Light-Duty Vehicle Greenhouse Gas Program -- Midterm Evaluation

Robin Moran, U.S. EPA, Office of Transportation and Air Quality
January 10, 2018
Transportation Research Board 97th Annual Meeting
   Session 742 -- Improving Road Travel Fuel Efficiency and Emissions, Part 2: Effective Policies
Overview

• GHG standards & how they work

• Midterm Evaluation of the 2022-2025 standards

• EPA’s technical work to assess key issues
Vehicle CO₂ emissions at record low

Vehicle GHG Standards began year-over-year improvements through 2025
Standards based on Vehicle Size – “Footprint”

CO₂ Footprint Target Curves for Trucks
(Separate footprint curve for Cars)

With a shift from cars to SUVs & trucks, an OEM’s standard becomes less stringent

As sales shift, OEM standards automatically adjust

2025 Projection: ~50 mpg compliance = ~36 mpg real-world
Midterm Evaluation -- Process

• When EPA first set the MY2017-2025 standards in the 2012 rulemaking, EPA committed to a midterm evaluation of MY2022-2025 standards
  • EPA must determine whether the 2022-2025 standards remain appropriate
  • Data-driven, holistic, transparent

• Steps Thus Far:
  ➢ **January 2017**: EPA Administrator McCarthy determined that the MY2022-2025 standards were appropriate and should not change
    • Following public comment on a Draft Technical Assessment Report issued jointly by EPA, NHTSA, and CARB in July 2016, and an EPA Proposed Determination in November 2016

  ➢ **March 2017**: EPA Administrator Pruitt announced he would reconsider the prior determination

  ➢ **August – October 2017**: Public comment & public hearing
    • EPA Administrator also took comment on appropriateness of MY2021 standards, separate from MTE

  ➢ No later than **April 1, 2018**: EPA Administrator has said he will make a new Final Determination (per the EPA regs)
Factors to Consider in Determination

<table>
<thead>
<tr>
<th></th>
<th>2012 Rulemaking – Factors</th>
<th>August 2017 FR Notice – Additional Factors</th>
</tr>
</thead>
</table>
| Technology           | • Powertrain improvements  
                       | • Light-weighting/safety  
                       | • Costs  
                       | • Feasibility  
                       | • Availability  
                       | • Market penetration  
         | • Advanced fuels  
                       | • Approaches to technology projections                                                                 |
| Consumers            | • Consumer acceptance  
                       | • Payback  
                       | • Fuel costs  
         | • Valuation of fuel savings  
                       | • Distributional effects  
                       | • Consumer purchasing & usage behavior (e.g., rebound)                                                                 |
| Fleet                | • Sales & mix  
         |                                                                                                           | • Reference fleet                                                                                     |
| Others               | • Employment  
                       | • Infrastructure  
         |                                                                                                           | • Air quality standards                                                                               |
How is EPA assessing these factors?

EPA continues to evaluate a wide range of information:

- **Public comments**
  - More than 280,000 comments received, mostly from citizens; about 100 comments from organizations

- **Extensive reviews of the literature**
  - Hundreds of reports/papers published in the literature since 2012, including major studies such as the 2015 National Academies of Science (NAS) report

- **Stakeholder outreach & collaboration**
  - Hundreds of meetings with automakers, suppliers, NGOs, consumer groups, labor, states/local governments, others
  - Collaboration with DOE, CARB, Canada
EPA Research: Technology & Modeling

- EPA’s **National Vehicle and Fuel Emissions Laboratory** has been performing state-of-the-art fuel economy and emissions testing since the 1970’s

- In-house **benchmarking testing of 30 vehicles** across wide range of powertrains & segments
  - Provides critical up-to-date engine and transmissions inputs for vehicle simulation modeling
  - All data is publicly available

- In-house **vehicle simulation modeling** (ALPHA)
  - Industry best practice recommended by NAS

- Commissioned **cost teardown studies** of key technologies
  - NAS-recommended best practice

- In-house **technology/cost optimization modeling** (OMEGA)

- Published over **30 peer-reviewed technical papers/reports**
  - Provides transparency and sparks technical feedback
EPA Research: Consumer Issues

- Role of fuel economy in purchase decisions
- **Consumer satisfaction** with fuel efficient technologies
- Consumer **willingness to pay** (WTP) for vehicle attributes
- **Potential tradeoffs**
- Affordability
- Energy paradox (or “energy efficiency gap”)
Consumer Satisfaction

EPA researching in two ways:

1) Professional auto reviews

• RTI coded >1000 auto reviews for each of MY 2014 & 2015 vehicles
  • 21 technologies, 22 operational characteristics (acceleration, handling, braking, etc.)
  • Is any mention of technology or operational characteristic positive, negative or neutral?

• Overall, 69% of mentions of technologies were positive

• Each technology had majority positive ratings

• Few correlations between existence of technology and problems with operational characteristics

2) Survey data of new car owners

• Research underway to conduct similar analyses using actual consumer data (Strategic Vision) for MY2014-2016 vehicles

---

Professional Auto Reviewers’ Evaluations of Fuel Efficient Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>% Positive</th>
<th>Technology</th>
<th>% Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Air Dam</td>
<td>100%</td>
<td>Electric Vehicle</td>
<td>74%</td>
</tr>
<tr>
<td>Active Grill Shutters</td>
<td>88%</td>
<td>Fuel Cell</td>
<td>100%</td>
</tr>
<tr>
<td>Active Ride Height</td>
<td>67%</td>
<td>Stop-Start</td>
<td>55%</td>
</tr>
<tr>
<td>Low Resistance Tires</td>
<td>53%</td>
<td>High Speed Auto. Transmission</td>
<td>65%</td>
</tr>
<tr>
<td>Electric Power Steering</td>
<td>65%</td>
<td>CVT</td>
<td>55%</td>
</tr>
<tr>
<td>Turbocharged</td>
<td>79%</td>
<td>DCT</td>
<td>69%</td>
</tr>
<tr>
<td>GDI</td>
<td>83%</td>
<td>Electric Assist/ Low Drag Brakes</td>
<td>56%</td>
</tr>
<tr>
<td>Cylinder Deactivation</td>
<td>80%</td>
<td>LED Lights</td>
<td>91%</td>
</tr>
<tr>
<td>Diesel</td>
<td>71%</td>
<td>Mass Reduction</td>
<td>89%</td>
</tr>
<tr>
<td>Hybrid</td>
<td>65%</td>
<td>Passive Aerodynamics</td>
<td>78%</td>
</tr>
<tr>
<td>Plug-In Hybrid Electric</td>
<td>63%</td>
<td>Technology Totals</td>
<td>69%</td>
</tr>
</tbody>
</table>


Consumer Willingness to Pay (WTP)

- EPA commissioned RTI (with subject matter expert, Dr. David Greene) to study consumer WTP for vehicle attributes from academic papers from 1995-2015

- Estimated WTP values for many attributes: fuel economy, performance, range, comfort, size, reliability, etc.

- WTP estimates for all vehicle attributes varied tremendously
  - Wide span of negative to positive values
  - Perhaps due to model specification – how well are researchers capturing the vehicle choice decision?

- Any one estimate is likely to be just that – one estimate from a wide distribution
  - Sensitivity analysis using the range is likely to give very uncertain outcomes – which may be all we can say about policy impacts
Potential for tradeoffs with other attributes?

- In the early years of CAFE, vehicles became smaller and less powerful for a while (mid-1970s to early 1980s)

- As fuel efficiency improves, concern often raised that other vehicle attributes might suffer ("tradeoffs")

- Footprint-based standards were intended to mitigate incentives for downsizing

- How will consumers respond ... will there be impacts on other vehicle characteristics?

Technical relationship between power and fuel economy

- EPA has investigated the relationship between performance and fuel economy for different engine technologies, using our ALPHA model.

- New research indicates that technology innovation is flattening the historic tradeoff between fuel economy and acceleration.
  - Win-win: better fuel economy and better performance.

- Advanced technology engines have a “sweet spot” of high efficiency that is better matched to vehicle speed/loads found on compliance test cycles.
  - Improving performance “costs” less fuel because operation remains close to the sweet spot.

![CO₂ as a function of 0-60 time for port fuel injection, gasoline direct injection, and turbo-downsized engines](https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3L4.pdf)

Based on EPA Proposed Determination Technical Support Document, p. 2-247
https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3L4.pdf
Summary

- EPA technical staff are continuing to conduct research on technologies, modeling, consumer, and other issues.

- EPA will continue assessing the many issues surrounding the MY2022-2025 standards using the best available data.

- EPA Administrator plans to make a new Final Determination no later than April 1, 2018.
Thank You

To find out more about the EPA Midterm Evaluation: