DOT’s CAFE Rulemaking Analysis

Kevin Green
Chief, CAFE Program Office
Volpe National Transportation Systems Center

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Roadmap

- What does DOT need to consider in setting CAFE standards?

- How does DOT use the CAFE Compliance and Effects Modeling System to help analyze potential CAFE standards?

- How might DOT approach the next round of CAFE standards for MYs 2022 and beyond?
For starters, what is CAFE?

- **Corporate Average Fuel Economy**
  - “Corporate”
  - “Average”
  - “Fuel economy”

- Why do we have CAFE standards?
  - Congress wanted vehicles to go further on each gallon of gas, in order to reduce energy consumption and our dependence on imported oil
What has CAFE accomplished since the 1970s?
CAFE Milestones During 1975 - 2008

NHTSA issues final regulation increasing light truck standards to 23.0 mpg by 2007

NHTSA proposes footprint-based passenger car and light truck standards, increasing estimated average required CAFE to 31.6 mpg by 2015

NHTSA issues final regulation creating “reformed” (footprint-based) light truck standards increasing to 24.1 mpg by 2011

President Bush issues memorandum announcing decision not to issue final rule for post-2010 CAFE standards

Earlier Milestones
- 1975: EPCA establishes CAFE standards
- 1977: NHTSA issues 1979 LT standard
- 1978: NHTSA issues 1980 LT standard
- 1979: NHTSA issues 1981 LT standard
- 1985: NHTSA issues 1986 PC standard
- 1988: NHTSA issues 1989(+) standard
- 1994: NHTSA issues ANPRM regarding potential increases to LT standards
- 1996: Congress prohibits any use of funds to increase CAFE standards

Congress removes prohibition on use of funds to increase CAFE standards

Congress passes EISA, requiring attribute-based standards at maximum feasible stringency and leading fleet to achieve at least 35 mpg by 2020
President Obama memorandum directing DOT to complete standards for MY 2011 and to coordinate with EPA on CAFE standards for MYs 2012-2016, and directing EPA to reconsider prior EPA decision to deny waiver allowing California to enforce CO2 standards

President Obama memorandum requesting DOT and EPA to collaborate with CARB on a technical assessment, and to then develop a coordinated national program for 2017-2025

President Obama announces agreement with major automakers on National Program for 2017-2025.

NHTSA issues footprint-based passenger car and light truck standards increasing estimated average stringency to 27.3 mpg by 2011

EPA and NHTSA issue Notice of Intent to propose light vehicle GHG and CAFE standards, previewing 250 g/mi CO2eq by 2016

CARB amends light vehicle CO2 standards to allow compliance through compliance with federal CO2 standards

EPA, NHTSA, and CARB “Interim Technical Assessment Report” evaluating potential “technology pathways” to reduce new vehicle CO2 emissions annually by 3-6% through 2025

NHTSA issues final standards increasing estimated average stringency to 40.3-41.0 mpg by 2021 and augural standards that, if finalized, would increase estimated average stringency to 48.7-49.7 mpg by 2025; EPA issues GHG standards reaching estimated average stringency of 163 g/mi CO2eq (54.5 mpg equivalent) by 2025; CARB determines to accept compliance with federal standards as compliance with CARB standards

NHTSA issues CAFE standards increasing average stringency to 34.1 mpg by 2016; EPA issues GHG standards reaching average stringency of 250 g/mi CO2eq (35.5 mpg equivalent) by 2016

NHTSA proposes standards increasing average stringency to 40.9 mpg by 2021 and 49.7 mpg by 2025; EPA proposes GHG standards reaching average stringency of 163 g/mi CO2eq (54.5 mpg equivalent)
Average Achieved Fuel Economy Levels

*post-MY2010 values estimated using MY2010-based forecast
What has Congress directed DOT to consider in setting CAFE standards?

- Standards must be “maximum feasible” for each fleet, each year since the late 1970s
  - Balancing technological feasibility, economic practicability, the effect of other motor vehicle standards of the Federal government on fuel economy, the need of the nation to conserve energy, and safety

- Since Congress passed EISA in 2007, standards must also:
  - Increase ratably from MY 2011 to MY 2020
  - Be attribute-based and defined by a mathematical function
  - Cause the combined national fleet to reach 35 mpg by 2020
  - Include a minimum standard for domestic passenger cars
Attribute - Based CAFE Standards

- Attribute has to be related to fuel economy
  - DOT has used vehicle footprint
  - Footprint = area within rectangle bounded by tires

- Mathematical function relates mpg to the attribute
  - Every vehicle footprint has a fuel economy target

- Required CAFE level for each of a manufacturer’s fleet = production - weighted average of fuel economy targets for vehicles produced

- Compliance determined by comparing actual CAFE level of fleet to required CAFE level (avg of vehicles’ targets)

Mathematical Functions DOT has Used

\[
T = \frac{1}{\frac{1}{a} + \left(\frac{1}{b} - \frac{1}{a}\right) \frac{e^{(x-c)/d}}{1 + e^{(x-c)/d}}}
\]

\[
TARGET = \frac{1}{\text{MIN} \left[ \text{MAX} \left( c \times \text{FOOTPRINT} + d, \frac{1}{a} \right), \frac{1}{b} \right]}
\]

\[
TARGET = \text{MAX} \left( \frac{1}{\text{MIN} \left[ \text{MAX} \left( c \times \text{FOOTPRINT} + d, \frac{1}{a} \right), \frac{1}{b} \right]} \right)
\]
Post - MY2011 CAFE Standards (Pass. Cars)
Post - MY2011 CAFE Standards (Light Trucks)

![Graph showing fuel economy targets and footprints for various years from 2012 to 2025. The graph displays a downward trend in fuel economy targets as footprint increases, indicating efforts to improve fuel efficiency.]
One implication of attribute-based standards? Average requirement depends on fleet mix

<table>
<thead>
<tr>
<th>Model Year</th>
<th>Passenger Cars</th>
<th>Light Trucks</th>
<th>Combined Fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>32.7 - 43.6</td>
<td>25.1 - 36.3</td>
<td>25.1 - 43.6</td>
</tr>
<tr>
<td>2018</td>
<td>33.8 - 45.2</td>
<td>25.2 - 37.4</td>
<td>25.2 - 45.2</td>
</tr>
<tr>
<td>2019</td>
<td>35.1 - 46.9</td>
<td>25.2 - 38.2</td>
<td>25.2 - 46.9</td>
</tr>
<tr>
<td>2020</td>
<td>36.5 - 48.7</td>
<td>25.2 - 39.1</td>
<td>25.2 - 48.7</td>
</tr>
<tr>
<td>2021</td>
<td>38.0 - 50.8</td>
<td>25.2 - 41.8</td>
<td>25.2 - 50.8</td>
</tr>
<tr>
<td>2022</td>
<td>39.8 - 53.2</td>
<td>26.3 - 43.8</td>
<td>26.3 - 53.2</td>
</tr>
<tr>
<td>2023</td>
<td>41.6 - 55.7</td>
<td>27.5 - 45.9</td>
<td>27.5 - 55.7</td>
</tr>
<tr>
<td>2024</td>
<td>43.6 - 58.3</td>
<td>28.8 - 48.1</td>
<td>28.8 - 58.3</td>
</tr>
<tr>
<td>2025</td>
<td>45.6 - 61.1</td>
<td>30.2 - 50.4</td>
<td>30.2 - 61.1</td>
</tr>
</tbody>
</table>

- ranges reflect lower and upper limits of mathematical functions defining standards
- plausible averages of manufacturers’ requirements fall in narrower ranges
What needs to go into a CAFE rulemaking analysis?

- range of regulatory alternatives (standards)
- costs, effects (e.g., fuel savings, CO$_2$ reduction), monetized benefits
- sensitivity analysis (e.g., impact of lower or higher fuel prices)
- uncertainty analysis
- environmental impacts (for EIS issued through NEPA process)
How does the CAFE model meet those needs?

**Inputs**
- market forecast
  - models
  - volumes
  - mpg levels
  - base tech., etc.
- standards
- available technology
  - availability
  - efficacy
  - cost
- economic inputs
  - fuel prices
  - discount rate
  - etc.

**Outputs**
- “response” fleet
  - applied tech.
  - new mpg levels
  - added cost
- compliance status
  - CAFE levels
  - credits
  - fines (if owed)
- national impacts
  - costs
  - travel (VMT)
  - fuel savings
  - emissions

**Model**
- Applies technologies to comply with standards
- Minimizes cost
- Separately for each OEM and model year

To regulatory documents
<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Estimated MY2016 Production</th>
<th>Estimated MY2025 Production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MY2008-Based</td>
<td>MY2010-Based</td>
</tr>
<tr>
<td>Aston Martin</td>
<td>1.0</td>
<td>0.6</td>
</tr>
<tr>
<td>BMW</td>
<td>566.5</td>
<td>423.9</td>
</tr>
<tr>
<td>Mercedes</td>
<td>381.1</td>
<td>347.7</td>
</tr>
<tr>
<td>Chrysler/Fiat</td>
<td>889.6</td>
<td>1,518.8</td>
</tr>
<tr>
<td>Ford</td>
<td>2,323.3</td>
<td>2,393.2</td>
</tr>
<tr>
<td>Geely (Volvo)</td>
<td>144.5</td>
<td>92.2</td>
</tr>
<tr>
<td>General Motors</td>
<td>2,835.0</td>
<td>2,893.9</td>
</tr>
<tr>
<td>Honda</td>
<td>1,449.8</td>
<td>1,658.1</td>
</tr>
<tr>
<td>Hyundai</td>
<td>588.6</td>
<td>983.5</td>
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<tr>
<td>Kia</td>
<td>636.1</td>
<td>378.2</td>
</tr>
<tr>
<td>Lotus</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Mazda</td>
<td>470.6</td>
<td>317.8</td>
</tr>
<tr>
<td>Mitsubishi</td>
<td>140.0</td>
<td>69.8</td>
</tr>
<tr>
<td>Nissan</td>
<td>1,279.2</td>
<td>1,217.3</td>
</tr>
<tr>
<td>Porsche</td>
<td>48.1</td>
<td>39.6</td>
</tr>
<tr>
<td>Spyker</td>
<td>20.0</td>
<td>26.6</td>
</tr>
<tr>
<td>Subaru</td>
<td>309.6</td>
<td>306.6</td>
</tr>
<tr>
<td>Suzuki</td>
<td>115.8</td>
<td>46.7</td>
</tr>
<tr>
<td>Tata (Jaguar/Land Rover)</td>
<td>105.0</td>
<td>81.9</td>
</tr>
<tr>
<td>Tesla</td>
<td>27.3</td>
<td>32.0</td>
</tr>
<tr>
<td>Toyota</td>
<td>3,202.4</td>
<td>2,502.1</td>
</tr>
<tr>
<td>Volkswagen</td>
<td>661.4</td>
<td>589.9</td>
</tr>
<tr>
<td>Total</td>
<td>16.2</td>
<td>15.9</td>
</tr>
</tbody>
</table>

Estimated MY2016 Production
Estimated MY2025 Production
Some Key Modeled Engine Technologies

- Stoichiometric Gasoline Direct Injection (GDI)
- Variable Valve Timing, Variable Valve Lift
- Turbocharging with Engine Downsizing
- High BMEP: 24 bar BMEP available beginning in 2012, 27 bar BMEP in 2017
- Cooled EGR (option for 24 bar engines, assumed required for 27 bar engines)
- Relative to fixed - valve naturally aspirated gasoline engine:
  Projected Effectiveness: 23 - 27% for 24 bar BMEP
  24 - 28% for 27 bar BMEP (low usage in 2025)
- Projected Cost in 2025: $800 - $2500
Some Key Modeled Transmission Technologies

- Greater than 6 speeds
- Dual Clutch Transmission
- High Efficiency Gear Box
- Optimized Shift Control

Relative to a 5-speed automatic transmission:
- Projected Effectiveness: 12% - 19%
- Projected Cost in 2025: $285 - $360
Technology Projections

DOT analysis projects that most OEMs could comply in 2025 by producing an overall fleet with:

<table>
<thead>
<tr>
<th>Technology</th>
<th>% of MY 2025 fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 bar BMEP turbo charged engines</td>
<td>43-57%</td>
</tr>
<tr>
<td>24 bar BMEP turbo charged engines</td>
<td>28-35%</td>
</tr>
<tr>
<td>27 bar BMEP turbo charged engines</td>
<td>5-6%</td>
</tr>
<tr>
<td>Advanced diesel engines</td>
<td>1%</td>
</tr>
<tr>
<td>New transmission with high efficiency gearbox</td>
<td>68-86%</td>
</tr>
<tr>
<td>Shift optimizer</td>
<td>66-86%</td>
</tr>
<tr>
<td>“Mild” Hybrid</td>
<td>9-17%</td>
</tr>
<tr>
<td>“Strong” Hybrid</td>
<td>2-3%</td>
</tr>
<tr>
<td>PHEV+EV</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

**NOTE:** the standards are performance standards, not technology mandates. Manufacturers can choose any technologies to meet the standards. The agency analysis projects one pathway for compliance. Percentages reflect difference in projections depending on MY 2008 vs MY 2010 baseline.
# Sample Model-Level Results (MY2025)

- Technologies commonly estimated as added in combination
  - Engine downsizing with SGDI and turbocharging
  - 8-speed AT with more efficient gearbox and further optimized shifting
  - Mass reduction (3.5% for passenger cars, 7.5% for light trucks)
  - Others (e.g., EPS, lower RR tires) varying among vehicles (per initial content)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Crown Victoria</td>
<td>V8 4.6L</td>
<td>24.5</td>
<td>42.8</td>
<td>57%</td>
<td>4,139</td>
<td>3,829</td>
<td>7.5%</td>
<td>$2,319</td>
</tr>
<tr>
<td>F150 (4wd)</td>
<td>V8 4.6L</td>
<td>20.4</td>
<td>31.0</td>
<td>66%</td>
<td>5,789</td>
<td>5,355</td>
<td>7.5%</td>
<td>$2,349</td>
</tr>
<tr>
<td>Chevrolet Malibu</td>
<td>V6 3.6L</td>
<td>26.5</td>
<td>41.9</td>
<td>63%</td>
<td>3,629</td>
<td>3,502</td>
<td>3.5%</td>
<td>$1,255</td>
</tr>
<tr>
<td>Ridgeline 4wd</td>
<td>V6 3.5L</td>
<td>22.0</td>
<td>35.0</td>
<td>63%</td>
<td>4,555</td>
<td>4,213</td>
<td>7.5%</td>
<td>$1,471</td>
</tr>
<tr>
<td>Genesis</td>
<td>V6 3.8L</td>
<td>28.0</td>
<td>47.1</td>
<td>59%</td>
<td>3,748</td>
<td>3,467</td>
<td>7.5%</td>
<td>$1,600</td>
</tr>
<tr>
<td>Mazda 6</td>
<td>V6 3.7L</td>
<td>25.8</td>
<td>42.2</td>
<td>61%</td>
<td>3,548</td>
<td>3,424</td>
<td>3.5%</td>
<td>$1,500</td>
</tr>
<tr>
<td>Altima</td>
<td>V6 3.5L</td>
<td>29.5</td>
<td>46.5</td>
<td>64%</td>
<td>3,355</td>
<td>3,238</td>
<td>3.5%</td>
<td>$1,372</td>
</tr>
<tr>
<td>Frontier 4wd</td>
<td>V6 4L</td>
<td>20.9</td>
<td>33.8</td>
<td>62%</td>
<td>4,428</td>
<td>4,096</td>
<td>7.5%</td>
<td>$1,603</td>
</tr>
<tr>
<td>Camry</td>
<td>V6 3.5L</td>
<td>29.6</td>
<td>47.6</td>
<td>62%</td>
<td>3,461</td>
<td>3,340</td>
<td>3.5%</td>
<td>$1,520</td>
</tr>
<tr>
<td>4runner 4wd</td>
<td>V6 4L</td>
<td>24.1</td>
<td>41.3</td>
<td>58%</td>
<td>4,750</td>
<td>4,394</td>
<td>7.5%</td>
<td>$1,787</td>
</tr>
<tr>
<td>Tacoma 4wd</td>
<td>V6 4L</td>
<td>22.7</td>
<td>39.1</td>
<td>58%</td>
<td>4,045</td>
<td>3,742</td>
<td>7.5%</td>
<td>$1,770</td>
</tr>
</tbody>
</table>

* excludes 0.9-1.6 mpg upward adjustments for AC and other off-cycle improvements

** cost includes estimated indirect costs and profit
Modeled Fuel Economy Levels in MY2025

- Reference case analysis assuming no market-driven fuel economy increases

<table>
<thead>
<tr>
<th>Fleet</th>
<th>MY2008-Based Forecast</th>
<th>MY2010-Based Forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Passenger Cars</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Requirement</td>
<td>56.2</td>
<td>55.3</td>
</tr>
<tr>
<td>Average Initial* CAFE</td>
<td>30.7</td>
<td>31.5</td>
</tr>
<tr>
<td>Average Achieved** CAFE</td>
<td>52.9</td>
<td>52.1</td>
</tr>
<tr>
<td><strong>Light Trucks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Requirement</td>
<td>40.3</td>
<td>39.3</td>
</tr>
<tr>
<td>Average Initial* CAFE</td>
<td>22.7</td>
<td>23.1</td>
</tr>
<tr>
<td>Average Achieved** CAFE</td>
<td>39.0</td>
<td>37.6</td>
</tr>
<tr>
<td><strong>Overall Fleet</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Requirement</td>
<td>49.7</td>
<td>48.7</td>
</tr>
<tr>
<td>Average Initial* CAFE</td>
<td>27.5</td>
<td>28.1</td>
</tr>
<tr>
<td>Average Achieved** CAFE</td>
<td>47.4</td>
<td>46.2</td>
</tr>
</tbody>
</table>

* Initial CAFE = average fuel economy given current technology
** Achieved CAFE = average fuel economy given added technology
Sensitivity Analysis (Discrete Side Cases)

- Fuel prices
- Rebound effect
- Value of avoiding CO₂ emissions
- Valuation of CH₄ and N₂O (non-zero)
- Military security benefits (non-zero)
- Consumer benefits (less than 100% of theoretical)
- Battery cost
- Mass reduction cost
- Potential for market-driven fuel economy increases (beyond required by CAFE)
- Exclusion of shift optimizer

See Final RIA, Chapter X (pp. 1084 - 1121)
Side Case with Market - Driven FE Increases

- Reference case assumes no additional fuel economy improvements once manufacturer achieves compliance
- Side cases simulate additional fuel economy improvements being applied as long as payback is achieved quickly (examined 1 - , 3 - , and 5 - year payback periods)
- Impacts average achieved fuel economy
- Impacts penetration rates for various technologies
- Example below is for MY2010 - based market forecast and 3 - year payback period given reference case fuel prices
- MY2025 results shown

**Average Achieved Fuel Economy**

<table>
<thead>
<tr>
<th>Fleet</th>
<th>Reference</th>
<th>With Market-Driven FE Increases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Cars</td>
<td>52.1</td>
<td>53.3</td>
</tr>
<tr>
<td>Light Trucks</td>
<td>37.6</td>
<td>39.9</td>
</tr>
<tr>
<td>Overall Fleet</td>
<td>46.2</td>
<td>48.0</td>
</tr>
</tbody>
</table>

**Penetration Rate**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Reference</th>
<th>With Market-Driven FE Increases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbocharging (18 bar)</td>
<td>56.5%</td>
<td>30.8%</td>
</tr>
<tr>
<td>Turbocharging (24 bar)</td>
<td>4.2%</td>
<td>20.5%</td>
</tr>
<tr>
<td>Cooled EGR (24 bar)</td>
<td>24.2%</td>
<td>31.9%</td>
</tr>
<tr>
<td>Cooled EGR (27 bar)</td>
<td>4.9%</td>
<td>10.8%</td>
</tr>
<tr>
<td>Shift Optimizer</td>
<td>65.6%</td>
<td>91.7%</td>
</tr>
</tbody>
</table>
Uncertainty Analysis (Probabilistic)

Monte Carlo method used to vary:

- technology costs
- technology effectiveness
- fuel prices
- potential for market-driven fuel economy increases (beyond required by CAFE)
- passenger car share of the new vehicle market
- average vehicle miles traveled per vehicle
- rebound effect
- value of oil consumption externalities

See Final RIA, Chapter XII (pp. 1122 - 1173)
Uncertainty Analysis – Example of Sampling

Monte Carlo Draw Profile, Combined Fleet, Effectiveness

Turbocharging and Downsizing - Level 2 (24 bar BMEP) - Medium Displacement
Uncertainty Analysis – Example of Results

Combined: Technology Cost for "Preferred Alternative" (2025) at 7% Discount Rate

Number of Instances

Total Incremental Technology Cost ($m)
Next Round of Evaluation / CAFE Rulemaking

- Per EISA (2007), each CAFE rulemaking may cover at most 5 model years
  - This is why the MY 2022 - 2025 standards in most recent CAFE final rule are “augural,” not final

- To establish final standards for MYs 2022 and beyond, DOT must undertake new rulemaking
  - Cannot be simply “the augural standards are OK”
  - Must evaluate meaningful range of regulatory alternatives
  - Must prepare DEIS and go through NEPA process
  - Must set standards separately at maximum feasible levels in each model year

- To help inform new rulemaking, agencies and CARB plan for a joint Technical Assessment in 2017/2018
  - NHTSA’s rulemaking will be concurrent with EPA decision on whether to revise 2022 - 2025 GHG standards
Appendix
Relationship between CAFE and GHG Stds.

- Fuel economy determined based on test fuel properties and vehicle’s CO₂, CO, and HC emission rates, with upward adjustments for technologies (e.g., more efficient AC systems) that reduce CO₂ emission rates under conditions outside “two cycle” fuel economy test procedures.

- GHG determined based on CO₂ emission rate, with corresponding (downward) adjustments for same “off cycle” technologies, and with downward adjustments for technologies (e.g., low-GWP refrigerants) that reduce HFC emissions.

- DOT augural MY2025 standard
  - Given MY2008-based market forecast, average required FE = 49.7 mpg
  - Agencies use value of 8,887 grams CO₂ per gallon of gasoline
  - Assuming all-gasoline fleet, 49.7 mpg is equivalent to 178.8 g/mi CO₂

- EPA MY2025 standard
  - Given MY2008-based market forecast, average required GHG = 163 g/mi
  - Assuming all-gasoline fleet without any adjustments for HFC-reducing technology, 163 g/mi is equivalent to 54.5 mpg

- Differences (49.7 mpg vs. 54.5 mpg, 178.8 g/mi vs. 163 g/mi) reflect projected adjustments (a.k.a. credits) for reducing HFC leakage and HFC GWP.
Earlier Estimates of Potential Response

  - Light Truck standard increased from 20.7 mpg in MY2004 to 22.2 mpg in MY2007
  - Projected to be achievable mostly through wider* use of “conventional” technologies
    - Lower - friction lubricants
    - SI engine design (e.g., reduced friction, VVT, OHV→OHC, cylinder deactivation)
    - 5- and 6-speed transmissions
    - Reduced rolling resistance and aerodynamic drag

- **2006 (MY2008 - 2011 Light Truck Standards)**
  - Light Truck standard reformed and increased to estimated 24 mpg in MY2011
  - Projected to be achievable through wider* use of technologies similar to those in 2003 rule, as well as wider* use of
    - Further SI engine changes (stoic. DI, engine turbocharging/downsizing)
    - 42V systems, reduced accessory loads
    - Hybrids (e.g., ISG) and diesels
    - Reduced vehicle mass

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*“Wider use” does not mean “universal” or “dominant” use. For some technologies, analyses suggested significant application for some manufacturers, yet none for other manufacturers.*
Earlier Estimates of Potential Response (cont’d)

- 2008/9 (MY2011 Standards)
  - Attribute-based standards (per EPCA/EISA)
  - Standards increased to estimated average requirement of 27.3 mpg in MY2011
  - Projected to be achievable through wider use of technologies similar to those in 2006 rule, as well as wider use of DCTs and electric power steering

- 2010 (MY2012 - 2016 Standards)
  - Standards increased to estimated average requirement of 34.1 mpg in MY2016
  - Projected to be achievable through wider use of technologies similar to those in 2009 rule, as well as wider* use of BISG systems and further vehicle mass reduction