May 31, 2022

Via cleancars@arb.ca.gov

The Honorable Lianne Randolph
Chair
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: Comments from Environmental Defense Fund on Advanced Clean Cars (ACC) II

Environmental Defense Fund (EDF) respectfully submits the following comments and attached documents in support of protective Advanced Clean Cars (ACC) II standards. EDF supports a rigorous and transformative ACC II program that ensures all new light-duty car and truck sales are zero-emission vehicles (ZEVs) by 2035. Our comments highlight the urgent need for a transition to a zero-emitting light-duty fleet in California and the availability of cost-effective ZEV passenger cars and trucks. We thank the Board for its consideration of this information in the development of the final standards.

EDF supports and thanks the California Air Resources Board (ARB) for its leadership in moving forward with these next generation multipollutant standards for passenger vehicles. California standards that achieve 100 percent sales of ZEVs by 2035 will mark a historic and important step in responding to the dual crises of climate change and air pollution and lead the nation toward a zero-emitting future.

With each passing year, the dangers of climate change and health-harming air pollution become more and more clear. This is particularly true in California, which not only faces dire climate change impacts[1] but also suffers from some of the worst air quality in the nation.[2] The South Coast and San Joaquin Valley, for instance, are the only two areas in the United States designated as "extreme" nonattainment for the federal health based ozone standard, and the San Joaquin Valley has the highest fine particulate levels in the nation.[3] And climate change worsens the effects of local pollutants: in addition to a severe increase in deadly wildfires, floods, droughts, and crop losses,[4] climbing temperatures exacerbate the pollution problem and result in more health harming high ozone days.[5] Consequential action must be taken to address this issue—and dramatically reducing transportation sector pollution is particularly essential.

California's transportation sector is the greatest contributor to criteria pollution and greenhouse gas (GHG) emissions in California, accounting for about 80 percent of ozone precursor

emissions and approximately half of statewide GHG emissions, when considering transportation fuel production and delivery.[6] California's light-duty vehicles are responsible for 13 percent of the state's ozone forming nitrogen oxide (NOx) pollution and 28 percent of the state's carbon dioxide (CO2) pollution.[7] And this pollution has a quantifiable impact on human health and life: a recent study by researchers at George Washington University and EDF found that, in the Bay Area alone, more than 2,500 lives are lost and 5,200 children develop asthma every year due to traffic-related air pollution exposure.[8] Thus, ambitious action to reduce emissions from the transportation sector will protect the health of the nearly 40 million residents of California today, and help prevent even more severe climate impacts from increasing in coming decades. Specifically, a rapid shift to ZEVs, ultimately ensuring 100 percent of new vehicles sold are ZEVs by 2035,[9] will reduce harmful pollution and save lives across the state.

Swift and significant reductions in vehicle emissions, and a shift to ZEVs, will protect all Californians. But this action is particularly important because air pollution, and pollution from the transportation sector, does not impact all communities equally. Communities of color and low-income communities suffer disproportionately from harmful vehicle pollution, because these groups constitute a higher percentage of the population near our roads and highways.[10] And these communities already face health disparities, including higher rates of chronic disease and premature death.[11] A recent report by the Moving Forward Network found that, on average, Asian and Black Americans bear a $PM_{2.5}$ pollution burden from cars, trucks and buses that is 56 and 44 percent higher, respectively, than white Americans.[12] According to the American Lung Association's 2022 State of the Air report, people of color are 3.6 times more likely to breathe the most polluted air when compared to white people.[13] An EDF analysis of the Bay Area study data referenced above found that neighborhoods with higher percentages of residents of color experienced double the rate of asthma from NO_2—a pollutant often used as a marker for transportation-related pollution.[14] Another recent study found that Black Americans are exposed to 21 percent more fine particle pollution compared to average concentrations.[15] The study concludes that highway vehicles are often among the largest sources of this disparity and that the disparity is systemic, holding for nearly all major sectors, as well as across states and urban and rural areas, income levels, and exposure levels.[16] The study also found that because of a legacy of racist housing policy and other factors, racial-ethnic exposure disparities have persisted even as overall pollution exposure has decreased.[17] Eliminating harmful pollution from the transportation sector is a critical measure that can help to protect public health, particularly for the communities most impacted by this pollution.

EDF agrees with ARB that deep reductions from the light-duty fleet are required to address the serious health harms from vehicles operating in communities across California. EDF also agrees that the path to achieving the needed long-term reductions in climate and air pollution is a full transition to ZEVs. A recent EDF analysis found that if all new cars, SUVs, and passenger trucks sold in California are zero-emitting starting by 2035, as ARB has proposed, the state could:[18]

- Prevent up to 7,406 premature deaths in total by 2050
- Eliminate more than 1.2 billion tons of climate pollution by 2050
- Significantly reduce the smog-forming and particulate pollution that disproportionately burdens communities of color and low-income communities

- Save Californians who buy a new ZEV in 2035 more than $13,000 over the life of the vehicle, compared to a gas-powered car
- Save the state of California $194 billion cumulatively by 2050 in health and economic benefits

These significant economic savings would be even higher if the analysis reflected today's elevated gasoline prices. Our report further substantiates the need for an urgent transition to zero-emitting passenger vehicles. We respectfully urge the Board to consider this and other attached analyses and the following recommendations in the development of a comprehensive ACC II program that addresses the serious health burden faced by Californians, especially those living and working near roads and highways. In particular, our comments urge the Board to (I) strengthen the proposed equity provisions, (II) address the feasibility of the Board's proposal, including even greater levels of ZEV ambition in 2030, (III) urge ARB to reduce its projected costs both to account for future ICEV controls and the latest ZEV costs projections – both of which underscore ARB's cost estimates are substantially overstated; and (IV) to include class 2(b) and 3 vehicles within the program.

I. The Equity Provisions of the Proposal Must Be Strengthened

ARB claims in the ISOR that the proposal "will reduce exposure to vehicle pollution in communities throughout California, including in low-income and disadvantaged communities that are often disproportionately exposed to vehicular pollution."[19] EDF fully supports this objective and respectfully urges the Board to strengthen the proposal to deliver cleaner vehicles and air to Disadvantaged Communities. In particular, the equity provisions in the proposed rule are voluntary and may never be utilized by most carmakers, thereby failing to guarantee emissions reductions in communities historically overburdened with transportation pollution. We urge ARB to adopt equity provisions that follow the framework recommended by environmental justice communities and allied stakeholders including EDF.[20]

These groups, including EDF, have recommended that the Board condition the availability of other credits on OEM participation in the equity programs. For example, the final rule could include a provision that the use of certain credits only be available to manufacturers that voluntarily utilize the equity program credits. Such a provision would not be mandatory and would not alter manufacturers' core compliance obligations. But a credit restriction would provide a stronger incentive for OEMs to meaningfully participate in the equity programs, thereby ensuring that more ZEVs are operating in Disadvantaged Communities. We urge ARB to craft equity provisions to ensure that there is no trade-off between ZEV access in Disadvantaged Communities and overall ZEV sales. We believe this would strengthen both the equity components and the environmental integrity of the rule, ensuring the intended air quality and climate benefits are achieved.

Ultimately, we recognize that, even with the strengthened provisions we and others have recommended the Board adopt, much more must be done to ensure swift and substantial ZEV deployment in Disadvantaged Communities and that the health and economic benefits of these

vehicles are equitably shared. We urge all stakeholders to pursue additional solutions that deliver these urgently needed benefits.

II. The Board's Proposal is Feasible and the Rapidly Accelerating Market for ZEVs Support Even Greater Levels of Ambition

EDF supports a rigorous and transformative ACC II program that ensures all new passenger vehicle sales are ZEVs by 2035, and, as reflected in the joint environmental letter to ARB, we believe even greater levels of ambition are possible, including at least 75 percent new ZEV sales by 2030. As noted by ARB in the Initial Statement of Reasons (ISOR), staff report protective and durable ZEV standards are reasonable and feasible based on U.S. and global auto industry trends, which include rapidly increasing availability of more diverse and more capable ZEV models, projected near-term cost parity between ZEV and internal combustion engine vehicles, accelerating U.S. ZEV sales, and dramatic increases in manufacturer investments to meet projected future demand. The global auto industry has embraced the zero-emission transition even as the U.S has not yet adopted protective standards similar to those in the other major global markets of China and Europe. The proposed ZEV sales requirements of ACC II will begin to align U.S. policy with policies in these markets and will reinforce existing market trends.

In 2016, there were only about 30 ZEV models available for purchase in the US.[21] By the 2021 model year, available ZEVs had more than doubled to 60 models. Based on firm model announcements from manufacturers, available ZEV models are projected to almost double again by model year 2025, when more than 110 models will be available for purchase.[22] This significant increase in US ZEV model availability mirrors global trends; since 2018 the number of electric car models has more than doubled globally, to 450 in 2021.[23] This trend is expected to continue after 2025; together Nissan, GM, Hyundai, and KIA expect to launch an additional 76 BEV models by 2030, while Volvo plans to sell only electric cars by 2030. Stellantis (Jeep, RAM, Dodge) plans to have battery-electric options for all models by 2030, while VW plans to sell only zero-emission vehicles in all major markets by 2040.[24]

ZEV purchase options have become significantly more diverse in the last 5 years. In 2016, virtually all ZEVs available in the US were small sedans. By 2021, 22 percent of available ZEV models were mid-size cars, while 18 percent were large cars, and 57 percent were SUVs.[25] From model year 2022 through 2024, four pickup trucks, an additional five SUVs, and one van will be launched in the US.[26] This increasing diversity of the ZEV fleet matches buying patterns of US consumers, which will increase the percentage of new vehicle sales that can be ZEV and enhance customer choice.

Increased ZEV choices have also been accompanied by increased capabilities that allow ZEVs to be used by more drivers. Globally, the sales-weighted average range of plug-in vehicles (BEV and PHEV) has increased from about 70 miles for vehicles sold in 2010 to almost 220 miles for vehicles sold in 2021.[27] The average range of new U.S. BEV models was 248 miles for those launched in 2021 and is almost 300 miles for models launching in 2022.[28] In model year 2022, there are two EVs available in the US with EPA estimated range greater than 400 miles.[29] GM estimates that their new Ultium battery, which will be produced in a joint venture with LG

Chemical beginning in 2024, will have twice the energy density of current batteries and will allow for maximum range of 500-600 miles.[30]

Battery charging speed has also increased. The average maximum charging rate of BEVs launched in 2019 was 119 kW, with only 38 percent of models capable of rates between 100 kW and 250 kW. By 2021, 53 percent of BEV models launched had maximum charging rates between 100 kW and 250 kW, and the average for all models was 140 kW.[31]

As noted below, at the same time that U.S. consumers are being offered a greater variety of more capable ZEV options, ZEV prices are also falling, primarily due to lower battery prices. According to BloombergNEF's (BNEF) annual battery price survey, average battery pack prices fell 89 percent between 2010 and 2020. Battery prices fell another 6 percent from 2020 to 2021, reaching an average price of $132/kWh. BNEF projects that prices will fall to $80/kWh in 2026 and $60/kWh in 2029. Based on these battery price projections many auto industry analysts and government researchers agree that EVs and internal combustion engine vehicles will reach life-cycle cost parity between 2023 and 2025.[32] And, as noted below in more detail, recent preliminary findings from Roush are consistent with these conclusions.

U.S. consumers have responded to the increased availability and capability of zero-emission vehicles. Mirroring global trends, U.S. ZEV sales have begun to accelerate in the last two years despite lingering supply chain problems due to COVID and the automotive chip shortage. In 2021, EV sales more than doubled compared to 2020, rising to 630,000 vehicles, a 4.5 percent market share nationally. EV sales remained strong in the first quarter of 2022 – up 60 percent nationally compared to the first quarter of 2021.[33] In the first quarter of 2022, California ZEV sales accounted for 16.3 percent of all car and light truck sales, compared to 4.6 percent nationally. This was an increase from the 10.8 percent ZEV sales share in California in the first quarter of 2021.[34]

U.S. consumers have shown particularly strong demand in response to the introduction of electric pickups. Reservations for the 2022 launch of the Ford F150 Lighting neared 200,000 vehicles by the end of 2021, causing Ford to double annual production capability to 160,000 units and this month Ford began delivering F150 Lightnings to both fleet and retail customers.[35] The 2022 GMC Hummer EV sold out in 10 minutes. Reservations for the 2023 Chevy Silverado EV totaled 110,000 vehicles in the first month.[36]

Automakers are projecting continued strong growth in ZEV sales in all markets, including the U.S., and are making significant investments to meet the demand. World-wide, car makers have announced investments of over $500 billion through 2030 to develop and manufacture new electric models.[37] This includes $9.8 billion to build, convert, or expand U.S. production facilities to manufacture BEVs, and $29 billion to increase U.S. manufacturing capacity for advanced vehicle batteries.[38] Just in the last year GM announced a 75 percent increase in global EV investments through 2025 (to $35 billion), Ford doubled their EV investment commitment through 2026 (to $50 billion), Hyundai tripled their investment commitment (to $23.4 billion), Stellantis committed $35.5 billion to their electrification strategy, and Nissan committed over $17 billion to their electrification strategy.[39]

These significant automakers investments will also lead to jobs both in California and states across the country.[40] In 2020, electric and hybrid electric vehicle employment grew more than six percent across the U.S., adding over 12,000 new jobs, the biggest increase of any clean energy category. California is the nation's leader in clean vehicle jobs.[41] Adopting ACC II will drive clean vehicle development and manufacturing and the well-paying jobs that come with that. And the ACC II program will support consumer demand and jobs across the country, including in states like Michigan and Kentucky. For instance, GM plans to increase its investment at its Michigan facilities, including factory ZERO in Detroit, to produce electric vehicles and amounting to over 7,000 new jobs.[42]Ford and SK Innovation are partnering to build BlueOval City manufacturing plant in Stanton, TN that will generate 6,000 new jobs and the BlueOval SK BatteryPark in Glendale, Kentucky that will create another 5,000 new jobs.[43]

Automaker investments will also support dramatic increases in U.S. ZEV sales in the next 10 years. VW aims for 50 percent of U.S. sales to be BEV by 2030, while Nissan and Honda have 40 percent BEV sales goals in 2030. GM projects that in 2030 it will have the capacity to produce one million BEVs per year in North America. [44] Other major manufacturers such as Ford, Stellantis, Toyota, Nissan and BMW have not released U.S. projections, but individually expect that by 2030 BEVs will be between 40 and 70 percent of their total sales globally. Volvo, Mercedes, Honda, VW, and GM all project that by 2035 between 80 percent and 100 percent of their global sales will be BEV.[45] Driving additional ZEVs into the market will also allow vehicles to flow into the used secondary market, making ZEVs more accessible to lower income drivers.

All these market trends support the conclusion that the ZEV sales requirements in the ACC II proposal and even more substantial deployment in the 2030 timeframe are both reasonable and achievable in the California market. As noted above, the ZEV sales share in California is already almost four times the national average due to California's significant support for and investment in ZEV deployment. ACC II will further reinforce California's leading position in U.S. ZEV sales while leveraging additional growth in the national ZEV market.

III. ARB has Overestimated ZEV Costs, Which are Rapidly Declining

According to a recent ERM report, many analysts and industry experts agree that for EVs to become cost competitive with ICE vehicles (based on total cost of ownership without considering tax or other incentives) battery pack prices must drop to around $100/kWh.[46] The cost of battery packs has already fallen dramatically, from over $1,000/kilowatt-hour (kWh) in 2010 to approximately $132/kWh in 2021 – prices fell a full 6 percent between 2020 and 2021.[47] Most analysts project that battery pack prices will continue to fall, reaching $100/kWh between 2023 and 2025 and $61-72/kWh by 2030. Auto manufacturers have offered similar projections.[48] And BNEF predicts prices of batteries to reach $80/kWh by 2026 and $60/kWh in 2029.[49] A preliminary analysis conducted by Roush Industries for EDF (explained in more detail below) also found similar battery pack cost projections based on a rigorous literature review.[50]

With costs declining there are already more affordable models on the market. In 2022, there will be three EV models available for under $30,000 (MSRP) with a driving range of over 100

miles.[51] There will be even more models with a net cost of under $30,000 when current federal, state, and local incentives are factored in. And the Ford F-150 Lightning pickup truck is available starting at just under $40,000.[52] In addition to these declining purchase prices, EVs save consumers substantial amounts in avoided fuel costs. A recent National Renewable Energy Laboratory (NREL) and Idaho National Laboratory (INL) study concluded that EVs could save drivers as much as $14,500 in fuel costs over 15 years compared to ICE vehicles.[53] And an EDF analysis, using the U.S. Department of Energy's Fuel Savings Calculator and based on March 2022 gas prices, compared the 2021 Hyundai Kona Electric with the 2021 Hyundai Kona (FWD, 2.0 L, 4cyl).[54] The study concluded that consumers who own the Kona Electric will save $5,670 in avoided fuel costs over the lifetime of the vehicle. Even with lower gasoline prices (in line with what was seen in March 2021), consumers who own a Kona Electric will save $5,360 in avoided fuel costs during the lifetime of the vehicle, compared to its gasoline counterpart.

i. <u>New Roush analysis finds BEV costs nearing parity with ICE</u>

Preliminary results from an analysis currently being conducted by Roush Industries for EDF looked at the incremental upfront cost of buying a BEV over a gasoline or diesel counterpart in 2030 and 2035.[55] The analysis also estimated the total cost of ownership (TCO) of BEVs and internal combustion engine vehicles (ICEVs) and TCO price parity. The TCO estimates consider vehicle, powertrain, fuel/electricity, maintenance, and BEV charger costs. Roush considered the base and premium model of 6 different subclasses of vehicles – compact and midsize car; small, medium and large SUV; and pickup truck.

For the fleet as a whole, a wide range of vehicle types will see savings. Roush found that the incremental powertrain cost of purchasing a BEV instead of an ICEV in 2030 will be lower for almost all vehicle subclasses and packages. When the Roush projections are combined on a fleetwide average basis, the incremental powertrain cost of purchasing a BEV is cheaper than an ICEV in both 2030 and 2035, regardless of the choice of ICEV technology.[56]

Roush also found that for every vehicle subclass and segment analyzed, it is less expensive to own a BEV purchased in 2030 over the life of the vehicle than it is to own a gasoline or diesel vehicle. And in almost every case there was TCO parity with ICEVs at the time of purchase in 2030. The payback for large premium SUV BEVs is estimated to take 2 years and the payback for premium pickup BEVs is one year after purchase in 2030. For a full summary of the preliminary results of this analysis see Attachment A.

These preliminary results, which are expected to be finalized shortly, reinforce the fact that ARB's proposal overstates the costs of BEVs and that in fact a rapid transition to BEVs is not only cost-feasible but will provide significant savings to consumers within the first few years of the program.

ii. <u>ARB must include updated delete costs</u>

As EDF has stated in previous comments, it is important that ARB account for the full cost of future GHG controls on ICEVs.[57] We specifically recommended that ARB add these additional costs to the ICEV delete costs when calculating the incremental cost of a ZEV. Failing to do so

biases the cost projections for BEVs on the high side. For MYs 2027 and beyond, ARB has assumed no further increase in the stringency of GHG standards for ICEV, and thus no added cost of compliance, even though available technologies can deliver additional reductions from these vehicles, and it is likely that they will deploy them. With this proposal, California is moving toward ensuring all new vehicles sold by 2035 are zero-emitting, and so, while neither EPA nor California have yet adopted post-2026 greenhouse gas standards, it is unreasonable to compare ICEVs with no additional greenhouse gas controls to ZEVs in the 2030 timeframe. ARB must correct this error to avoid overestimating the cost of BEVs.

EDF submitted a new analysis to the ACC II docket in February that quantifies the additional ICEV delete costs beyond 2026 that would result from applying available GHG control technologies to post-2026 vehicles.[58] We are attaching the analysis to these comments as well. See Attachment C.

Our modeling concludes that when all available ICEV control technology is employed, there is a $3,350 per vehicle incremental compliance cost over ARB's MY 2026 compliance costs for passenger cars and a $2,886 incremental cost for light trucks. This is in addition to the $965 GHG compliance cost that ARB modeled for MY 2025[59] vehicles in the SRIA.[60] For context, if ICEVs are required to adopt these additional GHG control technologies by 2030, the added delete cost of $3,350 per vehicle for passenger cars would be more than twice ARB's current estimated incremental cost of $1,366 for BEV300 small cars in 2030.[61] In other words, simply incorporating these additional ICEV costs without addressing any of the other issues we have raised with ARB's ZEV cost assumptions, including the rapidly declining costs Roush identified above, would result in ZEVs reaching cost parity with ICEVs much earlier in the program and possibly well before 2030. To accurately project the cost of ZEV sales requirements, we strongly urge ARB to include these additional delete costs in its final analysis.

IV. ARB Should Include Class 2b and 3 Vehicles in ACC II ZEV Program

EDF strongly encourages ARB to include class 2b and 3 vehicles in the light-duty ZEV standards. These vehicles are among the fastest growing classes of vehicles and are a growing contributor to harmful emissions. And the technology is available to accelerate their transition to ZEVs in the same timeframe as passenger vehicles. ARB's ACT regulation requires only 55 percent of new class 2b/3 vehicle sales to be ZEVs in 2035. Including these vehicles in ACC II would result in twice the number of ZEV pick-ups, vans and delivery vehicles on the road by 2035 than would otherwise occur if they remain subject to the ACT regulation.

Light-duty trucks and class 2b and 3 trucks have very similar in use patterns as well as engine and transmission configurations. In fact, many class 2b trucks are simply different configurations or larger versions of a manufacturer's class 2a model with engines and transmissions that can be nearly identical in configuration. According to EPA's MOVES3 model, more than three-fourths of all Class 2b and 3 vehicle sales are made to individuals, meaning they are not used as commercial vehicles like Class 4-8 vehicles.[62] EPA regulates criteria emissions from class 2b and 3 vehicles under the light-duty Tier 3 rulemakings because "Most are built by companies with even larger light-duty truck markets, and as such they frequently share major design

characteristics and potential emissions control technologies with their LDT counterparts."[63] Moreover, class 2b and 3 vehicles are currently chassis certified by EPA in the same way as light-duty vehicles so integrating them into the light-duty ZEV program is also consistent with these compliance demonstrations.[64] And, EPA is planning to include class 2b and 3 vehicles in its next generation light-duty vehicle standards.[65]

Their similarities to light-duty trucks make class 2b and 3 vehicles prime candidates for early ZEV adoption. Indeed, Ford, the world's largest manufacturer of cargo vans, has already started producing and shipping its e-Transit all electric cargo van for last-mile urban deliveries, backed with a multi-billion dollar investment.[66] And General Motors launched BrightDrop, a new business that will produce the EP1 and the EV600, zero-emitting advanced freight vehicles for last mile delivery.[67] As operation of class 3 last-mile delivery vehicles is rapidly increasing, it is vital that these vehicles be prioritized for the transition to zero-emission. We strongly urge ARB to include class 2b and 3 vehicles in the ACC II program.

Conclusion

We appreciate ARB's consideration of these comments and look forward to ARB's adoption of a historic final rule that will achieve the climate and air pollution benefits that Californians urgently need.

Respectfully submitted,

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Attachments:

Attachment A: Preliminary LDV Electrification Study by Roush Advanced Engineering for EDF (March 24, 2022)

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

Attachment C: Comments from Environmental Defense Fund on Advanced Clean Cars (ACC) II delete costs, submitted to Sustainable Transportation and Community Division (February 24, 2022)

[1] *See, e.g.*, California's Fourth Climate Change Assessment, California's Changing Climate 2018: A Summary of Key Findings from California's Fourth Climate Change Assessment (California is "one of the most 'climate-challenged' regions of North America."), http://www.climateassessment.ca.gov/state/docs/20180827-StatewideSummary.pdf; U.S. GLOB. CHANGE RSCH. PROGRAM, 2 IMPACTS, RISKS AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT (David Reidmiller et al. eds., 2018) (impact of climate change in exacerbating California's recent record-breaking fire seasons, multi-year drought, heat waves, and flood risk, and explains the particular threat from sea level rise and ocean acidification because California has "the most valuable ocean-based economy in the country."), https://nca2018.globalchange.gov/; Declaration of Elizabeth Sheehle at B-019- B-024, *Union of Concerned Scientists v. NHTSA* (D.C. Cir. No. 19-1230) (Chief of the Research Division of the California Air Resources Board discussing climate change impacts on California), https://www.edf.org/sites/default/files/71_NGOs_and_States_Statutory_Addendum_and_Standing_Declarations_11-24-20.pdf; Declaration of Jay Chamberlian at B-27-B-32, *Union of Concerned Scientists v. NHTSA* (D.C. Cir. No. 19-1230) (Chief of the Natural Resources Division of the California Department of Parks and Recreation discussing impacts of climate change on California's state parks, https://www.edf.org/sites/default/files/71_NGOs_and_States_Statutory_Addendum_and_Standing_Declarations_11-24-20.pdf.

[2] *See* American Lung Association, *State of the Air* at 16 (2022), https://www.lung.org/getmedia/74b3d3d3-88d1-4335-95d8-c4e47d0282c1/sota-2022.pdf.

[3] U.S. EPA, NONATTAINMENT AREAS FOR CRITERIA POLLUTANTS (GREENBOOK), https://www.epa.gov/green-book. *See also* ENVIRONMENTAL DEFENSE FUND, CALIFORNIA: 100% NEW ZERO-EMISSION VEHICLE SALES BY 2035 WILL DELIVER EXTENSIVE HEALTH, ENVIRONMENTAL AND ECONOMIC BENEFITS (May 2021) at 4. https://blogs.edf.org/climate411/files/2021/05/Final-Combined-CA-ZEV-Report-5.4.21.pdf

[4] *See, e.g.*, *supra* note 1.

[5] The National Climate Assessment concluded that, "Earth's climate is now changing faster than at any point in the history of modern civilization" and that "the evidence of human-caused climate change is overwhelming and continues to strengthen, that the impacts of climate change are intensifying across the country, and that climate-related threats to Americans' physical, social, and economic well-being are rising." U.S. GLOB. CHANGE RSCH. PROGRAM, 2 IMPACTS, RISKS AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT (David Reidmiller et al. eds., 2018), 1515 pp. doi: 10.7930/NCA4.2018.

[6] ISOR at 4.

[7] ARB, Advanced Clean Cars (ACC) II Workshop (May 6, 2021). https://ww2.arb.ca.gov/sites/default/files/2021-05/acc2_workshop_slides_may062021_ac.pdf

[8] Veronica Southerland et. al., *Assessing the Distribution of Air Pollution Health Risks within Cities: A Neighborhood-Scale Analysis Leveraging High-Resolution Data Sets in the Bay Area*, 129 CALIFORNIA. ENV. HEALTH PERSP. 1, 9 (Mar. 2021), https://ehp.niehs.nih.gov/doi/10.1289/EHP7679.

[9] CALIFORNIA EXECUTIVE ORDER N-79-20, https://www.gov.ca.gov/wpcontent/uploads/2020/09/9.23.20-EO-N-79-20-text.pdf.

[10] Gregory M. Rowangould, *A Census of the US Near-Roadway Population: Public Health and Environmental Justice Considerations*, 25 TRANSPORTATION RESEARCH PART D 59, 61 (2013), https://www.sciencedirect.com/science/article/pii/S1361920913001107.

[11] National Academies of Sciences, *Communities in Action: Pathways to Health Equity* (2017), https://www.nap.edu/catalog/24624/communities-in-action-pathways-to-health-equity.

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

[13] *See* American Lung Association, *State of the Air* at 11(2022), https://www.lung.org/getmedia/74b3d3d3-88d1-4335-95d8-c4e47d0282c1/sota-2022.pdf.

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

[15] Christopher W. Tessum et. al, *PM2.5 Polluters Disproportionately and Systemically Affect People of Color in The United States*, SCIENCE ADVANCES, (Apr. 2021) at 2. https://advances.sciencemag.org/content/7/18/eabf4491

[16] *Id.* at 3.

[17] *Id.*
[18] EDF. 2021. *California 100% new zero-emission vehicles sales by 2035 will deliver extensive health, environmental and economic benefits*. http://blogs.edf.org/climate411/files/2021/05/Final-Combined-CA-ZEV-Report-5.4.21.pdf
[19] ISOR at 6.
[20] Letter from 36 environmental stakeholders to Chair Lianne Randolph and members of the Board re: Proposed Advanced Clean Cars II Rule (May 31, 2022).
[21] E. Bibra, et al, *Global EV Outlook 2022, Securing supplies for an electric future*, International Energy Agency, May 2022.
[22] Rachel MacIntosh, Sophie Tolomiczenko, Grace Van Horn. April 2022. *Electric Vehicle Market Update: Manufacturer Commitments and Public Policy Initiatives Supporting Electric Mobility in the U.S. and Worldwide*, ERM for EDF, Version 6. ("ERM Market Update 2022") Attachment B.
[23] E. Bibra, et al, *Global EV Outlook 2022, Securing supplies for an electric future*, International Energy Agency, May 2022. ("Global EV Outlook 2022")
[24] ERM Market Update 2022.
[25] Global EV Outlook 2022.
[26] ERM Market Update 2022.
[27] Global EV Outlook 2022.
[28] Bloomberg New Energy Finance*, Zero-Emission Vehicles Factbook, A BloombergNEF special report prepared for COP26*, November 10, 2021
[29] U.S. Department of Energy, www.fueleconomy.gov; these vehicles are the Lucid Air and Tesla Model S
[30] ERM Market Update 2022.
[31] Bloomberg New Energy Finance*, Zero-Emission Vehicles Factbook, A BloombergNEF special report prepared for COP26*, November 10, 2021
[32] ERM Market Update 2022.
[33] Global EV Outlook 2022.
[34] J. Hill, *Tesla dominates first quarter EV sales in California*, the Driven, May 3, 2022, https://thedriven.io/2022/05/03/tesla-dominates-first-quarter-ev-sales-in-california/
[35] F. Lambert*, Ford starts customer deliveries of the F-150 Lightning electric pickup truck*, electrek, May 26, 2022. https://electrek.co/2022/05/26/ford-starts-customer-deliveries-f-150-lightning-electric-pickup-truck/
[36] ERM Market Update 2022.
[37] *Id.*
[38] *Id.*
[39] *Id.*
[40] E2. 2021.*Clean Jobs America 2021*. https://e2.org/wp-content/uploads/2021/04/E2-2021-Clean-Jobs-America-Report-04-19-2021.pdf
[41] *Id.*
[42] General Motors, "GM to Invest $300 Million, Add 400 Jobs at Michigan Plant for New Chevrolet Electric Vehicle." (Mar. 12, 2019). https://media.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2019/mar/0322-orion.html#:~:text=%E2%80%94%20General%20Motors%20is%20investing%20%24300,jobs%20to%20the%20Orion%20plant; General Motors "Factory ZERO Becomes First U.S. Auto Plant to Install 5G Technology," (Nov. 19, 2020). https://media.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2020/nov/1120-factory0-evsite.html.
[43] Ford, "Ford to lead American's Shift to Electric Vehicles with New Mega Campus in Tennessee and Twin Battery Plants in Kentucky; $11.4B Investment to create 11,000 jobs and power new lineup of Advanced EVs." (Sept. 27, 2021). https://media.ford.com/content/fordmedia/fna/us/en/news/2021/09/27/ford-to-lead-americas-shift-to-electric-vehicles.html
[44] ERM Market Update 2022.
[45] *Id.*
[46] *Id.*
[47] *Id.*
[48] *Id.*
[49] McKerracher, Colin, "Hyperdrive Daily: The EV Price Gap Narrows," Bloomberg (May 25, 2021). https://www.bloomberg.com/news/newsletters/2021-05-25/hyperdrive-daily-the-ev-price-gap-narrows

[50] Himanshu Saxena, Sawyer D. Stone, Vishnu Nair, Sajit Pillai, "LDV Electrification Study," Roush Advanced Engineering for EDF (March 24, 2022) Slide 35. Attachment A.
[51] ERM Market Update 2022.
[52] https://www.kbb.com/car-news/ford-f-150-lightning-pricing-announced/
[53] National Renewable Energy Laboratory (NREL). "News Release: Research Determines Financial Benefit from Driving Electric Vehicles." 22 Jun. 2020, https://www.nrel.gov/news/press/2020/research-determines-financial-benefit-from-driving-electric-vehicles.html.
[54] Assuming residential electricity rates for charging, 10-year vehicle lifetime, 15,000 miles driven per year, and 55 percent city driving. National average gas price as of March 11, 2022. National average electricity price for residential customers as of latest EIA report for December 2021. ERM Market Update 2022.
[55] Himanshu Saxena, Sawyer D. Stone, Vishnu Nair, Sajit Pillai, "LDV Electrification Study," Roush Advanced Engineering for EDF (March 24, 2022). Attachment A.
[56] Fleet assumed to consist of 75% "base" and 25% "premium" vehicles and 20.5% small sedans, 20.5% mid-sized cars, 26% small SUVs, 11% medium SUVs, 11% large SUVs and 11% pickups. ICEV technology ranged from an Atkinson engine without hybridization to strong hybrids.
[57] Comments from Environmental Defense Fund on Advanced Clean Cars (ACC) II at 4 (June 11, 2021).
[58] Comments from Environmental Defense Fund on Advanced Clean Cars (ACC) II, submitted to Sustainable Transportation and Community Division (February 24, 2022). https://www.edf.org/sites/default/files/content/Letter-ARB-EDF-Analysis-Impact-Post-2026-GHG-Standards-ACCII-ICEV-Costs.pdf. Attachment C.
[59] In the SRIA, ARB references cost compliance estimates for MY 2026 ("GHG emissions cost estimates in 2026MY from ACC I") and for MY 2025 ("the GHG compliance costs from the Advanced Clean Cars I LEV III GHG are also avoided with ZEV technologies. These costs are determined to be $965 in 2021 dollars for 2025 model year vehicles and beyond and are applied to all ZEV technology combinations from 2025 to 2035."). Because the MY that ARB utilized in its compliance cost estimates is unclear, we have used MY 2026 throughout this comment.
[60] SRIA at 60, Table 25.
[61] SRIA at 157, Table A.1.
[62] EPA MOVES3. https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves
[63] 79 Fed. Reg. 23414, Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards (April 28, 2014).
[64] Class 2b and 3 diesel pickup trucks and vans have an option to certify using the chassis dynamometer test procedure. As an alternative, some engines used in class 2b and 3 diesel trucks are certified as engines on an engine dynamometer. Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards. 2014. Final RIA, Page 1-9.
[65] White House, "Executive Order on Strengthening American Leadership in Clean Cars and Trucks," (August 5, 2021). https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-cars-and-trucks/
[66] Ford Media Center, "Ford Pro Begins Shipping Electric E-Transit to Customers, Works to Boost Production," (Feb. 8, 2022). https://media.ford.com/content/fordmedia/fna/us/en/news/2022/02/08/2022-e-transit-production.html
[67] Jamie LaReau, "GM startup to make new electric truck for FedEx, other delivery services," *Detroit Free Press* (Jan. 12, 2021). https://www.freep.com/story/money/cars/general-motors/2021/01/12/gm-bright-drop-delivery-ev-delivery/6625884002/