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February 25, 2021

Northeast States for Coordinated Air Use Management
89 South Street, Suite 602
Boston, MA 02111

To Whom It May Concern,

The undersigned organizations continue to be encouraged by the forward progress made by entities participating in the Multi-State Zero-Emission Truck and Bus initiative organized by the Northeast States for Coordinated Air Use Management (NESCAUM) in advancing zero-emission trucks and buses. It is inarguable that a suite of policies is necessary to transition to zero-emission trucks and buses on a timeline commensurate with the public health and climate impacts caused by transportation and in a way that maximizes benefits to the environment, the grid, and to communities most impacted by pollution while minimizing cost. However, this letter focuses on the importance of adopting standards passed by California in 2020 to increase the availability of zero-emission trucks and reduce emissions from combustion trucks. By including the Advanced Clean Trucks (ACT) rule and the Heavy-Duty Omnibus (HDO) rule in the model action plan, NESCAUM can help ensure that states are demonstrating strong commitments to achieving a zero-emission transportation sector. State leadership on these issues is critical – especially in the absence of protective national standards. These programs are needed to protect public health and the environment, help mitigate climate change, and stimulate the economy. The Biden Administration also has the opportunity to adopt federal standards that help secure substantial emission reductions. We offer these comments with that context in mind.

We believe a suite of policies is necessary to achieve the goals set by the 15 states and Washington, DC in their Memorandum of Understanding (MOU). The ACT rule and the HDO rule are foundational policies that can be complemented with a range of policies to realize a wide-scale transition to zero-emission vehicles. Measures such as a fleet rule, incentives to defray or help finance the relative higher purchase price of zero-emission trucks and buses, and assistance with the cost and deployment of infrastructure will be needed. This is not a task solely for one agency or department – true change requires an "all hands on deck" approach that includes utility commissions, relevant transportation and environmental agencies, utilities, private companies, and others. The following comments address misconceptions and frequently asked questions about the ACT and HDO rules that have come to our attention in recent weeks.

The transition to zero-emission vehicles must reflect the urgency of the health crisis caused by transportation pollution.

Despite making up only around 10 percent of the nation's vehicles, heavy-duty vehicles (HDVs) are responsible for 28 percent of climate change-causing emissions from the transportation sector, as well as 45 percent of on-road nitrogen oxide (NOx) emissions, and 57 percent of on-road, direct fine particulate matter ($PM_{2.5}$) emissions.[1] Forty percent of NOx pollution is from the transportation sector.[2] NOx contributes to ozone and the formation of secondary particulate matter (PM), which, along with primary PM emissions (elemental black carbon), are associated with an increased risk of premature deaths, hospitalization, and emergency room visits. Numerous respiratory and cardiovascular diseases are linked to these pollutants, such as asthma, decreased lung function, heart attacks, and lung cancer.[3]

Reducing NOx and PM emissions is vital for improving public health and meeting the federal National Ambient Air Quality Standards for ozone and $PM_{2.5}$. Cleaning up HDV emissions is long overdue for the communities living adjacent to highways, ports, and freight hubs that disproportionately suffer from harmful air pollution. The communities most burdened by this pollution are predominantly communities of color and low-income communities.[4] A report by the Union of Concerned Scientists confirms this across the country, stating that Asian Americans, African Americans, and Latinos are exposed to 34 percent, 24 percent, and 23 percent more $PM_{2.5}$ pollution (respectively) from cars, trucks, and buses than the national average."[5]

To put a finer point on it, allowing transportation and freight to continue with the status quo will have a detrimental impact on health in communities, particularly those in close proximity to highways and other major sources of transportation pollution. Indeed, a new study estimates that more than 20,000 people die prematurely every year as a result of the health burden from motor vehicle pollution on our roads, demonstrating the severity of this sector on human health.[6] States must act now to mitigate these vehicles' impact and ensure that environmental justice communities are prioritized and equipped to take part in infrastructure and vehicle deployment programs.

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[1] Union of Concerned Scientists, *Ready for Work: Now is the Time for Heavy-Duty Electric Vehicles* (Dec. 2019) at 2, https://www.ucsusa.org/sites/default/files/2019-12/ReadyforWorkFullReport.pdf.
[2] ChargEVC, *Full Market Vehicle Electrification in New Jersey* (Oct.,2020), http://www.chargevc.org/wp-content/uploads/2020/10/ChargEVC-Full-Market-Electrification-Study-FINAL-Oct-7-2020.pdf
[3] American Lung Association, *Health Effects of Ozone and Particle Pollution*, http://www.stateoftheair.org/health-risks.
[4] Union of Concerned Scientists, *Factsheet: Inequitable Exposure to Air Pollution from Vehicles in the Northeast and Mid-Atlantic*, https://www.ucsusa.org/sites/default/files/attach/2019/06/Inequitable-Exposure-to-Vehicle-Pollution-Northeast-Mid-Atlantic-Region.pdf.
[5] Union of Concerned Scientists, *Ready for Work: Now is the Time for Heavy-Duty Electric Vehicles* (Dec. 2019) at 2, https://www.ucsusa.org/sites/default/files/2019-12/ReadyforWorkFullReport.pdf.
[6] Environmental Defense Fund, *Accelerating to 100% Clean: Zero Emitting Vehicles Saves Lives, Advance Justice, Create Jobs* (Aug. 27, 2020) at 2, https://www.edf.org/sites/default/files/documents/TransportationWhitePaper.pdf.

Allowing transportation and freight emissions to continue "business-as-usual" will also delay critical reductions in greenhouse gas (GHG) pollution, causing greater GHG buildup in the atmosphere over time and exacerbating the impacts of climate change. Acting urgently to curb transportation emissions will set us on course for the steep and persistent reduction pathway necessary to avoid the worst effects of climate change.

The ACT and HDO rules are foundational policies to transition medium- and heavy-duty fleets to zero-emission technology.

Thanks to improving economics and forward-looking policies, the medium- and heavy-duty vehicle (MHDV) sector is heading towards a zero-emission future. However, additional action is needed to accelerate this transition and maximize benefits. One of the most effective actions states can take to jumpstart the zero-emission MHDV market would be to adopt relevant manufacturing and emission standards, including the ACT and HDO rules. The ACT rule will ensure more zero-emission MHDVs are available for sale, while the HDO rule will reduce emissions from new fossil fuel MHDVs that continue to be sold. The rules work in tandem and, if adopted together, would come into effect simultaneously. They send a clear market signal around which industry, government, and other stakeholders can plan and mobilize investments. These rules were extensively researched and developed by California and follow all federal Clean Air Act requirements for adoption. States may quickly start the regulatory and/or legislative process to adopt these rules under the Section 177 provision of the Clean Air Act and begin enforcement for vehicle model year (MY) 2025 (calendar year 2024), contingent on California receiving a federal waiver from the U.S. Environmental Protection Agency (EPA) under the Clean Air Act for each rule.

Today, on a total cost of ownership basis and without incentives, certain zero-emission trucks are cost-competitive if not less expensive than their fossil fuel equivalents. Most classes of vehicles are expected to achieve total cost of ownership parity by 2030.

Although electric truck purchase prices are rapidly declining, they remain higher than most comparable diesel trucks. However, electric trucks are attractive on a total cost of ownership (TCO) basis due to fuel cost savings from charging with potentially less expensive electricity and anticipated 50 percent lower maintenance costs than a comparable diesel or gasoline vehicle.[7] In many cases, these savings will compensate for higher up-front vehicle costs. It is important to remember that upfront vehicle costs will continue to fall as battery prices decline. According to Bloomberg New Energy Finance, battery costs have decreased by 89 percent over the past ten years and continue to drop.[8] Additionally, electric trucks' residual values are expected to be higher than used diesel trucks because a purchaser will receive a more reliable truck with much lower fuel and maintenance costs.[9] Meanwhile, financial institutions are exploring ways to pull forward expected fuel and maintenance savings to reduce electric MHDV purchase prices further.[10] The same downward price trend seen in trucks also holds true for buses.

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[7] Andrew Burke and Anisha Kumar Sinha, *Technology, Sustainability, and Marketing of Battery Electric and Hydrogen Fuel Cell Medium- Duty and Heavy-Duty Trucks and Buses in 2020-2040* (2020), UC Davis Institute of Transportation Studies, *available at* https://escholarship.org/uc/item/7s25d8bc#article_main.

[8] BNEF, *Battery Pack Prices Cited Below $100/kWh for the First Time in 2020, While Market Average Sits at $137 kWh* (Dec. 16, 2020), https://about.bnef.com/blog/battery-pack-prices-cited-below-100-kwh-for-the-first-time-in-2020-while-market-average-sits-at-137-kwh/.

[9] Oberon Insights, *Electric Trucks should have better residual values than diesel*, https://www.oberoninsights.com/insights/residual-value.

[10] Sebastian Blanco, *Proterra Ready for Electric Bus Battery Leasing with $200-Million Credit Facility*, Forbes (Apr. 18, 2019), https://www.forbes.com/sites/sebastianblanco/2019/04/18/proterra-ready-for-electric-bus-battery-leasing-with-200-million-credit-facility/?sh=4f2a81ae2314.

Zero-emission trucks and buses are quickly becoming available across every size and duty cycle. In the North American market, more than 100 zero-emission truck and bus models are either already available or coming to market by 2022, ranging from shuttle buses and cargo vans to school buses and tractor-trailers (Figure 1 and Figure 2).[11] Rapid technological progress is unlocking electrification of even the most demanding duty cycles. Daimler, Paccar, and Volvo, who collectively account for nearly 90 percent of the Class 7-8 truck market, are all actively testing zero-emission Class 8 tractors and have announced plans to bring them to series production over the next 1-2 years.[12] In addition, several other legacy and zero-emission vehicle manufacturers are currently developing prototypes and first-generation commercial products, including hydrogen fuel cell vehicles for long-haul operations.

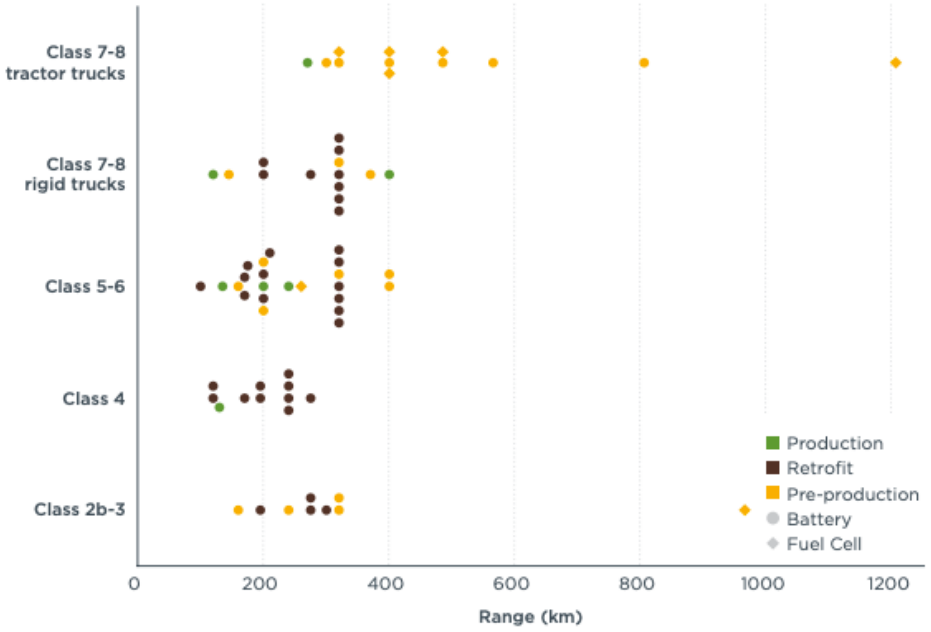

Figure 1. Available and Announced Zero Emissions Truck Models in the U.S. and Canada[13]

[11] Ben Sharpe, et al., *Race to Zero - How manufacturers are positioned for zero emission commercial trucks and buses in North America*, International Council on Clean Transportation and Environmental Defense Fund (Oct. 2020), Appendix E, https://www.edf.org/sites/default/files/documents/Race%20to%20Zero-ICCT_EDF_PQ-FINAL.pdf.
[12] Daimler, *Freightliner eCascadia*, https://freightliner.com/trucks/ecascadia/?gclid=Cj0KCQiAk53-BRD0ARIsAJuNhpvaY5r5sdujZrtV0MVKCZW1b7S45zOAePmr-OXhBQpd8evPgzOW5MkaArDzEALw_wcB; Paccar, *Kenworth T680E and Peterbilt 579EV*, https://www.kenworth.com/news/news-releases/2020/october/t680e/ and https://www.peterbilt.com/electric-vehicles, Volvo, *Volvo VNR Electric Truck to Hit the Market Dec.3*, https://www.truckinginfo.com/10129692/volvo-vnr-electric-truck-to-hit-the-market-dec-3.
[13] Ben Sharpe, et al., *Race to Zero - How manufacturers are positioned for zero emission commercial trucks and buses in North America*, International Council on Clean Transportation and Environmental Defense Fund (Oct. 2020), Figure 7, https://www.edf.org/sites/default/files/documents/Race%20to%20Zero-ICCT_EDF_PQ-FINAL.pdf..

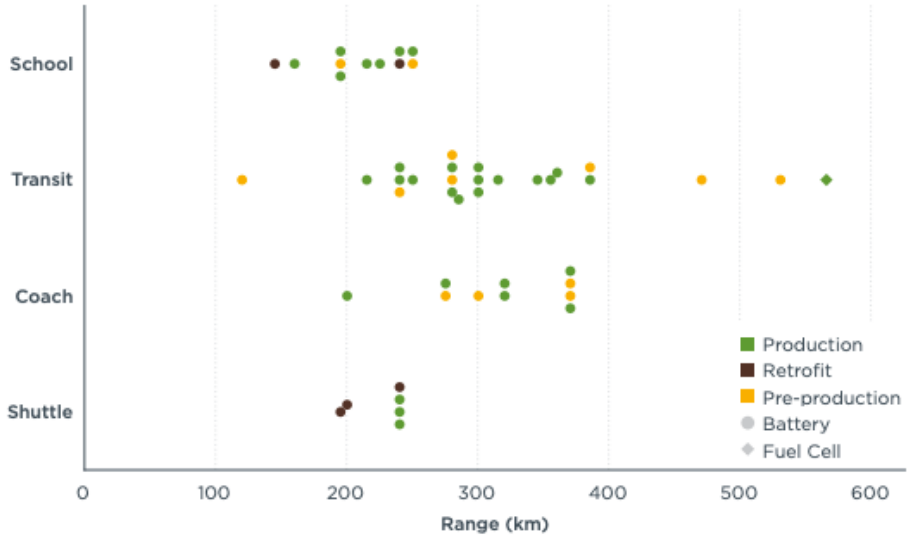

Figure 2. Available and Announced Zero Emissions Bus Models in the U.S. and Canada[14]

Although the upfront cost of zero-emission trucks and buses still exceeds that of their diesel counterparts and requires mitigation, cost parity over the total cost of ownership will be achieved well before the MOU's currently proposed 2050 timeframe. Medium-duty trucks (Class 3-6) are already cost-competitive over the TCO, and heavy-duty short-haul vehicles (Class 7-8) are expected to achieve TCO parity with diesel-powered vehicles by 2025, without incentives.[15] Heavy-duty long-haul vehicles (likely powered by hydrogen fuel cells) are expected to demonstrate TCO parity without incentives by around 2030.[16] As component costs continue to decline, the business case for zero-emissions vehicles will only strengthen leading up to 2040.

Fleet owners and operators are banding together in groups such as the Corporate Electric Vehicle Alliance (CEVA) to loosely aggregate and signal strong demand for more diverse zero-emission MHDV model options.[17] As discussed above, model availability continues to grow, and regulations like the ACT rule can further enhance that availability.

The ACT rule will soon be accompanied by purchase requirements that will further stimulate participating states' zero-emission truck market. California plans to finalize an aggressive fleet purchase requirement by 2022, which other states can and should consider adopting. Adopting the ACT rule will act as an accelerator to increase the supply of electric trucks, achieve economies of scale from higher production volumes, lower costs, and encourage solutions to increase demand and possibly result in significant savings.[18]

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[14] *Id.* at Figure 8.
[15] North American Council for Freight Efficiency, *Electric Trucks: Where They Make Sense* (May 2019) at 13-14, https://nacfe.org/emerging-technology/electric-trucks/.
[16] ICF, Comparison of Medium- and Heavy-Duty Technologies in California – Executive Summary (Dec. 2019) at 4, https://www.caletc.com/assets/files/ICF-Truck-Report_Final_December-2019.pdf.
[17] Ceres, *Corporate Electric Vehicle Alliance*, https://www.ceres.org/our-work/transportation/corporate-electric-vehicle-alliance.
[18] Chris Busch, *et. al.*, *Clean Trucks, Big Bucks: California Energy Policy Simulator evaluation of the proposed Advanced Clean Trucks Rule*, Energy Innovation and Environmental Defense Fund (Jun. 2020), https://energyinnovation.org/wp-content/uploads/2020/06/Clean-Trucks-Big-Bucks_June_17_2020.pdf

Deploying electric truck infrastructure is technically and economically feasible and offers a host of potential benefits.

Meeting the electric infrastructure needs to support the deployment of MHD battery electric vehicles (BEVs) is technically feasible – that is, the ability to integrate BEVs into the grid already exists. The expected generation and capacity needs for BEVs over the next half-century are below historical annual growth rates.[19] For example, there have been periods of rapid electric demand growth in the US associated with home electrification and the addition of household appliances (1970-75) and with the widespread adoption of air conditioning (1990-95). These years saw annual generation increases equal to the needs of tens of millions of BEVs.[20] While the increased load from MHD BEVs will more than likely require additional investment in grid infrastructure, utilities can and should plan to mitigate the need for expensive build-out of grid infrastructure through non-wires solutions, such as on-site generation and storage, and ensure new load is integrated to avoid exacerbating peak demand. MHD BEVs' challenge is not feasibility and could in fact lower consumer electricity prices by increasing grid utilization.

There are many potential benefits to developing a robust electric charging network for MHD BEVs. For example, due to the large battery size and, in some cases, predictable operation schedules, MHD BEVs may be prime candidates for vehicle-to-grid applications. Vehicle-to-grid technologies can improve grid stability and reliability, help integrate more renewable energy, and in some applications, possibly offer additional revenue streams to BEV owners. Another advantage to the infrastructure build-out is high-quality job creation.[21]

In 2019, over a quarter-million Americans were employed in the clean vehicle industry.[22] To date, over $300 billion in global private investments have flowed into electric vehicles.[23] Moreover, thanks to the lower cost of filling up with electricity rather than fossil fuels and lower maintenance costs, electric vehicles save fleets and consumers money. These savings are largely redirected towards local services—the most labor-intensive and skill-diverse sector of the economy—and are less likely to be outsourced.[24] Shrinking and shifting expenditures from diesel and gasoline to the labor-intensive service industry will serve as a potent job creator and economic stimulant. Of course, protections must be included to prevent exploitative practices and ensure new jobs are equitably distributed. Moreover, there is a need for zero-emission workforce training and development programs that prioritize displaced workers, residents of pollution-burdened communities, communities facing barriers to employment, low-income communities, and communities of color.

The ACT and HDO rules are built around flexibility and designed for an evolving market with segments in different electrification suitability stages.

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[19] US DRIVE, *Summary Report on EVs at Scale and the U.S. Electric Power System*, https://www.energy.gov/sites/prod/files/2019/12/f69/GITT%20ISATT%20EVs%20at%20Scale%20Grid%20Summary%20Report%20FINAL%20Nov2019.pdf.

[20] *Id*. at 3

[21] E2, ACORE, CELI, bw Research Partnership, *Clean Jobs, Better Jobs: An examination of clean energy job wages and benefits* (Oct. 2020), https://e2.org/wp-content/uploads/2020/10/Clean-Jobs-Better-Jobs.-October-2020.-E2-ACORE-CELI.pdf.

[22] E2, *Clean Jobs America 2020: Repowering America's Economy in the Wake of COVID-19* (Apr. 2020), https://e2.org/reports/clean-jobs-america-2020/.

[23] Paul Lienert and Christine Chan. *Charged: A Reuters analysis of 29 global automakers found that they are investing at least $300 billion in electric vehicles, with more than 45 percent of that earmarked for China* (Jan. 20, 2019), Reuters, https://graphics.reuters.com/AUTOS-INVESTMENT-ELECTRIC/010081ZB3HD/index.html.

[24] David Roland-Holst, et al. *Exploring Economic Impacts in Long-Term California Energy Scenarios* (June 2018), Consultant Report for the California Energy Commission, https://ww2.energy.ca.gov/2018publications/CEC-500-2018-013/CEC-500-2018-013.pdf.

The ACT rule starts with low sales requirements and gradually increases, leaving time for technology to improve, the supporting ecosystem to mature, and vehicle prices to decline. The ramp-up in sales requirements is modest: from adopting the rule in 2021 to the second year of compliance in calendar year 2025, the sales requirement only grows to 10-13% of sales. We can expect significant advancements in range and efficiency in the intervening years, expanding suitability for a wider spectrum of zero-emission vehicle uses and classes. The HDO rule follows a comparable transition with stronger emission standards beginning in MY 2024 and then tightening further in MY 2027.

While unique use cases that are harder to electrify, such as snowplows, may persist, large percentages of each state's truck fleet will be suitable for a transition to zero-emission vehicles over the rules' lifetime, and these exceptions should not dictate the rule. Further, both the ACT and HDO rules employ credit mechanism systems that incentivize voluntary early action and permit a high degree of compliance flexibility. For example, the ACT rule allows zero-emission credit trading between manufacturers and between most truck classes, accounting for vehicle size, enabling manufacturers to shift credits from truck segments ripe for electrification to those that are less suitable. However, states must adopt complementary measures that explicitly prioritize frontline communities to ensure that those most burdened by harmful air pollution are not further negatively impacted and experience disproportionate pollution reduction benefits.

The ACT rule can accommodate potential fluctuations in vehicle sales from year-to-year. The rule does this by basing manufacturers' ZEV credit requirements on average truck sales data from the previous three years. In that way, peaks or troughs in purchases due to economic or regulatory forces are smoothed and have minimal impact on the overall trajectory of ZEV sales.

The HDO rule is a vital complement to the ACT rule with substantial public health and environmental benefits.

The HDO rule makes much-needed reforms, such as strengthening NOx and PM emission standards for new fossil fuel trucks, introducing a new NOx standard for a low-load certification cycle, extending manufacturer warranties, and improving in-use testing to better align with actual operations and global standards. Moreover, the proposed emission standards derive from nearly a decade of rigorous research and analysis demonstrating that the new requirements are not only technically feasible but cost-effective methods of emissions reduction.

The HDO rule is expected to cut NOx emissions from HDVs by 75 percent below current standards beginning in 2024 and 90 percent in 2027.[25] In addition to cleaning up NOx, the proposed rule looks to institutionalize PM pollution controls and prevent backsliding by adopting a more stringent standard that aligns with current industry certifications. These reductions in California are projected to amount to $36 billion in statewide health benefits from 3,900 avoided premature deaths and 3,150 hospitalizations from 2022 to 2050.

While the ACT rule works year-over-year to gradually increase the share of new truck sales that are zero-emission, the HDO rule curtails toxic air pollution from new diesel vehicles that will continue to be sold in the interim. The ACT and HDO rules are two sides of the same coin: together, they collectively

[25] California Air Resources Board, *Facts about the Low NOx Heavy-Duty Omnibus Regulation*, https://ww2.arb.ca.gov/sites/default/files/classic//msprog/hdlownox/files/HD_NOx_Omnibus_Fact_Sheet.pdf.

enable a state's long-term vision of a zero-emission MHDV fleet and address toxic transportation pollution in the near-term.

Seven years of research and analysis informed the HDO rule to ensure it is technically feasible, cost-effective, and adheres to all legal requirements.

When developing the HDO rule, the California Air Resources Board (CARB) thoroughly evaluated the technical feasibility of the rule's emission standards in partnership with the Southwest Research Institute (SwRI), Manufacturers of Emission Controls Association, U.S. EPA, South Coast Air Quality Management District, and engine manufacturers. The testing convincingly demonstrated and modeled cost-effective solutions to meet both 2024 and 2027 standards.[26] Importantly, certification data shows that many manufacturers today certify well below current standards and nearly meet the 2024 requirements.[27] Moreover, several engine manufacturers have already committed to developing compliant MY 2024 engines and are actively making plans to meet the MY 2027 requirements.[28]

CARB staff has demonstrated the technical feasibility of both the 2024 and 2027 proposed NO_x standards through several years of extensive development and testing in partnership with SwRI.[29] The development and testing, together with related work by manufacturers, show that the proposed 2024 standards can be met using a combination of improved engine calibration, the newest configuration of after-treatment devices and urea injection. The 0.02 g/bhp-hr NO_x standard proposed for MY 2027 and subsequent years can be achieved by further refinements to the aftertreatment plus well-established powertrain technologies including cylinder deactivation – a technology widely used in passenger vehicles.[30] Moreover, recent opposed-piston engine testing were able to reduce NO_x emissions below the MY 2027 requirement in a Peterbilt tractor using conventional downstream aftertreatment equipment.[31] A cost assessment showed that opposed-piston engines "cost 11 percent less than conventional engines of the same power and torque" with substantially less NO_x and CO_2 emissions.[32]

It should be noted that the timeline set out by the current iteration of the low NO_x rule does not present undue constraints. The NO_x standards preceding the recent HDO rule, which largely mirrored the EPA standards, were some of the most technology-forcing emissions standards ever adopted – requiring the development of an entirely new catalyst, new particulate filters, and a system that had to track the amount of NO_x in the tailpipe, an amount that varies greatly under different driving conditions and integration of an advanced and complex engine exhaust gas recirculation system. Those new technological elements all had to work in concert without significantly impacting fuel consumption. Despite these challenges, manufacturers were readily able to meet these standards in a timely manner. In contrast,

[26] California Air Resources Board, *Technological Feasibility of Proposed Standards*, https://ww3.arb.ca.gov/regact/2020/hdomnibuslow NOx /appi.pdf.
[27] California Air Resources Board, *Public Hearing to Consider the Proposed Heavy-Duty Engine and Vehicle Omnibus Regulation and Associated Amendments, Staff Report - Initial Statement of Reasons*, https://ww3.arb.ca.gov/regact/2020/hdomnibuslownox/isor.pdf
[28] California Air Resources Board, *Responses to Comments on the Environmental Analysis for THE PROPOSED HEAVY-DUTY ENGINE AND VEHICLE OMNIBUS REGULATION AND ASSOCIATED AMENDMENTS*, https://ww3.arb.ca.gov/regact/2020/hdomnibuslow NOx /res20-23attbrtc.pdf.
[29] *Id.* at ES-12.
[30] *Id.* at III-12 to III-27.
[31] Achates Power, *Achates Power Opposed-Piston Heavy-Duty Diesel Engine Demonstration Performance Results – Ultralow NOx without additional hardware*, https://achatespower.com/wp-content/uploads/2020/12/Achates-Power-Opposed-Piston-Heavy-Duty-Diesel-Engine-Demonstration-Performance-Results-Ultralow-NOx-without-additional-hardware.pdf
[32] *Id.* at 2.

"meeting the envisioned CARB 2024 targets would require very modest increases in technology complexity and costs."[33] Thus, compliance can reasonably be achieved on the timeline set forth by CARB.

Per CARB's extensive economic analysis, the cost in California to manufacturers of complying with the rule is $4.07 billion from 2022 through 2050. These costs are dwarfed by the rule's $36.8 billion in expected public health benefits for Californians over the same period – the significance of which should not be given short shrift in other states that pass analogous rules. And, manufacturers can expect to pass on costs through higher prices. However, buyers are not without benefits: the HDO rule would lengthen manufacturer emission warranty periods, effectively eliminating repair costs to vehicle owners during that extended period. Also, the HDO's longer useful life and durability requirements would encourage manufacturers to produce more durable components, resulting in fewer failures and less downtime for vehicle owners. As a percent of baseline purchase prices, price increases are minimal and expected to range from 0.4 to 9.5 percent, with an average of 2.6 percent in MY 2024 to 2026, 5.2 percent in MY 2027 to 2030, and 5.8 percent in MY 2031 and beyond. Consequently, the HDO rule's cost-effectiveness is $5.45 per pound of NOx reduced – well within the range of previously adopted emission regulations.

The ACT and HDO rules will not prompt manufacturers to exit participating markets, and fears of a pre-buy/no buy scenario are unwarranted.

The trend towards zero-emission MHDVs and the sharp curtailment of diesel emissions is global and durable. In many ways, the HDO rule is an opportunity to catch up with European regulators, while the ACT rule is a way to continue maintaining American manufacturing competitiveness relative to China. And, while the trend is global, so too are the truck manufacturers. The notion that multinational (and even multi-state) OEMs will abandon markets rather than invest and innovate is counterintuitive based on their stated intent.[34] For example, at the end of 2020, the European Automobile Manufacturers' Association, which includes major truck manufacturers such as Daimler, Volvo, Scania, CNH, MAN, DAF, and Ford, committed to only sell zero-emission trucks by 2040.[35] Also, as previously mentioned, several manufacturers are already close to meeting the initial HDO rule emission standards and have committed to developing compliant engines.

Analysis performed by EDF clearly shows that there are significant benefits inherent in more stringent standards.[36] When reviewing market growth in response to 2007 and 2010 federal engine standards, there was smooth growth in vehicle demand prior to, and during implementation of the 2014 Phase 1 fuel efficiency and emissions standards. Indeed, the purchase of MY 2014 vehicles was *higher* than any year since 2005.[37] This demonstrates that strict standards do not lead to dampened adoption of cleaner vehicles; as well, these standards can lead to fuel cost savings, an important component of making the economic case for the transition.

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[33] International Council on Clean Transportation, *Estimated cost of diesel emissions-control technology to meet the future California low NOx standards in 2024 and 2027* (May 20, 2020), https://theicct.org/publications/cost-emissions-control-ca-standards.
[34] Volvo Trucks, *The Future of Electric Trucks*, https://www.volvotrucks.us/innovation/electromobility/.
[35] European Automobile Manufacturers' Association, *Joint Statement: The Transition To Zero-Emission Road Freight Transport*, https://www.acea.be/uploads/publications/acea-pik-joint-statement-the-transition-to-zero-emission-road-freight-trans.pdf
[36] Katherine Rittenhouse and Matthew Zaragoza-Watkins, *Strategic Response to Environmental Regulation: Evidence from U.S. Heavy-Duty Vehicle Air Pollution Regulations*, MIT CEEPR Working Paper, (2016).
[37] Heavy Duty Trucking, *Healthy Demand Overall for Trucks in September*, Heavy Duty Trucking (Oct. 3, 2014), http://www.truckinginfo.com/channel/fleet-management/news/story/2014/10/healthy-demand-overall-for-trucks-in-september.aspx?ref=rel-recommended.

It should also be noted that "the pre-buy in response to 2007 criteria pollutant standards [was found] to be approximately symmetric, short-lived, and small in volume relative to previous estimates"[38] – indicating that fears of mass purchase of more polluting vehicles before implementation of a standard may not come to fruition. The bottom line is that, rather than seeing fleets buy dirtier, ostensibly cheaper vehicles in a panic, there is clear evidence that no meaningful adjustment in market purchasing occurs as a result of these standards – fleets recognize the cost savings over time of cleaner vehicles and do not seem inclined to ignore those benefits to reap the marginally lower purchase price of more polluting vehicles while they still can.

Future national low-NOx or ZEV truck standards are uncertain, and communities need emission reductions today.

Toxic air pollution from fossil fuel MHDVs is an urgent public health emergency. Although the federal EPA launched a Cleaner Trucks Initiative in 2018 to reduce NOx emissions from HDVs, the rulemaking is in its infancy and was delayed indefinitely in 2020. Due to federal lead-time requirements and other rulemakings at EPA, it is doubtful a national low-NOx standard could take effect before MY 2027. At a minimum, this would create a gap of several years between the HDO rule schedule and federal implementation, delaying critical reductions in toxic air pollution and greenhouse gas emissions. Notably, federal and state action is not mutually exclusive and is, in fact, complementary. States should adopt the more robust ACT and HDO rules in line with Section 177 requirements under the federal Clean Air Act while also advocating for a strong national standard. In this way, MOU states can take concrete action today to address toxic air pollution from vehicles registered in-state while getting a new national standard to clean up out-of-state trucks that travel across state lines. Adopting ambitious state rules will go a long way to ensuring near-term air quality improvements for all residents and accelerating the transition to a cleaner transportation future.

Conclusion

States should adopt the ACT and HDO rules, bolstering the zero-emission MHDV market and easing the long-term transition to a clean transportation sector. Fundamentally, these regulations are feasible, economical, and represent a timely means of achieving necessary reductions in air pollution and GHG emissions. These programs' importance should be highlighted in the model action plan developed by the states and facilitated by NESCAUM.

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[38] Katherine Rittenhouse and Matthew Zaragoza-Watkins, *Strategic Response to Environmental Regulation: Evidence from U.S. Heavy-Duty Vehicle Air Pollution Regulations* at 33, MIT CEEPR Working Paper, (2016).

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