LIGHT-DUTY VEHICLE GREENHOUSE GAS STANDARDS: 2025 AND BEYOND

Christopher Grundler, Director
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

September 17, 2015
U.S. GHG/Fuel Economy standards provide significant benefits to climate, oil, consumers

Model Year

GHG Emissions (grams/mile)

Midterm Evaluation

163 g/mi CO₂

54.5 mpg
(if all reductions from fuel economy)

Year-over-year improvements
We are just getting started in effort to avert the worst impacts of climate change
Even With Our GHG Rules

Light Duty GHG Emissions

- We're Headed Here
- But We Need To Go Here

- 2025
- 2030
- 2035
- 2040
- 2045
- 2050
Imagination

Determination

Patience

Cooperation
We Have the Imagination

WE’VE DONE BIG THINGS

- Cars replaced horses in 20 years
  1900–1920

- U.S. Interstate Highway System
  built in 35 years
  1955–1990

- MPG set to double for passenger cars in 15 years
  2010–2025

- Digital navigation replaced paper maps in 15 years
  1995–2010

WE CAN DO BIG THINGS
Auto Industry will change more in the next 10 years than in the last 100

“Regulatory and marketplace demands with respect to fuel efficiency, connectivity, and safety … may well herald a new golden age of automotive innovation”

BCG: Accelerating Innovation: New Challenges for Automakers (January 2014)
What does the future hold … Empty Shelf or Smorgasbord?

“Yet maintaining the current pace of emissions reductions will be challenging because automakers have exhausted available technologies to reduce emissions, leaving “nothing sitting on the shelf”

Alliance of Automobile Manufacturers, Automotive News, March 26, 2015

OR

“We’ve got a whole smorgasbord or buffet of technology that can be implemented”

Mark Reuss, GM President of North America, Automotive News, February 5, 2011
Auto industry ranks 3rd largest sector for global R&D investment

Auto R&D Budget
> $100 Billion/year
(>$270 Million/day)

Source: Booz & Co.
Thompson Reuters lists Fuel Economy among the 5 “hottest areas” of automotive innovation.

<table>
<thead>
<tr>
<th>TOPIC AREA</th>
<th>DEFINITION</th>
<th>CATEGORY</th>
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<tbody>
<tr>
<td>Fuel Economy</td>
<td>Also known as fuel efficiency, or the maximization of the distance traveled on a unit of fuel</td>
<td>Propulsion</td>
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<tr>
<td>Telematics</td>
<td>Global Positioning System technology integrated with computers and mobile communications technology in automotive navigation systems</td>
<td>Navigation</td>
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<tr>
<td>Autonomous Driving</td>
<td>Automobiles that are capable of driving themselves without input from a human passenger</td>
<td>Handling</td>
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<td>Driver Assistance</td>
<td>Various systems such as auto braking, lane departure warning, and traffic sign recognition that help the driver become aware of and avoid road hazards</td>
<td>Safety &amp; Security</td>
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<tr>
<td>Heads-Up Displays (HUDs)</td>
<td>Systems for displaying data from a smartphone to the windshield of an automobile so a driver can keep his/her eyes on the road</td>
<td>Entertainment</td>
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</table>

“Technology is most certainly playing a key role in developing next generation automobiles that will be more fuel efficient, safer, and fun to drive.”
Powertrain suppliers have a key role – and opportunity – to lead innovation

“CAFE regulations are driving just about every innovation activity [in the automotive industry].”
Andy Pontius, Faurecia Chief Technologist, SAE Automotive Engineering, July 2015

Half of the 2015 PACE awards (7 of 14) went to supplier innovations to improve fuel economy

"A new level of efficiency is being achieved with basic science -- new materials and electronics"
J. Ferron, Director of Judging, PACE Awards

Half of the Global Automotive Innovation Challenge awards (6 of 12) were also related to fuel economy technologies
GHG Compliance … Good News So Far

- Automakers beat standards first two years
- Widespread use of credit flexibilities
Manufacturers are aggressively adopting technology
Vehicles are meeting future standards -- with mostly gasoline powertrains, across segments.

### MY2015 Fleet Volume That Meets MY2020 Standards

- **Powertrain Type**
  - Gasoline: 52%
  - Diesel: 24%
  - HEV: 20%
  - PHEV: 3%
  - EV: 1%
  - CNG: 0%

- **Vehicle Class**
  - Small Car: 33%
  - Midsize Car: 29%
  - Large Car: 28%
  - Sport Utility Vehicles: 12%
  - Vans / Minivans: 1%
  - Pickup Trucks: 1%

**Notes:**
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Many of today’s top-selling vehicles* can already meet future standards

<table>
<thead>
<tr>
<th>Model</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
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<tbody>
<tr>
<td>Ford F-150</td>
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<td>Ram 1500</td>
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<td>Chevy Silverado</td>
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<td>Subaru Outback</td>
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<td>Nissan Rouge</td>
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<td>Honda CR-V</td>
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<td>Jeep Renegade</td>
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<td>Mazda 6</td>
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<td>Honda Civic HF</td>
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<td>Hyundai Sonata</td>
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<td>Ford Focus SFE</td>
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- 25 TRUCK configurations meet 2020 or later
- 26 SUV configurations meet 2020 or later
- 63 CAR configurations meet 2020 or later

*At least one variant of vehicle model
Vehicles are meeting future standards with a variety of technologies

<table>
<thead>
<tr>
<th>Engine</th>
<th>Trucks</th>
<th>SUVs</th>
<th>Cars</th>
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<tbody>
<tr>
<td>Diesel</td>
<td>X</td>
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<td>Turbocharging</td>
<td>X</td>
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<td>High Compression Atkinson</td>
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<td>X</td>
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<td>GDI</td>
<td>X X</td>
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<td>Cylinder Deactivation</td>
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<td>X</td>
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<td>Stop-start</td>
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<td>X</td>
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<td>Transmission</td>
<td>8+ Speed Transmissions</td>
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<td>X</td>
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<td>CVT</td>
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<td>X X X</td>
<td>X</td>
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<tr>
<td>Road Loads</td>
<td>Mass Reduction*</td>
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<td>X X</td>
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<tr>
<td>Tires**</td>
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<td>X X X</td>
<td>X X X</td>
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<tr>
<td>Aero**</td>
<td>X X X</td>
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*compared to MY2008 curb weight
** Top 25% of class + other active/passive features
Comprehensive study – good early input to MTE process

Consistent with the Agencies’ 2012 rule analysis, affirmed that 2025 standards can be met through advanced gasoline vehicle technologies

Many recommendations in line with our research plan already underway, others help prioritize
Midterm Evaluation – Overview

- Technical review of longer term standards for 2022-2025
  - In coordination with NHTSA and CARB
  - EPA’s decision could go one of 3 ways:
    - Standards remain same; more stringent; less stringent
Midterm Evaluation – Technology Assessment

- Advanced technology assessment
- Mass reduction feasibility/cost study
- Cost teardowns
- Modeling tools
- Collaboration: NHTSA, CARB, DOE, Canada
• Testing 20+ vehicles/engines across a wide range of powertrains and segments

  ▪ Cars, SUVs, pickups
  ▪ Naturally aspirated and boosted engines
  ▪ Gasoline and diesel
  ▪ I4 and V6 engines
  ▪ 6 and 8+ speed AT/DCT transmissions and CVTs
Midterm Evaluation – Market Research

• Vehicle sales
• Fleet mix changes (cars v. trucks)
• Technology penetration in fleet
• Consumer satisfaction surveys
• Automotive reviews
EPA study finds 4 out of 5 mentions of MY 2014 FE technologies in auto reviews have positive or neutral ratings.

For all technologies, positives outweigh negatives.

Most positives (80-100%)
- active aero, mass reduction, cylinder deactivation, LEDs, GDI, turbocharging

Least positive (but still >50%)
- CVTs and stop-start

But no universal issues with technologies -- some manufacturers implementing better than others.
Midterm Evaluation Timeline

- **2012**: Final Rule 2017 - 2025 Standards
- **2016 June**: Draft Technical Assessment Report (TAR) for public comment
- **2018 April**: Proposed Determination/NPRM for public comment
- **2022**: Final Determination

Going forward

- Extensive stakeholder outreach
- Data-driven
- Transparent: we’ll share results of technical work along the way

www.epa.gov/otaq/climate/mte.htm
“There is such a thing as being too late when it comes to climate change.”

- President Obama, August 3, 2015