ZEV TASK FORCE

MULTI-STATE MEDIUM- AND HEAVY-DUTY ZERO-EMISSION VEHICLE ACTION PLAN

A POLICY FRAMEWORK TO ELIMINATE HARMFUL TRUCK AND BUS EMISSIONS

JULY 2022

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This *Action Plan* was developed by the following jurisdictions* through the Multi-State ZEV Task Force facilitated by the Northeast States for Coordinated Air Use Management (NESCAUM):

California
Colorado
Connecticut
Hawaii
Maine
Maryland
Massachusetts
Nevada
New Jersey
New York
North Carolina
Oregon
Pennsylvania
Rhode Island
Vermont
Virginia
Washington
District of Columbia
Quebec

**This Action Plan uses the terms "jurisdictions" and "states" interchangeably to mean the participants in the MHD ZEV initiative, including the District of Columbia and Quebec.*

SECTION I

INTRODUCTION

Earth's climate is changing faster than it has at any point in the history of modern civilization, driven primarily by greenhouse gas (GHG) emissions from human activities. The impacts—including more frequent and intense precipitation and wind events, flooding, heat waves, drought, wildfires, retreating snow and ice pack, ocean warming and acidification, accelerating sea level rise, and large-scale biodiversity loss—are being felt by communities across the globe and will worsen in coming years. Because GHGs can persist in the atmosphere for decades to centuries, how much worse these impacts will become depends on how deeply and rapidly humanity can decarbonize all economic sectors.[1]

The transportation of freight and people is the largest source of GHGs in the United States and the second largest source of GHGs in Canada. Medium- and heavy-duty (MHD) vehicles—including large pickup trucks and vans, delivery trucks, box trucks, school and transit buses, and long-haul delivery trucks—are a significant component of these emissions and a major source of nitrogen oxides (NO_X), particulate matter (PM), and hazardous air pollutants that harm public health. Widespread electrification of MHD vehicles is needed to avoid the worst effects of climate change and improve air quality and health outcomes, especially in frontline and overburdened communities located near freight hubs, bus depots, trucking corridors, and other emissions sources, which are disproportionately impacted by pollution from diesel trucks and buses and more vulnerable to the effects of climate change. At the same time, many underserved communities, including rural communities, lack access to clean and reliable transportation options. Given the mounting climate and public health consequences of truck and bus emissions, the extended turnover times associated with MHD vehicles, and the potential to create substantial economic and job growth by transitioning to ZEVs, the time for bold action is now.

FIGURE 1: MHD VEHICLE CLASSIFICATION
BY GROSS VEHICLE WEIGHT RATING (GVWR)

WT CLASS	CLASS 2B	CLASS 3	CLASS 4	CLASS 5	CLASS 6	CLASS 7	CLASS 8
GVWR	8,501-10,000 LB 3,856-4,536 KG	10,001-14,000 LB 4,537-6,350 KG	14,001-16,000 LB 6,351-7,257 KG	16,001-19,500 LB 7,258-8,845 KG	19,501-26,000 LB 8,846-11,793 KG	26,001-33,000 LB 11,794-14,969 KG	>33,000 LB >14,969 KG
EXAMPLE VEHICLES	Crew Size Pickup Work Truck Utility Van Walk-In Van	City Delivery Large Walk-in Bucket Truck Box Truck	School Bus Single Axle Rack Truck Refuse Truck	Coach Bus Semi Tractor Dump Truck Fire Truck			

SOME DEFINITIONS

THIS *ACTION PLAN* USES THE FOLLOWING TERMS TO REFER TO CERTAIN TYPES OF ON-ROAD VEHICLES:

MEDIUM-AND HEAVY-DUTY (MHD) refers to vehicles with a gross vehicle weight rating (GVWR) greater than or equal to 8,501 pounds (3,860 kilograms) regardless of how they are powered.

ZERO-EMISSION VEHICLES (ZEVs) INCLUDE:

Battery electric vehicles (BEVs) powered solely by an electric motor and battery;
Plug-in hybrid electric vehicles (PHEVs) powered by a combination of an electric motor and a fossil-fueled internal combustion engine; and
Fuel cell electric vehicles (FCEVs) powered by an electric motor fueled by hydrogen.

Recognizing the urgent need for action, a diverse coalition of 19 jurisdictions in the United States and Canada has committed, through the Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding (MOU),[2] to work to slash GHG emissions and air pollution by accelerating the market for zero-emission trucks, vans, and buses. In the United States, these jurisdictions collectively represent 43 percent of the population, 49 percent of the economy, and 36 percent of the nation's MHD vehicles.[3]

To achieve a timely transition and ensure near-term progress, the participating jurisdictions committed to strive to make at least 30 percent of sales of new MHD vehicles ZEVs by 2030, and 100 percent of sales ZEVs by no later than 2050. In light of positive market developments since the announcement of the MOU in 2020, the strategies in this *Action Plan* could enable an even more rapid transition and accelerate the substantial environmental, public health, and economic benefits associated with the widespread deployment of MHD ZEVs. Indeed, individual jurisdictions are encouraged to consider establishing targets more ambitious than the MOU, as some have already done.

Rapidly electrifying MHD trucks and buses will deliver widespread GHG reductions and health benefits and substantial economic and employment opportunities. However, achieving the pace and scale of vehicle adoption needed to meet the goals of the MOU will require a concerted and coordinated effort within and across all levels of government in close collaboration with stakeholders and community members. A suite of well-designed and equity-driven public policies and programs—such as ZEV sales requirements, vehicle and infrastructure purchase incentives, and infrastructure planning and deployment—will be needed to address key market barriers and ensure no community is left behind.

To translate commitment into action, the MOU directed the participating jurisdictions to develop this *Multi-State MHD ZEV Action Plan* to recommend policy options to foster a self-sustaining market for zero-emission MHD vehicles. With a focus on near term strategies, the *Action Plan* includes more than 65 recommendations for state policymakers to support the rapid, equitable, and widespread electrification of trucks, vans, and buses.

NESCAUM

As the non-profit association of air quality agencies in the six New England states, New Jersey, and New York, NESCAUM catalyzes, guides, and supports state initiatives to improve air quality and address climate change. NESCAUM's focus on clean transportation includes working closely with states on adoption and implementation of California's emission standards for new cars and trucks. NESCAUM also facilitates the Multi-State ZEV Task Force.

Established in 2013, the Task Force drives ZEV adoption through analysis and peer-to-peer discussion of innovative policies and programs, rapid dissemination of tested models, and development of consensus recommendations for state action. NESCAUM led the Task Force in developing two previous action plans for light-duty ZEVs; model state grant and procurement contract provisions to promote reliability, accessibility, convenience, and interoperability of public charging; and policy recommendations on topics such as streamlining permitting for fast charging stations, accelerating ride-hailing electrification, establishing right-to-charge laws, and collecting EV charging utilization data.

Development of the *Action Plan*

Building off the success of a similar multi-state initiative for light-duty ZEVs,[4] the participating jurisdictions worked through the existing Multi-State ZEV Task Force to develop this *Action Plan*. Led by NESCAUM, the Task Force includes dozens of representatives from state environmental, energy, and transportation agencies across the country and serves as a unique forum for galvanizing state leadership on transportation electrification policy through research and analysis, information sharing, and coordinated action on shared priorities.

The Task Force began by building knowledge and understanding of the MHD vehicle market and the barriers to widespread fleet electrification. The Task Force heard from public and private sector

experts about the current market, new MHD ZEV technologies, the operational needs of MHD fleets, opportunities to advance equity, and other issues that must be understood to prioritize and develop well-designed market-enabling policies and programs. Input from many partners and stakeholders—including environmental justice and community-based organizations, truck and bus manufacturers, industry and technology experts, charging and fueling providers, utility companies, public and private sector fleet representatives, commercial financing experts, and environmental advocates—helped shape and refine the *Action Plan's* recommendations.

Organization of the *Action Plan*

The *Action Plan* is organized as follows:

SECTION II describes the need to ensure a just and equitable transition to zero-emission trucks, vans, and buses and provides principles to guide states as they engage with overburdened and underserved communities and workers;

SECTION III explains why bold action to accelerate market transformation is needed now to protect public health, especially in frontline and overburdened communities, and to maximize and equitably distribute the economic benefits of the transition;

SECTION IV provides an overview of the developing MHD ZEV market, with a focus on electrification of transit buses, school buses, and commercial fleets;

SECTION V discusses sector-wide opportunities, including advances in technology, declining battery costs, and favorable economics; and barriers, including higher up-front costs, issues for small fleets, lack of knowledge and awareness, the critical need for charging infrastructure, production issues, commercial electricity rate design, lack of financing options, and other challenges;

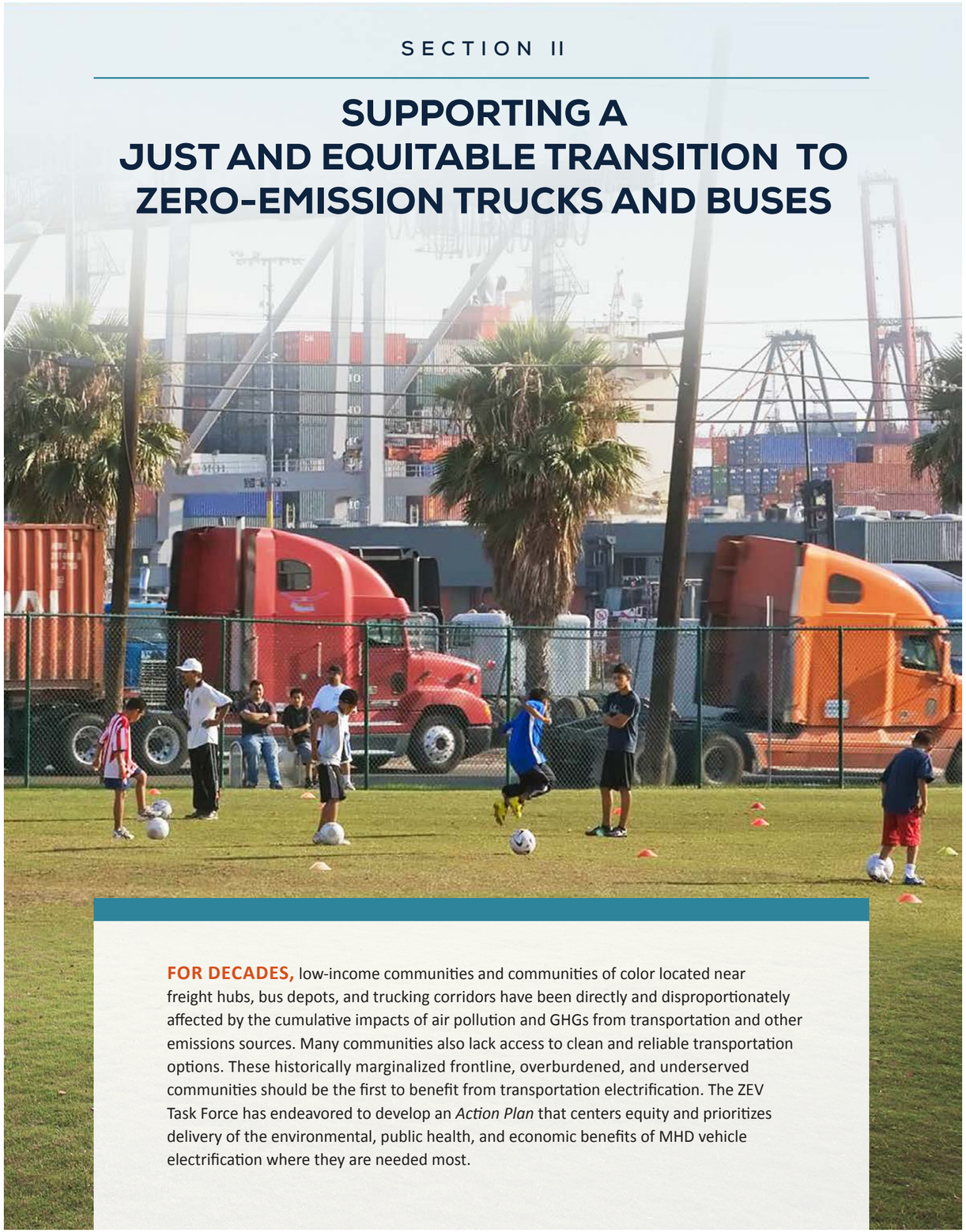
SECTION VI recommends strategies for state policymakers and key partners to support the rapid, equitable, and widespread deployment of MHD ZEVs, including sales and fleet purchase requirements, vehicle and infrastructure purchase incentives, electric utility and utility regulator actions, innovative financing mechanisms, outreach and education, economic equity and workforce development, community air monitoring, long-haul and community infrastructure planning and deployment, and areas for ongoing research and evaluation; and

THE APPENDIX includes recommendations for local and U.S. federal government policymakers to accelerate the transition to MHD ZEVs.

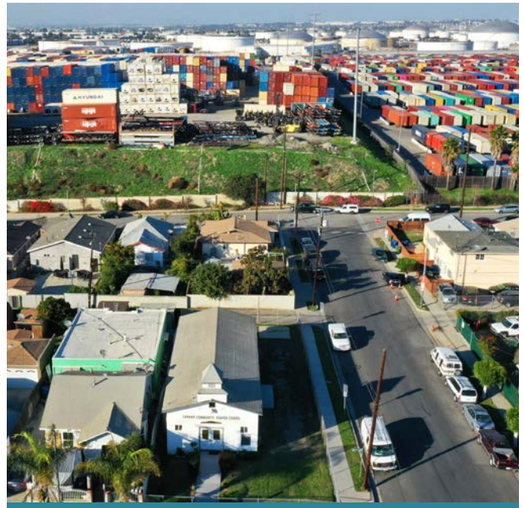
NESCAUM assisted the participating jurisdictions with development of the *Action Plan* and engagement with partners and stakeholders to solicit input on draft recommendations. A jurisdiction's participation in the MHD ZEV initiative should not be interpreted as an endorsement of all the recommendations included in the *Action Plan*. Each jurisdiction is expected to promote MHD ZEV market growth in ways that best address its unique needs and opportunities. NESCAUM looks forward to assisting the participating jurisdictions, through coordinated and individual actions, to implement the *Action Plan's* recommendations.

SECTION II

SUPPORTING A JUST AND EQUITABLE TRANSITION TO ZERO-EMISSION TRUCKS AND BUSES



FOR DECADES, low-income communities and communities of color located near freight hubs, bus depots, and trucking corridors have been directly and disproportionately affected by the cumulative impacts of air pollution and GHGs from transportation and other emissions sources. Many communities also lack access to clean and reliable transportation options. These historically marginalized frontline, overburdened, and underserved communities should be the first to benefit from transportation electrification. The ZEV Task Force has endeavored to develop an *Action Plan* that centers equity and prioritizes delivery of the environmental, public health, and economic benefits of MHD vehicle electrification where they are needed most.



KEY CONCEPTS

This *Action Plan* frequently uses the terms "equity," "overburdened communities," and "underserved communities." Specific definitions for these terms vary and in some states these or similar terms are defined by law. The *Action Plan* does not prescribe definitions for states to follow. Each state should engage with its communities to co-develop appropriate terminology, definitions, and indicators. For purposes of this *Action Plan*:

EQUITY means the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as persons of color; indigenous persons; members of religious minorities; LGBTQ+ persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality.

OVERBURDENED COMMUNITIES are geographic areas or populations that bear a disproportionate share of the cumulative impacts of air pollution and climate change. Overburdened communities include frontline communities that experience the "first and worst" of these impacts.

UNDERSERVED COMMUNITIES are geographic areas or populations, including the populations listed in the definition of equity, that have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life.

To encourage collaboration in the *Action Plan* development process, the Task Force engaged with nationally recognized equity and environmental justice organizations and community-based groups in the participating jurisdictions to understand the issues facing overburdened and underserved communities and collaborate on the development of equitable MHD vehicle electrification strategies. Invaluable contributions from the BlueGreen Alliance, EVNoire, Green For All, and other organizations are reflected throughout the *Action Plan*. In addition, the Moving Forward Network, a national network of organizations that center grassroots, frontline knowledge, expertise, and engagement with communities that bear negative impacts of the global freight transportation system, provided the Task Force with a comprehensive set of recommendations, which the Task Force used to shape the *Action Plan's* recommendations.[5]

These organizations identified several priorities for state action, including the need to co-develop and expand community air monitoring programs to better assess and address air pollution "hot-spots"; identify overburdened communities through outreach and analysis of localized air quality and health data; implement policies that prioritize ZEV and charging and fueling infrastructure investment and deployment to directly benefit overburdened and underserved communities; and reduce emissions from diesel powered vehicles while the market transitions to ZEVs. These priorities are reflected throughout the strategies and recommendations in Section VI and the Appendix.

These organizations also emphasized the critical importance of ensuring a just and equitable transition for workers across the transportation sector, including workers needed to support the widespread electrification of MHD vehicles. The subsection titled *Economic Equity for Workers* in Section VI recommends that states partner with community groups, labor groups, and others to develop workforce development programs to ensure that workers are prepared to fill new jobs created by the transition.

New Jersey's "Whole-of-Government" Approach to Environmental Justice

Pursuant to an Executive Order signed by the Governor of New Jersey in 2020, and detailed guidance issued by the New Jersey Department of Environmental Protection, all executive branch agencies in the state are charged with working together to build a stronger and fairer New Jersey for all by advancing environmental justice as a core principle of all state policies and programs. The Order requires executive branch agencies to apply principles of environmental justice to their operations, participate in the newly formed Environmental Justice Interagency Council (EJIC), and create assessments and action plans to improve the effects of agency policy on environmental justice communities. The EJIC will help agencies to adopt the principles, complete initial assessments, participate in workshops and trainings, and develop action plans, and will oversee a transparent process for setting milestones and evaluating action plan implementation progress.

This subsection also discusses several important issues confronting transportation sector workers—including low wages, inadequate benefits and working conditions, and driver misclassification[6]—that are outside the scope of the MOU, which is focused on the climate, air quality, and public health benefits to be achieved by electrifying trucks and buses, and by extension the scope of this *Action Plan*. These issues are also beyond the expertise and jurisdiction of the state agencies participating in the Task Force and intersect with policies and programs of other government agencies, including departments of health, labor, education, and economic and community development. The *Action Plan* discusses these issues to underscore the opportunity and need to address conditions for workers in connection with the transition to MHD ZEVs, and to promote collaboration with other parts of government whose engagement and expertise are needed to effectively address these issues.

A "whole-of-government" approach is needed to ensure that state MHD vehicle electrification policies and programs advance equity and environmental justice for overburdened and underserved communities and for workers affected by the transition. Moreover, the Task Force's engagement in connection with the development of this *Action Plan* is not a substitute for direct outreach and coordination with communities and workers as states develop and implement their MHD ZEV policies and programs. States must directly engage and coordinate with communities and workers with the most at stake, and mobilize inter-agency coordination and collaboration, as early as possible in the transition. To facilitate effective engagement at all levels of government, training and additional resources and staff will be needed.

Principles for a Just and Equitable Transition

The principles below are intended to guide the participating jurisdictions as they engage with overburdened and underserved communities and workers in developing just and equitable MHD vehicle electrification policies and programs. They are informed by guidance received from community-based organizations and the principles and concepts outlined in foundational environmental justice and community engagement frameworks such as the *Principles of Environmental Justice*, the *Jemez Principles for Democratic Organizing*, and the *Principles of Working Together*.[7]

JUST AND EQUITABLE PROCESS

Inclusive, accessible, and transparent community engagement processes, which elevate the voices of overburdened and underserved community members and workers in all aspects of clean transportation planning and decision-making, are fundamental to improving air quality and ensuring a just and equitable transition to a zero-emission on-road transportation system.

1. States should work with community groups to co-develop robust community engagement frameworks designed to institutionalize inclusive, accessible, and transparent engagement practices that:

a. Recognize and elevate community knowledge, expertise, and leadership, and encourage open communication and collaboration;

b. Include community input in all aspects of policymaking, including resource allocation, needs assessment, program planning, implementation, and evaluation;

c. Ensure opportunities to engage are regular and promote broad participation, with special consideration given to historically marginalized communities by:

- Providing translation services and materials in widely spoken languages in their states to address cultural and language barriers to participation;
- Holding meetings at times and locations that are convenient, familiar, and accessible to community members;
- Distributing materials well in advance of meetings; and
- Communicating complex matters in terms that are easy to understand; and

d. Ensure community members have access to relevant information, research, data, and key agency staff and decision-makers.

2. To identify overburdened communities, states should engage with communities to develop identification parameters, such as health metrics at the finest geographic scales available, air pollution measurements from regulatory monitoring sites and local and regional monitoring networks, modeled air pollution estimates, locations of current and planned emissions sources, locations of sensitive populations, and truck counts.

3. States should build knowledge and capacity within communities to provide input on community needs and priorities to inform the development of state clean transportation policies and effectively advocate for zero-emission technology by partnering with community-based organizations and representatives to:

a. Develop and implement MHD ZEV community outreach and education programs;

b. Provide technical assistance and materials on zero-emission truck and bus technologies and the environmental, public health, and economic benefits associated with transportation electrification, through workshops, trainings, and dissemination of other resources; and

c. Explore additional ways to support community engagement with state policymakers.

4. States should establish or utilize existing environmental justice and equity councils and advisory bodies to ensure the integration of equity considerations and overburdened and underserved community voices in clean transportation policymaking processes, and should regularly engage with community representatives to evaluate these forums to ensure they are effective and meet community needs.

JUST AND EQUITABLE OUTCOMES

Policies to accelerate the transition to zero-emission trucks and buses must deliver direct benefits and ensure just and equitable outcomes for overburdened and underserved communities.

1. States should prioritize and operationalize equity in all aspects of policymaking, including resource allocation, needs assessment, planning, implementation, and evaluation.

2. State policies should prioritize delivery of direct benefits to overburdened and underserved communities.

3. States should consider the goals and strategies outlined in climate justice planning documents developed by the environmental justice community and develop state MHD vehicle electrification policies and metrics that support those goals and strategies.

SECTION III

WHY ZERO-EMISSION TRUCKS AND BUSES?

MHD VEHICLES play a critical role in the nation's transportation system and in everyday life. Each year, trucks of all sizes transport billions of tons of commodities and packages to and from ports, railyards, airports, warehouse distribution centers, and retail outlets across the country. Last-mile delivery trucks have become a familiar sight in our neighborhoods due to the rapid growth in e-commerce and home delivery of consumer goods. Public transit buses continue to serve as the primary mode of personal transportation for millions of Americans, logging billions of passenger miles every year, while roughly half a million school buses—the nation's largest fleet—transport 26 million children to and from school every day.[8]

While MHD trucks and buses comprise only five percent of the total number of on-road vehicles in the United States today, their annual mileage per vehicle is significantly greater than that of passenger vehicles (*see* Figure 2) and they have an outsized impact on air quality and climate change. Powered predominantly by diesel engines, the trucks and buses that keep the economy running are among the most polluting vehicles on our roads.

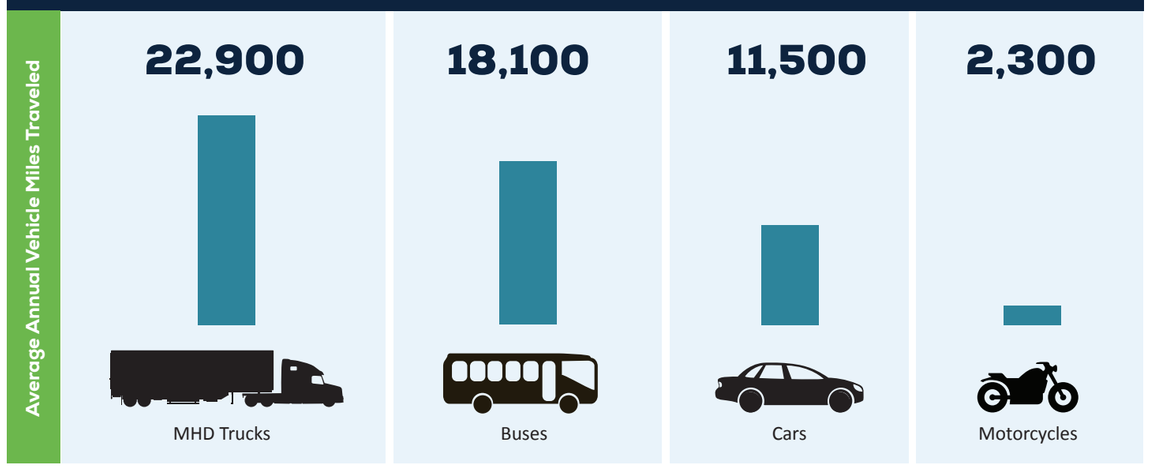
After passenger cars and trucks, MHD vehicles are the second largest source of transportation sector GHG emissions in the United States and a major contributor to smog-forming pollutants and $PM_{2.5}$ that harm the environment and public health. MHD vehicles account for 30 percent of GHG emissions,[9] 42 percent of smog-forming NO_X emissions (a precursor pollutant to ground level ozone), and 51 percent of direct $PM_{2.5}$ emissions (PM less than 2.5 micrometers in diameter) from on-road vehicles in the United States (*see* Figure 3) and are a significant source of emissions of hazardous air pollutants.[10]

The Disproportionate Impacts on Overburdened Communities and Workers

Decades of research confirm that exposure to ground level ozone, NO_X, and $PM_{2.5}$ worsens asthma and other cardio-respiratory illnesses, especially in children and older adults, leading to additional trips to doctors and emergency rooms, missed days of school and work, and thousands of premature deaths each year. Exposure to $PM_{2.5}$ can trigger heart attacks and strokes, exacerbate obesity and diabetes, and contribute to cognitive challenges.[11] Recent studies establish a clear link between proximity to traffic pollution and adverse public health impacts.[12] One study found strong evidence of a causal connection between long-term exposure to traffic-related air pollution and childhood asthma.[13]

Low-income communities and communities of color that are often located near trucking corridors, ports, fleet garages, warehouses, and other truck distribution hubs are hit hardest by this pollution burden and bear a disproportionate share of the associated health and economic consequences (*see* Figure 4).[14] Moreover, residents living near these facilities are often disproportionately overrepresented in jobs (e.g., truck drivers and warehouse and rail yard workers) that place them on the front lines of truck pollution and increase their exposure.[15] At the same time, many frontline and overburdened communities also experience disproportionately higher exposure to the impacts of climate change, such as more frequent and intense flooding and extreme heat.[16]

FIGURE 2: 2019 U.S. ON-ROAD ANNUAL VMT BY VEHICLE TYPE



Data Source: U.S. Federal Highway Administration, Annual Vehicle Distance Traveled in Miles and Related Data - 2019 (1) by Highway Category and Vehicle Type (revised Oct. 2021), https://www.fhwa.dot.gov/policyinformation/statistics/2019/pdf/vm1.pdf .

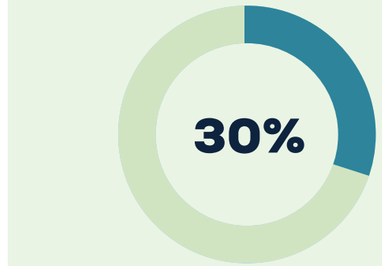
With truck freight volumes expected to continue to increase over the next decade, pollution from trucks will present an increasingly greater public health risk to frontline and overburdened communities located near heavy truck traffic. Rapid truck and bus electrification offers a transformative opportunity to address important equity and environmental justice issues and achieve large-scale reductions in diesel emissions needed to protect public health and stabilize the climate. This transition will take time, especially for heavy-duty trucks, which are on a longer path to commercialization and will benefit from further advances in ZEV propulsion technologies and the development of robust charging and fueling infrastructure networks.

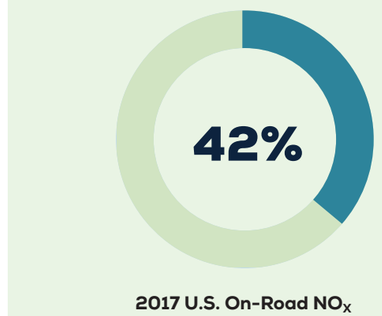
To maximize emissions reductions and the environmental, public health, and economic benefits associated with MHD vehicle electrification, it is also critical for states to equitably accelerate the shift to renewable energy sources.[17] The participating jurisdictions are well positioned for this transition. All have renewable portfolio or clean energy standards, which require a specified percentage of power sold by electric utilities operating in their states to come from renewable energy sources. Most also have 100 percent renewable energy requirements or goals.[18] Importantly, states must engage with frontline and overburdened communities to inform decisions about the siting of renewable energy facilities and infrastructure.

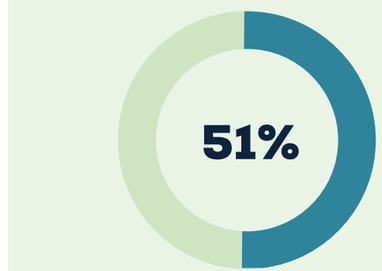
Quantifying the Public Health and Climate Benefits of MHD ZEVs

Achieving the MOU's MHD ZEV sales targets will deliver deep reductions in emissions of GHGs, NO_X, and $PM_{2.5}$. An analysis by the International Council on Clean Transportation

FIGURE 3: MHD VEHICLE SHARE OF TOTAL U.S. ON-ROAD EMISSIONS







MHD Vehicle Emissions Other Vehicle Emissions

Data Sources: U.S. Environmental Protection Agency, U.S. Greenhouse Gas Emissions and SInks 1990-2019 (Apr. 2021), http://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2019 ;
U.S. Environmental Protection Agency, 2017 National Emissions Inventory: January 2021 Updated Release, Technical Support Document (Jan. 2021), https://www.epa.gov/sites/default/files/2021-02/documents/nei2017_tsd_full_jan2021.pdf .

(ICCT) concluded that achieving 100 percent MHD ZEV sales in 2050 would slash well-to-wheel carbon dioxide equivalent emissions from the MHD vehicle segment in the participating jurisdictions up to 73 percent below 2020 levels.[19] Fully decarbonizing the electric grid by 2050 would deliver even greater emission reductions. ICCT also projected a fleet-wide decline in NO_X emissions between 78 and 98 percent below 2020 levels by 2050, depending on whether the jurisdictions adopt California's Heavy-Duty Engine and Vehicle Omnibus Regulation. In addition, emissions of $PM_{2.5}$ from MHD vehicles would drop by 73 percent below 2020 levels in 2050.

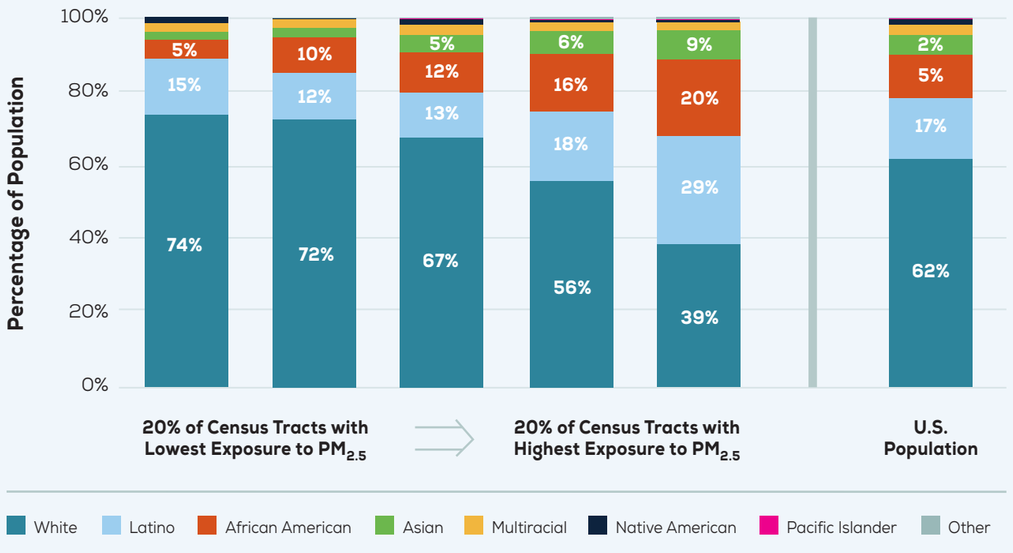
Maximizing the Economic Benefits of the Transition

With the right policies in place to boost investment in domestic MHD ZEV manufacturing and associated industries, transforming the MHD vehicle sector promises to deliver vast economic benefits and job creation. Macroeconomic analyses of MHD ZEV adoption find a large net benefit to households and businesses.[20] Zero-emission trucks and buses cost less to fuel and maintain than conventional vehicles, and with approximately 14 million MHD vehicles on the road today,[21] the net lifetime operating savings at full electrification will be substantial.[22] Moreover, widespread adoption of MHD ZEVs, powered by renewable energy sources, will foster greater energy security and insulate consumers from price fluctuations by reducing overall reliance on foreign oil.

Money spent purchasing MHD ZEVs and associated charging and fueling equipment cascades throughout the entire economy, boosted by other new spending generated by cost savings, creating jobs, and paying the salaries of thousands of workers over the life of each vehicle. Governments play a critical role in shepherding these impacts. Each dollar of public investment in MHD ZEVs generates almost three dollars of additional private investment that would not otherwise occur.[23] In seeking these benefits, governments should ensure that policies promoting MHD ZEVs rely on domestic labor to manufacture and service these vehicles wherever possible, or many of these benefits will accrue to markets overseas instead.[24]

Despite being a comparatively new technology, the transition to MHD ZEVs implicates traditional automotive employment skills. As with conventional vehicles, electric truck, van, and bus production

FIGURE 4: ON-ROAD $PM_{2.5}$ POLLUTION EXPOSURE BY RACIAL DEMOGRAPHIC



In the United States, residents of color tend to have significantly higher exposure to $PM_{2.5}$ concentrations relative to the national average. In the census tracts with highest exposure to $PM_{2.5}$ from on-road vehicles, residents of color are overrepresented while in the cleanest census tracts, the population has a higher fraction of white residents than the United States as a whole.

Data source: D. Reichmuth, *Air Pollution from Cars, Trucks and Buses in the US: Everyone is Exposed, But the Burdens are not Equally Shared*, Union of Concerned Scientists (Oct. 16, 2019), https://blog.ucsusa.org/dave-reichmuth/air-pollution-from-cars-trucks-and-buses-in-the-u-s-everyone-is-exposed-but-the-burdens-are-not-equally-shared/ .

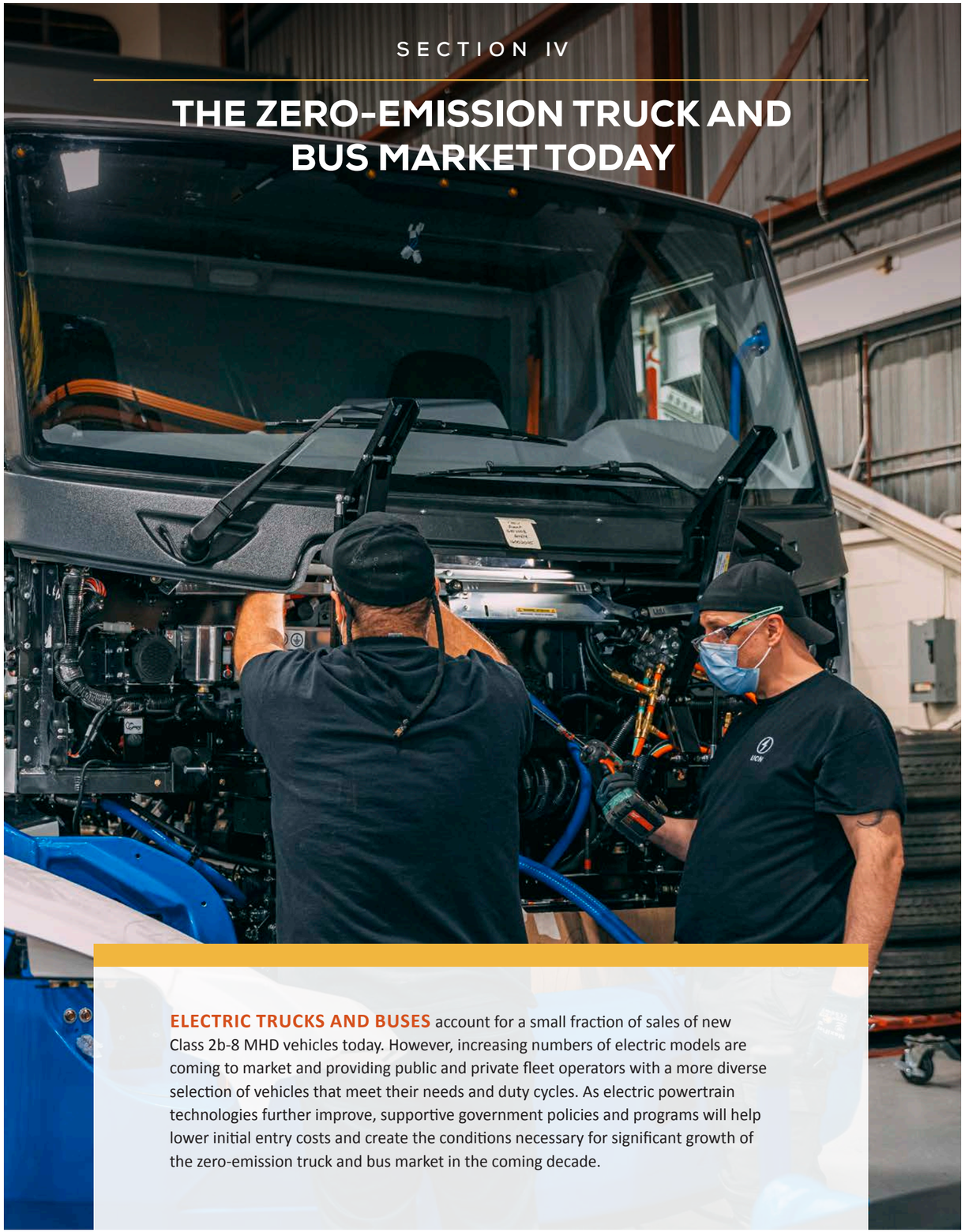
employs thousands to design, manufacture, and maintain vehicles and their supporting infrastructure. Jobs in these sectors include an assortment of assemblers, machinists, electrical technicians, and civil construction workers in addition to high-skill occupations in design and engineering; most are unionized vocations and pay supportive wages.[25] While some automotive and energy sector jobs may disappear due to industrial realignment, new direct job gains at similar skill levels in similar locations, and job opportunities in new business areas like battery logistics, will more than offset these losses provided there are strong policies to ensure growth in North American manufacturing and support workers in the transition.[26]

Government and private sector cooperation in the transition will be essential. With adequate training, workforce policy safeguards, and a focus on North American value chains, workers in automotive, civil infrastructure, and related secondary industries will have opportunities for equally or higher paying jobs. Working in concert with federal actions, states are uniquely poised to adopt policies and programs to maximize and ensure the equitable distribution of the economic and employment benefits of the transition to MHD ZEVs in their jurisdictions.

The environmental, public health, and economic benefits of a widespread shift to zero-emission trucks and buses are helping to drive a developing market for these vehicles. As the next section explains, electric powertrain technology has a strong foothold in the MHD vehicle market.

SECTION IV

THE ZERO-EMISSION TRUCK AND BUS MARKET TODAY



ELECTRIC TRUCKS AND BUSES account for a small fraction of sales of new Class 2b-8 MHD vehicles today. However, increasing numbers of electric models are coming to market and providing public and private fleet operators with a more diverse selection of vehicles that meet their needs and duty cycles. As electric powertrain technologies further improve, supportive government policies and programs will help lower initial entry costs and create the conditions necessary for significant growth of the zero-emission truck and bus market in the coming decade.

More than 125 different zero-emission models are currently available across Class 2b-8 vehicle segments in North America, and this number is anticipated to exceed 240 models by 2023.[27] Altogether, more than 55 manufacturers have announced plans to produce battery electric school, shuttle, and transit buses; drayage, long-haul, refuse, and work trucks; cargo and step vans; and yard tractors in the next few years.

In addition, several manufacturers have announced plans to develop Class 4-8 hydrogen fuel cell trucks and buses. Using hydrogen fuel pumps, these trucks and buses can be refueled in a manner similar to fossil fuel-powered vehicles and may be well suited for high mileage transit bus routes and heavy-duty long-haul trucking applications. Penetration of FCEV technology has advanced furthest in the transit bus segment: nearly 200 hydrogen-fueled buses were deployed in the United States in 2021.[28]

Early Progress on Zero-Emission Fleets

A growing number of public and commercial fleets are piloting electric trucks and buses. By matching duty cycles with vehicle capabilities, these early deployments are serving as a proving ground for the technology. To date, the largest MHD ZEV deployments have targeted replacement of urban delivery vans, drayage trucks, and transit and school buses. These applications are well suited for early deployment because they serve predictable routes, generally travel less than 100 miles per day roundtrip, and return to a centralized fleet depot, which enables fleet operators to strategically deploy vehicles and manage vehicle charging operations.

Transit Buses

Among all MHD vehicles, zero-emission transit buses have achieved the most widespread adoption, with more than 3,500 combined battery electric and hydrogen fuel cell transit buses in operation or on order in the U.S. and more than 600 in Canada.[29]

Early leadership in zero-emission transit bus deployment has been driven by a combination of local, municipal, and state government fleet purchase mandates; federal grant programs; state vehicle purchase incentives;[30] and the availability of a diverse group of BEV and FCEV models from both traditional and zero-emission-only bus manufacturers.

School Buses

The pace of electric school bus adoption has accelerated in recent years as school districts across the U.S. have funded, ordered, delivered, or deployed more than 1,700 electric school buses.[31] More than 250 electric school buses currently serve schools in Quebec. Many manufacturers are planning to ramp up production in the coming years to meet the increasing demand.

Some school districts are exploring the potential for electric school buses to provide vehicle-to-grid (V2G) services.[32] During periods when electric school buses sit idle in the evenings and summer months, the batteries can be used to store and discharge electricity back to the grid during periods of peak demand when electricity is costlier. Providing V2G services benefits school districts and utility ratepayers by generating revenue that improves the economics of fleet electrification while reducing electricity distribution system costs for ratepayers.

Commercial Fleets

Large corporate fleets are responsible for much of the early momentum in commercial MHD fleet electrification. These early adopter investments are largely driven by corporate sustainability commitments and a desire to achieve operational savings. Collectively, commercial fleets have pre-ordered more than 100,000 electric MHD ZEVs and begun deploying the first vehicles.[33]

Most last-mile delivery vehicles travel urban and suburban routes of less than 100 miles per day and present the greatest near-term opportunity for electrification.[34] Many of these routes can be served by zero-emission models that are commercially available today. In the growing e-commerce and parcel delivery space, companies like Amazon, DHL, FedEx, IKEA, and UPS are among the earliest adopters of electric delivery vans for last-mile deliveries.

Battery electric Class 7 and 8 short- and long-haul trucks are on a longer path to commercialization, but several pilot projects demonstrating their viability are underway. Today, there are more than 28 different battery electric and hydrogen fuel cell Class 7 and 8 truck models in various stages of development and production. Most are expected to come to market over the next three years.[35]

Short-haul drayage trucks, which transport freight loads between ports, warehouses, and distribution facilities, sit idle for periods while the container units are loaded and unloaded. This idle time is ideal for charging battery electric drayage trucks.

Electric School Buses: A Quebec Priority

The widespread adoption of electric school buses is a top priority for the Quebec government. In response to a request for proposals in 2016, Quebec selected its first project, which resulted in the production of the first North American electric school bus. Since then, Quebec has adopted several additional measures to accelerate zero-emission school bus fleet adoption, including a regulation requiring all new school bus purchases to be electric as of October 2021. Quebec is striving to achieve an all-electric school bus fleet by 2040 and has set an interim goal to electrify 55 percent of its school buses by 2030.

The duty cycle and more favorable business case for short-haul battery electric drayage trucks has led to pilot deployments along routes connecting port facilities, distribution centers, and railyards.

Early experiences with electric truck and bus deployment illustrate the important environmental, economic, and equity benefits that electrification of the MHD sector can deliver, while providing valuable insights into the challenges associated with taking commercial fleet electrification to scale. As discussed in the next section, a rapid transition from small-scale deployments by leading early adopters to a self-sustaining market across all vehicle classes requires overcoming a set of key barriers to widespread fleet electrification.

Volvo LIGHTS Project in Southern California

Led by the South Coast Air Quality Management District and Volvo Group North America, the Volvo Low-Impact Green Heavy Transport Solutions (LIGHTS) project brought together 14 diverse partners—private fleets, government agencies, ports, community colleges, equipment suppliers, a utility, and others—to develop and test a model for successful deployment of Class 8 battery-electric trucks. The $90 million project was funded by California Climate Investments, a statewide initiative that puts billions of cap-and-invest dollars to work reducing GHG emissions, strengthening the economy, and improving public health and the environment. The project deployed 25 Volvo VNR electric trucks, 25 freight handling vehicles, 58 chargers, and local site solar power generation. The Volvo LIGHTS project also launched innovative programs to train the specialized workforce needed to support, maintain, and repair battery-electric trucks. The three-year collaboration showed that heavy-duty, battery-electric trucks and equipment can be successfully integrated into commercial fleets moving freight with less noise and zero-tailpipe emissions.

SECTION V

BUILDING MARKET MOMENTUM AND ADDRESSING BARRIERS

THE MARKET for MHD zero-emission vehicles is primed for rapid growth. The fast pace of technology development, sharply declining battery costs, and the potential for significant operational cost savings are generating growing interest in truck and bus electrification by fleets of all types.[36]

Positive Market Developments

Rapid Technology Advances

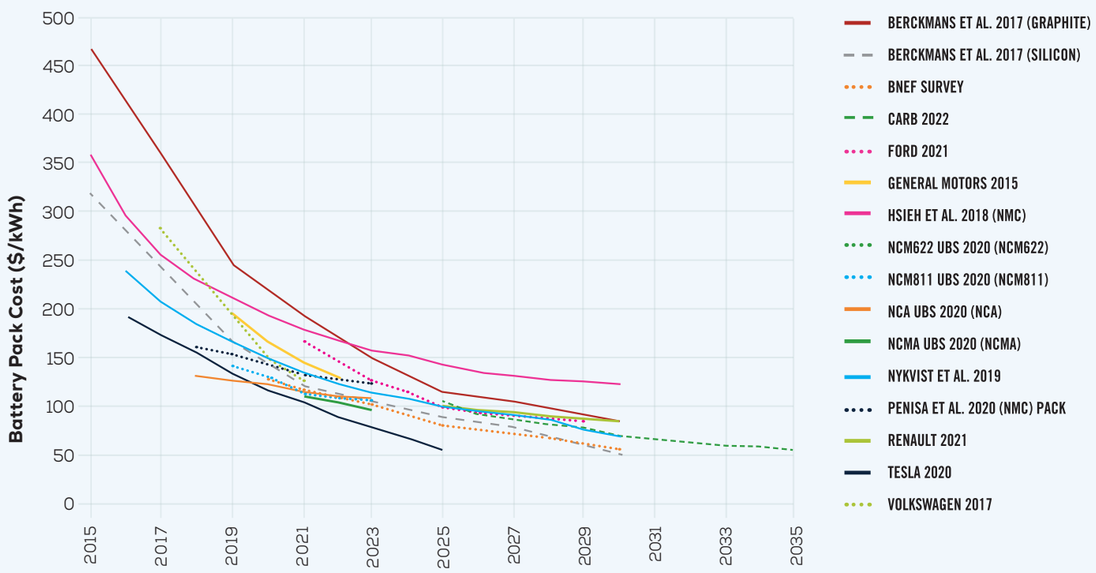
Many components of electric powertrains are the same across multiple platforms. Investment in first-to-market applications, like transit buses and urban delivery vans with shorter, fixed daily duty cycles, are speeding the transfer of technology to more challenging and less market-ready applications, like regional freight trucks and long-haul tractor trailers. Significant investment in research and development is resulting in continuous improvements in battery capacity, longer ranges, and faster charging. Nearly all the major truck manufacturers and suppliers offer electric models, are running MHD ZEV demonstration projects, or have announced plans to commercialize electric options for an expanding number of fleet applications.

Declining Battery Costs

Battery costs continue to be the single largest factor influencing EV purchase prices. However, rapid advances in battery chemistry, increasing energy density, and more efficient pack design are driving sharp reductions in battery costs. During the last decade, battery prices declined by nearly 90 percent, falling from more than $1,100 per kilowatt hour (kWh) to an average of $137 per kWh.[37] With further advancements in battery technology expected and growing market demand, multiple market analysts forecast a continued steady decline in battery prices through 2035 (*see* Figure 5).[38]

Declining battery costs will be reflected in lower prices and longer ranges for vehicles, leading to an improved business case for electrification and making zero-emission trucks and buses more affordable for a wider range of commercial fleets.

FIGURE 5: ELECTRIC VEHICLE BATTERY PACK COSTS IN THE U.S. THROUGH 2035



Data Source: S. Searle, et al., Comments on Proposed Advanced Clean Cars II (ACC II) Regulations, ICCT (May 31, 2022), https://www.arb.ca.gov/lists/com-attach/461-accii2022-BWxcOQZkUnVXDgJy.pdf (ICCT report forthcoming).

Emerging Favorable Economics for Battery Electric MHD Vehicles

The economics of electrification factor heavily in commercial fleet purchasing decisions. Battery electric MHD vehicles have the potential to deliver significant lifetime operational savings over diesel trucks and buses through lower fuel, maintenance, and electric powertrain costs. A recent analysis by the U.S. Department of Energy's Lawrence Berkeley National Laboratory illustrates the substantial opportunity for operational costs savings even with fleet applications that are the most challenging to electrify. The analysis compared the total cost of ownership (TCO) of a Class 8 long-haul battery electric truck with its diesel counterpart and projected a 13 percent lower TCO per mile for the battery electric truck, leading to a net savings of $200,000 over an assumed 15-year lifetime of the electric truck.[39]

Over the next few years, due to rapidly declining battery prices, multiple classes of trucks and buses are expected to be competitive with internal combustion engines on an upfront cost basis and significant TCO savings will be possible for a wide range of fleet applications.[40] Smaller Class 3-6 commercial delivery vans and step vans are already approaching TCO parity with internal combustion engine vehicles within this market segment.[41] Market analysts project favorable TCO without government subsidies for medium-duty ZEV applications in many weight classes by 2025, and for applications in all weight classes by 2030.

To build on these positive technological developments, bold leadership and early action by policymakers and other key partners are needed to increase model availability and overcome initial cost and charging infrastructure barriers.

INFRASTRUCTURE INVESTMENT AND JOBS ACT

Signed into law on November 15, 2021, the historic Infrastructure Investment and Jobs Act (IIJA) provides critical funding for states to accelerate MHD vehicle electrification. The IIJA provides more than $15 billion in funding for MHD vehicle electrification-eligible investments, including $250 million for projects that reduce truck emissions at port facilities; $5 billion for clean school bus purchases; and over $10 billion for clean transit buses, refueling infrastructure, and bus facility upgrades. This large infusion of federal funding will spur market development and greater demand for zero-emission trucks and buses as state and local governments accelerate their fleet transition efforts.

Existing Sector-Wide Barriers

Higher Upfront Cost of MHD ZEVs

Among the primary barriers to commercial zero-emission fleet adoption are the incremental upfront purchase cost of zero-emission trucks and buses and associated infrastructure compared to internal combustion (e.g., diesel or gasoline) vehicles. For example, according to a 2019 survey by the Vermont Energy Investment Corporation, the average cost of an electric Class C school bus without charging infrastructure ranged from $265,000 to $400,000[42] as compared to $110,000 for a diesel bus. It is expected that prices for electric buses will decline substantially, so that the lower maintenance and fuel costs for an electric bus should more than make up for the higher purchase price, but that future return on investment does not help school districts reduce the necessary initial capital outlay. Results from an analysis supporting the adoption of California's Advanced Clean Trucks regulation projected favorable TCO for BEVs over diesel and FCEVs in nearly all classes leading up to 2030 without government subsidies.[43]

Barriers for Small Fleets

Small trucking companies operating with six or fewer trucks make up 90 percent of carriers in the United States.[44] Instead of purchasing new trucks to replace older trucks that have reached the end of their useful lives, many smaller fleets, independent owner/operators, and contract drivers buy used trucks on the secondary market. Because these smaller fleets and contract drivers often have slimmer profit margins, fewer capital resources, and less certain access to credit,[45] there is less capacity to assume the inherent risks and uncertainties associated with adoption of new technology. Enhanced incentives can help overcome the upfront cost barrier.

The Need for Fleet Outreach and Education Programs

Many fleet operators—especially small fleets and independent owner/operators—lack knowledge and awareness of zero-emission technology and its benefits. This is a threshold barrier to a successful and timely sector-wide transition. A robust fleet outreach and education effort targeted to small fleets and independent owner/operators that provides information on the public health impacts of diesel emissions on overburdened communities and drivers, zero-emission technology, government incentive programs, tools to calculate operational costs, installation of charging infrastructure, and other considerations, is essential to give fleets the information they need to make the shift to electric trucks.

Critical Need to Deploy Charging Infrastructure

Rapid deployment of depot, public, and highway corridor charging infrastructure to serve commercial fleets with a variety of charging needs is vitally important and will require strategic planning and coordinated action between states, utilities, fleet managers, and property owners who lease space to delivery companies, warehouses, and other facilities that are integral to the goods movement sector. While most MHD fleets have extended downtimes and will be able to utilize lower-powered 50 kW to 150 kW DC fast charging, or even Level 2 overnight depot charging, the duty cycles of some MHD fleets with larger batteries will require much higher-powered DC fast charging and a significant additional upfront capital investment. A fleet of transit buses, for example, could easily require several megawatts of electrical capacity and significant modifications to existing parking facilities that may be located in space constrained urban areas.

Depending on the size of the fleet and the type of vehicles, upgrades to electrical panels and power lines at the facility may be needed, along with utility upgrades to power lines and other distribution infrastructure that will often require expensive trenching. Determining how these costs will be allocated, along with the timing and other logistics of charging infrastructure deployment, can add significant complexity to the fleet electrification process, particularly for fleets that lease their facilities.

In addition to facility depot charging infrastructure, an accessible public fast charging network along regional and long-haul trucking routes is needed to fully electrify MHD fleets. The buildout of a charging network along major trucking corridors will require sustained private sector financial support, leveraged by public funding, and clear direction from utility regulators to ensure inclusive long-term utility planning. Projects like the Swan Island MHD public charging site, which is located less than a mile from Interstate-5 in Portland, Oregon, offer new partnership models for expanding charging availability along major trucking routes (see photo below).

Production Issues

While there is a steady increase in the number of MHD ZEV product offerings, more electric options with longer ranges are needed for long-haul applications in particular. Low production volumes are also limiting more widespread deployment of electric trucks and buses and making it more difficult to establish a successful performance record for new models. Rapid growth of the electric truck and bus market will require the development of a robust supply chain and skilled workforce, particularly given the lingering effects of the COVID-19 pandemic on the availability of some vehicle components. Strong state MHD vehicle electrification and economic development policies will incentivize industry investment in supply chain manufacturers, distributors, retailers, and service providers.

Lithium-ion Battery Recycling in Quebec

Lithion Recycling in Montreal uses an innovative, efficient, and cost-effective hydrometallurgical process to recycle lithium-ion batteries, the most widely used batteries for electric vehicles and portable electronics today. Its process can recover 95 percent or more of lithium, nickel, cobalt, and other critical minerals for reuse in new batteries. By enabling the battery manufacturing industry to maximize its production scrap value and efficiently recycle end-of-life batteries, this technology is helping to close the battery life-cycle loop.

Electricity Rates

Commercial electricity rates are not designed specifically for electric MHD vehicle charging—particularly the high-power charging required for certain MHD vehicle applications. In addition to energy charges for actual electricity use, commercial facilities are also assessed demand charges for the maximum power used during a billing cycle. Demand charges associated with EV charging can be significantly greater than energy charges and make the cost of electricity prohibitive. Rate reform is needed to mitigate demand charges and incentivize fleet charging during lower cost off-peak periods and periods of high renewable energy generation. Managed charging strategies, while not a substitute for improved rate design, will be essential to ensure that electricity rates are competitive with the cost of diesel fuel over the long term. Co-locating battery storage at fleet depots can also help to manage demand and electricity costs.

Lack of Financing Options

Widespread commercial fleet electrification will not happen without private sector capital investment. While financiers have indicated a strong interest in commercial fleet electrification, actual investment today has been limited[46] by the perceived risks and uncertainties associated with electric trucks and buses and the need for economies of scale to leverage private capital.

Different Charging Standards

The interoperability of vehicle charging stations is important to maximize vehicle flexibility and convenience. Manufacturers of transit and school buses equipped with plug-in connectors all use the SAE-approved J1772 CCS Type 1 charger. While the SAE J3068 three-phase AC standard can accommodate overnight charging of any MHD vehicle and DC charging up to 500kW, MHD ZEV manufacturers have not yet widely adopted this standard. A common open charging standard for trucks is needed to make public charging seamless, achieve economies of scale, avoid stranded assets, and minimize the need for future modifications to charging connectors. A high-powered charging standard to serve the power and charge time needs of multiple MHD vehicles—the Megawatt Charging System (MCS)—is under development by the Charging Infrastructure Initiative (CharIN) Task Force, which is comprised of industry, utility, and government agency representatives.[47] Once finalized, the MCS is expected to become the industry standard for high powered heavy-duty vehicle fast charging.

Lithium-ion Battery Production and Recycling

Today's EV batteries require lithium, cobalt, nickel, manganese, copper, and other minerals to generate and store the electricity that powers the vehicle. Extraction of these minerals, some of which are located in a small number of developing nations without adequate regulatory protections, causes damaging environmental impacts and is associated with public health risks, child labor, poverty wages, and dangerous working conditions.[48] Moreover, most battery production is presently based in Asia. North America must develop its own battery supply chain in order to minimize the risk of disruption to its automotive and other industries. The need to address the social, environmental, and economic implications of battery production and recycling is widely acknowledged.

At the other end of the battery life cycle, there is growing interest in finding end-of-life solutions through re-manufacturing, repurposing, and recycling that could reduce reliance on virgin raw materials, cut the costs of battery production, and lower life cycle battery emissions.

Other Challenges for Battery Electric Truck and Bus Deployment

Expert technical assistance and close coordination with utilities will be needed for individual fleets to assess the overall costs and benefits of electrification, understand charging options, and properly sequence infrastructure deployment with vehicle purchases. Lengthy permitting and utility interconnection processes add complexity and costs to infrastructure deployment. Battery weight presents a potential obstacle for heavy-duty long-haul applications. The weight of the batteries needed to increase electric range could cause some fully loaded trucks to exceed vehicle weight limitations, thereby

limiting their cargo carrying capacity, although this issue is expected to diminish over time due to improvements in battery and vehicle design.

Other Challenges for Hydrogen Truck and Bus Deployment

While hydrogen trucks and buses are being piloted in small numbers across the country, the current TCO for fuel cell vehicles and costs for constructing and commissioning hydrogen fueling stations are significantly higher than for battery electric MHD vehicles. The average hydrogen station carries a median capital cost of $1.9 million,[49] and hydrogen fuel averages over $16 per gasoline gallon equivalent.[50] Increasing uptake of hydrogen trucks and buses will depend on hydrogen fuel becoming cost competitive with electricity and other transportation fuels and the ability to scale vehicle manufacturing, fuel production, and fueling infrastructure network development. According to industry experts, demand from trucking alone will not be enough to drive down hydrogen fuel production and transportation costs; demand will also be needed from a broad range of industrial and commercial applications.

Other challenges for hydrogen trucks and buses relate to the GHG emissions associated with fuel production and leakage in the supply chain. Less than one percent of hydrogen fuel produced globally today is "green" fuel, produced by an electrolytic process powered by renewable energy, because it is not cost competitive with hydrogen produced from natural gas except in limited areas where renewable energy prices are extremely low.[51] In addition, hydrogen is susceptible to leakage into the atmosphere where it reacts to potentially increase the impacts of certain GHGs.[52] Further research is needed to better understand the impacts of hydrogen leakage from production to end use. Significant progress remains to be made for hydrogen to become a cost-effective and zero-emission replacement for fossil fuels.

All levels of government have important roles to play to accelerate the market transformation needed to achieve state climate, air quality, and equity goals. Safety considerations are also important. Planning, training, and resources will be needed to ensure fleet maintenance staff, vehicle operators, and first responders are equipped to identify and respond to incidents involving ZEV technologies. The next section offers a series of recommended actions for state policymakers to overcome key market barriers and speed the transition to a zero-emission transportation sector. Recommended actions for local and U.S. federal government policy makers are included in the Appendix.

SECTION VI

STRATEGIES AND RECOMMENDATIONS

WITH A FOCUS ON NEAR-TERM STRATEGIES, this section includes more than 65 recommendations for state policymakers to support the rapid, equitable, and widespread electrification of trucks, vans, and buses, including vehicle sales and purchase requirements, vehicle and infrastructure incentives, actions for electric utilities and utility regulators, innovative financing mechanisms, outreach and education, economic equity and workforce development, community air monitoring, infrastructure planning and deployment, and areas for ongoing research and evaluation.

There is considerable diversity in the economic base, population density, settlement patterns, resource availability, and other key characteristics that shape the participating jurisdictions' unique policy needs and opportunities. A jurisdiction's participation in the MHD ZEV initiative should not be interpreted as an endorsement of all the recommendations included in the *Action Plan*. The recommendations are not intended to provide a uniform pathway for states to follow, but rather to guide inter-state coordination and inform state-specific actions. Each jurisdiction is expected to promote MHD ZEV market growth in ways that best address its unique needs and opportunities. Further, to implement many of these strategies, considerable resources, adequate staffing, new and sustainable sources of funding, and strong and enduring partnerships will be required. The participating jurisdictions should consider using the framework provided by the *Action Plan* to develop their own plans informed by robust engagement with stakeholders and communities, especially overburdened and underserved communities and workers, and tailored to meet the needs of their jurisdictions.

Vehicle Sales and Purchase Requirements

Regulatory programs requiring manufacturers to sell increasing percentages of zero-emission trucks and buses, such as California's Advanced Clean Trucks (ACT) regulation, are one of the most effective tools available to rapidly advance the market for MHD ZEVs. Under the ACT regulation, manufacturers of Class 2b-8 vehicles must sell an increasing percentage of ZEVs. State adoption of the ACT regulation will ensure zero-emission trucks and school buses are available for purchase by fleets in the state, provide significant reductions in diesel emissions that are critical to improving air quality and public health in frontline and overburdened communities, and support local economic development and job growth.

While market-enabling programs such as incentives are also important, regulatory requirements mandating MHD ZEV sales establish a regulatory floor that provides market certainty needed to drive investments in zero-emission technologies and charging and fueling infrastructure. Indeed, the ZEV

California's Fleet Purchase Requirements

To complement the ACT regulation, California is developing the Advanced Clean Fleets (ACF) regulation to require fleets that are well suited for electrification (i.e., drayage fleets, public fleets, federal fleets, and other high priority fleets) to transition to MHD ZEVs. These fleet purchase requirements will further accelerate the uptake of MHD ZEVs and the benefits they offer to those communities most impacted by harmful truck emissions. The ACF regulation builds on California's Innovative Clean Transit regulation, which requires public transit agencies to transition to a 100 percent zero-emission bus fleet, and its Zero-Emission Airport Shuttle regulation, which requires airport shuttle operators to transition to zero-emission shuttles.

sales mandate for passenger vehicles, established by California and adopted by other states, has prompted unprecedented investment in light-duty zero-emission technologies and substantial growth in the market share of light-duty ZEVs. The ACT regulation may be an even more important driver of electrification of the MHD vehicle sector given the costs and characteristics of trucks and buses. Accordingly, many of the MOU states have adopted, or are considering adopting, California's ACT regulation to accelerate the widespread deployment of MHD ZEVs.[53]

While the Clean Air Act preempts every state except California from establishing motor vehicle emissions standards that are more stringent than U.S. federal standards, most states may "opt-in" to California's standards. In addition to California, 15 states have adopted California's ZEV regulation for passenger vehicles, helping to drive the market and create economies of scale that lower the overall cost of electrification. Together, these states represent more than 35 percent of new light-duty vehicle sales in the United States. Quebec was the first Canadian government to adopt a similar regulation. Adoption of California's light-duty vehicle emissions standards by other states has resulted in stronger federal emission standards for GHGs and criteria pollutants. Similarly, state adoption of California's MHD vehicle standards will provide the underpinning for more stringent federal standards.

States can also play an important leadership role by being early adopters of zero-emission trucks and buses. Government fleet electrification targets, such as zero-emission school bus fleet targets adopted by Colorado (100 percent by 2035), Connecticut (100 percent by 2040), New York (100 percent by 2035), and Quebec (100 percent by 2040), provide quantifiable emission reductions and, at the same time, build confidence in MHD ZEVs by publicly demonstrating the viability of zero-emission technologies. Some use cases, such as emergency response, will be more difficult to transition. State agency responses to extreme weather events can require extended duty cycles, rapid refueling, or positioning vehicles where charging or specialized fueling facilities may not be available. In addition to leading by example, setting requirements for private fleets that are well positioned to transition to MHD ZEVs can also help to transform the market.

Recognizing the critical role ZEV sales and purchase requirements play in driving MHD vehicle electrification, and the importance of ensuring emissions reductions in communities most affected by pollution from diesel trucks and buses, the Task Force offers the following recommendations:

1. States should consider adopting:

a. The ACT regulation to establish zero-emission sales requirements for trucks, along with a one-time fleet reporting requirement, adjusted as needed based on the size of the state, to collect data on fleet operations;

b. Corresponding fleet purchase requirements, such as the Advanced Clean Fleets regulation and the Zero-Emission Airport Shuttle regulation; and

c. California's Heavy-Duty Engine and Vehicle Omnibus regulation to reduce NO_X and PM emissions from heavy-duty trucks while the market transitions to ZEVs.[54]

2. States should set MHD ZEV fleet purchase and annual reporting requirements for publicly owned, controlled, and contracted fleets designed to achieve 100 percent zero-emission MHD fleet vehicle purchases where technically feasible by no later than 2040, and sooner for applications better suited for electrification in the near term. States should prioritize electrifying public fleet vehicles operating in communities disproportionately affected by air pollution.

3. States should support continuous progress toward public sector MHD fleet electrification targets by:

a. Performing a rigorous analysis to identify the best opportunities in state agency fleets for MHD zero-emission replacement vehicles;

b. Requiring that all fleet acquisitions consider operation and maintenance costs and account for the savings associated with lower operation and maintenance costs of ZEVs and any benefits associated with V2G services; and

c. Streamlining and, wherever possible, aggregating MHD ZEV and charging infrastructure procurement processes across states and regions.

4. States should adopt purchase and reporting requirements for publicly owned, controlled, and contracted transit fleets, such as California's Innovative Clean Transit regulation, and require transit agencies to develop and periodically update transition plans to meet zero-emission purchase and contract requirements. States should prioritize electrifying public transit vehicles operating in communities disproportionately affected by air pollution.

5. States should establish zero-emission purchase and reporting requirements for publicly owned and contracted school bus fleets designed to achieve 100 percent zero-emission purchases and contracts by no later than 2040 and sooner for fleets operating in communities disproportionately affected by air pollution. States should provide school districts with resources to develop and periodically update transition plans and provide technical assistance to school districts in communities disproportionately affected by air pollution.

6. States adopting MHD ZEV sales and purchase requirements and other regulatory programs should work together to share their experience and expertise and coordinate on adoption and implementation issues such as reporting practices.

Vehicle and Infrastructure Purchase Incentives

Providing purchase incentives to reduce or eliminate the purchase price differential for MHD ZEVs and the cost of charging and fueling infrastructure are among the most important actions that states can take to accelerate electric truck and bus adoption in this early market. This is particularly true for smaller fleets, independent owner/operators, and minority-owned fleets in low- and middle-income communities that may not have sufficient capital or access to affordable financing sources to front load the cost of higher priced ZEVs and charging/fueling infrastructure. Incentives should phase down over time as the market matures and affordable private sector financing becomes more widely available.

Incentive programs can take several forms, including tax credits, sales tax waivers, low-interest loans, rebates, and point-of-sale voucher programs. The most effective incentive programs are point-of-sale programs that provide "cash-on-the-hood" at the time of purchase. Data collection and reporting requirements in incentive programs should be structured to minimize the administrative burden on fleets.

The MOU directs the participating jurisdictions to accelerate the deployment of zero-emission trucks and buses to benefit communities that have been historically burdened with higher levels of air pollution. This can be achieved by designing incentive programs that prioritize the electrification of fleets operating in communities that are disproportionately impacted by diesel emissions and that support the goals outlined in climate justice planning documents developed by environmental justice communities.

States should also be mindful that scrappage requirements, a common feature of truck and bus incentive programs, could preclude some large and small fleets from participating in incentive programs because they may not have older vehicles to scrap. Sound asset management practices often encourage large fleets to keep new trucks for three to five years before selling them into a secondary market for purchase by smaller fleets. Consequently, fleets that do not have older, more polluting vehicles to scrap, or that do not want to forego the sales proceeds of the vehicle to be replaced, may not be eligible for incentive programs with scrappage requirements. Scrappage requirements are also a disincentive to fleet operators that are expanding their operations and to those that prefer to lease, rather than purchase vehicles. Thus, as currently structured, incentive programs that require the scrappage of older vehicles (e.g., pre-2010) could slow the pace of electric truck and bus adoption.

Washington's Plans for Fleet Transition

In 2021, the Governor of Washington issued an Executive Order outlining a comprehensive strategy for transitioning the state's MHD and light-duty vehicle fleets to BEVs. The Order establishes fleet conversion targets for 2030, 2035, and 2040 and requires 24 state agencies to purchase EVs when vehicles with internal combustion engines need to be replaced. When a battery-powered model is not available, agencies must acquire "the lowest-emission, cost-effective option," such as a PHEV. A state-wide strategy is being developed to recommend policies and charging infrastructure investments to support the transition. Individual state agencies will develop and update their own implementation plans and publicly report on their progress.

TRUCK AND BUS PURCHASE INCENTIVE PROGRAMS

In 2009, California launched the first state MHD zero-emission vehicle point-of-sale voucher program—the Hybrid and Zero–Emission Truck and Bus Voucher Incentive Project. Since then, more than 1,400 fleets have received funding from the program for 7,000 zero- and near-zero-emission trucks and buses. The program served as a model for New York's Truck Voucher Incentive Program. Both programs offer funding for new vehicle purchases and internal combustion vehicle conversions. Other state programs include the Massachusetts MOR-EV Truck Program, New York City's Clean Trucks Program, and New Jersey's pilot Zero-Emission Incentive Program for medium-duty trucks operating in designated overburdened communities in the Camden, Newark, and New Brunswick areas. These programs are providing important early lessons about effective purchase incentive design and implementation.

Stable and sustainable sources of funding are needed to support state incentive programs and provide the market certainty needed to drive industry and private sector capital investment in zero-emission transportation technology. In addition to general fund appropriations, other potential funding sources include utility system benefit charges, motor vehicle registration fees, and "feebate" programs or other transportation-related fees or taxes. Market-based GHG emission cap-and-invest programs operating in California, Quebec, and the Northeast and Mid-Atlantic states generate steady and significant sources of funding used to support a variety of climate programs, including EV incentive programs. States could also explore opportunities to co-fund incentive programs with local governments. In exploring potential funding sources, states should consider whether particular revenue generating mechanisms could impose a disproportionate burden on overburdened, underserved, and low-income communities.

The Task Force offers the following recommendations for design of vehicle and infrastructure incentive programs to improve the economics of electrification for fleets and prioritize electrification of trucks and buses that operate in overburdened and underserved communities:

1. States should establish MHD ZEV point-of-sale or other equally effective fixed reimbursement vehicle and infrastructure incentive programs that:

a. Subsidize a portion of the total incremental cost differential between an electric and diesel or gasoline truck and bus, or conversion or repowering to a zero-emission powertrain where appropriate;

b. Are available to fleets and businesses operating under a variety of charging models, including fleets that lease their facilities or charge off-site and businesses that do not own their own fleets;

c. Integrate seamlessly with other programs that support onsite renewable energy generation and battery storage;

d. Operate in coordination with programs that provide funding for planning, fleet audits, and technical assistance;

e. Require compliance with open communications standards;

f. Require reporting on vehicle and infrastructure utilization in accordance with a specified format and schedule and sharing of charging data with utility providers upon request; and

g. Decline over time based on an evaluation of fleets and applications needing the most assistance to electrify.

2. To deliver early benefits to communities historically exposed to higher levels of air pollution, state vehicle and infrastructure incentive programs should:

a. Reserve a percentage of funding for deployments that will benefit state-defined overburdened communities;

b. Prioritize and offer increased incentives that cover a larger portion of the cost differential to fleets that are domiciled or operate in overburdened communities such as ports and drayage trucks, fleets operating near warehouse and goods distribution hubs, and school and transit buses; and

c. Provide technical assistance to help fleets that are domiciled or operate in overburdened communities apply for incentives and understand financing and infrastructure deployment options.

3. To support small fleets, minority-owned fleets, and independent owner/operators, state vehicle and infrastructure incentive programs should:

a. Reserve a percentage of funding for applications from these fleets;

b. Offer increased incentives that cover a larger portion of the cost differential;

c. In collaboration with other key partners, provide technical assistance to help these fleets apply for incentives and understand financing and infrastructure deployment options; and

d. To simplify the application process for fleets, consider requiring zero-emission truck manufacturers or dealers to complete and submit application forms on behalf of fleets.

4. As a condition of receiving incentive program funding, states should consider requiring applicants to certify compliance with state and federal tax and labor laws and maintain in-state registration for a fixed period following acquisition of the vehicle.

5. States should work through the ZEV Task Force to form a workgroup to consider issues relating to the design of MHD ZEV incentive programs, including the role of scrappage and options for flexible scrappage requirements that can maximize fleet participation while securing emission reductions, performance-based incentives that reward increased electric range and/or lower electricity use, requirements for reporting charging infrastructure uptime data, stacking of incentives from multiple incentive programs, and how incentive programs could evolve to support growth of a secondary market for MHD ZEVs.

6. States should strive to establish sustainable sources of funding to support vehicle and infrastructure incentive programs.

7. States should consider providing exemptions (or reductions) from sales tax and registration fees for zero-emission trucks and buses until overall cost parity is achieved.

Actions for Electric Utilities and Utility Regulators

Widespread electrification of trucks and buses will present a new set of grid management challenges and opportunities for utilities. Many fleets will require fast high-powered charging to reduce refueling time for their electric trucks and buses, along with localized grid upgrades to serve the increased power load. While the prospect of significantly lower fuel and maintenance costs and resulting lower TCO is a key driver of fleet electrification, MHD vehicle charging costs can be adversely affected by commercial electricity rates not specifically designed for ZEV charging.

Utilities and utility regulators must play a central role in MHD fleet electrification to ensure a smooth and rapid transition. Strategic long-range planning, close coordination and consultation with truck and bus fleets, properly sequenced utility investment in "make-ready" charging infrastructure, and development of beneficial commercial electricity rates designed to incentivize fleet charging during low-cost and low-demand periods are vital to achieving MHD fleet electrification at the pace and scale necessary to meet state electrification goals.

Utility on-bill financing programs can help address barriers associated with the upfront capital costs of zero-emission vehicles and infrastructure. For charging infrastructure, "tariffed on-bill financing," which does not require a credit check and recovers costs through a monthly utility bill charge that is less than the estimated fuel, maintenance, and other operational savings associated with deployment of zero-emission vehicles, is more accessible to less credit worthy customers or customers who are unwilling to incur indebtedness. This form of financing could also be extended to financing for on-site solar and battery storage to support managed charging. In the subsection below titled *Ongoing Multi-State Research and Policy Development*, the Task Force recommends that states further explore the potential benefits of tariffed on-bill financing.

If managed well, fleet electrification could deliver important grid and ratepayer benefits. The additional revenues generated from truck and bus charging have the potential to put downward pressure on electricity rates for all ratepayers. Fleet charging at times of peak solar and wind generation paired with investments in energy storage could help increase integration of renewable energy sources into the electric grid and manage load. In apportioning costs for utility make-ready infrastructure and other MHD ZEV programs, it will be important to avoid imposing unfair burdens on low-income ratepayers.

The Task Force thanks M.J. Bradley and Associates for facilitating a robust utility stakeholder engagement process that provided expert input on the critical roles of electric utilities and utility regulators in MHD vehicle electrification. Recognizing that utilities in the participating jurisdictions are subject to different regulatory frameworks and require flexible approaches to MHD vehicle electrification, the Task Force offers the following recommendations for utilities and utility regulators to address these challenges:

1. Utility regulators should:

a. Consider requiring utilities to incorporate transportation electrification into integrated resources planning;

b. Unambiguously exempt charging providers from regulation as electric utilities to eliminate regulatory uncertainty and barriers to expansion of the electric vehicle supply equipment (EVSE) sector;

New York State Public Service Commission's Equity-Focused MHD Utility Programs

In July 2020, the New York Public Service Commission issued a final order establishing a $701 million make-ready charging infrastructure program with targeted elements designed to accelerate adoption of electric trucks and buses in designated environmental justice and low- and moderate-income communities. The order creates a MHD ZEV make-ready infrastructure pilot program ($15 million), a transit authority make-ready program ($10 million), a clean MHD innovation prize ($20 million), and a fleet assessment service. In particular, the order requires that MHD make-ready funding support diesel emission reductions in environmental justice communities and identifies projects operating or domiciled in such communities as being of heightened interest for the clean MHD innovation prize. Together, these programs are intended to advance and scale truck and bus electrification in alignment with equitably achieving New York's air quality and climate goals.

c. Consider adopting utility targets for deployment of "make-ready" and other charging infrastructure for MHD ZEVs that align with state environmental and transportation electrification goals, regulatory requirements for MHD ZEV penetration, and overburdened and underserved community priorities, and require utilities to develop plans to achieve those targets; and

d. Support state electricity decarbonization and renewable energy targets to maximize GHG reductions and air quality improvements and avoid shifting transportation emissions to fossil-fueled power plants.

2. To ensure transmission and distribution system capacity to serve new electric loads from battery electric MHD fleet charging, meet electrification targets, and inform utility, fleet, and government planning processes, utility regulators should consider directing utilities to:

a. Conduct assessments of system capacity by identifying MHD vehicle customer fleets, fleet plans for electrification, and the need for and costs of system upgrades to serve new interconnections, giving consideration to resilience, reliability, and other grid impacts;

b. Proactively prepare for grid upgrades and be positioned to complete upgrades as needed to serve new load;

c. Establish streamlined standard interconnection review processes and timelines to eliminate long interconnection wait times; and

d. Develop and make available to fleets, EVSE providers, and planning agencies detailed hosting capacity maps that enable identification of preferable least-cost locations for charging infrastructure that optimize the use of existing distribution system assets.

3. Utility regulators should consider adopting policies and guidelines encouraging utilities to:

a. Provide all necessary service-line extension and make-ready electrical infrastructure on the utility side of the meter for all non-residential customers installing separately metered charging infrastructure at reduced or no cost to the customer;

b. Require compliance with open communication standards for all utility-funded charging infrastructure;

c. Establish fleet services programs with a single point of contact to provide comprehensive technical assistance; advise fleets on incentive programs, rate options, infrastructure deployment, managed charging, and opportunities to provide grid services; coordinate data collection; and work with vehicle manufacturers, charging equipment providers, permitting authorities, and others as necessary to facilitate fleet electrification;

d. Offer utility on-bill financing and repayment for MHD ZEVs and charging infrastructure and prioritize financing for small fleets, transit agencies, and school districts with fewer capital resources;

e. Explore the development of technical standards and interconnection rules to allow bi-directional grid services;

f. Offer revenue-generating V2G services and enable vehicle-to-building services for electric school buses and other MHD ZEV fleets that are valued consistent with traditional grid services; and

g. Require notification from large fleets in advance of commencing vehicle electrification activities.

4. To ensure early emission reductions and transportation system improvements in overburdened and underserved communities, utility regulators should:

a. Prioritize investments in overburdened and underserved communities by establishing requirements for deployment of make-ready infrastructure and investment of incentive funding to benefit fleets operating in or near these communities; and

b. Support utility engagement with overburdened and underserved communities in their service territories in planning, developing, and implementing utility MHD ZEV programs.

5. Utility regulators should consider adopting a societal cost/benefits test adapted specifically for EV programs to ensure that all societal benefits are accounted for in cost/benefit analyses for utility transportation electrification projects.

6. When approving utility programs, utility regulators should provide utilities with the flexibility necessary to:

a. Employ different charging infrastructure ownership models, including ownership of charging stations, to meet fleet needs;

b. "Future-proof" make-ready charging infrastructure investments to serve anticipated future EVSE deployment and avoid costly incremental upgrades;

c. Plan for and finance ongoing operations and maintenance expenses to support uptime; and

d. Conduct clustering studies to develop a coordinated make-ready system to serve multiple fleets in a single geographic area.

FIGURE 8:
INNOVATIVE UTILITY RATE DESIGN APPROACHES TO LOWER FLEET CHARGING COSTS

UTILITY PROVIDER	**Pacific Gas & Electric Company (CA)**	**Hawaiian Electric Company (HI)**	**Southern California Edison (CA)**	**Xcel Energy (CO)**
PROGRAM NAME	**Business High Use EV Rate**	**eBus Pilot Rate**	**TOU-EV-8, TOU-EV-9**	**Schedule S-EV**
PROGRAM TYPE	**Subscription and Volumetric TOU**	**Critical Peak Pricing**	**Volumetric TOU**	**Critical Peak Pricing and TOU**
DESCRIPTION	Commercial fleet customers with over 100 kW in monthly charging demand pay a monthly subscription charge (based on maximum charging consumption) plus a three-tier volumetric TOU rate (per kWh). Overage charges apply if a customer's consumption exceeds its subscription level.	For bus fleet customers, demand charges are eliminated from 9:00am-5:00pm when solar energy is abundant and 10:00pm-9:00am when electricity demand is low. Higher rates and demand charges apply during peak periods (5:00pm-10:00pm).	Commercial fleet customers with between 20-500 kW or over 500 kW in monthly charging demand pay a static monthly customer charge plus a volumetric TOU rate (per kWh) for energy used in designated TOU periods throughout the day. Demand charges are suspended for the first five years, then phased back in over the next five years.	For fleet customers, generation and transmission demand charges are replaced with TOU rates and critical peak pricing. Under critical peak pricing, Xcel notifies customers to shift charging away from peak hours (12:00pm-8:00pm) up to 15 times per year for a maximum of 60 hours.

7. Utility regulators should provide utilities with flexibility to offer commercial customer contracts that:

a. Allow installation of charging infrastructure in advance of projected utilization;

b. Avoid requirements for vehicle-to-charger ratios; and

c. Offer multiple metrics for completion of contract term-length requirements (e.g., fixed term, electricity usage, or the number of MHD ZEVs deployed).

8. Utility regulators should encourage utilities to adopt a range of commercial rate structures and customer incentive programs for MHD ZEVs that are tailored to meet fleet charging needs and designed to recover utility costs while lowering charging costs, mitigating demand charges, and providing clear grid-benefit focused price signals to fleet customers that are consistent for all utilities within the state to the maximum extent possible. Rate reform should be focused on long-term sustainable rate design solutions that offer time-variant rates, promote off-peak charging and charging during periods of peak renewable energy generation, and avoid non-coincident peak demand charges. Utilities and utility regulators should consider different rate reform models, including those described in Figure 8 that have been implemented in some states.

9. States should work together in regional and national forums in which state agencies, utility regulators, and utilities can meet to discuss issues and needs related to MHD vehicle electrification, such as:

a. The scale of utility investment in grid transmission and distribution capacity needed to meet states' MHD ZEV sales and purchase requirements;

b. Sequencing utility investment priorities;

c. The performance of programs with respect to equity and environmental justice;

d. Ways of quantifying and communicating the long-term benefits of electrification for concerned stakeholders;

e. Strategies for providing transparent information and assistance to fleets to support evaluation of the total cost of electrification for operations extending across utility service areas; and

f. Long range planning for highway corridor electrification.

Mobilizing Private Capital to Finance Fleet Conversions

Unlocking private capital to finance commercial fleet conversions is essential to achieve fleet electrification at scale. While government incentives and ratepayer funded programs are important tools in today's early market to help offset the higher upfront capital costs of zero-emission trucks and buses and associated

School Bus Electrification in Maryland

Montgomery County, Maryland, has a plan to electrify its entire fleet of 1,400 school buses through an innovative public-private partnership using "electrification-as-a-service" financing to eliminate upfront capital costs for the county and create budget neutrality relative to the cost to own and operate new diesel buses over time. In the first phase of the three-phase plan, Highland Electric Transportation is providing turnkey electric fleet services that will bring in 326 electric buses and electrify five parking depots over a four-year period. Highland is directly financing the purchase of the electric buses and charging equipment, overseeing construction and engineering on site, training drivers and bus maintenance staff, providing managed charging, and paying for all repair and maintenance services. The county's savings from the lower fuel and maintenance costs of electric school buses, volume purchasing, tax depreciation, and a small amount of incentives are used to pay Highland over time, making the transition affordable for the county.

infrastructure, they must be supplemented by complementary tools and policies that drive the private sector capital investment needed to finance electrification of the commercial fleet sector.

Although commercial lenders are following the emerging electric truck and bus market with great interest, low-cost commercial bank loans and other forms of conventional financing are generally not available to commercial fleets on favorable terms today,[55] particularly smaller fleets that may have a less favorable credit rating. This is due not only to higher upfront costs, but also because costs arising from risks and uncertainties associated with this new technology—referred to as the "total cost of electrification"—make financing prohibitively expensive for many fleets and deter capital markets from engaging.[56]

A primary risk factor for fleets and financiers is continuing uncertainty about the residual value of electric trucks and buses. Battery-powered trucks and buses do not yet have a well-established resale value in secondary markets, making it difficult for financiers to account for residual value in upfront financing terms. Other technology and policy risk factors include uncertainty about the efficacy of the technology; the costs of charging infrastructure; soft costs, including the need for regulatory permits and approvals, changes to business operations, and new maintenance practices; the availability and long-term stability of government incentive programs; and the adoption of regulatory requirements to drive new model availability and market demand.

The biggest hurdle to electrification that commercial fleets typically face is a limited capital budget. Shifting capital expenses to operating budgets can help fleet managers to reduce or avoid capital expenses altogether. Innovative financing tools, such as battery leasing programs, on-bill utility financing, on-bill tariff financing, first loss protection programs, zero-interest and revolving loans, charging services, electrification-as-a-service approaches, and novel business models that harness ongoing savings by treating electrification costs as more manageable operating expenses are gaining traction. Inter-agency and multi-state collaboration will be important to support the establishment of successful financing programs at scale.

The Task Force offers the following recommendations to support increased use of these innovative financing tools and business models to improve the economics for fleets and financiers:

1. Transit agencies and school districts should explore the cost benefits of fixed-price service approaches for charging services, infrastructure, or electrification. Electrification-as-a-service, the most comprehensive of the three approaches, provides leased buses, charging infrastructure, and managed charging and maintenance services for a fixed monthly fee or fixed dollar-per-mile rate. In conjunction with incentives and grants, savings from lower maintenance and fuel costs associated with battery electric buses offset the higher costs of electric buses and charging infrastructure, offering fleets a budget-neutral approach to electrification.

2. To lower the costs of financing, utilities should offer transferable utility on-bill financing and on-bill repayment to fleet customers. Under this "pay-as-you-save" approach, which builds on the successful energy efficiency model, the utility funds some of the capital acquisition costs and owns the vehicle battery or charging infrastructure. The fleet customer pays a fixed monthly charge on its utility bill out of the operational savings realized from lower maintenance costs and lower fuel costs associated with beneficial commercial rates.[57]

3. To lower the upfront costs of fleet electrification at scale, transit agencies, state educational agencies, and school districts should consider bus and battery leasing models offered by several electric bus manufacturers as an alternative to purchasing the entire vehicle and as a means to achieve upfront cost parity with diesel buses. Fleets can lease an entire bus with little or no upfront cost, or lease only the battery.

4. Electric bus manufacturers and government agencies should consider the use of tax-exempt leases, which can further lower fleet electrification costs. Because interest earned on leases to government agencies is tax exempt, bus manufacturers and other lessors can pass the savings along to fleets in the form of lower interest payments.

5. To address residual value risk and insure against economic losses if vehicles lose more value than expected, or in the event of a foreclosure, state-chartered green banks should consider commercial fleet first loss protection programs, which are designed to insulate commercial lenders from a pre-determined amount of financial loss.[58]

Adapting this commonly utilized instrument for financing fleet electrification would enhance the credit worthiness of an electrification loan. Some green banks have the capability to provide this service in the near-term, but in time it can and should transfer to private intermediaries, including commercial banks.

6. Green banks should consider offering loans with advantageous terms (e.g., wider access to finance for fleets with sub-optimal credit scores, lower interest rates, longer maturity, reduced collateral requirements, and grace periods) to fleets most in need and integrate the loans seamlessly with incentive programs.

7. To finance fleet conversions, states should consider establishing state innovative financing programs, such as California's MHD ZEV Fleet Purchasing Assistance Program established by legislation in 2021 for administration by the California Pollution Control Financing Authority.[59]

Outreach and Education

Many fleet operators are not informed about the rapidly developing electric truck and bus market, especially small fleets and independent owner/operators. In addition, fleets and drivers would benefit from a better understanding of the hazards of long-term exposure to diesel emissions and the impacts of diesel truck traffic on overburdened communities. Therefore, robust fleet outreach and education initiatives are needed to increase consideration and adoption of zero-emission technology in the MHD vehicle sector.

The Task Force makes the following recommendations for outreach and education to public and private sector fleets:

1. States should work together with utilities, truck and bus manufacturers, charging and fueling providers, leading fleets, and other key partners to understand the primary considerations for fleets of different types and sizes, with particular attention paid to small fleets and independent owner/operators, and develop and implement multi-media outreach and education programs that are tailored to meet fleet-specific needs and concerns and improve understanding of the public health impacts of long-term exposure to diesel emissions.

2. States should develop educational materials that use plain language and avoid technical jargon and make materials available in non-English languages predominantly spoken in their jurisdictions.

3. States should consider working with partners to establish a "one-stop shop" for information on key topics associated with the transition to electric trucks and buses, including the environmental and cost benefits of electrification, available electric truck and bus models, incentives, and financing options for MHD zero-emission vehicles and fueling infrastructure, managed charging options, required permits and approvals, interconnection coordination with utilities, and other technical issues.

4. States should consider partnering with truck manufacturers, dealerships, EVSE providers, trucking associations, and other partners to provide demonstrations, test drives, and other peer-to-peer and hands-on user learning opportunities, especially for small fleets, minority-owned fleets, and independent owner/operators.

Economic Equity for Workers

Workers employed in the transportation sector and related industries have an important stake in the transition to electric transportation. As federal and state funding to accelerate MHD ZEV adoption and infrastructure deployment ramps up, policymakers have an opportunity to develop policies and leverage public investments to ensure just and equitable outcomes for workers. A brief overview of the key workforce and labor issues the ZEV Task Force learned about from national equity-centered organizations is provided below. As discussed in Section II, the Moving Forward Network provided the Task Force with a comprehensive set of recommendations for states to consider as they work to address these issues.[60]

DOMESTIC JOB GROWTH

Globally, job growth will result from the manufacture of ZEVs, charging infrastructure, batteries, and other advanced technology vehicle components. New jobs will also be created through the installation, commissioning, and maintenance of new electric distribution and charging infrastructure; the provision of planning services and technical assistance to fleets; the maintenance and repair of electric trucks and buses at dealerships and after-market repair shops; and end-of-life battery recycling and reuse services.

A central issue for workers is whether new manufacturing jobs will land in North America or other regions. Recent analyses shed light on the tremendous opportunity for workforce change and job growth in particular market segments and states, while emphasizing that without strong government policies to drive demand for North American manufactured products and to support the development of its industries, there is a risk of overall job loss in the North American automotive sector.[61]

JOB QUALITY

Workers in an electrified transportation sector need high-quality, family-sustaining jobs that provide living wages, good benefits, career enhancement opportunities, scheduling predictability, and worker health and safety protections. High-quality jobs provide equitable access to upward mobility, improve worker retention, and enhance work quality.

JOB ACCESS AND PREVENTION OF JOB LOSS

Many of the new, higher-quality jobs will require electrical, mechanical, and other specialized skills. Creating equitable access to these job opportunities will require developing workforce training and re-training programs for workers from overburdened, underserved, and low-income communities. Pre-apprenticeships will be needed to address employment barriers and provide participants with foundational skills, such as construction skills, that they can apply in a range of jobs as the labor market changes. Certified apprenticeships will also be needed to connect workers to high-quality job opportunities and careers and to support life-long employability. Program participants may also need access to wrap-around support services, tutoring, and secondary learning opportunities to overcome obstacles to employment. Workers currently employed in the automotive sector—such as truck and bus maintenance and repair technicians—will need customized training to upskill and successfully navigate job transitions. The adoption of recruitment and hiring practices designed to ensure inclusive

California's Equity-Focused Workforce Development Efforts

A 2017 California state law (AB 398) calls for workforce interventions to ensure that the transition to a carbon-neutral economy creates high-quality jobs; prepares workers to adapt and master new low- and zero-emission technologies; broadens career opportunities for workers from disadvantaged communities; and supports workers whose jobs may be at risk. Through its High Road Climate Agency Partnership initiative, the California Workforce Development Board (CWDB) assists state energy and transportation agencies to improve economic equity by adopting labor policies and mobilizing existing or new workforce development initiatives. The CWDB also administers the High Road Construction Careers (HRCC) initiative, which funds partnerships among local building and construction trades councils, workforce boards, community colleges, and community-based organizations to help workers and job seekers from disadvantaged backgrounds build middle-class careers in the construction trades. Multi-craft pre-apprenticeship programs and support services delivered by these HRCC partnerships are helping build a diverse and inclusive clean energy workforce in California.

access to new job opportunities, such as partnerships with community-based organizations to conduct outreach in target communities and to prepare job applicants for the hiring process, will be as important as workforce training programs.

JUST OUTCOMES FOR DRIVERS

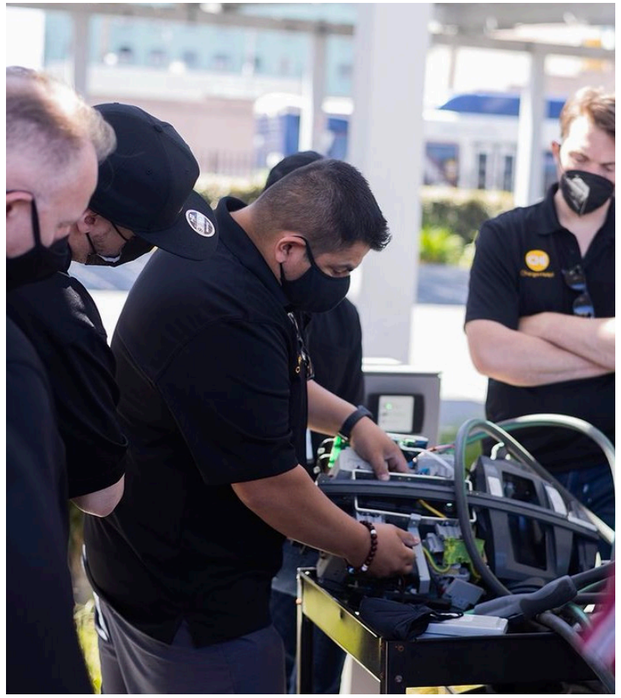
When truck drivers in the freight system are misclassified as contractors rather than employees, they can be left bearing costs for leasing, operating, and maintaining vehicles that should be borne by companies hiring them. Addressing driver misclassification is an important step for avoiding an unjust allocation of electrification costs, particularly as states adopt new clean truck regulations.[62]

State governments that adopt a "whole-of-government" approach, mobilize inter-agency discussion of these issues, and engage with labor organizations, industry, overburdened and underserved communities, and workforce training and educational institutions early in the transition will be best positioned to proactively promote domestic job growth and support a just and equitable transition for workers. Accordingly, the Task Force makes the following recommendations:

1. States should establish or utilize existing inter-agency workgroups to address economic and labor issues stemming from MHD vehicle electrification by, for example, developing measures to drive domestic economic development and job growth all along the MHD ZEV and charging infrastructure supply chain; leveraging public funding to promote high-quality jobs with living wages and benefits, career enhancement opportunities, and worker protections; and deterring worker misclassification.

2. States should partner with overburdened and underserved community leaders and members to understand and proactively address barriers that may prevent community access to training programs, jobs, and small business ownership opportunities, including access by historically marginalized residents, and should conduct outreach and education about resources and programs to help community residents find and prepare for high quality jobs in an electrified transportation sector.

3. States should engage and convene diverse partners—including industry groups, trade associations, labor unions, and transit agencies—to compile data and analyze anticipated labor market changes associated with MHD vehicle electrification; identify workforce development and training or re-training needs for an inclusive workforce; and track measurable outcome-based indicators of workforce diversity in employee recruitment, training, and retention.



4. States should provide funding to develop or update pre-apprenticeship and apprenticeship programs and partnerships at high schools, community colleges, vocational and technical schools, training organizations, and government agencies to equip workers with the necessary skills for high quality jobs and careers and entrepreneurship in the clean transportation sector. Existing workers in the automotive sector at risk of job loss should be targeted for training to assist with upskilling.

5. Training and apprenticeship programs should be developed with input and support from relevant industries. States should enlist employers to sponsor, participate in, and fund apprenticeship and training programs for jobs in vehicle manufacturing and assembly, fueling infrastructure deployment, the battery supply chain, and repair and maintenance of vehicle mechanical and electrical systems. Sponsoring employers should compensate trainees for their time and commit to offer jobs to a percentage of top graduates.

6. States should work together to advocate for significant increases in U.S. federal funding for workforce training and apprenticeship programs.

Community Air Monitoring

The regulatory air monitoring system used across the U.S. to measure compliance with federal ambient air quality standards is not designed for monitoring at the community level due to the size, complexity, and cost of the monitors. Because air quality can vary significantly depending on proximity to sources, topography, and other local environmental factors, an accurate assessment of community air quality requires several monitors placed throughout study areas.

In recent years, smaller, easier to use, and lower-cost air quality sensors have become more widely available. These portable sensors make it easier to examine localized air quality trends and identify contributing pollution sources by providing reasonably accurate

Addressing Truck Pollution in Newark's South Ward

A truck count carried out by trained volunteers showed that an estimated 4,500 heavy-duty trucks travel through the South Ward neighborhoods on their way to and from the Port of Newark and Newark International Airport each day. To better understand air pollution levels resulting from this constant truck traffic, the South Ward Environmental Alliance (SWEA) is collaborating with universities and community-based environmental justice organizations to gather local air monitoring data. Low-cost PurpleAir monitors are deployed at schools, day care centers, and churches, and trained community residents use hand-held portable air sensors to gather additional data at suspected pollution hot spots. SWEA is sharing results with the New Jersey Department of Environmental Protection to inform future air monitoring in the Ward's overburdened neighborhoods. Informed and empowered by local data, residents can advocate for actions to reduce emissions, such as establishing zero-emission zones and adjusting truck routes.

and cost-effective real-time data to interested parties. Community air monitoring promises to become an increasingly important tool for regulators to assess air quality and inform the development of emission reduction strategies for frontline and overburdened communities. Successful community air monitoring projects require a collaborative effort in which state environmental and public health agencies work together with community co-partners to define goals and design and implement all aspects of the monitoring program.

Identifying communities that are disproportionately exposed to diesel truck and bus pollution is essential for states to effectively address environmental justice issues, including prioritizing investments in zero-emission trucks and buses operating in and near these communities. Many government agencies have taken steps to define indicators that can be used in conjunction with geographic analysis tools to identify exposure "hot spots" and the characteristics of the communities where they occur. These actions can provide states with insights to inform future analysis and action, and arm communities with information needed to advocate for improvements in local air quality.

To prioritize the delivery of air quality and public health benefits to communities disproportionately burdened by diesel truck and bus emissions, the Task Force makes the following recommendations for state action to implement community air monitoring programs:

1. State agencies should work with communities (and schools, day care facilities, nursing homes, hospitals, or other sensitive receptors as appropriate) located near ports, railyards, trucking distribution hubs, fleet depots, and major trucking corridors to design community air monitoring programs that deploy mobile or portable sensors to support collection of reasonably accurate and cost-effective localized data to develop a more granular picture of air quality for more effective policy planning and evaluation. States should prioritize community air monitoring projects that target pollutants with the greatest public health impact.

2. States should consider co-locating portable air sensors with existing regulatory air monitors in advance of deployment to test the accuracy of the portable air sensors. When feasible, states should also consider locating new regulatory air monitors in communities that have deployed portable air sensor networks.

3. States should work with U.S. federal partners to provide communities with funding, technical assistance, and basic training on air monitoring science to build community capacity and the knowledge necessary to support successful community-led monitoring programs, and to engage with states on the development and implementation of air pollution regulatory activities that impact their communities.

4. States should participate in community air monitoring peer-to-peer learning workshops or other training programs to share experiences and learn about best practices for successful community air monitoring projects.

5. States should consider integrating data from community air monitoring programs with available vehicle noise pollution data and MHD vehicle traffic safety data, especially data on deaths and injuries, and publish data in an easily accessible on-line dashboard.

6. States should work together to define technical specifications for portable air quality sensors and identify sensors that meet those specifications.

7. Building on existing spatial analysis methods that may include vehicle population data, community and regional-scale modeling, and network data, and in consultation with local communities and health departments, states should develop a geographic mapping system for identifying overburdened communities. This should include rigorous indicators of potential disproportionate health impacts from transportation and other emission sources. Examples of existing analytical tools that could be useful include CalEnviroScreen and the U.S. Environmental Protection Agency's EJScreen.[63] States should publish the results online to facilitate public engagement and feedback; target enhanced incentives and utility investment; and identify the need for more specific risk assessment and pollution reduction measures, giving priority to communities where reductions in air pollution are needed most.

New York's Statewide Community Air Monitoring Initiative

The New York State Department of Environmental Conservation (DEC) is undertaking a statewide community air quality monitoring effort in ten state-defined disadvantaged communities (DACs) that are home to an estimated five million New Yorkers. Monitoring will focus on locations in these communities with high air pollution burdens. The results will help DEC target strategies to reduce air pollution and GHG emissions in these areas to help achieve the goals of New York's Climate Leadership and Community Protection Act. The DACs were selected for monitoring using criteria developed by New York's Climate Justice Working Group comprised of members of environmental justice and community organizations across the state.

Port of Providence Community Air Monitoring Project

Complaints about odors and air quality from residents of communities located adjacent to the Port of Providence and nearby industrial facilities led the Rhode Island Department of Environmental Management (DEM) to launch a community-scale air monitoring project to study ambient air pollution levels near sensitive community locations surrounding the Port. Working with community representatives, DEM located five portable Clarity air sensors in the study area to collect one year of data on ambient air quality levels of $PM_{2.5}$, volatile organic compounds, and air toxics. DEM also plans to conduct compliance inspections of nearby industrial facilities to assess the impact of emissions from these sources on community air quality. The final report will include findings and recommendations for follow-up to address identified air quality issues.

West Coast Clean Transit Corridor

Data Source: HDR, West Coast Clean Transit Corridor Initiative Fact Sheet (June 2020) https://westcoastcleantransit.com/resources/G20-049%20West%20Coast%20Clean%20Transit%20Corridor%20Fact%20Sheet.pdf

Sixteen investor-owned and municipal utilities serving California, Oregon, and Washington teamed up to accelerate development of corridor charging facilities for trucks between the Mexican and Canadian borders. The utilities recognized that early and coordinated investment would be needed to build out a robust and seamless charging network. An initial report proposes a phased approach to developing 27 multi-station charging sites along the 1,300-mile Interstate-5 corridor at 50-mile intervals, and 41 sites on other major connecting highways, with stations designed to serve medium-duty trucks in the first phase and big rigs in the second phase. The report highlights the need for additional electric grid capacity to support interconnections in rural areas, recommends standardization of charging equipment, and calls for new and expanded federal and state programs to foster infrastructure development and ZEV truck adoption by commercial fleets.

Planning for and Deploying Public Charging and Fueling Infrastructure

As manufacturers bring more zero-emission trucks to market, a reliable and accessible network of public charging and fueling infrastructure will be needed in community settings and along regional- and long-haul trucking corridors. States will need to engage a broad set of partners in the near term to plan for infrastructure build out on pace with MHD ZEV adoption.

Battery-electric trucks that travel local and regional routes within and between communities and that neither park at a depot overnight nor have home base charging, such as drayage and delivery trucks and vans owned by small fleets and independent owner/operators, will need access to level 2 charging at overnight parking locations and DC fast charging near their daily routes. Planning for deployment of level 2 and DC fast charging infrastructure at locations that smaller fleets can conveniently access is an important step that states and municipalities, utilities, ports, industry groups such as truckers and motor carrier companies, EVSE providers, and other key partners can take to address the charging barrier for fleets without access to depot charging. States can also support accelerated deployment of charging infrastructure for electric trucks and buses by encouraging municipalities to streamline local permitting.

Zero-emission technologies for long-haul, heavy payload applications are not as market ready

today as those with shorter duty cycles. As the technology for these applications matures, however, zero-emission trucks will need access to a robust network of DC fast chargers and hydrogen fueling stations at rest areas and truck stops along highway corridors. There are many important actions states and other partners should take now to prepare federal and state highways for zero-emission trucks. Foremost, early strategic planning among state agencies in coordination with other states, fleets, utilities, charging and fueling providers, and other key partners is needed. Staff preparing long-range transportation infrastructure plans should recognize that a robust and interoperable network is needed to maximize utilization.

As states and utilities begin planning for highway corridor charging facilities, they should consider how utility upgrades could be efficiently integrated into highway rights-of-way.[64] These improvements could expand grid capacity, provide high-capacity electricity access for DC fast charging stations, and serve other important needs such as transmission of solar or wind power generated in highway interchanges and in outlying areas. In some areas, placing high voltage DC transmission lines underground, along with other utility assets such as hydrogen pipelines and broadband fiber optic cables, may be an efficient way to utilize public rights-of-way, improve grid resilience, and support "next generation" highways serving zero-emission freight.[65]

A significant barrier to readying long-haul trucking corridors for zero-emission trucks is the current prohibition of most commercial activities within the interstate right-of-way. While recent Federal Highway Administration guidance confirms that federal law permits user-pay charging and fueling stations at fringe and corridor parking areas under some circumstances,[66] such stations are not currently allowed at interstate rest areas. Amending U.S. federal law to allow user-pay charging and fueling at these areas is a long overdue step that Congress should take to ensure seamless corridor charging and fueling networks without gaps, provide trucking fleets with the operational confidence and certainty needed to scale up fleet electrification, and modernize the nation's interstate highway system.

Finally, state action is needed to establish appropriate weight limits for electric trucks. Current weight limitations can impact the payload capacity of

battery-powered trucks, particularly long-haul freight trucks, because the additional weight of the battery system can result in reduced payload capacity. In 2019, Congress amended U.S. federal law to allow electric-powered trucks to exceed the maximum weight limit by up to 2,000 pounds on federal interstates. Similar changes are needed to state laws establishing weight limits for trucks operating on state roads that are not part of the federal interstate system.

The Task Force makes the following recommendations to foster the development of a robust public charging and fueling network for MHD ZEVs:

1. States should establish inter-agency and regional strategic infrastructure planning workgroups that include representatives from environmental, energy, and transportation agencies, utility regulators, utilities, fleets, ports, charging providers, overburdened and underserved communities, industry groups, and other key partners and stakeholders to begin long-range planning for public infrastructure deployment along highway corridors and in community settings. Infrastructure planning should include analysis to identify where and what level of infrastructure is likely to be needed; how to prioritize deployment in overburdened and underserved communities; the potential need for grid upgrades and strategies to leverage planned street or highway projects to deliver needed transmission capacity; and solutions to address any identified interconnection or other siting barriers.

2. States should work together to consider how best to support implementation of a fast-charging network for MHD ZEVs that is interoperable, reliable, accessible, and standardized with similar payment systems, pricing information, and charging speeds.

3. States should coordinate with utilities, municipalities, industry groups, and charging providers to plan for public MHD vehicle charging facilities with a range of charging capacities for use by small and independent owner/operators along commercial truck routes and at convenient overnight parking locations for drayage and delivery trucks. States and municipalities should look for opportunities to dedicate under-utilized public parking areas and property lots to cost effectively host charging infrastructure.

4. States should encourage local jurisdictions to streamline permitting for MHD vehicle fast charging stations and should help to improve consistency in permitting across local jurisdictions by providing informational resources and best practices and taking other actions as appropriate.

5. States should advocate for amendments to 23 U.S.C. § 111(a), or policy guidance from the Federal Highway Administration, to explicitly allow publicly or privately owned user-pay EV charging and hydrogen fueling stations at rest areas within the interstate right-of-way to support the development of robust charging and fueling networks and ensure that gaps in services along corridors can be addressed.

6. State environmental, energy, and transportation agencies should work with utilities to identify opportunities for commercial installation of solar arrays with integrated battery storage on publicly owned interstate and state highway interchange rights-of-way to power DC fast chargers along highway corridors and generate a new source of revenue for infrastructure maintenance.[67]

7. To ensure consistency with U.S. federal weight limits for battery-powered vehicles, and to minimize potential issues related to how the heavier weight of such vehicles may affect payload capacity, states should amend applicable laws to increase weight limits by 2,000 pounds for zero-emission trucks.

8. States should work through the ZEV Task Force to form or utilize an existing workgroup that includes representatives from state environmental, energy, and transportation agencies to explore ways to work together and with the federal government to determine how existing and new funding opportunities (e.g., CMAQ, DERA, and the National Electric Vehicle Infrastructure Program) can best be used to support transportation electrification. Among other things, this workgroup may evaluate innovative examples of federally funded transportation electrification projects; develop "best practices" for interagency coordination on transportation electrification project selection and development; and engage with federal government partners to identify ways to streamline processes for eligible state entities to suballocate funding and/or delegate project management responsibilities for transportation electrification projects.

Ongoing Multi-State Research and Policy Evaluation

Since the release of the first *Multi-State State ZEV Action Plan* to advance adoption of light-duty ZEVs in 2014, the Task Force states have collaborated with partners to fill gaps in the information needed to design and implement effective market-enabling policies and programs and to evaluate policy outcomes. In this regard, the Task Force provides an ongoing forum for states to identify research needs and share information.

The market for electric trucks and buses is much newer and state efforts to develop market-enabling policies and programs are just getting underway. Through multi-state collaboration and partnerships with subject matter experts, the Task Force can proactively gather information and analyses needed to support the design of effective MHD ZEV policies and programs and pursue continuous learning about outcomes as new policies and programs are tested and mature.

With the expectation that needs for data collection, research, and peer-to-peer exchange will evolve, the Task Force offers the following recommendations:

1. States should partner with research organizations that advise commercial fleets and utilities on electrification initiatives to identify and collect regional and national data about the adoption of MHD ZEVs, barriers to adoption, charging infrastructure needs and deployment trends, and the impact of the MHD ZEV transition on small and minority-owned trucking fleets and independent owner/operators.

2. States should support research initiatives to inform the development of state and federal policies to promote sustainable battery manufacturing and supply chains, including policies designed to avoid adverse impacts to public and environmental health in the United States, Canada, and abroad resulting from the mining and processing of raw materials such

as cobalt and lithium. States should consider a particular focus on sustainable refining, which could occur within the participating jurisdictions.

3. States should work with research partners to analyze the relative costs and benefits of different approaches to battery reuse, remanufacturing, recycling, and disposal to support consideration of state policies that could accelerate the most promising market opportunities.

4. States should work together to identify potential state government actions to support electrification of freight movement associated with port operations through direct engagement with municipalities, ports, port authorities, and drayage fleet owners and operators that are participating in current port electrification efforts.

5. States should work with research partners to investigate the impacts of restrictions on direct-to-consumer vehicle sales and service on MHD ZEV market development and fleet deployments.

6. To address emissions associated with freight movement in a more comprehensive manner, states should explore the adoption of inspection and maintenance programs for heavy-duty diesel trucks, indirect source rules for warehouses and other trucking distribution facilities, and local planning guides for new facilities.

7. States should work with research partners to collect, analyze, and widely distribute results from state, municipal, transit, and school bus fleet electrification to improve fleets' understanding of the total cost of electrification, innovative charging and financing solutions, and best practices for V2G integration.

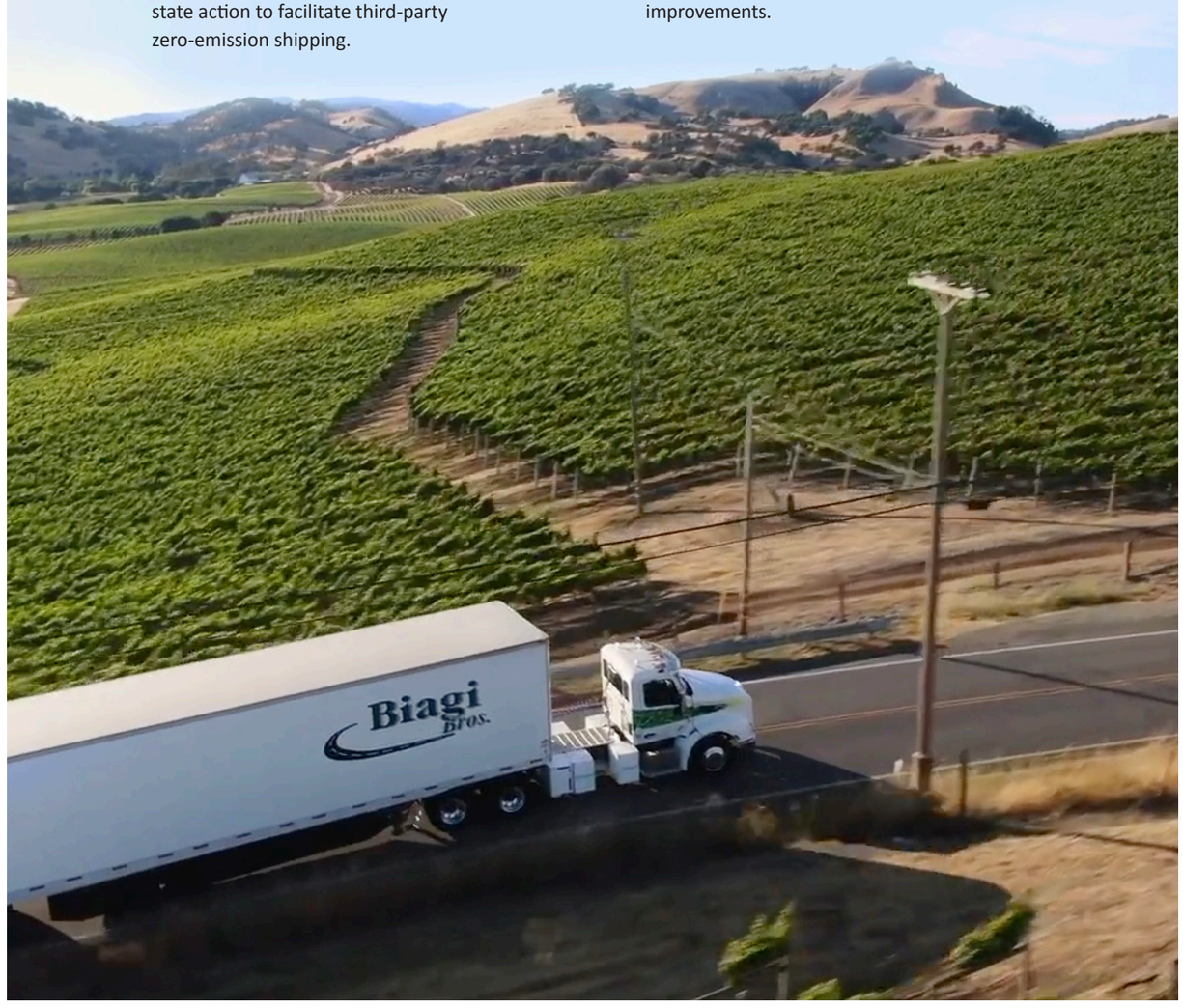
8. States and other partners should research potential funding streams to support market-enabling policies and programs needed to accelerate the equitable transition to MHD ZEVs by carefully evaluating revenue generating mechanisms and concepts, such as congestion pricing and low- and zero-emission zones, low carbon fuel standards, utility system benefit charges, motor vehicle registration fees, and other feebate programs, and work with stakeholders to develop guiding principles for funding streams.

9. States should work with research partners to determine whether additional weight allowances are needed to ensure that MHD ZEV load capacity remains competitive with MHD diesel-powered vehicles.

10. States should engage with corporate shippers that do not own their own fleets and wish to procure zero-emission shipping services to identify existing barriers and opportunities for state action to facilitate third-party zero-emission shipping.

11. Utilities and utility regulators should engage with fleets, financing experts, and other relevant stakeholders to explore the potential benefits and impacts of tariffed on-bill financing and consider pilot projects to test the effectiveness of this financing approach as a means to increase MHD ZEV adoption.

12. Through the ZEV Task Force and other multi-state forums, states should continue their well established practice of coordinated research and analysis and state-to-state exchange of data and other information to evaluate early MHD ZEV policies and programs, identify models for recommended implementation, and ensure continuous improvements.



LOCAL AND U.S. FEDERAL GOVERNMENT RECOMMENDATIONS

The Local Government Role

Local governments, including municipal and county governments, have an important and unique role to play in facilitating the transition to zero-emission trucks and buses. Municipal and county governments exert considerable control over charging infrastructure through zoning ordinances, engineering design requirements, and permitting regulations. Compared to their state and federal counterparts, local jurisdictions possess a much better understanding of their communities' needs and opportunities. As a result, local agencies are poised to make meaningful planning decisions and take targeted actions to advance MHD vehicle electrification.

The Task Force offers the following recommendations for local governments to advance MHD vehicle electrification:

1. Local governments should actively engage in planning for charging and fueling infrastructure for MHD ZEVs and incorporate charging and refueling needs into their transportation, climate, or energy plans as appropriate.

2. Local governments should incentivize electric truck and bus adoption by establishing non-monetary incentives, such as allowing off-peak delivery hours for zero-emission trucks, implementing micro-hubs, and giving zero-emission trucks priority or exclusive access to curbside loading zones, and should also consider establishing monetary incentives, such as rebates or fee exemptions and discounts associated with congestion pricing or low- or zero-emission zones.

3. Local governments should offer property tax credits to incentivize businesses without fleets to install charging infrastructure for trucks that serve their businesses.

4. Local governments should establish near- and long-term targets and plans for electrifying municipal and transit fleets—including transit buses and paratransit vehicles, refuse collection trucks, and MHD municipal vehicles—and should take immediate steps to make progress toward targets, including piloting vehicles and installing charging infrastructure in centralized depots where vehicles are parked.

5. Local agencies responsible for building codes, land use regulations, and engineering compliance should amend existing policies and rules to minimize administrative burdens for charging infrastructure planning, permitting, and construction. Local agencies should prioritize streamlining the process for zoning reviews and obtaining electrical and building permits for DC fast charging stations and should work with utilities to offer permitting guidance and technical support for fleets. Agencies should also offer guidance documents and fact sheets online that identify where to find relevant zoning ordinances and permit applications, key steps and associated timelines, applicable fees, and points of contact.

6. Local governments should coordinate with utilities, charging providers, and states to plan for public MHD vehicle charging facilities for small fleets and independent owner/operators and to identify opportunities to site stations at publicly- and privately-owned parking lots and other properties located along commercial truck routes and at convenient overnight parking locations.

Santa Monica's Zero-Emission Delivery Zone Pilot

The City of Santa Monica and the Transportation Electrification Partnership established a voluntary pilot zero-emission delivery zone in one of its highest-traffic areas to combat air quality and public health impacts from truck emissions and to incentivize and test new ZEV delivery vehicles. Participating businesses operating ZEV delivery vehicles in the zone—including IKEA, Axlehire, Guyaki, Foodcycle, and Shopify—receive priority curb space in designated loading zones. Convenient deliveries and quicker turnaround times produce tangible benefits for participating businesses' bottom lines while also providing positive impacts from reduced diesel emissions.

New Jersey's Model EV Ordinance

In September 2021, New Jersey enacted a Model Statewide EV Ordinance that streamlines the local approval process for installing convenient and cost-effective charging infrastructure. The model ordinance establishes minimum requirements for EVSE and make-ready parking spaces and consistent guidance for electrification in each of the state's municipalities. Several sections of the model ordinance, including requirements for municipal approvals and permits, EV-ready development, and minimum parking requirements cannot be altered, while other sections related to health and safety can be modified by municipalities as needed. The model ordinance supersedes requirements in communities with existing EV charging ordinances.

APPROACHES TO LOW- AND ZERO-EMISSION ZONES

Many cities around the world are reducing emissions and improving public health by implementing low-emission zones (LEZs) that assess an entrance fee for vehicles that do not meet specified emissions standards. LEZs in European cities have proven highly effective at reducing emissions in high-traffic or high-density areas where pollution exposure risk is elevated. Zero-emission zones (ZEZs) are a type of LEZ where only ZEVs are allowed. A growing number of municipalities are demonstrating a pathway to the development of ZEZs by establishing LEZs along with a plan to tighten restrictions and expanding the zone over time. LEZs and ZEZs can also incorporate infrastructure for walking, biking, and other low-carbon mobility to enhance neighborhoods and improve public health.

The U.S. Federal Government Role

Federal leadership is vitally important to set a national agenda that will align policy at every level of government, provide critically needed funding, and drive public and private sector action to support electrification of trucks and buses. In 2020, the Coalition Helping America Rebuild and Go Electric (CHARGE), a broad U.S. coalition of transportation, industry, environmental, labor, health, equity, and civic organizations, was formed to develop a set of principles and policy recommendations for federal action to support an equitable transition to a zero-emission transportation sector. States should consider advocating for CHARGE's comprehensive suite of recommendations for federal action to enable truck and transit bus electrification.[68] The Task Force offers the following additional recommendations for federal agency and congressional action:

1. Given the demonstrated effectiveness of federal emission standards as a market driver of clean vehicle technology, the U.S. Environmental Protection Agency (EPA) should adopt increasingly stringent GHG and criteria pollutant emission standards for MHD vehicles.

2. The U.S. Department of Transportation (DOT) should streamline processes for eligible entities to suballocate funding and/or delegate project management responsibilities for transportation electrification projects and provide clear and up-to-date program-specific guidance on eligibility criteria and suballocation requirements that can be used by all states.

3. Congress should amend 23 U.S.C. § 111(a), or the Federal Highway Administration should issue policy guidance, to explicitly allow publicly or privately owned user-pay EV charging stations and hydrogen fueling stations at rest areas within the interstate right-of-way to support the development of robust charging and fueling networks and ensure that gaps in services along corridors can be addressed.

4. EPA and DOT should provide states with additional funding to purchase low-cost community air quality sensors and develop and publish program guidance on the use of such sensors by residents to evaluate air quality in their neighborhoods, ensure modeled emission reductions materialize, and inform transportation and air quality planning.

5. DOT should take a leadership role to facilitate and encourage coordination and collaboration among federal, regional, state, and other entities to ensure a seamless network of public charging that will catalyze electrification of long-haul, drayage, and other MHD use cases.

6. Congress should establish a manufacturers' tax credit for the sale of MHD ZEVs.

7. Congress should expand the EV charging tax credit in 26 U.S.C. § 30C by eliminating the $100,000 cap on allowable expenses per site.

8. U.S. federal agencies should reserve a portion of federal infrastructure funding for high-capacity chargers to serve heavy-duty trucks.

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