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# Light-Duty Vehicles, Air Pollution, and Climate Change

On August 5, 2021, President Biden signed Executive Order 14037, "Strengthening American Leadership in Clean Cars and Trucks" (86 *Federal Register* 43583). The order required, among other items, executive agencies to revisit and amend the federal standards that regulate air pollution emissions, greenhouse gas (GHG) emissions, and fuel economy of new passenger cars and light trucks. These standards include the Motor Vehicle Emission and Fuel Standards promulgated by the U.S. Environmental Protection Agency (EPA), the Corporate Average Fuel Economy (CAFE) Standards promulgated by the National Highway Traffic Safety Administration (NHTSA), and the Light-Duty Vehicle GHG Emissions Standards promulgated by EPA. The order also included a nonbinding electrification goal that "50 percent of all new passenger cars and light trucks sold in 2030 be zero-emissions vehicles, including battery electric, plug-in hybrid electric, or fuel cell electric vehicles." EPA published its proposal—the "Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles"—on May 5, 2023 (88 *Federal Register* 29184). NHTSA published its proposal—the "Corporate Average Fuel Economy Standards for Passenger Cars and Light Trucks for Model Years 2027– 2032"—on August 17, 2023 (88 *Federal Register* 56128).

## Emissions from Light-Duty Vehicles

The light-duty vehicle (LDV) and medium-duty vehicle (MDV) sectors (defined at 40 C.F.R. §86 and 49 C.F.R. §523) generally include passenger cars, light trucks, and most sport utility vehicles; as well as class 2b and class 3 trucks such as large pickups and vans. EPA reports that these vehicles contribute to air pollution, such as "ozone, particulate matter, and air toxics, which are linked with premature death and other serious health impacts, including respiratory illness, cardiovascular problems, and cancer." The agency estimates that LDVs and MDVs currently account for approximately 11% of the United States' annual anthropogenic emissions of nitrogen oxides ($NO_x$), 8% of volatile organic compounds (VOC), and 1% of fine particulate matter ($PM_{2.5}$). Further, according to EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021 (published April 2023), LDVs emitted over 1 billion metric tons of GHGs in 2021, or 17% of the United States' annual anthropogenic emissions of GHGs.

## Agency Authorities

### EPA's Air Pollution Standards

Section 202 of the Clean Air Act Amendments of 1970 (CAA; P.L. 91-604, as amended) requires EPA to establish standards for emissions of air pollutants from new motor vehicles which, in the Administrator's judgment, cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. Standards under Section 202 must also consider issues such as technological feasibility, the cost of compliance, and industry lead time, among other items. EPA has since promulgated standards for emissions of nonmethane organic gases (NMOG), NOx, PM, carbon monoxide (CO), and formaldehyde (an air toxic).

### NHTSA's CAFE Standards

The Energy Policy and Conservation Act of 1975 (EPCA; P.L. 94-163) established CAFE standards for passenger cars beginning in model year (MY) 1978 and for light trucks beginning in MY1979. The standards are designed primarily to conserve petroleum. They require each auto manufacturer to meet a target for the sales-weighted fuel economy of its entire fleet of vehicles sold in the United States in each model year. Under EPCA, CAFE standards and new vehicle fuel economy rose steadily through the late 1970s and early 1980s. After 1985, Congress did not revise the legislated standard for passenger cars for several decades, and it remained at 27.5 miles per gallon (mpg) until 2011. The light truck standard was increased to 20.7 mpg in 1996, where it remained until 2005. In 2007, Congress enacted the Energy Independence and Security Act (P.L. 110-140), mandating a phase-in of higher CAFE standards reaching 35 mpg by 2020. This was the last legislation passed by Congress to set fuel economy goals.

### EPA's GHG Standards

In the 2007 decision *Massachusetts v. EPA*, the Supreme Court held that EPA has the authority to regulate GHGs from new motor vehicles as "air pollutants" under CAA Section 202. In the 5-4 decision, the Court's majority concluded that EPA must decide whether GHG emissions from new motor vehicles contribute to air pollution that may reasonably be anticipated to endanger public health or welfare or provide a reasonable explanation why it cannot or will not make that decision. In December 2009, EPA promulgated findings that GHGs endanger both public health and welfare and that GHG emissions from new motor vehicles contribute to that endangerment (74 *Federal Register* 66495). With these findings, the CAA required EPA to establish standards.

## Current Standards

### Air Pollution Standards

The most recent air pollution standards for LDVs are referred to as Tier 3 (79 *Federal Register* 23414). Tier 3 standards were finalized in March 2014, to be phased-in between 2017 and 2025, and closely align with California's Low-Emission Vehicle (LEV) III program. Manufacturers must meet fleet-average tailpipe emissions standards for NMOG + NOx, PM, CO, and formaldehyde in a given model year across several different test cycles. Tier 3 also includes standards for low-sulfur fuel, evaporative emissions, and on-board diagnostics, as well as compliance

flexibilities such as an emissions averaging, banking, and trading program.

### CAFE and GHG Standards: Rulemakings

EPA's current set of GHG emissions standards (86 *Federal Register* 74434), promulgated in December 2021, extends through MY2026, culminating in a projected industry fleet-wide GHG compliance target of 161 grams/mile (g/mi). NHTSA's current set of fuel economy standards (87 *Federal Register* 25710) also extends through MY2026, culminating in a projected industry fleet-wide fuel economy target of 49 mpg.

### CAFE and GHG Standards: Attributes

The agencies' fuel economy and GHG standards apply to the new fleet of passenger cars and light trucks sold by a manufacturer within the United States during a given model year. Starting with the standards finalized in 2010, the agencies have used the concept of a vehicle's "footprint" (i.e., the measured area enclosed by the four tires) to set differing targets for different-sized vehicles, all of which increase in stringency year after year. Generally, the larger the vehicle footprint, the lower the corresponding fuel economy target and the higher the $CO_2$-equivalent emissions target. This concept differs from the original CAFE standards, which grouped domestic passenger cars, imported passenger cars, and light trucks into three broad categories. The newer, "attribute-based standards" enable manufacturers to produce a range of vehicle sizes rather than designing a lighter and smaller vehicle fleet overall to meet categorical targets.

Manufacturers must report vehicle characteristics sold each model year. These data allow EPA and NHTSA to calculate each manufacturer's CAFE and GHG targets under the standards given the specific pattern of sales. The agencies then compare the calculated targets against the vehicles' fuel economy and emissions results from EPA-approved test cycles to determine compliance. To facilitate compliance, the agencies provide manufacturers various flexibilities. A manufacturer's fleet-wide performance (as measured on the test cycles) can be adjusted through the use of alternative fuel vehicles, air conditioning efficiency improvements, and "off-cycle" technologies (e.g., active aerodynamics, thermal controls, and idle reduction). Further, manufacturers can generate credits for over-compliance with the standards in a given year. They can bank, borrow, and transfer these credits within their own fleets or trade them with other manufacturers to achieve compliance.

## NHTSA's 2023 Proposal

NHTSA's 2023 proposal includes new fuel economy standards for passenger cars and light trucks for MY2027-MY2031, as well as augural standards for MY2032, that would increase at a rate of 2% per year for passenger cars and 4% per year for light trucks. The agency currently projects that the proposed standards would require an industry fleet-wide average for passenger cars and light trucks of roughly 58 mpg in MY2032. NHTSA projects that the proposed standards would reduce U.S. gasoline consumption by a total of 88 billion gallons and would reduce average fuel outlays by $1,043 per vehicle over the lifetimes of the LDVs under compliance.

## EPA's 2023 Proposal

**Air Pollution Standards.** EPA's 2023 proposal for LDVs (Tier 4) includes NMOG + $NO_x$ standards that would phase-down to a fleet average of 12 milligrams (mg)/mi by MY2032, representing a 60% reduction from the existing Tier 3 standards. The MDV proposal would see a 66% and 76% reduction, for 2b and class 3 vehicles, respectively. EPA is also proposing a PM standard of 0.5 mg/mi.

**GHG Standards.** EPA's 2023 proposal for LDV GHG standards would increase in stringency each year from MY2027 to MY2032. The agency projects the proposed standards would result in an industry-wide average target for the light-duty fleet of 82 g/mi of $CO_2$ in MY2032, representing a 56% reduction relative to the existing MY2026 standards. Additional components of the proposal include, among other items, narrowing the difference in stringency between passenger cars and light trucks, phasing out the off-cycle credit programs, and rescinding regulations that would consider upstream power sector emissions tied to electric vehicle use, which are to start in MY2027.

In projecting potential industry compliance, EPA estimates that one potential pathway to meet the proposed standards would be through

- about 67% electric vehicle penetration in MY2032 across the combined LDV fleet;
- about 40% electric vehicle penetration by MY2032 across the combined MDV fleet;
- widespread use of gasoline particulate filters to reduce PM emissions; and
- improvements in technology to reduce GHGs from conventional gasoline vehicles.

Manufacturers could also choose to employ hybrid or plug-in hybrid technologies to help meet the proposed standards.

EPA estimates that the total benefits of the proposal exceed the total costs, with net present value of benefits in the range of $850 billion to $1.6 trillion. EPA calculates that between $63 billion and $280 billion of total benefits are attributable to reduced emissions of air pollutants; $330 billion to climate benefits; $450 billion to $890 billion to fuel savings; and $280 billion to $580 billion to repair and maintenance savings, through 2055. Estimates for compliance costs for vehicle technology range from $180 billion to $280 billion, or by about $1,200 per vehicle on average in MY2032.

EPA contends that its proposal builds upon announcements by automakers that collectively signal a rapidly growing shift away from internal-combustion engine technologies and toward zero-emission technologies, including electrification. Further, the agency points to P.L. 117-58 (the Infrastructure Investment and Jobs Act) and P.L. 117-169 (commonly referred to as the Inflation Reduction Act), which provide investment to accelerate the development of and market for zero-emission technology. Incorporating these initiatives, EPA provides a "no action" analysis in the proposal that estimates an electric vehicle penetration of 52% by MY2030 in the absence of the proposed rule.

**Richard K. Lattanzio**, Specialist in Environmental Policy

IF12433

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