EPA’S LIGHT-DUTY VEHICLE EMISSIONS CONTROL PROGRAMS

Bill Charmley, U.S. Environmental Protection Agency
Topics

• Tier 3 Vehicle and Fuels Program

• Light-duty Greenhouse Gas National Program

• Midterm Evaluation of 2022-2025 Light-duty GHG Standards
TIER 3 VEHICLE AND FUELS PROGRAM
• Systems approach to reducing motor vehicle pollution: more stringent vehicle standards enabled by gasoline sulfur control

• Creates a harmonized vehicle program
  – Coordinated with California Low Emission Vehicle (LEV) III standards
  – Enables auto industry to produce and sell one vehicle nationwide

• Part of comprehensive approach to create cleaner, more efficient vehicles
  – Phase in begins model year (MY) 2017
  – Coordinated compliance with both LEV III and light-duty GHG/fuel economy standards for MY 2017-2025
Tier 3 - Air Quality and Health

• Tier 3 standards will have immediate health and air quality benefits when they take effect in 2017
  – Reduce ozone, particulate matter (PM), and toxics

• Help States and Local areas attain and maintain ozone and PM NAAQS
  – Tier 3 provides cost-effective national reductions that avoid more expensive local controls

• Reduce pollution near roads
  – More than 50 million people live, work, or go to school near major roads

“There is not another air pollution control strategy that we know of that will produce as substantial, cost-effective and expeditious emissions reductions.”

—Bill Becker, Executive Director of National Association of Clean Air Agencies
Tier 3 – Vehicle and Fuel Standards

• **Vehicles**
  - Phase in 2017 - 2025
  - Tighter VOC and NOx tailpipe standards
    – 80% reduction from today’s fleet average
  - Tighter PM tailpipe standard
    – 70% reduction in per-vehicle standard
  - Evaporative emissions standards
    – Reduced fuel vapor emissions and improved system durability
  - Revised certification test fuel from E0 to E10 to better reflect in-use gasoline

• **Fuels**
  - Lower annual average sulfur standard from 30 to 10 ppm, starting January 1, 2017
  - Maintain the current per-gallon sulfur caps (80 ppm at refinery gate, 95 ppm at retail)
REDUCING AIR POLLUTION FROM PASSENGER CARS & TRUCKS

TIER 3 VEHICLE & FUEL STANDARDS WILL PROVIDE SUBSTANTIAL POLLUTION REDUCTION AT LOW COST

Strengthening standards for smog-forming volatile organic compounds and nitrogen oxides by 80% Establishing a 70% tighter particulate matter standard

Final fuel standards will reduce sulfur in gas by more than 60% Every car built prior to the standards will run cleaner - cutting a projected 260,000 tons NOx by 2018

Clean gas standards will cost refineries less than a penny per gallon on average

$72 per vehicle in 2025
BY 2030, EPA PROJECTS
ANNUAL PREVENTION OF:

UP TO 2,000 PREMATURE DEATHS

50,000 RESPIRATORY ILLNESSES IN CHILDREN

2,200 ASTHMA ATTACKS

1.4M LOST WORK/SCHOOL DAYS & DAYS WHEN ACTIVITY WOULD BE RESTRICTED

THE FINAL STANDARDS ARE EXPECTED TO PROVIDE
Up to $13 in health benefits for every $1 spent
TO MEET THE STANDARDS
TOTAL HEALTH RELATED BENEFITS IN 2030 WILL BE BETWEEN
$6.7-19 billion annually
Large decreases in ozone design values across the country
- Many counties with decreases over 1 ppb

Also meaningful reductions in ambient PM and air toxics
LIGHT-DUTY VEHICLE
GREENHOUSE GAS
NATIONAL PROGRAM
In 2014 the climate science has become even more certain – and the U.S. prepares for domestic mitigation and global challenges.
Why GHG Emissions Matter

Global Temperature and CO$_2$ Emissions

![Graph showing global temperature and CO$_2$ emissions.](image)

Figure source: updated from Karl et al. 2009

Global Temperature by Decade

![Graph showing global temperature by decade.](image)

Figure source: NOAA NCDC
Why GHG Emissions Matter
Where does the carbon come from?

Carbon Emissions and Sources

Data from Boden et al. 2012

Major North American CO$_2$ Sources & Sinks

Figure source: King et al. 2012
National Program has huge GHG, oil, and consumer benefits

**OBAMA ADMINISTRATION Fuel Economy Standards In the year 2025**

The fleet-wide average will be

**54.5 MPG**

Consumers will have saved

**$1.7 TRILLION**

at the pump over the life of the program.

A family that purchases a new vehicle in 2025 will save

**$8,200**

in fuel costs when compared with a similar vehicle in 2010.

Over the life of the program, the standards will:

Save 12 billion barrels of oil.

Eliminate 6 billion metric tons of carbon dioxide pollution.

This program, together with standards already put into place by this administration for Model Years 2011-2016, will result in significant cost savings for consumers at the pump, dramatically reduce oil consumption, cut pollution and create jobs.
GHG/FE Standards Lay Out a 14-Year Transformation for the Auto Industry - 2012-2025

(2 cycle compliance: CAFE 1978-2011, GHG 2012-2025)
CO₂ standards based on sales-weighted size (footprint) of each manufacturer’s fleet

Cars - CO₂ Target Curves (with sample vehicle footprints)
Separate standard curves for Cars and Trucks

Trucks - CO2 Target Curves (with sample vehicle footprints)

- Subaru Forester
- Nissan Murano
- Ford Escape
- Toyota Tacoma
- Dodge Ram 1500
- Dodge Caravan
- Ford F-150
# 2025 CO$_2$/Fuel Economy Targets and Labels – example vehicles

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Example Model</th>
<th>Footprint (sq. ft.)</th>
<th>2025 CO$_2$ Target (g/mi)</th>
<th>2025 CAFE Target (mpg)</th>
<th>2025 Projected Label (mpg)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cars</strong></td>
<td></td>
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<tr>
<td>Compact car</td>
<td>Honda Fit</td>
<td>40</td>
<td>131</td>
<td>61</td>
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<tr>
<td>Midsize car</td>
<td>Ford Fusion</td>
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<td>147</td>
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<td>Fullsize car</td>
<td>Chrysler 300</td>
<td>53</td>
<td>170</td>
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<td><strong>Trucks</strong></td>
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<tr>
<td>Small SUV</td>
<td>Ford Escape 4WD</td>
<td>43</td>
<td>170</td>
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<tr>
<td>Midsize crossover</td>
<td>Nissan Murano</td>
<td>49</td>
<td>188</td>
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<tr>
<td>Minivan</td>
<td>Toyota Sienna</td>
<td>56</td>
<td>209</td>
<td>39</td>
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<tr>
<td>Large pickup</td>
<td>Chevy Silverado</td>
<td>67</td>
<td>252</td>
<td>33</td>
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</table>

2025 Fleet-wide projection of 54.5 mpg translates to ~ 40 mpg avg. label value
Technology improvements needed for every aspect of vehicle that contributes energy losses…

- Engine, transmission, drive line
- Aerodynamics, tires, brakes
- Accessories (e.g., A/C, EPS, alternators)
- Mass reduction
- Electrification (start/stop, mild HEV, strong HEV, PHEV, EV)
EPA’s Technology Penetrations Project Increasing Use of Advanced Technologies

### Engines and Transmissions
- **Direct Injection**
- **8-speed Transmission**
- **Turbocharged and Downsized**

### Turbocharging
- **18 Bar BMEP or less**
- **24 Bar BMEP**
- **27 Bar BMEP**

### Battery Electric Technologies
- **EV & PHEV**
- **Strong HEV**
- **Mild HEV**
The Economist ranks U.S. GHG/FE Standards as 6th most important action worldwide to cut climate emissions

Curbing climate change: The deepest cuts
Our guide to the actions that have done the most to slow global warming
Sep 20th 2014
The first few years – good news so far

- **Manufacturers are ahead of the game**
  - Fleet-wide industry beat standards by about 10 g/mi (1mpg) for MY 2012, first year of program
  - Huge bank of credits
  - Credit trading between firms for first time in the 40-year history of EPA’s LD vehicle program

- **Consumers appear to love their choices**
  - Sales are booming, even as price tags rise slightly
  - Fuel economy clearly a key marketing tool
    - NADA’s 2014 New Car Shopper Preference Survey ranks fuel economy the #1 most important factor considered in purchasing for both cars and trucks
Fleet-wide progress is steady

- Reduced-emissions vehicles are being produced in significant volumes
GHG high performers: It’s not just hybrids

- A number of non-hybrid gasoline and diesel vehicles in 2015MY already meet their footprint-based GHG targets for future years

<table>
<thead>
<tr>
<th>2015MY Vehicles meeting and surpassing GHG targets for ...</th>
<th>2017</th>
<th>2019</th>
<th>2021</th>
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</thead>
<tbody>
<tr>
<td><strong>Cars</strong></td>
<td>Toyota Camry</td>
<td>Dodge Dart Aero</td>
<td>GMC Canyon</td>
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<tr>
<td></td>
<td>Volkswagen Golf</td>
<td>Honda Accord</td>
<td>Mitsubishi Outlander</td>
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<td></td>
<td>Buick Lacross</td>
<td>Ford Fiesta SFE</td>
<td>Nissan Pathfinder</td>
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<td>Subaru Legacy</td>
<td>Nissan Altima</td>
<td>Range Rover Evoque</td>
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<td></td>
<td>Chevrolet Malibu</td>
<td>Toyota Corolla LE Eco</td>
<td>Subaru Forester</td>
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<td></td>
<td>Buick Regal</td>
<td>Chevrolet Cruze ECO</td>
<td>Nissan Rouge</td>
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<td></td>
<td>Volvo V60</td>
<td>Mazda MAZDA3</td>
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<tr>
<td></td>
<td>Acura TLX</td>
<td>Honda Fit</td>
<td>BMW 328d xDrive</td>
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<td></td>
<td>Hyundai Tucson</td>
<td>Hyundai Sonata</td>
<td>BMW X5 xDrive 35d</td>
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<td></td>
<td>Toyota Tacoma</td>
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<td>Ram 1500</td>
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<tr>
<td><strong>Minivans</strong></td>
<td>BMW X3 xDrive 28i</td>
<td>GMC Canyon</td>
<td>Mazda MAZDA6</td>
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<td></td>
<td>Jeep Cherokee</td>
<td>Range Rover Evoque</td>
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<td></td>
<td>Ford Escape</td>
<td>Subaru Forester</td>
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<tr>
<td></td>
<td>Nissan Pathfinder</td>
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<td>Chevrolet TRAX</td>
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<td>BMW X3 xDrive28d</td>
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<td>Hyundai Tucson</td>
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<td>Toyota Tacoma</td>
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<tr>
<td><strong>SUVs/Pickups/Crossovers</strong></td>
<td>BMW 535d</td>
<td>Honda Odyssey</td>
<td>BMW 328d xDrive</td>
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<td>Mercedes-Benz E250</td>
<td>Nissan Quest</td>
<td>BMW X5 xDrive 35d</td>
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<td></td>
<td>Bluetec 4Matic</td>
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<td>Ram 1500</td>
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</table>

+ vehicles meeting future year targets

Increased Stringency / Reduced Emissions
Many new technologies are rapidly gaining market share
Consumers have an increasing number of high FE/low CO₂ vehicle choices.
MIDTERM EVALUATION OF THE 2022-2025 LIGHT-DUTY GHG STANDARDS
• Technical review of longer-term standards (2022-2025)

• In coordination with NHTSA and California Air Resources Board

• EPA’s decision on the 2022-2025 standards could go one of 3 ways:
  • standards remain appropriate; more stringent; less stringent

• Data driven, transparent

• Extensive stakeholder dialogue to gather data/information
What factors will we consider for the Midterm Evaluation?

- Powertrain improvements
- Light-weighting and impacts on vehicle safety
- Market penetration of fuel efficient technologies
- Consumer acceptance
- Payback periods for consumers
- Fuel prices
- Fleet mix
- Infrastructure
- Employment impacts
- Many others …
Midterm Evaluation Major Milestones

  - Agencies will request public comment on the Draft report

- EPA Proposed Determination (on whether 2022-2025 standards are appropriate)
  - EPA will request public comment on the Proposed Determination

- EPA Final Determination (on whether 2022-2025 standards are appropriate) no later than April 2018
EPA’s National Vehicle and Fuel Emissions Laboratory has many technical projects underway to support the Midterm Evaluation

- Through our National Center for Advanced Technology (NCAT) group, researching future advanced engine and transmission technologies to support modeling, advanced technology testing, and demonstrations
- Continued development of modeling tools:
  - Vehicle simulation modeling (ALPHA - Advanced Light-Duty Powertrain and Hybrid Analysis)
  - Technology feasibility and cost model (OMEGA - Optimization Model for reducing Emissions of Greenhouse gases from Automobiles)
  - Technology packages efficiencies (Lumped Parameter Model)
  - Exploring potential use of consumer choice modeling
- Mass reduction study with FEV for a full-size pickup
- Continued cost teardown work with FEV on mild hybrid, diesel, others
- Research on consumer issues – content analysis of auto reviews, consumer satisfaction surveys, affordability
- Continued work on economic issues (VMT rebound, energy security)
- In addition to working with CARB and NHTSA, EPA is collaborating with Environment Canada and Transport Canada on aerodynamics, light-weighting, vehicle modeling, and other areas
• EPA’s standards for criteria emissions and GHGs provide important air quality, public health, and climate benefits

• Already seeing exciting auto industry innovations as year-over-year improvements needed to meet the 2025 targets

• So far auto industry is off to a good start, even beating the standards

• We look forward to dialog with all stakeholders to inform the Midterm Evaluation of 2022-2025 standards
Non-hybrids are closing the gap

- Today, non-hybrids have many technologies emphasized in early hybrids
  - Improved aerodynamics
  - Low rolling resistance tires
  - Increased use of lightweight materials
- Since 2004, the difference between average hybrid and non-hybrid midsize cars has narrowed from 24 to 15 mpg.