UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 14,414 (Mar. 28, 2022)

Docket No. EPA-HQ-OAR-2019-0055
Via Regulations.gov
May 16, 2022

COMMENTS OF ENVIRONMENTAL AND PUBLIC HEALTH ORGANIZATIONS

Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club ("Commenters") respectfully submit these comments in response to the Environmental Protection Agency's (EPA) Proposed Rule for Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards, 87 Fed. Reg. 17,414 (Mar. 28, 2022) (the "Proposal"). Many of the materials cited in these comments are attached as exhibits and are listed in the "List of Attachments."

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TABLE OF ACRONYMS

ABT	Averaging, Banking, and Trading Program
ACEEE	American Council for an Energy Efficient Economy
ACF	Advanced Clean Fleets
ACT	Advanced Clean Trucks
ALA	American Lung Association
ANL	Argonne National Laboratory
BEV	Battery Electric Vehicle
CARB	California Air Resources Board
CATL	Contemporary Amperex Technology Co. Limited
CEQ	The White House Council on Environmental Quality
DEF	Diesel Exhaust Fluid
DMV	Department of Motor Vehicles
DOT	Department of Transportation
DRIA	Draft Regulatory Impact Analysis
EDF	Environmental Defense Fund
EFS	NREL Electrification Futures Study
EIA	Energy Information Agency
FCEV	Fuel Cell Electric Vehicle
FHWA	Federal Highway Administration
FTP	Federal Test Procedure
GHG	Greenhouse Gas
GSA	General Services Administration
HD ZEV	Heavy-Duty Zero-Emission Vehicle
HDE	Heavy-Duty Engine
HDV	Heavy-Duty Vehicle
HEV	Hybrid Electric Vehicle
HHDE	Heavy Heavy-Duty Engine
ICCT	International Council on Clean Transportation
IPCC	United Nations Intergovernmental Panel on Climate Change
ISA	Integrated Science Assessment
IWG	Interagency Working Group on the Social Cost of Greenhouse Gases
LADOT	Los Angeles Department of Transportation
LLC	Low-Load-Cycle
MFN	Moving Forward Network
MOU	Memorandum of Understanding
MOVES	Motor Vehicle Emissions Simulator

MY	Model Year
NEI	National Emissions Inventory
NEMS	National Energy Modeling System
NESCAUM	Northeast States for Coordinated Air Use Management
NHTSA	National Highway Traffic Safety Administration
NREL	National Renewable Energy Laboratory
NTE	Not-to-Exceed
OMB	Office of Management and Budget
PM	Particulate Matter
REV Midwest	Regional Electric Vehicle Midwest Coalition
SC-GHG	Social Cost of Greenhouse Gases
SCR	Selective Catalytic Reduction
SET	Supplemental Emission Test
SRIA	Standardized Regulatory Impact Analysis
TCO	Total Cost of Ownership
UCS	Union of Concerned Scientists
VMT	Vehicle Miles Traveled
WRI	World Resources Institute
ZETI	CALSTART's Zero-Emission Technology Inventory

I. INTRODUCTION

With this rulemaking, EPA has an opportunity to take critical steps toward addressing the public health burdens, environmental injustices, and climate dangers caused by heavy-duty vehicles (HDVs) powered by internal combustion engines. More than a decade after EPA's existing criteria pollutant standards took effect, communities continue to suffer the impacts of air pollution from these vehicles. EPA must set strong emissions standards for both criteria pollutants and greenhouse gases (GHGs) in this rulemaking to achieve critically necessary protections to public health and welfare, especially in light of the feasibility and increasing fleet penetration of zero-emission technologies. We also urge EPA to finalize the rule before the end of this calendar year, particularly the criteria pollutant standards given statutory lead time requirements, so that the new standards take effect in model year (MY) 2027. *See* 42 U.S.C. § 7521(a)(3)(C). Finalizing quickly is critical to avoid unjustifiably withholding both necessary GHG reductions and the air quality benefits that overburdened communities need now.

In these comments, Environmental and Public Health Organizations (specifically Clean Air Task Force, Environmental Law & Policy Center, National Parks Conservation Association, and Sierra Club) make the following points:

Section II: Section 202 of the Clean Air Act requires EPA to promulgate emissions standards that prioritize public health and welfare. To enable EPA to carry out this mandate, Congress directed the Agency to set technology-forcing standards that spur improvements in emissions control technologies. The record of HDVs' negative impacts on public health, environmental justice, climate change, and national parks and wilderness areas shows that protective emissions standards are desperately needed. To satisfy its statutory mandate and to fulfill its duty to engage in reasoned decisionmaking, EPA must promulgate standards that are supported by the record and that reduce emissions of dangerous air pollutants from heavy-duty vehicles and engines as much as possible.

Section III: Zero-emission technologies can achieve significant pollutant reductions and are already being deployed within the heavy-duty fleet today. Despite the increasing growth of these technologies, EPA undermines its proposed criteria pollutant and GHG programs by greatly underestimating baseline (business-as-usual) heavy-duty zero-emission vehicle (HD ZEV) market penetration in MY 2027 and later. As a result of this underestimate, EPA proposes less stringent emissions standards than are warranted; overlooks the generation of a significant amount of credits that will allow vehicles to pollute at higher levels; and inadvertently exempts many vehicles from having to install *any* emissions controls to meet GHG standards. EPA's proposed HD ZEV baseline penetration rate of 1.5% for MY 2027 is based on outdated information and flawed methodology. It also fails to account for current market projections indicating significantly higher baseline sales; HD ZEV sales required by the Advanced Clean Trucks (ACT) rule and other state-level requirements; federal, state, local, and private sector commitments and incentives; and recent cost estimates supporting the viability of HD ZEVs across vehicle segments. Based on our analysis, EPA should revise its assessment of baseline HD ZEV penetration to at least 8–11% for MY 2027, and 19–27% by MY 2030. This correction is necessary for the standards to perform as EPA intends. In addition, we urge EPA to use this rulemaking to drive additional ZEV deployment in the heavy-duty sector in light of the current and rapidly increasing feasibility of zero-emission technologies across the range of HDV classes and applications.

Section IV: Finalizing the criteria pollutant standards proposed as "Option 2" would be arbitrary and capricious because that option (1) fails to prioritize public health and welfare despite the availability of existing, feasible pollution-reduction technologies and (2) disregards the Clean Air Act's technology-forcing directive. EPA must strengthen its proposed criteria pollutant program by incorporating zero-emission technologies into its feasibility analysis, setting stronger emissions standards that both account for the technological feasibility and baseline market penetration of zero-emission technologies *and* accelerate the deployment of those technologies. EPA must also modify its crediting proposals to ensure that "transitional" credits and credits for battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs) do not undermine the effectiveness of its criteria pollutant program. Beyond making those changes, Commenters urge EPA to adopt Option 1 with further improvements to testing provisions, numerical emissions standards, warranty and useful life periods, and implementation schedule. In addition, EPA should revise the proposed durability demonstration, strengthen the proposed anti-tampering and inducement provisions, reject exemptions for vocational vehicles, and finalize the proposed particulate matter (PM) standard and closed crankcase requirements.

Section V: Advancements in zero-emission technologies and the rapid growth of HD ZEV sales have created a critical need for EPA to update its Phase 2 GHG standards. But by dramatically underestimating baseline HD ZEV penetration and failing to include zero-emission technologies in its standard-setting analysis, EPA proposes unjustifiably weak standards that will effectively exempt many vehicles from installing any GHG emissions control technologies. EPA must also revise its proposal to provide credit multipliers to plug-in hybrid, all-electric, and FCEVs. Because credit multipliers erode emissions reductions, they are not warranted for ZEVs that will already be produced as a result of state-level and other requirements and commitments (and thus need no incentive).

Section VI: Cost-benefit analysis also supports establishing stringent standards in this rulemaking. EPA's cost-benefit analysis should quantify the rule's climate benefits based on the social cost of greenhouse gases (SC-GHG), and EPA should consider these benefits—as well as the additional benefits from Commenters' proposed improvements—in finalizing the standards. And while EPA has previously found that sales impacts from heavy-duty emissions standards were too uncertain to quantify—a position with which Commenters continue to agree—Commenters generally endorse the Agency's conclusions regarding the potential sales impacts of this rulemaking. Despite uncertainties, Commenters agree with EPA that the adverse sales impacts, if any, from proposed Option 1 (including pre-buy and low-buy effects) are likely to be minimal and short lived.

Section VII: EPA has the opportunity in this rulemaking to set a strong foundation for ambitious future rules that will achieve significant emissions reductions through widespread deployment of zero-emission technologies within the heavy-duty sector. Both now and in the future, EPA must fully analyze zero-emission technologies as feasible emissions control technologies, and it must set standards that reflect these technologies' deep emissions reductions capability. Electrification and fuel cell technologies are, or will soon be, feasible and cost-effective across the full range of HDVs, including long-haul applications. In order to achieve the United States' climate goals and carry out the Clean Air Act's mandate to protect public health and welfare, EPA must forge paths toward greater acceleration of zero-emission technology deployment in the entire heavy-duty sector.

II. EPA MUST ESTABLISH STRONG EMISSIONS STANDARDS TO MEET ITS OBLIGATIONS UNDER THE CLEAN AIR ACT AND SATISFY FUNDAMENTAL PRINCIPLES OF ADMINISTRATIVE LAW.

As detailed below, EPA must set protective, evidence-based standards in this rulemaking to comply with the Clean Air Act's statutory commands, act in accordance with principles of reasoned decisionmaking, and mitigate HDVs' contribution to ongoing public health and climate crises.

A. Clean Air Act Section 202(a) requires EPA to set emissions standards for heavy-duty vehicles and engines that prioritize public health and welfare and spur improvements in technology.

To carry out its statutory mandate in this rulemaking, EPA must promulgate emissions standards that prioritize public health and welfare by harnessing advancements in emissions reduction technology. The Clean Air Act makes clear that EPA's primary duty is to protect public health and welfare by minimizing harmful air pollution. Congress declared that the express purpose of the Clean Air Act is to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare." 42 U.S.C. § 7401(b)(1).

Section 202(a)(1), the source of EPA's general authority to regulate motor vehicles and engines, directs EPA to promulgate standards that "prevent or control" emissions of air pollutants that "cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." 42 U.S.C. § 7521(a)(1). The Supreme Court held in *Massachusetts* that Congress clearly provided EPA with "the statutory authority to regulate the emission of [greenhouse] gases from new motor vehicles" pursuant to Section 202(a)(1)–(2). *Massachusetts v. EPA*, 549 U.S. 497, 532 (2007) (concluding that there is "nothing counterintuitive" to EPA regulating GHG emissions from vehicles considering the statutory factors). Under the terms of the statute, then, EPA must choose a regulatory response commensurate with the "endanger[ment]" that pollution from heavy-duty vehicles and engines cause to public health and welfare. *C.f. id.* at 532 (noting that Section 202(a) "charge[s] [EPA] with protecting the public's 'health' and 'welfare'"); *Coal. for Responsible Regulation v. EPA*, 684 F.3d 102, 117, 122 (D.C. Cir. 2012) (stating that EPA must carry out "the job Congress gave it in § 202(a)—utilizing emission standards to prevent reasonably anticipated endangerment from maturing into concrete harm."). Any "balancing" of factors, such as costs, availability of technology, and lead time, must prioritize the principal harm-reduction mandate animating the statute. *See Husqvarna AB v. EPA*, 254 F.3d 195, 200 (D.C. Cir. 2001) (emphasizing, in case involving similar statutory language in Section 213, that "[t]he overriding goal of the section is air quality and the other listed considerations, while significant, are subordinate to that goal").

Section 202(a)(3), which gives EPA specific authority to set standards regulating criteria pollutant emissions from heavy-duty vehicles and engines, affirms the central importance of this protective mandate. The Act requires that these standards reflect the "*greatest degree of emission* *reduction achievable* through the application of technology which the Administrator determines will be available for the model year to which such standards apply." 42 U.S.C. § 7521(a)(3)(A)(i) (emphasis added). While EPA must also consider "cost, energy, and safety factors associated with…such technology," *id.*, it must place primary importance on achieving the greatest degree of emissions reduction. *See Husqvarna*, 254 F.3d at 200 (concluding that "EPA did not deviate from its statutory mandate or frustrate congressional will by placing primary significance on the 'greatest degree of emission reduction achievable' and by considering cost, noise, energy and safety factors as important but secondary factors").

To bring about critical air quality improvements, Congress authorized EPA to set technology-forcing standards that require manufacturers to develop entirely new technologies or significantly improve existing ones. *See NRDC v. EPA*, 655 F.2d 318, 328 (D.C. Cir. 1981) (stating that "Congress intended the agency to project future advances in pollution control capability"); 87 Fed. Reg. at 17,436 & n.97. Section 202(a)(2), which pertains to EPA's general motor vehicle and engine authority, provides that emissions standards "shall take effect after such period as the Administrator finds necessary to permit the development and application of the requisite technology." 42 U.S.C. § 7521(a)(2). This language embodies Congress's intent that EPA "press for the development and application of improved technology rather than be limited by that which exists today." *NRDC v. EPA*, 655 F.2d at 328 (quoting S. Rep. No. 1196, 91st Cong., 2d Sess. 24 (1970)). EPA embraced this "technology-forcing approach" in its Heavy-Duty Greenhouse Gas Emissions Phase 2 Rule (the subject of targeted updates in this Proposal), promulgating standards "predicated on performance of technologies not only currently deployed but those which reasonably can be developed during the phase in period." 81 Fed. Reg. 73,478, 73,493, 73,809 (Oct. 25, 2016). Similarly, Section 202(a)(3)(A)(i) prescribes a technology-forcing approach by directing EPA to establish standards that are "achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply." 42 U.S.C. § 7521(a)(3)(A)(i); *Crete Carrier Corp. v. EPA*, 363 F.3d 490, 491 (D.C. Cir. 2004) (stating that this section "is a technology-forcing provision; it mandates regulations with which manufacturers can comply only by adopting new technologies as they become available"); *NRDC v. Thomas*, 805 F.2d 410, 428–30 & n.30 (D.C. Cir. 1986) ("Congress intended the EPA…to engage in reasonable predictions and projections in order to force technology.").

While EPA has considerable discretion to set emissions standards that rely on ambitious technological developments, Congress made the important policy decisions. Congress directed EPA, the expert agency with authority over air pollution from vehicles and engines, to develop a record and apply the Section 202(a) criteria to the facts to develop standards. *See Gundy v. United States*, 139 S. Ct. 2116, 2136 (2019) (Gorsuch, J., dissenting). In doing so, the Agency is "not obliged to provide detailed solutions to every engineering problem, but ha[s] only to identify the major steps for improvement and give plausible reasons for its belief that the industry will be able to solve those problems in the time remaining." *Nat'l Petrochemical & Refiners Ass'n v. EPA*, 287 F.3d 1130, 1136 (D.C. Cir. 2002) (internal quotation marks and citations omitted). Indeed, courts have consistently upheld EPA's technology-forcing vehicle and engine regulations over manufacturers' objections about technological readiness. *Id.* at 1136–41 (upholding NO_X and PM regulations predicated on future developments in pollution control technology); *NRDC v. Thomas*, 805 F.2d at 428–34 (upholding PM regulation over manufacturers' concerns about the feasibility of trap-oxidizer technology); *NRDC v. EPA*, 655 F.2d at 331–36 (same). And manufacturers have consistently risen to the challenge, later complying with the very standards they previously claimed were impossible to meet. *See, e.g.*, 87 Fed. Reg. at 17,536 (explaining that manufacturers deployed technologies that EPA had not predicted to meet the 2001 heavy-duty criteria pollutant standards, which they had unsuccessfully challenged in *National Petrochemical & Refiners Association*).

B. Emissions standards must be supported by the record and represent an exercise of reasoned decisionmaking.

Under the Clean Air Act, EPA's action may be reversed if it is arbitrary, capricious, an abuse of discretion, not in accordance with law, or in excess of statutory authority. 42 U.S.C. § 7607(d)(9)(A), (C). "To withstand review, the agency must have examined all relevant facts and data and articulated a rational explanation for its decision, including a reasonable connection between the facts and ultimate outcome." *Hearth, Patio & Barbecue Ass'n v. EPA*, 11 F.4th 791, 805 (D.C. Cir. 2021). "A rule is arbitrary and capricious if the agency: (1) 'has relied on factors which Congress has not intended it to consider,' (2) 'entirely failed to consider an important aspect of the problem,' (3) 'offered an explanation for its decision that runs counter to the evidence before the agency,' or (4) 'is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.'" *U.S. Sugar Corp. v. EPA*, 830 F.3d 579, 606 (D.C. Cir. 2016) (quoting *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983) and applying the same standard of review under the CAA as under the Administrative Procedure Act).

In setting emissions standards, EPA "must also provide a reasoned explanation of its basis for believing that its projection is reliable. This includes a defense of its methodology for arriving at numerical estimates." *Bluewater Network v. EPA*, 370 F.3d 1, 22 (D.C. Cir. 2004) (quoting *NRDC v. EPA*, 655 F.2d at 328). To comply with the Administrative Procedure Act, the Agency must examine the relevant data and show that the data is accurate and defensible. *See Dist. Hosp. Partners v. Burwell*, 786 F.3d 46, 57 (D.C. Cir. 2015). Courts require agencies to use "the best information available." *Catawba County v. EPA*, 571 F.3d 20, 45 (D.C. Cir. 2009). If the agency receives new and better data, it must deal with it in a reasonable fashion and cannot blindly accept outdated or inaccurate information. *See Dist. Hosp. Partners*, 786 F.3d at 57; *Flyers Rights Educ. Fund v. FAA*, 864 F.3d 738, 745 (D.C. Cir. 2017) ("Agency reasoning…must adapt as the critical facts change.").

C. Safeguarding public health, remedying environmental injustices, and tackling the climate crisis requires strong emissions standards.

In the sections below, Commenters detail the outsized contribution of HDVs to dangerous air pollution, public health burdens, environmental injustices, and climate change. The scale of these problems, in combination with the Agency's statutory mandates, demands a swift and protective regulatory response from EPA in this rulemaking.

1. HDVs emit large quantities of deadly pollution.

EPA must fulfill its mandate to curb emissions from HDVs, which lead to air pollution that causes significant negative health impacts. As EPA notes, "Heavy-duty (HD) engines operating across the U.S. emit NO_X and other pollutants that contribute to ambient levels of ozone, PM, and NO_X. These pollutants are linked to premature death, respiratory illness (including childhood asthma), cardiovascular problems, and other adverse health impacts. Data show that heavy-duty engines are important contributors to concentrations of ozone and $PM_{2.5}$ and their resulting threat to public health."[1] In particular, NO_X emissions increase levels of ozone, because ground-level ozone forms when there are high concentrations of ambient NO_X and VOCs and when solar radiation is high.[2] NO_X emissions (along with other gaseous precursors such as VOCs and SO_X) also impact particulate matter by forming secondary particles through atmospheric chemical reactions.[3] Reductions in NO_X emitted from HDVs would therefore result in reduced ambient levels of ozone and PM and improved health and environmental outcomes. *See* 87 Fed. Reg. at 17,417.[4]

HDVs are particularly notable contributors to particulate matter (PM) and criteria air pollutants. For example, the California Air Resources Board (CARB) found that HDVs are responsible for more than 70% of NO_X emissions from on-road mobile sources.[5] In addition, the International Council on Clean Transportation (ICCT) found that for urban driving, the NO_X emissions from one line-haul truck are equivalent to the emissions from 100 cars for each mile driven.[6] Nationally, HDVs are the largest contributor to mobile-source emissions of NO_X, making up about 32% of NO_X emissions from on- and off-road mobile sources.[7]

Air pollution has become so significant that the public-health burdens attributable to air pollution are "now estimated to be on a par with other major global health risks such as unhealthy diet and tobacco smoking, and air pollution is now recognized as the single biggest environmental threat to human health."[8] Researchers at the University of Chicago studied the impact of air pollution on life expectancy, and found that "the deadly effects of $PM_{2.5}$ on the heart, lungs, and other systems have a more devastating impact on life expectancy than

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[1] *See* Margaret Zawacki et al., *Mobile Source Contributions to Ambient Ozone and Particulate Matter in 2025*, 188 Atmospheric Environment 129–41 (2018), https://doi.org/10.1016/j.atmosenv.2018.04.057. *See also* Kenneth Davidson et al., *The Recent and Future Health Burden of the U.S. Mobile Sector Apportioned by Source*, Environmental Research Letters (2020), https://doi.org/10.1088/1748-9326/ab83a8.
[2] *See* EPA, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards—Draft Regulatory Impact Analysis 171 (Mar. 2022), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf.
[3] *See id.* at 174.
[4] *See also id.* at Chapter 4: Health and Environmental Impacts.
[5] *See* CARB, CARB Staff Current Assessment of the Technical Feasibility of Lower NOx Standards and Associated Test Procedures for 2022 and Subsequent Model Year 1 (2019), https://www.arb.ca.gov/msprog/hdlownox/white_paper_04182019a.pdf.
[6] *See* Huzeifa Badshah et al., *Current State of NOx Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States*, ICCT (Nov. 2019), https://theicct.org/publication/current-state-of-nox-emissions-from-in-use-heavy-duty-diesel-vehicles-in-the-united-states/.
[7] *See* EPA, EPA Announces the "Clean Trucks Plan" 2 (2021), https://www.epa.gov/system/files/documents/2021-08/420f21057.pdf. Data is from MOVES3 for onroad and nonroad sectors and 2017 National Emissions Inventory (NEI) for all other mobile sectors.
[8] *See* Ken Lee & Michael Greenstone, *Air Quality Life Index Annual Update*, Energy Policy Institute at the University of Chicago (2021), https://aqli.epic.uchicago.edu/wp-content/uploads/2021/08/AQLI_2021-Report.EnglishGlobal.pdf.

communicable diseases like tuberculosis, behavioral killers like cigarette smoking, and even war."[9]

Particulate pollution from HDVs can cause severe health impacts even with only short-term exposures. There is consistent evidence showing the relationship between short-term exposure to PM and mortality, particularly cardiovascular and respiratory mortality. Short- and long-term exposure to $PM_{2.5}$ can cause harmful health impacts such as heart attacks, strokes, worsened asthma, and early death.[10] In addition, short-term PM exposure has been linked to increases in infant mortality, hospital admissions for cardiovascular disease, hospital admissions and emergency visits for chronic obstructive pulmonary disease, and severity of asthma attacks and hospitalization for asthma in children. Year-round exposure to PM is associated with elevated risks of early death, primarily from cardiovascular and respiratory problems such as heart disease, stroke, influenza, and pneumonia.[11]

Not surprisingly, air pollution from HDVs often occurs along highways and in industrial or urban hubs. A new Clean Air Task Force (CATF) map and data visualization tool, Deaths by Dirty Diesel,[12] highlights the price that communities pay in negative health impacts from diesel engines (including trucks and other diesel-fueled equipment). Deaths by Dirty Diesel makes data on health impacts from diesel pollution easily accessible to community members on a state, county, and metro area basis.

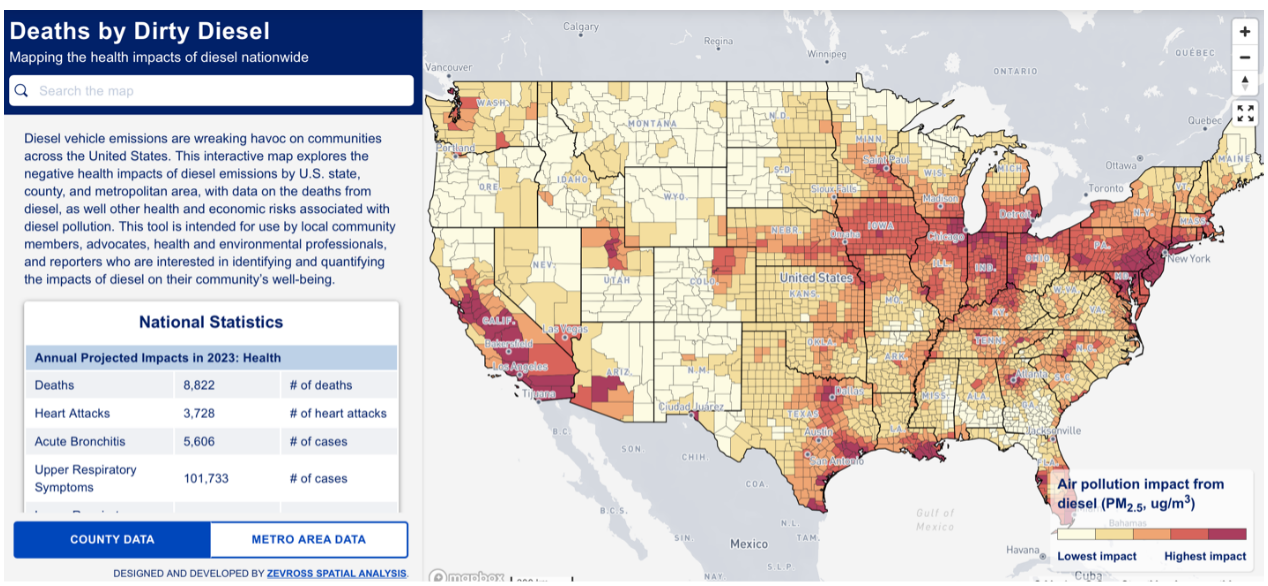

Figure 1: CATF's Deaths by Dirty Diesel Mapping Tool. The map shows the particulate matter ($PM_{2.5}$) emissions from diesel vehicles, with dark red showing the areas with the highest pollution.

[9] *See* World Health Organization (WHO), WHO Global Air Quality Guidelines (2021), https://apps.who.int/iris/bitstream/handle/10665/345329/9789240034228-eng.pdf.
[10] *See* EPA, Integrated Science Assessment (ISA) for Particulate Matter (Dec. 2019), https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534.
[11] *See* American Lung Association, State of the Air 2022 at 21–22 (2022), https://www.lung.org/research/sota.
[12] *See* CATF, Deaths by Dirty Diesel Map, https://www.catf.us/deathsbydiesel/. *See also* CATF, Deaths by Dirty Diesel Map: Health Impacts Methodology, https://cdn.catf.us/wp-content/uploads/2022/01/06091832/deaths-dirty-diesel-methodology.pdf.

The Deaths by Dirty Diesel tool illustrates the various impacts of PM,[13] with a focus on the negative impacts from fine particulate matter, or $PM_{2.5}$. The colors on the map depict diesel engines' contribution to $PM_{2.5}$ air pollution in various geographic areas. The tool also contains data on the adverse health, social, and economic impacts attributable to emissions from diesel engines, including deaths, heart attacks, acute bronchitis, respiratory symptoms, asthma, emergency room visits, cancer risk, monetized health losses, and lost work and activity days.[14] The tool shows the clear linkage between high levels of diesel-related air pollution and threats to public health and welfare. For example, while risk is not spread evenly across any state, the data show that California, New Jersey, and New York have the highest cancer risk from diesel pollution, and Wyoming, Montana, and Oregon have the lowest. The tool is intended to help visualize the vast impact of diesel pollution on communities and to make that information accessible to the general public.

Not coincidentally, the negative impacts of diesel pollution are often clustered along the country's busiest interstate highways. California offers the starkest example: residents of Los Angeles cope with the country's worst diesel pollution, at 0.726 ug/m^3, but the map shows that a driver heading north from Los Angeles on Interstate 5 would continue to encounter dangerously high diesel particulate matter levels in California's Central Valley (Fresno County, CA: 0.451 ug/m^3), in the Bay Area (San Mateo County, CA: 0.465 ug/m^3), and even at the north end of I-5 in the Puget Sound region (Kitsap County, WA: 0.221 ug/m^3).[15] Many of these counties, including Los Angeles and Fresno Counties in California, are in non-attainment status for their $PM_{2.5}$ air quality.[16]

According to the American Lung Association (ALA) State of the Air 2022 report, fourteen counties received failing grades on all three of the air quality indicators that ALA reviewed: daily particulate matter pollution, annual particulate matter pollution, and ozone pollution.[17] Seven of those are California counties bisected by I-5, three are other California counties that sit just to the east of I-5, and another three are California counties bisected by other interstate highways (I-8, I-10, I-15, and I-40). The last is in Arizona, southeast of Phoenix and at the convergence of three highways (I-8, I-10, and I-19).[18] EPA must take action to reduce the dangerous levels of pollution found across the country in this rulemaking.

2. <u>Emissions from HDVs perpetuate environmental and health injustices.</u>

Environmental justice, energy justice, and equity considerations are central to the Proposal, given the vast history of disproportionate environmental and public-health burdens

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[13] *See* CARB, Inhalable Particulate Matter and Health (PM2.5 and PM10), https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health.
[14] CATF, Deaths by Dirty Diesel Map: Health Impacts Methodology, https://cdn.catf.us/wp-content/uploads/2022/01/06091832/deaths-dirty-diesel-methodology.pdf.
[15] *See* CATF, Diesel pollution is a deadly problem in the United States (Jan. 2022), https://www.catf.us/2022/01/diesel-pollution-deadly-problem-united-states/.
[16] *See* EPA, Current Nonattainment Counties for All Criteria Pollutants (2022), https://www3.epa.gov/airquality/greenbook/ancl.html.
[17] *See* ALA, State of the Air 2022 at 19.
[18] *See* Department of Transportation, Federal Highway Administration, National Highway Freight Network Map, https://ops.fhwa.dot.gov/freight/infrastructure/nfn/maps/nhfn_map.htm (last modified Mar. 5, 2020).

placed on communities of color and low-income communities.[19] Communities that are overburdened with pollution from sources such as major roadways, industrial sites, and agriculture are predominantly low-income, and a large percentage of residents of these communities are people of color and non-English speakers.[20] With the improvements described later in these comments, this rulemaking could bring about significant air-quality and health improvements in communities that are disproportionately burdened with air pollution from trucking and overburdened from pollution more broadly.[21]

EPA must set strong emissions standards to meet the obligations established by presidential directives on environmental justice. Under Executive Order 12,898, EPA "shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." 59 Fed. Reg. 7,629 (Feb. 11, 1994). And Executive Order 14,008 directs EPA to develop "programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.'' 86 Fed. Reg. 7,619, 7,629 (Jan. 27, 2021). It also establishes the Administration's policy ''to secure environmental justice and spur economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution.'' *Id.*

This rulemaking presents a critical opportunity to mitigate the adverse health impacts plaguing communities that are overburdened by air pollution from HDVs and other sources. As noted by the ALA's 2022 State of the Air report, which grades counties on daily and long-term measures of particle pollution and daily measures of ozone, "Close to 19.8 million people live in the 14 counties that failed all three measures. Of those, 14.1 million are people of color. People of color were 61% more likely than white people to live in a county with a failing grade for at least one pollutant, and 3.6 times as likely to live in a county with failing grades for all three pollutants."[22] As described in Section II.C.1 above, all 14 of these counties are located in the vicinity of at least one major highway that overburdens county residents with pollution from trucks.

According to the ALA's report, more than 137 million Americans live in places that received failing grades for unhealthy levels of ozone or PM in their air. In addition to the disproportionate impact on people of color noted above, ALA outlines other "high-risk" groups that are impacted by the pollution in these regions. For example, low-income communities are particularly vulnerable and at risk of health impacts from pollution. More than 15.9 million people whose incomes meet the federal definition for living in poverty reside in counties that

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[19] For more information on the history and definition of the environmental justice movement, *see* Initiative for Energy Justice, Section 1—Defining Energy Justice: Connections to Environmental Justice, Climate Justice, and the Just Transition (Dec. 23, 2019), https://iejusa.org/section-1-defining-energy-justice/.

[20] *See* Gina M. Solomon et al., *Cumulative Environmental Impacts: Science and Policy to Protect Communities*, 37 Annual Review of Public Health (Jan. 6, 2016), https://pubmed.ncbi.nlm.nih.gov/26735429/.

[21] *See* EPA, ISA for Particulate Matter at Ch. 12: Populations and Lifestages Potentially at Increased Risk of a Particulate Matter-Related Health Effect; Section 5: Sociodemographic Factors, https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter.

[22] *See* ALA, State of the Air 2022 Key Findings, https://www.lung.org/research/sota/key-findings.

received a failing grade on at least one of ALA's pollutant indicators, while over 2.6 million people living in poverty reside in counties that received failing grades on *all three* pollutant measures. In addition, around 31 million children (under age 18) and almost 21 million older adults (age 65 or older) live in counties that received a failing grade on at least one pollutant.[23]

A new paper, titled "Pollution from Freight Trucks in the Contiguous United States: Public Health Damages and Implications for Environmental Justice" and currently undergoing peer review, explores the spatial implications of pollution from freight trucks in the United States.[24] The authors find evidence that the negative health impacts of emissions from freight trucking are disproportionately distributed across the country and are disproportionately likely to impact certain racial and ethnic groups. In particular, they find that pollution from freight trucking is more likely to occur in counties and census tracts with higher proportions of Black and Hispanic residents.

In fact, it is well established that communities of color and economically disadvantaged communities are disproportionately exposed to environmental burdens from a variety of sources. The White House Council on Environmental Quality (CEQ) recently released a preliminary Climate and Economic Justice Screening Tool, which identifies communities around the country that are "marginalized, underserved, and overburdened by pollution"[25] and would therefore qualify for Justice40[26] investments (President Biden's key environmental justice initiative). The Screening Tool identifies census tracts as "disadvantaged" if they are above the threshold for one or more environmental or climate indicators (*e.g.*, exposure to diesel PM or $PM_{2.5}$, traffic proximity and volume, or proximity to hazardous waste sites) *and* above the threshold for socioeconomic indicators related to income and education.[27] A recent analysis found that 64% of the population in census tracts the Screening Tool identifies as disadvantaged are Hispanic/Latino, Black or African American, or American Indian or Alaskan Native. Overall, 50% of Hispanic/Latino, Black or African American, and American Indian or Alaskan Native individuals in the country reside in disadvantaged communities, compared to just 17% of White, Non-Hispanic/Latino individuals.[28]

These findings show the critical need for EPA to minimize the harmful emissions from the HDV sector. Doing so will not only improve a significant public-health and environmental issue, but will also decrease air pollution and improve well-being in overburdened communities.

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[23] *See* ALA, State of the Air 2022 at 18.
[24] Priyank Lathwal et al., *Pollution from Freight Trucks in the Contiguous United States: Public Health Damages and Implications for Environmental Justice*, arXiv:2204.06588 (2022), https://arxiv.org/abs/2204.06588.
[25] CEQ, Preliminary Climate and Economic Justice Screening Tool, https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5.
[26] The White House, The Path to Achieving Justice40 (July 20, 2021), https://www.whitehouse.gov/omb/briefing-room/2021/07/20/the-path-to-achieving-justice40/.
[27] CEQ, Climate and Economic Justice Screening Tool: Technical Support Document 4–8 (Apr. 2022), https://static-data-screeningtool.geoplatform.gov/data-pipeline/data/score/downloadable/cejst_technical_support_document.pdf.
[28] Emma Rutkowski et al., *Justice40 Initiative: Mapping Race and Ethnicity*, Rhodium Group (Feb. 24, 2022), https://rhg.com/research/justice40-initiative-mapping-race-and-ethnicity/.

3. Emissions from HDVs fuel the intensifying climate crisis.

Strong emissions standards are also necessary to curtail HDVs' outsized contribution to climate change. Over twelve years ago, based upon a massive scientific record, EPA found that new motor vehicles and engines contribute to the GHGs that force climate change and endanger the public health and welfare of current and future generations. 74 Fed. Reg. 66,496 (Dec. 15, 2009). The Endangerment Finding specifically included emissions from heavy-duty trucks and buses. 74 Fed. Reg. at 66,499. At the time, the transportation sector was responsible for 23% of total annual U.S. GHG emissions. *Id.* Since then, transportation sector emissions have only increased as a share of U.S. emissions, surpassing the electric power sector as the largest U.S. source of GHG emissions, contributing 29% of total GHG emissions in 2019 and 27.2% in 2020.[29]

On April 29, 2022, EPA denied four petitions to reconsider the Endangerment Finding. 87 Fed. Reg. 25,412 (Apr. 29, 2022). In denying the petitions, EPA stated:

> The science supporting the Administrator's finding that elevated concentrations of greenhouse gases in the atmosphere may reasonably be anticipated to endanger the public health and welfare of current and future U.S. generations is robust, voluminous, and compelling, and has been strongly affirmed by recent scientific assessments of the National Academies, the US Global Change Research Program, and the Intergovernmental Panel on Climate Change.[30]

HDVs are the second largest domestic contributor of GHGs in the transportation sector. From 1990 to 2019, transportation GHG emissions from fossil fuel combustion increased by 20.9%.[31] Medium- and heavy-duty truck GHG emissions nearly doubled between 1990 and 2019.[32] This increase was driven, in part, by substantial growth in medium- and heavy-duty truck vehicle miles traveled (VMT), which increased by 107% between 1990 and 2020.[33] Transportation sources also produce other climate-forcing pollutants such as CH_4, N_2O and HFCs.[34]

These comments incorporate and build upon the comments submitted by environmental and public health NGOs, including some signatories here, on EPA's Proposed Rule Regarding

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[29] EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks at ES-21 (Apr. 15, 2022), https://www.epa.gov/system/files/documents/2022-04/us-ghg-inventory-2022-main-text.pdf.
[30] EPA, Decision Document, EPA's Denial of Petitions Relating to the Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act 1 (Apr. 1, 2022), https://www.epa.gov/system/files/documents/2022-04/decision_document.pdf; *see also id*. at 11–13 (documenting the continued advances in climate science that bolster the Endangerment Finding).
[31] EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks at 3-23 (The COVID-19 pandemic led to a 13.7% decrease from 2019–2020 and is considered an outlier.). *See* Energy Information Agency (EIA), Annual Energy Outlook 2022 (Narrative) 11 (Mar. 2022), https://www.eia.gov/outlooks/aeo/pdf/AEO2022_Narrative.pdf (discussing the outlier nature of 2020).
[32] EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks at 2-36.
[33] *Id*. at 3-26
[34] *Id*.

Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emission Standards.[35] Those comments were a continuation of a series of comments updating the record underlying the Endangerment Finding with increasingly dire evidence of the current and future impacts of climate change and the transportation sector's outsized contribution.

Since the NGOs' most recent set of transportation comments were filed, the United Nations Intergovernmental Panel on Climate Change (IPCC) released several constituent pieces of the Sixth Assessment Report.[36] The report warns that the world must quickly and drastically cut its dependence on fossil fuels or face climate disaster. GHGs from human activities are the most significant driver of observed climate change since the mid-20th century.[37] As GHG emissions from human activities increase, they build up in the atmosphere and warm the climate, leading to increasingly destructive changes around the world—in the atmosphere, on land, and in the oceans.[38] Steep and swift reductions in GHG emissions are essential to avoid the most catastrophic consequences of climate change.[39]

In 2019, GHG emissions from the global transport sector accounted for 23% of global energy-related CO_2 emissions—with 70% of those emissions coming from road vehicles.[40] Overall global transport emissions have increased 57% since 1990, growing at an average of 2% per year between 2010 and 2019, and faster than any other sector.[41] Global freight transport grew 68% between 2000 and 2015.[42] To have a chance at limiting global temperature increase to 1.5℃ and avoid the worst impacts of climate change, current GHG emissions from the transportation sector must drop by 59% by 2050 as compared to 2020 emissions.[43]Analysis conducted by ICCT finds that new HD ZEV sales of 45% or higher by 2030 is necessary to avoid greater than 2℃ of warming.[44] Meanwhile, the IPCC predicts that without intervention, CO_2 emissions from transport could grow in the range of 16% to 50% by 2050.[45] The IPCC concluded that "[l]and-based, long-range, heavy-duty trucks can be decarbonised through battery-electric haulage… complemented by hydrogen[-based]…fuels in some contexts."[46]

In another report issued since the last set of NGO comments, the Office of Management and Budget (OMB) assessed the costs of climate change to the federal government, estimating that they could grow to as much as $128 billion annually due to disaster relief, flood insurance,

[35] Comments of Center for Biological Diversity et al., Regarding Proposed Rule Regarding Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emission Standards (Docket No. EPA-HQ-OAR-2021-0208) (Sept. 27, 2021).
[36] IPCC, AR6 Synthesis Report: Climate Change 2022, https://www.ipcc.ch/report/sixth-assessment-report-cycle/.
[37] *See generally* IPCC, Climate Change 2022: Impacts, Adaptation, and Vulnerability: Summary for Policymakers (Feb. 27, 2022), https://report.ipcc.ch/ar6wg2/pdf/IPCC_AR6_WGII_SummaryForPolicymakers.pdf.
[38] *Id*. at SPM-7–SPM-8.
[39] *Id*. at SPM-13.
[40] IPCC, Climate Change 2022: Mitigation of Climate Change 10-4 (Apr. 4, 2022) (Draft), https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_FullReport.pdf.
[41] *Id*. at 10-9.
[42] *Id*. at 10-11.
[43] *Id*. at 10-5.
[44] Claire Buysse et al., *Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States*, ICCT (Apr. 8, 2022), https://theicct.org/racing-to-zero-hdv-us-apr22/.
[45] IPCC, Climate Change 2022: Mitigation of Climate Change at 10-5.
[46] *Id*.

crop insurance, healthcare expenditures, wildland fire suppression, and flood risk.[47] OMB considered costs that damage physical infrastructure, social conditions, health of people and ecosystems, and economic productivity. The OMB report underscores the IPCC's stark warnings.

To stave off the worst impacts of climate change, the U.S. has set a goal of reaching net zero emissions no later than 2050.[48] This commitment, along with the Clean Air Act's commands, require reducing and ultimately eliminating GHG emissions from the heavy-duty truck sector as rapidly as feasible. This rulemaking is an important step in achieving that critical goal.

4. Emissions from HDVs damage national parks and wilderness areas.

NO_X emissions from the heavy-duty sector also harm plants, wildlife, and visibility within national parks and wilderness areas, including those that have been designated as "Class I" under the Clean Air Act and receive special air quality and visibility protections.[49] As EPA has noted in the past, "[e]nvironmental impacts of concern are associated with these pollutants and include light extinction, decreased tree growth, foliar injury, and acidification and eutrophication of aquatic and terrestrial systems." 85 Fed. Reg. 3,306, 3,310 (Jan. 21, 2020). These impacts are especially damaging in areas already suffering from a range of climate change impacts, such as the Rocky Mountains, Sierra Nevada Mountains, Appalachian Mountains, and Southwestern Desert ecosystems. For example, ozone phytotoxicity can lead to foliar injury and reduce the photosynthetic capacity of plants and trees, including Jeffrey and Ponderosa pines and other high-elevation coniferous species.[50] Moreover, many of the tree species weakened by ozone and other air pollutants linked to NO_X emissions are already facing climate change-driven stressors, such as drought, high temperatures, and native bark beetle attacks.[51] As a result, NO_X and GHG pollution from the heavy-duty sector directly contributes to the ongoing tree mortality and mega-wildfire crisis that has devastated the Western United States in recent years. Additionally, nitrogen deposition from NO_X pollution causes widespread deleterious impacts across land and water ecosystems, including from both direct exposure (*e.g.*, nitrogen enrichment) and biological effects (*e.g.*, decreases in biodiversity, fish declines). *See* 87 Fed. Reg. at 17,454–56. Examples of nitrogen deposition impacts include expansion of algae blooms in high altitude lakes within Sequoia and Kings Canyon National Parks[52] and the spread of invasive, fire-prone grasses in

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[47] *See generally* OMB, Federal Budget Exposure to Climate Risk (Apr. 2022), https://www.whitehouse.gov/wp-content/uploads/2022/04/ap_21_climate_risk_fy2023.pdf.
[48] The White House, FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies (Apr. 22, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/.
[49] *See* National Park Service, Air, Class I, https://www.nps.gov/subjects/air/class1.htm.
[50] Ricardo Cisneros et. al., *Ozone, nitric acid, and ammonia air pollution is unhealthy for people and ecosystems in southern Sierra Nevada, California*, 158 Envtl. Pollution 3261 (2010). *See also* 87 Fed. Reg. at 17,455.
[51] Ricardo Cisneros et. al., *Ozone, nitric acid, and ammonia air pollution is unhealthy for people and ecosystems in southern Sierra Nevada, California,* 158 Envtl. Pollution 3261 (2010).
[52] National Park Service, Sequoia and Kings Canyon Park Air Quality, https://www.nps.gov/seki/learn/nature/airqualitymon.htm.

Joshua Tree National Park.[53] These harms affect the public welfare in countless ways, damaging the ability of ecosystems to clean the air and water and to provide the basic natural resources humans rely on for food, shelter, and material goods. *See generally* Draft Regulatory Impact Analysis (DRIA) Chs. 4.2, 4.3. EPA must take action to mitigate these harms in this rulemaking.

III. EPA UNDERMINES THE CRITERIA POLLUTANT AND GHG STANDARDS BY GREATLY UNDERESTIMATING BASELINE HD ZEV MARKET PENETRATION AND FAILING TO CONSIDER ZERO-EMISSION TECHNOLOGIES IN ITS STANDARD-SETTING ANALYSIS.

EPA's goal of strengthening existing criteria pollutant and GHG standards for MY 2027 and later HDVs is appropriate considering the urgent need to address these air pollutants and the significant harms they cause to public health and welfare. However, the Agency's proposed standards are too lenient, in part because they rely on inaccurate estimates of future baseline HD ZEV market penetration levels, and because they fail to further drive the implementation of zero-emission technologies that can achieve deep emissions reductions. For the reasons explained in this section, instead of EPA's proposed 1.5% HD ZEV sales estimate for MY 2027, the Agency should—at a minimum—assume baseline HD ZEV sales will progress such that they reach between 8% and 11% by MY 2027, and between 19% and 27% by MY 2030.[54] Moreover, because zero-emission technologies are already feasible and cost-competitive in many HD market segments, including those for which EPA proposes revisions, in order to fulfill its obligations under the Clean Air Act the Agency should adopt standards that would accelerate the deployment of these technologies above these baseline estimates.

The Proposal's underestimate of the baseline market penetration of HD ZEVs and its failure to propose standards that further drive adoption of zero-emission technologies ignores the Agency's obligations under the Clean Air Act and weakens the proposed standards in several ways:

1. Considering more accurate (higher) baseline HD ZEV market penetration "could lead to a more stringent NO_X emission standard," as EPA acknowledges. 87 Fed. Reg. at 17,561.

2. Underestimating the baseline market penetration of HD ZEVs will lead to the generation of a significant amount of credits that will dramatically undermine the goals of the NO_X standards and fail to protect public health and welfare. 87 Fed. Reg. at 17,561.[55] Allowing for ZEVs to generate NO_X emissions credits is a

[53] National Park Service, Park Air Profiles - Joshua Tree National Park, https://home.nps.gov/articles/airprofiles-jotr.htm.

[54] EPA's 1.5% HD ZEV baseline penetration rate applies to Class 4–8 HDVs and omits vehicles in Classes 2b and 3. EPA also is not proposing adjusting standards for long-haul trucks. Accordingly, the 8–11% estimate for MY 2027 HD ZEV sales includes vehicles in Classes 4–8 and not Class 2b/3 vehicles and not long-haul tractors. For greater detail on the assumptions underlying this estimate, please see Appendix A. Including Class 2b and 3 vehicles would raise baseline ZEV penetration rates even higher, given the rapid market advancements in Class 2b and 3 ZEVs. Throughout this section, "heavy-duty" vehicles only refer to Class 4–8 vehicles and not Class 2b and 3.

[55] EPA notes that it includes an FEL cap on NO_x emissions to help limit the impact credits generated from BEVs or FCEVs could have in enabling vehicles to exceed the NO_x standard. However, if HD ZEV market penetration is higher than EPA projects, "there is the potential for a greater portion of CI engines to emit up to the level of the FEL

significant departure from EPA's prior rules,[56] and a revised, more accurate baseline HD ZEV penetration estimate would require reconsideration of these credits to ensure that the rule reflects the greatest degree of emission reduction achievable, as is EPA's statutory mandate.

3. Disregarding the feasibility of zero-emission technologies in establishing the stringency of the proposed criteria pollutant standards unjustifiably takes proven emission reduction technologies off the table.

4. Because the GHG standards apply as a fleet average, by underestimating the MY 2027 HD ZEV market penetration in the Proposal, EPA in turn underestimates the percentage of vehicles that would be able to meet the current Phase 2 standards without installing emission-reduction technologies, undermining the program's goal of requiring all conventional vehicles to install such controls.[57]

5. Failing to revisit the GHG standards with an approach that would further drive adoption of zero-emission technologies—a regulatory path that is clearly feasible—results in standards that fall far short of achieving necessary climate and health benefits.

The combination of applying an unreasonably low baseline HD ZEV market penetration estimate and failing to set criteria pollutant and GHG standards that further drive adoption of zero-emission technologies means that not only does EPA fail to set technology-forcing standards, as Congress directed it to do, but that the Agency actually limits itself to technologies that are inferior to what is available today. *See NRDC v. EPA*, 655 F.2d at 328 (emphasizing that EPA should "press for the development and application of improved technology rather than be limited by that which exists today").

The Proposal underestimates baseline HD ZEV market penetration in several ways. First, EPA bases its estimate on the number of HD ZEVs it expects as a result of California's regulatory requirements for HDVs in 2027, extrapolated to a national level, but its methodology is flawed for several reasons. In particular, EPA relies on HD ZEV projections from California's ACT[58] rulemaking in 2019, which are based on projected 2027 HD sales that are significant underestimates—notably lower than EPA's own projections in its MOtor Vehicle Emission

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cap," 87 Fed. Reg. at 17,560, further undermining the goals of the regulatory program. EPA notes the importance of "consider[ing] what impact NO_x emissions credits generated from BEVs and FCEVs might have on the NO_x emission reductions expected from the proposed rulemaking. *Id.* at 17,561. Further, as discussed in Section IV.D.2.c of these comments, EPA's proposed FEL cap is unreasonably high.

[56] *See* 87 Fed. Reg. at 17,556 ("However, under the current criteria pollutant program, manufacturers do not have a pathway to generate NO_x emission credits for HEVs, BEVs, or FCEVs. For BEVs and FCEVs, current 40 CFR 86.016-1(d)(4) stipulates that these technologies may not generate NO_x emission credits…"); *id.* at 17,561–62 (proposing to allow ZEVs to generate NO_x emissions credits); 40 CFR 86.016-1(d)(4) ("Electric heavy-duty vehicles may not generate NO_x or PM emission credits.").

[57] EPA explains in the Proposal that "[t]he intent of the existing HD GHG Phase 2 program was to set the stringency of the standards at a level that all conventional vehicles would need to install some level and combination of emission-reducing technologies or offset another conventional vehicle not installing such technology, since at that time we predicted very little market penetration of EVs." 87 Fed. Reg. at 17,603.

[58] CARB, Advanced Clean Trucks Regulation—Final Regulation Order (Mar. 15, 2021), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf.

Simulator (MOVES) model and when compared to historical HDV sales data, as discussed in more detail below. As a result, the Proposal's baseline ZEV sales projections for California in 2027 are unreasonably low and out of line with other, more accurate data and information. In calculating its baseline HD ZEV penetration estimate, EPA should rely on its own up-to-date MOVES data (which is also more in line with historical sales data) rather than California's 2019 projections.

Further, in extrapolating to the national level, EPA relies on a ratio from a 2021 report by ICCT on U.S. and Canada ZEV sales. But there is no reason to believe that this ratio will continue to hold in the future. Moreover, EPA ignores the HD ZEV sales that will result in other states that have already adopted the ACT rule, as well as those that have signed the Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding (MOU),[59] which targets ZEV sales and commits to ZEVs achieving 30% of all HDV sales by 2030 and 100% of all HDV sales by 2050. If EPA used MOVES data and looked at these existing state-level commitments, the baseline HD ZEV market penetration for 2027 would be significantly higher than that calculated in the Proposal.

In addition to the flaws in EPA's methodology, the Agency ignores other highly relevant information that shows that its approach in the Proposal is a significant underestimate of baseline ZEV penetration in the heavy-duty sector. This includes:

- Current market projections indicating significantly higher baseline HD ZEV sales;
- Federal, state, local, and private sector actions supporting a much higher baseline HD ZEV penetration rate; and
- Recent HD ZEV cost estimates supporting the viability of ZEVs across vehicle segments.

EPA must consider the additional data available and presented in these comments to fulfill its obligations to engage in reasoned decisionmaking and to set emissions standards that are supported by the record. In particular, EPA should update its assessment of baseline HD ZEV penetration in the range of at least 8–11% for MY 2027, significantly higher than EPA's proposed rate of just 1.5%.[60] Assuming that all states that have signed the MOU also adopt the ACT, national HD ZEV market penetration will reach 8% in 2027. Assuming that additional state programs and private sector commitments drive some ZEV penetration in non-MOU states, national HD ZEV market penetration will reach 11% in 2027. By 2030, baseline HD ZEV penetration will reach 19–27%, accordingly. It is important for EPA to consider baseline market penetrations beyond MY 2027 since manufacturers have three model years to carry back ZEV

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[59] *See* NESCAUM, Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding (NESCAUM MOU) (last accessed May 10, 2022), https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf/.

[60] *See, e.g.*, 87 Fed. Reg. at 17,458 (noting that EPA "may re-evaluate our approach, especially if we receive information showing higher BEV/FCEV market penetration in the MY 2027 or later timeframe"); *id.* at 17,471 (requesting comment on whether to include zero-emission technologies in the feasibility analysis for the final rule); *id.* at 17,599 (considering "whether it would be appropriate in the final rule to increase the stringency of the standards more than what we have proposed"); *id.* (requesting information and data to support "HD ZEV penetration rates of 5 or 10 percent (or higher)" in the MY 2027–2029 timeframe).

credits; sales between MY 2028 and MY 2030 are, consequently, available for compliance in 2027. *See* 81 Fed. Reg. at 73,638 ("The agencies proposed and are adopting for Phase 2 the five year credit life and three year deficit carry-over provisions from Phase 1 (40 CFR 1037.740(c) and 1037.745)."). High baseline HD ZEV penetration in MYs 2028–2030 would allow manufacturers to accrue large numbers of credits that they could apply to prior years, diluting the standards. The carry-over provision effectively allows manufacturers to average sales across a multi-year period; having permitted compliance on a multi-year average basis, EPA is required to examine baseline market penetration across the same multi-year period.

Moreover, to comply with its Clean Air Act obligations, EPA should go further than correcting its baseline HD ZEV penetration estimate by including zero-emission technologies in the technology packages underlying the criteria pollutant and GHG standards. EPA requested comment "on how the Agency can best consider the potential for ZEV technologies to significantly reduce air pollution from the heavy-duty vehicle sector." 87 Fed. Reg. at 17,420. As detailed below, zero-emission technologies are already available and cost-competitive in many HD market segments. Importantly, given technological advancements and substantial investments and commitments in the public and private sectors, greater adoption of zero-emission technologies is clearly feasible prior to MY 2030. In addition to these comments, EPA should consider the data presented in the comments on this Proposal submitted by the Moving Forward Network (MFN), Environmental Defense Fund (EDF), and ICCT, all of which further elaborate on the feasibility and importance of achieving significantly greater levels of ZEV penetration within the HD fleet.[61] Doing so would fulfill EPA's statutory mandate by delivering substantial climate and health benefits, as is detailed in the research supporting the MFN, EDF, and ICCT comments on this Proposal.

A. EPA's methodology is flawed and fails to account for states adopting HDV standards that will result in greater baseline HD ZEV market penetration by MY 2027.

EPA's approach to calculating national HD ZEV sales in 2027 is flawed because it relies on outdated data and fails to capture the impact of state policies driving additional HD ZEV sales. In its proposed approach, EPA begins by estimating MY 2027 HD ZEV sales in California. To do this, EPA takes into consideration the ACT rule passed by CARB in June 2020. 87 Fed. Reg. at 17,600.[62] The ACT rule requires that HD ZEVs make up a certain percentage of a manufacturer's California sales. For example, in MY 2027, 20% of Class 4–8 vehicles and 15% of Class 7–8 tractors sold in California must be ZEVs. 87 Fed. Reg. at 17,597 Tbl.XI-2 & 17,600.[63] EPA then scales to a national estimate of HD ZEV market penetration for MY 2027

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[61] When considering GHG standards that further drive adoption of zero-emission technologies, EPA should ensure that it preserves the original Phase 2 stringency for ICE vehicles. *See, e.g.*, Sara Kelly et al, *ICCT Comments on EPA's Proposed Heavy-Duty Engine and Vehicle Standards* 17–18, ICCT (May 10, 2022), https://theicct.org/wp-content/uploads/2022/04/public-webinar_10May2022.pdf (urging EPA to preserve the original Phase 2 stringency for internal combustion engine (ICE) vehicles by removing ZEV crediting and requiring all ICE vehicles to meet the original Phase 2 GHG standards).

[62] *See also* CARB, Notice of Decision: Advanced Clean Trucks Regulation (June 2020), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/nod.pdf.

[63] *See also* CARB, Appendix A – Proposed Regulation Order: Advanced Clean Trucks Regulation 5–6 (May 2020), https://ww3.arb.ca.gov/regact/2019/act2019/30dayatta.pdf.

using a static assumption that California will represent 42% of national HD ZEV sales. This approach is problematic for several reasons detailed below.

First, EPA underestimates the number of vehicles impacted by California standards by relying on inaccurate sales projections used in the ACT rulemaking. EPA uses estimates from the ACT rulemaking of the total Class 4–8 on-road vocational vehicle and tractor sales in California in MY 2027 of 20,938 (15,945 Class 4–8 vehicles and 4,993 tractors).[64] These sales estimates are well below the on-road Class 4–8 vocational vehicle and tractor sales in California derived from several other sources and are inconsistent with actual sales and registration data.

According to the California DMV, 50,000 MY 2018 HDVs were registered as of October 2018; 52,688 MY 2019 HDVs were registered as of January 1, 2020; and 59,758 MY 2020 HDVs were registered as of January 1, 2021.[65] These real-world new model year registrations are more than double those EPA estimated for MY 2027 in the Proposal. CARB's estimate of 20,938 HDV sales in MY 2027 is based on data from the EMFAC2017 modeling tool with an adjustment to "remove out-of-state sales" as explained in the ACT Standardized Regulatory Impact Analysis (SRIA).[66] In its documentation, CARB states that 84–90% of new registrations for Class 4–8 vehicles of model year age -1 or 0 were first sold in California.[67] CARB states that it applied this factor to the EMFAC2017 projections to estimate new in-state sales of HDVs in MY 2027, but even applying this factor to EMFAC2017 projections still results in higher estimated MY 2027 sales than what CARB presents in the SRIA. Furthermore, if the out-of-state sales factor were applied to real-world California DMV registration data, new HDV sales would still be significantly higher than CARB's EMFAC2017-based estimates.

Furthermore, a retrospective analysis by CARB has found that EMFAC2017 significantly underestimated future HDV sales compared to real-world sales.[68] For instance, analysis by CARB found that EMFAC2017 projected sales for heavy-duty trucks and buses in 2018 underestimated real-world sales by 15,633 in calendar year 2018.[69] CARB has updated its estimates of in-state HDV sales in its EMFAC2021, which projects higher sales for 2027.[70]

In addition, EPA has developed its own sales projections using its MOVES3 modeling tool, which finds much higher sales for the relevant vehicles in California. The sales projections in MOVES3 are more consistent with California vehicle registration data. EPA's MOVES "is a

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[64] 87 Fed. Reg. at 17,600, Table XI-3 (citing CARB, Advanced Clean Trucks Regulation Standardized Regulatory Impact Analysis 25 (Aug. 8, 2019), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/appc.pdf.).
[65] California Department of Motor Vehicles (CA DMV), *Vehicle Fuel Type Count by Zip Code* (May 5, 2022), https://data.ca.gov/dataset/vehicle-fuel-type-count-by-zip-code.
[66] CARB, Advanced Clean Trucks Regulation Standardized Regulatory Impact Analysis at 24.
[67] CARB, Attachment D: Emissions Inventory Methods and Results for the Proposed Advanced Clean Trucks Regulation Proposed Modifications 3 (2019), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/30dayattd.pdf.
[68] *See* CARB, EMFAC202x Updates 34, 68, 94 (July 30, 2020), https://ww2.arb.ca.gov/sites/default/files/2020-07/EMFAC202x_2nd_Workshop_07302020_ADA.pdf (showing EMFAC2017 projections underestimated HD sales in California).
[69] *Id*. at 68.
[70] CARB, Emissions Inventory, EMFAC, https://arb.ca.gov/emfac/emissions-inventory (last accessed May 10, 2022) (attached to these comments as an Excel spreadsheet).

state-of-the-science emission modeling system"[71] that "undergoes major updates and review every few years,"[72] including significant peer-reviewed updates for the most recent MOVES3 version. In MOVES3, EPA put substantial effort into estimating vehicle populations by source type and calendar year, acknowledging that vehicle population is "a critical input" that is "ever changing as new historical data becomes available and new projections are generated."[73]

In the Proposal, EPA relies on MOVES for all HDV sales and inventory projections, *except* those used in estimating the 2027 HD ZEV sales.[74] However, even when using MOVES sales and inventory data in the Proposal, EPA is inconsistent with versions, mixing data from the most recent MOVES3 version with data from previous MOVES versions. *See* 87 Fed. Reg. at 17,600–01 (basing MY 2027 projections on vehicle population data from the 2016 HD GHG Phase 2 rulemaking, which used a previous version of MOVES, but basing short-haul tractor sales share on MOVES3 data). EPA should be consistent in the data source used for the sales and inventory projections. For these reasons, EPA should rely on its own and most current MOVES3 data rather than outdated MOVES versions or California's previous projections. Sales estimates by MOVES3 and other sources are significantly higher than what EPA assumes in the Proposal, as shown in Table 1 below.

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[71] EPA, Overview of EPA's MOtor Vehicle Emission Simulator (MOVES3) 3 (Mar. 2021), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1011KV2.pdf.
[72] EPA, Population and Activity of Onroad Vehicles in MOVES3 8 (Apr. 2021), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1011TF8.pdf.
[73] *Id.* at 7–8.
[74] *See, e.g.*, 87 Fed. Reg. at 17,492 (MOVES data used for inventory analysis when considering feasibility of standards); *id.* at 17,568 ("MOVES-projected sales volumes were used to determine first-year sales and cumulative sales" when calculating direct manufacturer costs); *id.* at 17,608 (MOVES data used to project sales in MY 2027 to model emissions impact and technology costs of GHG standard revisions); DRIA at 204 (MOVES was used to "estimate emission inventories for air quality monitoring"); 87 Fed. Reg. at 17,600 (MOVES3 used to determine the fraction of short-haul tractors relative to overall tractor sales for MY 2027). EPA also used MOVES projections of total HD sales for MY 2027 but used EMFAC for California sales to extrapolate ZEV penetration rates, and then applied those to MOVES-based national sales numbers to arrive at a national percentage ZEV sales number). *See* 17 Fed. Reg. at 17,600–01 (noting that total national HDV sales numbers are based on sales split by vehicle category used in HD GHG Phase 2 rulemaking); EPA, Regulatory Impact Analysis: Greenhouse Gas Emission and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles–Phase 2 at 7-49, Tbl. 7-55 (Aug. 2016) (noting that sales estimates are based on MOVES).

Table 1: Comparison of California HD Sales Estimates by Source

Source	Class 4-8 Vocational and Tractor Sales in California			
	2020	2025	2027	2030
EPA Proposal			20,938	
CA DMV (actual registrations)[75]	59,758			
MOVES3[76]	60,421	61,003	62,047	63,614
EMFAC2021[77]	43,161	44,397	45,326	47,809
EMFAC2017[78]	36,642	40,459	42,013	43,486

Second, EPA wrongly assumes that California will continue to represent an oversized share of national HD ZEVs sales by failing to accurately capture the impact of other states' policies on HD ZEV sales. The Proposal correctly points out that numerous states "have announced plans to shift the heavy-duty fleet toward zero-emission technology." 87 Fed. Reg. at 17,598.[79] Yet when calculating baseline HD ZEV market penetration, EPA fails to discuss or account for the full range of state policies and commitments, particularly those from outside of California. Considering them would lead to substantially higher and more accurate baseline HD ZEV penetration rates.

EPA notes that "[o]utside California, several states have signaled interest in shifting to heavy-duty ZEV technologies and/or establishing specific goals to increase the heavy-duty electric vehicle market." 87 Fed. Reg. at 17,598. EPA further explains that 15 states and the District of Columbia have signed the MOU targeting ZEV sales equaling 30% of all HDV sales by 2030 and 100% of all HDV sales by 2050. 87 Fed. Reg. at 17,598. The Proposal fails to include both Virginia and Nevada as MOU signatories, and these two states bring the total MOU signatories to 17 states and the District of Columbia.[80] HDV sales in MOU states, including

[75] CA DMV, Vehicle Fuel Type Count by Zip Code (May 5, 2022), https://data.ca.gov/dataset/vehicle-fuel-type-count-by-zip-code. These are California DMV registrations for MY 2020 "Heavy" vehicles as of January 1, 2021. The California DMV does not provide which vehicle classes are included in this category.
[76] Calculated using EPA MOVES3 version 3.0.2, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves. See Appendix A for details.
[77] CARB, Emissions Inventory, EMFAC.
[78] CARB, EMFAC2017 Web Database (last accessed May 10, 2022), https://arb.ca.gov/emfac/2017/ (attached to these comments as an Excel spreadsheet).
[79] *See, e.g.*, 87 Fed. Reg. at 17,595, n.813, n.814 (citing states' and cities' expansion of electric bus fleets); *id.* at 17,596–97 (noting that the "BEV market for transit and school buses continues to grow," and identifying several cities with ZEV transit bus programs); *id.* at 17,597 (listing several states with ZEV school bus programs); *id.* at 17,598 (explaining the ACT rule and states that have signed a related MOU).
[80] Electrification Coalition, Nevada Joins Multi-State Agreement to Electrify Trucks and Buses (Mar. 31, 2022), https://www.electrificationcoalition.org/nevada-joins-multi-state-agreement-to-electrify-trucks-and-buses/; Sierra

California, make up a significant portion of national HDV sales—about 36.5%.[81] In March 2022, Northeast States for Coordinated Air Use Management (NESCAUM) and the MOU states issued a comprehensive and detailed draft Action Plan to meet their goals.[82] Despite mentioning the MOU, the Proposal does not factor into its baseline HD ZEV market penetration the fact that ZEVs will be added to the heavy-duty fleet more rapidly in these 17 states and D.C., which make up more than a third of national HDV sales.[83] An analysis by ICCT estimates that 36% of HDV sales in MOU states (excluding California) would be ZEVs in 2030 if all states implement the goal set out in the MOU.[84] ICCT estimates that this would translate to 153,820 HD ZEV sales in MOU states (excluding California) in 2030.[85]

In addition to the MOU, EPA cites the adoption of the ACT rule in three states—New York, New Jersey, and Washington, 87 Fed. Reg. at 17,598 nn.846–48—but in fact, *five* states in addition to California have adopted the ACT rule,[86] which with California would comprise 20%[87] of total HDV sales in 2027.[88] Other states also have relevant legislation underway. In May 2022, Connecticut passed legislation authorizing the state's Department of Energy and Environmental Protection to adopt the ACT rule.[89] Maine has also made progress toward adopting ZEV standards for the state's HDVs and is currently seeking additional public and stakeholder comment on its proposed ACT rule.[90] The Proposal correctly notes the expectation that more

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Club, Governor Northam Signs Virginia onto Multi-State Agreement to Electrify Trucks and Buses (Dec. 9, 2021), https://www.sierraclub.org/press-releases/2021/12/governor-northam-signs-virginia-multi-state-agreement-electrify-trucks-and.

[81] Claire Buysse, et al., *Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States*, ICCT (Apr. 8, 2022). This is consistent with MOVES3 projections for MY 2027, which show 219,092 heavy-duty sales in all the MOU states, as compared to 606,659 total heavy-duty sales nationally, or 36% of all sales. See Appendix A for the relevant MOVES3 sales projections.

[82] NESCAUM, Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Action Plan: A Policy Framework to Eliminate Harmful Truck and Bus Emissions, Draft for Public Comment (NESCAUM Action Plan) (Mar. 10, 2022), https://www.nescaum.org/documents/mhd-zev-action-plan-public-draft-03-10-2022.pdf.

[83] The MOU signatories are: California, Connecticut, Colorado, Hawaii, Maine, Maryland, Massachusetts, Nevada, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, and the District of Columbia. *See* NESCAUM MOU.

[84] Arijit Sen et al., *Benefits of the 2020 Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding* 5, ICCT (Apr. 2022), https://theicct.org/wp-content/uploads/2022/04/md-hd-mou-benefits-apr22.pdf.

[85] *Id*. at 5, Figure 1; *id.* at 15, Table A4, excluding 2b/3 vehicles.

[86] States that have adopted the ACT rule include New York, New Jersey, and Washington, as cited in the Proposal, along with Oregon and Massachusetts.

[87] Calculated using EPA MOVES3, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves. See Appendix A for the relevant MOVES3 sales projections.

[88] Laura Bliss, *How Six States Could Transform the U.S. Trucking Industry*, Bloomberg (Jan. 6, 2022), https://www.bloomberg.com/news/articles/2022-01-06/how-zero-emission-laws-will-reshape-u-s-trucking.

[89] *See* Electric Trucks Now, *States Are Embracing Electric Trucks* (last accessed May 10, 2022), https://www.electrictrucksnow.com/states; Governor Ned Lamont, State of Connecticut, Governor Lamont Applauds Final Passage of Climate Legislation That Includes New Emissions Standards for Medium and Heavy-Duty Vehicles (Apr. 29, 2022), https://officeofthegovernor.cmail20.com/t/ViewEmail/j/74D52C48B1231B922540EF23F30FEDED/BC5917CDF0297FE1025DA65DC0D0F53A?alternativeLink=False.

[90] State of Maine Board of Environmental Protection, *Meeting Minutes* (Jan. 20, 2022), https://www.maine.gov/dep/bep/calendar.html.

states will follow,[91] and Colorado, Illinois, and Vermont have "signaled plans to weigh the new regulations" as well.[92] HD ZEV sales in ACT-adopting states will need to reach between 30% (Class 7–8 tractors) and 50% (Class 4–8 trucks) by 2030, and 40% (Class 7–8 tractors) to 75% (Class 4–8 trucks) by 2035 in order to meet the ACT targets.[93] But again, EPA fails to account for the fact that the states that have adopted the ACT rule have committed to ZEV adoption at a more rapid pace than EPA projects, even absent any additional federal regulation, and that others are already taking action to join them.

Instead of factoring these state policies directly into its calculations, EPA takes an approach that leads to a significant underestimate of baseline HD ZEV market penetration by MY 2027. In the DRIA, EPA cites a 2021 analysis by ICCT that notes that 42% of cumulative HD ZEVs sold through 2020 in the U.S. and Canada have been in California.[94] This leads EPA to conclude that 42% of annual national HD ZEV sales will be in California in MY 2027. But this will not be the case in 2027. While California represents 42% of cumulative HD ZEV sales in the United States and Canada, it only comprises 10% of U.S. HDV registrations.[95] As noted above, states that have signed the MOU, including California and other ACT-adopting states, represent 36.5% of HDV registrations.[96] As these policies take effect in these states, the relative share of HD ZEV sales in California will fall, even as national sales increase. California would only represent 28% of total HD ZEV sales nationally if all MOU states achieve the ACT targets (with the MOU states representing 72% of total HD ZEV sales).[97] And these figures do not account for the high possibility that other states beyond the MOU states also see growth in HD ZEV sales, as detailed in Section III.C below.

There has been a similar trend of other states making up a larger share of light-duty ZEV sales. In 2015, a total of 64,175 light-duty ZEVs were sold in the United States, with 53% sold in California.[98] However, as of 2021, California's relative share has fallen to 35% as light-duty ZEV sales have dramatically accelerated nationally, driven by other federal and state policies and significant consumer interest in ZEVs (Figure 2). As of 2021, new light-duty ZEV sales totaled 166,582 in California (nearly 5 times higher than in 2015) and 473,426 nationally (nearly 7 times higher than in 2015).[99] These trends demonstrate not only how quickly ZEV sales have

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[91] 87 Fed. Reg. at 17,598 (noting that "we anticipate more states to follow with similar proposals" to the states that have adopted California's ACT rule).

[92] Laura Bliss, *How Six States Could Transform the U.S. Trucking Industry*, Bloomberg (Jan. 6, 2022), https://www.bloomberg.com/news/articles/2022-01-06/how-zero-emission-laws-will-reshape-u-s-trucking.

[93] CARB, Advanced Clean Trucks Regulation, Final Regulation Order, Table A-1 at 5 (Mar. 15, 2021), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf; Rachel MacIntosh et al., *Electric Vehicle Market Update* 15, EDF (Apr. 2022), http://blogs.edf.org/climate411/files/2022/04/electric_vehicle_market_report_v6_april2022.pdf.

[94] Ben Sharpe & Claire Buysse, *Zero-Emission Bus and Truck Market in the United States and Canada: A 2020 Update* 5, ICCT (May 21, 2021), https://theicct.org/publication/zero-emission-bus-and-truck-market-in-the-united-states-and-canada-a-2020-update/.

[95] For MY 2020. See Appendix A for details on these calculations.

[96] Claire Buysse et al., *Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United States*, ICCT (Apr. 8, 2022). See also MOVES3 projections for MY 2027.

[97] See Appendix A for details on these calculations. Calculated using EPA MOVES3, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.

[98] Alliance for Automotive Innovation, Electric Vehicle Sales Dashboard (last accessed May 10, 2022), https://www.autosinnovate.org/resources/electric-vehicle-sales-dashboard.

[99] *Id*.

accelerated but also how they have grown in states beyond California. Over the long term, with other state policies and federal incentives taking effect, regional differences in ZEV sales will diminish for HDVs, just as they have for light-duty vehicles.

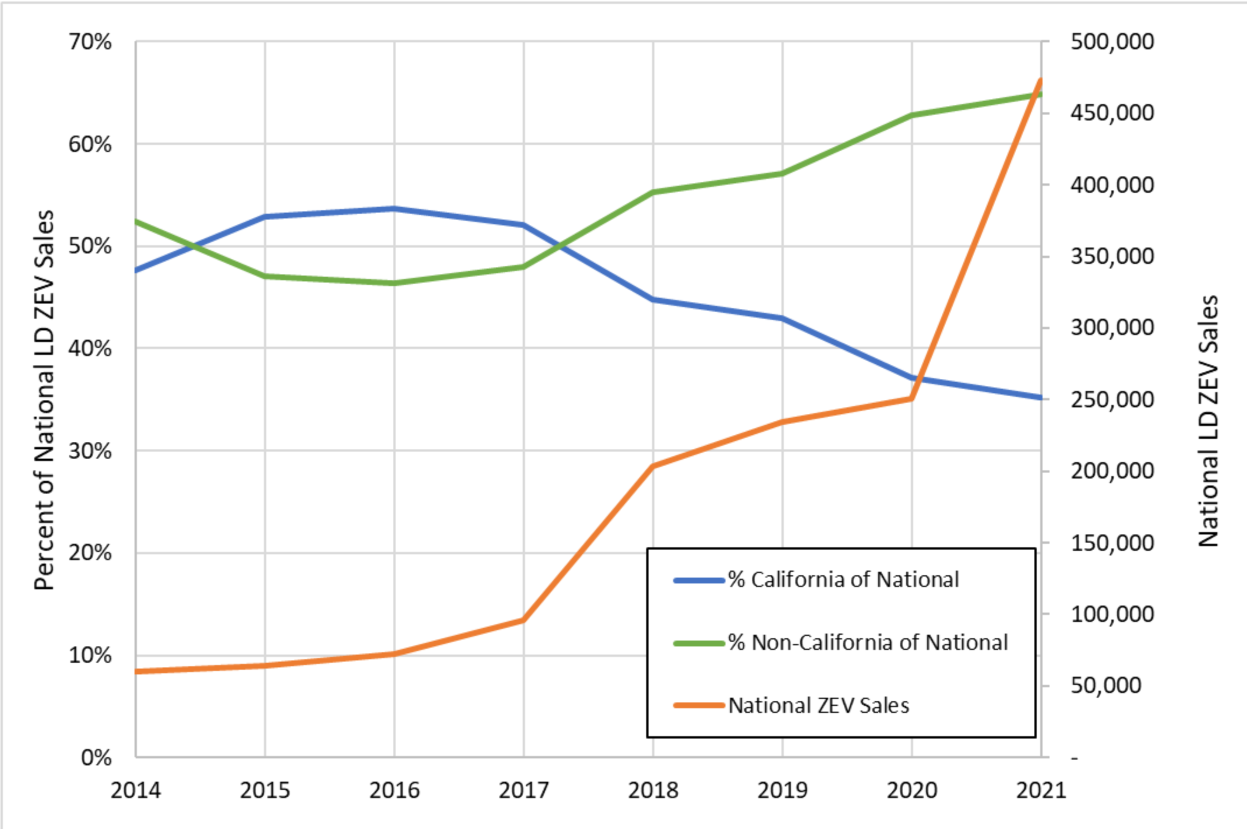

Figure 2: California Light-Duty ZEV sales share compared to National Light-Duty ZEV sales[100]

In light of this data, EPA should not calculate forward-looking national HD ZEV sales using outdated HDV sales estimates and backward-looking sales shares. Instead, EPA should factor in the impact of policies in other states beyond California in the Agency's estimate of baseline HD ZEV market penetration. This should include states that 1) have adopted the ACT rule; 2) have committed to the MOU; and 3) are taking actions to deploy zero-emission transit and school buses (where it is possible to separately quantify those actions). This would result in a baseline HD ZEV market penetration estimate of at least 8% by 2027 and 19% by 2030.[101]

Still, even these more accurate baseline estimates would fail to reflect growing HD ZEV deployment in states that may adopt regulatory policies in the future or deployment that is driven by local government programs and private sector investments, as discussed below in Section III.C. As such, a baseline HD ZEV market penetration of 8% by 2027 and 19% by 2030 would be conservative. Accounting for modest additional state and private sector actions would bring

[100] Developed using data from the Electric Vehicle Sales Dashboard. *See id*.
[101] This assumes MOU states adopt ACT targets for 2027 and 2030. For detailed description of the methodology to develop these estimates, see Appendix A.

baseline HD ZEV market penetration to at least 11% by 2027 and 27% by 2030.[102] In addition, the faster-than-expected gains in the cost-competitiveness of HD ZEVs, as detailed below in Section III.D, offers additional evidence that HD ZEV uptake will continue to increase and that a MY 2027 HD ZEV penetration rate of between 8% and 11% by 2027 is a feasible and conservative baseline estimate.[103]

B. Current market projections indicate significantly higher baseline HD ZEV sales.

Current market analyses project rapid growth in HD ZEVs by the late 2020s, further illustrating that EPA's proposed baseline market penetration is a significant underestimate and that standards that further drive adoption of zero-emission technologies are clearly feasible.

In discussing advances to the HD ZEV market, EPA cites two modeled projections: the Energy Information Administration's (EIA) Annual Energy Outlook 2021 ("AEO 2021") and the National Renewable Energy Laboratory's (NREL) Electrification Futures Study (2018). EPA also requests comment on sources for estimates and projections of the HD ZEV market. There are additional and up-to-date projections that demonstrate much higher baseline national HD ZEV penetration than the limited information that EPA considered in the Proposal, as shown in Table 2 below. These include:

- Boston Consulting Group discusses the fact that "change is unfolding at electrifying speed in the commercial vehicle industry," driven by economics and policies.[104] The report predicts BEV sales in the range of 19–23% and FCEV sales in the range of 3–6%, with a central estimate of 25% ZEVs by 2030 (and 10% ZEVs by 2025). Even in its conservative scenario, zero-emission commercial vehicle sales would reach 6% in 2025 and 15% in 2030.

- NREL's "Decarbonizing Medium- and Heavy-Duty On-Road Vehicles" report finds that "zero-emission vehicles (ZEVs) can reach total-cost-of-driving parity with conventional diesel vehicles by 2035 for all medium- and heavy-duty (MD/HD) vehicle classes," with smaller trucks and short-haul trucks achieving cost parity soon.[105] The analysis concludes that "demand for ZEV could rise rapidly...once cost parity is reached" and that ZEV sales could reach 42% by 2030.[106]

[102] This assumes MOU states adopt ACT targets for 2027 and 2030 and non-MOU states achieve 4% HD ZEV penetration by 2027 and 11% HD ZEV penetration by 2030. For a detailed description of the methodology to develop these estimates, see Appendix A.

[103] For a detailed description of the methodology to develop these estimates, see Appendix A.

[104] Peter Wiedenhoff et al., *What the Shift to Zero-Emission Vehicle Means for Commercial Transportation*, Boston Consulting Group (Mar. 22, 2022), https://www.bcg.com/en-us/publications/2022/what-the-shift-to-zero-emission-vehicles-means-for-commercial-transportation.

[105] Catherine Ledna et al., *Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis* 2, NREL (Mar. 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

[106] *Id*. at 3.

- ACT Research's "Charging Forward Update" report projects that BEVs will reach 21% of Class 4–8 sales by 2027.[107]

- The International Energy Agency's Global EV Outlook 2021 projects that due to federal and state policies incentivizing ZEVs and charging infrastructure, ZEV sales for buses and trucks will reach 20% and 8%, respectively, by 2030.[108]

- BNEF's Electric Vehicle Outlook 2021 states that "in urban duty cycles, battery electric trucks of any size become the cheapest option for several use cases in the 2020s," with "battery electric trucks becoming a viable option for heavy-duty long-haul operations" by the late 2020s.[109] BNEF's Economic Transition Scenario projects that U.S. HD ZEV sales will reach 5% in 2027 for commercial HDVs and 38% in 2027 for buses.

The AEO 2021 report that EPA cites in the Proposal projects that HD ZEVs will only make up 0.12% of new truck sales in 2027.[110] This projection is substantially lower than other available market-based projections and should not be relied upon for the rulemaking. The model projects that only 485 electric medium- or heavy-duty vehicles will be sold in 2027, which is completely inconsistent with existing state policies and private sector commitments.[111] Importantly, the National Energy Modeling System (NEMS), the model used for the AEO 2021 report, does not consider the impact of California and other states adopting the ACT rule or signing the MOU. NEMS also does not factor in total cost-of-ownership in calculating vehicle sales demand,[112] does not appear to reflect the latest projected battery costs, and imposes exogenous maximum zero-emission technology penetration of 10%.[113]

For its second source, EPA cites the NREL Electrification Futures Study (EFS).[114] Compared to AEO 2021, NREL projects a greater market penetration of HD ZEVs, but the analysis is still dated compared to more recent analyses. NREL EFS projects 2027 HD ZEV sales shares of 5% for Class 3–6, 2% for Class 7–8, and 9% for buses in its Medium Scenario; and 10% for Class 3–6, 7% for Class 7–8, and 45% for buses in its High Scenario. As NREL's analysis was completed in 2017, it does not account for all the significant advancements in the

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[107] Jennifer McNealy, *ACT Research Releases Updated BEV and FCEV Study & Adoption Forecasts for NA CV Markets*, ACT Research (Feb. 7, 2022), https://content.actresearch.net/blog/nacev-act-research-releases-updated-bev-and-fcev-study-adoption-forecasts-for-na-cv-markets.
[108] IEA, Prospects for Electric Vehicle Deployment (2021), https://www.iea.org/reports/global-ev-outlook-2021/prospects-for-electric-vehicle-deployment (IEA's definition appears to include Class 2b/3 categories).
[109] BNEF, Electric Vehicle Outlook 2021 (2021), https://about.bnef.com/electric-vehicle-outlook/.
[110] 87 Fed. Reg. at 17,596
[111] EIA, Annual Energy Outlook 2021, Table 49. Freight Transportation Energy Use (last accessed May 10, 2022), https://www.eia.gov/outlooks/archive/aeo21/tables_ref.php (attached to these comments as an Excel spreadsheet).
[112] EIA, Transportation Sector Demand Module of the National Energy Modeling System: Model Documentation (Dec. 2020), https://www.eia.gov/outlooks/aeo/nems/documentation/transportation/pdf/m070(2020).pdf.
[113] National Energy Modeling System input file "Max Share of Each Fuel Type" corresponding to parameter "EFSHXG" for formula (199) as discussed in *id.* at 108. NEMS input files can be found at: https://www.eia.gov/outlooks/aeo/info_nems_archive.php
[114] Trieu Mai et al., *Electrification Futures Study: Scenarios of Electric Technology Adoption and Power Consumption for the United States*, NREL (2018), https://www.nrel.gov/docs/fy18osti/71500.pdf.

HD ZEV market that EPA proposes to take into account in this rulemaking. For instance, the NREL EFS assumes that battery costs decline such that they reach $135/kWh by 2050. This is a much slower pace than has been demonstrated in the real world. In fact, according to BNEF, the average lithium-ion battery pack cost was $137/kWh in 2020, down from $295/kWh in 2016.[115] Projected battery costs have fallen significantly to such an extent that a report by Roush Industries notes that "battery cost projections made in 2017-2018 are already obsolete."[116] Analysis conducted by Roush finds that battery costs could reach $59–68/kWh by 2027. Other analyses have cited costs of $100/kWh by 2025.[117] Furthermore, the NREL EFS pre-dates California's ACT program and the MOU signed by 17 states, so it does not consider the impact that these policies will have on market evolution.

Accordingly, EPA should place greater weight on recent studies that more accurately reflect a current assessment of the HD ZEV market, and which project more rapid market penetration of HD ZEVs in the coming years.

Table 2: Recent Studies with Market Projections for HD ZEVs

Market Projection	Percent National HD ZEV Sales
ACT Research "Charging Forward Update"[118]	24% by 2027 for Class 4–8 commercial vehicles
NREL "Decarbonizing Medium and Heavy-Duty On-road Vehicles"[119]	42% by 2030 for Class 3–8 vehicles
Boston Consulting Group "What the Shift to Zero-Emission Vehicles Means for Commercial Transportation"[120]	25% by 2030 (range of 21% to 29%)
IEA Global EV Outlook[121]	8% for trucks and 20% for buses by 2030 under Stated Policies Scenario
BNEF Electric Vehicle Outlook 2021[122]	5% for trucks and 38% for buses by 2027

[115] BNEF, Electric Vehicle Outlook 2021 (2021).
[116] Vishnu Nair et al., *Technical Review of: Medium and Heavy-Duty Electrification Costs for MY 2027- 2030* 44, Figure 15, Roush Industries for EDF (Feb. 2, 2022), http://blogs.edf.org/climate411/files/2022/02/EDF-MDHD-Electrification-v1.6_20220209.pdf.
[117] Peter Wiedenhoff et al., *What the Shift to Zero-Emission Vehicle Means for Commercial Transportation*, Boston Consulting Group (March 22, 2022); Chad Hunter, NREL, Spatial and Temporal Analysis of the Total Cost of Ownership for Class 8 Tractors and Class 4 Parcel Delivery Trucks 10 (Sept. 2020), https://www.nrel.gov/docs/fy21osti/71796.pdf.
[118] Jennifer McNealy, *ACT Research Releases Updated BEV and FCEV Study & Adoption Forecasts for NA CV Markets*, ACT Research (Feb. 7, 2022), https://content.actresearch.net/blog/nacev-act-research-releases-updated-bev-and-fcev-study-adoption-forecasts-for-na-cv-markets.
[119] Catherine Ledna et al., *Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis* 2, NREL (Mar. 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.
[120] Peter Wiedenhoff et al., *What the Shift to Zero-Emission Vehicle Means for Commercial Transportation*, Boston Consulting Group (Mar. 22, 2022).
[121] IEA, *Prospects for Electric Vehicle Deployment* (2021), https://www.iea.org/reports/global-ev-outlook-2021/prospects-for-electric-vehicle-deployment.
[122] BNEF, Electric Vehicle Outlook 2021 (2021).

C. Federal, state, local, and private sector actions and commitments support a much higher baseline HD ZEV market penetration rate, as well as the feasibility of including zero-emission technologies in the technology packages underlying the standards.

EPA's proposed HD ZEV market penetration estimate also fails to account for plans by entities at all levels within the public and private spheres beyond state-adopted ACT rules and the MOU, which would significantly expand the HD ZEV market. This suggests that even a MY 2027 baseline HD ZEV penetration rate of 8% to 11% is a conservative estimate. The federal government, cities, and states across the country have implemented plans to transition their heavy-duty fleets to ZEVs. The private sector, too, has seen rapidly increasing commitments from both manufacturers and fleet managers. The Proposal notes a few of these public and private commitments, but it fails to capture the depth and breadth of the pace at which these commitments and goals are being announced. This section offers a non-exhaustive survey of some of the many goals and commitments already made; several sources are regularly updated and available to EPA to track the rapidly expanding HD ZEV market.[123] A more accurate picture of the national HD ZEV landscape clearly indicates that EPA's estimate of only 9,376 HD ZEV sales nationally by MY 2027[124] is a gross underestimate—especially given that fleets have already ordered or deployed at least 19,000 Class 4–8 ZEVs[125]—and supports a baseline HD ZEV market penetration of at least 8–11% in MY 2027. In addition, these goals and commitments further show the need for EPA to treat zero-emission technologies as feasible and to incorporate them into its standards-setting analysis.

1. Other state policies and commitments

On the state level, commitments and incentives extend beyond the ACT rule and the MOU. For example, CARB's Innovative Clean Transit regulation directs large transit agencies to make 25% of new bus purchases zero-emission in 2023, increasing to 50% by 2026 and 100% by 2029.[126] More than 3,500 BEV and hydrogen FCEV transit buses are already in operation or on order nationwide.[127] New York has also signed into law plans to electrify all school buses in the

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[123] For updated information, EPA should consult the following resources: EDF, Electric Fleet Deployment & Commitment List (last accessed May 10, 2022), https://docs.google.com/spreadsheets/d/1l0m2Do1mjSemrb_DT40YNGou4o2m2Ee-KLSvHC-5vAc/edit#gid=2049738669 (tracking fleet-level orders, vehicles in operation, and commitments); CALSTART, Zero-Emission Technology Inventory (2022), https://globaldrivetozero.org/tools/zero-emission-technology-inventory/ (tracking HDV ZEV models and commercial availability); DOE, Federal and State Laws and Incentives, Alternative Fuels Data Center (last accessed May 10, 2022), https://afdc.energy.gov/laws (tracking federal, state, and local laws and commitments within all ZEV sectors).

[124] 87 Fed. Reg. at 17,600.

[125] This value was calculated by selecting the Class 4–8 trucks listed as deployed or ordered in EDF's Electric Fleet Deployment & Commitment List, as of May 10, 2022. The list is regularly updated to include additional new commitments. EDF, Electric Fleet Deployment & Commitment List.

[126] Sandra Wappelhorst & Felipe Rodríguez, ICCT, Decarbonizing Bus Fleets: Global Overview of Targets for Phasing Out Combustion Engine Vehicles (Dec. 9, 2021), https://theicct.org/decarbonizing-bus-fleets-global-overview-of-targets-for-phasing-out-combustion-engine-vehicles/ ; CARB, Innovative Clean Transit Fact Sheet (May 16, 2019), https://ww2.arb.ca.gov/resources/fact-sheets/innovative-clean-transit-ict-regulation-fact-sheet.

[127] NESCAUM Action Plan at 15; Hannah Hamilton et al., CALSTART, Zeroing in on ZEBs 10 (Dec. 2021), https://calstart.org/wp-content/uploads/2022/01/2021-ZIO-ZEB-Final-Report_1.3.21.pdf.

state by 2035—yielding 50,000 electric HDVs in that state alone.[128] CARB is also developing the Advanced Clean Fleets (ACF) rule, which EPA did not analyze in the Proposal, to complement the ACT rule. The ACF rule will regulate public and private fleets, new mobility fleets, large employer fleets, rental fleets, and delivery fleets, with the "goal of achieving a zero-emission public bus and truck fleet in California by 2045 and significantly earlier for certain market segments like last mile delivery and drayage trucks."[129] In addition, California's Low NO_X Heavy-Duty Omnibus Regulation (the "Omnibus"), adopted in 2020, "will cut NO_X emissions from heavy-duty trucks by roughly 75 percent below current standards beginning in 2024 and 90 percent in 2027."[130] These regulations are expected to be fully effective by 2024, likely increasing HD ZEV uptake in California even more than the ACT rule alone.[131]

In addition, state-level commitments do not end with states that have enacted the ACT rule or signed the MOU. In fact, goals have been announced, commitments made, regulations passed, or financial incentives provided (such as rebates or funding) *specific to the heavy-duty sector* in at least 39 states plus the District of Columbia.[132] These heavy-duty sector programs are in addition to many broader state and local programs targeted at ZEV adoption generally (across all vehicle sectors), which exist in all 50 states[133] and include: medium- and heavy-duty or diesel emissions reduction funding, rebates, or HDV replacement grants in states such as Delaware, Idaho, Indiana, Iowa, Michigan, Montana, New Mexico, Ohio, South Dakota, Texas, and Wyoming;[134] allowance for HD ZEVs to exceed weight limits in Arizona; ZEV school and/or transit bus programs and incentives in Illinois, Minnesota, Missouri, Oklahoma, Texas, West Virginia, and Wisconsin; and a diesel refuse truck replacement program in Nebraska.[135] Other states beyond those that have adopted the ACT rule or signed the MOU have also been forming smaller regional-specific collaborations aimed at HD ZEV adoption. For example, Illinois, Indiana, Michigan, Minnesota, and Wisconsin recently signed an MOU establishing the Regional Electric Vehicle Midwest Coalition (REV Midwest), which "aims to create [a] cohesive regional

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[128] Michelle Lewis, *New York State Commits to 100% Electric School Buses by 2035*, Electrek (Apr. 8, 2022), https://electrek.co/2022/04/08/new-york-state-governor-100-electric-school-buses-2035/ (New York City had already passed legislation that required electrifying its entire school bus fleet—9,500 buses—by 2035 prior to the state's commitment); World Resources Institute (WRI), Statement: New York Enacts First-in-Nation Plan to Electrify All State School Buses (Apr. 7, 2022), https://www.wri.org/news/statement-new-york-enacts-first-nation-plan-electrify-all-state-school-buses.

[129] Rachel MacIntosh et al., *Electric Vehicle Market Update* 15, EDF (Apr. 2022).

[130] *Id.*; Patricio Portillo, Natural Resources Defense Council, California Omnibus Rule Adds Momentum to Cut Truck Pollution (Aug. 27, 2020), https://www.nrdc.org/experts/patricio-portillo/california-omnibus-rule-adds-momentum-cut-truck-pollution.

[131] *Id*.

[132] *See* DOE, Federal and State Laws and Incentives, Alternative Fuels Data Center (last accessed May 10, 2022), https://afdc.energy.gov/laws (tracking federal, state, and local laws and commitments within all ZEV sectors).

[133] Information on regulations and programs in all states, including those that have signed the MOU or adopted ACT regulations, is available in *id*., and from the NC Clean Energy Technology Center, Database of State Incentives for Renewables and Efficiency (last accessed May 10, 2022), https://programs.dsireusa.org/system/program.

[134] Many of these programs are funded as part of the Volkswagen Environmental Trust/Volkswagen settlement.

[135] This list is compiled from information available at DOE, Federal and State Laws and Incentives, Alternative Fuels Data Center (last accessed May 10, 2022), https://afdc.energy.gov/laws (does not include the vast array of programs and incentives available in the MOU and ACT states).

framework to accelerate the transition to electric vehicles."[136] One of REV Midwest's three key foundations is to accelerate medium- and heavy-duty fleet electrification.[137] These state actions provide strong support for reducing emissions from the heavy-duty sector by transitioning to ZEVs, which will further enable HD ZEV market penetration in excess of that projected in the Proposal.

2. Federal commitments

The federal government's procurement goals and commitments will also lead to greater HD ZEV market penetration. President Biden recently signed Executive Order 14,057, directing the federal government to transition to 100% ZEV acquisitions for all federal fleets (including HDVs) by 2035.[138] The federal fleet is large, and in 2020 included 39,246 heavy-duty trucks (Classes 5–8), 103,215 medium-duty trucks (Classes 2b–4), and 8,057 buses.[139] As this large number of vehicles ages, the directive in the Executive Order will further drive HD ZEV penetration as federal agencies replace conventional vehicles with ZEVs. The ZEV transition within the federal fleet is already underway, with the General Services Administration (GSA) doubling the amount of ZEV medium- and heavy-duty models available to federal agencies.[140] In accordance with Executive Order 14,057, individual agencies will develop and annually update their own ZEV fleet strategies to meet the ZEV target in the Executive Order, and already have been directed to "maximiz[e] acquisition and deployment of zero-emission light-, medium-, and heavy-duty vehicles where the General Services Administration…offers one or more zero-emission vehicle options for that vehicle class."[141]

The federal government has also committed significant funds toward achieving increased HD ZEV development and demand.[142] The Infrastructure Investment and Jobs Act of 2021 (the

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[136] Rachel MacIntosh et al., *Electric Vehicle Market Update* 16, EDF (Apr. 2022); Regional Electric Vehicle Midwest Coalition, Memorandum of Understanding Between Illinois, Indiana, Michigan, Minnesota, and Wisconsin 1 (Sept. 30, 2021), https://www.michigan.gov/documents/leo/REV_Midwest_MOU_master_737026_7.pdf.

[137] Rachel MacIntosh et al., *Electric Vehicle Market Update* 16, EDF (Apr. 2022); Regional Electric Vehicle Midwest Coalition, Memorandum of Understanding Between Illinois, Indiana, Michigan, Minnesota, and Wisconsin 1 (Sept. 30, 2021), https://www.michigan.gov/documents/leo/REV_Midwest_MOU_master_737026_7.pdf.

[138] U.S. Office of the Federal Chief Sustainability Officer, 100% Zero-Emission Vehicle Acquisitions by 2035, Including 100% Light-Duty Acquisitions by 2027, Federal Sustainability Plan (last accessed May 10, 2022), https://www.sustainability.gov/federalsustainabilityplan/fleet.html; The White House, Executive Order on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, Executive Order 14,057, Section 102(a)(ii) (Dec. 8, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability/.

[139] GSA, FY 2020 Federal Fleet Open Data Set, at tab 2-6T (May 25, 2021), https://www.gsa.gov/policy-regulations/policy/vehicle-management-policy/federal-fleet-report.

[140] The White House, Fact Sheet: Vice President Harris Announces Actions to Accelerate Clean Transit Buses, School Buses, and Trucks (Mar. 7, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/07/fact-sheet-vice-president-harris-announces-actions-to-accelerate-clean-transit-buses-school-buses-and-trucks/ (noting increase in GSA models available).

[141] White House, Executive Order on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, Executive Order 14,057, Section 204 (Dec. 8, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability/.

[142] For a list of ZEV-related programs funded by the Bipartisan Infrastructure Law, *see* DOE, Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act of 2021), Alternative Fuels Data Center (last accessed

"Bipartisan Infrastructure Law") "provides critical funding for states to accelerate MHD vehicle electrification."[143] Examples of programs that the law will fund include: EPA's Clean School Bus Program with $5 billion over the next five years (FY 2022–2026) to replace conventional school buses with ZEV models;[144] the Department of Transportation's (DOT) Low-No Program with $5.5 billion toward purchases of low- or no-emission transit vehicles, "more than 10 times greater than the previous five years of funding;"[145] and DOT's Grants for Buses and Bus Facilities Program with $5.1 billion over the next five years to support modernizing and electrifying bus fleets.[146] DOT's Federal Transit Administration also plans to award funding for ZEVs through the American Rescue Plan, including $7 million to replace diesel school buses with ZEV buses in underserved communities, and an additional $10 million for ZEV school buses through the Diesel Emissions Reduction Act School Bus Rebate Program.[147] DOE has also increased funding for ZEV research, allocating $127 million in funding to industry through its SuperTruck 3 program, "focused for the first time on reducing costs and improving durability in hydrogen and battery electric trucks."[148] EPA does not discuss or account for the Bipartisan Infrastructure Law funding or other recent federal funding in the Proposal, and these commitments will certainly accelerate the pace of growth in the HD ZEV market nationwide. When adopting the final rule, EPA must consider the impacts that this federal funding will have on HD ZEV development and uptake.

May 10, 2022), https://afdc.energy.gov/laws/infrastructure-investment-jobs-act; *see also* The White House, Fact Sheet: The Bipartisan Infrastructure Deal (Nov. 6, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/11/06/fact-sheet-the-bipartisan-infrastructure-deal/; NESCAUM Action Plan at 18.

[143] *Id.*

[144] EPA, Clean School Bus Program Funding (last accessed May 10, 2022), https://www.epa.gov/cleanschoolbus.

[145] Federal Transit Administration, Biden-Harris Administration and the U.S. Department of Transportation Announce Nearly $1.5 Billion in Grants Funded by the Bipartisan Infrastructure Law to Modernize Bus Fleets and Facilities, New Release (Mar. 7, 2022), https://www.transit.dot.gov/about/news/biden-harris-administration-and-us-department-transportation-announce-nearly-15-billion.

[146] Federal Transit Administration, President Biden and the U.S. Department of Transportation Announce $409 Million for 70 Transportation Projects in 39 States (Mar. 14, 2022), https://www.transit.dot.gov/about/news/president-biden-and-us-department-transportation-announce-409-million-70-transportation; Federal Transit Administration, Fiscal Year 2021 Buses and Bus Facilities Projects (last accessed May 10, 2021), https://www.transit.dot.gov/funding/grants/fiscal-year-2021-buses-and-bus-facilities-projects.

[147] White House, Fact Sheet: Vice President Harris Announces Actions to Accelerate Clean Transit Buses, School Buses, and Trucks (Mar. 7, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/07/fact-sheet-vice-president-harris-announces-actions-to-accelerate-clean-transit-buses-school-buses-and-trucks/. *See also* Rachel MacIntosh et al., *Electric Vehicle Market Update* 18, EDF (Apr. 2022).

[148] The White House, Fact Sheet: Vice President Harris Announces Actions to Accelerate Clean Transit Buses, School Buses, and Trucks (Mar. 7, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/07/fact-sheet-vice-president-harris-announces-actions-to-accelerate-clean-transit-buses-school-buses-and-trucks/. Multiple other governmental and industry research projects are focused on ZEVs, including: Advanced Research on Integrated Energy Systems (providing a real-world environment for testing large battery and fuel cell electric trucks); Million Mile Fuel Cell Truck consortium (developing cost effective technology with industry for next generation fuel cells); and 21st Century Truck Partnership (launching a new electrification tech team focused on removing barriers to wide-scale truck electrification and deploying technology to improve freight efficiency).

3. City and other local government actions

Cities and other local governments are also committing to a shift to zero-emission technologies in the heavy-duty sector. EPA notes one specific commitment by the Los Angeles Department of Transportation (LADOT) to electrify its entire transit fleet by 2030 or sooner. 87 Fed. Reg. 17,597. The commitment from just this one municipal agency will yield approximately 501 ZEVs by 2030.[149] But several other cities and states have announced commitments specifically aimed at electrifying local fleets. As EPA notes, numerous other cities and localities across the country have set ZEV transit and/or school bus commitments or piloted ZEV bus programs. 87 Fed. Reg. at 17,597. EPA lists ZEV transit bus programs in Chicago, Seattle, New York City, and Washington, D.C., and school bus programs in school districts in California, Virginia, Massachusetts, Michigan, Maryland, Illinois, New York, and Pennsylvania. 87 Fed. Reg. at 17,597. According to data from the World Resources Institute (WRI), in the six months prior to April 2022, "the number of committed electric school buses increased over 50 percent to a total of more than 1,800," and at least 37 states have either procured one or more electric school buses, or announced plans to do so, "with California, Maryland and Florida leading the way."[150] States and cities have also ordered other Class 4–8 ZEVs across the country, such as refuse and fire trucks, including in states beyond those that have signed the MOU or adopted the ACT rule, such as Wisconsin, Florida, Arizona, and Alaska. [151] Despite noting a few of these commitments, the Proposal fails to capture the speed and breadth of local government actions, and its projections fail to account for any significant HD ZEV penetration outside of California. All of these commitments provide further evidence that even baseline HD ZEV market penetrations within the range of 8–11% for MY 2027 and 19–27% for MY 2030 are conservative estimates. At least some modest level of HD ZEV uptake in states that have not adopted the ACT

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[149] LADOT, Zero-Emission Bus Rollout Plan 7 (Oct. 2020), https://ww2.arb.ca.gov/sites/default/files/2020-12/LADOT_ROP_Reso_ADA12172020.pdf.

[150] Arianna Skibell & Ariel Wittenberg, *How Electric Buses Reduce Toxic Exposure for Kids*, E&E News (Apr. 13, 2022), https://www.eenews.net/articles/how-electric-buses-reduce-toxic-exposure-for-kids/. See also Leah Lazer and Lydia Freehafer, WRI, The State of Electric School Bus Adoption in the U.S. (Aug. 5, 2021), https://www.wri.org/insights/where-electric-school-buses-us; WRI, Dataset of Electric School Bus Adoption in the United States (last accessed May 10, 2022), https://datasets.wri.org/dataset/electric_school_bus_adoption; Hannah Hamilton et al., CALSTART, Zeroing in on ZEBs (Dec. 2021), https://calstart.org/wp-content/uploads/2022/01/2021-ZIO-ZEB-Final-Report_1.3.21.pdf. School buses have especially attractive potential for electrification, as districts have begun to look into using electric school bus fleets to provide vehicle-to-grid services, meaning that "when electric school buses sit idle in the evenings and summer months, the batteries can be used to store and discharge electricity back to the grid during periods of peak demand when electricity is costlier," which "improves the economics of fleet electrification while reducing electricity distribution system costs for ratepayers." NESCAUM Action Plan at 15–16; *see also, e.g.,* The Lion Electric Co., Lion Electric Announces Successful Electric School Bus Vehicle-to-Grid Deployment with Con Edison in New York (Dec. 14, 2020), lion-electric-announces-successful-electric-school-bus-vehicle-to-grid-deployment-with-con-edison-in-new-york-301191980.html. For a recent compilation of current and proposed electric school bus V2G project, *see* Norma Hutchinson and Greggory Kresge, *3 Design Considerations for Electric School Bus Vehicle-to-Grid Programs*, TheCityFix (Feb. 14, 2022), https://thecityfix.com/blog/3-design-considerations-for-electric-school-bus-vehicle-to-grid-programs/.

[151] EDF, Electric Fleet Deployment & Commitment List (last accessed May 10, 2022), https://docs.google.com/spreadsheets/d/1l0m2Do1mjSemrb_DT40YNGou4o2m2Ee-KLSvHC-5vAc/edit#gid=2049738669 (listing 10,034 HD ZEVs already deployed or ordered by federal, state, and local governments).

rule or signed the MOU is likely and would lead to baseline HD ZEV penetration of 11% or higher by MY 2027.

4. Private fleet commitments

As heavy-duty fleet managers establish their own environmental goals and recognize the increasingly favorable economics of ZEVs, both the speed of innovation and the demand for HD ZEVs are increasing at a rate that EPA's proposed 1.5% market penetration does not reflect. A 2018 survey of fleet managers listed "sustainability and environmental goals" as the primary motivator for transitioning to ZEVs, with "lower cost of ownership" as the second most important factor.[152] In fact, "[l]arge corporate fleets are responsible for much of the early momentum in commercial MHD fleet electrification…driven by corporate sustainability commitments and a desire to achieve operational savings."[153] These cost and sustainability motivations exist independent of regulatory requirements, and support the expectation that HD ZEV uptake will continue to grow in all states, including those that have not yet adopted more stringent regulations. While the Proposal mentions a few examples of fleet commitments to a zero-emission future, it again fails to capture the speed and breadth of these commitments that are driven not only by governmental policy but also by private industry interests, with commitments being made nationwide.

According to EDF's Electric Fleet Deployment & Commitment List (see Attachment 101 to these comments), commercial fleets have already ordered or deployed more than 164,000 medium- and heavy-duty electric vehicles, of which at least 19,000 are Class 4–8 electric vehicles.[154] The Proposal cites a few examples of commercial fleets that have made efforts toward acquiring ZEVs, such as UPS, FedEx, DHL, Walmart, Anheuser-Busch, Amazon, and PepsiCo. 87 Fed. Reg. at 17,597. These orders cover the full range of heavy-duty applications—from last-mile delivery vehicles to trucks intended to cover longer distances—and include orders such as UPS's order of 10,000 Class 4 cargo vans[155] and orders and/or deployments of over 2,500 Class 8 tractors by Amazon, UPS, PepsiCo, DHL, Walmart, and Anheuser-Busch.[156] Walmart and PepsiCo have also both placed orders with Tesla for its upcoming electric Semi, for 130 and 100 trucks, respectively.[157] Examples from just these six companies total 12,730 HD ZEVs already ordered or deployed, evidencing significant momentum toward greater deployment within private fleets. EPA should factor such commitments and deployments into its HD ZEV market penetration estimates. At the very least, these fleet commitments show significant momentum toward greater HD ZEV deployment

[152] *See* 87 Fed. Reg. at 17596; Steven Nadel & Peter Huether, *Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers* 10–11, American Council for an Energy-Efficient Economy (ACEE) (June 2021), https://www.aceee.org/research-report/t2102.
[153] NESCAUM Action Plan at 16.
[154] These values were calculated from EDF's Electric Fleet Deployment & Commitment List as of May 10, 2022. The list is regularly updated to include additional new commitments. *See id*. *See also* NESCAUM Action Plan at 16.
[155] EDF, Electric Fleet Deployment & Commitment List.
[156] *Id*.
[157] Rachel MacIntosh et al., *Electric Vehicle Market Update* 33, EDF (Apr. 2022); Fred Lambert, *Tesla Semi Receives Order of 30 More Electric Trucks from Walmart*, Electrek (Sept. 6, 2018), https://electrek.co/2018/09/06/tesla-semi-new-order-electric-truck-walmart/; Fred Lambert, *Tesla (TSLA) Secures Massive Order of Tesla Semi Electric Trucks from Walmart*, Electrek (Sept. 29, 2020), https://electrek.co/2020/09/29/tesla-tsla-secures-order-tesla-semi-electric-trucks-walmart/.

within private fleets and offer further support for a MY 2027 baseline HD ZEV market penetration of 8–11%, as a conservative estimate.

Companies with heavy-duty fleets are also announcing their commitment to a zero-emissions future. Several of these commitments include aims to reduce carbon emissions by one-third to one-half by 2030.[158] Amazon, PepsiCo, and Walmart all plan to reach net zero carbon emissions across their businesses by 2040, including their long-haul tractor operations.[159] AT&T plans to be carbon neutral even earlier, by 2035.[160] Anheuser-Busch plans to reduce carbon emissions by 25% by 2025, and FedEx is committed to 50% of its pickup and delivery fleet purchases being electric by 2025 and 100% by 2030.[161]

It is true that several large fleets such as those cited by EPA are some of the earliest adopters of HD ZEVs, but they are not alone. Interest in developing HD ZEV fleets is far-ranging, evidenced by the fact that over 135 different commercial fleets have either ordered or deployed HD ZEVs.[162] Additionally, at least 59 commercial fleets, both large and small, have announced fleet-level commitments to increased ZEV penetration and/or reduced carbon emissions.[163] In a recent survey of nearly 250 U.S.-based fleets that have used clean fuels and vehicles, nearly 85% said that their use of clean vehicle technologies would grow over the next five years.[164] In considering what the heavy-duty sector will look like in MY 2027 and beyond, EPA must consider the breadth and scale of these announcements and the fact that these commitments are considered technologically and economically feasible by such a large range of fleet managers.

5. <u>Manufacturer commitments</u>

Government and fleet commitments would not be possible if manufacturers were not producing HD ZEVs, and manufacturers are in fact rapidly increasing their HD ZEV production to meet the growing demand. For example, at May 2022's Advanced Clean Transportation Expo, manufacturers such as Cummins and Navistar made clear that they are committed to deploying zero-emission technologies at a rapid pace. Cummins CEO Tom Lineburger stressed the need "to move faster for the sake of our kids and grandkids,"[165] and Navistar CEO Mathias Carlbaum suggested that "[b]y 2030…50% of all trucks by volume will be BEVs."[166] Navistar's CEO reiterated to reporters that "[w]e believe 50% of our sales will be electric by 2030," and that

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[158] EDF, Electric Fleet Deployment & Commitment List.
[159] *Id*.
[160] *Id*.
[161] *Id*.
[162] *Id*.
[163] *Id*.
[164] Jack Roberts, *On the Glide Path to Net Zero*, HDT Truckinginfo (May 10, 2022), https://www.truckinginfo.com/10170224/on-the-glide-path-to-net-zero.
[165] Jack Roberts, *Cummins CEO: Get on the Path to Net-Zero Emissions*, HDT Truckinginfo (May 12, 2022), https://www.truckinginfo.com/10170751/cummins-ceo-get-on-the-path-to-net-zero-emissions.
[166] Jack Roberts, *Navistar CEO Calls for Long-Term Commitment to Net Zero*, HDT Truckinginfo (May 12, 2022), https://www.truckinginfo.com/10170459/navistar-ceo-calls-for-long-term-commitment-to-get-to-net-zero.

100% of sales would be ZEVs by 2040.[167] EPA should consider manufacturers' vehicle offerings, plans, and commitments when estimating baseline HD ZEV market penetration for the final rule, as well as when considering more stringent emissions standards that drive adoption of zero-emission technologies.

According to ACEEE, "growing numbers of electric truck and bus models are reaching the market or are scheduled to be on the market soon, with models ranging from heavy-duty pickup trucks to 18-wheel tractor-trailers."[168] The pace of innovation in this sector has accelerated in recent years. In 2016, Oak Ridge National Laboratory identified just eight commercially available medium- and heavy-duty ZEV options.[169] By 2019 this number had grown more than tenfold. EPA's DRIA includes "a snapshot of BEVs in the heavy-duty truck and bus markets as of 2019," based on 2019 research by the Union of Concerned Scientists (UCS). According to this "snapshot," by 2019 there were already at least 82 different HD ZEV models: 34 trucks and 48 buses. *See* DRIA at 58–59.[170] And by MY 2020, the market had grown even larger. EPA's own research conducted for the Proposal and contained in EPA's Memorandum to Docket reveals that by 2020, the number of ZEVs available for purchase climbed again to 177 unique makes and models from 52 producers in regulatory classes 3–8.[171]

These numbers are certain to increase further, but EPA's grossly underestimated 1.5% baseline HD ZEV market penetration fails to reflect this anticipated growth. As EPA notes, "given the dynamic nature of the BEV market, the number and types of vehicles available are changing fairly rapidly," 87 Fed. Reg. at 17,595, as evidenced by the increasing frequency of new HD ZEV product announcements and commitments by manufacturers. Some of these are included below in Table 3.

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[167] Alan Ohnsman, *Big Rigs Going Electric as Navistar, Cummins, Daimler Rev Up Next-Generation Trucks*, Forbes (May 13, 2022), https://www.forbes.com/sites/alanohnsman/2022/05/13/big-rigs-going-electric-as-navistar-cummins-daimler-rev-up-next-generation-trucks/?sh=5daf4f25419d.

[168] Steven Nadel & Peter Huether, *Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers* at iv, ACEEE (June 2021).

[169] Paige Jadun et al., *Electrification Futures Study: End-Use Electric Technology Cost and Performance Projections through 2050* 20, NREL (2017), https://www.nrel.gov/docs/fy18osti/70485.pdf (citing Alicia K. Birky et al., Oak Ridge National Laboratory, Transportation Electrification Beyond Light Duty: Technology and Market Assessment (Sept. 2017), https://info.ornl.gov/sites/publications/Files/Pub72938.pdf).

[170] *See also* UCS, Ready for Work: Now Is the Time for Heavy-Duty Electric Vehicles (2019), https://www.ucsusa.org/resources/ready-work.

[171] *See* Angela Cullen, HD2027 Proposed Changes to Heavy-Duty Greenhouse Gas Emissions—Memorandum to Docket 2 (Docket No. EPA-HQ-OAR-2019-0055) (Nov. 2021), https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-0880; 87 Fed. Reg. at 17,595.

Table 3: Manufacturer Commitments for HD ZEV Production

Manufacturer	Commitments or actions
Daimler Trucks	● Announced goals of selling carbon neutral commercial vehicles across all markets by 2039.[172] ● Freightliner division currently taking orders for all-electric eCascadia and eM2 trucks.[173] ● Freightliner division has developed electric versions of Cascadia Class 8 tractor, M2 Class 6 medium-duty chassis, and MT50 medium-duty step van.[174] ● Freightliner Electric Innovation Fleet has been operating at customer sites, totaling over one-million miles of operation as of October 2021.[175] ● Partnered with NextEra Energy Resources and BlackRock Renewable Power in January 2022 to invest approximately $650 million to design, develop, install, and operate a nationwide charging network for M/HD BEV and hydrogen fuel cell trucks.[176] ● Full line of ZEV commercial vehicles could be ready by 2027.[177] ● Daimler's Mercedes-Benz division unveiled a new electric model, the eActros LongHaul, expected to be ready for production by 2024, and an electric-fuel cell truck, the GenH2, which has potential to drive more than 600 miles before refueling and should be commercially available by 2025.[178]
Envirotech Vehicles Inc.	● Investing $280.7 million in manufacturing all-electric, zero-emission vehicles and zero-emission drive trains for medium to heavy-duty commercial vehicles.[179]
General Motors	● In January 2021, launched BrightDrop, which focuses on electric first-to-last-mile products, software, and services. Working with FedEx to add up to 20,000 ZEVs to the fleet.[180]

[172] Rachel MacIntosh et al., *Electric Vehicle Market Update* 29, EDF (Apr. 2022).
[173] *Id*.
[174] *Id*.
[175] *Id*.; Daimler Truck, One Million Real-World Electric Miles: Freightliner's Battery Electric Customer Fleets Reach Important Milestone (Oct. 5, 2021), https://northamerica.daimlertruck.com/PressDetail/one-million-real-world-electric-miles-freightliner-s-2021-10-05.
[176] Rachel MacIntosh et al., *Electric Vehicle Market Update* 29, EDF (Apr. 2022); Heavy Duty Trucking, *Daimler Plans to Create Nationwide Truck Charging Network*, HDT Truckinginfo (Jan. 31, 2022), https://www.truckinginfo.com/10160673/daimler-truck-plans-to-create-nationwide-truck-charging-network.
[177] Reuters, *Daimler Trucks Labour Chief Wants Clean Tech Investments in Germany* (Feb. 13, 2021), https://www.reuters.com/article/us-daimler-trucks-divestiture-idUSKBN2AD0EO.
[178] Mike De Socio, *Keep Your Eyes on These 9 Electric Truck and Van Companies in 2021*, GreenBiz (Jan. 4, 2021), https://www.greenbiz.com/article/keep-your-eyes-these-9-electric-truck-and-van-companies-2021.
[179] Rachel MacIntosh et al., *Electric Vehicle Market Update* 58, Appendix D, EDF (Apr. 2022); Andrew Moreau, *Electric-Vehicles Firm Going to Osceola Plans to Invest Millions, Hires 800 Workers*, Arkansas Democrat Gazette (Feb. 23, 2022), https://www.arkansasonline.com/news/2022/feb/23/electric-vehicles-firm-going-to-osceola/.
[180] Rachel MacIntosh et al., *Electric Vehicle Market Update* 29, EDF (Apr. 2022); General Motors, GM Launches BrightDrop, a New Business That Will Electrify and Improve the Delivery of Goods and Services (Jan. 12, 2021), https://media.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2021/jan/ces/0112-brightdrop.html.

	● Will release two all-electric models in 2021.[181]
Lion Electric Company	● Started work on a new factory in early 2022 that will "represent the largest dedicated production site for zero-emission medium and heavy-duty vehicles in the U.S. upon its completion, with an expected annual production capacity of up to 20,000 vehicles per year,"[182] a nine-fold increase in production capacity.[183]
Mack Trucks	● Added production of Mack LR Electric model as part of $84 million site overhaul.[184]
Navistar	● Launched NEXT eMobility solutions unit to focus on electrification in truck and school bus markets.[185] ● Developed prototype electric school bus and electric truck.[186] ● Launched fully electric International eMV series in August 2021.[187] ● Developing properties in Texas that will invest more than $275 million in electrification efforts.[188]
Nikola Motor Company	● Has over 9,000 orders for its hydrogen semi trucks.[189]
PACCAR's Kenworth & Peterbilt divisions	● Partnering with Dana for electric truck powertrain development.[190] ● Kenworth, Peterbilt, and DAF brands now have over 60 alternative-fuel trucks being tested in real-world applications across North America and Europe.[191] ● Has delivered hydrogen fuel cell Kenworth T680 trucks for field and performance testing.[192]

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[181] Rachel MacIntosh et al., *Electric Vehicle Market Update* 29, EDF (Apr. 2022).
[182] *Id*.
[183] Alejandro de la Garza, *U.S. School Buses May Never Be the Same Thanks to Biden's Infrastructure Plan*, Time (Nov. 15, 2021), https://time.com/6117544/electric-school-buses/.
[184] Rachel MacIntosh et al., *Electric Vehicle Market Update* 61, Appendix D, EDF (Apr. 2022); Pamela Stroka-Holzmann, *Mack Trucks Completes $84M Plant Renovation in Lehigh County*, Lehigh Valley Live (Oct. 2, 2020), https://www.lehighvalleylive.com/allentown/2020/10/mack-trucks-completes-84m-plant-renovation-in-lehigh-county.html.
[185] Rachel MacIntosh et al., *Electric Vehicle Market Update* 29, EDF (Apr. 2022).
[186] *Id*.; Navistar, Navistar Launches New Business Unit, NEXT eMobility Solutions (Oct. 28, 2019), https://news.navistar.com/2019-10-28-Navistar-Launches-New-Business-Unit-NEXT-eMobility-Solutions.
[187] Rachel MacIntosh et al., *Electric Vehicle Market Update* 29, EDF (Apr. 2022); Navistar, Navistar Launches New Electric International eMV Series, Now in Production and Available to Order (Aug. 31, 2021), https://news.navistar.com/2021-08-31-Navistar-Launches-New-Electric-International-R-eMV-TM-Series,-Now-in-Production-and-Available-to-Order.
[188] Rachel MacIntosh et al., *Electric Vehicle Market Update* 29, EDF (Apr. 2022).
[189] Sebastian Blanco, *Anheuser-Busch's Order for 800 Nikola Hydrogen Trucks is a Play for Younger Beer Drinkers*, Forbes (May 3, 2018), https://www.forbes.com/sites/sebastianblanco/2018/05/03/anheuser-busch-800-nikola-hydrogen-trucks/?sh=3f74aba74d4c.
[190] Rachel MacIntosh et al., *Electric Vehicle Market Update* 29, EDF (Apr. 2022).
[191] Josh Fisher, *Paccar Tests More Zero-Emission Trucks Ahead of 2021 Production*, FleetOwner (July 30, 2020), https://www.fleetowner.com/emissions-efficiency/article/21137951/paccar-tests-more-zeroemission-trucks-ahead-of-2021-production.
[192] *Id*.

	● Orders in the last three months of 2021 tripled over previous orders, with customers in 44 states.[193]
Proterra	● Announced a $76 million investment in new zero-emission electric transit and commercial ZEV manufacturing operations.[194]
Tesla	● Investing $1 billion in Gigafactory, to produce a range of ZEVs including the Tesla Semi Truck.[195] ● As of 2018, Tesla had about 2,000 Semi pre-orders,[196] and pre-orders have continued.[197]
Volvo	● Using nearly $45 million in CARB grant funding, launched Volvo LIGHTS, focused on "providing a range of vehicle, charging, and workforce development innovations" in the HD ZEV market. Innovations include "new lithium-ion battery chemistries that increase energy density by more than 20 percent and prevent premature degradation to reduce cost, as well as multiple truck configurations with all-electric ranges of up to 250 miles."[198] ● Currently taking orders for the electric Mack refuse truck.[199] ● Committed to selling 50% zero-emission trucks globally by 2030.[200]

[193] Scooter Doll, *Kenworth Says Electric Truck Orders Have Tripled the Past Three Months, Quoting Customers in 44 States*, Electrek (Jan. 14, 2022), https://electrek.co/2022/01/14/kenworth-says-electric-truck-orders-have-tripled-the-past-three-months-quoting-customers-in-44-states/.

[194] Rachel MacIntosh et al., *Electric Vehicle Market Update* 62, Appendix D, EDF (Apr. 2022); South Carolina Office of the Governor, Proterra Expanding South Carolina Operations with New EV Battery System Manufacturing Facility in Spartanburg County (Dec. 14, 2021), https://governor.sc.gov/news/2021-12/proterra-expanding-south-carolina-operations-new-ev-battery-system-manufacturing.

[195] Rachel MacIntosh et al., *Electric Vehicle Market Update* 41, EDF (Apr. 2022); Rebecca Hennes, *Tesla's New $1b 'Gigafactory' Will Open Near Austin, with Musk Calling it an 'Ecological Paradise,'* Houston Chronicle (July 23, 2020), https://www.chron.com/news/houston-texas/article/Tesla-Texas-gigafactory-Austin-Abbott-Musk-15428792.php.

[196] Luke Stangel, *Tesla Semi Picks Up Another Big Backer, the Country's Second-Largest Grocery Chain*, Silicon Valley Business Journal (Nov. 19, 2018), https://www.bizjournals.com/sanjose/news/2018/11/19/tesla-semi-big-customers-albertsons-tsla.html (noting pre-order announcement by Elon Musk).

[197] *See, e.g.*, Suvrat Kothari, *Tesla Semi: Everything We Know in May 2022*, TopElectricSUVs (Apr. 30, 2022), https://topelectricsuv.com/news/tesla/tesla-semi-all-we-know-feb-2022/#Large_order_book (noting Tesla's "large order book" including orders for 100 trucks by PepsiCo, 40 trucks by Anheuser-Busch, 130 trucks by Walmart, at least 150 trucks by Pride Group Enterprises, and 50 trucks plus plans to reserve "thousands more" by EV Semi-Fleet).

[198] Rachel MacIntosh et al., *Electric Vehicle Market Update* 29, EDF (Apr. 2022); Volvo LIGHTS, About Volvo LIGHTS (last accessed May 10, 2022), https://www.lightsproject.com/about/.

[199] Rachel MacIntosh et al., *Electric Vehicle Market Update* 29, EDF (Apr. 2022).

[200] Deborah Lockridge, *Volvo: Take the Leap in Electrification*, Truckinginfo (Oct. 12, 2021), https://www.truckinginfo.com/10153752/volvo-take-the-leap-in-electrification.

While the above table includes a sample of relevant product announcements and commitments, CALSTART's Zero-Emission Technology Inventory (ZETI) offers information regarding HD ZEV commercial availability. According to the ZETI tool, the growth of zero-emission medium- and heavy-duty models in the United States and Canada has been rapid, with more manufacturers entering the market and the number of available ZEV models exceeding 200.[201] The progress and potential in the manufacturing sector further underscores that EPA's proposed baseline HD ZEV market penetration of 1.5% in MY 2027 is an underestimate, and that much higher deployment is eminently feasible.

D. Recent cost estimates support the viability of HD ZEVs across vehicle segments.

Declining costs for HD ZEVs also support a baseline market penetration rate much higher than 1.5%, as well as the feasibility of including HD ZEVs in EPA's standard-setting analysis. EPA notes that "[t]he lifetime total cost of ownership (TCO)...is likely a primary factor for heavy-duty fleets considering BEV purchases." 87 Fed. Reg. at 17,596. Numerous cost studies—including those cited by EPA—estimate that at least some categories of HD ZEVs have already reached TCO parity with their diesel counterparts, and more categories will reach TCO parity prior to 2027. EPA should consider these favorable TCO projections in its estimates for baseline HD ZEV market penetration, which would support much higher penetration rates in MY 2027 and beyond.

In addition to the ICCT (2019) estimate cited by EPA, which concluded that at least some HD ZEVs could reach cost parity in the "early 2020s," *see* 87 Fed. Reg. at 17,596, several other recent studies that EPA did not consider estimate when various classes of HD ZEVs will reach cost parity with their conventional counterparts. These studies generally show that transit buses, refuse trucks, school buses, and Class 4–7 short-haul rigid trucks such as delivery and utility vehicles—all of which are covered by the Proposal and make up approximately 47% of the entire HD market—either have already reached cost parity with their diesel counterparts for some vehicle categories, or will do so by 2027 for nearly all categories. Table 4 below includes TCO parity estimates from the key recent literature.

[201] CALSTART, *Model Availability to Follow Upward Trajectory, ZETI Analytics*, https://globaldrivetozero.org/tools/zeti-analytics/ (see table titled "Growth of Models Available by Region and OEMS by Region Trending Upwards").

Table 4: Projections for When HD ZEVs Reach TCO Parity with Conventional Vehicles

	ICCT 2019[202]	**ZEV Alliance 2020**[203]	**BEAN 2021**[204]	**NREL 2021**[205]	**ANL 2021**[206]	**EDF/MJB 2021**[207]	**CARB 2021**[208]	**EDF/Roush 2022**[209]	**NREL 2022**[210]
Transit buses, primarily Class 8			Before 2024					Before 2027	
Refuse trucks, primarily Class 8			Before 2025			Before 2025	Before 2025	Before 2027	
Short-haul rigid trucks Class 4-7 (*e.g.*, delivery, utility)	2020-2025	2027 (Class 7 Cargo)	2022-2026	2020 (Class 4 Delivery)	2023 (Class 4 Delivery)	Before 2025 (Delivery Vans & Trucks, Service Vans)	Before 2025	Before 2027	2026-2035[211]
Short-haul rigid trucks Class 8 (*e.g.*, delivery, utility)			2028			Before 2025			
Short-haul tractors, primarily Class 8			2028-2033	2023	2027	Before 2025	Before 2025		
School buses, primarily Class 6-7			Before 2026					Before 2027	
Long-haul rigid trucks, Class 4-8						After 2030 (Class 3-7 Box Trucks)			2030-2035
Long-haul tractors, primarily Class 8	By 2030 (FCEV 2025-2028)	After 2030	2040-2045	After 2050	2031	Before 2025	Before 2025		2030-2035

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[202] Dale Hall & Nic Lutsey, *Estimating the Infrastructure Needs and Costs for the Launch of Zero-Emission Trucks*, ICCT (Aug. 2019), https://theicct.org/wp-content/uploads/2021/06/ICCT_EV_HDVs_Infrastructure_20190809.pdf.
[203] Dan Welch et al., International ZEV Alliance, Moving Zero-Emission Freight Toward Commercialization, (Oct. 2020), https://www.zevalliance.org/zero-emission-freight-2020/.
[204] Ehsan Sabri Islam et al., Argonne National Laboratory (ANL), A Detailed Vehicle Modeling & Simulation Study Quantifying Energy Consumption and Cost Reduction of Advanced Vehicle Technologies Through 2050 (Oct. 1, 2021), https://anl.app.box.com/s/xzhqi4x5sw3anw6rbgz7f67l6ti0qikd (using ANL's BEnefit ANalysis modeling); *see also* ANL, Vehicle Systems & Mobility Group, BEAN (last accessed May 10, 2022), https://vms.es.anl.gov/tools/bean/.
[205] Chad Hunter et al., NREL, Spatial and Temporal Analysis of the Total Cost of Ownership for Class 8 Tractors and Class 4 Parcel Delivery Trucks (Sept. 2021), https://www.nrel.gov/docs/fy21osti/71796.pdf.
[206] Andrew Burnham et al., ANL, Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains (Apr. 2021), https://publications.anl.gov/anlpubs/2021/05/167399.pdf.
[207] Dana Lowell & Jane Culkin, M.J. Bradley & Associates, Medium- & Heavy-Duty Vehicles: Market Structure, Environmental Impact, and EV Readiness (July 2021), https://www.edf.org/sites/default/files/documents/EDFMHDVEVFeasibilityReport22jul21.pdf.
[208] These CARB estimates include California incentives. CARB, Draft Advanced Clean Fleets Total Cost of Ownership Discussion Document, Advanced Clean Fleet Workshop (Sept. 9, 2021), https://ww2.arb.ca.gov/sites/default/files/2021-08/210909costdoc_ADA.pdf.
[209] Vishnu Nair et al., *Technical Review of: Medium and Heavy-Duty Electrification Costs for MY 2027-2030*, Roush Industries for EDF (Feb. 2, 2022).
[210] Catherine Ledna et al., *Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis*, NREL (Mar. 2022).
[211] *Id*. at 21. NREL investigated different cost-parity situations. For most scenarios, medium-duty Class 4–6 trucks reached cost parity well before 2035, often before 2030.

Each of these cost studies contains slightly different parameters, leading to some variation in the projections based on factors such as the study's estimated battery pack price or the inclusion of infrastructure costs. However, the variation is small and the studies all indicate that TCO is not far from favoring HD ZEVs for the classes that have not yet already achieved TCO parity. ICCT considered many of these cost studies to develop a summary of literature that includes consensus estimates for when HD ZEVs will reach TCO parity, as shown in the table below:[212]

	Segment	Share of HDV sales	Year of TCO parity between ZEVs and ICEVs	Upfront cost ratio of ZEVs to ICEVs in 2027	Market readiness
Fast	**Transit buses** primarily class 8	1.3%	Before 2025	1-1.1	Mature market, depot charging
	Refuse trucks primarily class 8	0.7%	Before 2025	1.1-1.15	Small-scale commercialization, depot charging
	Short-haul rigid trucks class 4-7 (e.g., delivery, utility)	40.1%	2022 (Class 4) -2027 (Class 7)	0.9-1.5	Small-scale commercialization, depot charging
Medium	**Short-haul rigid trucks** class 8 (e.g., delivery, utility)	15.7%	2028	1.45-6	Approaching commercialization, depot charging
	Short-haul tractors primarily class 8 (e.g., drayage, beverage)	8.6%	2025-2033	1.3-1.8	Approaching commercialization, depot charging
	School buses primarily class 6-7	4.9%	2026	1.25	Mature market, depot charging, some limitations in rural areas
	Other buses (e.g. shuttle buses, regional transit)	3.3%	2027-2030	1-1.2	Mixed charging requirements
Slow	**Long-haul rigid trucks** class 4-8	2.5%	After 2030		Mixed charging requirements
	Long-haul tractors primarily class 8	15.0%	No Consensus	2-2.4	Approaching range-limited commercialization, requires significant publicly accessible charging

Not shown: Motorhomes (8.0% of sales).

Sources: ANL, ANL's BEAN tool, NREL (2021), NREL (2022), EDF, CARB, ZEV Alliance

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One reason for these favorable TCO projections is that upfront HD ZEV prices have been declining as "[b]attery prices have been consistently reducing more rapidly than projections," and lower battery prices mean that HD ZEVs will reach cost parity sooner.[213] As battery costs and HD ZEV prices decline, more fleet managers will seek to add ZEVs to their heavy-duty fleets. In 2010, battery pack costs were over $1,000/kWh, but have fallen dramatically to approximately $132/kWh in 2021.[214] Costs are expected to continue this downward trajectory, "reaching $100/kWh between 2023 and 2025 and $61–72/kWh by 2030. Auto manufacturers have endorsed these projections."[215] Other analysis has found battery costs in the range of

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[212] This table summarizing ZEV cost literature is from: Sara Kelly et al., *ICCT Comments on EPA's Proposed Heavy-Duty Engine and Vehicle Standards* at 23.
[213] Amol Phadke et al., *Why Regional and Long-Haul Trucks are Primed for Electrification Now* 8, Lawrence Berkeley National Laboratory (Mar. 2021), https://eta-publications.lbl.gov/sites/default/files/updated_5_final_ehdv_report_033121.pdf.
[214] Rachel MacIntosh et al., *Electric Vehicle Market Update* 10, EDF (Apr. 2022). These 2021 battery pack price estimates are based on BloombergNEF. *Id.* at 20.
[215] *Id*. at 10.

$59-68/kWh by 2027.[216] BNEF projects battery pack prices will drop to approximately $80/kWh in 2026 and $60/kWh in 2029, and Ford has targeted $80/kWh by 2030.[217]

Battery prices have fallen largely due to a rise in the search for and extraction of key raw materials, greater manufacturing scale, and technological improvements such as improved quality and material substitution. Because of significant commitments to the development of a domestic battery raw material and manufacturing industry, temporary changes in battery raw material prices or supply chain issues should not have a significant impact on these longer-term cost projections and trends.[218] There are substantial industry and government investments in developing the battery manufacturing sector and lowering battery costs. Many manufacturers are making strides toward significant domestic battery production, with an expected 13 new battery cell gigafactories opening in the United States by 2025,[219] further supporting this downward trend. Automakers have also announced research and production partnerships aimed at securing ready supplies of batteries and developing less expensive batteries.[220] For example, Daimler recently announced a battery technology partnership through which the company will work with lithium-ion battery manufacturer and developer Contemporary Amperex Technology Co. Limited (CATL) for its supply of lithium-ion battery packs and to jointly work toward designing and developing next-generation battery cells and packs specifically for trucks.[221] Additionally, in its Energy Storage Grand Challenge, DOE announced a goal to reduce battery cost to $80/kWh by 2030 for 300-mile range EVs.[222] The Bipartisan Infrastructure Law also includes additional funds aimed at "expand[ing] the processing and manufacturing of advanced batteries, including for EVs and the electric grid."[223] These federal funds include: $3 billion for battery material processing; $3 billion for battery manufacturing and recycling; $10 million for the Lithium-Ion

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[216] Vishnu Nair et al., *Technical Review of: Medium and Heavy-Duty Electrification Costs for MY 2027- 2030* 36, Roush Industries for EDF (Feb. 2, 2022).
[217] Rachel MacIntosh et al., *Electric Vehicle Market Update* 20, EDF (Apr. 2022); Colin McKerracher, *Hyperdrive Daily: The EV Price Gap Narrows*, Bloomberg (May 25, 2021), https://www.bloomberg.com/news/newsletters/2021-05-25/hyperdrive-daily-the-ev-price-gap-narrows; Todd Gillespie, *Rising Battery Costs Hit Carmakers, Threaten Climate-Change Path*, Bloomberg Green (Nov. 30, 2021), https://www.bloomberg.com/news/articles/2021-11-30/even-the-battery-boom-can-t-escape-world-s-supply-chain-woes.
[218] *See, e.g.*, Laurence Iliff, *At a Toxic Lake in California, Enough Lithium to Transform North America's EV Industry*, Automotive News (Nov. 29, 2021), https://www.autonews.com/manufacturing/salton-sea-california-has-enough-lithium-transform-north-americas-ev-industry (noting that as more ZEVs come to the market, the demand for lithium and other minerals will increase, making the value and development of domestic mineral extraction projects more certain); DOE, Vehicle Technologies Office, Federal Consortium for Advanced Batteries (FCAB), https://www.energy.gov/eere/vehicles/federal-consortium-advanced-batteries-fcab (DOE and ANL project aimed at long-term competitiveness in the global battery value chain).
[219] Rachel MacIntosh et al., *Electric Vehicle Market Update* 21, EDF (Apr. 2022); Fred Lambert, *13 Battery Gigafactories Coming to the US by 2025—Ushering New Era of US Battery Production*, Electrek (Dec. 27, 2021), https://electrek.co/2021/12/27/13-battery-gigafactories-coming-us-2025-ushering-new-era/.
[220] Rachel MacIntosh et al., *Electric Vehicle Market Update* 23, EDF (Apr. 2022).
[221] Cristina Commedatore, *Daimler Trucks to Ramp Down ICE Spending, Focus on ZEVs*, FleetOwner (May 25, 2021), https://www.fleetowner.com/technology/article/21165073/daimler-truck-to-ramp-down-ice-spending-focus-on-zevs.
[222] Rachel MacIntosh et al., *Electric Vehicle Market Update* 20, EDF (Apr. 2022); DOE, Department of Energy Releases Energy Storage Grand Challenge Roadmap (Dec. 21, 2020), https://www.energy.gov/articles/department-energy-releases-energy-storage-grand-challenge-roadmap.
[223] Rachel MacIntosh et al., *Electric Vehicle Market Update* 17, EDF (Apr. 2022).

Battery Recycling Prize; $60 million for Battery Recycling RD&D; $50 million for state and local programs; and $15 million for Collection Systems for Batteries.[224] The White House has also issued Executive Order 14,017, directing the Secretary of Energy and the relevant agencies to identify and address any risks to the battery supply chain.[225] Advances in battery recycling technology are likely to lead to additional decreases in battery prices. A report by Roush Industries also details additional advancements in battery systems, such as lithium iron phosphate batteries, dry battery electrode coating processes, and tabless anodes, that will lead to greater efficiency and reduced costs for ZEVs.[226] Finally, sustained high diesel and gasoline prices would likely make HD ZEVs more attractive and could allow for TCO parity even sooner.

Moreover, charging infrastructure is developing alongside ZEV demand. The Biden Administration has already allocated $7.5 billion toward charging infrastructure,[227] and manufacturers are investing as well. For example, Daimler Truck North America recently partnered with NextEra Energy Resources and BlackRock Renewable Power to invest approximately $650 million to design, develop, install, and operate a nationwide charging network for medium- and heavy-duty BEV and hydrogen fuel cell trucks.[228] Cost studies such as Roush (2022) and ICCT (2019) have found that even if fleets bear high infrastructure costs, overall vehicle ownership cost parity is not far off, with ICCT (2019) concluding that overall fleet ownership costs will generally favor electric trucks over conventional trucks by 2030.[229]

We urge EPA to comprehensively consider these numerous relevant studies pointing to transformative cost projections for HD ZEVs in the classes and time periods covered by the Proposal. The cost studies show that many HD ZEVs are already both technologically feasible and cost effective, or will be so prior to MY 2027, meaning that they will be independently attractive to HD truck purchasers. As Daimler Truck AG's chief technology officer explained, "In the very moment that the customer starts benefiting more from a zero-emission truck than from a diesel truck, there is no reason to buy the diesel truck anymore."[230] By failing to consider the full literature of cost projections, EPA assumes inappropriately low HD ZEV adoption and, as a result, proposes standards that are too lenient. These favorable cost projections provide additional support for EPA to reconsider its baseline HD ZEV market penetration rates for MY 2027 and beyond in the final rule.

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[224] *Id*.

[225] The White House, Executive Order on America's Supply Chains, Executive Order 14,017 § 3(b)(ii) (Feb. 24, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/02/24/executive-order-on-americas-supply-chains/.

[226] Vishnu Nair & Gary Rogers, *Reducing Medium- and Heavy-Duty Fuel Consumption and Criteria Pollutants*, Roush Industries (Sept. 2021).

[227] Rachel MacIntosh et al., *Electric Vehicle Market Update* 25, EDF (Apr. 2022).

[228] *Id*. at 29; Heavy Duty Trucking, *Daimler Truck Plans to Create Nationwide Charging Network*, HDT Truckinginfo (Jan. 31, 2022), https://www.truckinginfo.com/10160673/daimler-truck-plans-to-create-nationwide-truck-charging-network.

[229] Dale Hall & Nic Lutsey, *Estimating the Infrastructure Needs and Costs for the Launch of Zero-Emission Trucks* at i, ICCT (Aug. 2019); Vishnu Nair et al., *Technical Review of: Medium and Heavy-Duty Electrification Costs for MY 2027-2030*, Roush Industries for EDF (Feb. 2, 2022).

[230] Cristina Commendatore, *Daimler Truck to Ramp Down ICE Spending, Focus on ZEVs*, Fleetowner (May 25, 2021), https://www.fleetowner.com/technology/article/21165073/daimler-truck-to-ramp-down-ice-spending-focus-on-zevs.

In sum, EPA's proposed 1.5% baseline HD ZEV market penetration for MY 2027 vastly underestimates the number of HD ZEVs that will enter the market. EPA must reconsider its estimates to account for current market projections; federal, state, local, and private sector actions and commitments; and recent cost estimates, all of which point to baseline HD ZEV market penetrations in the range of 8–11% for MY 2027 and 19–27% for MY 2030. Failure to adjust the proposed emissions standards to account for these more accurate baseline figures will undermine the goals of the criteria pollutant and GHG programs. More accurate and reasonable baseline HD ZEV market penetration rates will support more stringent standards at levels that fulfills the Agency's duty to protect public health and welfare. Moreover, the recent cost studies outlined in Table 4 and in the separate comments on this Proposal submitted by MFN, EDF, and ICCT—along with the numerous public and private commitments detailed above—offer a strong record to support inclusion of zero-emission technologies in the technology packages underlying the criteria pollutant and GHG standards. EPA should revise the Proposal accordingly.

IV. EPA MUST STRENGTHEN THE PROPOSED CRITERIA POLLUTANT PROGRAM.

EPA's inaccurate estimate of baseline HD ZEV market penetration undermines its proposed criteria pollutant standards, but the Agency must also remedy other aspects of its criteria pollutant proposal. EPA must reject proposed Option 2, which fails to achieve the emissions reductions necessary to protect public health and welfare and flouts the Clean Air Act's technology-forcing directive. EPA should incorporate zero-emission technologies into its feasibility analysis, setting stronger emissions standards that both account for the technological feasibility and baseline market penetration of zero-emission technologies *and* accelerate the deployment of those technologies. In addition, EPA must modify its crediting proposal to ensure that credits for electric vehicles and "transitional" credits do not undermine the effectiveness of its criteria pollutant program. Apart from making those changes, EPA should finalize Option 1, *with* Commenters' recommended improvements to testing provisions, numerical emissions standards, warranty and useful life periods, and implementation timelines. Finally, regardless of which option it ultimately selects, EPA should revise the proposed durability demonstration, strengthen the proposed anti-tampering and inducement provisions, reject exemptions for vocational vehicles, and finalize the proposed PM standard and closed crankcase requirements.

A. Finalizing proposed Option 2 would be arbitrary and capricious because it falls far short of the Clean Air Act's public health and technology-forcing directives.

Finalizing proposed Option 2 would be arbitrary and capricious because it embodies a wholly inappropriate balancing of the statutory factors set forth Section 202(a)(3)(A)(i). *See* 42 U.S.C § 7521(a)(3)(A)(i) (requiring "appropriate consideration" of cost, energy, and safety). In comparison to Option 1 and the alternative approaches we advocate for in Sections IV.B–H below—all of which would achieve greater public health and welfare gains without imposing unreasonable costs or technological challenges—Option 2 is contrary to EPA's statutory mandate and unsupported by the record. *Cf. Bluewater Network v. EPA*, 370 F.3d 1, 21–22 (D.C. Cir. 2004) (holding that EPA had not adequately explained its balancing of technological feasibility against cost and other statutory factors in setting emissions standards under Section 213).

First, Option 2's minimal emissions reductions are woefully inadequate in light of the clear endangerment that heavy-duty vehicles and engines pose to public health and welfare. *See* Sections II.C.1–2, *supra* (describing health impacts). EPA acknowledges the seriousness of these threats to public health and welfare and the need to achieve greater reductions in emissions. *See generally* 87 Fed. Reg. at 17,441–56; DRIA Ch. 4. And it correctly concludes, based on extensive data, that both Options 1 and 2 are technologically feasible. 87 Fed. Reg. at 17,436; *see generally* DRIA Ch. 3. Option 2, however, would unjustifiably allow much higher criteria pollutant emissions than Option 1 or a national program based on the Omnibus. *See* DRIA at 262, 277–87. In 2045 alone, Option 2 would create 120,000 tons more NO_X than Option 1 and achieve only a 47% reduction in NO_X emissions from the baseline, compared to Option 1's 61% reduction. 87 Fed. Reg. at 17,579–80; DRIA at 262 (Table 5-34). Option 2's higher emissions—nearly 1.25 million more tons of NOx between 2027–2045 than Option 1, *see* DRIA at 262 (Table 5-34)—translate into worse human health outcomes. According to EPA's own analysis, Option 1 would produce at least \$11 billion and up to \$50 billion more in present-value monetized benefits than Option 2 (depending on the discount rate and other factors) due to reduced mortality and avoided illnesses. *See* DRIA at 403–04 & Table 9-1. And those figures do not account for the additional unquantified but valuable human health and environmental benefits that Option 1 would create. 87 Fed. Reg. at 17,428, 17,590.

Second, Option 2 falls far short of the Clean Air Act's technology-forcing directive[231] by letting manufacturers off the hook from improving the durability of emission control components, thereby eroding Option 2's already limited emissions benefits. *See* 87 Fed. Reg. at 17,437–38. Option 1's useful life and warranty periods align with those of the Omnibus, compelling manufacturers to make critical durability improvements that are still eminently feasible. 87 Fed. Reg. at 17,500, 17,508. Option 2, on the other hand, shaves off years and tens of thousands of miles from Option 1's useful life periods without even attempting to provide a technological feasibility rationale. EPA even acknowledges that, according to its data, "most of the proposed standards are achievable *well beyond* the proposed Option 2 mileage" for spark-ignition engines. 87 Fed. Reg. at 17,501 (emphasis added). Option 2 repeats the same mistake with its proposed warranty periods. 87 Fed. Reg. at 17,508. In light of Congress's clear intent that EPA set technology-forcing standards, it would be unreasonable for the Agency to adopt useful life and warranty periods that are significantly weaker than what manufacturers can attain (and which are already required by the Omnibus).

Finally, Option 2's inferior performance on emissions reduction, public health, and technological feasibility grounds cannot be justified by cost, energy, safety, or lead time considerations. Despite its leniency, Option 2 manages to produce *higher* costs, and fewer net benefits, than Option 1. 87 Fed. Reg. at 17,589; DRIA at 403. Sufficient lead time also exists for manufacturers to comply with both options. *See* 87 Fed. Reg. at 17,436. And both options present the same safety and energy profiles, with neither having a negative impact on those factors relative to the baseline. 87 Fed. Reg. at 17,440, 17,459–60. Because the Clean Air Act's "overriding" goal of improving air quality weighs against Option 2, and the Act's "subordinate" considerations of cost, energy, safety, and lead time point in the same direction or are neutral, EPA must reject Option 2. *Husqvarna AB*, 254 F.3d at 200; *see Bluewater Network*, 370 F.3d at

[231] As discussed in Section IV.B below, both Options 1 and 2 fail to reflect the superiority and feasibility of electrification and other zero-emission technologies that eliminate criteria pollutant tailpipe emissions from HDVs.

21 (explaining that EPA's standards "must be grounded in 'appropriate consideration' of the relevant statutory factors," with support from "analysis and evidence" in the record).

In sum, Option 2 amounts to an industry giveaway that sacrifices critically important public health and welfare benefits in favor of political expediency and technological complacency. EPA understands this, flatly admitting that "Option 1 may be a more appropriate level of stringency as it would result in a greater level of achievable emission reduction for the model years proposed, which is consistent with EPA's statutory authority under Clean Air Act section 202(a)(3)." 87 Fed. Reg. at 17,417, 17,440. Because Option 2 fails to achieve the statutory mandate, finalizing it would constitute an abuse of discretion and arbitrary and capricious agency action.

B. EPA's standards should reflect the superior performance of zero-emission technologies, which will be widely available by 2027 and represent the greatest degree of emission reduction achievable.

The feasibility analysis underlying EPA's proposed NO_X, PM, HC and CO emissions standards does not address the reductions achievable through zero-emission technologies, including hybrid electric vehicle (HEV), BEV, or FCEV technologies. 87 Fed. Reg. at 17,458. EPA bases that decision on "current market penetration of BEVs (0.06 percent in MY 2019) or projected penetration rate in the MY 2027 timeframe (1.5 percent)," concluding that assessment of those technologies would not "meaningfully impact [EPA's] analysis for developing the numerical level of the proposed Option 1 and 2 standards." *Id.* But EPA recognizes that "information showing higher BEV/FCEV market penetration in the MY 2027 or later timeframe" could require "inclu[ding] HEV, BEV and/or FCEV technologies in [its] feasibility analysis," and that it may have to "re-evaluate [its] approach" in the final rule. *Id.* (requesting comment on revising numeric standards to include HEV, BEV and FCEV technologies).

EPA should revise its emissions standards to reflect both the feasibility and the baseline market penetration of zero-emission technologies. The Agency's reason for excluding those technologies—a projected market penetration rate of no more than 1.5% by MY 2027—is a gross underestimate. An updated, more accurate record indicates that by MY 2027, zero-emission technologies will be (and in many cases are already) cost-effective and feasible across the heavy-duty fleet, and are capable of providing deep reductions in NO_X, PM, and HC emissions. *See* Section III, *supra*. The Clean Air Act's core command—that standards "reflect the greatest degree of emission reduction achievable through the application of technology" which "will be available for the model year to which the standards apply," 42 U.S.C. § 7521(a)(3)(A)(i)—therefore requires EPA to consider and include these technologies within its standard-setting analysis. That is especially so in light of the statute's technology-forcing nature. *Nat'l Petrochemical & Refiners Ass'n,* 287 F.3d at 1140 (noting that the statute does not require "*present* availability"). EPA cannot consequently base its standards solely on "currently available technologies"—and even if it could, zero-emission technologies are currently available. *See* 87 Fed. Reg. at 17,418, 17,458 (characterizing updated standards as reflecting "technology improvements which have become available over the 20 years since" EPA's prior standards were promulgated). Rather, its standards must be based on a reasonable assessment of the technologies that "will be available for the model years to which [the] standards apply." 42 U.S.C. § 7521(a)(3)(A)(i).

C. EPA's proposal to permit BEVs and FCEVs to generate NO_X credits would, as currently structured, allow unnecessary and unlawful pollution.

In a departure from its previous regulations, EPA has proposed to permit manufacturers to generate NO_X emissions credits, from MY 2024 onwards, for BEVs and FCEVs. 87 Fed. Reg. at 17,556–57. Absent changes to the Proposal, those credits will substantially undermine the effectiveness of EPA's NO_X standard. Commenters urge EPA to include BEV and FCEV technologies in its analysis of the appropriate NO_X standard. *See* Section IV.B, *supra*. In the alternative, EPA should eliminate the provisions allowing BEVs and FCEVs to generate NO_X credits, or at a minimum sunset the generation of those credits in MY 2026.

EPA's proposed NO_X emissions credits are intended to provide an incentive for adoption of zero-emission technologies and an "opportunity for manufacturers to develop and refine transferable technologies to BECs and FCEVs (*e.g.*, batteries, electric motors)." 87 Fed. Reg. at 17,556–57. EPA's Proposal would provide a one-for-one credit—that is, it does not include multipliers—because these technologies are relatively "mature," and in reliance on analyses indicating that "BEV technologies will reach parity in the total cost of ownership with CI or SI engine technologies in most market segments by 2025 or earlier." *Id.* at 17,561–62. Although the Proposal would allow manufacturers to generate credits from BEVs and FCEVs, EPA's underlying emissions standards do not consider "[hybrid electric vehicles (HEV)], BEV, or FCEV technologies," based on EPA's conclusion that such technologies can achieve only limited penetration within the relevant model years. *Id.* at 17,458 (also requesting comment on whether EPA should instead include such technologies in its feasibility analyses for its NO_X standards based on "information showing higher BEV/FCEV market penetration in the MY 2027 or later timeframe").

As currently structured, the credit proposal would permit unnecessary and unlawful pollution. As EPA recognizes, NO_X emissions credits create "the potential for a greater portion of CI engines to emit up to the level of the FEL cap." *Id.* at 17,560–61. Three elements of the Proposal sharply increase the likelihood and magnitude of those increased emissions. First, EPA has (as set forth in Section III, above) markedly underestimated HD ZEV market penetration in the relevant model years, even in a baseline scenario. *See also* 87 Fed. Reg. at 17,561–62 (recognizing that BEV technologies may reach cost parity in most market segments by 2025 or earlier). A more realistic estimate of baseline market penetration undermines EPA's rationale for providing NO_X credits; there is no need to provide regulatory incentives for vehicles that will be built and sold based on their cost-competitiveness, to meet existing regulatory requirements, or to satisfy corporate or fleet commitments. And such an estimate suggests that the credits will erode the standards' effectiveness far more than the Proposal acknowledges, permitting a substantial number of vehicles to pollute at the FEL cap with concomitant adverse effects for surrounding communities.[232] The result is a standard that, taken as a whole, fails to achieve the statute's requirement of the greatest achievable emissions reductions. 42 U.S.C. § 7521(a)(3)(A)(i).

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[232] *See* CARB, Final Statement of Reasons for Rulemaking Including Summary of Comments and Agency Responses 196–203 (Aug. 27, 2020), https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf (assessing impacts of credits on emissions reductions).

Second, notwithstanding the feasibility and cost-effectiveness of zero-emission technologies, EPA has failed to account for BEV and FCEV technologies in proposing the stringency of its underlying emissions standards. The Proposal's treatment of those technologies is therefore inappropriately asymmetric: EPA excludes their emergence from its assessment of the "greatest degree of emission reduction achievable," 42 U.S.C. § 7521(a)(3)(A)(i); but it allows that emergence to result in higher-polluting engines through its crediting mechanism. *See U.S. Sugar Corp. v. EPA*, 830 F.3d 579, 631 (D.C. Cir. 2016) (The Clean Air Act "demands that [EPA] take the bitter with the sweet," so that "if the EPA includes a source in a [regulated category]" it must "take into account that source's emissions levels in setting" standards.).

And third, EPA's proposed FEL caps are unreasonably high. *See* Section D.2.c, *infra*. That failure exacerbates the effect of the Proposal's credit mechanism, and results in unacceptable emissions and health impacts.

EPA must remedy these flaws. EPA requests comment on the following scenario: if "BEV and FCEV technologies" are "projected to reach a greater degree of market penetration than [the Agency's current] projections," could EPA "incorporate that [higher] level of BEV and FCEV penetration into [its] calculation of an appropriate numerical standard to represent the combined benefits of achieving NO_X control from engines along with zero tailpipe NO_X emissions from BEV and FCEV technologies." 87 Fed. Reg. at 17,561. BEV and FCEV technologies are indeed projected to reach far greater market penetration than EPA has assumed. *See* Section III, *supra.* The availability and cost-competitiveness of those technologies alone warrants their inclusion in EPA's standard-setting analysis. *See* Section IV. B, *supra.* The need for such inclusion is substantially more acute if EPA allows BEVs and FCEVs to generate credits for use in the standards' Averaging, Banking and Trading (ABT) program. EPA cannot permit *compliance* with the standards through technologies that will be relatively widely adopted in the relevant model years, while *ignoring* those technologies in its standard-setting analysis. A "combined" standard, 87 Fed. Reg. at 17,561, if appropriately based on foreseeable levels of BEV and FCEV penetration (as well has HEV development), would allow the standards and credits to function as they should, and bring EPA's standards into conformity with the Clean Air Act's command to require the greatest achievable emission reduction. 42 U.S.C. § 7521(a)(3)(A)(i).

In the alternative, we ask EPA to eliminate the provisions of its rule allowing BEVs and FCEVs to generate NO_X credits, *see* Section IV.E, *infra* (suggesting elimination of transitional credits), or at a minimum to "sunset" the generation of BEV and FCEV NO_X credits no later than MY 2026. EPA recognizes in its Proposal that once "BEVs and FCEVs [have transitioned] into mainstream technologies in the heavy-duty market," it would be appropriate to "sunset, i.e., end, the generation and use of NO_X emissions credits for BEVs and FCEVs." 87 Fed. Reg. at 17,561. A more accurate projection of BEV and FCEV emergence indicates that the transition is occurring at a pace that warrants excluding those vehicles from the NO_X credit program. *See* Section III, *supra.* If EPA does permit BEVs and FCEVs to generate NO_X credits, the Agency should at least end the generation of credits well before MY 2027. Given the likelihood that BEVs and/or FCEVs will be cost-competitive in most applications by 2027, allowing credits beyond that point would needlessly dilute EPA's emissions standards. And if EPA retains non-ZEV transitional credits in its final rule, manufacturers will—even without BEV and FCEV credits—amass ample credits to retain any necessary flexibility in compliance with the standards.

See Section IV.E, *infra* (describing glut of credits that will result from gap between federal and Omnibus standards during MY 2024–26). Commenters also agree that EPA should not adopt any emission credit multipliers, 87 Fed. Reg at 17,562 (requesting comments on whether emission credit multipliers should be included in the final rule). If EPA does permit the generation of NO_X credits from BEVs and FCEVs, Commenters support EPA's proposed useful-life and warranty certification requirements for the generation of NO_X credits from those vehicles, 87 Fed. Reg. at 17,553. We would also urge EPA to shorten the lifespan of any NO_X credits generated by BEVs and FCEVs for the reasons explained in Section IV.E (discussing the effects of credit oversupply).

Finally, EPA should in any event—but especially if it includes provisions for BEV and FCEV credits—make its FEL caps more stringent. *See* Section IV.D.2.c, *infra*. The inclusion of credits, as EPA acknowledges, increases the risk that a greater number of HDVs will pollute up to the level of the FEL cap. *See also* 87 Fed. Reg. at 17,552 ("The zero-tailpipe emissions performances of BEVs and FCEVs inherently provides the opportunity for manufacturers to generate more credits from these vehicles relative to conventional engines that produce between zero and the level [of] the standard."). Ensuring that the FEL cap is appropriately stringent is, consequently, an especially critical component of any standard that includes credits.

D. EPA should improve Option 1 to achieve additional feasible emissions reductions from HDEs.

In addition to incorporating zero-emission technologies into its feasibility analysis and rectifying its BEV and FCEV crediting proposal, as described in Sections IV.B-C above, EPA should improve several features of its proposed Option 1. Below, Commenters recommend changes to EPA's proposed testing provisions and emissions standards that would achieve greater emissions reductions through the application of feasible technologies. We also highlight the importance of adopting warranty and useful life provisions at least as stringent as those proposed in Option 1, and implementing standards and testing procedures that better control NO_X emissions that occur when engines are operating at low speeds or idling.

1. <u>Testing must ensure better control of real-world NO_X emissions.</u>

As part of Option 1, EPA proposes several changes to its laboratory-based duty cycle tests, in-use (sometimes called "off-cycle") testing procedures, and verification testing. The current regulations must be revised to better regulate low load emissions and protect public health in communities overburdened by vehicle pollution. Commenters generally support making changes to close gaps in the current duty cycle and in-use testing procedures to reduce the amount of dangerous air pollution breathed by individuals living, working, and attending school in near-road communities. But Commenters oppose EPA's proposed "flexibilities" that would weaken verification testing.

a) Changes to duty cycle and in-use testing are warranted.

Commenters support changes to duty cycle and in-use testing to curtail the extremely high emissions that occur when HDVs are idling or traveling at low speeds. Selective catalytic reduction (SCR)-based emissions control systems, typically used on diesel engines, work best when the engine's exhaust is at a high temperature, *i.e.*, when trucks are traveling at higher speeds or when engines are working at "higher load." 87 Fed. Reg. at 17,418. This means that when trucks and buses are moving at lower speeds on congested highways through urban areas, on city streets, pulling into and out of logistics facilities and warehouses, or idling—the times when these vehicles are closest to pedestrians and cyclists and closest to people's homes, schools, and workplaces—they are emitting the highest levels of dangerous pollution.[233]

EPA determines whether engines comply with emissions limits using two types of tests, laboratory-based and in-use testing, neither of which currently captures the higher emissions happening at lower speeds when trucks are often nearest to people.

EPA's laboratory-based test procedure measures emissions while an engine is operating over precisely defined "duty cycles." The current duty cycles involve operating under sustained high load, or transitioning from low to high loads, "but do not provide for demonstrating emission control under sustained low-load operations." 87 Fed. Reg. at 17,422.

EPA also requires compliance with "Not-To-Exceed" (NTE) standards to be shown while engines are in use on the road in the real world. Measurements of emissions occurring below certain torque, power, and speed values are currently excluded from consideration, however, as are data occurring in certain ambient conditions or when aftertreatment temperatures are below a certain level. 87 Fed. Reg. at 17,472. EPA's Proposal notes that less than 10% of the data collected during a typical in-use test is actually subject to EPA's current in-use emissions standards, and that in-use testing data indicates that low load operation could account for more than half of a vehicle's NO_X emissions during a typical workday. 87 Fed. Reg. at 17,472.

A 2019 study by ICCT found that, on average, trucks traveling at speeds below 25 miles per hour emitted NO_X at more than five times EPA's certification limit.[234] That study also found that, on average, trucks only achieved NO_X emissions at or below the certification limit when traveling at highway speeds above 50 mph.[235] For each mile of urban driving, a single "line-haul" truck used in long-distance shipping can emit *one hundred times* the NO_X pollution that a car would emit.[236] Even when traveling on highways in populated urban areas, trucks will often be moving at lower speeds due to congestion. The Federal Highway Administration's 2020 list of "major freight highway bottlenecks and congested corridors" shows that many of the most congested highways in the United States are near densely populated urban areas that are also ozone nonattainment areas, such as Chicago, New York City, Los Angeles, California's Bay Area, Dallas/Fort Worth, and Denver.[237] As EPA's Proposal notes, 72 million Americans live within 200 meters of freight routes, and people of color and those with lower incomes are disproportionately likely to live near freight truck routes and to live in urban areas. 87 Fed. Reg.

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[233] Huzeifa Badshah et al., *Current State of NO_x Emissions from In-Use Heavy-Duty Diesel Vehicles in the United States* 17, ICCT (Nov. 2019), https://theicct.org/publication/current-state-of-nox-emissions-from-in-use-heavy-duty-diesel-vehicles-in-the-united-states/.
[234] *Id.* at i.
[235] *Id.*
[236] *Id.*
[237] FHWA, 2020 National List of Major Freight Highway Bottlenecks and Congested Corridors: FHWA Freight Mobility Trends: Truck Hours of Delay at 11, Map 1 (2020), https://ops.fhwa.dot.gov/freight/freight_analysis/mobility_trends/national_list_2020.pdf; EPA, 8-Hour Ozone (2015) Nonattainment Areas (Apr. 30, 2022), https://www3.epa.gov/airquality/greenbook/jnc.html.

at 17,451. Studies have consistently found that environmental hazards such as air pollution are more prevalent in areas where people of color and low income populations represent a higher fraction of the population compared with the general population, and a recent study found that $PM_{2.5}$ pollution from HDVs disproportionately impacts people of color. 87 Fed. Reg. at 17,452. It is crucial that these overburdened near-road communities do not continue to experience disproportionate levels of air pollution due to high levels of emissions from HDVs traveling at lower speeds. *See* Section II.C, *supra*.

EPA proposes improving its duty cycle testing by adding a new low-load cycle to its current Federal Test Procedure (FTP) and Supplemental Emission Test (SET) duty cycles. 87 Fed. Reg. at 17,460. The new low-load cycle (LLC) would be identical to the Omnibus LLC, and would be subject to a different (higher) set of emissions limitations than the FTP and SET cycles. 87 Fed. Reg. at 17,463–64. Commenters support adoption of a low-load duty cycle to better limit the higher emissions that occur at low loads, though, as discussed below, we believe EPA should set more stringent emissions limits on this cycle.

EPA also proposes changes to its in-use testing program to consider data across a wider range of operational conditions. Each 300-second moving average window of data would be sorted into one of three bins—idle, low load, and medium/high load, each of which would be subject to a different numerical emissions standard—based on the average power of the engine over that 300-second period, with measurement of the CO_2 emissions rate being used as a surrogate for engine power. 87 Fed. Reg. at 17,473. A complete in-use test would require at least 2,400 moving average windows per bin. 87 Fed. Reg. at 17,473. EPA still proposes to exclude certain data from consideration, specifically data that captures engine operation during times when: the engine is off, ambient temperatures are below a certain level, the engine is operating at more than 5,500 feet above sea level, an auxiliary emission control device is active, or periodic PEMS zero and span drift checks or calibrations are occurring. 87 Fed. Reg. at 17,474.

Commenters support adopting in-use testing procedures that capture the higher emissions that occur when engines are at low load or idling so that the test captures the full range of real-world emissions.

b) EPA should not weaken verification testing.

Among the Option 1 "flexibilities" on which EPA requests comment is a drastic weakening of the standards' verification testing for Heavy Heavy-Duty Engines (HHDEs)—one that would permit emissions that vastly exceed EPA's proposed standards. The three types of verification testing include: confirmatory testing, in which EPA verifies a manufacturer's test results before an engine is certified; selective enforcement audit, in which EPA conducts testing of engines that come off the production line; and in-use testing of engines that have already entered commerce. 87 Fed. Reg. at 17,563. EPA's proposed "interim in-use [NO_X] standard[s]" for HHDEs would be based on purported "uncertainty in how the emissions control technologies deteriorate." 87 Fed. Reg. at 17,563–65. The proposed flexibility is discussed in terms that suggest that it would apply not just to in-use testing, but also to confirmatory and selective enforcement audits. But EPA's justification—the possibility of deterioration in control technologies' performance—has no bearing on confirmatory testing or selective enforcement audits, which apply to new engines that have not deteriorated. There is no basis for applying the proposed interim in-use standards during either confirmatory testing or selective enforcement audits.

As for in-use testing, EPA's standards already incorporate a margin for deterioration over time; providing an additional allowance for deterioration in EPA's in-use testing effectively double-counts that anticipated decrease in effectiveness. To the extent any further residual uncertainties remain, EPA's proposed rule—through its crediting and averaging provisions, as well as its generous scaling and measurement allowances—provides ample allowance for them. *Id.* at 17,467, 17,469, 17,474, 17,553. There is consequently no reasonable basis for the inflated testing standards—even at the low end of the suggested range of alternative standards, let alone the high end—for which EPA has requested comment. *Id.* at 17,564. Including the proposed interim in-use standards would establish a substantial incentive for manufacturers to design engines to the weaker standards, after certification, or to avoid the cost of long-lasting components that would ensure sustained emissions performance. *See, e.g.*, Notices of Filing Consent Decrees, 63 Fed. Reg. 59,330–34 (Nov. 3, 1998) (describing enforcement actions against manufacturers over defeat-devices that relaxed emissions controls after certification testing). The record fully demonstrates the feasibility of meeting Option 1's standards without an additional allowance for deterioration. *See* DRIA at 108–30 (describing feasibility testing from Southwest Research Institute).[238]

2. EPA should strengthen the proposed standards and implement them in a single step to achieve greater emissions reductions through the application of feasible and cost-effective technologies.

While Commenters prefer the more stringent numerical emissions standards of Option 1 to the unjustifiably lax standards of Option 2, we urge EPA to further strengthen the standards in certain key areas: (1) duty cycle and in-use (off-cycle) standards, (2) idle standards, and (3) the FEL cap. EPA should also reject its proposed two-step approach for Option 1, finalizing the more stringent standards in MY 2027 instead of delaying their application until MY 2031.

a) EPA should adopt more stringent duty cycle and in-use (off-cycle) standards.

Commenters urge EPA to consider setting stricter duty cycle and in-use standards. While Option 1 is far superior to Option 2, it still fails to fully capture the emissions reductions that can be achieved by various diesel engine technologies. As outlined in the technical comments of MFN, EPA's feasibility analysis does not give sufficient credit to the emissions reduction capabilities of variable valve actuation strategies (such as cylinder deactivation), mild hybridization, and opposed-piston engines. *See* Comments of MFN, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. Similarly, a recent analysis by Roush Industries confirmed the technological feasibility of cylinder deactivation, mild hybridization, and limiting auxiliary emissions control devices.[239]

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[238] *See also* Achates Power, Heavy-Duty Diesel Engine In-Use Testing (last accessed May 12, 2022), https://achatespower.com/wp-content/uploads/2022/04/Achates-Power-Heavy-Duty-Diesel-In-Use-Testing-Results.pdf (testing of opposed-piston design, in fleet service with Walmart Corporation, achieving emissions well below Option 1 standards throughout life).

[239] Vishnu Nair & Gary Rogers, *Reducing Medium- and Heavy-Duty Fuel Consumption and Criteria Pollutants* 6, 8, 23–28, 38–40, Roush Industries (Sept. 2021).

Increased stringency is particularly warranted for the low-load and idle bins of the in-use standards and the LLC of the duty cycle standards. The Proposal notes that European vehicles with similar highway-speed NO_X emissions as American trucks have lower low-load emissions. 87 Fed. Reg at 17,472. EPA is correct to interpret this information as suggesting "that manufacturers are responding to the European certification standards by designing their emission controls to perform well under low-load operations, as well as highway operations." *Id.* Manufacturers of American HDEs should likewise be able to design emissions controls that perform well both under highway and low-load conditions. A number of available technologies can increase exhaust temperature at low load and thereby increase the effectiveness of SCR-based emissions controls, including cylinder deactivation and other forms of variable valve actuation. And some engines are able to currently achieve EPA's proposed 2031 standard with compliance margins of 50% for the low-load bin. *See* Comments of MFN, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. CARB also notes that its testing data supports the feasibility of an LLC standard stricter than that included in Option 1 or the Omnibus. *See* Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022.

b) EPA should adopt more stringent and mandatory idle standards.

As one element of duty cycle testing changes included in Option 1, EPA proposes an optional NO_X idle standard starting in MY 2023, which by MY 2027 would align with the Omnibus clean idle standard of 5.0 g/hr. 87 Fed. Reg. at 17,464. While manufacturers would not be required to certify compliance with the idle standard, "once included the idle standard would become mandatory and full compliance would be required." *Id.* EPA requests comment on whether the standard should instead be mandatory for MY 2027 and beyond. *Id.*

Commenters support inclusion of a mandatory idle standard for model years 2027 onward, to better protect individuals from the higher emissions that occur during idling, such as when trucks are stopped at city streetlights. EPA should set a mandatory idle standard for MY 2027 onward that is at least as stringent as the 5.0 g/hr standard proposed in Option 1, and should consider setting it at a lower, more protective level. A 5.0 g/hr or lower standard is technologically feasible. Many HDE manufacturers are already planning to comply with a 5.0 g/hr standard in MY 2027 because of the CARB standard. The best-performing current engines are already achieving the 5.0 g/hr requirement, and some are achieving it with a wide compliance margin. *See* Comments of MFN, to be filed in Docket EPA-HQ-OAR-2019-005 on May 16, 2022. The Omnibus idle standard was proposed before results from CARB's Stage 3 engine testing were available, and that testing showed NO_X emissions far below the 5.0 g/hr adopted in the Omnibus and proposed by EPA as Option 1. *See* Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022.

c) EPA should lower the proposed FEL cap.

Option 1's proposed FEL cap for NO_X is far too lenient because it fails to require the greatest degree of emissions reduction achievable by technologies that will be available by MY 2027. *See* 42 U.S.C. § 7521(a)(3)(A)(i). Flouting Congress's direction to set technology-forcing standards, EPA instead proposes FEL caps that are based on the "average NO_X emission levels achieved by recently certified CI engines." 87 Fed. Reg. at 17,522. But "recently certified" engines were designed to comply with standards promulgated more than twenty years ago, and do not utilize the improved pollution-control technologies that will be available in MY 2027. *See id.* at 17,419 (noting emergence of new technologies). EPA's proposed FEL cap of 150 mg/hp-hr for MY 2027 is twice as high as the Omnibus's FEL cap of 100 mg/hp-hr for MY 2024–2026, and three times higher than the Omnibus's general NO_X emission standard of 50 mg/hp-hr (which will take effect in MY 2024).[240] 87 Fed. Reg. at 17,552; Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. Given that manufacturers will already be required to implement technologies to achieve a 50 mg/hp-hr standard and a 100 mg/hp-hr FEL cap in several markets *three years* before EPA's rule takes effect, the proposed 150 mg/hp-hr cap lacks any technical justification. Commenters also support and incorporate by reference comments by MFN and CARB demonstrating the technological feasibility of (and the health and equity rationales for) a lower FEL cap. *See* Comments of (1) MFN and (2) CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. Establishing a lower FEL cap is technologically achievable and would better conform with the Clean Air Act's core pollution-minimizing mandate.

d) EPA should implement the emissions standards in a single step, applying the more stringent standards to MY 2027 instead of MY 2031.

Life-saving emissions reductions must be achieved as swiftly as possible in light of the public health crisis wrought by HDV emissions and the availability of feasible and cost-effective pollution control technologies. Commenters urge EPA to apply the NO_X emissions standards for both laboratory-based duty cycle testing and in-use "off-cycle" testing in a single step, finalizing the more stringent standards in MY 2027 instead of delaying their application to MY 2031. *See* 87 Fed. Reg. at 17,421–22. There is no reason to wait until 2031. The proposed Option 1 FTP, SET, and LLC NO_X standards for MY 2027 are too lenient because they fail to reflect the application of feasible technologies that are already available or can be refined well in advance of that model year, let alone MY 2031. *See* 42 U.S.C. § 7521(a)(3)(A)(i). Commenters support and incorporate by reference comments by MFN and CARB demonstrating the technological feasibility of implementing the more stringent standards in a single step in MY 2027. *See* Comments of (1) MFN and (2) CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. And while Commenters urge EPA to strengthen its off-cycle standards, *see* Section IV.D.2.a, *supra*, at the bare minimum, the Agency should apply its proposed MY 2031 off-cycle numerical requirements to MY 2027.

3. <u>EPA should adopt warranty and useful life periods at least as long as those proposed in Option 1.</u>

To further ensure that emissions will be properly controlled over a greater portion of an engine's operational life, Commenters also support lengthening warranty and in-use periods. Emissions controls, like other components of engines, typically work less efficiently and become more likely to malfunction as they age. The Clean Air Act specifies that emissions standards under Section 202(a) "shall be applicable to such vehicles and engines for their useful life (as determined under [42 U.S.C. § 7521(d)]…) whether such vehicles and engines are designed as complete systems or incorporate devices to prevent or control such pollution." 42 U.S.C. §

[240] The Omnibus's FEL caps decrease to 50–70 mg/hp-hr in later model years, depending on service class. *See* Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022.

7521(a)(1). EPA's standards therefore include a durability requirement: a requirement that manufacturers demonstrate their engines will meet the standards throughout the regulatorily defined "useful life" of the engine.[241] The Clean Air Act also requires EPA to specify a warranty period within which manufacturers are responsible for the cost of repairing or replacing emissions control components that fail. 42 U.S.C. § 7541(a)(1).

EPA is correct to note that, "practically, any difference between the regulatory useful life and the generally longer operational life of in-use engines represents miles and years of operation without an assurance that emission standards will continue to be met." 87 Fed. Reg. at 17,495. In a 2013 report, EPA found that in the real world, many HDEs did not reach the end of their operational life (their first rebuild) until they had been driven more than *twice* the current useful life mileages for those classes of engines. 87 Fed. Reg. at 17,498. In other words, many HDEs are driven hundreds of thousands of miles beyond the point to which manufacturers must currently show emissions controls can last.

The warranty period is the period during which the Clean Air Act requires a manufacturer to warrant to the purchaser that an engine will conform with applicable Section 202 regulations. 42 U.S.C. § 7541(a)(1); 40 C.F.R. § 1068.115. As the Proposal notes, warranty periods have remained the same since 1983, even as useful life has increased, so that today the emissions warranty periods range from 22–54% of regulatory useful life. 87 Fed. Reg. at 17,505. With EPA's proposed changes to lengthen the useful life, this gap would grow even larger if warranty periods are not correspondingly increased.

As the Proposal notes, extending the warranty period to cover a greater fraction of an engine's regulatory useful life and operational life provides important incentives for behaviors and actions that lead to reduced NO_X emissions. Because a warranty is voided if operators do not properly maintain the engine, an increased warranty period would incentivize proper maintenance for a longer period of time. 87 Fed. Reg. at 17,505. Owners similarly would be incentivized not to install emissions control defeat devices that would void the engine warranty. *Id.* Manufacturers would be incentivized to simplify repair processes and better train technicians if they are responsible for the costs of repairs for a longer period. *Id.* Because manufacturers investigate possible defects whenever warranty claims are submitted, 40 C.F.R. § 1068.501(b), a longer warranty period would provide more information and greater opportunity to identify defective parts, 87 Fed. Reg. at 17,506.

Commenters support increasing the useful life mileage values for HDEs and extending the warranty period to cover a larger portion of the engines' operational lives. Because the current useful life and warranty periods cover only a fraction of the real-world operational life of trucks, older trucks on the road are very likely emitting higher levels of NO_X, and neither truck operators nor manufacturers have the proper incentives to ensure that emissions controls on those older trucks are functioning properly. Useful life and warranty periods covering a greater fraction of HDEs' expected operational life will help to protect people from dangerous NO_X, ozone, and particulate matter pollution, and will shift more of the costs and risks of designing functional pollution control equipment to engine manufacturers, who have control over design, rather than effectively requiring operators to bear those costs.

[241] 40 C.F.R. § 86.004-26(c)-(d) and § 86.004-28(c)-(d). 40 C.F.R. § 86.004-2.

Specifically, we urge EPA to adopt useful life and warranty periods at least as long as those proposed in Option 1. EPA notes that it "could justify proposing useful life requirements equivalent to the operational life data presented in Section IV.A.2 [of the Proposal], but [is] proposing somewhat shorter (less stringent) values in proposed Option 1 considering the effect of useful life on the feasibility of meeting the proposed Option 1 standards." 87 Fed. Reg. at 17,500. As the Proposal also notes, the Option 1 useful life periods generally align with those in the Omnibus. *Id.* EPA proposes in Option 1 to adopt warranty periods covering close to 80% of useful life, which would align with the MY 2027 and MY 2031 warranty periods adopted by CARB. 87 Fed. Reg. at 17,508. The fact that many manufacturers must comply with the Omnibus standards when they take effect supports the technological feasibility of setting useful life and warranty periods at a level approximately as stringent as the Omnibus. Given the Clean Air Act's command that EPA set regulations reflecting the "greatest degree of emission reduction achievable," 42 U.S.C. § 7521(a)(3)(A)(i), and EPA's statement that it could justify even longer useful life periods equal to operational life, we urge EPA to consider setting useful life periods more stringent than those proposed in Option 1 if the Agency determines that longer periods would be feasible in combination with the emissions standards it finalizes. Additionally, we urge EPA to adopt new warranty and useful life values in a single step, finalizing its proposed Option MY 2031 values as standards applicable to MY 2027 in order to achieve the emissions reductions from these changes as swiftly as possible.

E. Transitional credits generated from compliance with the Omnibus threaten to unlawfully diminish the stringency of EPA's NO_X standards.

EPA has proposed allowing various types of NO_X credits to be used within its ABT program, with a credit lifespan of five years. 87 Fed. Reg. at 17,552–53. Under that proposal, "transitional" credits, early adoption incentive credits, and BEV and FCEV credits could be generated as early as MY 2024. 87 Fed. Reg. at 17,552–57. EPA's Proposal does not adequately assess the impact of those pre-MY 2027 credit mechanisms on its emissions standards—especially given the gap between the EPA and Omnibus standards from MY 2024–26, and the extraordinarily large number of credits that could result from that gap. If EPA uses a single national credit bank, that credit surplus would threaten to drastically and unlawfully erode the emissions reductions achieved by the standards. *See* 42 U.S.C. § 7521(a)(3)(A)(i). That potential erosion should be a central factor in EPA's decision whether to allow transitional credits, and (if it does allow them) how to limit those credits' use; EPA is consequently required to thoroughly address it before including transitional credits in its final rule. *See Michigan v. EPA*, 576 U.S. 743, 750 (2015) (to be lawful, agency decisions must rest on a consideration of all relevant factors).

EPA's existing NO_X standards that apply to MY 2024 through MY 2026 are much higher than the Omnibus standard—.2 g/hp-hr, rather than .05 g/hp-hr. Engines certified to the Omnibus standard in that time will, consequently, generate a very large quantity of credits against the federal standard (approximating .15 g/hp-hr per engine sold per year). California and other states adopting the Omnibus have a substantial market share; the credits generated prior to MY 2027 are therefore likely to be significant. Depending on the FEL cap incorporated into the final rule, whether the final rule allows BEVs and FCEVs to generate NO_X credits, and manufacturers' decisions, the transitional credits generated between MY 2024–2026 could allow a large fraction of HHDEs to emit at the FEL cap even in MY 2030 and beyond. *See* Comments of MFN, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022.

That threat requires EPA to carefully assess the impact of the surplus credits generated by the gap between the pre-2027 EPA and Omnibus standards. *Michigan*, 576 U.S. at 750. And it further demands some adjustment to the Proposal's NO_X crediting structure. EPA should adjust its standards to account for the effect of its transitional crediting program on manufacturers' actual compliance responsibility. In the alternative, EPA should eliminate or amend the transitional crediting mechanism (*e.g.*, by establishing a separate credit bank for states adopting the Omnibus, and/or shortening the credit life of NO_X credits to no more than three years) so as to ensure the "greatest degree of emission reduction achievable" in the relevant model years. 42 U.S.C. § 7521(a)(3)(A)(i).

F. EPA should revise the proposed durability demonstration.

The Proposal's durability demonstration is substantially weaker than the Omnibus requirements, and it undermines the standards' effectiveness. 87 Fed. Reg. 17,547–48. In particular, EPA's demonstration allows for bench-aging of aftertreatment systems but does not require full testing of engines to ensure their emissions performance over their useful life. Given the centrality of engine design to emissions performance, that failure is likely to produce significant oversights in durability testing. Commenters ask EPA to adopt the comprehensive durability testing used in the Omnibus, combining dynamometer aging (with no fuel-based acceleration factors) with aftertreatment bench aging.[242]

G. The proposed anti-tampering and inducement provisions are inadequate.

EPA should improve the stringency of its proposed modifications to its inducement program to better ensure that operators properly maintain emissions control equipment. As EPA notes, SCR systems depend upon "an adequate supply of diesel exhaust fluid (DEF)." 87 Fed. Reg. 17,536–38. "Inducement" systems—creating engine derates that reduce a vehicle's maximum speed when the SCR lacks adequate DEF or the system has been tampered with—ensure that operators sustain that supply and properly maintain their aftertreatment systems. *Id.* at 17,537. In response to complaints that "vehicles are experiencing inducements for reasons outside of the operator's control," which may be "difficult to diagnose," EPA has proposed "progressively increasing inducement derate schedules," which restrict the maximum speed of vehicles with tampered SCRs or which have failed to maintain adequate DEF supply. *Id.* at 17,538, 17,543.

EPA's proposed inducement schedule offers insufficient incentives to ensure maintenance of SCRs. The Proposal indicates an initial derate that would allow most vehicles to continue to operate at up to 65 mph—close to the speed limit—decreasing after 60 hours of use to 50 mph. Vehicles with a recent history of low-speed operation—an average below 20 mph, for the previous 30 hours of engine operation—are initially restricted to 50 mph, decreasing to 35 mph after 60 hours of operation (the "LSI" limit). *Id.* at 17,543–44. The former limits—to numbers at

[242] *See* CARB, California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles (Aug. 27, 2020), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/frob-1.pdf.

or near the speed limit—are unlikely to induce prompt corrective action.[243] The LSI limit provides virtually no assurance of prompt corrective action. A vehicle that routinely operates at an average speed of 20 mph cannot be expected to respond to a derate that restricts its speed to 50 mph. In many cases (such as drayage and similar uses) such vehicles are unlikely to promptly respond even to the final derate, limiting speeds to 35 mph.[244]

And even for those vehicles whose owners might respond to the derates—which EPA suggests are limited to those that must travel substantial distances to reach a job site, 87 Fed. Reg. at 17,543—the Proposal's 60 hours of non-compliant use would still produce massive quantities of excess pollution. As EPA acknowledges, lack of adequate DEF can "cause NO_X emissions to increase to levels comparable to having no NO_X controls at all." *Id.* at 17,536. That is likely to be especially harmful in urban areas where HDV operations are concentrated, and where vehicles are consistently operating at speeds well below EPA's proposed derates. For those reasons, Commenters urge EPA to adopt a more stringent inducement regime than proposed, such as a dual schedule providing less severe derates when the detected fault is unlikely to lead to excess NO_X emissions, but imposing more severe derates where NO_X emissions are substantially affected so as to demand prompt repair. *See* Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022.

H. EPA should not provide exemptions for vocational vehicles.

EPA has requested comment on exempting a portion of engines from compliance with its updated emissions standards by allowing them to instead comply with pre-MY 2027 requirements through MY 2029. *Id.* at 17,565. That exemption is unnecessary, and EPA should not adopt it. The Proposal states that EPA is considering an allowance for up to 5% of a manufacturer's production volume within the Medium HDE or HHDE families that manufacturers show would be used in low volume, specialty vocational vehicles. *Id.* The purported reason for such an allowance would be to provide "lead time and flexibility to redesign" those vehicles. *Id.* EPA's Proposal provides more than adequate lead time to meet requirements in MY 2027. *See* Comments of CARB, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022. And to the extent that some vehicles present unique design difficulties, manufacturers can and should generate cleaner engines to compensate for those few nonconforming engines through the standards' ABT provisions. *See* Section IV.E, *supra* (noting likely excess of credits). But if EPA does adopt an exemption, it should identify the specific vocational categories for which redesigns will be infeasible, and limit any exemption to those categories alone.

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[243] *See* FHWA, Freight Management and Operations, Freight Facts and Figures 2010 (2010), https://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/docs/10factsfigures/table3_8.htm (reporting maximum interstate average speeds below 60 mph).

[244] *See* Andrew Papson & Michael Ippoliti, *Key Performance Parameters for Drayage Trucks Operating at the Ports of Los Angeles and Long Beach* 6, CALSTART (Nov. 15, 2013), https://calstart.org/wp-content/uploads/2018/10/I-710-Project_Key-Performance-Parameters-for-Drayage-Trucks.pdf (noting maximum speeds for near-dock operations of only 40 mph, and average speeds under 7 mph).

I. EPA should finalize the proposed PM standard and closed crankcase requirements.

Finally, Commenters support EPA's proposals to adopt a revised PM standard and to require closed crankcase ventilation systems for compression-ignition engines, both of which will achieve important reductions in PM pollution. 87 Fed. Reg. at 17,461–62, 17,466–67. The proposed PM standard of 5 mg/hp-hr is unquestionably feasible (even allowing for measurement variability), as manufacturers are already certifying engines well below this level. *Id.* at 17,462. Finalizing a PM standard at least that low will preserve these gains by preventing backsliding in the future. Similarly, given that a sizable portion of the market has already embraced closed crankcases, *see id.* at 17,466, EPA should require this eminently feasible technology on all compression-ignition engines. Crankcase emissions comprise a significant portion of the direct PM (and other pollutant) emissions from HDVs,[245] exposing communities and vehicle operators to unnecessary health risks. EPA must carry out its duty to protect public health and welfare by requiring manufacturers to eliminate these harmful emissions by adopting this readily available and affordable technology. *See* DRIA at 139 (estimating initial technology cost of $37 per engine).

V. EPA MUST STRENGTHEN THE PROPOSED GHG STANDARDS.

Just as EPA must strengthen its criteria pollutant proposal to carry out its statutory mandate under the Clean Air Act, Commenters urge EPA to improve its proposed GHG standards. EPA proposes to make targeted adjustments to the existing HDV GHG Phase 2 standards and advanced technology incentives finalized in 2016 for certain vocational vehicles and combination tractors. 87 Fed. Reg. at 17,598–609. EPA predicated these existing standards and incentives on an assumption that it was unlikely that ZEV options would be available for HDVs during Phase 2's timeframe (MY 2021 through MY 2027 and later). *Id*. at 17,595. That assumption has been proven incorrect in the intervening years. *Id*. at 17,595–98. EPA notes the increasing number of manufacturers now producing electric HDVs along with state legislation and commitments for zero-emission trucks. *Id*. In light of these developments, EPA proposes to revise CO_2 emissions standards for a subset of MY 2027 vehicles and adjust the advanced technology multipliers. 87 Fed. Reg. at 17,598–609. While these revisions are directionally necessary, the Agency continues to dramatically underestimate both baseline HD ZEV market penetration and the feasibility of zero-emission technologies to achieve increasingly stringent emissions standards. In doing so, it fails to "utiliz[e] emission standards to prevent reasonably anticipated endangerment from maturing into concrete harm." *Coal. for Responsible Regulation*, 684 F.3d at 122 (describing "the job Congress gave [EPA] in § 202(a)").

A. The proposed standards fall short of the requirements of the Clean Air Act because they underestimate baseline HD ZEV market penetration and the feasibility of zero-emission technologies.

Significant improvements in zero-emission technologies and the rapid growth of HD ZEV sales have brought about a critical need for updates to the Phase 2 GHG standards. The Phase 2 standards were not based on hybrid, fuel cell, or battery electric vehicle technology. 87

[245]Michael Gerhardt et al., *Crankcase Emissions for MY2007+ Heavy-Duty Diesel Trucks* 12, EPA (2020), https://www.epa.gov/sites/default/files/2021-01/documents/04-moves3-crankcase-hd-diesel-trucks-2020-10-14.pdf

Fed. Reg. at 17,594. Instead, EPA premised the vocational vehicle standards on controls including improvements in powertrain and driveline technology. *Id*. at 17,593. The standards for combination tractors were based on improvements in the tractor's powertrain, aerodynamics, tires, idle reduction, and other vehicle systems. *Id*. at 17,594. However, considering the improvements and growth in zero-emission technologies described above in Section III, EPA should in this rulemaking reconsider the technology package underlying the Phase 2 standards.[246]

The Agency's mandate and stated intent was, and continues to be, to ensure that all regulated vehicles must install *some* combination of GHG emission reduction technology. 87 Fed. Reg. at 17,602–03. Because manufacturers comply with the standards on a fleetwide average basis, every additional ZEV (which is counted at a 0 g/mi CO_2 emissions level) means that the remainder of the fleet can do less to reduce its GHG emissions. *Id*. at 17,601. In 2016, EPA dramatically underpredicted the level of future ZEV production, especially for school buses, transit buses, delivery trucks, and short haul tractors, which, according to EPA's estimates in the Proposal, now means that "approximately five percent of conventional heavy-duty vehicles would be able to meet the current HD GHG Phase 2 standards without installing emission-reducing technologies because the standards apply as a fleet-average." *Id*. (citing EPA, *Memo to Docket, HD 2027 Proposed Changes to Heavy-Duty Greenhouse Gas Emissions* (Nov. 2021)). While Commenters support EPA's plan to increase the stringency of 17 of the 33 MY 2027 vocational vehicle and tractor standards in line with updated baseline HD ZEV market penetration estimates, *id*. at 17,598, basing those updates on the Agency's proposed *underestimate* would result in standards that remain far too lenient—continuing the same problem EPA currently seeks to fix. Moreover, in light of Commenters' cost and market projections described in Section III, the record now supports including zero-emission technologies in the technology package underlying the GHG standards.

EPA estimates that ZEVs will make up just 1.5% of HD sales in MY 2027. *Id*. at 17,601. At this level, the Agency estimates that 5% of the conventional HD fleet would not need to do anything to meet the fleet-average standards. *Id*. This calculation demonstrates how imperative it is to get the baseline ZEV penetration estimate right: without correction, for every 1.5% of additional ZEV penetration, roughly an additional 5% of the fleet will install *no* GHG emission controls, counter to the requirements of the Clean Air Act. *See* 42 U.S.C. § 7521(a)(1) (requiring standards that "prevent or control" pollution). To update the stringency of the proposed standards, EPA merely applied the technology packages finalized in Phase 2 to the 5% of the conventional fleet it predicts would otherwise not install any technology due to the increased ZEV penetration. 87 Fed. Reg. at 17,601. Therefore, an accurate baseline ZEV penetration estimate, at minimum, is imperative to properly strengthening the standards.

As described in detail above in Section III, EPA's estimates are significantly and demonstrably incorrect. Its proposed 1.5% baseline ZEV penetration estimate is based on outdated data and a flawed methodology, and fails to consider recent, relevant studies and to take into account real-world ZEV sales commitments. Commenters' analysis provides support for at least 8–11% HD ZEV penetration by 2027 and 19–27% HD ZEV penetration by 2030. Failing to increase the stringency of the standards in line with this already conservative estimate would

[246] Comments on this Proposal submitted by MFN, EDF, and ICCT also detail the feasibility of achieving significantly greater deployment of zero-emission technologies within the HD fleet.

result in approximately 27–37% of the fleet installing *no* GHG emission controls in MY 2027, and 63–90% of the fleet installing *no* GHG emission controls in MY 2030.[247]

Given the data presented in Section III above, the Agency has a long way to go to "provide a reasoned explanation of its basis for believing that its projection is reliable…[and] defen[d]…its methodology for arriving at numerical estimates." *Bluewater Network*, 370 F.3d at 22 (internal citations omitted). Emissions standards must properly account for "the rapid pace of progress…, and the industry's own forecasts," *NRDC v. EPA*, 655 F.2d at 333—factors that here support a baseline HD ZEV penetration rate much higher than 1.5%, as well as incorporating zero-emission technologies into the standard-setting analysis. EPA must therefore update the record in accordance with these comments and examine the relevant data and demonstrate that the data is accurate and defensible. *See Dist. Hosp. Partners v. Burwell*, 786 F.3d 46, 57 (D.C. Cir. 2015). Courts require agencies to use "the best information available," *Catawba County v. EPA*, 571 F.3d 20, 45 (D.C. Cir. 2009), which the Agency failed to do in the Proposal. The market for ZEVs is accelerating rapidly with changes in technology, consumer demand, regulatory requirements, and fleet and manufacturer commitments, and "[a]gency reasoning…must adapt as the critical facts change." *Flyers Rights Educ. Fund, Inc. v. FAA*, 864 F.3d 738, 745 (D.C. Cir. 2017). The Agency's baseline HD ZEV market penetration estimate must exhibit a "sufficient linkage between theory, reality, and the result reached." *API v. EPA*, 862 F.3d 50, 68 (D.C. Cir. 2017). Considering that even the *known* commitments for ZEV production—including state-level commitments related to the ACT rule—far outpace EPA's estimate, the linkage between reality and result must be corrected.

EPA recognizes the gravity of the climate crisis and acknowledges that some sectors of the HD market are transitioning to zero-emission technologies at rates exceeding the Agency's original expectations. However, the Proposal continues EPA's history of significantly underestimating the future of ZEVs. This flawed forecast results in standards that do not comport with the requirements of the Clean Air Act and are not responsive to the dire effects of climate change, the transportation sector's outsized impact, or the available information indicating significantly higher baseline HD ZEV penetration and the further advancement of zero-emission technologies.

B. Credit multipliers that do not meaningfully incentivize additional ZEV deployment undermine the GHG standards and should be eliminated.

EPA must reconsider its proposal on advanced technology credit multipliers to avoid diluting the GHG standards by providing unnecessary incentives to HD ZEVs that will be built even under a business-as-usual scenario. The 2016 Phase 2 GHG rule provides credit multipliers to plug-in hybrid (3.5X), all-electric vehicles (4.5X), and fuel cell vehicles (5.5X) to incentivize the deployment of advanced technologies. 87 Fed. Reg. at 17,594. When Phase 2 was finalized, EPA concluded that these technologies were important to achieving significant future emissions reductions in the HD sector, but were unlikely to be adopted in the market without additional incentives. *Id*. at 17,603. However, as described above in Section III.A, EPA's pessimism was mistaken. In 2016, EPA found that there was only one manufacturer that had certified an

[247] 8% ÷ 1.5% = 5.33 x 5% = 26.66%; 11% ÷ 1.5% = 7.33 x 5% = 36.66%
19% ÷ 1.5% = 12.67 x 5% = 63.3%; 27% ÷ 1.5% = 18 x 5% = 90%

all-electric HDV, 87 Fed. Reg. at 17,603, but that number ballooned to 52 in MY 2020.[248] Commenters agree with the Agency's conclusion that "credit multipliers…may no longer be appropriate" and could "reduc[e] the effective stringency of the existing MY 2024 through 2027 standards." 87 Fed. Reg. at 17,603. In fact, EPA warns that at 8.5% ZEV penetration, *all* of the projected reductions from Phase 2 would be lost due to the credits. *Id*. at 17,604.

EPA proposes three options to reduce the impact of the credit multipliers on the stringency of the standards. *Id*. at 17,605–07. The first, precluding the multipliers from being utilized by ZEVs certified in California, inappropriately omits ZEVs that are required to be sold in other states that have adopted the ACT rule or other binding requirements. If a state already requires a certain percentage of HD sales to be ZEVs, those vehicles should be reflected in the baseline and should not accrue credit multipliers.

The second option would cap the number of credits a manufacturer could receive, precluding credit multipliers to ZEVs sold *above* a certain threshold. This seems to turn EPA's original balancing on its head. EPA describes its rationale for credits:

> The HD GHG Phase 2 advanced technology credit multipliers represent a tradeoff between encouraging a new technology that could have significant benefits well beyond what is required under the standards and providing credits that do not reflect real world reductions in emissions which in effect allow for emissions increases by other engines and vehicles.

Id. at 17,603. The intention of the credit multipliers is to encourage technology deployment and emissions reductions that would not occur without the incentive; therefore, it should be those additional ZEVs that receive a credit multiplier, not the ones that would be produced under a business-as-usual scenario. Every credit multiplier will lessen the emissions reductions required of conventional vehicles, and therefore should only be available for HD ZEVs that are actually *incentivized*. This approach, however, would require an accurate assessment of the baseline. As noted above, Commenters' assessment indicates that HD ZEV penetration will be at least 8–11% by 2027 and 19–27% by 2030. If a manufacturer is incentivized by the credits to produce more ZEVs than business-as-usual, only then should credits be available in the 2024–2027 timeframe.

The final proposed option provides no rationale based on incentivizing additional ZEVs, but merely attempts to phase out the credit multipliers in an orderly fashion. HD ZEVs that would be built anyway—as the analysis in Section III indicates—should not be eligible for credit multipliers. Commenters recommend phasing out multipliers for these vehicles as expeditiously as possible.

VI. COST-BENEFIT ANALYSIS SUPPORTS STRONGER EMISSIONS STANDARDS.

EPA's cost-benefit analysis should include a quantification of the rule's climate benefits based on the social cost of greenhouse gases (SC-GHG). Commenters' proposed improvements to EPA's criteria pollutant and GHG proposals would deliver increased climate benefits by

[248] EPA, Memo to Docket, HD 2027 Proposed Changes to Heavy-Duty Greenhouse Gas Emissions 2 (Nov. 2021).

incorporating and driving zero-emission technologies across the heavy-duty sector, and EPA must consider these additional benefits in finalizing the standards.

EPA has previously found that sales impacts from heavy-duty standards were too uncertain to quantify, and Commenters believe that continued uncertainty cautions against attempting to quantify them as part of this rulemaking's Regulatory Impact Analysis. Despite this continued uncertainty, Commenters agree with EPA that the adverse sales impacts, if any, from Option 1 (including pre-buy and low-buy effects) are likely to be minimal and short lived.

A. EPA must quantify the climate benefits of this rule by considering the Interagency Working Group's interim estimates for SC-GHG.

The federal government has quantified the climate impacts of proposed regulations for more than a decade, since the Ninth Circuit Court of Appeals held in 2008 that the National Highway Traffic Safety Administration (NHTSA) had acted arbitrarily and capriciously by failing to do so when assessing the costs and benefits of various alternative fuel-economy standards. *See Center for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1201 (9th Cir. 2008) (finding "no evidence to support NHTSA's conclusion that the appropriate course was not to monetize or quantify the value of carbon emissions reduction at all").

As Commenters and others have previously explained,[249] and as EPA and NHTSA both recently determined,[250] the best available and most appropriate values for estimating monetized climate impacts are the interim estimates published in February 2021 by the federal government's Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).[251] Although the IWG's interim estimates are widely acknowledged to be significant underestimates,[252] they remain appropriate representations of the lower bound of potential climate impacts and have been applied in dozens of previous rulemakings[253] and their use has been upheld by federal courts.[254]

[249] *See* Comments of Center for Climate and Energy Solutions et al. on Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 43,736 (Aug. 10, 2021) (Docket No. EPA-HQ-OAR-2021-0208-0268).
[250] *See* EPA, Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 74,434, 74,504 (Dec. 30, 2021) (determining that the interim estimates, "while likely an underestimate, are the best currently available SC-GHG estimates," and that they remained "appropriate for use in estimating the global social benefits of [GHG] emission reductions expected from this final rule"); NHTSA, Corporate Average Fuel Economy Standards for Model Years 2024–2026 Passenger Cars and Light Trucks, 84 Fed. Reg. 25,710, 25,724 (May 2, 2022) (determining that the IWG values "are based on the best available science and economics and are the most appropriate values to focus on in the analysis of this rule," even though they "likely significantly underestimate the full benefits to social welfare of reducing greenhouse gas pollution").
[251] *See* IWG, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide—Interim Estimates Under Executive Order 13,990 (2021), https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.
[252] *See, e.g.*, *id.* at 4 (acknowledging that current social cost valuations "likely underestimate societal damages from [greenhouse gas] emissions"); Richard L. Revesz et al., *Improve Economic Models of Climate Change*, 508 Nature 173 (2014) (explaining that the IWG's values, though methodically rigorous and highly useful, are very likely underestimates).
[253] Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Colum. J. Envt'l L. 203, 270–84 (2017) (listing all uses through mid-2016).
[254] *Zero Zone v. Dept. of Energy*, 832 F.3d 654, 679 (7th Cir. 2016).

In the Proposal, EPA requested comment on "how to address the climate benefits" of the proposed rule, noting that a federal district court had issued an injunction against the use of the IWG's interim estimates by EPA and other defendants. 86 Fed. Reg. at 17,608 & n.888. *See Louisiana v. Biden*, Order, No. 2:21-CV-01074, ECF No. 99 (W.D. La. Feb. 11, 2022). However, the Fifth Circuit Court of Appeals has since stayed that injunction, *Louisiana v. Biden*, Order, No. 22-30087, Doc. No. 00516242341 (5th Cir. Mar. 16, 2022), meaning there is currently no reason for EPA to depart from its historical and preferred approach of monetizing climate impacts using the IWG's interim estimates. Indeed, NHTSA has already returned to using the interim estimates, finding them to be "more accurate and reasonable" than other values. NHTSA, Corporate Average Fuel Economy Standards for Model Years 2024–2026 Passenger Cars and Light Trucks, 87 Fed. Reg. 25,710, 25,724 (May 2, 2022).

Commenters encourage EPA to follow the approach that NHTSA recently took in finalizing its Light-Duty Vehicle Corporate Average Fuel Economy Standards for Model Years 2024–2026. In that rulemaking, NHTSA explicitly stated its independent determination that although the IWG interim estimates significantly underestimate the full benefits of GHG emissions reductions, they remain the best available values. *Id.* at 25,724–25. Critically, NHTSA provided additional justification for adopting a global damages valuation and for combining climate effects discounted at an appropriate consumption-based rate with other costs and benefits discounted at a capital-based rate. *Id.* at 25,879–80. NHTSA then used the IWG's interim estimates and recommended discount rates in the agency's main cost-benefit analysis. *Id.* at 25,724. However, NHTSA also conducted sensitivity analyses using additional discount rates, as well as the SC-GHG estimates it used in 2020 (which attempted to exclude global climate impacts), while cautioning that the 2020 values "do not reflect the best available science and economics for estimating climate effects." *Id*. NHTSA then determined that "even if NHTSA's cost-benefit analysis applied the misleadingly low SC-GHG estimates from the 2020 rule, which severely underestimate the impacts of climate effects on U.S. citizens," the results would not change the agency's determination that the final standards were "the maximum feasible under its statutory authority." *Id*. By taking a similar approach in this rulemaking, EPA can protect against challenges to the Agency's application of the SC-GHG, as well as confirm that strengthening the standards as Commenters propose will deliver meaningful net benefits to society under a range of analytical assumptions.

B. If EPA decides to quantify the sales impacts of the standards, Commenters agree that any impacts are likely to be minimal and short-lived.

EPA has previously declined to quantify the sales impacts of heavy-duty regulations, determining that adverse impacts were not certain to occur, and that it was not possible to isolate the effects of the standards from other, potentially stronger, factors, such as broader macroeconomic conditions. In the 2011 Phase 1 GHG standards, EPA and NHTSA noted that "whether pre-buy or delayed purchase is likely to play a significant role in the truck market depends on the specific behaviors of purchasers in that market," and explained that the Agencies would not project fleet turnover effects "[w]ithout additional information" about the likelihood of future market conditions. EPA & NHTSA, Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, 76 Fed. Reg. 57,106, 57,332 (Sept. 15, 2011). Similarly, in the 2014 Tier 3 standards, EPA explained that it had "not attempted to estimate explicitly the effects of the rule on scrappage of older vehicles and the turnover of the vehicle fleet," because it did not "have a good estimate of the effect of new vehicle price changes on vehicle turnover." EPA, Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards, 79 Fed. Reg. 23,414, 23,617 (Apr. 28, 2014). And most recently, in the 2016 Phase 2 GHG standards, EPA and NHTSA again declined to project sales and turnover effects, explaining that while the standards might affect sales to some degree, "the size of that effect is likely to be swamped" by macroeconomic conditions, and that it was "unlikely to be possible to separate the effects of the existing standards from other confounding factors." 81 Fed. Reg. at 73,875.[255]

We recognize that EPA has now developed a peer-reviewed methodology to estimate the sales impacts of heavy-duty regulations, which it suggests could be applied in the final rule. While we do not think EPA should quantify sales effects in the final rule, for the reasons noted above in the previous rulemakings, we do concur in the Agency's ultimate conclusion that any such effects are likely to be minimal and short-lived. According to the Agency's example results, proposed Option 1 is unlikely to cause extensive or long-lasting adverse sales impacts, with potential pre- and low-buy for Class 8 trucks ranging "from zero to approximately two percent increase in sales over a period of up to 8 months before the 2031 standards begin (pre-buy), and a decrease in sales from zero to approximately two percent over a period of up to 12 months after the 2031 standards begin (low-buy)." 87 Fed. Reg. at 17,429.

As EPA's analysis of previous, comparable heavy-duty regulations determined, historical pre-buy/low-buy effects have been limited—where there is evidence that they have even occurred at all.[256] Specifically, these effects have been shown to be limited by *vehicle type* (with "some evidence for Class 8 vehicles" but no such evidence for Classes 6 or 7[257]), limited in *magnitude* (with "[s]mall" pre-buy effects for Class 8 vehicles prior to the 2010 and 2014 regulations[258]), and limited in *duration* (with "some evidence for Class 8 vehicles of short-term pre-buy and low-buy" lasting "typically less than 8 months"[259]).[260] And on the limited occasions

[255] CARB similarly declined to attempt to estimate sales impacts from the Omnibus, observing that while some studies had explored the relationship between general cost increases and purchasing behavior, they resulted in a "very wide range" of "highly uncertain" estimates, which CARB cautioned "may change markedly in the span of only several years due to the dynamics of industry, and modern global economics." CARB, Attachment B to Resolution 20-23, Response to Comments on the Environmental Analysis for the Proposed Heavy-Duty Engine and Vehicle Omnibus Regulation and Associated Amendments 14 (Aug. 26, 2020). https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/res20-23attbrtc.pdf.
[256] EPA, Analysis of Heavy-Duty Vehicle Sales Impacts Due to New Regulation at 8–16 , EPA-420-R-21-013 (2021), https://cfpub.epa.gov/si/si_public_pra_view.cfm?dirEntryID=349838&Lab=OTAQ.
[257] *Id.* at 8.
[258] *Id.*
[259] *Id.*
[260] *See id.* at 9 ("Pre-buy and low-buy effects, where they occur, are short lived, with the period of significance not extending beyond 8 months pre and post regulation.").

when both pre-buy and low-buy effects have occurred in the past, they often cancel each other out in a matter of months, with a net sales impact of zero.[261]

Moreover, while there is mixed evidence of limited pre-buy and low-buy behaviors surrounding some prior heavy-duty vehicle regulations, the evidence is neither definitive nor predictably consistent across regulations or vehicles. As EPA concluded from its literature review, "pre-buy and low-buy do not occur universally. These effects do not appear to show up in all rules, or for Class 7 vehicles."[262] In fact, in the case of the 2010 regulations, Class 7 vehicles actually showed some evidence of reduced sales before the implementation of the regulations, and increased sales after the implementation of the regulations—the opposite of pre-buy/low-buy and contrary to a simplistic assumption that higher expected regulatory costs necessarily result in greater adverse sales impacts, given that the 2007–2010 regulations "are largely seen as the most extensive (and expensive) HDV emissions standards."[263]

Similarly, not all purchasers can be expected to engage in the same kind of behavior in response to regulations. For example, smaller firms, which make up a plurality of trucking companies, "typically have lower pricing power, and as such are less likely to engage in pre-buy, low-buy, or class-shifting behavior."[264] Likewise, contrary to claims regularly advanced by industry advocates, trucking firms' responses to increased costs "may not always follow what would be expected by theory."[265] Studies "suggest that trucking companies may pass on, and recoup (or more than recoup) certain costs, and that economic responses to HDV emissions regulations may be more complex than anticipated and may be counterintuitive in certain respects."[266]

Further, as EPA noted in its 2021 analysis, "[g]iven the high relative costs of [HDVs], we also do not expect much of a pre-buy effect, as any advantage associated with increasing early purchases because of anticipated HDV price increases are offset by the costs of managing excess vehicle capacity, which can be expensive, or selling or scrapping older stock."[267] Commenters agree with this assessment.

Commenters also strongly support EPA's view that the extended useful life and warranty periods of proposed Option 1—in addition to ensuring critical real-world emissions reductions—are likely to reduce the potential for adverse sales impacts. As EPA explains, "[t]his is because longer useful life periods are expected to make emission control technology components more durable, and more durable components, combined with manufacturers paying

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[261] *See id.* at 20 (citing Rittenhouse and Zaragoza-Watkins's (2018) finding that pre-buy prior to the 2007 regulation was "followed by a near-symmetrical reduction in sales in the months immediately after the regulation went into effect—for an overall near zero net sales impact"); National Academies of Sciences Engineering and Medicine, *Reducing Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two: Final Report* 329 (2020), https://doi.org/10.17226/25542 ("The pre-buy and low-buy impacts [of the 2007 standards] were short-lived and small in volume…and they roughly canceled out, leaving an insignificant net impact on sales.").
[262] EPA, Analysis of Heavy-Duty Vehicle Sales Impacts Due to New Regulation at 99.
[263] *Id.* at 39.
[264] *Id.* at 16.
[265] *Id.* at 43.
[266] *Id.*
[267] *Id.* at 54.

for repairs during the proposed longer warranty periods, would in turn reduce repair costs for vehicle owners." 87 Fed. Reg. at 17,590. The reduced repair costs can be expected to alleviate some of the effect of increased vehicle purchase costs, and "[a]s a result, they may reduce incentives for pre- and low-buy and mitigate adverse sales impacts." *Id.* at n.785.

Commenters also agree with the Manufacturers of Emission Controls Association (MECA) and the Advanced Engine Systems Institute that the technology required by Option 1 is neither new, nor untested, but rather reflects the "evolution of familiar technology."[268] As these organizations correctly point out: "2027 is not like 2007/2010 when emission controls were put on trucks for the first time. Truck manufacturers and operators have 20 years of experience with hardware and maintenance of systems."[269] The Proposal's reliance on familiar technology, combined with the enhanced durability and warranty provisions, means that purchasers can be expected to face reduced incentives to engage in pre-buy behavior in response to these standards. *See* Comments of MFN, to be filed in Docket EPA-HQ-OAR-2019-0055 on May 16, 2022.

Finally, Commenters' proposed improvements to the GHG standards can also be expected to reduce the potential for adverse sales impacts of the standards. Manufacturers often improve the fuel efficiency of their vehicles as part of their strategy for complying with GHG standards, which are less likely to cause adverse sales impacts because the benefits of fuel savings accrue to the vehicle purchaser, thereby lowering transport costs and stimulating the economy.[270] Fuel efficiency and GHG standards also reduce the impact of fuel price volatility on new vehicle demand, and insulate manufacturers and workers from fuel price shocks, leading to more stable sales and employment numbers.[271]

VII. THIS RULE MUST SET A STRONG FOUNDATION FOR AMBITIOUS FUTURE RULEMAKINGS.

This rulemaking presents an opportunity for EPA to set a strong foundation for ambitious future rules that will achieve significant emissions reductions through widespread deployment of zero-emission technologies within the heavy-duty sector. Given HDVs' contribution to widespread public health problems and dangerous climate change, it is critical that this sector transition to zero-emission technologies as rapidly as possible.

While *this* Proposal should do more to accelerate the deployment of those technologies to bring about greater emissions reductions, Commenters welcome the opportunity to comment on the goals and principles EPA should follow as it undertakes a series of future rulemakings to clean up the transportation sector. *See* 87 Fed. Reg. at 17,420 (referencing future light- and heavy-duty rulemakings and requesting comment "on how the Agency can best consider the potential for ZEV technologies to significantly reduce air pollution from the heavy-duty vehicle

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[268] Rasto Brezny (Manufacturers of Emission Controls Association) & Patrick Quinn (Advanced Engine Systems Institute), Supporting EPA's Clean Trucks Rule 8 (Jan. 18, 2022).
[269] *Id.* at 5.
[270] *See* Katherine Rittenhouse & Matthew Zaragoza-Watkins, *Anticipation and Environmental Regulation*, 89 J. Envtl. Econ. & Mgmt. 255, 267 (2018).
[271] *See id.*; Matthew Zaragoza-Watkins, *Analysis of Market Impacts of GHG and Fuel-Economy Standards for Heavy-Duty Vehicles* (May 11, 2015), attachment to Comment of EDF on EPA's Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2 (Docket No. EPA-HQ-OAR-2014-0827) (Aug. 16, 2016).

sector”). Each rulemaking must be viewed as a stepping stone for the next and with recognition of the interrelationship with other sectors to adequately protect public health and welfare. This rulemaking will be followed by another to set new stringent GHG emissions standards for heavy-duty engines and vehicles starting in MY 2030, and EPA must lay the groundwork now for a rule that protects human health and welfare and leads to the necessary acceleration of zero-emission technologies. Setting insufficiently stringent standards in this rulemaking could jeopardize EPA’s ability to fulfill its statutory obligations not only now but in future rulemakings.

A. Upcoming rulemakings must account for and drive advancements in zero-emission technologies.

In addition to fixing the insufficiencies in the Proposal, we urge EPA to consider zero-emission technologies in establishing its GHG emissions standards, both now and when the Agency sets Phase 3 standards for MY 2030 and later. Already, baseline HD ZEV market penetration will reach 19–27% by 2030.[272] Analysis conducted by ICCT finds that new HD ZEV sales of 45% or higher by 2030 is necessary to avoid greater than 2℃ of warming, and policies that allow greater than 2℃ of warming will fail to protect health and welfare.[273] EPA must set standards now with these goals and obligations in mind.

Accelerating the deployment of zero-emission technologies is feasible, cost-effective, and necessary in order to achieve the United States’ climate goals and protect public health and welfare. There are additional advancements in zero-emission technologies that EPA should consider, as detailed in a recent analysis by Roush Industries.[274] Manufacturers have also acknowledged that regulations help provide the motivation needed to achieve goals. For example, Daimler’s general manager for product strategy and market development explained that “[r]egulations provide motivation—and we all need some of that sometimes,” and that “[i]t’s always easier to just do what you’ve always done. So we see the need for things like [California’s Advanced Clean Trucks Rule] to help us along.”[275] Moreover, considering zero-emission technologies in the standard-setting analysis fulfills Congress’s expectations that “[w]hen a breakthrough occurs....standards can be toughened.” *See* 116 Cong. Rec. S20598 (daily ed. Dec. 18, 1970) (statement of Sen. Muskie); *see also* 116 Cong. Rec. H5348, H5358–59 (daily ed. June 10, 1970) (statement of Rep. Farbstein) (expressing the belief that the internal combustion engine was unsustainable and that alternative power sources were necessary and achievable). There has been such a “breakthrough” in zero-emission technologies, across all HDV classes and applications. EPA must acknowledge these developments and set standards accordingly, now and in the future.

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[272] See Appendix A.

[273] Claire Buysse et al., *Racing to Zero: The Ambition We Need for Zero-Emission Heavy-Duty Vehicles in the United State*, ICCT (Apr. 8, 2022); Arijit Sen & Josh Miller, *Emissions Reduction Benefits of a Faster, Global Transition to Zero-Emission Vehicles*, ICCT (Mar. 2022), https://theicct.org/wp-content/uploads/2022/03/Accelerated-ZEV-transition-wp-final.pdf.

[274] Vishnu Nair & Gary Rogers, *Reducing Medium- and Heavy-Duty Fuel Consumption and Criteria Pollutants*, Roush Industries (Sept. 2021).

[275] Jack Roberts, *On the Glide Path to Net Zero*, Truckinginfo.com (May 10, 2022), https://www.truckinginfo.com/10170224/on-the-glide-path-to-net-zero.

1. <u>Zero-emission technologies are achievable even for long-haul applications.</u>

In proposing updates to the GHG standards, EPA focuses on four vehicle types (school buses, transit buses, delivery trucks, and short-haul tractors) "because they will likely have the highest EV sales of all heavy-duty vehicle types between now and 2030." 87 Fed. Reg. at 17,598. While these sectors are likely to transition to zero-emission technologies the fastest, there is also increasing potential in long-haul sectors beyond MY 2027. Several long-haul ZEVs are currently in development, and cost studies find that TCO parity is not far off for even the largest HD ZEVs that travel long distances. As shown in Table 4 in Section III.C, several studies estimate that TCO parity will be achieved as early as 2030–2035 for long-haul rigid trucks and 2025–2030 for long-haul tractors.[276]

EPA believes "that it is not appropriate to propose updates to the sleeper cab tractor standards in this action because the typical usage and daily miles traveled by these vehicles is beyond the range available in current electric tractors under development." 87 Fed. Reg. at 17,600. In fact, however, "many manufacturers are now road-testing electric tractor prototypes for hauls significantly longer than 100 miles…Daimler, Peterbilt, Tesla, and Volvo seem to be furthest along, but several other companies are also developing products."[277] EPA should at least consider these developments for the Phase 3 standards, as reducing criteria pollutants and GHG emissions from these larger vehicles is necessary for protecting public health and welfare.

The pattern of driving for many long-haul routes also supports a potential path to achieving zero emissions. "The estimated average distance traveled between 30-minute driver breaks is 150 miles and 190 miles for regional-haul and long-haul trucks respectively in the U.S. Thirty minutes of charging using 500 kW or mega-Watt scale fast-chargers would add sufficient range without impairing operations and economics of freight movement."[278] According to a recent report by the North American Council for Freight Efficiency, about half of all Class 8 tractors engaged in regional-haul applications (range of about 200 miles) could already switch to battery-electric technology "with minimal or no impact on operations, productivity, or efficiency."[279] The Federal Motor Carrier Safety Administration also has several restrictions on the driving hours for long-haul trucks. The maximum continuous driving allowed without a 30-minute mandatory break is 8 hours (approximately 450 miles), meaning that "a range of 500

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[276] ICCT (2019), ZEV Alliance (2020), ANL (2021), EDF/MJB (2021), CARB (2021), and NREL (2022) all find TCO parity reached for long-haul tractors at least by 2035. Only BEAN (2021) and NREL (2021) find TCO parity for long-haul tractors to be achieved later than 2035 (between 2040 and 2050). For long-haul rigid trucks, both studies that provide estimates find similar timelines for TCO parity—EDF/MJB (2021) estimates after 2030 and NREL (2022) estimates between 2030–2035.

[277] Steven Nadel & Peter Huether, *Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers* 18, ACEEE (June 2021).

[278] Amol Phadke et al., *Why Regional and Long-Haul Trucks are Primed for Electrification Now*, Lawrence Berkeley National Laboratory (Mar. 2021).

[279] Jack Roberts, *Half of All Regional-Haul Trucks Could Go Electric Now*, HDT Truckinginfo (May 5, 2022), https://www.truckinginfo.com/10169971/half-of-all-regional-haul-trucks-could-go-electric-now; *see also* North American Council for Freight Efficiency, Electric Trucks Have Arrived: The Use Case for Heavy-Duty Regional Haul Tractors (May 2022), https://nacfe.org/wp-content/uploads/edd/2022/05/HD-Regional-Haul-Report-FINAL.pdf.

miles will be sufficient to cover the maximum allowed continuous driving."[280] Long-range tractor models, including at least one with a range of up to 500 miles, are scheduled to enter the market soon.[281] For example, Tesla's Semi, expected to hit the market next year, will have a range of 500 miles at highway speed, and will be powered by a new solar-powered high-speed DC charging system that will supply about 400 miles of electricity in 30 minutes.[282] Moreover, nearly 80% of freight in the United States is transported less than 250 miles, meaning that 500-mile range is not necessary for all long-haul applications.[283] Daimler's Mercedes-Benz brand has started customer testing a new long-haul truck, the eActros LongHaul, which has a 310-mile range and should be ready for production by 2024.[284]

Long-haul fleet managers are likely to find zero-emission technologies advantageous for other reasons as well. "Electric motors can deliver peak torque almost instantly, allowing them to do very well in towing large loads from a dead start or up a gradient."[285] While battery packs add additional weight to the truck, electric drivetrains are "substantially lighter relative to a diesel drive train, which offsets a significant amount of battery pack weight."[286] And even the additional battery pack weight is unlikely to be an issue for trucks, "since most truck trips tend to be limited by volumetric capacity of payload as opposed to payload weight," meaning that any minor weight added by electrification "is likely to be acceptable for most trucks."[287]

Regardless of whether EPA considers more stringent emissions standards for long-haul trucks in this rulemaking, the Agency should consider these and future developments in this sector as promising evidence of the technological and economic feasibility of heavy-duty zero-emission technologies on a broad scale. In order to achieve the United States' climate goals and carry out the Clean Air Act's mandate to protect public health and welfare, EPA must consider paths toward greater deployment of zero-emission technologies in the entire heavy-duty sector, including long-haul trucks.

2. Fuel cell/hydrogen technology and other innovations offer additional promise for long-haul and other heavy-duty market segments.

The heavy-duty truck market is rapidly innovating, and EPA should consider all of these innovations in setting emissions standards, including developments in hydrogen fuel cell technology. For medium- and heavy-duty long-haul trucks, full transition to zero-emissions may require some use of hydrogen fuel cells. Hydrogen FCEVs are scheduled to enter the heavy-duty

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[280] Amol Phadke et al., *Why Regional and Long-Haul Trucks are Primed for Electrification Now* 5, Lawrence Berkeley National Laboratory (Mar. 2021).
[281] Steven Nadel & Peter Huether, *Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers*, ACEEE (June 2021).
[282] John O'Dell, *Elon Musk Unveils Superfast, 500-mile Range Tesla Semi-Truck*, trucks.com (Nov. 17, 2017), https://www.trucks.com/2017/11/17/elon-musk-unveils-tesla-electric-semi-truck/.
[283] *Id.*
[284] Mike De Socio, *Keep Your Eyes on These 9 Electric Truck and Van Companies in 2021*, GreenBiz (Jan. 4, 2021), https://www.greenbiz.com/article/keep-your-eyes-these-9-electric-truck-and-van-companies-2021.
[285] Steven Nadel & Peter Huether, *Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers* 10, ACEEE (June 2021).
[286] Amol Phadke et al., *Why Regional and Long-Haul Trucks are Primed for Electrification Now* 5, Lawrence Berkeley National Laboratory (Mar. 2021).
[287] *Id.*

tractor market in 2022, and will provide an alternative to BEVs that may be attractive in long-haul applications.[288] For long-haul trucks, a hydrogen tank can be fueled approximately 15 times faster than a battery can be charged, takes up significantly less cargo capacity, and has a longer range.[289]

EPA recognizes FCEV potential, stating that "[i]f additional data on FCEV sales is available when we are conducting analyses for the final rulemaking, then we would likely evaluate using those data." DRIA at 56. And manufacturers are currently developing FCEV models. Daimler's Mercedes-Benz brand, for example, has recently announced the GenH2, an electric-fuel cell truck that promises to drive more than 600 miles before needing to refuel.[290]

Several recent studies have also considered the entry of FCEVs into the market, including NREL (2022) (projecting that FCEVs will make up 2% of heavy-duty sales by 2030 and 21% by 2040)[291] and BNEF EV Outlook (2021) (projecting that FCEVs will comprise 3% of heavy-duty sales by 2040 in the Economic Transition Scenario and 10% of heavy-duty sales by 2050 in the Net Zero Scenario).[292] DOE has explained that "[d]ue to advancements for fuel cells and clean hydrogen production, hydrogen fuel cell electric vehicles are expected to become cost-competitive for long-haul heavy-duty trucks with greater than 500-mile range by 2035."[293] EPA should consider all feasible zero-emission technologies, including both battery electric and fuel cell technologies, both now and when setting the upcoming Phase 3 standards.

VIII. CONCLUSION

EPA must finalize a strong rule this year to curtail dangerous emissions from heavy-duty vehicles and engines. Adopting Commenters' recommendations would result in a feasible, cost-beneficial, and technology-forcing rule that fulfills EPA's statutory duty to protect public health and welfare.

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[288] Chris Randall, *Hyzon to Deliver 18 FC Trucks to Hylane*, Electrive.com (Apr. 11, 2022), https://www.electrive.com/2022/04/11/hyzon-to-deliver-18-fc-trucks-to-hylane/#:~:text=Delivery%20of%20the%20vehicles%20is,part%20of%20Hylane%27s%20mobility%20model.

[289] Thomas Walker, *Why the Future of Long-Haul Heavy Trucking Probably Includes Lots of Hydrogen*, GreenBiz (June 15, 2021), https://www.greenbiz.com/article/why-future-long-haul-heavy-trucking-probably-includes-lots-hydrogen.

[290] Mike De Socio, *Keep Your Eyes on These 9 Electric Truck and Van Companies in 2021*, GreenBiz (Jan. 4, 2021).

[291] Catherine Ledna et al., *Decarbonizing Medium- & Heavy-Duty On-Road Vehicles: Zero-Emission Vehicles Cost Analysis*, NREL (Mar. 2022).

[292] BNEF EV Outlook (2021).

[293] DOE, DOE Projects Zero Emissions Medium- and Heavy-Duty Electric Trucks Will Be Cheaper than Diesel-Powered Trucks by 2035 (Mar. 7, 2022), https://www.energy.gov/articles/doe-projects-zero-emissions-medium-and-heavy-duty-electric-trucks-will-be-cheaper-diesel.

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14. Priyank Lathwal et al., *Pollution from Freight Trucks in the Contiguous United States: Public Health Damages and Implications for Environmental Justice*, arXiv:2204.06588 (2022)

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APPENDIX A

Baseline Estimates of National HD ZEV Sales by 2027

Methodology:

Data on projected on-road state and national M/HD sales was obtained from EPA's MOtor Vehicle Emission Simulator (MOVES), version 3.02.[294] The data was extracted for state, vehicle type, registration type, model year, and projection year. Reported data is on-road vehicles only. Sales data for MY 2027 is a linear interpolation between 2025 and 2030 projection years. The methodology attempts to mimic EPA's methodology in the Proposal, using California HD ZEV sales as required by ACT, estimating HD ZEV sales outside of California, and extrapolating to a total national HD ZEV sales percentage (excluding long-haul tractors) for 2027 and 2030. All Class 2b and 3 vehicles are removed from these estimates.

California's ACT rule requires Class 4–8 vehicles to achieve 20% ZEV sales in 2027 and 50% in 2030 and Class 7–8 tractors to achieve 15% ZEV sales in 2027 and 30% in 2030.[295] The MOU states committed to achieve 30% M/HDV ZEV sales by 2030, with no specificity on interim targets or class breakdown.[296]

This analysis presents estimates for baseline HD ZEV sales based on three levels of inclusion:

- "California and ACT States" presents national HD ZEV sales based just on sales from California and the five states that have adopted ACT, assuming that they achieve ACT targets, with no additional HD ZEV sales outside of these states. It includes sales requirements for tractors, Class 4–8 vehicles, including school buses and other buses but not transit buses. Class 2b and 3 vehicles are excluded from ZEV sales requirements (numerator) and national HD sales (denominator). Long-haul trucks are included in the count of Class 4–8 ZEV sales required by the ACT rule.

- "All MOU States" presents national HD ZEV sales from California and the ACT states (as described above), as well as from all the states that have signed the MOU, with the assumption that those MOU states achieve ACT requirements. No additional HD ZEV sales outside of these states are included. This uses the same vehicle category exclusions as the "California and ACT States" estimates.

- "MOU States + Modest Action From Other States" presents national HD ZEV sales from California, the ACT states, and the MOU states (again, assuming the MOU states achieve ACT requirements), and adds HD ZEV sales from non-MOU states with an assumption that those other states achieve 3% ZEV tractor sales and 4% ZEV Class 4–8 in 2027.

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[294] EPA MOVES3, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.
[295] CARB, Advanced Clean Trucks Regulation, Final Regulation Order, at 5 (Mar. 15, 2021), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf.
[296] *See* NESCAUM MOU at 3–4.

Results - Baseline ZEV Sales Estimates:

Year	California and ACT States	All MOU States	MOU States + Modest Action from Other States
	Total HD Sales (excluding 2b/3 and transit buses)[297]		
2025	120,199	215,420	596,647
2027	122,271	219,092	606,659
2030	125,379	224,599	621,676
	Total HD ZEV Sales[298]		
2025	12,085	21,620	30,332
2027	23,055	41,262	55,589
2030	57,224	102,315	143,515
	National Percent (non-long-haul) HD ZEV Sales[299]		
2025	2.4%	4.3%	6.0%
2027	4.5%	8.0%	10.7%
2030	10.7%	19.1%	26.9%
	National Percent HD ZEV Sales[300]		
2025	2.0%	3.6%	5.1%
2027	3.8%	6.8%	9.2%
2030	9.2%	16.5%	23.1%

[297] Total HD Sales excluding Class 2b/3 vehicles and transit buses. Transit buses were removed to provide an estimate of Class 4–8 vehicles that would be affected if ACT targets were adopted.
[298] This presents HD ZEV sales excluding any ZEVs in with Class 2b/3 and transit buses.
[299] This presents national HD ZEV sales percentage removing long-haul tractors from the denominator as EPA did in the Proposal. This excludes Class 2b/3 from numerator and denominator and transit buses from numerator.
[300] This presents national HD ZEV sales percentage including long-haul tractors in denominator. This excludes Class 2b/3 from numerator and denominator and transit buses from numerator.

MOVES3 HD vehicle classes assumed to be covered by ACT requirements:

Vehicle Type	Class	MOVES Source ID	MOVES Regulatory Class
Class 4–8 Vocational Trucks			
Other Buses	Class 4–5	41	42
	Class 6–7	41	46
	Class 8	41	47
School Buses	Class 4–5	43	42
	Class 6–7	43	46
	Class 8	43	47
Refuse Truck	Class 6–7	51	46
	Class 8	51	47
Single Unit Short-Haul Trucks	Class 4–5	52	42
	Class 6–7	52	46
	Class 8	52	47
Single Unit Long-Haul Trucks	Class 4–5	53	42
	Class 6–7	53	46
	Class 8	53	47
Motor Home	Class 4–5	54	42
	Class 6–7	54	46
	Class 8	54	47
Tractors			
Combination Short-Haul Trucks	Class 6–7	61	46
	Class 8	61	47
	Class 8	61	49
Combination Long-Haul Trucks	Class 8	62	47
	Class 8	62	49

MOVES3 HD vehicle classes assumed to be affected by Proposal:

Vehicle Type	Class	MOVES Source ID	MOVES Regulatory Class
Class 4–8 Vocational Trucks			
Other Buses	Class 4–5	41	42
	Class 6–7	41	46
	Class 8	41	47
Transit Buses	Class 4–5	42	42
	Class 6–7	42	46
	Urban Bus (Class 8)	42	48
School Buses	Class 4–5	43	42
	Class 6–7	43	46
	Class 8	43	47
Refuse Truck	Class 6–7	51	46
	Class 8	51	47
Single Unit Short-Haul Trucks	Class 4–5	52	42
	Class 6–7	52	46
	Class 8	52	47
Single Unit Long-Haul Trucks	Class 4–5	53	42
	Class 6–7	53	46
	Class 8	53	47
Motor Home	Class 4–5	54	42
	Class 6–7	54	46
	Class 8	54	47
Non-Long Haul Tractors			
Combination Short-Haul Trucks	Class 6–7	61	46
	Class 8	61	47
	Class 8	61	49

HD Sales Projections from MOVES:

Year	National Sales from MOVES3 (Version 3.0.2)				
	Class 4–8 Vocational	Total Tractors	Day Cab Tractors	Total without Long-Haul Tractors	Total with Long-Haul Tractors
2025	451,302	145,345	54,650	505,952	596,647
2027[301]	463,544	143,115	53,812	517,355	606,659
2030	481,906	139,771	52,554	534,460	621,677

Year	California HD Sales from MOVES3 (Version 3.0.2)		
	Class 4–8 Vocational	Tractors	Total HD Vehicles
2020	45,268	15,153	60,421
2025	46,643	14,360	61,003
2027	47,907	14,140	62,047
2030	49,804	13,810	63,614

301 Interpolation between MOVES 2025 and 2030 projections.