July 5, 2023

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Attention: Docket ID No. EPA-HQ-OAR-2022-0829

Re.: Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles, 88 Fed. Reg. 29184 (May 5, 2023)

Environmental Defense Fund (EDF) respectfully submits the following comments in support of Environmental Protection Agency's (EPA) Proposed Rule, *Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles*, 88 Fed. Reg. 29184 (May 5, 2023) ("Proposal" or "Proposed Standards"). These comments highlight the importance and urgency of finalizing health protective standards for new light- and medium-duty vehicles by the end of the year that ensure deep reductions in greenhouse gas (GHG) and criteria pollution by leveraging a range of zero emitting technologies and internal combustion engine vehicle (ICEV) improvements that automakers have available, including battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), hybrid vehicles, fuel cell vehicles, and internal combustion engine and vehicle technologies. Near-term emissions reductions are vital to mitigating the effects of climate change and to protecting public health, especially the health of low-income communities and communities of color, which are disproportionately impacted by transportation air pollution.

EPA's proposal is a vital step forward toward addressing the largest source of greenhouse gas emissions and a significant source of health-harming particulate matter (PM) and smog-forming nitrogen oxide (NOx) pollution in the United States. EDF urges EPA to finalize protective light- and medium-duty standards, consistent with and building from the proposals the agency has put forward, that account for the progress already underway thanks to manufacturer and fleet investments and commitments, federal investments, and state policies like the Advanced Clean Cars II (ACC II) rule. EDF supports EPA's finalization of the most protective multipollutant standards possible that deliver pollution reductions at least at the level of the proposal and that result in about two-thirds of new light-duty vehicles and 40% of new medium-duty vehicles sold in 2032 are zero-emitting, putting us on the path to zero emissions from new vehicles in 2035. We encourage EPA to secure even greater pollution reductions by providing for a voluntary (but once chosen, enforceable) alternative leadership pathway that, for manufacturers choosing the pathway, would ensure ACC II levels of ZEV deployment nationwide. We also recommend that the agency consider strengthening the standards in the 2031-32 timeframe, which is especially vital if EPA finalizes standards that are less protective than the proposal in the early years of the program. Doing so could potentially increase cumulative benefits relative to the proposal (and, at minimum, must offset any loss in cumulative benefits).

Executive Summary

EPA's primary proposal is eminently feasible and consistent with the automakers own publicly announced product plans. In fact, EPA's proposed standards, in certain aspects, reflect a conservative assessment of zero-emitting vehicle (ZEV) deployment in the coming years. The historic investments in the Inflation Reduction Act (IRA) and Bipartisan Infrastructure Law (BIL) have rapidly accelerated an American electric vehicle manufacturing renaissance, dramatically advanced purchase price parity for passenger ZEVs, and accelerated already declining costs for vehicles at the same time. Leveraging these trends, most manufacturers have made commitments consistent with and even greater than the levels of ZEV deployment EPA projects in this rule and leading states have continued to adopt California's ACCI and ACC II rules. These factors strongly support EPA's proposed standards and, as outlined below, our comments provide additional analysis and information to support standards that deliver even greater pollution reductions.

Section I presents information and analyses related to the urgent need to reduce climate and health harming pollution from passenger vehicles along with the consumer savings and job-creating benefits of ZEVs. This includes a new analysis undertaken with WSP evaluating certain currently available ZEVs and finding that they will deliver significant consumer savings compared to comparable gasoline alternatives – including up to $18,000 over a 10-year period. The section also presents information from a recent jobs and investment analysis, likewise undertaken with WSP, documenting $120 billion in United States EV manufacturing investments and over 143,000 jobs.

Section II describes EPA's manifest legal authority to adopt standards to reduce harmful greenhouse gas and criteria pollution from light- and medium-duty vehicles and assesses how EPA's proposed standards are consistent with section 202 of the Clean Air Act (CAA) and the Agency's longstanding approach to setting vehicle emissions standards. It also describes how EPA's proposed standards are performance based and can be met using a range of ZEV technologies and conventional engine and vehicle combinations and improvements.

Section III examines a series of interlocking analyses and factors that support EPA's proposed emissions standards, including 1) extensive, independent analysis related to rapidly-declining ZEV costs, including the impacts of the IRA in further advancing ZEV cost declines and accelerating ZEV deployment; 2) manufacturers' projections of battery cost declines; 3) an assessment of market indicators, including manufacturer investments and commitments, which are broadly consistent with our analyses and reinforce the proposal; 4) a discussion of leading state actions, including the ACC II rule; and 5) a new quantitative analysis of how each of these factors, independently, will contribute to significant levels of ZEV deployment. Based on these analyses, Section III also includes recommendations for how EPA might further strengthen standards, including the importance of adjustments in stringency in the later model years (2031-2032) of EPA's program especially if EPA pursues adjustments to the phase-in of the standards in the early years of the program, for example, as contemplated in Alternative 3. We also recommend that EPA adopt a voluntary (but once chosen, enforceable) alternative leadership pathway that allows leading manufacturers to comply with EPA's standards by meeting California's ACC II standards nationwide.

Section IV presents a recent cost analysis by Roush that supports finalizing protective standards for Class 2b and 3 vehicles and market developments that further support the feasibility and lead time reflected in EPA's proposal.

Section V describes information and analysis related to ZEV charging infrastructure and grid support. We submit and summarize a new analysis from WSP that examines existing and announced charging infrastructure in the U.S. that supports passenger ZEV deployment at levels reflected in EPA's proposal. The analysis finds, since passage of the IRA, a wide range of companies have announced investments in infrastructure that are 4.5 times greater than existing charging infrastructure and will deliver over 70 percent of the infrastructure EPA projects will be needed by 2030 to meet stronger standards (and over 100 percent of EPA's projected 2030 need when considering both concrete and soft announcements). The section also looks at existing and projected electric grid support for widespread light- and medium-duty ZEV adoption.

Section VI examines supply chain issues and the availability of the critical minerals needed to support protective standards. We include a summary table of manufacturer and other company announcements and investments in securing sufficient minerals in the U.S. and free-trade-agreement countries to support rapid electrification.

Section VII urges EPA to adopt a final rule that continues to drive emissions reductions from internal combustion engines and plug-in hybrids, including adopting strong NMOG+NOx and PM2.5 standards and amending the PHEV utility factor to better reflect real world electric drive usage.

The above analyses and others are included as attachments to these comments and summarized more fully in Appendix A. We appreciate EPA's consideration of our comments and respectfully urge the agency to swiftly finalize standards to fully realize the health, environmental, and economic benefits of this rule, and to provide a stable investment signal and regulatory certainty for manufacturers.

Table of Contents

I. Strong standards will help address the climate crisis, protect public health, grow American jobs, and save consumers money.

A. Protective standards are urgently needed to safeguard public health.

The transportation sector is now the single largest source of greenhouse gas emissions in the United States, and passenger cars and trucks are the largest contributor, at 58 percent of all transportation sources and 17 percent of total U.S. greenhouse gas emissions. Passenger vehicles also emit harmful pollutants, including fine particulate matter (PM2.5) and oxides of nitrogen (NOx). These pollutants contribute to the formation of soot and smog and contribute to elevated concentrations of pollution near roadways, where millions of people live and go to school, and people of color and people with low income are disproportionately exposed to air pollution from vehicles.

Please see EDF's comments on the Proposed Rule, *Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards*, 86 Fed. Reg. 43726 (August 10, 2021) dated September 27, 2021, and resubmitted to this docket, for a more thorough discussion of the substantial health and environmental harms associated with the pollution and GHG emissions from passenger vehicles.[1]

In addition to the research presented in our previous comments, we are including additional, analyses that further demonstrate the impact of light- and medium-duty vehicle emissions on vulnerable populations and the need for and benefits of zero-emitting solutions, including for light-duty trucks.

A recent study by Calvin Arter et. al. estimated the air quality and health impacts of on-road vehicular emissions from five vehicles classes, including light-duty autos and light-duty trucks, on $PM_{2.5}$ and O_3 concentrations at a 12 × 12 kilometer scale for 12 states and Washington D.C. as well as four large metropolitan statistical areas in the Northeast and Mid-Atlantic U.S. in 2016.[2] In the region considered, the research found that light-duty trucks are responsible for the most $PM_{2.5}$-and ozone-attributable premature mortalities, with 46% of those mortalities from directly emitted primary particulate matter and 80% of those mortalities from ozone-attributable NOx emissions. This study demonstrates the importance and urgent need to address tailpipe emissions from light-duty trucks and supports EPA's proposal to include Class 2b and 3 vehicles in the rulemaking.

The American Lung Association (ALA) released its updated State of the Air report and finds that nearly 36% of Americans—119.6 million people—still live in places with failing grades for unhealthy levels of ozone or particle pollution.[3] The number of people living in counties with failing grades for daily spikes in deadly particle pollution was 63.7 million, the most ever reported under the current national standard. The report also finds again that the burden of living with unhealthy air is not shared equally. Although people of color are 41% of the overall

[1] EDF's comments on the Proposed Rule, *Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards*, 86 Fed. Reg. 43726 (August 10, 2021) dated September 27, 2021, at 4-6. Accessible at https://www.regulations.gov/comment/EPA-HQ-OAR-2021-0208-0688. (Attachment A)

[2] Calvin A Arter *et al* Mortality-based damages per ton due to the on-road mobile sector in the Northeastern and Mid-Atlantic U.S. by region, vehicle class and precursor, 2021 *Environ. Res. Lett.* 16. https://iopscience.iop.org/article/10.1088/1748-9326/abf60b (Attachment B)

[3] American Lung Association, State of the Air, Key Findings, 2023. https://www.lung.org/research/sota/key-findings (Attachment C)

population of the U.S., they are 54% of the nearly 120 million people living in counties with at least one failing grade. And in the counties with the worst air quality that get failing grades for all three pollution measures, 72% of the 18 million residents affected are people of color, compared to the 28% who are white.

ALA also recently released a new report that estimates the health and economic benefits of a transition to 100 percent zero-emission new passenger vehicle sales by 2035, coupled with non-combustion electricity generation.[4] ALA find that, by 2050, the national public health benefits in the U.S. due to cleaner air could reach $978 billion in public health benefits, 89,300 fewer premature deaths, 2.2 fewer asthma attacks and 10.7 million fewer lost work days.

These recent studies align with and reinforce the need for and the feasibility of protective emissions standards for passenger vehicles in the timeframe proposed by EPA.

B. Protective standards will help to grow American jobs.

In addition to delivering significant health and environmental benefits, protective standards that help to ensure additional ZEV deployment will also bolster the economy and grow U.S. jobs. The U.S. is currently making historic investments in electric vehicle manufacturing and domestic job creation, both of which have been catalyzed by the IRA and BIL. According to a report by Environmental Defense Fund and WSP USA, more than $120 billion in EV manufacturing investments and 143,000 new U.S. jobs have been announced in the last eight years, with more than 40 percent of those announcements happening in the last six months, since passage of the IRA (Figure 1).[5] Over $31 billion of those announced investments has been toward the manufacturing of electric passenger cars and trucks, providing over 55,000 new jobs and $65.3 billion in investment supporting over 60,000 jobs in battery manufacturing. Protective EPA standards that drive additional electrification of the transportation sector can help support and accelerate these important trends, promoting continued investment in zero-emitting vehicles, batteries and components and associated America jobs.

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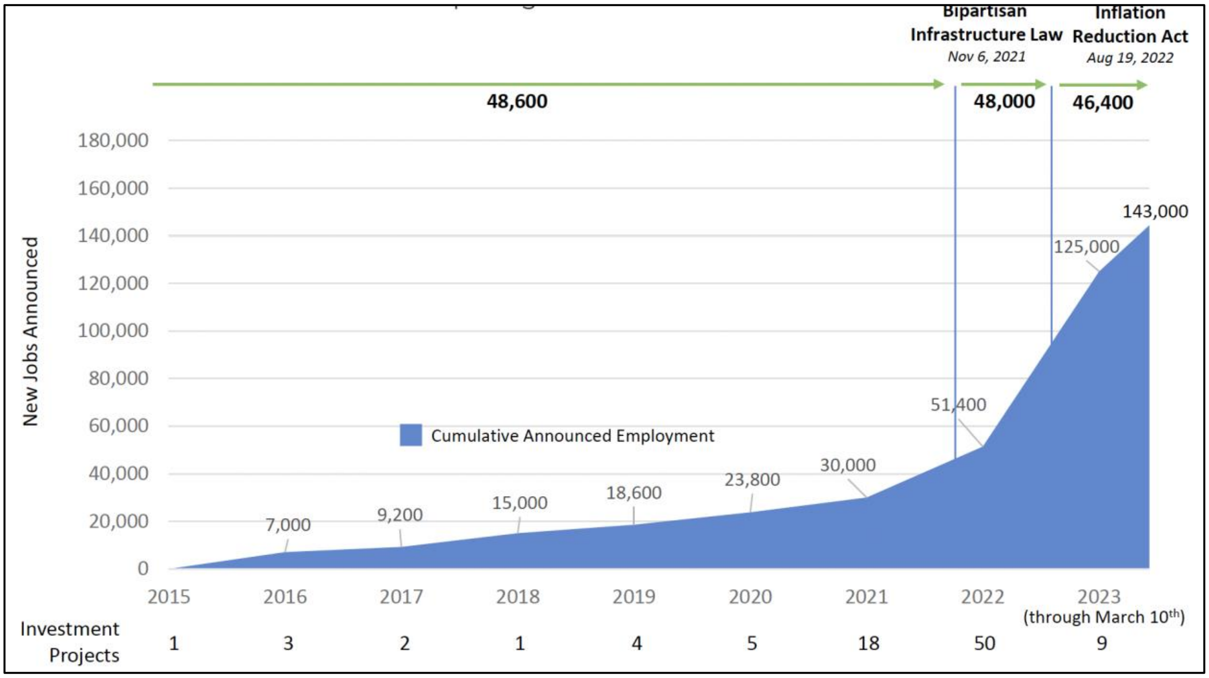
[4] American Lung Association, "Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity," June 2023. https://www.lung.org/clean-air/electric-vehicle-report/driving-to-clean-air. (Attachment D)

[5] U.S. Electric Vehicle Manufacturing Investments and Jobs, Characterizing the Impacts of the Inflation Reduction Act after 6 Months, WSP for EDF, (March 2023). https://blogs.edf.org/climate411/files/2023/03/State-Electric-Vehicle-Policy-Landscape.pdf (Attachment E)

Figure 1: New EV Job Announcements Accelerated by National Policy



Source: WSP, *U.S. Electric Vehicle Manufacturing Investments and Jobs*

In addition to these sector-wide trends, EDF also commissioned a study by M.J. Bradley & Associates in 2021 that focused on the broader economic and employment effects associated with the production of electric F-Series light trucks, including the Ford F-150 Lightning, as a case study for the broader electric vehicle manufacturing sector within the U.S.[6] The report shows that EV manufacturing in the U.S. has the potential to support significant positive job and GDP impacts. Specifically, the analysis, which was conducted prior to passage of the IRA, finds that a single direct job associated with the production of electric F-Series vehicles could support 13 to 14 jobs in the wider U.S. economy. And every 1,000 such direct electric F-Series production-related jobs would support $1 billion in direct, indirect, and induced labor income benefits and $1.6 billion in U.S. GDP. The results show that a plant supporting 3,300 jobs[7] could result in 44,000 jobs in the wider economy, providing $319 million in direct income and over $3.2 billion in direct, indirect, and induced labor income benefits.

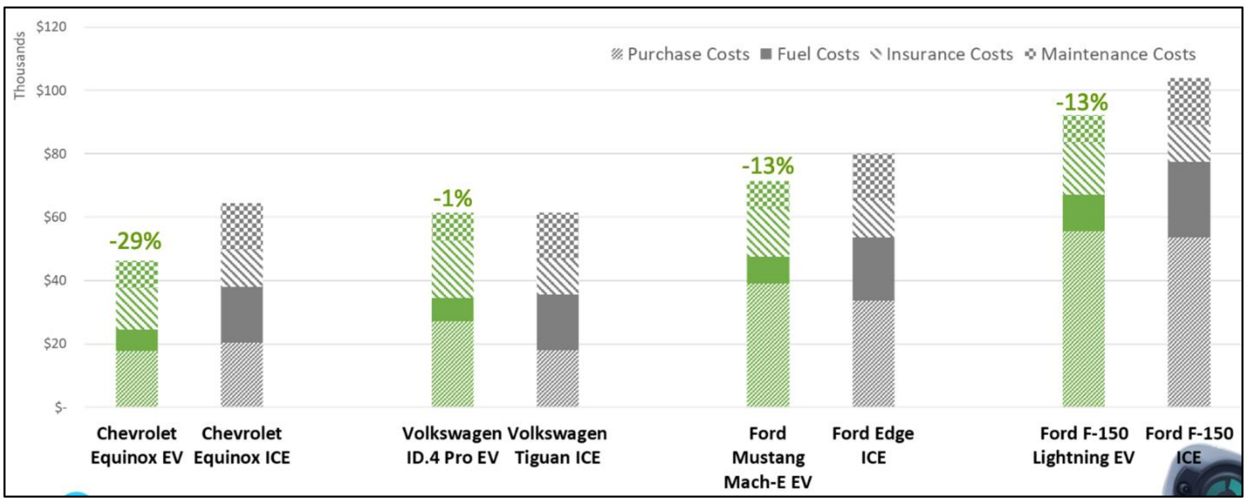
C. Consumers are already seeing savings from today's ZEVs.

Consumers will also benefit from protective standards that help ensure additional adoption of ZEVs. As discussed in section III below, the upfront costs and the lifetime costs of ZEVs are declining rapidly and are expected to continue to do so over the timeframe of this rulemaking, which will further increase the savings of owning a ZEV as compared to an ICEV. But consumers are already seeing savings today. WSP performed an analysis for EDF that compares the lifetime costs, over 10 years, of owning and operating a number of the most popular or

[6] Amlan Saha, Miranda Freeman, Jane Culkin, and Dana Lowell, U.S. Light Truck Electrification: Economic and Jobs Impact Study, M.J. Bradley & Assoc. for EDF, Nov. 2021. (Attachment F).
[7] Ford announcements suggest that its new EV plant in Tennessee would support between 3,200 and 3,300 direct jobs.

widely anticipated current EVs compared to gasoline vehicles.[8] The costs considered include purchase and financing of the vehicle and home charger (for EVs) and annual vehicle registration, maintenance, insurance, and fuel costs. The analysis accounts for federal and state EV and charger tax credits. WSP compared the Chevrolet Equinox EV to the Equinox RS, the Ford Mustang Mach-E Premium to the Ford Edge ST-Line, the Volkswagen ID.4 Pro to the Tiguan SE and the Ford F-150 Lightning XLT to the gasoline F-150 XLT. The analysis finds that higher upfront purchase price and insurance costs for EVs are outweighed by the lower maintenance and fuel costs. Over 10 years, all of the studied EVs are estimated to be less expensive to own and operate than the comparable gasoline vehicle, with total life-time savings of up to $18,440. As shown in Figure 2, the Chevy Equinox EV has the greatest savings over 10 years at 29% and the VW ID.4 has the lowest savings at 1%. The analysis also concluded that rural EV drivers would see additional lifetime savings than urban drivers. In addition to cost savings, there are other attributes of EVs that consumers value, including better performance and reduced noise.

Figure 2: Existing EV vs. ICEV – Total Costs After 10 Years



Source: WSP, *Electric Vehicle Total Cost of Ownership Analysis*

II. EPA has authority to set standards under the Clean Air Act that ensure deep reductions in harmful pollution based on the availability of ZEV technologies.

EPA has clear authority to establish performance-based emission standards under Section 202(a)(1). EPA's approach, including setting performance-based standards, considering ZEVs, and continuing the longstanding use of averaging, banking, and trading (ABT), is consistent with the text and structure of the CAA and the history of EPA regulation of vehicular emissions under CAA Section 202(a). Moreover, the recent enactment of the IRA strongly reaffirms EPA's authority under the CAA and removes any doubt that EPA's actions here are fully consistent with Congress's will.

[8] Electric Vehicle Total Cost of Ownership Analysis, Summary Report, WSP for EDF (July 2023), https://blogs.edf.org/climate411/wp-content/blogs.dir/7/files/WSP-Total-Cost-of-Ownership-Analysis-July-2023.pdf (Attachment G).

A. EPA has authority to consider ZEV technology in setting emission standards.

The language, structure, and legislative history of the CAA clearly show that Congress granted EPA authority to consider all available technologies, including ZEV technologies, in setting emission standards under Section 202(a). More recent acts of Congress have reaffirmed legislative intent that EPA consider the emissions-reducing potential of ZEVs in its rules.

Section 202(a)(1) directs EPA to set emissions standards for new "motor vehicles" -- a term defined broadly and functionally to include "any self-propelled vehicle designed for transporting persons or property on a street or highway," 42 U.S.C. 7550(2). Such standards are applicable regardless of "whether such vehicles and engines are designed as complete systems or incorporate devices to prevent or control such pollution."[9] The Act's language thus explicitly rejects limitations to internal-combustion engines or to particular kinds of technologies. It just as clearly includes technology beyond ICEVs, including ZEVs, which are plainly a "complete system[]" that can "prevent" pollution.

This reading of Section 202 is well supported by its core function and by the long history of its interpretation by EPA and the courts. In Section 202, Congress authorized EPA to "project future advances" in technology, and not be confined to pollution-control methods that were currently available.[10] Indeed, Congress expected EPA to "adjust to changing technology."[11] Based on its clear CAA authority, EPA has factored ZEV technologies (ranging from mild hybrid technologies to fully electric battery-powered vehicles) into its rules for more than two decades.[12] EPA first included ZEVs in its fleetwide averages in its 2000 "Tier 2" criteria pollutant standards.[13] The agency has continued to consider and incentivize these technologies in every one of its six greenhouse gas rules for both light- and heavy-duty vehicles.[14] Accordingly, its decision to do so again in this rule now that ZEV technologies are more widely available is eminently reasonable.

The IRA and BIL both include myriad provisions that seek to support a transition to ZEV technology through funding of credits for vehicles, components, and critical infrastructure. These laws were passed with the knowledge that EPA was already setting standards under Section

[9] 42 U.S.C. § 7521(a)(1).
[10] *NRDC v. EPA*, 655 F.2d 318, 329 (1981) (quoting Senate report from 1970 amendments stating EPA was "expected to press for the development and application of improved technology rather than be limited by that which exists today." S. Rep. No. 1196, 91st Cong., 2d Sess. 24 (1970)).
[11] S. Rep. No. 89-192, at 4 (1965).
[12] 65 Fed. Reg. 6698 (Feb. 10, 2000) ("Tier 2" criteria pollutant standards). For a detailed review of this history, *see* Brief of Amici Curiae Margo Oge and John Hannon in Support of Respondents, *Texas v. EPA*, No. 22-1031, 24-31 (D.C. Cir, Mar. 2, 2023), *Texas v. EPA*, No. 22-1031, 33 (D.C. Cir, Mar. 2, 2023), https://www.edf.org/sites/default/files/2023-03/Texas%20-%20Former%20EPA%20Managers.pdf (Attachment H).
[13] 65 Fed. Reg. 6698 (Feb. 10, 2000).
[14] 75 Fed. Reg. 25324 (May 7, 2010) (Light-duty model year 2011 and later); 76 Fed. Reg. 57106 (Sept. 15, 2011) (Heavy-duty model year 2014 and later); 77 Fed. Reg. 62624 (Oct. 15, 2012) (Light-duty model year 2017 and later); 81 Fed. Reg. 73478 (Oct. 25, 2016) (Heavy-duty model year 2021 and later); 85 Fed. Reg. 24174 (Apr. 30, 2020) (Light-duty model year 2021 and later); 86 Fed. Reg. 74434 (Dec. 30, 2021) (Light-duty model year 2023 and later); *See also* EPA's Answering Brief, *Texas v. EPA*, No. 22-1031, 15-16 (D.C. Cir, Apr. 27, 2023), https://www.edf.org/sites/default/files/2023-05/Texas%20-%20EPA%20Final%20Brief.pdf (Attachment I).

202(a) that would increase ZEV proliferation and an intent to support those regulations.[15] Congress' aim with the funding was to "combine[] new economic incentives to reduce climate pollution with bolstered regulatory drivers that will allow EPA to drive further reduction under its CAA authorities,"[16] with the expectation that "future EPA regulations will increasingly rely on and incentivize zero-emission vehicles as appropriate."[17]

Additionally, several provisions in the IRA directly affirm EPA's authority to consider ZEVs under Section 202(a). Section 60106 of the law provides $5 million for EPA "to provide grants to States to adopt and implement greenhouse gas and zero-emission standards for mobile sources pursuant to section 177 of the [CAA]."[18] Section 177 allows other states to adopt California's vehicle emission standards, which must be at least as protective as the federal standards and meet certain other statutory requirements.[19] As members of Congress explained in an amicus brief supporting EPA's MY 2023-2026 light-duty GHG standards, "Congress's explicit endorsement of states' use of Section 177 to enact 'greenhouse gas and zero-emission standards' clearly demonstrates its comfort with and support for state and federal standards that contemplate compliance through zero-emission vehicle manufacturing."[20]

The IRA also made amendments to the CAA affirming that Congress regards programs incorporating ZEV technology as an important aspect of EPA's mission to reduce air pollution under the law.[21] Those amendments include adding a definition of "zero-emission vehicle" into the newly added CAA Section 132, which consists of a program of EPA grants and rebates towards the purchase of zero-emission heavy duty vehicles.[22] In passing the IRA, Congress made clear that it "recognizes EPA's longstanding authority under CAA Section 202 to adopt standards that rely on zero emission technologies."[23]

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[15] The BIL was passed after EPA's 2023-2026 light-duty GHG standards, which rely on ZEV technology, had been proposed and the IRA was passed 9 months after they were finalized. Brief of Senator Thomas R. Carper and Representative Frank Pallone, Jr. as Amici Curiae in Support of Respondents, *Texas v. EPA*, No. 22-1031, 29 (D.C. Cir, Mar. 2, 2023), https://www.edf.org/sites/default/files/2023-03/Texas%20-%20Members%20of%20Congress%20%28Sen.%20Carper%20and%20Rep.%20Pallone%29.pdf (Attachment J).

[16] 168 Cong. Rec. E868-02 (daily ed. Aug. 12, 2022) (statement of Rep. Pallone discussing the IRA).

[17] 168 Cong. Rec. at 880-02 (daily ed. Aug. 12, 2022) (statement of Rep. Pallone); *see also* Greg Dotson and Dustin J. Maghamfar, *The Clean Air Act Amendments of 2022: Clean Air, Climate Change, and the Inflation Reduction Act,* 53 ENV'T L. REP. 10017, 10030 (2023) ("The IRA directs EPA to support zero emission technologies for heavy-duty vehicles and port equipment, to reduce emissions in low-income and disadvantaged communities, as well as to support state ZEV requirements. This is a recognition of the evolving importance and availability of zero emission technologies."), https://www.eli.org/sites/default/files/files-pdf/53.10017.pdf (Attachment K).

[18] Inflation Reduction Act of 2022, P.L. 117-1698 ,136 Stat. 2068-69 (2022).

[19] 42 U.S.C. § 7507, 7543(b).

[20] Brief of Senator Thomas R. Carper and Representative Frank Pallone, Jr. as Amici Curiae in Support of Respondents, *Texas v. EPA*, No. 22-1031, 33 (D.C. Cir, Mar. 2, 2023); *see also* Greg Dotson and Dustin J. Maghamfar, *The Clean Air Act Amendments of 2022: Clean Air, Climate Change, and the Inflation Reduction Act,* 53 ENV'T L. REP. 10017, 10030 (2023) ("[I]t is a necessary precondition [of the IRA's funding for zero-emission standards under section 177] that . . . EPA can establish zero emission standards pursuant to the CAA.").

[21] Brief of Senator Thomas R. Carper and Representative Frank Pallone, Jr. as Amici Curiae in Support of Respondents, *Texas v. EPA*, No. 22-1031, 32 (D.C. Cir, Mar. 2, 2023) ("By incorporating these new programs into the Act's existing air pollution control framework, Congress clearly demonstrated that clean energy and zero-emission vehicle programs are central to the Act's implementation going forward.").

[22] 42 U.S.C. § 7432(d)(5); *see also* Inflation Reduction Act of 2022, P.L. 117-1698, 136 Stat. 2064-65 (2022) (creating new CAA section 133 to provide grants for "zero-emission port equipment or technology.").

[23] 168 Cong. Rec. E879–02, at 880 (daily ed. Aug. 26, 2022) (statement of Rep. Pallone).

B. EPA properly decided not to reopen its longstanding use of averaging, banking, and trading.

EPA has used an ABT approach in standards for light- and heavy-duty vehicles since the 1980s, including each of its previous light-duty GHG rules upon which this proposal builds.[24] Within this decades-long history, EPA has repeatedly explained why such an approach is reasonable and consistent with the text of Section 202.[25] Based on EPA's settled and longstanding use of ABT in its Section 202 rules and ABT's well-established basis in the statute, the agency's decision not to reopen "the basic structure of the ABT program" is reasonable.[26]

C. EPA's proposal is performance-based and can be cost-effectively met with a range of different technologies.

As with EPA's decades-long reliance on the ABT provisions described above, EPA has likewise long established performance-based standards that can be met with a range of emissions-improving technologies. EPA's proposed standards are no exception – they are performance-based and can be met using a range of ZEV and ICEV improvements.

Because EPA's OMEGA 2 model is designed to show only the most cost-effective compliance pathways, it does not capture the full range of possible pathways automakers may choose to take based on the numerous factors that influence product lines. To demonstrate that the standards can be met with a range of technologies (including increased deployment of PHEVs), EDF contracted with Roush to project the relative cost of PHEVs and BEVs in the 2024-2035 timeframe.[27] EDF then used Roush's cost projections for PHEVs in conjunction with EPA's costs for BEVs and ICEVs to conduct an analysis of compliance costs under possible scenarios in which PHEV and ICEV sales represent a greater proportional share of manufacturers' sales than EPA modeled while still meeting the GHG emissions targets set in EPA's proposal.

EDF evaluated 3 alternative pathways towards compliance with EPA's proposed standards:

- Pathway 1 (ICEV Pathway): assumes the greatest possible GHG control from ICEVs using EPA's OMEGA 2 model; assumes no PHEV technologies
- Pathway 2: sets PHEV and BEV sales to roughly equivalent levels leaving ICEV emissions at the level projected in EPA's compliance simulation of its proposed standards
- Pathway 3: increases PHEV sales further than Pathway 2 by maximizing ICEV emission controls as in Pathway 1

Because Pathway 1 does not assume PHEV deployment, EDF was able to model it using EPA's OMEGA 2 model directly. EDF constrained battery availability in the model to limit BEV sales

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[24] 75 Fed. Reg. 25328 (2010) (Light-Duty Tier 1 Standards); 77 Fed. Reg. 62705-06 (2012) (Light-Duty Tier 2 Standards); 85 Fed. Reg. 24320 (2020) (Light-Duty Tier 3 Standards).

[25] *See, e.g.,* 55 Fed. Reg. 25412-13 (1990).

[26] 88 Fed. Reg. 29277.

[27] Vishnu Nair, Himanshu Saxena, Sajit Pillai, Alternative Powertrain Pathways for Light-Duty and Class 3 Vehicles for MYs 2024, 2027, and 2035 to Meet Future CO2 Emission Targets, Roush for EDF (June 2023). (Attachment L)

so that the model would apply more ICEV control technology than EPA modeled.[28] By running OMEGA 2 multiple times with various battery capacity caps, we found that limiting annual battery capacity to 954 GWh produced the lowest ICEV emissions while still enabling compliance with the proposed standards. ICEV emissions averaged 205 g/mi and represented 40% of new vehicle sales, with BEVs accounting for the remaining 60 percent. These ICEV emissions were 18% lower than in EPA's simulation, while ICEV sales were 7% higher.

Recent work performed by the ICCT is consistent with these findings and indicates that even greater levels of ICEV greenhouse gas control could offset BEV sales.[29] The ICCT projected that manufacturers could reduce MY 2022 emissions by 25-37% in the 2030-2035 timeframe.[30] This is 2-18% more than the potential reduction we found using OMEGA 2 above. This greater degree of ICEV emissions reduction would reduce the number of BEVs required to meet the proposed 2032 GHG standards to as low as 50%, significantly lower than the 60% level EDF modeled above. Moreover, neither EDF's nor ICCTs ICEV analysis separately accounts for the role of PHEVs could play.[31]

For Pathways 2 and 3, we evaluated the role PHEVs could play either in isolation (Pathway 2) or in combination with ICEVs (Pathway 3) in allowing manufacturers to meet the standards and, as a consequence, sell fewer BEVs. EPA discusses PHEV technology in its proposal and includes several aspects of PHEV technology in the OMEGA 2 input files. However, the model does not appear to allow the selection of PHEV technology as a compliance pathway. Thus, EDF used estimates of the emissions and cost of PHEVs to adjust OMEGA 2 projections outside of the model. We assumed PHEVs would have an onroad all-electric range of 50 miles, as this is the effective minimum onroad range allowable for a PHEV to qualify as a ZEV under California's Advanced Clean Cars II program. While this is the type of PHEV EDF chose to use in its modeling, vehicle manufacturers would be free under EPA regulations to choose the best mix of PHEV ranges which still met the GHG standards.

Using EPA's proposed formula for calculating a vehicle model's utility factor (UF)—the split of a PHEV's driving between gasoline and electricity—the UF for a PHEV50 is about 0.67. This means that 67% of a PHEV50's mileage is performed using electricity and 33% of its mileage uses gasoline. In terms of CO_2 emissions, a PHEV50 can be considered equivalent to two-thirds of a BEV and one-third of a strong hybrid ICEV. EDF further assumed that the GHG

[28] The ICEV pathway required both ICEV control and increased BEV sales. Since increased BEV sales are generally more cost effective than reducing ICEV emissions, the only way to force OMEGA 2 to apply more ICEV control was to limit BEV sales. This was done by reducing the total battery capacity available to manufacturers per model year, which is input to the model on line 67 of the batch file.

[29] Slowik, Peter, Aaron Isenstadt, Logan Pierce, Stephanie Searle, White Paper, "Assessment of Light-Duty Electric Vehicle Costs and Consumer Benefits in the United States in the 2022–2035 Time Frame," The International Counsel on Clean Technologies (2022), https://theicct.org/wp-content/uploads/2022/10/ev-cost-benefits-2035-oct22.pdf (Attachment M).

[30] *Id.*

[31] Some manufacturers, including Toyota, have indicated that they will rely more heavily on PHEVs for emissions reductions. Peter Johnson, *Toyota's New CEO Adjusts EV Plans but Sticks to a Hybrid Approach*, electrek (Apr. 7, 2023), https://electrek.co/2023/04/07/toyotas-new-ceo-adjusts-ev-plans-but-sticks-to-a-hybrid-approach/.

performance of a PHEV50 while operating on gasoline would be 205 g/mi, the same level as described in the ICEV control-focused run above.[32]

PHEVs cost more than BEVs due to requiring both electric and gasoline powertrains. Because the OMEGA 2 output did not project costs for complete PHEVs, we used the incremental cost difference between Roush's BEV and PHEV50 costs and applied that difference to EPA's BEV costs to derive projected PHEV costs.[33] On a sales-weighted basis, considering the difference in electrification costs across vehicle segments and the types of vehicles that OMEGA2 is projecting to become electrified, we found that the average incremental PHEV50 cost, absent IRA vehicle tax credits, was $6,700 in MY 2032 relative to a BEV.[34] Following EPA's methodology for applying the IRA vehicle tax credits, we included the credit for the additional number of BEV plus PHEV sales in each pathway, as EPA had already accounted for the tax credits available for BEVs projected in their analysis.

Table 1 shows results for EPA's proposal and EDF's three alternative pathways for fleet mix, vehicle costs and savings, and cumulative net benefits.[35]

Adjusts EV Plans but Sticks to a Hybrid Approach[32] Since PHEVs are required to meet the same criteria pollutant emission standards as ICEVs when operating on gasoline, substituting PHEVs for BEVs at equivalent fleetwide GHG levels has no impact on criteria pollutant emissions.

[33] Roush's BEV costs are lower than EPA's, so we took this approach in lieu of substituting Roush's costs for both BEVs and PHEV50s.

[34] Based on interpolation between costs in MY 2027 and MY 2035.

[35] Vehicle costs were taken from the "vehicles.csv" files produced by OMEGA 2 for the BEV (EPA) and ICEV pathway analyses. The additional cost of PHEVs includes the partial addition of the IRA tax credits, as described above. Fuel, and maintenance and repair savings per BEV and ICEV were taken from the MY_period_costs.csv file produced by the OMEGA Effects model for the proposal. Fuel savings for PHEVs and improved ICEVs were based on the relative CO2 emissions described above. Maintenance and repair savings for PHEVs compared to BEVs were based on information discussed on pages 4-35 and 4-36 of the Draft RIA. The net present value of net benefits for the EPA and ICEV pathway analyses were taken from the "social_effects_global_ghg_annual.csv" files produced by the OMEGA Effects model. Net benefits for the two PHEV pathways were based on the net benefits of the ICEV pathway, less the increased cumulative net present value of increased vehicle costs. In the case of net benefits, we used vehicle costs without IRA tax credits as tax credits as considered to be a transfer payment and excluded from net benefit calculations and the current credits end after the 2032 MY.

Table 1: Summary of Alternative Compliance Pathways

Scenario	2032 Fleet Mix			Fleetwide Average Per-Vehicle Cost in MY 2032 (with IRA credits)	Sales-Weighted Fleetwide Average Per-Vehicle Savings in 2032	Net Present Value of 2027-2055 Net Benefits ($ billion)
	% BEV	% PHEV	% ICEV			
BEV (EPA)	67%	0%	33%	$(400)	$3,620	$1,675
Pathway 1 (ICEV Pathway)	60%	0%	40%	$800	$3,720	$1,100
Pathway 2 (PHEV Pathway)	38%	42%	21%	$1,850	$3,240	$800
Pathway 3 (PHEV + ICEV Pathway)	31%	49%	21%	$2,900	$3,870	$500

As the Table shows, manufacturers choosing to comply with increased application of ICEV control technology (per OMEGA 2) (Pathway 1) could reduce the need for BEV sales by 7% in 2032. Average vehicle costs increase to $800 after IRA credits which is more than offset by vehicle savings principally in the form of less fuel usage. Likewise, cumulative net benefits still exceed one trillion dollars.

Manufacturers choosing to comply by adding PHEVs (either on their own or in combination with ICEV improvements) (Pathway 2 or 3) could further reduce BEV sales in 2032 to be anywhere from 31-38% and remain compliant with the standards. These are well below EPA's projected level of 67% in the least cost BEV-only pathway. Per vehicle costs increase to $1,850-$2,900, though still well below operation savings. Cumulative net benefits decrease significantly, but remain above zero due to the relatively high vehicle operation savings.

In summary, EDF's modeling, plus ICCT's projections of manufacturers' capability in reducing CO_2 emissions from ICEVs, provides three viable examples of compliance pathways automakers could choose to take—one reliant on ICEVs, one on PHEV controls and the third on both—all of which demonstrate the flexibility afforded manufacturers to cost-effectively reduce emissions using a mix of technologies with lesser reliance on BEV sales than is shown in EPA's modeling. Of course, these are illustrative compliance pathways, and manufacturers could choose to rely on a combination of ICEV improvements and PHEV sales in a manner that would provide yet further cost-effective options to meet EPA's standards.

III. EPA's final light-duty standards should deliver pollution reductions at least at the level of the proposal.

In this section, we outline the breadth of factors supporting the feasibility and cost-effectiveness of protective pollution standards. We recommend that EPA strengthen the standards in a manner that delivers pollution reductions at least as great as the proposal that EPA is considering. We also highlight the importance of adjustments that could secure even greater pollution reductions by including in the final rule a voluntary (but once chosen, enforceable) alternative leadership pathway that, for manufacturers choosing the pathway, would ensure ACC II levels of ZEV deployment nationwide. In addition, especially if EPA modifies the proposal's phase-in of the standards in the early years of the program as indicated in Alternative 3, we recommend that EPA consider increasing the stringency of the 2031-2032 standards to potentially increase cumulative GHG reductions relative to the proposal, and at minimum, protect the benefits achieved under the standards as proposed.

A. Feasibility, cost, and lead time support final standards at least as protective as the proposal.

In this section, we examine a series of interlocking analyses and factors that support standards at least as protective as EPA's proposed emissions standards, including 1) extensive independent analysis related to rapidly-declining ZEV costs, including the impacts of the IRA in further advancing ZEV cost declines and accelerating ZEV deployment; 2) manufacturers' projections of battery cost declines; 3) an assessment of market indicators, including manufacturer investments and commitments, which are broadly consistent with and reinforce these study findings; 4) a discussion of leading state actions, including the ACC II rule; and 5) presentation of a revised baseline analysis, which synthesizes and quantifies each of these factors. Each of these factors, both individually and when taken together, demonstrate that EPA's proposed standards are feasible and cost-effective.

i. ZEV costs are rapidly declining.

The costs of batteries and ZEVs have declined significantly over the last few years. Recent analyses project that costs will continue to decline, even when IRA investments are not considered. The decline has been dramatically accelerated by the IRA.

The IRA provides $369 billion in investments to help achieve a 40 percent nation-wide reduction of carbon emissions by 2030.[36] The IRA significantly reduces the upfront cost of ZEVs by offering consumers $7,500 in tax credits for new light-duty EVs and $4,000 for used EVs.[37] In addition, the IRA provides $3 billion to the Department of Energy's Advanced Technology Vehicle Manufacturing Loan Program for loans to manufacture clean vehicles and their

[36] White House, "Building a Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action," January 2023, Version 2. https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf
U.S. Dep't of the Treasury, *Treasury Annoucnes Guidance on Inflation Reduction Act's Strong Labor Protections*, https://home.treasury.gov/news/press-releases/jy1128#:~:text=The%20Inflation%20Reduction%20Act%20is,build%20a%20clean%20energy%20economy.
[37] *Id.*

components in the United States, $2 billion to the Department of Energy for Domestic Manufacturing Conversion Grants, which will fund manufacturers' retooling of production lines for clean vehicles, and $40 billion in loan authority supported by $3.6 billion in credit subsidy for innovative clean energy technologies, including critical minerals processing, manufacturing, and recycling, all of which will drive down the costs of batteries and EV manufacturing.[38][39] In addition, the IRA will distribute $500 million to accelerate domestic manufacturing of clean energy technologies and components,[40] $2 billion for auto manufacturing facility conversion,[41] and $3 billion in loans to build out the domestic clean vehicle manufacturing network,[42] all of which will drive down the costs of batteries and EV manufacturing. EDF and WSP found that over $120 billion in private EV supply ecosystem investments and 143,000 new jobs have been announced in the last eight years and nearly $50 billion of that, representing 42 percent of all announced EV investments, has occurred since the passage of the IRA.[43]

1. Independent analyses commissioned by EDF show rapidly declining ZEV costs.

A May 2023 study by Roush for EDF assessed and quantified, where possible,[44] the key impacts of the IRA on the cost of electrifying MY 2025 and 2030 light-duty vehicles, using costs from a previous Roush study[45] as a baseline. Both studies analyzed six subclasses of light-duty vehicles—compact cars, midsize cars, small SUVs, midsize SUVs, large SUVs, and pickup trucks—under two segments: base (non-performance) and premium (performance). With the exception of large SUVs and pickups, BEV200s were assumed to be a viable alternative to base model gasoline vehicles and BEV300s a comparable substitute for premium model gasoline vehicles. For large SUVs and pickups, the analysis assumes BEV300s as an alternative to base gasoline model, and BEV400s as a comparable substitute for premium gasoline models.

Roush's May 2023 study concluded that IRA vehicle and charger credits enable the purchase price of BEVs to be equal to or less than an equivalent gasoline vehicle in both MYs 2025 and 2030 for compact cars, midsize cars, small SUVs, and midsize SUVs, in both base and premium segments.[46] As shown in Table 2, which applies IRA vehicle tax credits, purchasers of some

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[38] *Id.*

[39] EDF, *U.S. Reaches Another Clean Transportation Milestone with New Treasury Department Guidelines for Electric Vehicle Tax Credits* (Mar. 31, 2023), https://www.edf.org/media/us-reaches-another-clean-transportation-milestone-new-treasury-department-guidelines-electric.

[40] Inflation Reduction Act of 2022, Section 30001.

[41] Department of Energy, *Domestic Manufacturing Conversion Grants*, https://www.energy.gov/mesc/domestic-manufacturing-conversion-grants.

[42] Inflation Reduction Act of 2022, Section 50142(a).

[43] U.S. Electric Vehicle Manufacturing Investments and Jobs, Characterizing the Impacts of the Inflation Reduction Act after 6 Months, WSP for EDF, (March 2023), https://blogs.edf.org/climate411/files/2023/03/State-Electric-Vehicle-Policy-Landscape.pdf

[44] Roush for EDF, Saxena, S. Pillai, "Impact of the Inflation Reduction Act of 2022 on Light-Duty Vehicle Electrification Costs for MYs 2025 and 2030" (2023) https://www.edf.org/sites/default/files/2023-05/Impact_IRA_LDV_Electrification_Costs_for_MYs_2025_and_2030_Roush.pdf (Attachment N).

[45] Himanshu Saxena, Vishnu Nair, Sajit Pillai, "Electrification Cost Evaluation of Light-Duty Vehicles for MY 2030,"(2023) Roush for EDF, https://www.edf.org/sites/default/files/2023-05/Electrification_Cost_Evaluation_of_LDVs_for_MY2030_Roush.pdf (Attachment O).

[46] Roush, Saxena, S. Pillai, "Impact of the Inflation Reduction Act of 2022 on Light-Duty Vehicle Electrification Costs for MYs 2025 and 2030" (2023) https://www.edf.org/sites/default/files/2023-05/Impact_IRA_LDV_Electrification_Costs_for_MYs_2025_and_2030_Roush.pdf

subclasses will see savings of more than $7,000 over an equivalent gasoline vehicle in 2025. With the IRA credits, large SUVs and pickup trucks will achieve purchase price parity by MY 2030. The analysis shows that these credits will help lower the purchase prices of BEVs faced by consumers.

Table 2: Upfront savings of BEV over gasoline vehicle in 2025 and 2030 purchase timeframes

Subclass	2025		2030	
	Base	Premium	Base	Premium
Small Car	$7,741	$4,441	$13,788	$12,740
Midsize Car	$7,333	$3,783	$13,586	$12,426
Small SUV	$5,535	$1,373	$12,760	$11,368
Midsize SUV	$6,301	$1,740	$13,857	$12,181
Large SUV	-$3,778	-$13,531	$9,564	$5,596
Pickup Truck	-$1,835	-$10,061	$10,443	$6,911

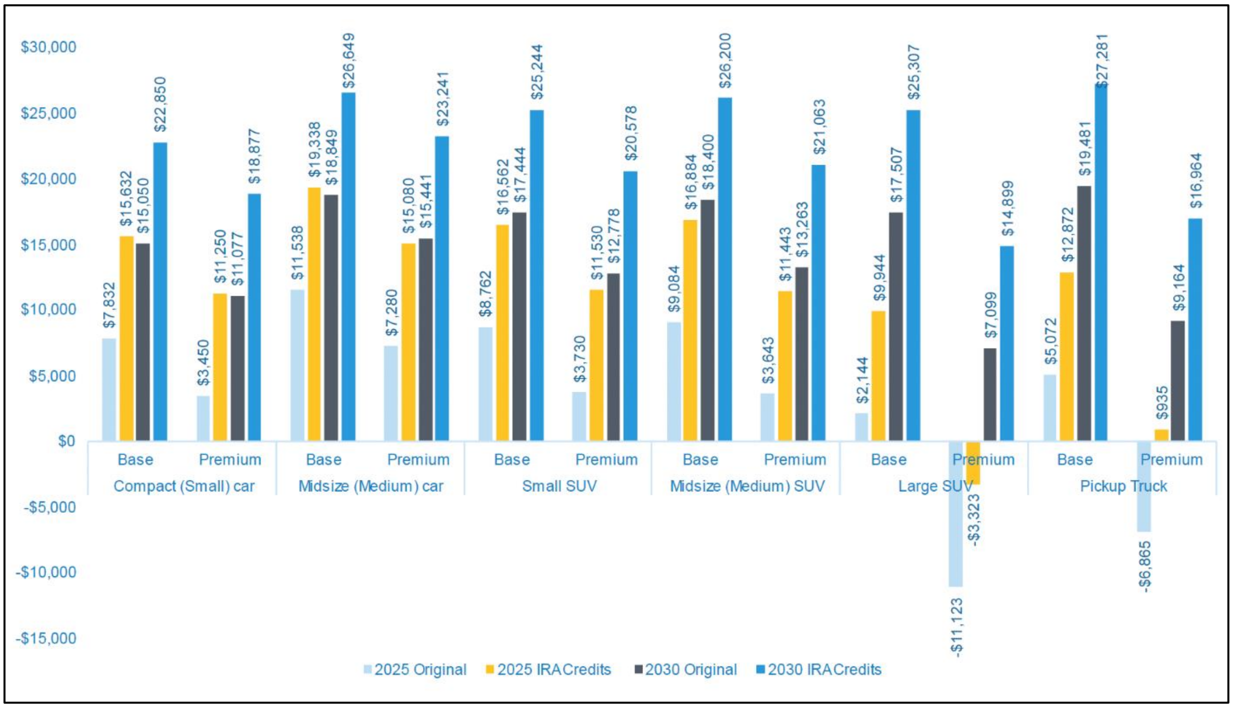
Source: Roush, *Impact of the Inflation Reduction Act of 2022 on Light-Duty Vehicle Electrification Costs for MYs 2025 and 2030*

Note: Positive numbers represent BEV upfront savings compared to combustion vehicles and negative numbers represent an upfront increase in price

The IRA credits also reduce the time to achieve total cost of ownership (TCO) parity for all classes and segments of light-duty vehicles – or the time it will take consumers to realize net cost savings. In MY 2025, TCO parity is achieved immediately for compact cars, midsize cars, small SUVs, and midsize SUVs, while TCO parity is achieved in 4 years and 2 years for base-segment large SUVs and pickup trucks, respectively. In MY 2030, TCO parity is achieved immediately for all segments and classes.

The net cumulative savings for a BEV with IRA credits compared to a gasoline vehicle is substantial across almost all subclasses and segments in the 2025 timeframe, growing even more significant by 2030 purchase timeframes (see Figure 3). In 2025, the BEV savings over an equivalent gasoline vehicle are sizeable, ranging from more than $11,000 to over $19,000 for compact cars, midsize cars, small SUVs and midsize SUVs, across both base and premium segments. Large SUVs and pickups see fewer savings in 2025, with the premium large SUV still costing more than a comparable gasoline vehicle. However, in the 2030 timeframe, the savings range from more than $14,000 to over $27,000 across all vehicle subclasses and segments, including large SUVs and pickup trucks, with base model pickups seeing the greatest savings.

Figure 3: Cumulative lifetime savings of BEVs over equivalent gasoline vehicles



Source: Roush, *Impact of the Inflation Reduction Act of 2022 on Light-Duty Vehicle Electrification Costs for MYs 2025 and 2030*

Note: The net savings are computed and indicated in the text above the columns

The IRA will also result in an estimated 30 percent reduction in charger-unit costs for all consumers. The consumer will save $300 on a $1,000 Level 2, 11.5 kW charger and the affordability and savings associated with the purchase price and charger unit price improve significantly over time.

Even without the significant impact of the IRA, BEVs still provide cost savings over the timeframe of EPA's proposal. An earlier Roush report for EDF (which only looked at 2030 purchase timeframe) found that for all BEVs up to a 300-mile range, purchase price parity with a comparable gasoline vehicle is reached by 2030, across all vehicle classes and segments.[47] And by 2030, the total cost of ownership for all BEVs up to a 400-mile range were found to be equal to or lower than their gasoline counterparts across all classes and segments. The study found that even without the IRA tax credits, BEVs purchased in 2030 could see an average cumulative net savings of about $15,000 over the lifetime of the vehicle, across all classes and segments. Moreover, as noted in Section 1, above, a new EDF study with WSP demonstrates that consumers are experiencing these savings right now when purchasing BEVs. Over 10 years of owning and operating select, current EVs to comparable gasoline vehicles, the analysis finds that

[47] Himanshu Saxena, Vishnu Nair, Sajit Pillai, "Electrification Cost Evaluation of Light-Duty Vehicles for MY 2030,"(2023) Roush for EDF, https://www.edf.org/sites/default/files/2023-05/Electrification_Cost_Evaluation_of_LDVs_for_MY2030_Roush.pdf.

current, higher upfront purchase price and insurance costs for EVs are outweighed by the lower maintenance and fuel costs, with total lifetime savings of up to $18,440.[48]

The Roush studies support EPA's proposed standards by showing that BEV costs are expected to continue to decline, achieving cost parity with gasoline vehicles over the timeframe of the rulemaking. These findings closely align with EPA's determination that BEVs represent the most cost-effective option for compliance and, in fact, demonstrate that EPA's BEV cost projections are likely conservative.

2. Roush's analyses are consistent with other recent analyses projecting substantial cost declines.

Recent expert analyses corroborate Roush's findings that BEV vehicle costs are declining rapidly and will soon be on par with comparable gasoline vehicle costs. A 2022 paper by ICCT analyzed bottom-up vehicle component-level costs to assess battery electric, plug-in hybrid electric, and conventional vehicle prices across the major classes of the U.S. light-duty vehicle market through 2035.[49] Their analysis did not consider the impact of the IRA or other federal or state tax incentives. Even without those benefits, ICCT found declining battery and assembly costs, resulting in shorter-range BEV150s and BEV200s estimated to reach price parity by 2024-2026, with mid-range BEVs seeing parity around 2026-2029 and longer-range BEVs achieving parity around 2029-2032. These findings apply to electric cars, crossovers, sport utility vehicles, and pickup trucks, which cover all light-duty vehicle sales in the United States. Table 3 summarizes the year by which BEVs reach price parity with ICEVs. ICCT's analysis is also consistent with Roush in finding that BEVs provide significant cost savings to consumers before purchase price parity is achieved. ICCT estimates that typical six-year fuel and maintenance cost savings range from $6,600 to $11,000 per vehicle purchased in 2025, with the greatest absolute savings for the pickup and SUV class.

Table 3: Summary of year by which BEV price parity is reached

Vehicle class	Range (miles)					
	BEV-150	BEV-200	BEV-250	BEV-300	BEV-350	BEV-400
Car	2024	2025	2027	2028	2029	2030
Crossover	2024	2025	2027	2028	2029	2030
SUV	2024	2025	2027	2028	2029	2030
Pickup	2025	2026	2028	2029	2031	2033

Note: Numbers in table are rounded to the nearest year.

Source: ICCT, *Assessment of Light-duty Electric Vehicle Costs and Consumer Benefits in the United States in the 2022-2035 Timeframe*

[48] Electric Vehicle Total Cost of Ownership Analysis, Summary Report, WSP for EDF (July 2023), https://blogs.edf.org/climate411/wp-content/blogs.dir/7/files/WSP-Total-Cost-of-Ownership-Analysis-July-2023.pdf (Attachment G).

[49] Peter Slowik, Aaron Isenstadt, Logan Pierce, Stephanie Searle. 2022. Assessment of Light-duty Electric Vehicle Costs and Consumer Benefits in the United States in the 2022-2035 Timeframe, ICCT. https://theicct.org/publication/ev-cost-benefits-2035-oct22/

Following their 2022 cost analysis, ICCT conducted a study assessing the future impact of the IRA on electrification rates for light-, medium-, and heavy-duty sales in the U.S. through 2035.[50] They estimate, on average over the period 2023-2032, the IRA tax credits will reduce light-duty EV purchase costs by $3,400 to $9,050. ICCT concludes that the IRA will accelerate electrification of both light-duty and heavy-duty sectors. By 2030, the study estimates a range of 48-61% EV share of light-duty vehicles in the U.S., increasing to 56-67% by 2032, which is the last year of the IRA credits.

3. Rapidly declining ZEV costs are also supported by manufacturers' projections of battery cost declines.

A key driver of BEV costs (and future cost projections) is the projected decline of battery costs. According to a report by ERM for EDF, the cost of battery packs fell dramatically from over $1,000/kilowatt-hour (kWh) in 2010 to approximately $132/kWh in 2021 and analysts and automakers project that battery pack prices will continue to fall overall, reaching $100/kWh between 2023 and 2025 and $61-72/kWh by 2030.[51] As early as 2021, companies like Renault and Ford had publicly announced targets of $80/kWh by 2030.[52] While ongoing supply chain disruptions caused battery pack prices to rise slightly in 2022, it is expected that the IRA, which provides up to $45/kWh battery cell credit and provides significant incentives for increasing EV manufacturing, will help further lower the cost of battery packs.[53] In its Q1 2023 earnings report, General Motors reported that it intends to reduce battery costs down to roughly $87 per kWh by calendar year 2025, a significant decrease from its original projection of $100 per kWh by 2025.[54]

For a 75 kWh battery pack, EPA modeled battery prices as $120/kWh through 2025 falling to $90/kWh by 2029, $75/kWh by 2035, and finally $65/kWh by 2050. EPA's choice is reasonable but conservative. EPA assumed that the per kWh price for battery packs decreases as packs get larger, consistent with modeling by ANL. In Figure 2-26 in the DRIA, EPA plots the average battery pack for vehicles modeled in OMEGA 2 by year. The average battery pack for vehicles throughout the model is roughly 100 kWh.

Plotted below in Figure 4 are EPA's battery pack costs as well as eight projections and DOE's target battery price all made within the last three and a half years. They clearly demonstrate that

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[50] Peter Slowik, Stephanie Searle, Hussein Basma, Josh Miller, Yuanrong Zhou, Felipe Rodríguez, Claire Buysse, Sara Kelly, Ray Minjares, Logan Pierce, Robbie Orvis and Sara Baldwin. 2023. Analyzing the Impact of the Inflation Reduction Act on Electric Vehicle Uptake in the United States, ICCT and Energy Innovation Policy & Technology LLC. https://theicct.org/publication/ira-impact-evs-us-jan23/ (Attachment P)

[51] Electric Vehicle Market Update: Manufacturer Commitments and Public Policy Initiatives Supporting Electric Mobility in the U.S. and Worldwide, ERM for EDF, September 2022, https://www.edf.org/sites/default/files/2023-05/Electric%20Vehicle%20Market%20Update%20April%202023.pdf. (Attachment Q).

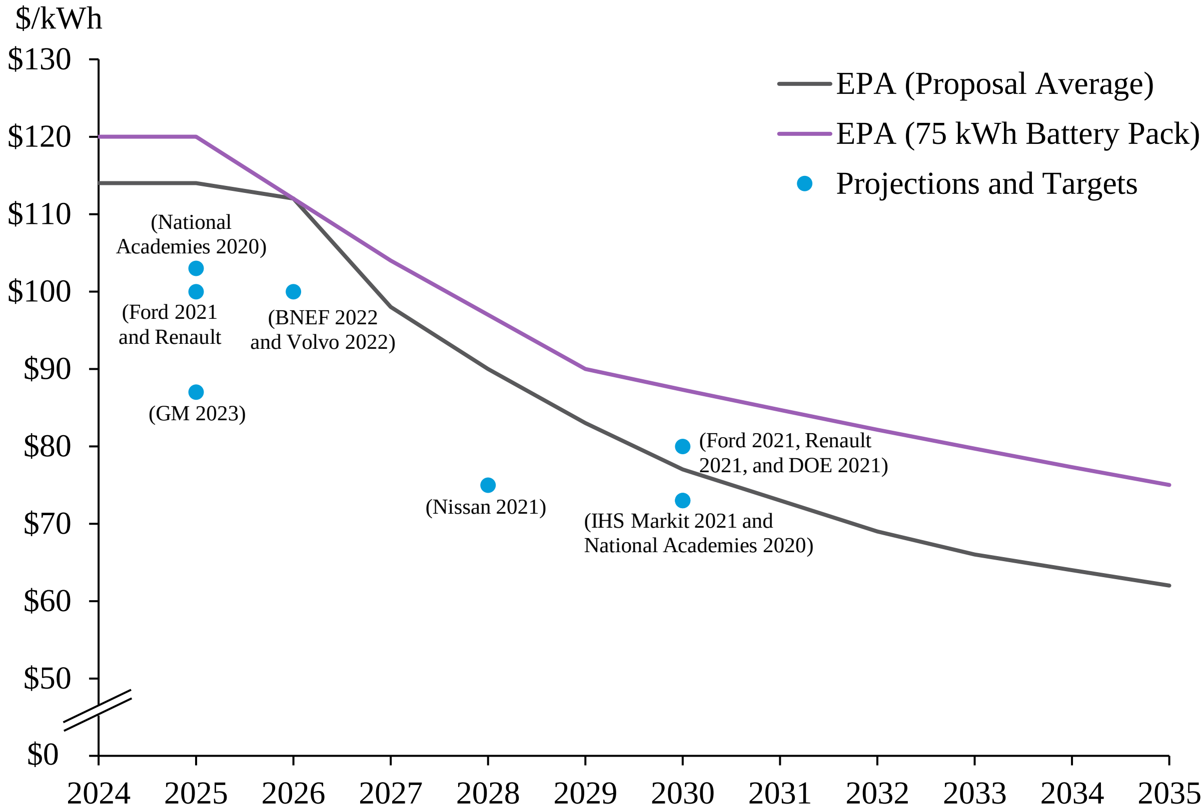
[52] BNEF, Battery Pack Prices Fall to an Average of $132/kWh, But Rising Commodity Prices Start to Bite, November 30, 2021. https://about.bnef.com/blog/battery-pack-prices-fall-to-an-average-of-132-kwh-but-rising-commodity-prices-start-to-bite/

[53] *Id.*

[54] Trey Hawkins, "GM Expects Battery Cells To Cost $87 Per kWh By 2025," GM Authority (May 5, 2023), https://gmauthority.com/blog/2023/05/gm-expects-battery-cells-to-cost-87-per-kwh-by-2025/.

EPA's battery cost estimates are reasonable, consistent with, and even conservative when compared to manufacturer and expert projections.

Figure 4: Projected Battery Price Costs[55]



Research into next generation battery chemistries also has the potential to dramatically drive down costs for BEVs. These types of step changes that occur with significant technological breakthroughs are not represented in the battery cost projections discussed above nor are they included in EPA's modeling. Novel technologies such as solid-state batteries and sodium-ion batteries are both promising avenues to reduce battery costs and increase performance. Additionally, many lithium-ion chemistries are being explored that reduce the reliance on rarer metals such as cobalt including lithium nickel manganese oxide, lithium sulfur, nickel iron aluminum oxide, and nickel manganese aluminum oxide.[56]

Improvements in the manufacturing of battery cells and packs also have the potential to substantially reduce costs. The dry battery electrode (DBE) process eliminates the need for the

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[55] https://insideevs.com/news/551144/nissan-proprietary-solid-state-batteries/ https://about.bnef.com/blog/battery-pack-prices-fall-to-an-average-of-132-kwh-but-rising-commodity-prices-start-to-bite/ ; https://news.ihsmarkit.com/prviewer/release_only/slug/2020-09-23-milestone-average-cost-of-lithium-ion-battery-cell-to-fall-below-100-per-kilowatt-hour-in-2023 https://nap.nationalacademies.org/download/26092 https://www.carexpert.com.au/car-news/volvo-ceo-price-parity-between-electric-and-combustion-vehicles-by-2025

[56] V. Nair, S. Stone, G. Rogers, and S. Pillai, "Medium and Heavy-Duty Electrification Costs for MY 2027- 2030," February 2022. Roush for EDF. (Attachment R)

wet slurry coating, drying, and solvent recapture steps in conventional battery manufacturing. These steps account for 50% of the energy consumption and 23% of the cost for cell manufacturing. Creating tables electrodes can improve yields, reduce cell costs, reduce internal resistance, reduce battery wear, and improve thermal management, all changes that could increase battery performance and drive down costs. Improvements in battery pack construction are also being investigated.

In their 2022 study Roush only considered conventional NMC and LFP batteries but stated "given the number of technologies that the industry is working on that have the potential to significantly reduce the cost and increase cell and pack energy density, it is likely that the future battery costs will be below those projected in this study [$68/kWh for an NMC battery pack in 2027]".[57]

ii. Market developments further support the feasibility and lead time reflected in EPA's proposal.

Market developments, including manufacturer plans to introduce new BEVs, concrete investments to produce these and other vehicles at volume, and future commitments for significant BEV sales are all consistent with and reinforce the conclusions of the above-described analyses and likewise support the feasibility of protective EPA standards. In fact, these market developments in many cases show manufacturers' plans to produce BEVs at even greater volumes than EPA has assumed.

Increasing BEV Availability and Sales Volumes. An updated report by ERM, based on announcements by major auto manufacturers, finds the number of electrified models available in the U.S. is projected to dramatically increase, reaching 197 by the end of 2025, with over 58 new models slated to launch in model years 2022-2025 (Figure 5).[58] As Figure 6 shows, these vehicles will be available across all vehicle types and classes, and, as a result of IRA tax incentives, there will be five light-duty EV models available with a net cost of under $30,000 manufacturer's suggested retail price (MSRP) by the end of 2023 and 15 models available for under $40,000.[59] In the United States, more than 800,000 light-duty EVs were purchased in 2022, a 65 percent increase from 2021. The first quarter of 2023 saw EV sales reach over 258,000 units, almost a 45 percent year over year increase.[60]

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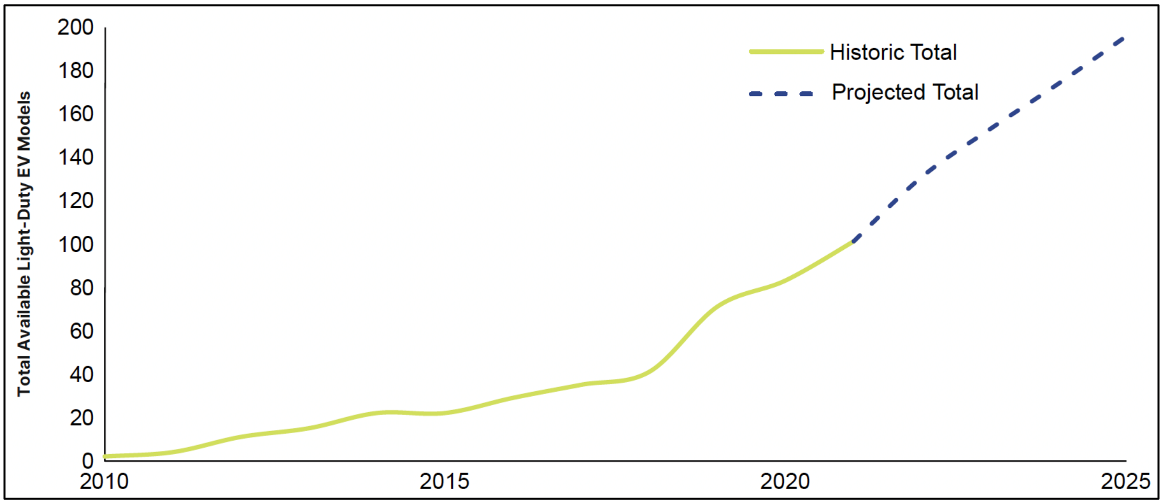
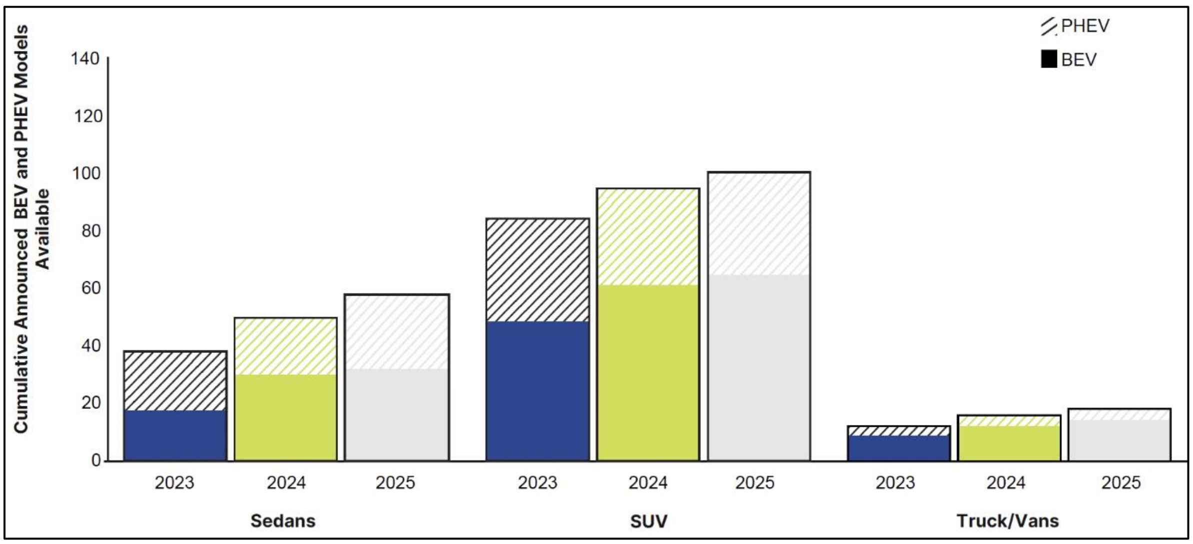
[57] V. Nair, S. Stone, G. Rogers, and S. Pillai, "Medium and Heavy-Duty Electrification Costs for MY 2027- 2030," February 2022. Roush for EDF.
[58] Electric Vehicle Market Update: Manufacturer and Commercial Fleet Electrification Commitments Supporting Electric Mobility in the United States. April 2023. ERM for EDF. https://www.edf.org/sites/default/files/2023-05/Electric%20Vehicle%20Market%20Update%20April%202023.pdf (Attachment S)
[59] *Id*.
[60] *Id*.

Figure 5: Total Light-duty PHEV and BEV U.S. Models Available by Year



Source: ERM, *EV Market Update* (April 2023)

Figure 6: Total Light-duty PHEV and BEV U.S. Models Available by Body Type

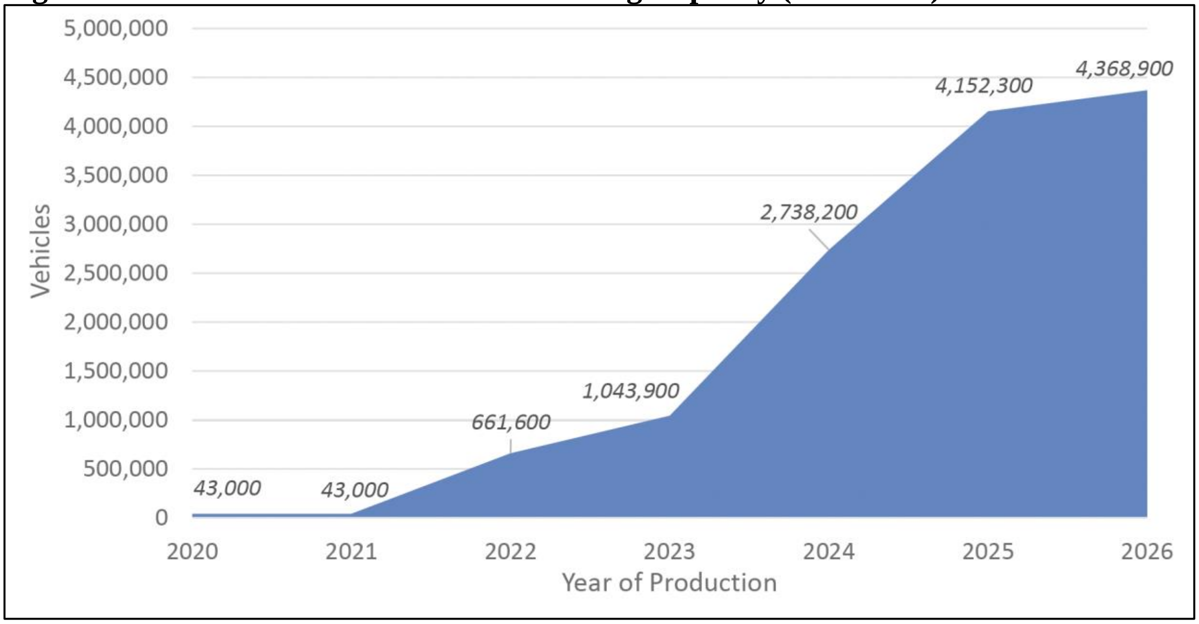


Source: ERM, *EV Market Update* (April 2023)

Near-Term Investments Dramatically Increase Production Capacity. In addition to introducing new electric vehicles, manufacturers are investing billions of dollars to produce them at volume. As noted above, a report by WSP for EDF found over $120 billion in private EV supply ecosystem investments and 143,000 new jobs announced in the last eight years. That analysis also evaluated the production capacity of announced facilities with concrete investments.

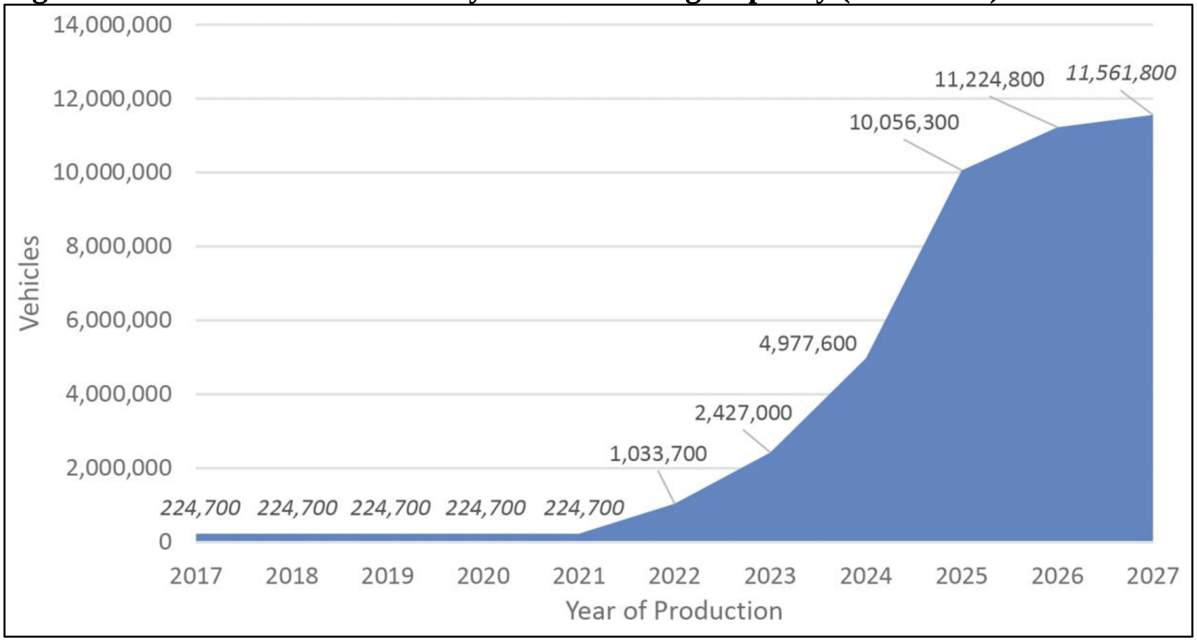
As shown in the Figures below, by 2026, U.S. manufacturing facilities will be capable of producing an estimated 4.3 million new electric passenger vehicles each year, which represents about 33 percent of all new vehicles sold in 2022. And by 2026, battery manufacturing facilities will be capable of producing more than 1,000 gigawatt hours (GWh) in battery capacity, sufficient to supply up to 11.2 million new passenger vehicles each year, which represents an estimated 84 percent of new vehicle sold in 2022. Both of these levels far exceed EPA's projections for BEV deployment.

Figure 7: Total Announced EV Manufacturing Capacity (2020-2026)



Source: WSP, *U.S. Electric Vehicle Manufacturing Investments and Jobs*

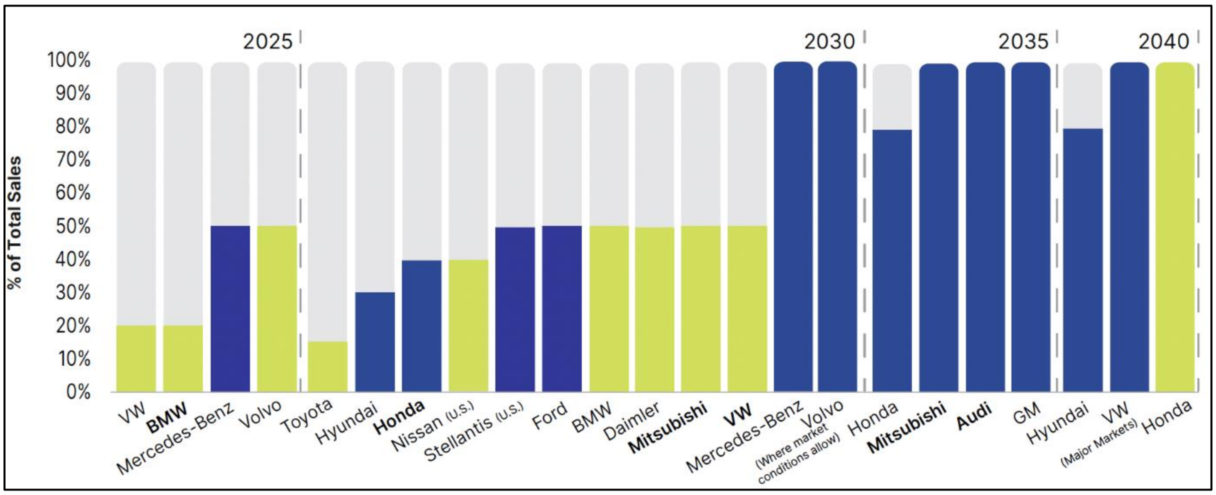
Figure 8: Total Announced Battery Manufacturing Capacity (2017-2027)



Source: WSP, *U.S. Electric Vehicle Manufacturing Investments and Jobs*

Manufacturer Commitments. In addition to near-term model availability and supporting production investments, vehicle manufacturers have articulated medium- to long-term commitments to even more substantially grow ZEV sales with many working toward a full ZEV fleet within the next decade. For instance, according to the recent market update from ERM, Ford expects 50 percent of its global vehicle volume, and 100 percent of its European volume, to be fully electric by 2030 with a goal of producing 2 million EVs annually by 2026; GM plans to offer a lineup of electric-only models by 2035; Honda has a goal of achieving carbon neutrality by 2050 and 100 percent ZEV sales in North America by 2040—with interim sales goals of 40 percent by 2030 and 80 percent by 2035; Volvo has committed to becoming a fully electric car company by 2030—with an interim goal of reaching 50 percent of global EV car sales and having one million EVs on the road by 2025; and Stellantis aims for 100 percent of sales in Europe and 50 percent of sales in the U.S. to be BEVs by the end of the decade.[61] As EPA notes in the preamble to this proposal, virtually every major automaker is already planning on widespread electrification across global fleets. Figure 9, below, is an updated synthesis of these manufacturer commitments.

Figure 9: Global Sales Goals by Manufacturers



Source: ERM, *EV Market Update* (April 2023)

Market indicators are consistent with and strongly support protective standards. Manufacturers have (and are planning to continue to) offer new vehicles. They have invested billions of dollars to produce these vehicles at near term volumes that far exceed EPA's projections. And almost every company has articulated medium- to longer term ZEV commitments that are broadly consistent with levels in EPA's proposal.

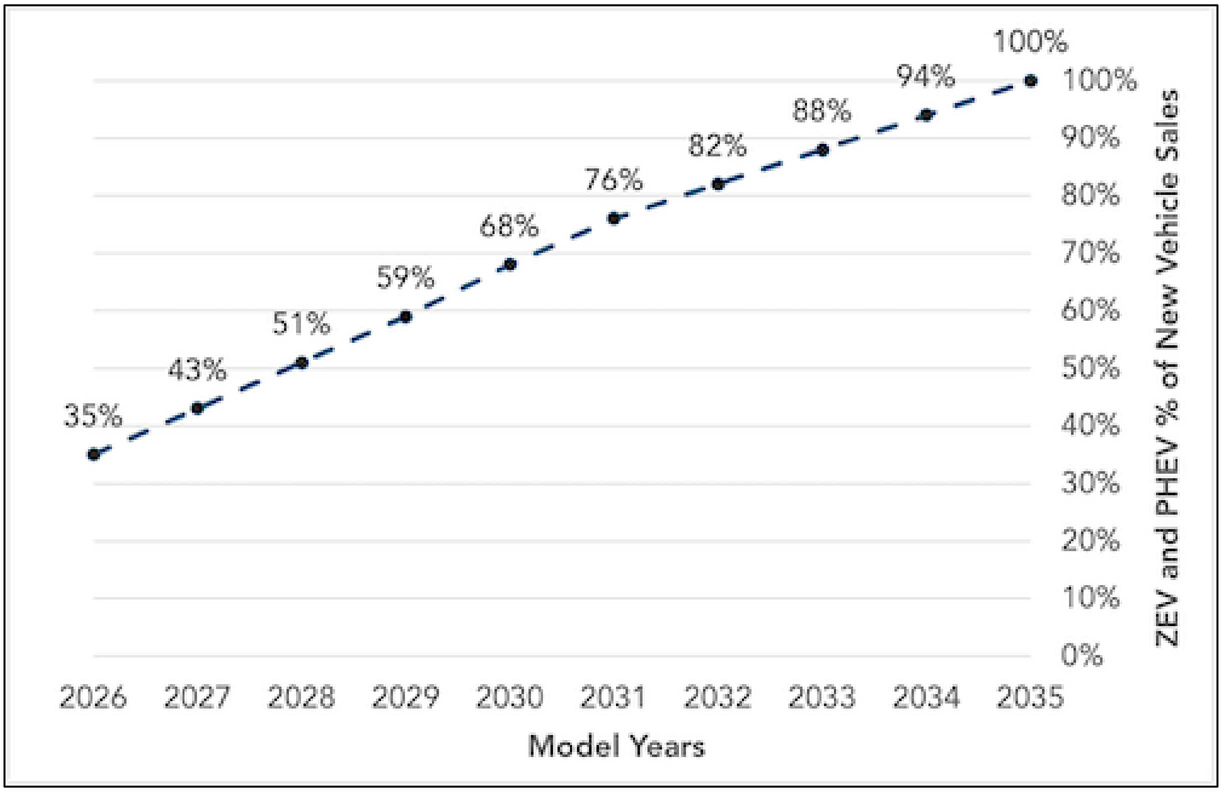
iii. State leadership further supports the feasibility of protective standards.

Along with this market dynamism, state policy leadership has played an important role in advancing ZEV deployment and strongly supports EPA's proposal. As part of California's overall approach to accelerate a large-scale transition to light-, medium- and heavy-duty ZEVs, the state adopted the ACC II rule in November 2022, which requires the sale of an increasing share of new passenger ZEVs starting with MY 2026, ensuring that all new passenger cars,

[61] *Id*.

trucks and SUVs sold in California will be zero emission by 2035.[62] The program relies on currently available advanced vehicle technologies, including battery-electric, hydrogen fuel cell electric and plug-in hybrid electric vehicles and will help meet the state's air quality and climate change goals. Figure 10 below shows ZEV and PHEV sales percentages required by ACC II.[63]

Figure 10: California ACC II ZEV and PHEV Sales



Source: California Air Resources Board, Advanced Clean Cars II Regulation

The program is expected to provide public health benefits of at least $12 billion over the life of the regulations by reducing premature deaths, hospitalizations and lost workdays associated with exposure to air pollution. Six other states – Massachusetts, New York, Oregon, Vermont,

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[62] https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii; California's ZEV regulation was first adopted in 1990 as part of LEV I standards and has undergone significant periodic modifications since that time. In January 2012, the state formally adopted the Advanced Clean Cars I program that set requirements for the deployment of electric vehicles at over 10% of new vehicle sales by 2025. Seventeen additional states have since adopted the ACCI regulations. California Air Resources Board, *States that Have Adopted California's Vehicle Standards Under Section 177 of the Federal Clean Air Act* (May 13, 2022), https://ww2.arb.ca.gov/sites/default/files/2022-05/%C2%A7177_states_05132022_NADA_sales_r2_ac.pdf.

[63] ACC II allows manufacturers to sell PHEV50s for up to 20% of the required ZEVs. . Using EPA's updated PHEV utility factors, PHEV50s equal 0.67 of a BEV. When including PHEV50s as two-thirds of a BEV in the calculation to compare EPA's proposal to ACC II, ACC II requires a higher percentage of ZEVs. E.g., in 2030, ACC II requires 68% of vehicles to be ZEVs, with PHEV50s constituting up to 20% of that 68%. Assuming 20% are PHEVs, the true ZEV share drops to 54%, lower than EPA's modeled 60%. When the PHEV50 share is included back at two-thirds, this raises ACC II ZEV share to 64%, higher than EPA's modeled 60%.

Virginia and Washington – have already adopted ACC II and a number of others are currently considering it. In February 2023, New Jersey Governor Phil Murphy announced a commitment to initiate the process to adopt ACC II.[64] And in March 2023, Maryland Governor Wes Moore announced the state would adopt ACC II.[65] In December 2022, the District of Columbia released a notice of proposed rulemaking and public hearing for the adoption of California's clean car standards.[66] Rhode Island's Department of Environmental Management held a virtual public listening session on May 18, 2023 to review the draft release of the "Rhode Island's Low-Emission and Zero-Emission Vehicle Programs" regulation, which is modeled on ACC II.[67] Colorado Governor Jared Polis' administration is also proposing a modified version of ACC II.[68]

States are also providing significant additional policy support to accelerate deployment of ZEVs, including billions of dollars in grants and incentives to produce and sell electric vehicles, batteries and components. WSP's EV investments analysis identified more than $15 billion in state and local incentives.[69] For example, California's ACC II regulations are backed by Governor Newsom's $2.4 billion dollar investment in vehicle incentives, charging infrastructure and public outreach.[70] Figure 11 shows the announced private investment and added jobs by state and indicates the contribution of state and local incentives toward that investment.

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[64] Governor Murphy Announces Comprehensive Set of Initiatives to Combat Climate Change and Power the "Next New Jersey", (February 15, 2023). https://nj.gov/governor/news/news/562023/approved/20230215b.shtml.

[65] The Office of Governor Wes Moore, *Governor Moore Announces Maryland Adoption of the Advanced Clean Cars II Rule to Combat the Effects of Climate Change* (Mar. 13, 2023), https://governor.maryland.gov/news/press/pages/Governor-Moore-Announces-Maryland-Adoption-of-the-Advanced-Clean-Cars-II-Rule-to-Combat-the-Effects-of-Climate-Change.aspx.

[66] DC Department of Energy & Environment, Notice of Comment Period for Proposed Rulemaking – Adoption of California Vehicle Emission Standards (Dec. 9, 2022), https://doee.dc.gov/release/notice-comment-period-proposed-rulemaking-adoption-california-vehicle-emission-standards.

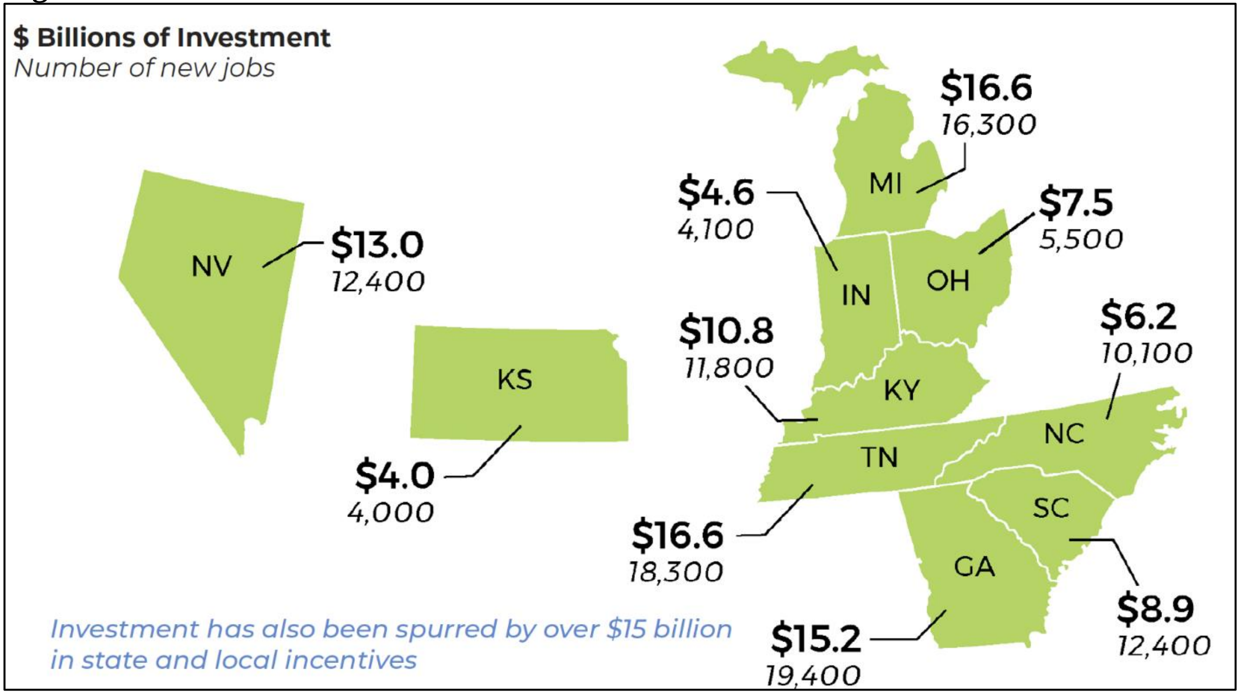
[67] State of Rhode Island Department of Environmental Management, *DEM Announces that Rulemaking Process to Implement Draft Clean Car & Truck Emissions Standards is Set to Start at May 18 Public Listening Session* (May 10, 2023), https://dem.ri.gov/press-releases/dem-announces-rulemaking-process-implement-draft-clean-car-truck-emissions-standards.

[68] CPR News, *Colorado Updated EV Plan Boosts Incentives but Avoids California-Style Ban on Gas Vehicles* (Dec. 8, 2022), https://www.cpr.org/2022/12/08/colorado-updated-evs-plan/.

[69] U.S. Electric Vehicle Manufacturing Investments and Jobs, Characterizing the Impacts of the Inflation Reduction Act after 6 Months, WSP for EDF, (March 2023). https://blogs.edf.org/climate411/files/2023/03/State-Electric-Vehicle-Policy-Landscape.pdf (Attachment E).

[70] California Air Resources Board, *Advanced Clean Cars II Regulations: All New Passenger Vehicles Sold in California to be Zero Emissions by 2035*, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii.

Figure 11: 86% of Announced EV Investment is in 10 States



Source: WSP, *U.S. Electric Vehicle Manufacturing Investments and Jobs*

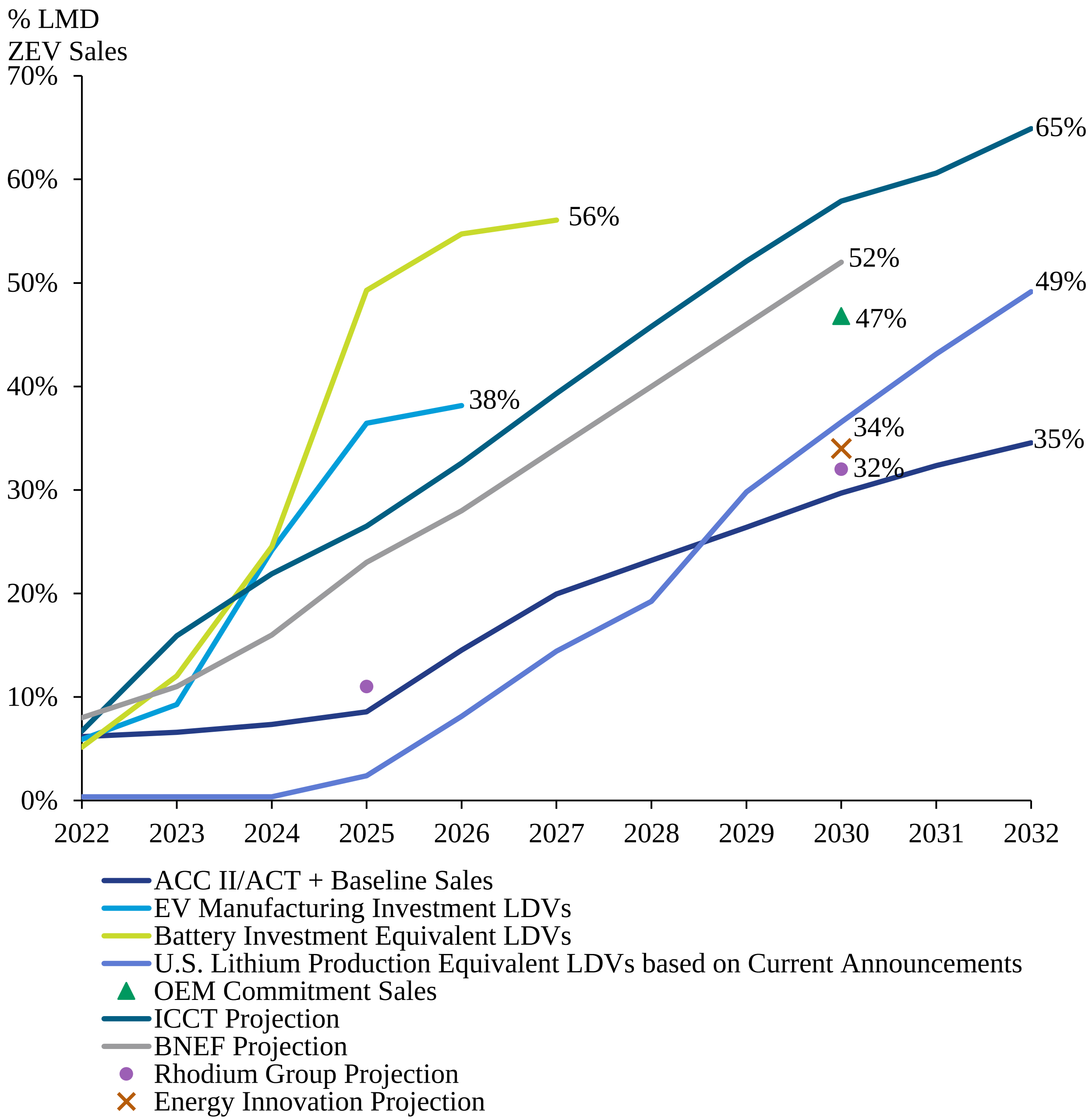
Together, these state programs and incentives further support the feasibility of strong multipollutant emissions standards that drive the deployment of ZEVs.

iv. EDF has quantified EV sales related to the impacts of state policy, manufacturer investments and commitments, and other analyses.

As described above, many independent indicators point toward significant ZEV adoption over the next decade. As Figure 12 below shows, EDF has quantified and plotted the impacts of state action, market developments (including manufacturer investments and commitments and lithium mining supply), as well as projections from a number of different independent organizations. The analysis shows many different indicators plotted together and supports EPA's No Action (baseline) case as well as the feasibility of the proposal. Under the No Action scenario, EPA's modeling projects BEV adoption at 27% in 2027 growing to 40% by 2030.

A description of the methodology and sources for each of the EV sales assessments is included below and importantly, each assessment addresses the independent impacts of each metric on EV deployment and does not evaluate the combined impacts of all taken together.

Figure 12: Indicators of Significant ZEV Adoption through 2032



Source: EDF

State Action

As discussed above, many states have taken action to promote ZEV adoption. Seven states[71] have already adopted ACC II with five additional states[72] along with the District of Columbia in the process of adopting. Additionally, many states have adopted the Advanced Clean Trucks

[71] California, Oregon, Washington, Massachusetts, New York, Vermont, and Virginia
[72] Maryland, Delaware, Colorado, Rhode Island, and New Jersey

(ACT) regulation which sets ZEV sales mandates for medium- and heavy-duty vehicles (MHDVs) including Class 2b and 3 starting with MY2024. The rule requires 5% of Class 2b and 3 sales be ZEV in MY2024 growing to 55% in 2035. Along with California, nine additional states have since adopted ACT.[73] To understand the impact of state action on baseline ZEV adoption, we assumed that the 12 states and the District of Columbia adopt ACC II and the 10 states adopted ACT.

To conservatively model sales in non-ACC II and non-ACT states, we used EIA's Annual Energy Outlook (AEO) 2023 ZEV sales projection. AEO2023 does not include ACC II adoption in their modeling and only minimally includes the impacts of the Inflation Reduction Act. The model uses the Congressional Budget Office's estimate for the Clean Vehicle Tax Credit (30D) which assumes roughly only 1 million ZEVs will receive a tax credit over the lifetime of the legislation. The model also does not include the impact of the additional relevant tax credits, such as the $45/kWh battery production tax credit. Given these factors, AEO2023's estimate of ZEV adoption remains a highly conservative estimate of ZEV adoption within the U.S. and might be considered the lowest bound of what is reasonable to expect in non-ACC II and non-ACT states. Nevertheless, an approach along these lines helps to isolate the impacts of ACC II in supporting nation-wide baseline levels of ZEV sales.

To calculate the Class 1/2a non-ACC II state ZEV sales values, we used AEO2023's LDV sales by technology type combining cars and light trucks.[74] In 2025, this projects 9% of LDV sales would be ZEVs growing to 16% in 2032. For Class 2b/3, an average of AEO2023's ZEV sales projection for light commercial vehicles (Class 2b) and light medium vehicles (Class 3) was used.[75] [76] In 2025, we assume non-ACT states have 0.24% ZEV sales rising to 0.30% ZEV sales in 2032.

ZEV sales as a result of state action along with low baseline sales in other states results in 30% ZEV sales in 2030 growing to 42% in 2035. The values are plotted above in Figure 12 with the label "ACC II/ACT + Baseline Sales." Under this scenario, Section 177 states account for 61% of the LMD ZEV sales nationwide in 2027 growing to 70% by 2035 even though they only account for 30% of vehicle sales.[77] This demonstrates that even with fairly low and unrealistic ZEV sales in non-Section 177 states, a robust nationwide adoption of ZEVs will result from current state action alone.

<u>Vehicle Manufacturer EV Commitments</u>

Many vehicle manufacturers have made commitments to transition a significant portion of their sales to ZEVs. While many of the commitments are for a share of manufacturers' global sales, several OEMs have made U.S. specific commitments or have committed to transition their entire fleet which would mean all of their U.S. sales would be ZEV as well. Even for global

[73] Oregon, Washington, Massachusetts, Vermont, New York, New Jersey, and Colorado have all adopted ACT. Maryland and Colorado have both passed legislation requiring the rulemaking to take place.
[74] U.S. Energy Information Administration, *Annual Energy Outlook 2023*, Table 38. Washington, D.C. Accessed April 4, 2023. https://www.eia.gov/outlooks/aeo/supplement/excel/suptab_38.xlsx
[75] Annual Energy Outlook 2023, Table 44 https://www.eia.gov/outlooks/aeo/supplement/excel/suptab_44.xlsx.
[76] Annual Energy Outlook 2023, Table 49 https://www.eia.gov/outlooks/aeo/supplement/excel/suptab_49.xlsx.
[77] Vehicle sales were based on MOVES3

commitments, manufacturers with significant U.S. sales volumes will nonetheless need to sell meaningful ZEVs to meet their commitments. Because some sales might exceed these global commitments while others fall short, we used global commitments as a reasonable proxy for U.S. sales share. Table 4 below shows OEM commitments and includes a total using 2022 manufacturer sales shares to calculate a weighted ZEV commitment.

Table 4: Manufacturer ZEV Commitments as Share of Total Sales

	2022 Market Share[78]	2030	2035	2040
Mercedes-Benz[79]	2%	100%	100%	100%
BMW[80]	2%	50%	50%	50%
Ford[81]	13%	50%	50%	50%
GM[82] [83]	16%	50%	100%	100%
Honda[84]	9%	40%	80%	100%
Hyundai[85] [86]	9%	30%	30%	80%
Mazda[87]	2%	33%	33%	33%
Nissan[88]	7%	40%	40%	40%
Rivian	<1%	100%	100%	100%
Stellantis[89]	12%	50%	50%	50%
Subaru[90] [91]	4%	40%	100%	100%
Tata[92]	1%	100%	100%	100%
Tesla	2%	100%	100%	100%
Toyota[93] [94]	15%	35%	50%	50%
Volvo[95] [96]	1%	100%	100%	100%
Volkswagen[97] [98]	4%	55%	55%	100%
Total	100%*	47%	63%	71%

*Due to rounding, the sum of the market share may not equal the total

All major OEMs have set ZEV targets of at least 30% sales starting in 2030. Considering both U.S.-specific and global commitments would result in 47% of new vehicles sold in the U.S. in

[78] Jerry Reynolds. Full-Year 2022 National Auto Sales by Brand. 2023. CarPro, https://www.carpro.com/blog/full-year-2022-national-auto-sales-by-brand
[79] Paul Eisenstein, *Mercedez-Benz Goes All-Electric by 2030*, Forbes (Oct. 4, 2021), https://www.forbes.com/wheels/news/mercedes-benz-all-electric-2030/.
[80] Luke Wilkinson, *Volkswagen 'New Auto' Strategy Predicts Near 100 percent EV Sales by 2040*, (July 15, 2021), https://www.carscoops.com/2023/03/bmw-expects-to-smash-50-ev-sales-goal-before-own-2030-deadline/.
[81] Mariella Moon, *Faraday Future's FF 91 Electric Vehicles Will Cost as Much as $309,000*, Engadget (June 1, 2023), https://www.engadget.com/faraday-futures-ff-91-electric-vehicles-will-cost-as-much-as-309000-053144006.html.
[82] Luke Wilkinson, *Volkswagen 'New Auto' Strategy Predicts Near 100 percent EV Sales by 2040*, (July 15, 2021), https://www.carscoops.com/2023/03/bmw-expects-to-smash-50-ev-sales-goal-before-own-2030-deadline/.
[83] David Shepardson, *GM Backs Setting Tough U.S Emissions Targets for 2030* (Sep. 20, 2022), https://www.reuters.com/business/autos-transportation/gm-backs-setting-tough-emissions-targets-2030-2022-09-20/.
[84] PR Newswire, *Honda Targets 100% EV Sales in North America by 2040, Makes New Commitments to Advances in Environmental and Safety Technology* (Apr. 23, 2021), https://www.prnewswire.com/news-releases/honda-targets-100-ev-sales-in-north-america-by-2040-makes-new-commitments-to-advances-in-environmental-and-safety-technology-301275727.html.
[85] ET Auto, *Hyundai to Raise Electric Vehicles Ration to 80% by 2040* (Sep. 7, 2021), https://auto.economictimes.indiatimes.com/news/hyundai-to-raise-electric-vehicles-ratio-to-80-by-2040/85998266.
[86] Inside EVs, *Hyundai Announces Accelerated Electrification Strategy*, https://insideevs.com/news/571125/hyundai-accelerated-electrification-strategy/.
[87] Mark Kane, *Mazda Announces Full-Scale Launch of BEVs in 2028-2030* (Nov. 22, 2022), https://insideevs.com/news/623055/mazda-full-scale-launch-bevs-2028-2030//

2030 being ZEVs. Even unrealistically assuming only the US-specific commitments and the 100% commitments apply, at least 29% of LDV sales in 2030 would be ZEVs growing to 44% in 2035 and 48% in 2040. The 2030 value is plotted above in Figure 12. We also note that the 2035 and 2040 estimates using both approaches are perhaps significantly understated given that some manufacturers with commitments in 2030 have not made 2035 or later commitments but will nonetheless likely increase ZEV sales during that timeframe.

EV Manufacturing Investment Announcements

As discussed above, in their March 2023 report, WSP analyzed investment announcements for domestic EV manufacturing. Their analysis found that announced investments amount to the production of 4.4 million EVs per year by 2026 in the U.S.[99] This equals roughly a third (31%) of all LDVs sold in the U.S. last year. Vehicle manufacturers have already committed to manufacturing these vehicles and it provides a lower bound for what might be expected as more manufacturers make EV investment announcements, and the industry continues to grow.

Over the past ten years, between 60% and 70% of the LDVs sold in the U.S. were domestically manufactured with imports accounting for the remaining 30% to 40%.[100] [101] It is reasonable to expect that not all EVs purchased in the U.S. will be domestically produced. To scale the vehicles, we have assumed that the proportion of EVs within the pool of domestically produced vehicles will be the same as those imported.

[88] Reuters, *Nissan Raises Global EV Targets; to Boost U.S. Input* (Feb. 27, 2023), https://www.reuters.com/business/autos-transportation/nissan-plans-build-second-us-battery-plant-gupta-says-2023-02-27/.
[89] Stellantis, *Accelerating the Drive to Electrification*, https://www.stellantis.com/en/technology/electrification.
[90] Reuters Staff, *Subaru Sets Mid 2030s Target to Sell Only Electric Vehicles* (Jan. 19, 2021), 1https://www.reuters.com/article/us-subaru-ev-idUSKBN1ZJ0BU.
[91] JustAuto, *Subaru to Invest $1.9 Billion in New EV Plant, Batteries,* https://www.just-auto.com/news/subaru-to-invest-us1-9bn-in-new-ev-plant-batteries.
[92] Jasper Jolly, *Jaguar Land Rover to Ramp up EV Production with £15bn Investment,* The Guardian (Apr. 19, 2023), https://www.theguardian.com/business/2023/apr/19/electric-car-jaguar-land-rover-ev-production-investment.
[93] Peter Johnson, *Toyota's New CEO Adjusts EV Plans but Sticks to a Hybrid Approach*, electrek (Apr. 7, 2023), https://electrek.co/2023/04/07/toyotas-new-ceo-adjusts-ev-plans-but-sticks-to-a-hybrid-approach/.
[94] Anjani, Trivedi, *This is Toyota's Boldest EV Rebranding Exercise Yet*, Washington Post (Jan. 30, 2023), https://www.washingtonpost.com/business/energy/this-is-toyotas-boldest-ev-rebranding-exercise-yet/2023/01/30/7d1af020-a063-11ed-8b47-9863fda8e494_story.html.
[95] Volvo, *The Future is Electric,* https://group.volvocars.com/company/innovation/electrification.
[96] Volvo, *Volvo Cars to be Fully Electric by 2030,* https://www.media.volvocars.com/global/en-gb/media/pressreleases/277409/volvo-cars-to-be-fully-electric-by-2030
[97] https://insideevs.com/news/574853/vw-group-bevs-make-up-55percent-us-sales-2030/
[98] Luke Wilkinson. *Volkswagen 'New Auto' strategy predicts near 100 per cent EV sales by 2040* (Jul. 15, 2021), https://www.autoexpress.co.uk/volkswagen/355550/volkswagen-new-auto-strategy-predicts-near-100-cent-ev-sales-mix-2040
[99] U.S. Electric Vehicle Manufacturing Investments and Jobs, Characterizing the Impacts of the Inflation Reduction Act after 6 Months, WSP for EDF, (March 2023). https://blogs.edf.org/climate411/files/2023/03/State-Electric-Vehicle-Policy-Landscape.pdf.
[100] Board of Governors of the Federal Reserve System. *Industrial Production and Capacity Utilization–G.17 Table 3*. Originally from Ward's Communications, Chrysler, and GM. 16 Nov 2022. https://www.federalreserve.gov/releases/g17/current/table3.htm.
[101] Bureau of Economic Analysis. Motor Vehicle Unit Retail Sales, Table 6. 2023, https://apps.bea.gov/national/xls/gap_hist.xlsx

If the U.S. imported 35% of its vehicles, the average of the last ten years, the EV manufacturing investments have been made already account for 48% of domestically made vehicles sold in the U.S. If the trend of more domestically produced EVs continues and only 20% of sales are imports, the U.S. produced 4.4 million EVs would result in 39% of LDV sales being EVs.

For this analysis, we chose an assumption of 80% domestically produced EVs. While this number is higher than the current share of domestic production, it is in line with the recent trend of onshoring EV manufacturing.[102] There are significant incentives and funding opportunities to make domestically producing EVs more attractive to manufacturers.

Manufacturers only make announcements for facilities a few years in advance of production. As such, this gives a glimpse into the near future but should the general trend in announcements continue, tremendous growth would be expected for domestic EV manufacturing. To that end, WSP's analysis is current only through March of 2023. Since that time, manufacturers have announced billions of dollars in additional investment and production capacity, which reinforces the likelihood that these trends will continue to grow and accelerate over time.

EV Battery Manufacturing Investment Announcements

WSP also published analysis assessing the annual capacity of lithium-ion batteries that will be produced in the U.S. based on announced investments.[103] Their analysis found 37 battery and component manufacturing and recycling announcements totaling nearly $80 billion in investment and over 1,000 GWh/year of capacity by 2027. Such a large investment into the EV battery industry demonstrates a significant shift towards EV adoption and the existing market expectation that EVs will be a dominant powertrain within the decade.

To get a sense of the scale of the battery investments, WSP calculated the number of LD EVs those batteries could support. They assumed an average LDV battery is 89 kWh, which would mean by 2027, the U.S. will be producing enough batteries to supply 84% of all domestic LDV sales if all of these batteries went exclusively to LDVs. However, it is likely there will be other demands for those batteries. The exact split between LD and HD demand for batteries will depend on how fast different vehicle classes electrify and the market demand for battery sizes. EDF used current energy consumption as a proxy for relative demand for batteries between LD and HD vehicles. According to MOVES3, in 2022, LDVs consumed 72% of the on-road energy. To calculate a more conservative value, EDF assumed that only two-thirds of batteries would go to LDVs. In this case, 56% of LDV sales could be outfitted with domestically supplied batteries that manufacturers have already invested in producing by 2027. As with manufacturing investments, additional investments have been made since WSP published its report and accordingly, these investments could only be expected to grow.

[102] David Gohlke, Zhou, Yan, Wu, Xinyi, and Courtney, Calista. 2022. "Assessment of Light-Duty Plug-in Electric Vehicles in the United States, 2010 – 2021". United States. https://doi.org/10.2172/1898424. https://www.osti.gov/servlets/purl/1898424. (Attachment Z)

[103] U.S. Electric Vehicle Manufacturing Investments and Jobs, Characterizing the Impacts of the Inflation Reduction Act after 6 Months, WSP for EDF, (March 2023). https://blogs.edf.org/climate411/files/2023/03/State-Electric-Vehicle-Policy-Landscape.pdf (Attachment E).

Lithium Mining Announcements

Announcements of domestic lithium mines have also increased recently. Using a Benchmark Mineral Intelligence (BMI) database of proposed lithium mines and production amounts by year, EDF assessed how lithium production would translate to vehicles.[104]

Forty-eight mines have been announced in the U.S. and are at some stage of development. Though only one is currently in operation, companies have claimed that many will start producing lithium in the next few years. Of the 48 mines, BMI has projections of potential production for 18 mines with 1 mine in operation, 7 "probable" mines and 11 considered "possible" mines.[105] To understand anticipated lithium production within the U.S., we used this information from BMI to develop two scenarios.

Scenario A: Only production from the 18 mines with announced anticipated production were included and they were weighted based on how far along in the development process the mine is consistent with BMI's weighting system. "Possible" mines were only weighed at 40%, "probable" mines were weighed at 50%, and mines in operation were weighed at 100%. This scenario does not include the other 30 announced mines that BMI identified. This provides a conservative estimate of U.S. lithium production. Under this scenario, domestic lithium production would supply enough material to outfit 25% of annual LDV sales with battery packs in 2035.

Scenario B: Production from the 18 mines described above was included and weighed at 100%. This assumes that all of the 18 mines will reach the projected production on the anticipated timeline but still does not include the other 30 announced mines that are at the beginning stages of production. Since only one-third of the announced lithium projects are included in this scenario, it remains a conservative estimate of domestic lithium production based on current announcements. Under this scenario, domestic lithium production would supply enough material to outfit 55% of annual LDV sales with battery packs in 2035.

EDF converted the tons of lithium production into an equivalent number of LDVs. We used BMI's projection for kg of lithium per kWh of battery for an average battery chemistry. This value falls over time as batteries are assumed to become more efficient from 0.66 to 0.56 kg LCE/kWh of battery. We assumed 89 kWh per EV to get the number of LDVs.

Since the IRA's Commercial Clean Vehicle Credit does not contain the same domestic source requirements for battery critical minerals that the Clean Vehicle Credit does, it is likely that domestically produced lithium will go to LDVs rather than HDVs at least through the end of the IRA credit in 2032. In this analysis, we assume none of the U.S. produced lithium goes to HDVs.

We plotted the results from Scenario B above as a possible representation of future U.S. lithium production from announced projects. As described more fully below, this does not fully account for all U.S. projects nor does it account for projects in countries with which the U.S. has a free trade agreement. This also does not reflect EDF's view on any particular project. Instead, based

[104] Benchmark Mineral Intelligence, Lithium Mine Projects (06.30.2023) (Excel spreadsheet), attached to comments submitted by Center for Biological Diversity, et al. Mining projects are current as of December 2022.
[105] BMI defines a "probable mine" as a project having secured a significant portion of its funding, and completed certain feasibility milestones necessary for production within the next five years. BMI defines a "possible mine" as a project in the early stages of development with only a small portion of financing secured.

on publicly available information, it provides an indication of the degree to which U.S. lithium supply may support future EV production based solely on current announcements.

EV Adoption Projections

Many organizations have made projections using a variety of models and methods to establish forward-looking estimates of ZEV sales. All of the projections included were conducted after the adoption of the Inflation Reduction Act and incorporate the sizable impact the legislation will have on cost and access to charging infrastructure. The projections are from ICCT, Rhodium Group, Energy Innovation, and Bloomberg NEF. [106,107,108,109] The first three studies included multiple scenarios. For this analysis the central scenario or one of the central scenarios was chosen as the best representation of each study. The projections for ZEV adoption by 2030 range from 32% to 58% of LDV sales.

***

All of the above demonstrates EPA's projections of baseline levels of ZEV deployment are reasonable (if not conservative) and that there are many factors that are accelerating the growth of ZEV sales apart from EPA's standards. They also show that EPA's proposed standards are reasonable and that even greater levels of reduction are possible (as we discuss below). Notably, across all of the indicators we evaluated, manufacturer investments in vehicle and battery manufacturing capacity show some of the highest levels of ZEV deployment, particularly in the near term. This finding is consistent with historical precedent showing periods of rapid technological change often occur more swiftly than models or secondary indicators are able to predict.

B. EPA should strengthen standards in a manner that delivers pollution reductions at least as great as the proposal.

The above analysis demonstrates the feasibility of standards that deliver pollution reductions at least as great as EPA's proposal. In this section we offer two suggested approaches EPA should pursue to further strengthen the standards: 1) adopting stronger standards in later model years of the program, reflecting additional ZEV deployment; and 2) finalizing a voluntary (but once chosen, enforceable) leadership pathway that incentivizes ACC II levels of ZEV deployment nationwide.

[106] Peter Slowik et al., *Analyzing the Impact of the Inflation Reduction Act on Electric Vehicle Uptake in the United States*. 2023. The International Council on Clean Transportation, https://theicct.org/publication/ira-impact-evs-us-jan23/]

[107] John Larsen et al., *A Turning Point for US Climate Progress: Assessing the Climate and Clean Energy Provisions in the Inflation Reduction Act.* 2022. Rhodium Group, https://rhg.com/research/climate-clean-energy-inflation-reduction-act/. (Attachment AA).

[108] Sara Baldwin and Robbie Orvis. *Implementing the Inflation Reduction Act: A Roadmap for Federal and State Transportation Policy.* 2022. Energy Innovation, https://energyinnovation.org/wp-content/uploads/2022/11/Implementing-the-Inflation-Reduction-Act-A-Roadmap-For-Federal-And-State-Transportation-Policy.pdf. (Attachment BB).

[109] Ira Boudway. *More Than Half of US Car Sales Will Be Electric by 2030.* 2022. Bloomberg Hyperdrive, https://www.bloomberg.com/news/articles/2022-09-20/more-than-half-of-us-car-sales-will-be-electric-by-2030.

i. Primary standards should be strengthened to reflect additional ZEV deployment in later years of the program.

The foregoing factors support protective standards. They also especially underscore the opportunities to strengthen the later model years of the program, similar to EPA's decision in its MY 2023-2026 standards to strengthen the MY 2026 standards. Even more so here, manufacturers have substantial lead-time, and most cost assessments project both upfront cost-parity (or savings) and substantial savings on a total cost of ownership basis in that timeframe. IRA credits will still apply, delivering further cost savings. Moreover, though our comments show that EPA has reasonably considered infrastructure, grid-related issues, supply and critical mineral considerations in both the near and long term, even stakeholders raising concerns about those considerations have focused most on perceived near-term constraints. And California's ACC II program will be delivering 76% ZEVs in 2031 and 82% in 2032. In summary, in the 2031-32 timeframe, there is broad consensus that ZEVs will be cheaper to purchase, own, and operate, will be produced at significant volumes relying on supply chains that have been strengthened and secured, and will be sold at percentages significantly greater than EPA's proposal in the states that have adopted ACC II standards.

In addition to being feasible, strengthening standards in later model years of the program is critical to delivering additional pollution reductions and important to ensure we are firmly on the pathway to ensuring all new vehicles sold by 2035 are zero-emitting. In this section, we have demonstrated how adjustments in stringency in these later model years will deliver significant emissions reductions. EPA should consider strengthening the later model years of the program across all of its proposed alternatives, but we underscore the vital importance of such strengthening in circumstances that would ensure any finalized alternative delivers pollution reductions at least as great as the proposal. To illustrate this, we have examined EPA's proposed Alternative 3 and examined how EPA might strengthen the later model years to ensure modified standards would deliver emission reductions at least as great as the proposal and, separately, at least as great as Alternative 1.

Table 5, below, shows the fleetwide targets for EPA's no action case, as well as the Proposal and Alternatives 1 and 3.

Table 5: Fleetwide Certification CO2 Targets Sales Under Certain EPA Options (g/mi)

Model Year	No Action	Proposal	Alternative 1 (Proposal less 10)	Alternative 3 (Linear)
2026	164.3	164.8	164.7	164.8
2027	163.6	152.5	141.7	167.6
2028	163.4	132.7	122.0	150.1
2029	164.4	112.2	102.0	132.9
2030	163.8	103.1	92.9	116.5
2031	163.6	93.6	83.4	99.5
2032	163.3	83.0	72.4	82.9

As the table demonstrates, GHG standards under the EPA Proposal and Alternative 1 are front-loaded, with the largest year over year reductions occurring between 2026 and 2029. In contrast, Alternative 3 achieves roughly the same GHG target as the Proposal in 2032, but achieves this level more gradually. In terms of "cumulative 2027-2032 MY grams per mile", Alternative 1 achieves 60 gram-years per mile more control than the Proposal, while Alternative 3 achieves 27 gram-years per mile less control than the Proposal. In other words, the slower decrease means cumulative GHG reductions from Alternative 3 are lower than the Proposal even though they reach the same standard by 2032.

As described above, we have combined the slower, but steadier levels of GHG reductions reflected in Alternative 3 with greater levels of GHG reductions in the later MYs so that the overall level of GHG reductions afforded in one scenario by the Proposal and the other, by Alternative 1, are achieved. EDF selected cumulative GHG emission reductions through CY 2055 as a reasonable metric for overall GHG reduction potential. To do this, we used a spreadsheet model that reflects the basic scrappage and annual mileage versus age distributions used in EPA's OMEGA 2 model. EDF assumed constant vehicle sales between 2027 and 2055, which is consistent with the results of EPA's OMEGA modeling. We also ignored VMT rebound, which is again reasonable given the small changes in ICEV CO2 emissions projected in EPA's OMEGA modeling.[110]

Using this model, EDF found that reducing the fleetwide GHG targets of Alternative 3 in MYs 2031 and 2032 by 2.1 and 4.2 g/mi, respectively, would match the Proposal's cumulative 2055 GHG emission reduction. Analogously, reducing the fleetwide GHG targets of Alternative 3 by 8.7 and 17.4 g/mi in MYs 2031 and 2032 would match Alternative 1's cumulative 2055 GHG emission reductions. The CO2 emission targets under these amended scenarios are shown in Table 6.

Table 6: Fleetwide Certification CO2 Targets Sales Under Certain EPA Options and Two New Scenarios (g/mi)

Model Year	Proposal	Alternative 3	Strengthened Alternative 3 Matching Proposal Performance	Alternative 1	Strengthened Alternative 3 Matching Alternative 1 Performance
2027	152.5	167.6	167.6	141.7	167.6
2028	132.7	150.1	150.1	122.0	150.1
2029	112.2	132.9	132.9	102.0	132.9
2030	103.1	116.5	116.5	92.9	116.5
2031	93.6	99.5	97.4	83.4	90.8
2032	83.0	82.9	78.7	72.4	65.5

[110] EPA assumed that BEVs would be driven the same number of miles as the ICEVs they replaced, so electrification produced no change in fleet VMT.

EDF also estimated the level of BEV sales under the two new control scenarios by assuming that ICEV emissions in 2032 continue through 2055 (roughly 250 g/mi CO2 for average ICEV). The results are shown in Table 7.

Table 7: BEV Sales Under Various EPA Options and Two New Scenarios

Model Year	Proposal	Alternative 3	Strengthened Alternative 3 Matching Proposal Performance	Alternative 1	Strengthened Alternative 3 Matching Alternative 1 Performance
2027	38%	32%	32%	38%	32%
2028	44%	37%	37%	47%	37%
2029	54%	45%	45%	55%	45%
2030	58%	53%	53%	64%	53%
2031	63%	62%	62%	68%	65%
2032	67%	68%	70%	69%	75%

The increased level of BEV sales in the last two years of Alternative 3 in order to match the performance of the Proposal are modest: less than 1% increase in MY 2031 and 3% points in MY 2032. The increases in BEV sales required to match the performance of Alternative 1 are more substantial but still reasonable: 3% points in MY 2031 and 7% points in MY 2032. Moreover, as we discuss earlier in these comments, automakers can also choose to meet standards through additional ICEV reductions and deployment of PHEVs.

EDF used the OMEGA 2 and OMEGA Effects models to project the cumulative benefits of the Proposal, Alternative 1 and the two other scenarios based on Alternative 3. The emission reductions projected for the four scenarios are summarized in Table 8.

Table 8: Cumulative Emission Reductions for Calendar Years 2027-2055 (Million metric tons for GHG, metric tons for criteria pollutants)

	Proposal	Strengthened Alternative 3 Matching Proposal Benefits	Alternative 1	Strengthened Alternative 3 Matching Alternative 1 Benefits
GHG	6,375	6,422	7,221	7,203
PM2.5	214,199	213,448	224,019	222,437
NOx	727,969	740,640	820,818	820,973
SOx	92,846	101,175	104,470	139,912

The GHG emission reductions for the two scenarios with strengthened later year standards either exceed those of the Proposal and Alternative 1 or are within 1%. The same relationship holds for emissions of fine PM and NOx. However, the SOx emission reductions for the two scenarios with strengthened later year standards are much larger than those for the Proposal and

Alternative 1, likely due to the fact that vehicle electrification is larger in the later years when the electrical grid is cleaner.

Accordingly, we encourage EPA to consider strengthening standards in later model years of the program (2031 and 2032), which can deliver important, additional emission reductions regardless of the alternative EPA finalizes. It is especially vital that the agency do so to ensure any final rule delivers emission reductions at least as great as the proposal, should EPA otherwise choose to pursue a pathway like Alternative 3 that, absent strengthening, would not deliver these benefits.

ii. EPA should finalize a Leadership Pathway to incentivize compliance with ACC II nationwide.

In response to EPA's request for comments on GHG regulatory alternatives, EDF recommends EPA finalize an alternative, "Leadership Pathway." Under the Leadership Pathway, manufacturers could choose to comply with California's ACC II ZEV sales requirements nationwide to demonstrate compliance with EPA's greenhouse gas requirements. Manufacturers would continue to comply with EPA's proposed Tier 4 air pollution standards.

The leadership pathway would be a voluntary, alternative compliance framework that manufacturers could choose, but once chosen, it would be enforceable. EPA has included similar, alternative pathways in past regulations where doing so would deliver equivalent or greater environmental benefits. Adopting a leadership pathway along these lines in these standards would allow manufacturers that anticipate exceeding the level of ZEVs reflected in EPA's proposal to comply with the same set of requirements in California and 177 states and nationwide in a consistent and streamlined fashion. As we demonstrate below, it would also deliver significant additional pollution reductions as compared to any of EPA's proposed alternatives.

Under ACC II, ZEVs must constitute a set percentage of a manufacturer's light-duty sales in MYs 2026 through 2035. The percentage of ZEV sales in MY 2032 is 82% growing to 100% by 2035. PHEVs with an EPA rated range of 50 miles count as a ZEV up to 20% of the ZEV percentage requirement (i.e., 16.4% of total sales in 2032). There are no explicit GHG standards for ICEVs starting in 2026. EPA projects that manufacturers could meet its proposed 2032 GHG standards by selling 67% BEVs by 2032, 15% less than under ACC II. While ICEV emissions are included in fleet-average GHG emissions counting towards the proposed standards, EPA's modeling indicates that little new ICEV controls are applied beyond 2026. Thus, on the surface, the ACC II ZEV standards appear to be more stringent than EPA's proposed GHG standards. In order to confirm this, EDF has conducted modeling using OMEGA 2 to compare fleet-average GHG emissions under ACC II ZEV standards and under EPA's proposed GHG standards. We analyzed a scenario in which ACC II ZEV requirements would be met through 2035, with ZEV sales constant thereafter (ACC II 2035).

EDF used OMEGA 2 to model the ZEV sales requirements by setting the minimum fraction of BEV sales within a vehicle segment (i.e., sedans, CUV/SUVs, and pickups) in the "required sales share" file to match those of ACC II. This is analogous to the approach taken by EPA when it modeled the impact of ACC II in California and ACC II adopting States. However, our analysis applied minimum ZEV sales requirements to all vehicle sales and did not create a second vehicle fleet for those sold in the ACC II states.[111]

As discussed above, ACC II allows PHEVs with a 50-mile on-road range to count as a full ZEV. EPA's proposal would set the utility factor for a PHEV50 at roughly 67%. The current OMEGA 2 model does not include the modeling of PHEVs. However, if a manufacturer chose to meet the ACC II ZEV sales requirements with the maximum 20% level of PHEV50 sales, effectively 6.7% of total ZEV operation would be powered by gasoline. For example, assuming maximum PHEV share in 2032, the 82% ZEV standard could be equivalent to 76.5% BEVs and 23.5% ICEVs.

We left the selection of which vehicles to electrify entirely up to OMEGA 2. We also left the GHG standards constant at the levels of the current MY 2025 GHG standards, as ACC II imposes no direct restrictions on ICEV emissions after 2025. As a practical matter, the control of ICEV emissions has little or no impact on fleetwide GHG emissions or vehicle electrification after 2025.

Table 9 shows BEV sales under the ACC II scenario, as well as under EPA's proposed GHG standards and EPA's Alternative 1 standards.

Table 9: ZEV Sales as a Function of Total Vehicle Sales

Model Year	EPA Proposal	EPA Alternative 1	ACC II 2035	ACC II 2035
	Simulation	Simulation	Regulation	Simulation
2026	27%	27%	35%	26%
2027	38%	38%	43%	34%
2028	44%	47%	51%	42%
2029	54%	55%	59%	50%
2030	58%	64%	68%	59%
2031	63%	68%	76%	66%
2032	67%	69%	82%	74%
2033	65%	69%	88%	77%
2034	66%	69%	94%	80%
2035	67%	70%	100%	83%

[111] EDF also increased the cap on total battery capacity usage on line 67 of the OMEGA 2 batch file. This arbitrary increase is not material to this case, as EDF is not claiming that there will be sufficient battery availability for all manufacturers to comply with ACC II nationwide. We only want to determine the relative benefits of individual manufacturers who might desire this option. They would only do so if they believed that they would have adequate access to ZEV battery capacity.

As the Table shows. projected ZEV sales under the EPA proposal and Alternative 1 are significantly less than those projected for the ACC II scenario. At the same time, while still higher than EPA's two scenarios, the projected BEV sales under the ACC II scenario using OMEGA 2 are lower than required by ACC II. The shortfall between the ACC II ZEV sales requirement and the level of ZEV sales in the OMEGA 2 simulation in 2032 is 8%. In 2035, the shortfall grows to 17%for ACC II 2035.[112]

We noticed that OMEGA 2 decreases its projections of ZEV sales in 2033 for some GHG/ZEV scenarios presumably due to the end of the IRA tax credits. This occurs to a greater degree for less stringent scenarios, like the Proposal, but to a much smaller degree for Alternative 1 and ACC II 2035. BEV sales then recover to 2032 levels by 2035 under the Proposal. Regardless of these modeling differences, actual real-world compliance with ACC II requirements would result in greater levels of ZEVs and greater environmental benefits than we have shown here. Fleetwide GHG levels under the various scenarios are shown in Table 10.

Table 10: Fleetwide GHG Certification Levels from OMEGA 2 Output (g/mi)

Model Year	EPA Proposal	EPA Alternative 1	ACC II 2035
2026	163	163	155
2027	152	151	150
2028	131	123	128
2029	110	101	110
2030	101	82	89
2031	92	74	73
2032	82	72	57
2033	85	73	49
2034	82	72	42
2035	81	72	34

The above table shows fleetwide certification (tailpipe) GHG emission levels are significantly lower under the ACC II scenario than under either EPA scenario.

We then used EPA's Effects Model to project total GHG and criteria air pollutant emission reductions from passenger cars and light-trucks through 2055. EDF used the same emission input files as EPA used in modeling its Proposal and Alternative, which assumed that new vehicles were equipped with gasoline particulate filters (i.e., emission_rates_vehicles-with_gpf.csv).

[112] EDF was unable to direct OMEGA 2 to increase BEV sales to meet the ACC II targets. As a result, the projected impacts for the ACC II scenarios are under-estimated.

The results are shown in Table 11. Reductions of both upstream and downstream emissions relative to EPA's No Action scenario are included, using EPA's upstream emissions input files.[113]

Table 11: Cumulative GHG and Criteria Pollutant Emission Reductions from Passenger Car and Light Trucks Through 2055 (GHG: million metric tons; criteria pollutant: U.S. tons)

Pollutant	EPA Proposal	EPA Alternative 1	ACC II 2035
GHG	(6,375)	(7,171)	(9,727)
PM	(214,189)	(223,417)	(252,088)
NOx	(727,829)	(811,792)	(1,079,758)
SOx	(92,859)	(106,288)	(191,797)
NMOG	(3,228,578)	(3,600,253)	(4,645,173)

ACC II 2035 is projected to achieve 53% more cumulative GHG emission reductions through 2055 than EPA's Proposal and 36% more than EPA's Alternative 1. The ACC II scenario would also achieve substantially greater criteria pollutant emission reductions than either EPA scenario.

Table 12 shows the monetized benefits projected for the three scenarios.

Table 12: Cumulative Net Monetized GHG and Criteria Pollutant Benefits from Passenger Car and Light Trucks Through 2055: Net Present Value in 2027 (billion 2021 dollars, discounted at 3% per year)

Pollutant	Criteria Pollutant Benefits	EPA Proposal	EPA Alternative 1	ACC II 2035
GHG	---	$8,543	$9,516	$11,847
Criteria	Wu	$1,321	$1,382	$1,501
Criteria	Pope	$2,642	$2,765	$3,002
Total	Wu	$9,864	$10,898	$13,348
Total	Pope	$11,185	$12,282	$14,849

The ACC II scenario would provide more GHG and criteria pollution benefits than either of the two EPA scenarios.

[113] We believe that EPA's estimates of upstream gasoline emissions are substantially under-estimated, as they fail to consider emissions from petroleum production, petroleum transportation and gasoline distribution. This issue is discussed in more detail in our heavy-duty comments.

Accordingly, EDF recommends that EPA adopt an alternative Leadership Pathway with ZEV sales consistent with ACC II through 2035 as an option for compliance with its Final Rule.[114] While the above analysis focuses on ACC II through 2035, EDF also evaluated ACC II through 2032 and likewise found it would deliver greenhouse gas and air pollutant benefits as compared to the proposal (although lesser in magnitude than ACC II through 2035). This reinforces our conclusion that a voluntary compliance alternative along these lines would deliver important additional environmental benefits and provide a pathway to align requirements with those that California and many other states either have, or likely will, adopt.

IV. EPA should finalize medium-duty standards that deliver needed pollution reductions from Class 2b and 3 vehicles.

EPA reasonably included Class 2b and 3 vehicles, referred to in the proposal as medium-duty vehicles (MDVs), in the same rule as the light-duty vehicles. The medium-duty large vans and pick-up trucks included in this proposal are more similar to LDVs in their use patterns and configurations than HDVs. Indeed, many 2b trucks are simply larger versions of 2a trucks with engines and transmissions that are nearly identical in configuration. Like LDVs, Class 2b and 3 vehicles are chassis certified rather than engine certified. Including MDVs in this proposal also aligns the treatment of these vehicles with previous criteria pollutant standards where chassis certified vehicles are considered separately from engine certified vehicles.

A. Feasibility, cost, and lead time support final Class 2b and 3 standards at least as protective as the proposal.

i. Costs for Class 2b and 3 ZEVs are rapidly declining.

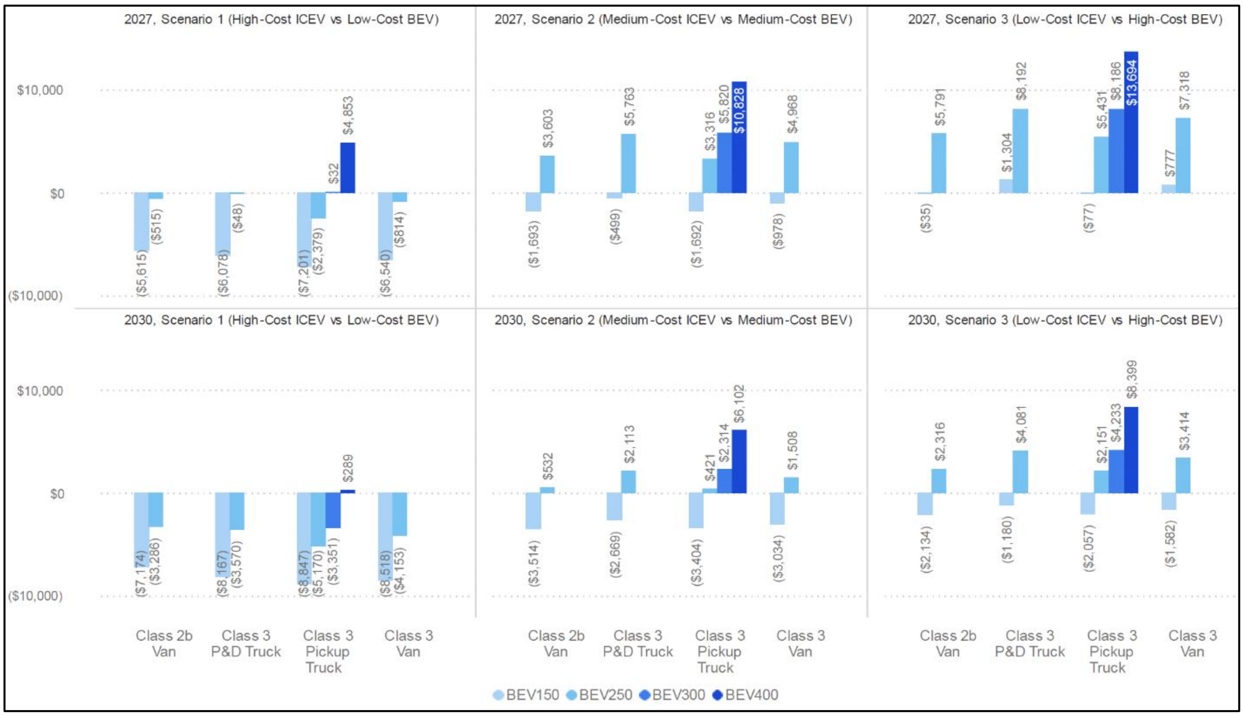
Like light-duty passenger vehicles, the costs of zero-emitting medium-duty passenger vehicles (Class 2b and Class 3) are rapidly declining. A recent study by Roush analyzed the upfront cost and TCO of MY 2027 and MY 2030 Class 2b and 3 BEVs compared to their ICEV counterparts.[115] The study also looked at the effect of IRA credits on BEV and charger purchase price and TCO in the 2023 and 2027 timeframes. Roush assumed three different scenarios that reflect increasing levels of cost: 1) the cost of electrification when migrating from a high-cost ICEV to a low-cost BEV (lowest incremental cost); 2) the cost of electrification when migrating from a medium-cost ICEV to a medium-cost BEV; and 3) the cost of electrification when migrating from a low-cost ICEV to a high-cost BEV (highest incremental cost). Gasoline price projections from the EIA's high oil price sensitivity case are used in Scenario 1, reference case gasoline prices are used in Scenario 2, and gasoline prices from the low oil price case are used in Scenario 3.

Figure 13 illustrates the incremental cost of electrifying Class 2b–3 vehicles under Scenarios 1, 2, and 3, without considering the impacts of the IRA. In Scenario 1 (the lowest incremental cost

[114] EDF also modeled a leadership pathway with ACC II ZEV consistent sales through only 2032. While EDF recommends having the leadership pathway extend through 2035, if EPA limited it to only 2032, it would still provide benefits in excess of any of EPA's current proposals. See Appendix B for more details.
[115] H. Saxena, V. Nair, and S. Pillai, "Electrification Cost Evaluation of Class 2b and Class 3 Vehicles in 2027–2030," May 2023. Roush. (Attachment T)

of electrification), the powertrain cost of all BEVs analyzed is less than the equivalent ICEV in the 2027–2030 timeframe, except in the case of the Class 3 pickup BEV300 (only MY 2027) and BEV400. And in all scenarios (except for Class 3 pickup and delivery (P&D) trucks and Class 3 vans in Scenario 3 in 2027), the powertrain cost of a BEV150 is less than the equivalent ICEV. However, in Scenarios 2 and 3, BEVs with a 250-mile or greater range in all Class 2b–3 vehicle types have more expensive powertrains than a comparable ICEV in MY 2027 and MY 2030. In the case of the Class 3 pickup truck, introducing a longer-range BEV (300 and 400 miles) necessitates a heavier, costlier battery pack, motor and power electronics, resulting in a more expensive electric vehicle. However, these costs are based on NMC811 battery technology, and several technologies that are currently being developed to support higher efficiency and lower production costs are expected to be available in the future.

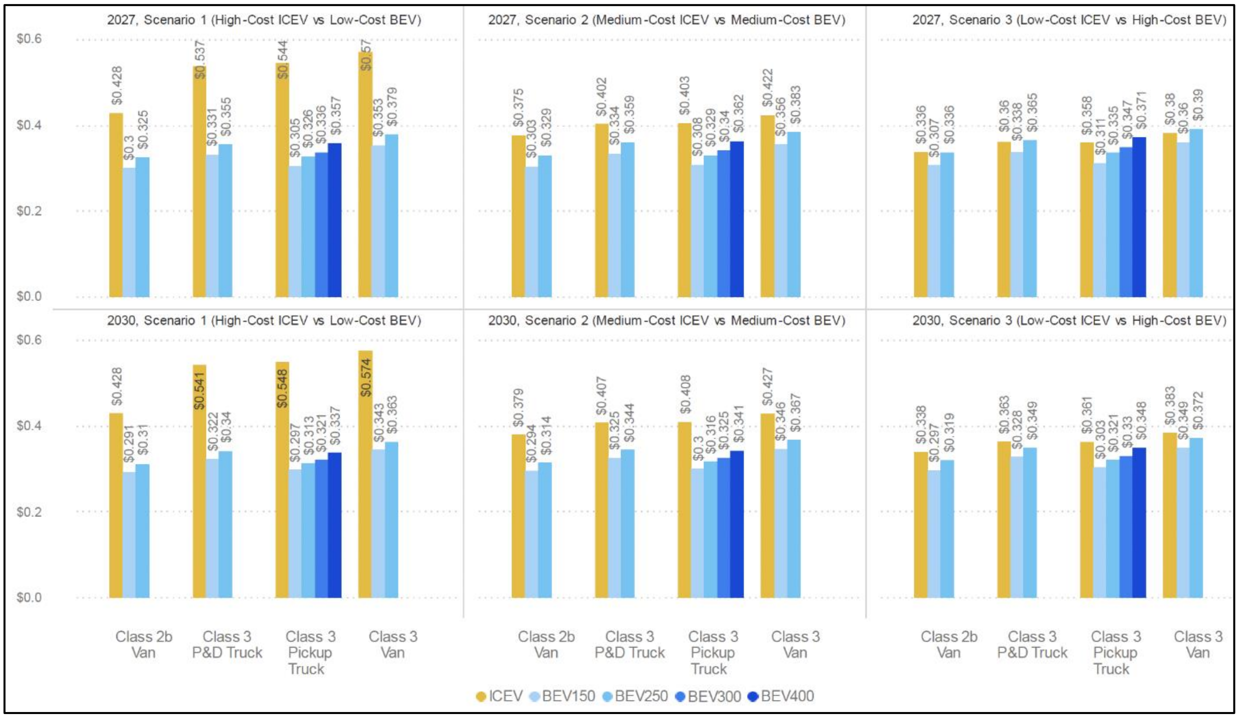
Figure 13: Projected incremental cost of BEV over ICE powertrain in 2027 and 2030 for Class 2b and 3



Source: Roush, *Electrification Cost Evaluation of Class 2b and Class 3 Vehicles in 2027-2030*

While the upfront cost of some medium-duty BEVs is higher than the ICEV counterpart, this study concludes that over the life of ownership of all Class 2b–3 vehicles, BEVs are almost universally less expensive to own and operate than comparable ICEVs, as shown in Figure 14. Across the vehicle types and three cost scenarios considered by Roush, the TCO of BEVs averages $0.334 per mile (ranging from $0.291 per mile to $0.39 per mile) while the TCO of ICEVs averages $0.428 per mile (ranging from $0.336 per mile to $0.574 per mile).

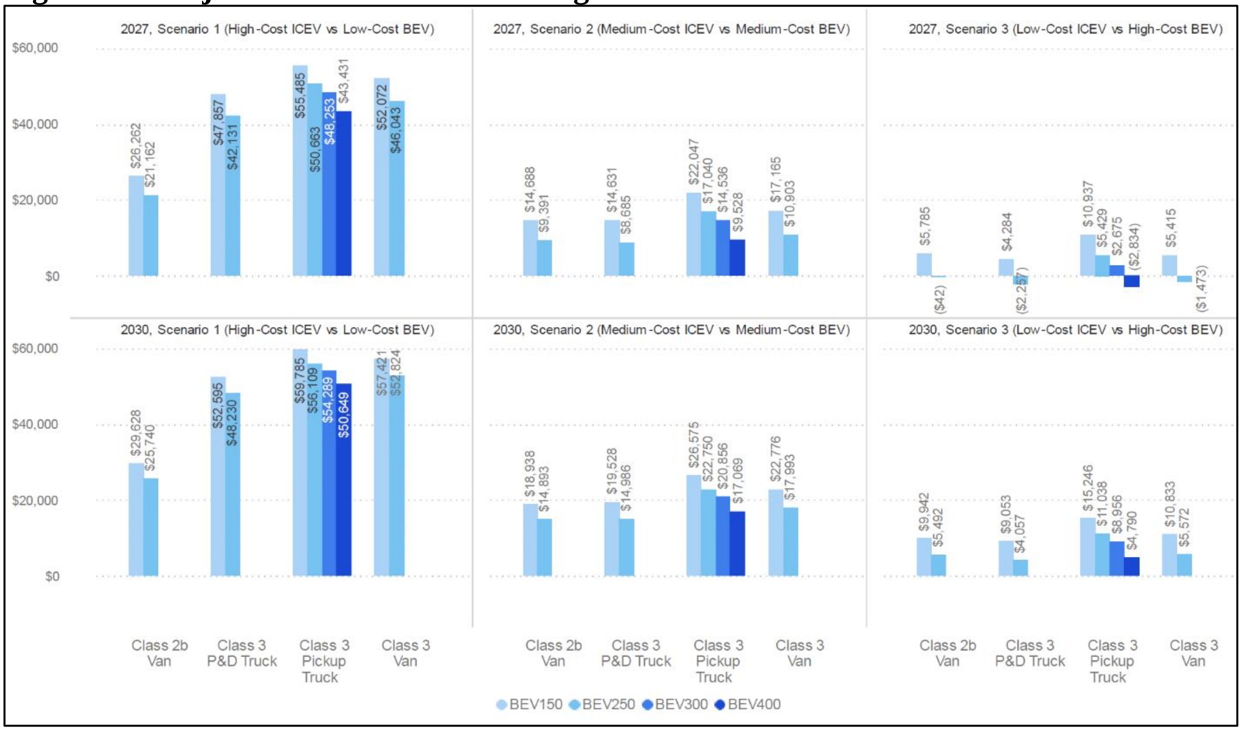
Figure 14: Projected range of total TCO per mile for Class 2b and 3 BEVs and ICEVs in 2027 and 2030



Source: Roush, *Electrification Cost Evaluation of Class 2b and Class 3 Vehicles in 2027-2030*

As shown in Figure 15 below, BEVs produce significant cumulative net savings compared to ICEVs over their assumed lifetime of 12 years. Scenario 1 has the highest savings and Scenario 3 has the lowest savings. With the exception of certain vehicle types in Scenario 3 in 2027, all BEVs across the three scenarios produce considerable savings compared to ICEV ownership. On average, this study shows that consumers and fleets who switch to BEVs can save about $20,000 for a MY 2027 purchase and $25,000 for a MY 2030 purchase over the lifetime of the vehicle.

Figure 15: Projected cumulative net savings of BEVs over ICEVs over their lifetime



Source: Roush, *Electrification Cost Evaluation of Class 2b and Class 3 Vehicles in 2027-2030*

Roush's study also evaluated the time it would take for BEVs purchased in MY 2027 and MY 2030 to achieve TCO parity with equivalent ICEVs. Table 13 below shows that under Scenario 1, all vehicles purchased in 2027 and 2030 achieve TCO parity within the first year of ownership, except the BEV400 pickup, which achieves parity after the first year. Under Scenarios 2 and 3, longer range BEVs take additional time to reach TCO parity.

Table 13: Time (in years) for BEVs to achieve TCO parity with comparable ICEVs purchased in 2027 and 2030

Vehicle Type	BEV Segment	2027			2030		
		Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
Class 2b Van	BEV150	<1	<1	2	<1	<1	<1
	BEV250	<1	4	End of Life	<1	1	4
Class 3 Pickup	BEV150	<1	<1	1	<1	<1	<1
	BEV250	<1	2	6	<1	<1	2
	BEV300	<1	4	9	<1	1	4
	BEV400	1	6	End of Life	<1	3	7
Class 3 P&D	BEV150	<1	<1	4	<1	<1	<1
	BEV250	<1	4	End of Life	<1	2	5
Class 3 Van	BEV150	<1	<1	4	<1	<1	<1
	BEV250	<1	5	End of Life	<1	2	6

Source: Roush, *Electrification Cost Evaluation of Class 2b and Class 3 Vehicles in 2027-2030*

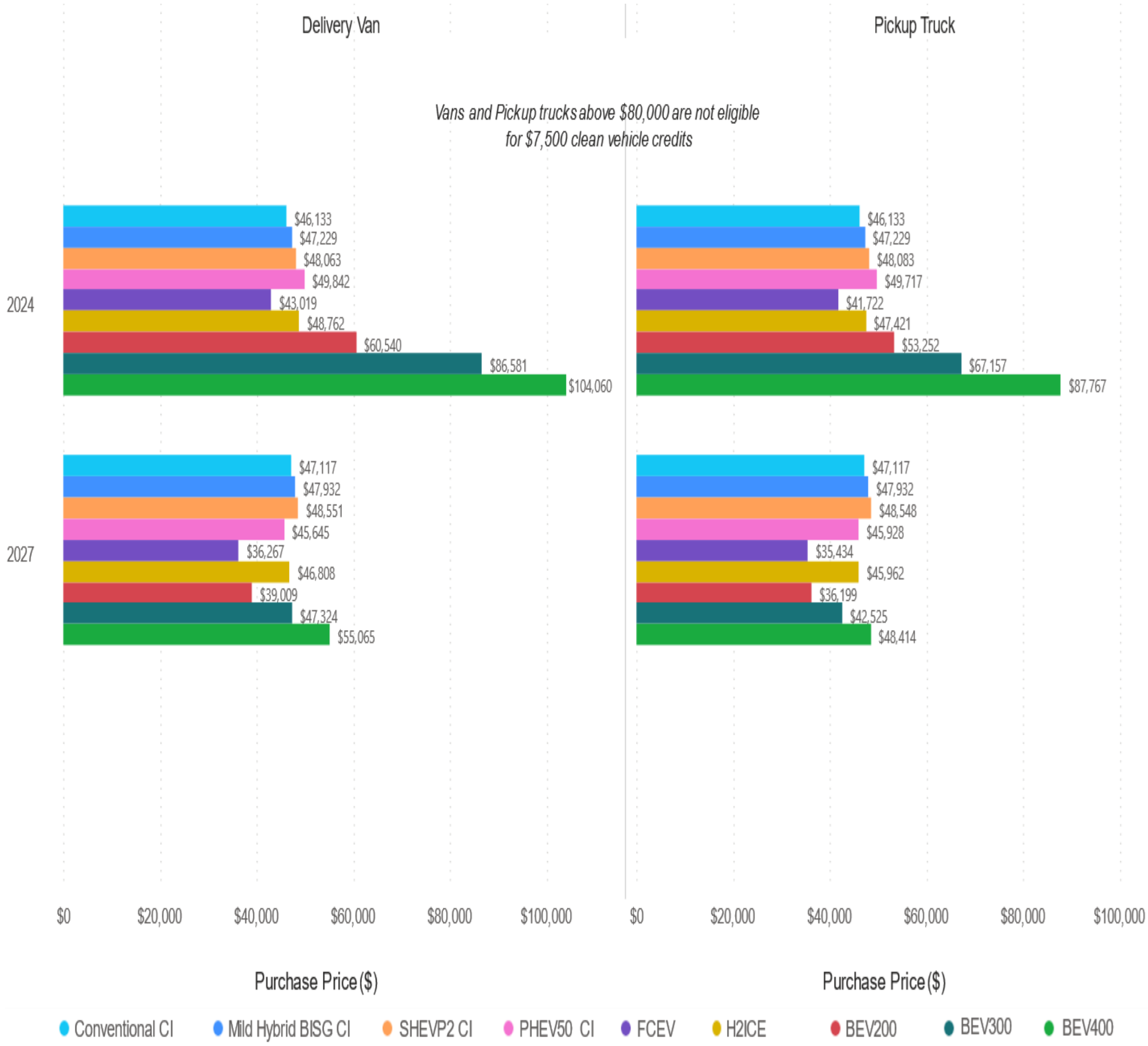
To estimate the sensitivity of the TCO of ICEVs to recent high fuel prices, a sensitivity analysis was performed using summer 2022 fuel prices. With ongoing geopolitical crises and volatility in the oil and gas sector, per the EIA, the price of retail gasoline reached an all-time high in 2022. Such high fuel prices have a direct impact on ICEV's operating expenses and TCO. Using 2022 peak fuel prices, even the class 3 BEV400 pickup achieved TCO parity within 1-2 years of ownership. These results make a compelling case, especially from a consumer and fleet savings standpoint, to electrify the class 2b–3 segment.

Roush's study also examined the potential impacts of the IRA on Class 2b–3 BEV costs in the near term (MY 2023) and the long term (MY 2027). They assumed economies of scale and sufficient raw material supply to meet demands in the production of MY 2023 BEVs. The study found that the incentives made available by the IRA will have a profound positive impact on the cost of MYs 2023 and 2027 Class 2b–3 BEVs, helping to offset higher purchase prices of BEVs. The results of this IRA impact analysis show acceleration of purchase price and TCO parity across all vehicle types purchased in 2023 and 2027 under Scenario 1. In 2027, purchase parity and TCO parity accelerate across all vehicle types and all scenarios. All BEVs achieve parity within the first year of ownership upon purchase, except for the Class 3 pickup truck BEV400, which achieves parity within 2 years of purchase. With clean vehicle credits (§30D) and charger credits, BEVs' cumulative net TCO savings in MYs 2023 and 2027 average about $5,000 and $27,000, respectively. And with qualified commercial clean vehicles (§45W) and charger credits, BEVs' cumulative net TCO savings in MYs 2023 and 2027 average about $6,000 and $23,000, respectively. Roush concludes that the purchase credit (§30D) and advanced manufacturing production credit (§45X) can provide OEMs with a financial buffer against potential market disruptions while also enabling them to produce BEVs at a competitive cost. On average, battery pack costs could reach as high as $218/kWh, almost 187% more than the estimated pack cost of $76/kWh, and still allow for purchase price parity within the first year of BEV ownership in MY 2027. Expected advancements in battery technology will further reduce battery costs and drive down the TCO of BEVs even below the estimates developed in the analysis.

Roush conducted a second study for EDF which expanded this analysis to PHEVs.[116] As described in Figure 16 (Figure 6 from the Roush report), Roush projects that PHEV50s in the Class 2b-3 segment will be very cost competitive with BEVs. Therefore, we encourage EPA to include PHEV technology pathways in its analysis of GHG emission control from Class 2b-3 vehicles in the final rule.

[116] H. Saxena, V. Nair, and S. Pillai, "Technical Review of: Alternative Powertrain Pathways for Light-Duty and Class 3 Vehicles to Meet Future CO2 Emission Targets," 13 March 2023. Roush for EDF.

Figure 16: Impact of the Clean Vehicle Credits on Class 3 vehicles in MYs 2024 and 2027



ii. Market developments further support the feasibility and lead time reflected in EPA's proposal for Class 2b and 3 vehicles.

Automakers have already begun producing electric versions of Class 2b and 3 cargo vans, step vans, box trucks, large SUVs and pickup trucks. According to ERM, there are currently 13 automakers – including Ford, GM, Daimler, Lightning, Rivian and VW – with plans to produce or already producing 17 models of medium-duty ZEVs with battery ranges up to 500 miles.[117] And fleets have already started ordering and implementing these ZEVs. USPS announced that it will purchase 9,250 Ford E-Transit electric delivery vans, which will contribute to USPS' pledge

[117] Rachel MacIntosh, Harrison Branner, Kayla Escobar, and Sophie Tolomiczenko, Electric Vehicle Market Update: Manufacturer & Commercial Fleet Electrification Commitments Supporting Electric Mobility in the United States, ERM for EDF (April 2023). https://www.edf.org/sites/default/files/2023-05/Electric%20Vehicle%20Market%20Update%20April%202023.pdf. (Attachment S)

to buy at least 66,000 electric vehicles through 2028.[118] In just two years since its launch in 2021, General Motors' BrightDrop has secured more than 30 commercial customers across industries like retail, rental, parcel delivery and service-based utilities, including FedEx, Walmart, Hertz, DHL Express and Purolator.[119] The company anticipates accelerating production of its electric delivery vans to reach a 50,000-unit annual volume capacity by 2025.[120] Amazon signed a deal with Rivian in 2019 to buy 100,000 Rivian step vans by 2030. Thousands of the delivery vans had been delivered to Amazon and put in circulation in cities across the nation by the end of 2022.[121] New York City announced it will purchase 925 EVs, including 382 Chevy Bolts, 360 Ford E-Transit vans, 150 Ford F-150 E-Lightning pickup trucks, 25 PHEV street sweepers, and seven Mack LR BEV garbage trucks.[122] These fleet and automaker commitments and investments are another clear indication that EPA's proposed standards for Class 2b and 3 vehicles are feasible.

V. Sufficient infrastructure, electric grid capacity, and policies exist to support strong standards.

EPA reasonably considered additional factors, including ZEV infrastructure, in projecting ZEV deployment in its proposal. Recent analyses indicate that buildout of EV infrastructure and the electric grid distribution capacity are sufficient to support EPA's proposed standards. Significant federal, state, and private investments are already being made to grow EV infrastructure. And states and utilities are initiating processes to ensure adequate infrastructure to meet demand.

A. Federal, state, and private investments support fast-growing infrastructure.

Investment in the infrastructure required to support rapid ZEV proliferation has already begun. Federal, state, and private parties have directed substantial resources into developing widespread charging networks and driving technological innovation. Together, these investments are laying the groundwork for protective standards.

In 2022, President Biden publicly committed to building out a national network of 500,000 EV chargers by 2030.[123] The federal government has made significant investments towards building the infrastructure necessary for a ZEV future with The Inflation Reduction Act (IRA) and

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[118] Mihalascu, Dan, "USPS To Purchase 9,250 Ford E-Transit Electric Delivery Vans." insideEvs. 1 Mar 2023. https://insideevs.com/news/655022/usps-purchase-9250-fordetransit-electric-delivery-vans

[119] Roberts, Daniel and Maria Violette, "Order Update: Your BrightDrop EV is on the Way." Brightdrop. 3 April 2023. https://www.gobrightdrop.com/newsroom/first-canadian-built-zevos-shipped.

[120] *Id.*

[121] Amazon, *Amazon's Electric Delivery Vehicles from Rivian Roll Out Across the U.S.* (July 21, 2022), https://www.aboutamazon.com/news/transportation/amazons-electric-delivery-vehicles-from-rivian-roll-out-across-the-u-s

[122] Lewis, Michelle, "New York City is buying 925 EVs – here's what's included." electrek. 4 Jan 2023. https://electrek.co/2023/01/04/new-york-city-is-buying-925-evs-heres-whats-included/.

[123] Fact Sheet: Biden-Harris Administration Announces New Standards and Major Progress for a Made-in-America National Network of Electric Vehicle Chargers, https://www.whitehouse.gov/briefing-room/statements-releases/2023/02/15/fact-sheet-biden-harris-administration-announces-new-standards-and-major-progress-for-a-made-in-america-national-network-of-electric-vehicle-chargers/.

Bipartisan Infrastructure Law (BIL). Both laws are putting billions of dollars towards building out charging networks and updating the grid to support the transition to ZEVs.

Multiple provisions of the IRA will boost the development of infrastructure to support light-duty ZEVs. The Alternative Fuel Refueling Property Credit will directly fund charging infrastructure in low-income and rural areas.[124] Qualifying businesses and individuals can be reimbursed for up to 30 percent of the cost of installing charging equipment in these areas, substantially reducing the costs of this equipment.[125] The Congressional Joint Committee on Taxation estimates this credit will cost almost $2 billion over its lifetime, demonstrating the sizeable impact it will make in driving additional investments from private parties.[126] The Advanced Energy Project Credit allocates $10 billion for facilities manufacturing advanced energy technologies, which includes manufacturing of charging and refueling infrastructure for ZEVs as well as grid modernization components.[127] Other provisions fund grants for infrastructure buildout in nonattainment areas,[128] and fund improvements to electricity generation and transmission.[129]

The BIL is another source of considerable federal investment in infrastructure development. Through its National Electric Vehicle Infrastructure (NEVI) and Charging and Fueling Infrastructure (CFI) discretionary grant programs, the law allocates $7.5 billion in funding explicitly towards building out ZEV charging and refueling infrastructure.[130] The NEVI program directs the Federal Highway Administration (FHWA) to provide funding to states to deploy EV charging stations to build an interconnected and reliable charging network. The FHWA has already announced its first set of plans under the program, which includes investment in all 50 states plus the District of Columbia and Puerto Rico.[131] This first round of NEVI investment is set to bring EV charging to 75,000 miles of highway across the country.[132] The CFI program provides additional funding for FHWA administered grants to state and local authorities for development of publicly accessible charging infrastructure.[133]

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[124] Inflation Reduction Act of 2022, P.L. 117-169, § 13404.
[125] Inflation Reduction Act of 2022, P.L. 117-169, § 13404.
[126] Joint Committee on Taxation, Estimated Budget Effects of the Revenue Provisions of Tile I—Committee on Finance, of an Amendment in the Nature of a Substitute to H.R. 5376, "An Act to Provide for Reconciliation Pursuant to Tile II of S. Con. Res. 14," as Passed by the Senate on August 7.2-22, and Scheduled for Consideration by the House of Representative on August 12, 2022, JCX-18-22, https://www.jct.gov/publications/2022/jcx-18-22/.
[127] Inflation Reduction Act of 2022, P.L. 117-169, § 13501.
[128] Inflation Reduction Act of 2022, P.L. 117-169, § 60101.
[129] Inflation Reduction Act of 2022, P.L. 117-169, § 50144, 50145, 50151, 50152.
[130] Infrastructure, Investment and Jobs Act of 2021, P.L. 117-58, 135 Stat. 445, 1421.
Infrastructure, Investment and Jobs Act of 2021, P.L. 117-58, 135 Stat. 445, 1421.
[131] U.S. Department of Transportation, Historic Step: All Fifty States Plus D.C. and Puerto Rico Greenlit to Move EV Charging Networks Forward, Covering 75,000 Milles of Highway (Sep. 27, 2022), https://www.transportation.gov/briefing-room/historic-step-all-fifty-states-plus-dc-and-puerto-rico-greenlit-move-ev-charging.
[132] U.S. Department of Transportation, Historic Step: All Fifty States Plus D.C. and Puerto Rico Greenlit to Move EV Charging Networks Forward, Covering 75,000 Milles of Highway (Sep. 27, 2022), https://www.transportation.gov/briefing-room/historic-step-all-fifty-states-plus-dc-and-puerto-rico-greenlit-move-ev-charging.
[133] U.S. Department of Transportation, Biden-Harris Administration Opens Applications for First Round of $2.5 Billion Program to Build EV Charging in Communities & Neighborhoods Nationwide,

On top of these programs, the BIL authorized more than $40 billion combined for the Congestion Mitigation & Air Quality Improvement Program, National Highway Performance Program, and Surface Transportation Grant Block Program.[134] These programs are not dedicated exclusively to charging, but constructing and installing charging infrastructure is an eligible activity under each of them. Additional funding from the BIL provides grants to states and local governments for reducing transportation carbon pollution, which will fund additional infrastructure investments.[135]

The ambition of these federal investments is being matched by infrastructure funding in many states, especially in states that have adopted, or are planning to adopt, California's Advanced Clean Cars II (ACC II) rule. For example, the California Energy Commission's (CEC) Clean Transportation Program announced it plans to invest $900 million for light-duty charging infrastructure through 2026.[136] The CEC estimates the plan will result in 90,000 new EV chargers across the state, more than doubling the state's existing network and helping it meet its goal of having 250,000 chargers by 2025.[137] Colorado has likewise made significant investments in preparing for a transition to ZEVs. The state's Charge Ahead Colorado Program provides grants that fund 80% of the cost of charging stations up to certain maximums based on type of charging equipment.[138]

B. Independent analysis commissioned by EDF shows existing and announced public charging infrastructure is on track to support increased passenger vehicle electrification.

A new study by WSP for EDF submitted along with our comments summarizes the existing public charging infrastructure in the U.S., the future public charging infrastructure needs based on EPA's proposal, and quantifies the announced EV charger deployment and investment and how it compares to those needs.[139] In this analysis, WSP conducted an extensive survey of charger deployment announcements to quantify the extent of the government and industry investment in public charging in the U.S. To the best of our knowledge, this is the first analysis that has attempted to quantify both the current state of the market and the cumulative impacts of future investments.

The analysis finds that as of June 2023 there were 58,000 existing public EV charging stations in the U.S. These stations host 155,700 ports that provide electricity to vehicles – 2% are Level 1, 78% are Level 2 and 20% are DCFC chargers (Figure 17).

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https://www.transportation.gov/briefing-room/biden-harris-administration-opens-applications-first-round-25-billion-program-build.

[134] Infrastructure, Investment and Jobs Act, P.L. 117-58, § 11115.

[135] Infrastructure, Investment and Jobs Act, P.L. 117-58, § 11403.

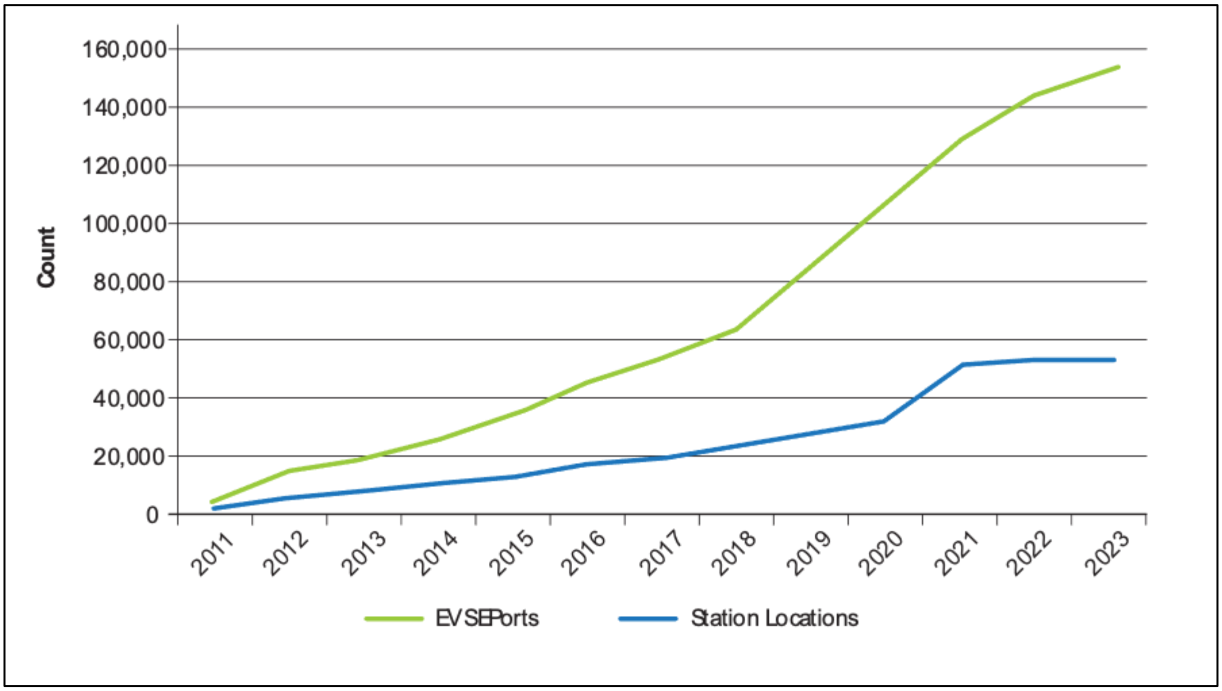
[136] California Energy Commission, CEC Approves $2.9 Billion Investment for Zero-Emission Transportation Infrastructure (Dec. 14, 2022), https://www.energy.ca.gov/news/2022-12/cec-approves-29-billion-investment-zeroemission-transportation-infrastructure.

[137] *Id.*

[138] Colorado Energy Office, *Charge Ahead Colorado*, https://energyoffice.colorado.gov/charge-ahead-colorado.

[139] U.S. Public EV Charging Infrastructure Deployment: Announced investment will rapidly expand publicly available charging, WSP for EDF (June 2023), https://blogs.edf.org/climate411/wp-content/blogs.dir/7/files/WSP-US-Public-EV-Charging-Infrastrcuture-Deployment-July-2023.pdf (Attachment U).

Figure 17: U.S. Public EV Charging Infrastructure



Source: U.S. Department of Energy, *Alternative Fuel Database* (June 19, 2023)

WSP estimates the number of public chargers that will be added to the current network over the next five years based on public announcements and commitments made by federal, state, and private organizations. Since 2021, based on a conservative estimate considering only the most concrete announcements, more than $21.5 billion in investments have been announced, which will result in over 800,000 new charger ports coming online before 2030 (Table 14).

Table 14: Announced Public Charging Ports and Investments

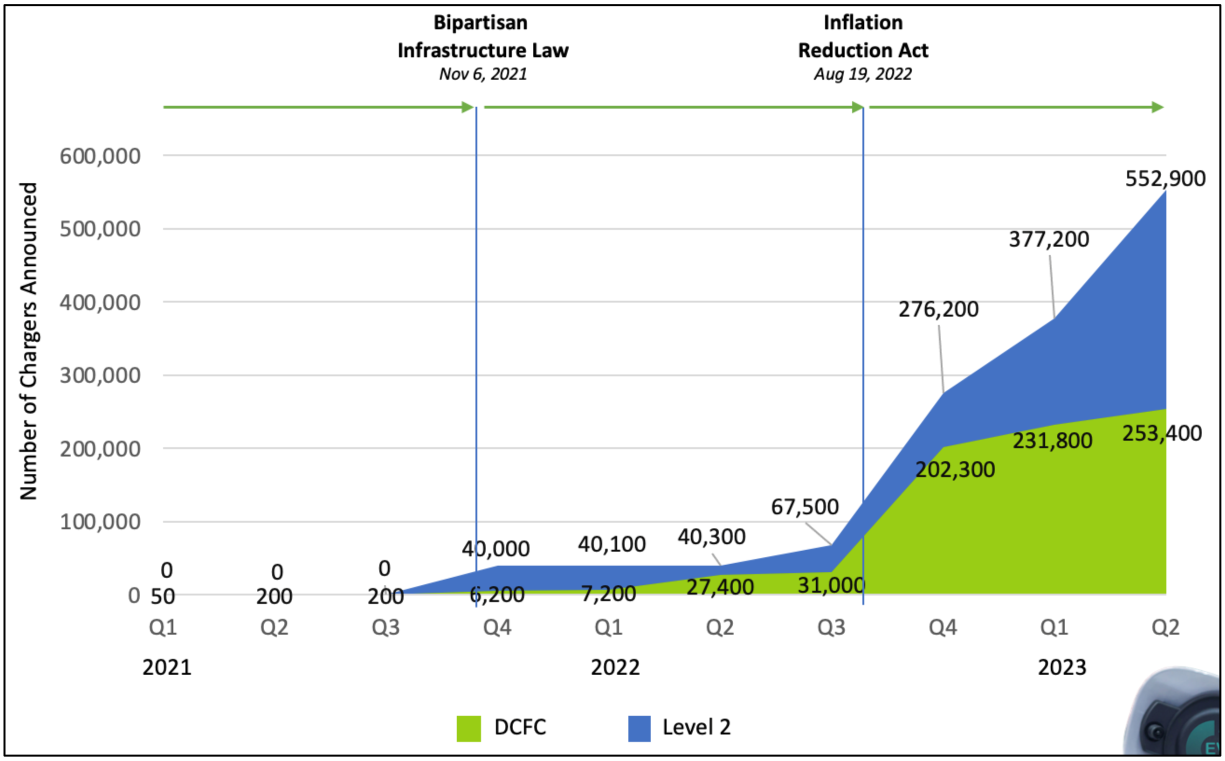
Charger Type	Ports	Investment *($ billions)*
Level 2	552,900	$2.1
DCFC	171,200	$6.7
DCFC 150	16,500 *	$8.4
Supercharger 250	4,800	$1.7
Supercharger 350	60,900	$2.1

*Includes a conservative estimate of 6,000 NEVI Ports
75,000-mile network / 50-mile intervals = 1,500 stations with 4 ports / station = 6,000 ports

Source: WSP, *U.S. Public EV Charging Infrastructure Deployment*

The pace of charger announcements increased markedly since the passage of the Inflation Reduction Act, representing 4.5 times the number of current public chargers, and underscoring the impact of recent federal policy in spurring the expansion (Figure 17).

Figure 17: EV Charger Announcement Timing



Source: WSP, *U.S. Public EV Charging Infrastructure Deployment*

In the Draft RIA for the proposal, EPA estimates that approximately 1,075,000 new Level 2 chargers and 135,000 new DCFC public chargers will be needed by 2030 to accommodate increasing numbers of EVs on the road, as a result of BAU and the proposed standards.[140] WSP's analysis finds that existing and already announced public EV charger deployments will provide at least 70% of the public chargers needed in the U.S. by 2030 under EPA's current proposed rule. For DCFC, existing and announced chargers account for more than 100% of the needed DCFC chargers past 2032.

When WSP further accounted for less concrete announcements, by assuming 25% of these softer announcements would materialize, along with 50% of unawarded grants resulting in previously unaccounted for charging ports, the analysis found announced investments would result in the deployment of well over 100% of the required chargers in 2030, 1.7 million ports.

The combination of market forces and incentives from recent federal policy have attracted a wide array of players to invest in public charger deployments. The analysis identified investments by 29 state governments, 18 charge network providers, 10 retailers, 7 vehicle manufacturers, 6 toll road operators, along with utilities, truck and service station operators, and fleet owners.

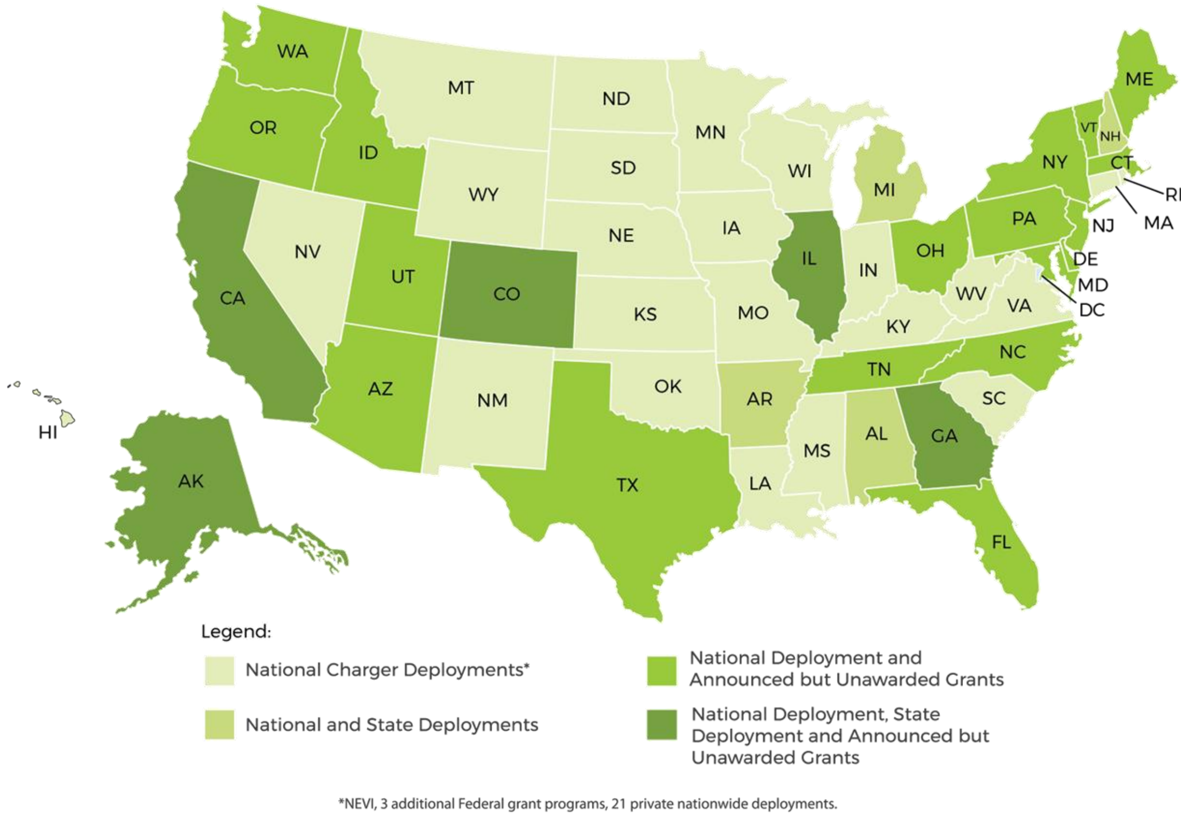
For example, Walmart announced it will install publicly available DCFC chargers at all of its retail locations in the U.S. by 2030 – and nearly 90% of Americans live within 10 miles of a

[140] U.S. Environmental Protection Agency (EPA) *Multi-Pollutant Emissions Standards for Model Year 2027 and Later Light-Duty and Medium-Duty Vehicles Draft Regulatory Impact Analysis*, April 2023, Figure 5-15.

Walmart.[141] Hertz and bp announced plans to build out a national network of EV fast charging infrastructure to accelerate the adoption of electric vehicles, bringing charging infrastructure to Hertz locations across America, including major cities such as Atlanta, Austin, Boston, Chicago, Denver, Houston, Miami, New York City, Orlando, Phoenix, San Francisco, and Washington, DC.[142] Hertz's goal is to make one-quarter of its fleet electric by the end of 2024 while bp aims to invest $1 billion in EV charging in the US by 2030. Pilot Company, General Motors, and EVgo have partnered to build a coast-to-coast network of 2,000 high power 350 kW fast chargers at Pilot and Flying J travel centers along American highways, with the first 200+ chargers expected to be available for use by drivers in 2023.[143] And General Motors and FLO announced a collaborative effort with dealers to install up to 40,000 public Level 2 EV chargers in local communities by 2026 through GM's Dealer Community Charging Program.[144] As shown in Figure 18, WSP found that these private sector deployments along with NEVI and other nationwide grant programs would dramatically expand the EV charging network nationwide.

[141] Vishal Kapadia, *Leading the Charge: Walmart Announces Plan to Expand Electric Vehicle Charging Network* (Apr. 6, 2023), https://corporate.walmart.com/newsroom/2023/04/06/leading-the-charge-walmart-announces-plan-to-expand-electric-vehicle-charging-network/
[142] *Fact Sheet: Biden-Harris Administration Announces New Standards and Major Progress for a Made-in-America National Network of Electric Vehicle Chargers* (Feb. 15, 2023), https://www.whitehouse.gov/briefing-room/statements-releases/2023/02/15/fact-sheet-biden-harris-administration-announces-new-standards-and-major-progress-for-a-made-in-america-national-network-of-electric-vehicle-chargers/.
[143] *Id.*
[144] *Id.*

Figure 18: Geographic Distribution of Announced EV Charger Deployments and Investments



Source: WSP, *U.S. Public EV Charging Infrastructure Deployment*

C. The electric grid can support widespread light- and medium-duty ZEV adoption.

The U.S. electric grid has provided reliable, cheap, instantaneous power to millions of homes and businesses every second of every day for well over a century. For so many end users, electrification represents the cheapest and most attainable decarbonization pathway.

Growing the electric grid to meet increased demand is nothing new. Since 1960, about a third of the year over year increases in state electricity sales have been higher than 5% with 7% of those years having increases higher than 10% annual growth.[166] The compound annual growth rate for the entire grid since 1960 is 2.8%. In their modeling, EPA projects that electricity demand under the proposal with experience a 1.51% compound annual growth rate between 2028 and 2050 only slightly higher than the expected growth under the no action case, 1.33% annually. The proposal is expected to increase the annual growth of electricity demand by only 0.18%.[145]

[145] *See* Draft Regulatory Impact Analysis Tables 5-2 and Table 5-3.

i. Utilities and states have already begun to implement programs to support light- and medium-duty ZEV charging.

Many of the largest electric utilities in the United States have affirmed their commitment to enabling the EV transition and emphasized the ability of the grid to support widespread vehicle electrification. On April 12, 2023, the Edison Electric Institute (EEI), the industry trade organization for all investor-owned utilities in the U.S., released a statement saying:

> "EEI and our member companies commend EPA for proposing new rules to help reduce emissions from passenger and other light-duty vehicles. Our industry has fully embraced a strategy that will deliver resilient clean energy to the customers and communities that we serve. Electrifying the transportation sector will be key to reducing emissions across the economy and to achieving our goals for a carbon-free future. We are committed to working with EPA Administrator Regan and the Biden administration to help build the electric vehicle charging infrastructure needed to accelerate the electric transportation transition and reduce vehicle emissions."[146]

In comments on EPA's proposed heavy-duty GHG rule, utilities made clear that they are actively preparing to meet the needs of increased deployment of light-, medium- and heavy-duty ZEVs and that they are confident in their ability to do so.

For instance, EEI emphasized in its comments on the heavy-duty proposal that its members are actively working to "ready the market for widescale adoption of light-, medium- and heavy-duty EVs."[147] They also noted that "the electric power sector has a long history of accommodating growth in electricity demand from the adoption of new technologies."[148]

Likewise, the Zero Emission Transportation Association (ZETA)[149] pointed out that "this is not the first-time electricity providers have navigated increases in electricity demand brought on by new technologies."[150] ZETA also made clear that strong EPA regulations that drive ZEV proliferation are helpful in "allow[ing] utilities to make the investments necessary to facilitate a smooth EV transition."[151]

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[146] Tom Kuhn. *EEI Statement on EPA's New Proposed Rule for Light-Duty Vehicles.* 2023, Edison Electric Institute,https://www.eei.org/en/news/news/all/eei-statement-on-epas-new-proposed-rule-for-light-duty-vehicles.
[147] Comments of the Edison Electric Institute on the Environmental Protection Agency's Proposed Rule, Greenhouse Gas Emissions Standards for Heavy-Duty Vehicles: Phase 3 at 6, EPA-HQ-OAR-2022-0985-1509 (June 15, 2023), https://www.regulations.gov/comment/EPA-HQ-OAR-2022-0985-1509.
[148] *Id.* at 7.
[149] ZETA's electric utility members include: Con Edison, Duke Energy, the Edison Electric Institute, NextEra Energy, Pacific Gas and Electric Company, Southern Company, and Xcel Energy.
[150] Comments of the Zero Emission Transportation Association on the Environmental Protection Agency's Proposed Rule, Greenhouse Gas Emissions Standards for Heavy-Duty Vehicles: Phase 3 at 29, EPA-HQ-OAR-2022-0985-1568 (June 16, 2023), https://www.regulations.gov/comment/EPA-HQ-OAR-2022-0985-1568.
[151] *Id.* at 30.

All of these points were further echoed by the Energy Strategy Coalition,[152] who stated that "EPA's HDV and LDMV proposals facilitate further investment in the generation and charging infrastructure needed to meet increased demand associated with electrification."[153] The Coalition also highlighted "the benefits that EVs can provide to grid reliability" through load shifting and shared examples of how its members are encouraging the adoption of vehicle-to-grid technology to further boost grid reliability.[154]

In addition to voicing their support of electrifying transportation, utilities have begun to implement programs to support EV adoption. Sixty-two electric utilities in 35 states and DC have received approval from their public utility commissions for investments related to EVs. The filings total $4.2 billion, a $512 million increase from between July 2022 and April 2023, underscoring the pace at which these programs are being implemented.[155]

Efforts to update planning processes have also improved the ability for the grid to meet demand from additional light- and medium-duty charging. If system operators and utilities have accurate forecasts well in advance of when grid needs arise, they can increase generating capacity and complete needed upgrades without as great of a need for mitigating solutions. In a recent article, Southern California Edison (SCE) emphasized the importance of planning for utilities: "On the forecasting and planning side, utilities and energy system planners must adapt planning efforts to reflect expected EV growth, including impacts from proposed and adopted policies and incentives. For example, to account for the new developing needs of the Advanced Clean Cars II and Advanced Clean Fleets policies in California, SCE and the other California investor-owned utilities were recently approved to use higher forecasts for transportation electrification than previously used."[156]

The New York Joint Utilities' Coordinated Grid Planning Process and California PUC's Freight Infrastructure Planning Framework, both currently under development, also represent examples of improved planning processes to enable accelerated vehicle electrification and grid interconnection.[157] [158]

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[152] Energy Strategy Coalition's members include: Austin Energy, Calpine Corporation, Constellation Energy Corporation, National Grid USA, New York Power Authority, NextEra Energy, Pacific Gas and Electric Company, and Sacramento Municipal Utility District.

[153] Comments of the Energy Strategy Coalition on the Environmental Protection Agency's Proposed Rule, Greenhouse Gas Emissions Standards for Heavy-Duty Vehicles: Phase 3 at 2, EPA-HQ-OAR-2022-0985-1626, https://www.regulations.gov/comment/EPA-HQ-OAR-2022-0985-1626.

[154] *Id.* at 7-8.

[155] Edison Electric Institute. *Electric Transportation Biannual State Regulatory Update*. (April 2023), https://www.eei.org/-/media/Project/EEI/Documents/Issues-and-Policy/Electric-Transportation/ET-Biannual-State-Regulatory-Update.pdf.

[156] Pamela MacDougall and Katie Sloan, *As the electric truck transition shifts into high gear, utilities must lead the charge*. 2022. Utility Dive, https://www.utilitydive.com/news/electric-truck-bus-ev-utilities-sce-edison-edf/634214/

[157] https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=20-e-0197&CaseSearch=Search

[158] Zero-Emissions Freight Infrastructure Planning. California Public Utilities Commission, https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/transportation-electrification/freight-infrastructure-planning.

Independent system operators (ISOs) and regional transmission organizations (RTOs), which forecast load in competitive electricity markets, have also started to incorporate electric vehicle adoption projections into their planning processes. ISO-New England for at least the last four years has completed a Transportation Electrification Forecast which is integrated into their annual load forecasting to assess their future generation needs on the system.[159] ERCOT, the ISO covering most of Texas, commissioned a study by the Brattle Group in 2022 to "develop a repeatable process for forecasting electric vehicle load impacts."[160] In their 2022 Load Forecast Report, PJM accounted for the anticipated load growth from EV charging needs.[161]

It is clear from these commitments and statements that utilities and the grid are prepared to meet the increasing charging needs of light- and medium-duty vehicles.

ii. EV charging has the potential to benefit the grid through managed charging and other programs.

Multiple studies have found that through managed charging, increases in EV adoption and charging will not meaningfully increase peak demand on the grid. In their study investigating the grid impacts of BEV adoption in Dallas and New York City, Needell, Wei, and Trancik found that "delayed home charging nearly eliminates the increase in the evening demand for electricity…even for BEV penetration levels well over 50%." Additionally, they found that "workplace charging emerges as a simple and effective solution for abating both the peak increase and the over-supply of [solar generation]." [162] A 2019 article in IEEE Electrification Magazine found that through managed charging, the peak demand from EVs in California could be cut to one-eighth of the size without managed charging leaving the increases within the margins for most residential feeders.[163]

VI. The supply chain for electric vehicle batteries and critical minerals is capable of safely and equitably meeting the demands of strong standards.

The current and projected critical minerals supply chain for EV batteries is capable of meeting the demands of strong standards. It is vital that any increase in minerals mining and processing be undertaken in a safe and equitable way that does not increase pollution burdens on underserved communities, which have historically faced disproportionate harms from these processes. Any projects undertaken must be carried out in a way that affirmatively prioritizes the needs of these communities.

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[159] ISO New England, *Final 2023 Transportation Electrification Forecast,* https://www.iso-ne.com/static-assets/documents/2023/04/transfx2023_final.pdf (Apr. 28, 2023).
[160] Brattle, *ERCOT EV Allocation Study* (Oct. 13, 2022), https://www.brattle.com/wp-content/uploads/2023/01/ERCOT-EV-Allocation-Study.pdf.
[161] Ethan Howland, *Data Centers, EVs Drive PJM's Long-Term Load Growth Forecast, but it Expects Some Utilities to See Declines* (Jan. 4, 2022), https://www.utilitydive.com/news/data-centers-evs-drive-pjm-load-growth-forecast-capacity-market/616584/.
[162] Needell et al., *Strategies for beneficial electric vehicle charging to reduce peak electricity demand and store solar energy*, Cell Reports Physical Science 4, 101287 March 15, 2023 https://doi.org/10.1016/j.xcrp.2023.101287 (Attachment V).
[163] Jonathan Coignard et al., *Will Electric Vehicles Drive Distribution Grid Upgrades?: The case of California.* 2019. IEEE Electrification Magazine, 10.1109/MELE.2019.2908794.

Domestic production of batteries and battery components is growing rapidly to meet the rising needs of the EV industry. Analysis by EDF and WSP found that there has been over $79.7 billion in investment in U.S. battery and battery component production announced within the past 8 years, resulting in almost 70,000 new jobs.[164] In 2026, these already announced investments will be capable of producing batteries sufficient to supply the equivalent of 11.2 million new passenger vehicles per year.[165]

Much of this investment has occurred within the last year as a result of the IRA's incentives for domestic battery production, which will continue to spur production growth and reduce battery costs throughout the timeframe of this rule.[166] The Advanced Manufacturing Production credit, for instance, provides up to $45 per kilowatt-hour for the production of battery cells and modules as well as up to 10% of the cost of critical minerals through 2032.[167] Additionally, the IRA's amendments to the Clean Vehicle Credit includes provisions requiring that qualifying vehicles source an increasing percentage of their critical minerals and battery components domestically, which will further incentivize increased domestic production capacity.[168]

The extraction, processing, and recycling of the critical minerals necessary to support rapid ZEV proliferation is also ramping up and supports the feasibility of protective emission standards. EDF has conducted a review of announced investments in the critical minerals supply chain, including new investments and expansion of existing capacities in raw minerals extraction (mining), materials separation and processing, and recycling efforts—in both the U.S. and free-trade-agreement countries - based on publicly available information from company websites and announcements issued by investors, government agencies, and news media on the operators, materials, locations, annual capacities, and timelines of the projects.[169] The compilation of projects includes the scale and date of any announced investments in the projects, including OEM investments, as well as the details of partnership agreements. We have also compiled information on specific funding levels secured under the BIL.

The numerous projects and partnerships identified demonstrate a growing effort—that is supported by the BIL and the IRA—to develop a secure supply of critical minerals. In October 2022, the White House announced $2.8 billion in funding under the BIL for projects to support "new, retrofitted, and expanded commercial-scale domestic facilities to produce battery materials, processing, and battery recycling and manufacturing demonstrations."[170] The funding is the first phase of a total $7 billion investment by the federal government to develop domestic

[164] U.S. Electric Vehicle Manufacturing Investments and Jobs, Characterizing the Impacts of the Inflation Reduction Act after 6 Months, WSP for EDF, (March 2023). https://blogs.edf.org/climate411/files/2023/03/State-Electric-Vehicle-Policy-Landscape.pdf. (Attachment E)
[165] *Id.*
[166] *Id.*
[167] Inflation Reduction Act of 2022, P.L. 117-1698 ,136 Stat. 1971-81 (2022).
[168] Inflation Reduction Act of 2022, P.L. 117-1698 ,136 Stat. 1956-57 (2022).
[169] The compilation is attached to this comment as an Excel file titled "Domestic Critical Minerals Projects." We are expanding the review to include countries with which the U.S. has free trade agreements. (Attachment W)
[170] U.S. DOE Office of Manufacturing and Energy Supply Chain Bipartisan Infrastructure Law: Battery Materials Processing and Battery Manufacturing Recycling Selections, *available at*: https://www.energy.gov/mesc/bipartisan-infrastructure-law-battery-materials-processing-and-battery-manufacturing-recycling.

supply chains for electric vehicle battery production.[171] According to project announcements, these investments in critical minerals projects have been spurred on by downstream consumer tax benefits under the IRA.[172]

In all, our review identified 74 domestic mining, processing, and recycling projects and an additional 30+ projects and agreements in countries with which the United States has a free trade agreement. Investment levels are not known for all projects but announced domestic investments total over $25 billion, including $1 billion funded under the BIL and $2.7 billion funded by automakers. Known investments in free-trade-agreement countries total over $800 million. Because less than half of the projects we identified included a projected investment amount, we can assume that the actual total investment in mining, processing, and recycling projects in the U.S. and in free-trade-agreement countries is far higher than these publicly announced figures reflect.

VII. Standards must continue to drive reductions from ICEVs and PHEVs.

EDF strongly supports EPA's proposed NMOG + NOX and PM2.5 standards. As our nation transitions to a zero-emitting fleet it is imperative that gasoline and diesel vehicles continue to reduce health-harming air pollutants to protect communities from the harms of vehicle emissions.

A. EDF supports strong NMOG + NOx standards.

EDF supports light-duty vehicle and medium-duty vehicle fleet average FTP NMOG + NOX standards that include both ICEVs and ZEVs in a manufacturer's compliance calculation. We also support the proposed fleet average standards that decline from 2027–2032 in the early compliance program, the elimination of higher certification bins, a requirement for the same fleet average emissions standard to be met across four test cycles (25 °C FTP, HFET, US06, SC03), and one fleet average NMOG + NOX standard in the -7 °C FTP test. These features are important to ensure increasing ZEV deployment results in rigorous air pollution reductions and likewise prevent any offsetting pollution increases from remaining internal combustion engine vehicles.

B. Standards that result in use of Gasoline Particulate Filters are vital.

EDF supports the proposed PM standard of 0.5 mg/mi for light-duty vehicles and medium-duty vehicles that must be met across three test cycles (-7 °C FTP, 25 °C FTP, US06), a requirement

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[171] U.S. DOE, October 19, 2022 Biden-Harris Administration Awards $2.8 Billion to Supercharge U.S. Manufacturing of Batteries for Electric Vehicles and Electric Grid, https://www.energy.gov/articles/biden-harris-administration-awards-28-billion-supercharge-us-manufacturing-batteries.

[172] *E.g.*, General Motors announced that, "[m]aterial sourced from Lithium Americas [Thacker Pass mine in Nevada] will help support EV eligibility for consumer incentives under the U.S. clean energy tax credits." Ford noted, in its announcement of a long-term agreement with Nemaska Lithium, that its lithium hydroxide should help qualify Ford vehicles for consumer tax benefits under the IRA. And Livent Corporation, in its announcement of the expansion of its largest lithium hydroxide production site in the U.S. said that its, "leading footprint in North America positions the company to take advantage of long-term growth opportunities and downstream incentives from the recently enacted Inflation Reduction Act (IRA), which encourages use of lithium produced or processed in North America."

for PM certification tests at the test group level, and a requirement that every in-use vehicle program (IUVP) test vehicle is tested for PM. EPA must ensure that the 0.5 mg/mi standard is a per-vehicle cap, not a fleet average.

EPA correctly relies on the availability of Gasoline Particulate Filters (GPFs) in setting its PM standard. GPFs are a highly feasible demonstrated technology with a proven track record at reducing pollution. They are already widely available, and are being put to use in other markets, including the European Union, India and China, where more stringent emissions standards have made them necessary.[173]

i. Additional reductions in PM pollution are urgently needed, especially in communities that have long faced elevated pollution burdens.

Continuing to drive criteria pollutant reductions is particularly important for low-income communities and communities of color, which have historically faced significant and elevated harms from health-harming transportation pollution. As a result of housing discrimination and other unjust policies, communities of color and low-income communities constitute a higher percentage of the population near our roads and highways and therefore suffer disproportionately from associated harmful pollution.[174] According to the American Lung Association's 2023 State of the Air report, people of color are almost four times more likely to breathe the most polluted air when compared to white people.[175] A report by Moving Forward Network also found that, on average, Asian and Black Americans are exposed to PM2.5 pollution that is 56 and 44 percent higher, respectively, than white Americans.[176] And an EDF analysis of the Bay Area in California found that neighborhoods with higher percentages of residents of color experienced double the rate of asthma from nitrogen dioxide (NO2) –a pollutant often used as a marker for transportation-related pollution.[177] Moreover, as described above, recent studies have found light-duty vehicles, including light-duty trucks are responsible for a significant share of pm-attributable premature mortalities.

Accordingly, finalizing the criteria standards EPA has proposed, including setting the PM standard at a level that will encourage the use of GPFs, is critical to protecting health and combatting environmental injustice.

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[173] Corning, *What Emissions Regulations and Standards are Currently in Place?*, https://www.corning.com/worldwide/en/products/environmental-technologies/emissions-control/emissions-regulations.html.

[174] Gregory M. Rowangould, *A Census of the US Near-Roadway Population: Public Health and Environmental Justice Considerations*, Transportation Research Part D 25, 59-67 (2013), https://www.sciencedirect.com/science/article/abs/pii/S1361920913001107.

[175] American Lung Association, *State of the Air Report 2023* (2023), https://www.lung.org/getmedia/338b0c3c-6bf8-480f-9e6e-b93868c6c476/SOTA-2023.pdf. (Attachment C)

[176] Jimmy O'dea, *Zero-Emissions Technology for Freight: Heavy-Duty Trucks, Tools to Advocate for Zero-Emissions Technology*, Moving Forward Network (2020), http://www.movingforwardnetwork.com/wp-content/uploads/2020/10/MFN_ZeroEmissionToolkit-1.pdf. (Attachment X)

[177] EDF, *Air Pollution's Unequal Impacts in the Bay Area* (2021), https://www.edf.org/airqualitymaps/oakland/health-disparities.

C. The PHEV utility factor should be conservative, with manufacturers given a voluntary alternative to use a utility factor based on real world data.

We likewise support EPA's proposal to amend its current approach to PHEV utility factors based on improved data about real world PHEV usage.[178] However, we encourage EPA to rely fully on this more accurate data, rather than continuing to consider the UFs developed in SAE J2841, which are based on dated and inaccurate assumptions.[179] The data compiled by ICCT from real-world sources represents the best estimate of actual PHEV utilization and should be the primary source for EPA's UF curves.

EPA's current approach to assigning fuel economy to PHEVs was first adopted in a 2011 rulemaking supporting the 2010 GHG standards.[180] Under that rulemaking, PHEVs are given a fuel economy that combines a 0 g/mi emissions value with their measured GHG emissions from operation on liquid fuel.[181] The utility factor for weighting the two values is based on a PHEV's charge-depleting range for city and highway driving.[182] These utility factor numbers were developed in SAE J2841"using data from the 2001 Department of Transportation 'National Household Travel Survey.'"[183] Because PHEVs were just beginning to be introduced at that time,[184] the utility factors were not based on real-world PHEV use. Instead, they assume that "[t]he first mode of operation is always electric assist or all electric drive, vehicles will be charged once per day, and future PHEV drivers will follow drive patterns exhibited by the drivers in the surveys used [in calculating the utility factors]."[185] EPA acknowledged in promulgating these utility factors that "current understanding of the above assumptions and the data upon which UFs were developed may change" and that "therefore, EPA may change the application of UFs in light of new data."[186] However, these utility factors have not been amended since the 2011 rule.

Meanwhile, California's treatment of PHEVs under the ACC II program is far more conservative, resulting in lower utility factors than EPA. ACC II allows PHEVs to "fulfill a

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[178] 88 Fed. Reg. 29254.
[179] 88 Fed. Reg. 29253.
[180] *See* Revisions and Additions to Motor Vehicle Fuel Economy Label, 40 Fed. Reg. 39478 (Jul. 6, 2011), https://www.govinfo.gov/content/pkg/FR-2011-07-06/pdf/2011-14291.pdf; Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 75 Fed. Reg. 25436 (May 7, 2010) ("PHEV compliance values will be determined by combining zero grams/ mile for grid electricity operation with the GHG emissions from the 2-cycle test results during operation on liquid fuel, and weighting these values by the percentage of miles traveled that EPA believes will be performed on grid electricity and on liquid fuel, which will vary for different PHEVs. EPA is currently considering different approaches for determining the weighting factor to be used in calculating PHEV GHG emissions compliance values"), https://www.govinfo.gov/content/pkg/FR-2010-05-07/pdf/2010-8159.pdf.
[181] 86 Fed. Reg. 74457 (Dec. 30, 2021), available at https://www.govinfo.gov/content/pkg/FR-2021-12-30/pdf/2021-27854.pdf.
[182] 40 C.F.R. § 600.116-12 ("To determine CREE values to demonstrate compliance with GHG standards, calculate composite values representing combined operation during charge-depleting and charge-sustaining operation using the following utility factors . . . ").
[183] 40 Fed. Reg. 39478 (Jul. 6, 2011), https://www.govinfo.gov/content/pkg/FR-2011-07-06/pdf/2011-14291.pdf
[184] 88 Fed. Reg. 29253.
[185] 40 Fed. Reg. 39478 (Jul. 6, 2011), https://www.govinfo.gov/content/pkg/FR-2011-07-06/pdf/2011-14291.pdf
[186] 40 Fed. Reg. 39478 (Jul. 6, 2011), https://www.govinfo.gov/content/pkg/FR-2011-07-06/pdf/2011-14291.pdf

portion of their total Annual ZEV Requirement" if they meet several qualifications.[187] A PHEV must have a "minimum certification range value of greater than or equal to 70 miles," based on California's 2026 ZEV and PHEV test procedures,[188] and have a minimum US06 all-electric range value greater than or equal to 40 miles to be considered a ZEV under the rules.[189] PHEVs that don't meet these requirements can still be counted for partial credit if they have a minimum certification range value between 43 and 70 miles[190] or have a US06 all-electric range of at least 10 miles.[191] Additionally, PHEVs can only be used to meet 20 percent of a manufacturer's total ZEV requirement.[192]

It is imperative that EPA assign a utility factor for PHEVs that reflects real-world electric drive share. A recent ICCT study examined the current state of PHEV usage in the United States and found strong evidence that real-world electric drive share is far below EPA's current utility factor label rating.[193] According to ICCT, "previous research and data from early adopters of PHEVs in the United States demonstrated that PHEVs achieved real-world electric drive share close to that expected by the U.S. Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA)." ICCT notes that EPA assumes that PHEVs achieve real-world electric drive share close to EPA's utility factor label rating in its treatment of PHEVs in the 2023-2026 light-duty GHG rule.

ICCT's analysis uses more recent data from two previously unexplored sources: self-reported fuel consumption from Fuelly.com and engine-off distance traveled collected by the California Bureau of Automotive Repair (BAR), which cover a broader variety of PHEV models and newer model years than prior datasets. ICCT concludes that real-world electric drive share may be 26-56% lower than assumed and real-world fuel consumption may be 42-67% higher than assumed within EPA's labeling program for light-duty vehicles.

ICCT also looked at studies in Europe that echoed their findings. "Recent studies with user data from over 20,000 European PHEVs have shown that, in real-world usage conditions, the [electric drive share] of PHEVs falls far short of the [utility factor] curve assumed in the [Worldwide Harmonized Light Vehicles Test Procedure (WLTP)]. For PHEVs owned by private individuals, the real-world fuel consumption is on average three times higher than the official WLTP values, while for company car PHEVs the fuel consumption is on average five times higher. Moreover, despite an increasing electric range and more public charging infrastructure, the deviation

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[187] California Zero-Emission Vehicle Requirements for 2026 and Subsequent Model Year Passenger Cars and Light-Duty Trucks, 13 C.C.R. § 1962.4(c)(e)(1).
[188] California Test Procedures for 2026 and Subsequent Model Year Zero-Emission Vehicles and Plug-In Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes, incorporated by reference in 13 C.C.R. § 1962.4, *available at* https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/ACC II/ACC IIfro_zev_tp_2026%2B.pdf. Certification range value is defined as a "PHEV's calculated combined urban and highway all-electric range values," equal to ".55 x Urban-All Electric (or Driving for FCEV) Range Value + .45 x Highway All-Electric (or Driving for FCEV) Range Value." 13 C.C.R. §1962.4(l).
[189] *Id.* at § 1962.4(c)(e)(1)(A)(8).
[190] *Id.* at § 1962.4(c)(e)(1)(A)(9).
[191] How much credit these PHEVS get is calculated based on an equation where the partial vehicle value is equal to Certification Range Value/100 + .20. *Id.* at § 1962.4(c)(e)(1)(B)(1).
[192] *Id.* at § 1962.4(c)(e)(1)(B)(2)
[193] Isenstadt, A., Zifei, Y., Searle, S., German, J. 2022. Real World Usage of Plug-In Hybrid Vehicles in the United States, ICCT. https://theicct.org/publication/real-world-phev-us-dec22/ (Attachment Y).

between real-world and official fuel consumption of PHEVs in Europe is observed to be growing."[194]

EPA acknowledges in the proposal that its current approach "significantly underestimates PHEV CO2 emissions"[195] and that the real-world data collected by ICCT from BAR is, in contrast, "a reasonable source for evaluating the real-world utility factors for recent PHEV usage."[196] However, instead of relying fully on this new data for developing its UF curve, EPA proposes to average the two datasets, giving each an equal weight.[197] Because, as discussed above, the ICCT-BAR UFs are a significantly better representation of real-world PHEV usage than EPA's current approach, EDF suggests that the agency rely solely on this data in setting its new UF curve. In addition to aligning EPA's default UF with the best available real-world data, we encourage the agency to provide manufacturers with an option to submit rigorous, real-world data to demonstrate their UFs are higher than these default values. An approach along these lines could allow for retrospective adjustment based on annual driving information submitted along with a manufacturer's compliance demonstration. An approach along these lines—a rigorous default UF combined with the option to certify better performance—would help to better reflect the actual emissions performance of PHEVs and provide incentives for manufacturers to develop and deploy PHEVs that operate more regularly on electricity.

D. EPA must put in place guardrails that prevent ICEVs from removing greenhouse gas reducing technologies.

EDF reviewed the output from EPA's modeling of manufacturers' compliance with the Proposal using the OMEGA 2 model and found instances where the model removed technology that was either on vehicles in the 2021 baseline fleet or that had been added in subsequent model years. The California Air Resources Board and others have described this technology removal in considerable detail within their comments. We recognize the light-duty GHG program, since its inception, has been performance-based and provided manufacturers flexibility in applying technology to some vehicles and not others. At the same time, the increasing availability of battery electric vehicles provides manufacturers an even greater ability to trade off emissions between vehicles (and potentially significantly increase emissions from some of the remaining combustion engine vehicles in their fleets). While we do not expect manufacturers to take this approach, we are concerned that the compliance model shows technology removal and an outcome along these lines is permitted under the current standards.

Accordingly, we encourage EPA to put in place guardrails to ensure, at the very least, technologies that manufacturers have previously deployed on combustion vehicles are not removed as larger numbers of ZEVs are introduced into the fleet. Notably, EPA's approach to its NMOG + NOx standards is likewise performance based with guardrails. Though those standards are designed somewhat differently around a bin structure, EPA has here proposed to eliminate higher emitting bins in a manner that would ensure, as vehicles become cleaner, manufacturers

194 *Id*.
195 88 Fed. Reg. 29252.
196 88 Fed. Reg. 29254
197 88 Fed. Reg. 29253.

can no longer offset those gains by certifying vehicles to higher-polluting levels. EPA should consider how it can apply the same concept to its greenhouse gas standards, perhaps through an emissions cap as a function of footprint curve that would retain the flexibility that has been a hallmark of the program but prevent any abuse that might come with increasing deployment of ZEVs.

Respectfully submitted,

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List of Attachments

Attachment A: EDF's comments on the Proposed Rule, *Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards*, 86 Fed. Reg. 43726 (August 10, 2021) dated September 27, 2021. Accessible at https://www.regulations.gov/comment/EPA-HQ-OAR-2021-0208-0688.

Attachment B: Calvin A Arter *et al* Mortality-based damages per ton due to the on-road mobile sector in the Northeastern and Mid-Atlantic U.S. by region, vehicle class and precursor, 2021 *Environ. Res. Lett.* 16. https://iopscience.iop.org/article/10.1088/1748-9326/abf60b

Attachment C: American Lung Association, *State of the Air Report 2023* (2023), https://www.lung.org/getmedia/338b0c3c-6bf8-480f-9e6e-b93868c6c476/SOTA-2023.pdf.

Attachment D: American Lung Association, "Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity," June 2023. https://www.lung.org/clean-air/electric-vehicle-report/driving-to-clean-air.

Attachment E: U.S. Electric Vehicle Manufacturing Investments and Jobs, Characterizing the Impacts of the Inflation Reduction Act after 6 Months, EDF and WSP (March 2023). https://blogs.edf.org/climate411/files/2023/03/State-Electric-Vehicle-Policy-Landscape.pdf

Attachment F: Amlan Saha, Miranda Freeman, Jane Culkin, and Dana Lowell, U.S. Light Truck Electrification: Economic and Jobs Impact Study, M.J. Bradley & Assoc. for EDF, Nov. 2021.

Attachment G: Electric Vehicle Total Cost of Ownership Analysis, Summary Report, WSP for EDF (July 2023).

Attachment H: Brief of Amici Curiae Margo Oge and John Hannon in Support of Respondents, *Texas v. EPA*, No. 22-1031, 24-31 (D.C. Cir, Mar. 2, 2023), *Texas v. EPA*, No. 22-1031, 33 (D.C. Cir, Mar. 2, 2023), https://www.edf.org/sites/default/files/2023-03/Texas%20-%20Former%20EPA%20Managers.pdf.

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Attachment J: Brief of Senator Thomas R. Carper and Representative Frank Pallone, Jr. as Amici Curiae in Support of Respondents, *Texas v. EPA*, No. 22-1031, 32 (D.C. Cir, Mar. 2, 2023), https://www.edf.org/sites/default/files/2023-03/Texas%20-%20Members%20of%20Congress%20%28Sen.%20Carper%20and%20Rep.%20Pallone%29.pdf.

Attachment K: Greg Dotson and Dustin J. Maghamfar, The Clean Air Act Amendments of 2022: Clean Air, Climate Change, and the Inflation Reduction Act, 53 ENV'T L. REP. 10017, 10030 (2023), https://www.eli.org/sites/default/files/files-pdf/53.10017.pdf.

Attachment L: Vishnu Nair, Himanshu Saxena, Sajit Pillai, Alternative Powertrain Pathways for Light-Duty and Class 3 Vehicles for MYs 2024, 2027, and 2035 to Meet Future CO2 Emission Targets, Roush for EDF (June 2023).

Attachment M: Slowik, Peter, Aaron Isenstadt, Logan Pierce, Stephanie Searle, White Paper, Assessment of Light-Duty Electric Vehicle Costs and Consumer Benefits in the United States in the 2022–2035 Time Frame, The International Counsel on Clean Technologies (2022), https://theicct.org/wp-content/uploads/2022/10/ev-cost-benefits-2035-oct22.pdf.

Attachment N: Saxena, S. Pillai, Impact of the Inflation Reduction Act of 2022 on Light-Duty Vehicle Electrification Costs for MYs 2025 and 2030, Roush for EDF (2023) https://www.edf.org/sites/default/files/2023-05/Impact_IRA_LDV_Electrification_Costs_for_MYs_2025_and_2030_Roush.pdf.

Attachment O: Himanshu Saxena, Vishnu Nair, Sajit Pillai, Electrification Cost Evaluation of Light-Duty Vehicles for MY 2030, Roush for EDF (2023). https://www.edf.org/sites/default/files/2023-05/Electrification_Cost_Evaluation_of_LDVs_for_MY2030_Roush.pdf.

Attachment P: Peter Slowik, Stephanie Searle, Hussein Basma, Josh Miller, Yuanrong Zhou, Felipe Rodríguez, Claire Buysse, Sara Kelly, Ray Minjares, Logan Pierce, Robbie Orvis and Sara Baldwin. 2023. Analyzing the Impact of the Inflation Reduction Act on Electric Vehicle Uptake in the United States, ICCT and Energy Innovation Policy & Technology LLC. https://theicct.org/publication/ira-impact-evs-us-jan23/

Attachment Q: Electric Vehicle Market Update: Manufacturer Commitments and Public Policy Initiatives Supporting Electric Mobility in the U.S. and Worldwide, ERM for EDF (September 2022).

Attachment R: Vishnu Nair, Sawyer Stone, Gary Rogers, Sajit Pillai. 2022. Medium and Heavy-Duty Electrification Costs for MY 2027- 2030, Roush Industries for Environmental Defense Fund. See http://blogs.edf.org/climate411/files/2022/02/EDF-MDHD-Electrificationv1.6_20220209.pdf

Attachment S: Rachel MacIntosh, Harrison Branner, Kayla Escobar, and Sophie Tolomiczenko, Electric Vehicle Market Update: Manufacturer & Commercial Fleet Electrification Commitments Supporting Electric Mobility in the United States, ERM for EDF (April 2023). https://www.edf.org/sites/default/files/2023-05/Electric%20Vehicle%20Market%20Update%20April%202023.pdf.

Attachment T: Himanshu Saxena, Vishnu Nair, Sajit Pillai, Electrification Cost Evaluation of Class 2b and Class 3 Vehicles in 2027–2030, Roush (May 2023).

Attachment U: U.S. Public Electric Vehicle (EV) Charging Infrastructure Deployment, WSP for EDF (July 2023).

Attachment V: Needell et al., Cell Reports Physical Science 4, 101287 March 15, 2023 https://doi.org/10.1016/j.xcrp.2023.101287.

Attachment W: EV Critical Minerals Projects and Partnerships, EDF (June 2023).

Attachment X: Jimmy O'dea, *Zero-Emissions Technology for Freight: Heavy-Duty Trucks, Tools to Advocate for Zero-Emissions Technology*, Moving Forward Network (2020), http://www.movingforwardnetwork.com/wp-content/uploads/2020/10/MFN_ZeroEmissionToolkit-1.pdf.

Attachment Y: Isenstadt, A., Zifei, Y., Searle, S., German, J., Real World Usage of Plug-In Hybrid Vehicles in the United States, ICCT (2022). https://theicct.org/publication/real-world-phev-us-dec22/

Attachment Z: David Gohlke, Zhou, Yan, Wu, Xinyi, and Courtney, Calista. 2022. "Assessment of Light-Duty Plug-in Electric Vehicles in the United States, 2010 – 2021". United States. https://doi.org/10.2172/1898424. https://www.osti.gov/servlets/purl/1898424.

Attachment AA: John Larsen et al., *A Turning Point for US Climate Progress: Assessing the Climate and Clean Energy Provisions in the Inflation Reduction Act.* 2022. Rhodium Group, https://rhg.com/research/climate-clean-energy-inflation-reduction-act/.

Attachment BB: Sara Baldwin and Robbie Orvis. *Implementing the Inflation Reduction Act: A Roadmap for Federal and State Transportation Policy.* 2022. Energy Innovation, https://energyinnovation.org/wp-content/uploads/2022/11/Implementing-the-Inflation-Reduction-Act-A-Roadmap-For-Federal-And-State-Transportation-Policy.pdf.

Appendix A: EDF Authored or Commissioned Reports and Analytics on Light-Duty ZEVs (as of July 2023)

Author	Title and Link	Description	Release Date
Roush	Alternative Powertrain Pathways for Light-Duty and Class 3 Vehicles for MYs 2024, 2027, and 2035 to Meet Future CO2 Emission Targets	Roush's study looks at the technology, cost, and efficiency of BEV, PHEV and fuel cell powertrains for light-duty and Class 3 vehicles. Given the level of maturity of alternative powertrain technologies, their cost, and incentives like the IRA purchase credits, a significant portion of the light-duty and Class 3 vehicle fleet is primed for transition to alternatives with a significantly lower carbon footprint.	June 2023
WSP	Electric Vehicle Total Cost of Ownership Analysis, Summary Report	WSP performed an analysis for EDF that compares the lifetime costs, over 10 years, of owning and operating select, current BEVs to comparable gasoline vehicles.	July 2023
WSP	U.S. Public EV Charging Infrastructure Deployment, Industry Investment Briefing	Assessment summarizes the existing public charging infrastructure in the U.S., future public charging infrastructure needs based on EPA's proposal, and announced EV charger deployment and investment.	July 2023
EDF	Domestic Critical Minerals Projects and Partnerships	EDF spreadsheet that summarizes investments in the critical minerals supply chain, including new investments and expansion of existing capacities in raw minerals extraction (mining), materials separation and processing, and recycling efforts in the U.S. The review identified 74 domestic mining, processing, and recycling projects and announced investments totaling over $25 billion, including $1 billion funded under the BIL, and $700 million in OEM investments.	June 2023
Roush	Impact of the Inflation Reduction Act of 2022 on Light-duty Vehicle Electrification Costs for MYs 2025 and 2030	Roush detailed, bottom-up assessment of the impact of the IRA on light- and medium-duty BEV costs, including upfront cost, price parity timeline and total cost of ownership. Report demonstrates rapidly declining costs and supports protective EPA standards.	June 2023
Roush	Electrification Cost Evaluation of Light-Duty Vehicles for MY 2030	Roush study to assess the upfront and lifetime costs of light-duty battery electric vehicles relative to traditional internal combustion engine vehicles in the 2030 timeframe, without considering the impacts of the IRA. Earlier referenced IRA analysis builds on this foundation.	May 2023
ERM	Electric Vehicle Market Update	ERM update on the status of manufacturer and commercial fleet electrification commitments.	April 2023

WSP	U.S. Electric Vehicle Manufacturing Investments and Jobs: Characterizing the Impacts of the Inflation Reduction Act After 6 Months.	WSP characterization of the impacts of the IRA after 6 months on investments and jobs. Finding 120 billion in investment; 143,000 new jobs and extensive new EV manufacturing capacity.	March 2023
ERM	Electric Vehicle Market Update	ERM update on the status of the ZEV market.	September 2022
ERM	Electric Vehicle Market Update	ERM analysis on the status of the ZEV market, including automaker and fleet investments and commitments, model availability, cost reductions and federal and state policies and incentives toward electrification.	April 2022
MJ Bradley & Associates	U.S. Light Truck Electrification: Economic and Jobs Impact Study	MJ Bradley study for EDF to evaluate the broad economic and employment impacts related to producing Ford Motor Company's electric F-Series trucks.	November 2021
EDF	California: 100% New Zero Emission Vehicle Sales by 2035 Will Deliver Extensive Economic, Health and Environmental Benefits	EDF analysis that estimates the economic savings and reductions in climate and criteria emissions as a result of all new passenger vehicle sales in California being 100% ZEV by 2035.	May 2021
MJ Bradley & Associates	Electric Vehicle Market Update	MJ Bradley analysis on the status of the ZEV market highlighting manufacturer commitments to ZEV production and increasing model availability of BEVs.	April 2021
EDF	Clean Cars, Clean Air, Consumer Savings:100% New Zero Emission Vehicle Sales by 2035 Will Deliver Extensive Economic, Health and Environmental Benefits to all Americans	EDF analysis that estimates economic savings and reductions in climate and criteria emissions as a result of all new passenger vehicle sales nationwide being 100% ZEV by 2035.	January 2021
EDF	Accelerating to 100% Clean: Zero Emitting Vehicles Save Lives, Advance Justice, Create Jobs	A compilation of health studies related to near roadway air pollution and the benefits of electrification.	August 2020

Appendix B: Results for Leadership Pathway with ACC II sales requirements through 2032

As discussed above in Section III.B.ii, EDF recommends EPA adopt a Leadership Pathway that would allow vehicle manufacturers to comply nationally with Advanced Clean Cars II. EDF's primary recommendation would be create the Leadership Pathway to include ACC II sales requirements through 2035 (ACC II 2035). The results of this analysis are discussed above in the body of the comment. If EPA were to elect only to require sales out through 2032 (ACC II 2032), this pathway would still result in increased benefits relative to EPA's Proposal as well as Alternative 1.

The tables included in Section III.B.ii that display the results of the analysis conducted by EDF are reproduced below but include the results for ACC II 2032 to demonstrate the increase in benefits possible under this pathway.

Table B-1: ZEV Sales as a Function of Total Vehicle Sales						
Model Year	EPA Proposal	EPA Alternative 1	ACC II 2032	ACC II 2032	ACC II 2035	ACC II 2035
	Simulation	Simulation	Regulation	Simulation	Regulation	Simulation
2026	27%	27%	35%	33%	35%	26%
2027	38%	38%	43%	42%	43%	34%
2028	44%	47%	51%	53%	51%	42%
2029	54%	55%	59%	59%	59%	50%
2030	58%	64%	68%	67%	68%	59%
2031	63%	68%	76%	75%	76%	66%
2032	67%	69%	82%	81%	82%	74%
2033	65%	69%	82%	70%	88%	77%
2034	66%	69%	82%	73%	94%	80%
2035	67%	70%	82%	77%	100%	83%

Table B-2: Fleetwide GHG Certification Levels from OMEGA 2 Output (g/mi)				
Model Year	EPA Proposal	EPA Alternative 1	ACC II 2032	ACC II 2035
2026	163	163	151	155
2027	152	151	146	150
2028	131	123	117	128
2029	110	101	103	110
2030	101	82	83	89
2031	92	74	64	73
2032	82	72	49	57
2033	85	73	74	49
2034	82	72	64	42
2035	81	72	50	34

Table B-3: Cumulative GHG and Criteria Pollutant Emission Reductions from Passenger Car and Light Trucks Through 2055 (GHG: million metric tons; Criteria Pollutant: U.S. tons)				
Pollutant	EPA Proposal	EPA Alternative 1	ACC II 2032	ACC II 2035
GHG	(6,375)	(7,171)	(8,722)	(9,727)
PM	(214,189)	(223,417)	(242,028)	(252,088)
NOx	(727,829)	(811,792)	(987,142)	(1,079,758)
SOx	(92,859)	(106,288)	(144,365)	(191,797)
NMOG	(3,228,578)	(3,600,253)	(4,374,631)	(4,645,173)

Table B-4: Cumulative Net Monetized GHG and Criteria Pollutant Benefits from Passenger Car and Light Trucks Through 2055: Net Present Value in 2027 (billion 2021 dollars, discounted @ 3% per year)					
Pollutant	Criteria Pollutant Benefits	EPA Proposal	EPA Alternative 1	ACC II 2032	ACC II 2035
GHG	---	$8,543	$9,516	$11,817	$11,847
Criteria	Wu	$1,321	$1,382	$1,521	$1,501
Criteria	Pope	$2,642	$2,765	$3,048	$3,002
Total	Wu	$9,864	$10,898	$13,338	$13,348
Total	Pope	$11,185	$12,282	$14,864	$14,849

*The similarity of the monetized benefits ACC II 2032 and ACC II 2035 are due to the timing of the ZEV sale increases and some anomalies in the model discussed above