private company linked to the vehicle industry as the primary source of its legislative arrangements, or whether a separate data collection process should be established by the Government for the purposes of the regulations. At face value, it would appear desirable to not duplicate the existing data collection process provided it meets all the data needs for the regulations and is subject to independent audit by the Government to ensure data integrity and accuracy.
In the interests of transparency, it would also appear desirable for the Department of Infrastructure and Transport to make annual CO₂ data collected at fleet, manufacturer and model level for the purposes of the CO₂ standards publicly available online. The Department of Infrastructure and Transport considers there are no issues of confidentiality with such data given model specific data is already published on the Government’s Green Vehicle Guide website.

**Q16** Do you agree that the current VFACTS database (supplemented and audited as necessary) is suitable as the primary data source for assessing and reporting compliance with the standards?

**Q17** Do you also agree that data collected for the purposes of the standard should be made publicly available on an annual basis?

### 3.2.4 What Legislation is Required?

At face value, the scope of the *Motor Vehicle Standards Act 1989* (the Act), which is administered by the Department of Infrastructure and Transport, would appear to provide a suitable regulatory umbrella (primary legislation) under which regulations setting CO₂ standards for light vehicles could be implemented. The relevant extracts from the Act are highlighted below:

The main objects of this Act are:

1. to achieve uniform **vehicle standards** to apply to new vehicles when they begin to be used in transport in Australia; and
2. to regulate the first supply to the market of used imported vehicles.

**vehicle standard** means a standard for road vehicles or vehicle components that is designed to:

1. make road vehicles safe to use; or
2. control the emission of gas, particles or noise from road vehicles; or
3. secure road vehicles against theft; or
4. promote the saving of energy.

However, as the Act refers to uniform standards, some amendments may be required to the Act to enable it to provide a framework for CO₂ standards based on a sales dependent average level of performance applied to individual legal entities (and which is likely to vary across those entities).

While the existing Act appears to provide the basis for suitable primary legislation, the subordinate legislative framework provided by the current Australian Design Rules (the ADRs are legislative instruments under section 7 of the Act) is clearly unsuitable. ADRs (including the noxious emissions ADRs) set common minimum standards for all vehicles within specified categories, are not company specific and have no linkage to sales volumes or average fleet targets for individual manufacturers. The Department of Infrastructure and Transport will investigate a suitable form of regulations for the CO₂ standards (assuming the Act represents suitable primary legislation).

**Q18** Do you agree that the *Motor Vehicle Standards Act* is the most appropriate primary legislation under which to write appropriate CO₂ regulations?

**Q19** If not, what alternative legal framework would you propose?
3.2.5 Who is Responsible?

As a regulatory requirement, legal corporate entities will need to be identified as being subject to the standards. It would not be possible to apply legal requirements on an industry body such as the FCAI (as applied in the voluntary agreements between the FCAI and the Government).

The vehicle manufacturers are the clear starting point for legal responsibility under the regulations, but as some vehicle makes and models are imported into Australia by agents, detailed consideration will need to be given as to the most effective and legally robust means of identifying the entities responsible for reporting performance and being accountable for compliance with the standards.

The merits and practicalities (including any legal issues), of allowing manufacturers to pool together to meet a specific target and to trade emissions “credits” will also need to be addressed. The EU Standards allow for such pooling, but it is not clear yet whether any manufacturer has taken up this option.

Q20 Do manufacturers, particularly importers, have any views regarding the identification of responsible entities under the standards?

Q21 Do you consider there is merit in allowing manufacturers to pool, or is it an approach that manufacturers are unlikely to pursue?

3.2.6 Is Banking and Trading Appropriate?

Where targets are set on an annual basis, there is a potential to design the regulations to allow manufacturers to bank “credits” where they have achieved an emissions outcome better than the legislation requires for that company in the relevant year. This allows a manufacturer to use those credits in future years (subject to maximum timeline) where they might otherwise exceed the required emission limit.

There is also a capacity to expand the system to allow manufacturers holding credits to trade (sell) those credits to other manufacturers.

While providing greater flexibility, such systems increase administrative complexity for both manufacturers and regulators, and as noted above, such systems are effectively only possible in a framework that sets annual targets. Annual targets are currently not being contemplated for the Australian CO₂ standards, but have not been ruled out.

Q22 Do you think there is sufficient merit to warrant the inclusion of banking and trading systems as a feature of Australia’s CO₂ standards?

Q23 Do you agree such systems are only possible where annual targets are set?

3.2.7 What are the Appropriate Sanctions for Non-compliance?

The aim in the Australian regulations should be to implement a transparent system which avoids unnecessary complexity and large administrative burdens, while providing reasonable flexibility for manufacturers to achieve compliance so as to avoid the use of penalties as much as possible. Nevertheless, some form of sanction is required to deter non-compliance. Possible approaches could include a simple “name and shame” approach alone, financial penalties or a combination of both. Banning models or manufacturers from the market for non-compliance would be a draconian approach and difficult to enforce.
A system of financial penalties would seem the simplest way to ensure compliance, as a name and shame approach alone may be an insufficient deterrent (particularly in certain sectors of the market where low emissions performance is not a priority).

Fines are used in both the EU and US standards. Under the EU legislation, manufacturers who fail to achieve compliance with the standards are subject to fines. From 2015 the penalty rate for exceedences is:

\[(€95 \text{ per } \text{g/km over target}) \times (\text{no. of vehicles registered in that year})\].

The US system is more complex. As noted above, it provides a system to enable manufacturers to bank and trade credits for early compliance which can be later used to offset any overshoot of the target. If a manufacturer does not have sufficient credits to offset an exceedence, then, as in the EU, financial penalties apply. The current US regulations state that:

“*The penalty, as adjusted for inflation by law, is $5.50 for each tenth of a mpg that a manufacturer’s average fuel economy falls short of the standard for a given model year multiplied by the total volume of those vehicles in the affected fleet.*”

**Q24 Do you agree that financial penalties are the most effective way to address non-compliance?**

**Q25 If not, what alternative would you suggest?**
Endnotes

1. Australia’s National Greenhouse Gas Inventory; Commonwealth of Australia, Australia’s low pollution future: the economics of climate change mitigation, 2008, p.40
2. Australia’s National Greenhouse Gas Inventory.
6. IEA, Transport, energy and CO₂; Global Fuel Economy Initiative, 50 by 50 global fuel economy initiative: Making cars 50% more fuel efficient by 2050 worldwide, 2009; ClimateWorks Australia, A low carbon growth plan for Australia, 2010; Smith School of Enterprise and Environment Future of mobility roadmap ways to reduce emissions while keeping mobile, University of Oxford, 2010.
7. IEA Transport, energy and CO₂, p. 184.
8. Climate Works Australia, Low carbon growth plan for Australia, 2010, p.73.
17. Light vehicles include all 4 wheeled road vehicles (passenger cars, sports utility vehicles, utilities, vans, light goods vehicles and light buses) up to 3.5 tonnes gross vehicle mass.
18. See for example:


22. See http://www.autocrc.com/files/Image/2009/AA2020TechnologyRoadmap.pdf . The roadmap project was commissioned by the Australian Automotive Industry Innovation Council and supported by the Federal Government and the Victorian State Government. Development of the AA2020 Roadmap was undertaken by AutoCRC, in partnership with the Australian National University, CSIRO and the Institute for Manufacturing at the University of Cambridge.


25. By way of comparison, the EU and the US market recorded average light vehicles improvements of about 10% over the period 2004-2009 (‘Are the latest fuel economy targets achievable?’, Automotive World, AutomotiveWorld.com, 10 July 2010, accessed 12 September 2010).


28. COAG requested the preparation of a RIS to consider the merits of voluntary vs mandatory CO2 standards for light vehicles. The Department of Infrastructure and Transport engaged a consultant (ACIL Tasman) to prepare the RIS, The draft (consultation) RIS was not completed prior to the 2010 Federal Election being called. The Australian Government’s election commitment to mandatory standards means that this COAG RIS process will not proceed.


31. See www.transportenvironment.org/Publications/prep_hand_out/lid/512


34. See www.greenvehicleguide.gov.au
Appendix A — Election Commitment of 24 July 2010
Emission standards for cars

The Gillard Labor Government will cut emissions on our roads by introducing new mandatory carbon dioxide emission standards for all new light vehicles, including cars, from 2015.

This is part of the Gillard Labor Government’s plan to make positive change to how we live, work and travel.

The 15 million light vehicles on Australian roads contribute more than 10 per cent of our nation’s total greenhouse gas emissions.

Modelling undertaken indicates that the new standards could save 2.6 million tonnes of carbon dioxide annually.

Fuel consumption savings

Motorists will see considerable savings at the petrol station. Modelling suggests that Australia could be saving around 1.1 billion litres of fuel worth $1.8 billion every year by 2024.

More fuel-efficient engine technology can be more expensive to make, but modelling demonstrates these potential costs are offset relatively quickly by fuel savings.

A typical motorist could save around $600 a year on fuel costs, with any additional car costs paid off in less than two years.

How will the standards work?

Carbon dioxide emissions from motor vehicles are usually measured in grams of carbon dioxide emitted per kilometre (g/km).

According to the Federal Chamber of Automotive Industries, the national average for carbon dioxide emissions from new light vehicles in Australia in 2008 was 222 g/km.
New legislation will require all car companies to reduce emission levels from vehicles they sell in Australia by introducing better technologies and changing the fleet mix. The levels set will be determined in consultation with industry and stakeholders.

The mandatory standard will set a national fleet-wide target of average carbon dioxide emissions and each individual motor vehicle company will have to contribute to this target.

The four-year transition period will ensure the industry properly prepares and plans for the new standards. The Cleaner Car Rebate will be established to support this transition, so that Australia’s light vehicle sector, which accounts for more than 10 per cent of Australia’s total carbon footprint, can play its part in cutting carbon dioxide emissions.

**How is this different to now?**

Australia has had various forms of industry targets for fuel efficiency since 1978. Various targets, measured in percentage cuts or litres per 100km, have been set over different periods. For example, the 2000 target was 8.2 litres per 100 km.

These targets have been voluntary, and have not delivered the environmental outcomes sought, nor provided investment certainty for the Australian car industry. A national standard, set in legislation, will ensure the Australian car industry focuses on both fuel efficiency and carbon emission standards.

The new system will be based in legislation, and will set a national fleet-wide target for average carbon dioxide emissions. Individual motor vehicle companies must then meet targets set in the regulations, which will define their contribution to the national total.

**When will the standards take effect?**

Average mandatory emission standards of 190 g/km by 2015 and 155 g/km by 2024 would represent cuts of 14 per cent and 30 per cent on 2008 levels respectively. These targets will be the starting point for further consultation.

This will allow industry to plan vehicle production with certainty about the future direction of Australia’s emissions targets.

Given that vehicle technology is developing rapidly to deliver more fuel-efficient and lower-emitting cars, progress against the targets will be monitored over time.

**What types of cars will be affected?**

All new four-wheeled light vehicles with a gross vehicle mass of 3.5 tonnes or less – passenger cars, sports utility vehicles and light commercial vehicles sold in Australia, whether they are imported or manufactured locally – will be included in the standards.

Electric vehicles are an important part of the new range of clean vehicles being developed by the global automotive industry. They promise environmental benefits when powered by renewable and low-emission sources of electricity.
The Australian Government will lead a work program to ensure Australia’s energy markets are ready to support the potential large-scale adoption of electric vehicles and related technologies.

A Gillard Labor Government will, through the Ministerial Council on Energy, ask the Australian Energy Market Commission to identify and address potential barriers to the uptake of electric vehicles.

Issues for consideration will include:

- Metering requirements and protocols.
- Technical and safety standards for electric vehicle connections.
- Network protection.
- The adequacy of current network infrastructure.
- The potential implications for tariffs.

The Australian Energy Market Commission will report and make recommendations on these issues to the Ministerial Council on Energy.

THE COALITION’S RECORD

Tony Abbott does not accept that climate change is real.

✗ Tony Abbott has no plan to improve the fuel efficiency of cars.

If he is elected Prime Minister, Mr Abbott has already made clear that he would cut funding for renewable energy:

✗ Tony Abbott has promised to cut the Green Car Innovation Fund by $270 million, putting at risk the production of new cars in Australia including the Toyota Hybrid Camry, Ford EcoBoost, and Holden Cruze.

✗ Tony Abbott is advocating a ‘direct action’ policy, under which emissions will actually increase. Estimates from the Department of Climate Change and Energy Efficiency show that under Mr Abbott’s policy, emissions would increase by 13 per cent from 2000 levels.

✗ Under the former Coalition Government, Australia was part of the problem on climate change, not part of the solution.

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## Appendix B

### EU Summary Assessment of CO₂ Standards Options
(Uniform Target vs Utility Approach vs Uniform Percentage Reduction)


<table>
<thead>
<tr>
<th></th>
<th>Option 1 Uniform target</th>
<th>Option 2 Utility approach</th>
<th>Option 3 % reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ reductions</td>
<td>624 Mt CO₂ eq.</td>
<td>634 to 638 Mt CO₂ eq.</td>
<td>626 Mt CO₂ eq.</td>
</tr>
<tr>
<td>Cost effectiveness¹</td>
<td>16 to 46 €/ton CO₂</td>
<td>32 to 40 €/ton CO₂</td>
<td>29 to 34 €/ton CO₂</td>
</tr>
<tr>
<td>Competitive neutrality/avoidance of unjustified distortions of competition</td>
<td>☹️/☺️</td>
<td>☺️/☺️</td>
<td>☺️/☺️</td>
</tr>
<tr>
<td>Producers of low emitting vehicles are winners, and high emitters are losers, since the target is the same for all.</td>
<td>☺️/☺️</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Slopes of 74 to 80% for mass and 64 to 67% for footprint achieve the most even distribution of sales-weighted average retail price increase. The most even un-weighted distribution is delivered for slopes of 39% to 47% for mass and 18% to 27% for footprint. For mass, depending on the assumptions in building the curve regarding the evolution of the fleet's mass, the curve could result in reduction requirements below 130g CO₂/km.</td>
<td>☺️/☺️</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Manufacturers of small vehicles get locked in their current market segment, while producers of bigger cars can either reduce CO₂ on their current fleet or develop sales in the small and medium segments.</td>
<td>☺️/☺️</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Social equity</td>
<td>☺️/☺️</td>
<td>☺️/☺️</td>
<td>☺️/☺️</td>
</tr>
<tr>
<td>The option rewards low emitting/small medium vehicle producers, thus maintaining the affordability of the most sold vehicles in Europe. For a high level of fleet averaging/without cross subsidisation, small petrol cars may face higher relative price increases.</td>
<td>☺️/☺️</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>For slopes below 80%, most mainstream manufacturers of small/medium cars representing 80% of the market sales are exposed to below average retail price increases. For mass, impacts on certain small car manufacturers can be seen above a 70% slope. At the vehicle level, for slopes below 60% and without fleet averaging/with cross subsidisation, small petrol cars face lower relative retail price increases than medium and large petrol cars.</td>
<td>☺️/☺️</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Because all manufacturers have to deliver the same relative reduction, manufacturers of small cars (which are already low emitters) face relatively high costs.</td>
<td>☺️/☺️</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Sustainability/compatibility with Kyoto targets</td>
<td>☺️/☺️</td>
<td>☺️/☺️</td>
<td>☺️/☺️</td>
</tr>
<tr>
<td>The target being 130 g CO₂/km for all manufacturer, its delivery will be function of whether the trading system will actually function smoothly, and of the level of the financial penalties.</td>
<td>☺️/☺️</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>For inclinations below 80% the possible perverse incentives to increase mass are avoided. However for mass, depending on the assumptions in building the curve regarding the evolution of the fleet's mass, the curve could result in missing the 130 g CO₂/km target.</td>
<td>☺️/☺️</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Outcome depends on the respective evolution of manufacturers market shares, which cannot be controlled.</td>
<td>☺️/☺️</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>
### Key Issues — Discussion Paper

<table>
<thead>
<tr>
<th>Equity to the diversity of European manufacturers</th>
<th>Option 1 Uniform target</th>
<th>Option 2 Utility approach</th>
<th>Option 3 % reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>☺</td>
<td>☻ Approach favourable, pooling reinforcing this effect.</td>
<td>☻ Approach favourable, pooling reinforcing this effect.</td>
<td></td>
</tr>
</tbody>
</table>

1 The cost-effectiveness calculations are based on the period 2006–2020.

### EU Further Evaluation of Utility Parameter Approach (Option 2) Comparing Mass vs Footprint

The EU assessment concluded Option 2 as the most promising subject to a number of caveats regarding the underlying assumptions in the establishment of the curve, its inclination and function of the utility parameter chosen. The EU’s summary comparison of the relative merits of mass versus footprint parameter in the EU context is set out in the table below.

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>Mass</th>
<th>Footprint</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good measure of utility</td>
<td></td>
<td>+</td>
<td>Mass is a proxy for other utility parameters such as vehicle size, special features. Footprint is directly linked to the utility (e.g. family car vs. mini town car)</td>
</tr>
<tr>
<td>Data availability</td>
<td>++</td>
<td>–/-</td>
<td>Mass readily available and reported. Footprint defined as inner surface between the wheels is not yet reported. Footprint defined as total surface (length times width, also called pan area) is available but not reported yet.</td>
</tr>
<tr>
<td>Impact on manufacturers</td>
<td></td>
<td></td>
<td>Both parameters result in comparable impacts in terms of relative price increase for manufacturers. Mass provides a better distribution of burden between manufacturers overall. Footprint is slightly more favourable to small car manufacturers.</td>
</tr>
<tr>
<td>Understandable</td>
<td></td>
<td>–/-</td>
<td>Footprint defined as the surface within the four wheels is less easy to apprehend.</td>
</tr>
<tr>
<td>Avoids perverse effects/gaming</td>
<td></td>
<td></td>
<td>Perverse effect of mass increase prevented by choosing a slope below 80%. Footprint less likely to be manipulated.</td>
</tr>
<tr>
<td>International compatibility</td>
<td></td>
<td>–</td>
<td>Mass is used for passenger cars in China and the Japan while footprint is used in the U.S. for light trucks</td>
</tr>
<tr>
<td>Allowing all relevant reduction techniques</td>
<td>–/-</td>
<td>++</td>
<td>Mass reduction allows CO₂ reduction Some of its “reduction” potential will be annihilated by a mass based curve. This will be function of the inclination of the line.</td>
</tr>
</tbody>
</table>

Preliminary conclusions suggest a preference for a mass-based system provided perverse effects are avoided and that the future evolution of the AMI is taken into account.

Note: AMI is a reference to Autonomous Mass Increase.
Appendix C

Design Issues for CO₂ Standards
(drawn from unpublished ACIL Tasman 2010 analysis)

Setting Targets

Limits define an upper threshold of emissions that should not be exceeded in any instance, whereas targets set a median value that on average should not be exceeded. With a target system, the overall target to be achieved by a manufacturer can be set at or around the value that is to be achieved, and provided that car sales remain more or less normally distributed above and below the target value (i.e., sales meet the target on average), the overall objective would be achieved. On the other hand, with a limit value system, the sales of vehicles below the limit value are completely unaffected, while those above the limit value are severely affected by heavy penalties or direct exclusion from the market.

In order to minimise the cost of compliance for manufacturers with the mandatory emissions target, it is envisaged that the regulations would include a number of flexibility mechanisms. Such flexibility mechanisms could include:

- Fleet averaging: Vehicle manufacturers could average their CO₂ emissions across their entire fleet of vehicles rather than having to meet the target in relation to each specific model.
- Pooling: Manufacturers could do the same fleet averaging amongst companies belonging to the same group; different manufacturers could be allowed to create a pool on their own initiative and trade the credits they need.
- Trading: An internal trading system could be put in place, whereby manufacturers would buy and sell the credits needed in order to achieve the overall target set by the regulation.

Applying targets to manufacturers’ average fleets rather than individual models allows the manufacturers to decide how best to meet any emissions reduction target. In this case, manufacturers may decide to pursue emissions reductions in models that deliver the necessary reductions at least cost.

Compliance Measures

The most severe penalty for non-compliance with mandatory CO₂ emissions targets for light vehicles is exclusion from the market altogether. However, exclusion attached to a target value for vehicle manufacturers would appear to be only a theoretical possibility. This is because it may be administratively complex, if not impossible, to determine the primary cause for non-compliance in the case of a vehicle manufacturer with a diverse range of models, and in turn to decide which models should be excluded from the market. In addition, excluding certain models from the market could be considered quite inflexible as well as draconian.

As an alternative to excluding certain models from the market, it is envisaged that a mandatory CO₂ emissions target for light vehicles would operate through a system of fines. This is considered to be a more appropriate option, because fines provide a known level of sanction which in turn provides manufacturers and importers with information necessary to make decisions in relation to any compliance measures that could be taken to mitigate the fine.
Possible Approaches

Based on CO₂ emissions and fuel economy standards applying elsewhere, there are several different approaches that could be used to set CO₂ emission standards for light vehicles:

• the Japanese approach, which bases standards on vehicle type and weight
• the European approach, which sets standards according to the mass of the vehicle
• the US “footprint” approach, which links standards to the product of average track width (the distance between the centreline of the tires) and wheelbase (the distance between the centres of the axles)
• the Korean approach, which sets an absolute standard in grams per kilometre, with which all vehicles must comply
• the Chinese approach which specifies standards according to vehicle mass and engine displacement
• the Taiwanese approach, which bases standards on engine size.

These approaches to regulating CO₂ emissions/fuel economy for light vehicles fall into four broad categories:

• a uniform fixed target (UFT) that all light vehicles must not exceed
• a uniform percentage increase in fuel economy applied to all manufacturers
• a standard based on the mass or weight of vehicles (weight-based standards)
• a standard based on other vehicle characteristics, such as size (footprint- or engine-based standards).

Each of these approaches is considered in turn below.

Uniform Fixed and Uniform Percentage Increase Targets

According to an International Energy Agency (IEA) information paper, a UFT for fuel efficiency is perhaps the simplest and most robust regulatory design. It was essentially the arrangement used to set the U.S. CAFE standards for passenger cars prior to model year 2011.

An advantage of a UFT is that manufacturer average targets and tradable credits could be used to allow manufacturers to over-or-under comply in a manner that maximises cost effectiveness. However, several concerns have been expressed in relation to a UFT including:

• difficulties in managing trading systems efficiently
• treatment of different manufacturers not being even-handed
• possible safety and social welfare impacts of excessive down-sizing of vehicles
• the difficulty of estimating costs of compliance.

According to the Joint Transport Research Centre, improvements in fuel economy through standards can be pursued in two ways:

• modification of the mix of new vehicles
• improvements in fuel economy of various types of new vehicles.

A major issue with the imposition of a UFT is its focus on modification of the mix of new vehicles. Because the level of fuel economy achieved is related to vehicle weight, a reasonably tight UFT would discriminate against heavier and more fuel-intensive vehicles in favour of lighter and less fuel-intensive vehicles. According to the Joint Transport Research Centre:
“...if the regulator wishes to reduce the share of fuel-intensive cars (or avoid their widespread adoption), a uniform standard would provide a strong signal in that direction.”

Provided a UFT is not set at a level that is too lax to have any meaningful impact, its achievement is likely to be relatively more costly or perhaps impractical for manufacturers of heavier and more fuel intensive vehicles. For this reason, it could be argued that a UFT discriminates unreasonably against manufacturers of heavier and more fuel-intensive vehicles.

The adoption of a UFT could also have severe ramifications for domestic vehicle manufacturers, which traditionally have specialised in production of passenger vehicles in large and medium passenger vehicle market segments. The imposition of a UFT may adversely affect domestic vehicle manufacturers, even to the point of eliminating their competitive niche and threatening their existence. This would be inconsistent with the Australian Government’s November 2008 policy statement, A New Car Plan for a Greener Future, which was intended to put the Australian automotive industry on a sustainable footing.

Another problem with a UFT is that it may provide little challenge for vehicle manufacturers who produce lighter and less fuel-intensive vehicles. In this situation, the level of fleet-wide fuel economy gains would be much less than if all vehicle manufacturers were required to improve their level of fuel economy. According to Stephen Plotkin of the Argonne National Laboratory in Washington DC, when reflecting on the previous U.S. fuel economy standards that took a UFT approach:

“...manufacturers of small vehicles may be able to comply with the standard without any action to improve efficiency design and technology, while manufacturers of larger vehicles, or a mix of vehicles, may have to take strong measures for compliance.”

Both concerns surrounding a UFT were raised by the Commission of the European Communities when considering what standard the EU should adopt:

“Using a uniform target raises concerns as to the respect of the diversity of European car manufacturers and does not meet the requirement of competitive neutrality for the European car market, as it would penalise manufacturers of larger cars while not providing sufficient incentive for manufacturers of smaller cars to continue reducing their CO₂ emissions once they have reached the level of 130 g CO₂/km in the absence of a trading system.”

Concerns that a UFT would discriminate against manufacturers of larger vehicles could be addressed by selecting a standard that is based on a vehicle attribute that correlates to fuel-intensity. Similarly, concerns that the adoption of a UFT may result in a lower level of fleet-wide fuel economy would also be addressed by the adoption of a standard based on vehicle attributes.

A variation of the UFT is a uniform percentage increase (UPI) approach. A UPI works through requiring each vehicle manufacturer to achieve a fixed percentage improvement in fuel economy from its fleet economy in a base year. Proponents of the UPI approach have argued that it is inherently less discriminatory than a UFT because it would take into account differences in the mix of vehicles sold by the different automakers. According to this view, the primary reason for differences in fleet fuel economy among competing automakers is differences in the type of vehicles they sell, not inherent differences in technical efficiency.

However, a UPI approach has also been criticised on several grounds, as explained by Plotkin, Greene and Duleep:

- It would reward companies that had failed to use the best designs and technologies (and thus have low base-year fuel economy levels) with a relatively low fuel economy improvement target and a complete array of unused technologies to achieve that target.
• It would penalise companies at the leading edge of fuel economy design and technology with high targets coupled with less technological “headroom” to improve their fleets, because they had already used many of the available technologies.

• It would lock manufacturers into existing relative positions, thus inhibiting competition. By locking in each company’s targets according to its fuel economy profile — and vehicle mix — in a particular base year, the UPI approach would severely restrict the ability of companies to move into upscale markets in future years.

• The precedent set by a UPI standard would provide a strong incentive not to perform better than the standard, because future tightening of the standard would penalise those with a higher target based on their superior fuel economy performance.

According to the US National Academy of Sciences, peer-reviewed literature on environmental economics has consistently opposed a UPI standard. It is generally considered the most costly way to meet an environmental standard.

A further difficulty with a UPI approach is that because it is based on past relationships, special care must be taken in dealing with new market entrants with no baseline from which to improve.

Due to the problems inherent in both UFT and UPI approaches, they are considered inappropriate for a CO₂ emissions standard for light vehicles in Australia. Therefore, they will not be considered further.

Weight-Based Standard

The basic notion of a weight-based standard is that vehicle manufacturers producing heavier vehicles have less stringent fuel economy standards or CO₂ emission targets than vehicle manufacturers producing lighter vehicles. Mass or weight is the vehicle attribute most closely linked fuel economy and in turn CO₂ emissions. According to the U.S. Environmental Protection Agency:

“Vehicle weight and performance are two of the most important engineering parameters that help determine a vehicle’s CO₂ emissions and fuel economy. All other factors being equal, higher vehicle weight ... and faster acceleration performance ..., both increase a vehicle’s CO₂ emissions and decrease fuel economy.”

An IEA information paper has opined that there is very good reason to base fuel economy standards on vehicle weight:

“There is a clear reason to differentiate standards on the basis of weight. According to the laws of physics, energy is in direct proportion to mass. Because of this, heavier vehicles with the same technologies, in theory, could not achieve the same fuel-efficiency as lighter ones.”

The main advantage of using a weight-based standard is that it overcomes the relative difficulties faced by manufacturers of heavier vehicles. According to Plotkin, the strength of the correlation between vehicle weight and fuel economy implies that a weight-based standard is likely to be reasonably uniform in the degree-of-difficulty it applies to a diverse set of vehicle manufacturers. Similarly, according to the IEA information paper:

“... if the primary objective of introducing attribute based standards is to cope with equity concerns between manufacturers, standards should be defined on vehicle weight.”

Some have contended that a standard based solely on vehicle weight is essentially neutral to vehicle weight, neither promoting nor discouraging changes to weight.

However, concerns have been expressed that a weight-base standard would not be technology-neutral. Weight-based standards could reduce the attractiveness of cutting vehicle weight as a strategy to improve fuel economy and reduce emissions, resulting in undue reliance on improvements in engine technologies. According to Plotkin:
“An important shortcoming of weight-based standards ... is that they tend to reduce or eliminate weight reduction as a strategy for compliance – since reducing weight, while improving fuel economy, will make the vehicle’s fuel economy target more stringent, with no net regulatory benefit to the company ... Weight reduction can be an important component of fuel economy improvement – obviously, since fuel economy and weight are so strongly correlated. Thus, weight-based standards limit the degree of improvement that a new standard can demand.”

A related concern regarding a weight-based standard is that it may actually provide an incentive for manufacturers to increase vehicle weight. The U.S. Environmental Protection Agency and National Highway Traffic Safety Administration chose a footprint-based standard over a weight-based standard because it was considered that a weight-based standard would be more prone to manipulation by vehicle manufacturers:

“... although the agencies recognize that weight is better correlated with fuel economy and CO₂ emissions than is footprint, the agencies continue to believe that there is less risk of “gaming” (artificial manipulation of the attribute(s) to achieve a more favourable target) by increasing footprint under footprint-based standards than by increasing vehicle mass under weight-based standards—it is relatively easy for a manufacturer to add enough weight to a vehicle to decrease its applicable fuel economy target a significant amount, as compared to increasing vehicle footprint.”

However, these problems are not insurmountable. According to Plotkin, standards based on vehicle weight could be set to provide some incentive to reduce weight by deliberately reducing the stringency of the standard applying for lighter vehicles. While standards would still allow higher emissions for heavier vehicles, the improvements to be made by heavier vehicles would be set higher than for lighter vehicles. This is effectively what the EU has done in designing its standards.

Concern has also been expressed that a weight-based standard may provide vehicle manufacturers with encouragement to move away from producing small cars into the more profitable, larger vehicle market segments. However, it is likely that any shift away from small car production on the part of some vehicle manufacturers will be met primarily with an increase in small car sales by competing companies rather than a shift in buying patterns towards larger cars.

Provided that possible perverse incentives for vehicle manufacturers to actually increase weight can be mitigated, weight-based standards should be considered further.

Other Attribute-Based Standards

In order to address concerns that weight-based standards reduce the incentive for weight reductions to increase fuel economy and reduce CO₂ emissions, a footprint-based standard has been suggested. According to the Joint Transport Research Centre:

“Reducing the weight of a vehicle with the same footprint does not change the goal set by the standard for that vehicle, but it does improve fuel economy. Footprint is also less prone to strategic manipulation than weight, because changing the footprint of existing models is difficult, and increasing it on new models tends to increase weight, which leads to lower fuel economy and/or reduce performance.”

An advantage of a footprint-based standard is that it is technology-neutral, leaving it up to the vehicle manufacturer to decide whether to improve fuel economy through reducing vehicle weight or upgrading engine technology.

However, there is a drawback with a footprint-based standard because a vehicle footprint is much less correlated with fuel economy than is vehicle weight. An IEA information paper has observed that one of the primary reasons for an attribute-based standard is to lessen the discriminatory allocation of the compliance burden among vehicle
manufacturers. However, the author of the paper also opined that in order to lessen discrimination, the attribute providing a basis for the standard should be proportionate to energy required. A potential problem with a footprint-based standard is that reliance on an attribute that is not proportionate to energy requirements could open up loopholes across the entire system. According to the IEA information paper:

“There is no reason why a large footprint, which does not necessarily have to require large energy by the laws of motion, ... should have a less stringent requirement.”

An attribute similar to a footprint is the pan area of a vehicle, which is vehicle length multiplied by vehicle width.

Another attribute that could be used to form the basis of a standard is engine capacity. As is the case with vehicle weight, there is also a close relationship between engine capacity and fuel economy. However, engine capacity has been criticised as an attribute for a standard, because it may discourage vehicle manufacturers from engine-downsizing as a means to achieve CO₂ emission reductions. According to the Institute for European Environmental Policy, using an attribute on which to base a standard that correlates too well with CO₂ emissions discourages the use of that attribute as a means for CO₂ emission reductions. The U.S. EPA has been more strident in its criticism of an attribute based standard based on engine capacity:

“EPA believes that a standard based on engine displacement does not guarantee any environmental benefit because of the disincentive to add certain CO₂-reducing technologies and the potential for manufacturers to adjust the sales of higher-displacement models regardless of whether or not it reflects market demand...”

“...EPA believes that the use of engine displacement for establishing CO₂ tailpipe standards will undermine readily achievable and feasible reductions of CO₂ emissions.”

It is also possible to design a standard based on a combination of measures. However, the Institute for European Environmental Policy explained that this approach was rejected in the EU for two main reasons:

- The composite measure would tend to be difficult to understand.
- Combinations of measures offer literally an infinite range of possibilities and there is no rational basis on which to make a final choice.

For the same reasons, standards based on a composite of measures will not be considered. However, standards based on some measure of the size of the vehicle and on engine size will be considered further.

**Conclusion on Parameter Design Issues**

Based on the above discussion, standards set through either UFT and UPI appear to have major problems. However, weight or footprint based standards warrant further consideration.
References


36. Ibid

37. Ibid


39. Institute for European Environmental Policy, ibid, p. 38

40. In the physical sciences, mass and weight have different properties. Mass is a measure of the amount of matter in a body, while weight is a measure of the force on the object caused by a gravitational field. In everyday use, given that all masses on Earth have weight and this relationship is usually highly proportional, “weight” often serves to describe both properties. For our purposes, both terms, weight and mass, will be used to refer to what strictly speaking is referred to as mass.


42. Onoda, ibid, p32

43. Onoda, ibid, p33


45. Joint Transport Research Centre, ibid, p19

46. Joint Transport Research Centre, ibid and Onoda, ibid

47. Department of Innovation, Industry, Science and Research (2008), Review of Australia’s Automotive Industry 2008: Background Paper, Canberra: Commonwealth of Australia, p1


49. Ibid


51. Commission of the European Communities, ibid, p37


53. Ibid

54. Ibid, p78-79


56. U.S. Congress, Office of Technology Assessment, ibid, p75


58. Onoda, ibid, p34

59. Plotkin 2009, ibid, p. 3850
60. Onoda, ibid, p34
61. Plotkin, Greene, Duleep, 2002, ibid, p. 88
62. Plotkin 2009, ibid, p. 3850
64. Plotkin 2009, ibid, p. 3850
65. Plotkin, Greene, Duleep, 2002, ibid, p. 88
66. Plotkin, Greene, Duleep, 2002, ibid, p. 88
67. Joint Transport Research Centre, ibid, p20
68. Onoda, ibid, p35
69. Plotkin 2009, ibid, p. 3850
70. Onoda, ibid, p35
71. Onoda, ibid, p35
73. Institute for European Environmental Policy (2007), ibid, p54
75. Institute for European Environmental Policy (2007), ibid, p51