Motor Vehicle Environmental Policy Division  
Ministry of Land, Infrastructure and Transport (MLIT)  
2-1-3 Kasumigaseki, Chiyoda-ku  
Tokyo, Japan 100-8918

Dear Mr. Suzuki:

The International Council on Clean Transportation (ICCT) would like to thank the Ministry of Land, Infrastructure and Transport (MLIT) for the opportunity to provide comments on Japan’s proposed 2020 fuel economy standards for light duty vehicles. The goal of the ICCT is to dramatically reduce conventional pollution and greenhouse gas emissions from personal, public, and goods transportation in order to improve air quality and human health, and mitigate climate change. The Council is made up of leading government officials and experts from around the world that participate as individuals based on their experience with air quality and transportation issues. The ICCT promotes best practices and comprehensive solutions to improve vehicle emissions and efficiency, increase fuel quality and sustainability of alternative fuels, reduce pollution from the in-use fleet, and curtail emissions from international goods movement.

We commend Japan for its continuing work to promote more efficient passenger vehicles. In addition to being the home of many of the world’s most efficient automakers, since 1998 Japan has been a leader in developing policies to promote vehicle efficiency including innovations such as attribute-based fuel efficiency standards, the establishment of long standard lead-times, and the world’s first fuel economy standards for heavy-duty vehicles. In addition, Japan has a long history of applying fiscal incentives to reward vehicle fuel efficiency, including levying vehicles taxes and registration fees as a function of vehicle weight and engine size. Taken in sum, these policies, along with the innovative work of its automakers, have helped Japan maintain one of the world’s most efficient passenger vehicle fleets.

In this context, the ICCT offers its perspective on the draft 2020 passenger vehicle fuel economy targets proposed by MLIT on August 19th. We focus our comments here on the following aspects of that proposal:

1) The proposed numerical targets relative to comparable EU and US requirements: On a technology basis the proposed 2020 fuel efficiency targets are less stringent and will require less effort to meet than fuel efficiency standards under consideration in the EU and US. Additional refinements to the proposal are still possible and the ICCT urges MLIT to make changes that would enable targets more consistent with those in the EU and US.
2) The continued use of vehicle mass to scale fuel economy targets to individual vehicles: A size-based fuel economy standard approach will result in a fully technology neutral design that would fully credit the adoption of lightweight materials, and provide a stronger check against vehicle upweighting.

3) Flattening of the standard slope to require larger reductions from heavier vehicles: Flattening of the implied slope of the targets reduces the disincentive for lightweight materials and reduces the incentive to upweight vehicles, but does not overcome the inherent limitations of a mass-based standard.

4) The adoption of a corporate average approach, to be imposed over the traditional binned standard structure: The implementation of the standard via a corporate average approach should also provide manufacturers with increased flexibility to identify least-cost compliance options.

5) The treatment of electric drive vehicles under the standards: MLIT’s assumptions of HEV market share in 2020 are conservative and should be appropriately revised upward.

Each of these topics is considered in brief below, with additional details provided in the Technical Appendix as appropriate.

The proposed numerical targets relative to comparable EU and US requirements

ICCT estimates that MLIT’s proposed 2020 stringency level of 20.3 km/L, or an efficiency improvement of 24% from 2009 levels for MY 2020 vehicles, translates to approximately 105 grams of carbon dioxide (CO₂) per kilometer on the European (NEDC) test cycle, unadjusted for differences in vehicle mass and average horsepower. This compares to anticipated targets of 95 g/km for Europe (2020) and 93 g/km for US passenger cars (2025), also on the NEDC. Normalized by vehicle size, mass, and power-to-weight ratio, ICCT estimates that the anticipated EU targets translate to 89 g/km on the 2009 Japanese fleet, while the proposed US 2025 passenger car targets range from between 76 and 86 g/km for the Japanese fleet, assuming no alternative fuel vehicles and varying degrees of air conditioning credits. On a technology basis (using constant vehicle size, mass, and power-to-weight ratio across the three regions), it is likely that Japan’s 2020 targets will be less stringent than anticipated EU and US standards.

Another way to assess standard stringency is to look at the annual percent increase in fuel economy. The proposed increase of 24% from 2009 levels for MY 2020 vehicles is approximately a 2% per year reduction in fuel consumption. For comparison, for passenger cars the US 2012-16 standards require an annual 4.6% reduction in fuel consumption. The US 2025 standards require further passenger car fuel consumption reduction of more than 4.1% per year, even after adjusting for the various credits allowed. In the EU, a reduction from 2010 average of 142 g/km to 95 g/km in 2020 represents an annual reduction in fuel consumption of about 3.9% per year (4.1% annual increase in fuel economy). Thus, on an annual efficiency improvement basis, the proposed Japanese standards are substantially less aggressive than the anticipated US and EU standards.
The continued use of vehicle mass to assign fuel economy targets to vehicles

As highlighted in several ICCT reports¹, the use of vehicle mass to scale passenger vehicle fuel efficiency targets is problematic. The use of vehicle mass as a scaling factor precludes or at least severely discounts the use of mass reduction, one of the most important means of improving fuel efficiency, to comply with the standard. Moreover, mass is a poor proxy of vehicle utility – all other things being equal, consumers allowed to choose between two vehicles with identical amenities (size, horsepower, safety, etc.) are likely to choose the lighter, more efficient vehicle. Size-based standards, in contrast, manage the potential competitiveness impact of fuel economy standards while allowing manufacturers access to the full suite of technological options to devise cost-effective strategies to improve vehicle efficiency.

Flattening of the slope of the efficiency targets

ICCT commends Japan on the implied slope of the 2020 standards, which will help to mitigate some of the issues raised about weight-based standards outlined above. The drawbacks of a weight-based standard, such as poor crediting of lightweighting technologies and uncertainty about the fleetwide efficiency target that will be met if average vehicle weight increases over time, can be reduced somewhat by adopting a flatter standard slope. Previously, Japan’s passenger vehicle fuel efficiency standards have been notable in part for having a very steep slope, with the 2015 standards in particularly having the steepest slope of any weight-based standard worldwide. Given the slope of the proposed targets to those in the EU and Korea, it appears that further reductions can be made while maintaining the same proposed average standards goal. Of course, even with a flatter slope, efficiency improvements achieved by reducing vehicle weight will still be discounted in a weight-based standard. A size-based standard would provide full credit for use of lightweight materials, while still serving to alleviate any potential competitiveness impacts.

The adoption of a corporate average approach

The ICCT supports use of flexibility mechanisms, such as averaging, banking, and trading (ABT), that are widely used worldwide to provide manufacturers with maximum flexibility to devise cost-effective means of complying with stringent environmental standards. Due to binned averaging approach used in the past, Japanese fuel efficiency regulations have limited the ability of manufacturers to generate credits from the sale of vehicles more efficient than required under the standards, and to use those credits to bring other vehicles into compliance that might be more costly to bring into compliance. MLIT has proposed that Japan’s 2020 targets be implemented via a corporate average approach applicable across all bins, which

should enable a more cost-effective standard by allowing manufacturers to develop flexible and specialized compliance solutions.

**The treatment of advanced technologies**

In contrast to the 2015 targets, hybrid gasoline-electric vehicles (HEVs) have been considered in establishing “Top Runner” vehicles in each weight class, with assumptions about relative sales percentages and smoothing used to establish the proposed 2020 targets. In doing so, MLIT has assumed HEV sales in 2020 of 18%, relative to a current market share of approximately 10% in 2010. As Japan is the market leader in terms of HEV market penetration, the use of HEVs as top runner vehicles is appropriate. As compared with EU and US, the market share assumption of HEVs in 2020 appears to be decidedly conservative (see appendix). Based on the present market share, expected progress in hybrid technology and reductions in battery costs, HEVs in Japan in 2020 timeframe is likely to exceed 25%. A more appropriate assumption regarding HEV market penetration would enable a more stringent fuel economy standard that is comparable to the proposed 2020 EU standard.

While the internal combustion engine is expected to remain the most common means of powering passenger vehicles for the near to mid-term, the past decade has seen the development and deployment of various electric drive powertrains, including plug-in hybrid vehicles (PHEVs) and battery electric vehicles (BEVs), with higher underlying efficiencies. Given their small fraction of current sales, MLIT has proposed that PHEVs and BEVs be excluded from the 2020 targets, while including crediting provisions for manufacturers marketing those vehicles that are proportional to the underlying efficiency of the vehicle. We commend Japan on its proposal to credit automakers for the sale of advanced BEVs and PHEVs in proportion to their underlying efficiency on the JC08 test cycle through the application of appropriate energy conversion factors (3.6 MJ/kWh for electricity and 32.9 MJ/L for gasoline). We believe that this approach is adequate in the near term, although the ICCT recommends use of well-to-wheels emissions accounting for electric drive vehicles in future fuel economy standards.

**Consideration of a 2025 standard**

In sum, we believe MLIT’s proposed 2020 targets to be a step forward in promoting passenger vehicle efficiency in Japan. As mentioned above, Japan has been a leader in developing fuel economy standards with a long lead time. Other countries, notably the United States, are now developing standards for 2020 as well as 2025. The ICCT is contributing its own efforts to the long-term outlook and review of vehicle technology options to reduce fuel consumption and potential costs. These efforts consist of vehicle technology simulations for a wide variety of technologies expected to be available in the marketplace in the 2020-2025 timeframe, as well as potential cost evaluation of these technologies through component-by-component analysis of changes required by making use of vehicle technology teardown analysis. The results of this ongoing work will provide a sound, and representative basis for setting stringent fuel economy standards for passenger cars and light-commercial vehicles in the 2025 timeframe. We would be delighted to share the results of our work with you as you
continue your work to reduce fuel consumption and CO₂ emissions from the transportation sector in Japan.

Thank you again for the opportunity to comment on the proposed 2020 standards. We look forward to hearing of your final decision on this manner, and to future opportunities to provide an international perspective on standard setting in Japan. Please feel free to contact our Japan lead Dr. Dan Rutherord <dan@theicct.org> or our passenger vehicle program lead Dr. Anup Bandivadekar <anup@theicct.org> with any questions, comments and suggestions.

Best regards,

Drew Kodjak
Executive Director, The International Council on Clean Transportation
Technical Appendix

Proposed stringency

Figure 1 compares the passenger vehicle fuel economy standards globally, normalized to gCO₂/km as measured on New European Driving Cycle (NEDC). Note that the figure includes the impact of light-trucks for US and Canada. As shown in the figure, the 2015 Japanese standard are among the strictest in the world, due in part to the fact to the larger share of smaller, lighter cars with smaller engine sizes and power in Japan compared with other Organization for Economic Cooperation and Development (OECD) countries. Going forward, it appears that the EU 2020 standards proposal is more stringent than the Japan 2020 proposal, whereas the proposed policy objectives in US and China are on track to close the gap with Japan dramatically by 2020.

Figure 1: Adopted and proposed passenger vehicle standards by country, NEDC test cycle

Potential of mass-reduction technologies and disincentives for mass reduction under mass-based standards

[1] China’s target reflects gasoline fleet scenario. If including other fuel types, the target will be lower.
Vehicle efficiency can be increased by powertrain efficiency improvement or reducing the loads on vehicles. Powertrain efficiency gains are equally incentivized under either size- or mass-based standards. Most of the reduction of vehicle loads, however, including inertia losses, tire rolling resistance losses, and accessory loads, is realized through mass reduction. In contrast, vehicle size relates only indirectly to aerodynamic losses, which have a relatively minor impact on fuel efficiency compared with these other factors.

The primary goal of standards is to provide an inducement to develop and market more efficient vehicles. Only a size-based standard rewards manufacturers that improve technology and reduce losses (inertia losses as well as losses due to other factors) without changing vehicle size, which is a utility parameter of great value to consumers. Mass-based regulations take away (or discount) the incentive for automakers to lightweight vehicles: if an automaker deployed these lightweighting technologies in a market with mass-indexed standards, they become subject to increasingly tougher standards (Figure 2). As a result, a mass-indexed standard discriminates against an important technology pathway to improve vehicle efficiency.

![Figure 2](image.png)

**Figure 2.** Impact of an identical efficiency-and-lightweighting technology package under size- and mass-based CO2 emission standards

Many engineering studies have shown that deploying lightweight materials, comprehensive mass-optimized vehicle structural designs, and advanced lightweight bonding and forming
techniques can reduce vehicle mass by up to 30% without any compromise in vehicle size or function and with very little increase in component costs.\(^2\) Table 1 summarizes the mass reduction potential of a number of vehicle components and cost increases using a MY 2010 Toyota Venza as the baseline vehicle, according to the 2010 Lotus Engineering study. Although the study used a multipurpose vehicle as the baseline vehicle, the technologies considered can be deployed on other passenger cars and light trucks as well.

<table>
<thead>
<tr>
<th>System</th>
<th>Weight (kg)</th>
<th>2020 Venza</th>
<th>2017 Venza</th>
<th>2020 Venza</th>
<th>2017 Venza</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>383</td>
<td>42%</td>
<td>135%</td>
<td>15%</td>
<td>98%</td>
</tr>
<tr>
<td>Closures/Fenders</td>
<td>143</td>
<td>41%</td>
<td>76%</td>
<td>25%</td>
<td>102%</td>
</tr>
<tr>
<td>Bumpers</td>
<td>18.0</td>
<td>11%</td>
<td>103%</td>
<td>11%</td>
<td>103%</td>
</tr>
<tr>
<td>Thermal</td>
<td>9.25</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Electrical</td>
<td>23.6</td>
<td>36%</td>
<td>96%</td>
<td>29%</td>
<td>95%</td>
</tr>
<tr>
<td>Interior</td>
<td>252</td>
<td>39%</td>
<td>96%</td>
<td>27%</td>
<td>97%</td>
</tr>
<tr>
<td>Lighting</td>
<td>9.90</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Suspension/Chassis</td>
<td>379</td>
<td>43%</td>
<td>95%</td>
<td>26%</td>
<td>100%</td>
</tr>
<tr>
<td>Glazing</td>
<td>43.7</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Misc.</td>
<td>30.1</td>
<td>24%</td>
<td>99%</td>
<td>24%</td>
<td>99%</td>
</tr>
<tr>
<td>Totals</td>
<td>1290</td>
<td>38%</td>
<td>103%</td>
<td>21%</td>
<td>98%</td>
</tr>
</tbody>
</table>

Table 1: Potential for Mass Reduction

Most car manufacturers, including Japanese manufacturers, have or are developing plans to reduce vehicle mass as a core part of the overall technology strategy to meet future fuel economy and CO\(_2\) emission standards. Ford has stated that it intends to reduce the weight of its vehicles by 250 to 750 lbs. per model from 2011 to 2020.\(^3\) On average, this would correspond to a 12% reduction from the current Ford new light-duty vehicle sales fleet in the US. Similarly, Nissan has a target of a 15% mass reduction per vehicle by 2015, representing a 500-lb reduction from their 2008 light duty vehicle average.\(^4\) Mazda’s goal of achieving a 220 lbs. reduction per vehicle is equivalent to a 6% reduction for the company’s current fleet,


and Mazda has indicated that it is targeting an additional 220 lbs. reduction by 2016. Toyota has indicated that it could that it may reduce the mass of the Corolla and mid-size models by 30% and 10%, respectively, in the 2015 timeframe. A mass-based standard will completely or partially fail to reward these efforts to reduce vehicle mass and improve efficiency.

**Flattening of the slope of the efficiency targets**

Conceptually, a “flat” fuel efficiency standard that requires manufacturers to meet the same fuel efficiency target regardless of sales mix can be thought of as an attribute-based standard with no slope. Many of the potential drawbacks of a weight-based standard, such as poor crediting of lightweighting technologies and uncertainty about the fleetwide efficiency target that will be met if average vehicle weight increases over time, can be managed by adopting a flatter standard slope. As Table 2 indicates, Japan’s passenger vehicle fuel economy standards have been the steepest to date, which exacerbates the potential flaws of weight-based standards. The proposed 2020 targets, on the other hand, are much flatter than previously years’ and thus a positive step toward alleviating some of the problems imposed by the weight-based standards. We believe that a further 10 percent reduction in the slope of the standards is possible without substantially worsening competitive positions of the manufacturers.

<table>
<thead>
<tr>
<th>Country</th>
<th>Standard</th>
<th>Slope (L/100km vs. mass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>2015</td>
<td>0.0039</td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>0.0024</td>
</tr>
<tr>
<td>EU</td>
<td>2015</td>
<td>0.0020</td>
</tr>
<tr>
<td>China</td>
<td>2015</td>
<td>0.0036</td>
</tr>
<tr>
<td>Korea</td>
<td>2015</td>
<td>0.0021</td>
</tr>
</tbody>
</table>

**Treatment of advanced vehicles**


6 Ibid.

7 The slope of the standard was calculated by converting all standards in NEDC equivalent l/100km terms, such that a linear regression of the standard would represent: Fuel Consumption (in l/100km) = (Slope) x (Mass) + Constant.
The US Supplemental Notice of Intent for the 2017-2025 model year light-duty vehicle GHG emissions and fuel economy standards proposed roughly 4% annual improvement across the two vehicle categories (passenger cars and light trucks). In the Interim Joint Technical Assessment Report released by the Environmental Protection Agency (EPA) and Department of Transport (DOT) in September 2010, both agencies considered four technology pathways, each with different emphasis and estimates of future technology penetration, to achieve the 4% annual improvement. As one of the major technologies considered in all four pathways, hybrid vehicle penetration ranges from 3% to 41% in MY 2025 fleet depending on the penetration level of other major technologies (Table 3). Scenarios A and D, assume that a 15% mass reduction is achieved across all new US light-duty fleet, in conjunction with a 34-41% market share for HEVs by 2025.

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8 Available online at: http://www.epa.gov/otaq/climate/regulations/ldv-ghg-tar.pdf
### Table 3. Technology paths for 4% annual improvement rate

<table>
<thead>
<tr>
<th>Path</th>
<th>Mass reduction</th>
<th>Gasoline &amp; Diesel vehicles</th>
<th>HEVs</th>
<th>PHEVs</th>
<th>EVs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path A</td>
<td>15%</td>
<td>65%</td>
<td>34%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Path B</td>
<td>20%</td>
<td>82%</td>
<td>18%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Path C</td>
<td>25%</td>
<td>97%</td>
<td>3%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Path D</td>
<td>15%</td>
<td>55%</td>
<td>41%</td>
<td>0%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Assuming a linear increase in light duty hybrid vehicle sales between now (4.3% new HEV market share in 2010) and 2025, it is estimated that an HEV market share of 17%-19% will be required by MY 2020. This penetration rate seems close to what Japan is projecting in its standard proposal. However, given the fact that Japan’s current light duty HEV penetration is much higher than that in the US, the 18% market penetration for 2020 may be too conservative. Applying the same rate of increase in hybrid market share in Japan would lead to a 2020 HEV market share in the range of 25-30%. This increased market penetration of HEVs would enable more stringent fuel economy standards and close the gap between the expected 2020 EU standards and the proposed Japanese standards.