

To: **Liane M. Randolph, Chair**
Honorable Board Members

From: Richard W. Corey, Executive Officer 

Date: January 10, 2022

Subject: Accelerating California's Transition to Zero-Emission Trucks

As we wrap up 2021 and move into 2022, I am writing to update you on the transition to zero emission trucks (ZET) – a challenge on which we are all keenly focused. Our Advanced Clean Trucks (ACT) and Heavy-Duty Low-NO_x Omnibus Regulations are already driving this change, and this past year, the Board went further and approved major new investments in this effort. The November Funding Plan, and the world-leading Heavy-Duty Inspection and Maintenance program approved by the Board in December represent major steps to reduce emissions from trucks. But much remains to be done.

In light of the pending Advanced Clean Fleets Regulation (ACF), and the October 2021 Board discussion regarding the urgency and need to accelerate the transition to ZETs, the purpose of this memo is to describe California Air Resources Board (CARB) staff's near-term approach to cleaning up the existing combustion fleet and accelerating the zero-emission market, and to highlight key considerations going forward. This memo also describes our current thinking on what will be needed in the longer term as well as the mechanisms that CARB staff will use to examine what additional authorities may be needed to further accelerate the ZET market. Senator and Board member Leyva's letter (co-signed by several legislators) dated October 27, 2021 (Attachment A) highlights the importance of aggressive but durable action using a range of policy tools. We know there is much more to do.

State of Play

Our thinking thus far has been driven by a range of key considerations, outlined here. Primary among them has been the pressing need to meet climate and public health challenges which grow ever more acute. With limited time and limited public dollars to invest, we have viewed accelerating the ZET transition as central to our strategy for driving down emissions to protect communities and meet our climate goals, especially given the long lifetime of trucks, and the need for private and public zero emission infrastructure investments. We are also closely focused on how these investments can support economic development, including for small fleets.

Critical public and community health needs

- California faces major air quality challenges. Attaining the federal ambient ozone standards in 2031 and 2037 is simply impossible without significant additional oxides of nitrogen (NO_x) emissions reductions from new and in-use trucks. Most of the State's

population lives in areas out of attainment with federally health-protective air quality standards with particular challenges in southern California.

- Trucks are the largest single source of air pollution from vehicles, responsible for 50 percent of greenhouse gas emissions, 25 percent of smog and fine particulate forming NO_x emissions, and more than 95 percent of toxic diesel particulate matter emissions; even though there are only about 2 million trucks among the 30 million registered vehicles in the State.
- The air pollution from trucks comes at a large public cost in the form of asthma, hospitalizations, cancer, and now a link with COVID-19 and dementia-related diseases including Alzheimer's disease. The impacts are disproportionately severe in communities near ports, intermodal railyards, warehouses and other freight hubs.
- Executive Order N-79-20 establishes a target by 2045 for all commercial trucks on California's roads to be zero-emission where feasible and for drayage trucks to meet that target by 2035. Thus, climate needs also point to a clear need to focus on a ZET transition.
- Trucks have long useful lives, meaning that trucks entering the roads now will remain there for decades.
- As we know from CARB's [200 truck study](#), combustion trucks, including trucks with engines certified to the optional 0.02 grams NO_x per brake-horsepower hour standard fueled by natural gas, are not performing in the field the way we would expect or in the way that communities need. Also, it is notable that a recent [International Council on Clean Transportation analysis](#) has shown that after factoring in upstream methane emissions, natural gas trucks are more harmful to the climate than diesel trucks.
- The Board has taken action to maximize emissions reductions from heavy-duty combustion engines, but these engines remain susceptible to deterioration and to becoming high emitters as they age. The new Heavy-Duty Inspection and Maintenance (HD I/M) program for trucks, which the Board recently approved, will help monitor and fix high-emitting engines, but cannot eliminate this issue alone. In addition, while the focus of this regulation is cleaning up the combustion fleet by creating a systematic requirement for testing and maintenance, these requirements may motivate some fleets to turn over faster to ZETs. Similar to having an old car, sometimes it becomes less expensive or time-consuming to buy a new car than to keep fixing an old one. HD I/M will help ensure emissions reductions in communities affected by pollution from trucks, like those that engage in regional haul.
- One of the most important things CARB can do to assure community health and equity benefits for those who live next to major truck corridors is accelerating the widespread deployment of ZETs. This is something that a strong zero-emission truck mandate (e.g., ACT) in combination with the proposed ACF regulation ensures and is something that CARB's incentive programs structure encourages. Because ZETs have no tailpipe emissions, they cannot become high emitters. They also lower PM emissions from reduced brake wear, and associated upstream emissions are expected to decline over time as the electrical grid gets even cleaner.
- Given these considerations, transitioning as rapidly as possible to a 100 percent ZET fleet will help us meet our greenhouse gas reduction and air quality goals and will

mitigate the impacts of increased exhaust emissions associated with malfunctions and deterioration endemic to combustion engines.

Opportunities

Availability of zero-emission trucks

- ZETs and buses are available for purchase today from dozens of manufacturers in a range of configurations. The current market is well situated for transit buses, school buses, delivery trucks, refuse trucks, and short haul tractors. There are more than 100 models of ZETs and buses commercially available now in all medium- and heavy-duty weight class categories and more have been announced. Many of these vehicles are manufactured in cab-and-chassis configurations for use as delivery or vocational trucks that can be equipped with a variety of body types to perform various functions.
- Data from fleets from the California Vehicle In-Use Study done in 2018 and from information reported to CARB in 2020 from large entities shows the daily operation of most trucks are already suitable for electrification.
- Nearly all single unit truck types average less than 100 miles per day and several ZET configurations are already available with 200-mile range capabilities.
- For tractors, the data show that about 30 percent of tractors owned by fleets are operated less than 100 miles per day, and about 60 percent operate less than 200 miles per day. Today's early ZET models are suitable for many of these shorter-range use cases and new models are expected to become commercially available in the next few years with considerably longer-range capabilities.
- At this point, 9 major manufacturers have announced upcoming medium- and heavy-duty ZET plans and many have ZET models in development with plans to launch them commercially prior to 2024.
- Multiple major and new truck parts suppliers have a variety of electric vehicle components and drive train solutions for vehicle manufacturers to use in assembling their vehicles.
- In summary, medium- and heavy-duty ZETs are already available with daily mileage range that is suitable for most single unit trucks and for tractors used in return to base and regional hub spoke applications. In some cases, additional time is needed for additional technology advances and for retail charging and hydrogen fueling infrastructure networks to be developed for highly variable use cases and for long-haul.

Economic benefits of zero-emission trucks

- For a number of truck types and use cases, the total cost of ownership of ZETs already pencils out against combustion trucks. These benefits will be further accelerated through CARB's existing ACT regulation. The regulation begins in 2024 and ramps up to 2035, where ZET sales will be 55 percent of Class 2b – 3 truck sales, 75 percent of Class 4 – 8 single unit truck sales, and 40 percent of truck tractor sales. Even in the absence of ACT, entities like Lawrence Berkeley National Laboratory are finding that

Class 8 battery electric trucks already offer a 13 percent lower total cost of ownership per mile as compared to diesel, which translates into a 3-year payback and savings of \$200,000 over a 15-year lifetime.

A growing multi-state zero-emission truck market

- Along with California, five other states have already completed adoption of the ACT regulation (Massachusetts, New Jersey, New York, Oregon, and Washington) and two more states (Colorado, and Maine) are currently in the public process required to adopt. New York has signed [legislation](#) including the same zero-emissions deadlines as California Executive Order N-79-20 for heavy-duty, light-duty, and off-road vehicles. The multi-state Medium- and Heavy-Duty Zero-Emission Vehicle MOU continues to grow with Quebec and Virginia joining in 2021 to now include 16 states, 1 province and the District of Columbia. Additionally 5 other states (Illinois, Indiana, Michigan, Minnesota, and Wisconsin) have created a [Regional Electric Vehicle Midwest Coalition MOU](#) to accelerate medium- and heavy-duty ZET deployment via collaboration on infrastructure, manufacturing and equity actions. As more states pass ACT regulations and supporting policies, the zero-emission supply chains grow, prices continue to drop (benefitting consumers and fleets), new economic opportunities for electric vehicle supply equipment (EVSE) providers continue to grow, and growing numbers of communities benefit from air quality improvements.

Near term: CARB's approach to accelerating the introduction and adoption of zero-emission trucks

With adoption of the ACT regulation, the Board took a major step in securing a zero-emission future. The ACT regulation is a manufacturing requirement and covers everything from heavy-duty pickups or work trucks to the semi-trucks used in drayage and long-haul applications. Starting with the 2024 model year, truck manufacturers will be required to produce and sell ZETs in growing numbers in California's market.

CARB staff are working on developing the next installment of policies to help transform the truck sector to zero emission - the ACF regulation, which will go to the Board in late summer 2022. The regulation as currently proposed is aggressive, but achievable. It would be phased-in to ensure that certain fleets and manufacturers work together to successfully place ZETs in service where most suitable as the ZET market expands, and ensure that CARB has institutional capacity to manage the rule, given the considerable scope and complexity of fleet regulations. The proposed phase-in schedule initially focuses where the best opportunities exist to electrify the fleet, sets clear targets for regulated fleets to make a full conversion to ZETs, and provides sufficient time for an infrastructure network to be developed. In addition, it aggressively pushes drayage trucks given the suitability of their duty cycles and their outsized impact on disproportionately impacted communities and ability to maximize emissions reductions in heavily impacted communities. This approach gives fleets the flexibility to phase-in ZETs in the most suitable applications first and focuses initial ZET infrastructure development to support communities around ports and railyards.

The ACF regulatory proposal as currently written attempts to strike a balance between moving the market quickly to zero emissions and the appropriate scope for a purchase mandate, recognizing that fleets more suited for electrification should lead, accounting for the economics of small fleets and the complexities of fleet regulation, and recognizing that additional tools will be needed to move the fleet to 100 percent zero emissions by 2045.

In addition to accelerating the deployment of ZETs, the proposed ACF regulation sends truck manufacturers a clear signal regarding the end of combustion truck sales in California—specifically, the regulation would state that 100 percent of manufacturer sales must be zero-emission by 2040. This end point for sales of new combustion engine trucks in California will ensure accelerated improvements in the economics of ZETs and the investments needed to expand the market quickly. It will increase confidence for infrastructure providers and ZET components suppliers to make investments to support a rapidly growing market, ensure that ZET technology advancements continue, will provide more air quality benefits to our communities, and provide more choice to fleets and consumers.

We are reviewing stakeholder feedback and will continue to engage as the ACF development process continues. For instance, truck owners question whether ZETs will be available to meet their needs, and are concerned that infrastructure will not be available in time; others, including some community stakeholders, argue more should be done in this rulemaking to include more fleets, to require upgrades to cleaner combustion upon vehicle retirement, or to completely phase-out all combustion truck sales by 2036 in this rulemaking. We will continue to seek an appropriate balance in ACF, given these comments and the considerations noted above, and with an eye toward California’s entire portfolio of tools.

Post-2022: CARB activities and broader truck portfolio

As Senator and Board member Leyva’s letter (October 27, 2021) indicated, with implementation of both the ACT and the proposed ACF regulations (as currently proposed), we estimate that in 2045, the California fleet would include 1.2 million ZETs out of a total of approximately 2.2 million trucks on the road. As proposed, ACF is expected to increase ZET deployments for larger trucks beyond what is already expected for ACT (i.e., with the proposed ACF regulation, ZETs would account for approximately 53 percent of the Class 4-8 straight trucks and nearly 70 percent of all tractors by 2045). Shifting the remaining fleet to zero-emission technology will require additional policy tools. From past experience with the Truck and Bus regulation, there are a number of administrative, enforcement, and economic challenges with fleet regulations that apply to nearly all truck owners including mom and pop businesses. As the Board looks to significantly expand the deployment of ZETs beyond ACF there must be careful consideration of how to do this in a manner that is economically feasible for the more than 100,000 fleets who rely on the secondary market to purchase trucks. As a Board, you will be making decisions on a number of related items that could also help build the ZET market faster than the analysis above suggests, including:

- Incentives (vehicles and infrastructure): These are critical, particularly in the early years and to help small operators. The zero-emission vehicle budget package reflected in the 2021 Funding Plan is a great start and we hope for significant further investments

in 2022. The 2021 budget includes initial funding commitments for 1,150 zero-emission drayage trucks, 1,000 zero-emission transit buses, and 1,000 zero-emission school buses, along with corresponding infrastructure, over three fiscal years, which will provide strong incentives for early-adopters, complementing CARB's regulations. Another new project that the Board approved, Innovative Small e-Fleets, will provide incentives for zero-emission trucks geared towards small and disadvantaged fleets to pilot innovative mechanisms such as flexible leases, peer to peer truck sharing, truck as a service, individual owner planning assistance and more.

- Corresponding Port and Local Policies. We are seeing efforts in many local governments and ports to support ZET efforts – including a recent Indirect Source Rule for warehouses in South Coast – but more needs to be done. For instance, with record breaking volumes of freight moving through the ports we think it is critical to continue to advocate for the San Pedro Bay Ports truck fees to finally be implemented. Collecting an increase in fees immediately would further support ZETs and infrastructure funding. The currently proposed \$10 per loaded Twenty-Foot Equivalent Unit container fee could contribute over \$130 million annually towards accelerating deployment of zero-emission freight technology. Continued delays in the implementation of this fee and the related funding program represent a lost opportunity for near-term emission reductions in the South Coast region.
- Federal partnership and leadership: Over half of the heavy-duty vehicle miles travelled in California are from federally certified trucks and their NO_x emissions will be significantly higher than California engines starting in the 2024 model year. The Clean Air Act requires changes to federal standards to provide manufacturers 4 years of lead time. Existing federal truck GHG standards already ratchet up in 2027. Federal truck rules to tighten NO_x emissions standards are anticipated to be proposed in January 2022 and must be finalized by the end of the year, or the opportunity will be lost to include emissions reductions associated with the 2027 model year and would put 2028 and 2029 in potential jeopardy. It is paramount that the US EPA align with CARB's Heavy-Duty Omnibus regulation and also push accelerated ZET policies nationwide within this federal rulemaking. From our collective experience with promulgating light-duty zero-emission technologies, regulations, and incentives, we know that manufacturers respond creatively when regulators inside and outside of California send strong, unified, regulatory signals. Advocating for federal adoption of cleaner NO_x truck standards as well as an ACT regulation (or its CO₂ regulatory equivalent) will help California communities, but, critically, will also ensure that communities everywhere benefit from a robust clean truck market.

Building the Portfolio

Staff understands more needs to be done, especially to reduce emissions in heavily impacted communities and to require upgrades to ZET upon vehicle retirement. Even with the above policies to kick start the early ZET market in high priority fleets, additional tools will provide the best opportunity to promote electrification in fleets and use cases where it is more challenging to make the transition to meet the Governor's Executive Order N-79-20. New

market tools, including those noted in Senator and Board member Leyva's letter, such as differentiated registration fees, restrictions or fees for polluting trucks entering low/zero-emission zones, and indirect source rules may be more effective at aggressively targeting emissions reductions in heavily impacted neighborhoods, and would help to better ensure that we are moving as quickly as possible to a zero-emission trucking future where feasible. With new authority, the ZET goals could be met in a manner that is more efficient, cost effective, and technologically feasible. These new tools, along with the existing tools described above, would achieve an accelerated adoption of ZETs while also providing fleets more flexibility regarding when they transition and minimizing the impact on the lowest income truck owners.

The 2022 State SIP Strategy, which is building on the just approved 2020 Mobile Source Strategy, will include a proposed commitment to accelerate the number of ZET beyond ACT by upgrading remaining combustion trucks to new or used ZETs. The 2022 State SIP Strategy and the upcoming legislatively mandated Senate Bill 1 report will further evaluate the potential advantages associated with additional authorities in accelerating this transition.

We are looking forward to working with you and the public to develop concepts and authorities needed to efficiently accelerate the transition to ZETs.