

Making the Case for Zero-Emission Solutions in Freight: Community Voices for Equity and Environmental Justice



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Executive Summary

"We need to go to zero-emissions now. And the transition to zero-emissions must be guided by community-based organizations, environmental justice leaders and impacted community members." - Humberto Lugo Martinez, Clean Air Now, Kansas

Making the Case for Zero-Emission Solutions in Freight

The Making the Case for Zero-Emission Solutions in Freight brief is a working document that centers community knowledge and expertise and identifies local solutions that call for community, industry, labor, government, and political action with the goal of advancing equity, environmental justice, and a zero-emissions focused just transition. In this report, the Moving Forward Network (MFN) outlines the ways that freight emissions jeopardize the health of communities of color and low-income communities, while also significantly contributing to climate change. The brief also provides community envisioned solutions, policy tools, technological considerations, and key recommendations.

The Freight System Harms Communities and Impacts the Climate

The global freight system relies upon platoons of ships, trucks, trains, and cargo handling equipment to move huge volumes of goods from places of manufacturing origin to the marketplace to local businesses, governments, communities, and the homes of consumers. All of which generates a significant amount of pollution that contributes to an ongoing health

crisis in environmental justice communities and the climate crisis across the globe. These operations are often located in communities and regions that already violate federal clean air standards. As many as 40% of U.S. ports and many freight facilities, such as railyards, freight corridors, and logistics centers, are in areas that currently do not meet the National Ambient Air Quality Standards for ground-level ozone (NO_x) and particulate matter (PM).

Furthermore, global freight transport accounts for about 36% of overall transportation emissions, which accounts for about 24% of direct CO₂ emissions, significantly contributing to climate change. From a climate perspective, the trend is more worrisome than current figures indicate as global freight traffic is accelerating substantially and emissions levels are therefore continuing to increase at an alarming rate.

Moving freight globally and through local neighborhoods produces unacceptable levels of diesel particulate, nitrogen oxides, and other harmful pollution, as well as climate pollutants that disproportionately harm communities of color and the broader environment. The freight transportation system issues a double whammy, throwing a one-two punch with local toxic exposures that profoundly impact environmental justice communities and sector workers, while also substantially contributing to global emissions and climate pollution, which in the throes of climate change, impacts us all and our planet greatly.

The Health Costs of Freight Pollution

Freight sector emissions have a devastating public health impact, especially for communities located alongside diesel-powered freight operations. Diesel is carcinogenic to humans and there is no safe level of exposure to particulate or ozone pollution produced by fossil fuel combustion. As freight operations continue to expand, this accelerates the public health impacts from freight pollutants including PM and NOx. PM triggers heart attacks, strokes, and asthma causes cancer, exacerbates obesity and diabetes, and contributes to cognitive challenges, including Alzheimer's, dementia, and mental health disorders. Even low levels of ozone can cause irreparable harm, including permanent lung damage, asthma, heart attacks, strokes, heart disease, and reproductive and developmental harm during pregnancy.

Epidemiological studies have consistently demonstrated that children and adults living in close proximity to sources of air pollution, such as busy roadways, have poorer health outcomes, including but not limited to: asthma, respiratory diseases, cardiovascular diseases, lung cancer, preterm births, and low birth weight infants, premature deaths, and other negative health impacts and disparities. Freight sector pollution extracts a heavy human health toll on communities and families at every step of the freight transport and supply chain.

Centering Environmental Justice Communities to Lead

Communities living in the shadow of freight operations are often working-class, poor communities of color that are caught at the dangerous intersection of toxic pollution, racism, poverty, political imbalance, and climate disaster. The added burden of freight pollution exacerbates the existing health

inequities already faced by environmental justice frontline communities and workers in the goods movement sector. These communities already contend with climate vulnerability and devastating climate change-related impacts such as flooding, extreme heat, increasingly intense storms, and exacerbation of existing health conditions. They are also being disproportionately exposed to harmful air pollution from ships, trucks, trains, and cargo handling equipment moving global freight.

Environmental justice communities that bear the brunt of the environmental and health impacts of compound sources of pollution, including diesel exhaust, understand the severity of the issues they face and also the solutions necessary to confront these issues to demand health and safety for their communities. Community voices and on the ground expertise, along with community engagement and activation, are essential to ensure the development of equitable, just solutions and policies that genuinely meet the needs of communities to improve environmental conditions and public health outcomes. The brief features community perceptions from five MFN regions of the public health impacts and disparities associated with freight emissions and poor air quality, and also lift grassroots solutions for zero-emission advancements. MFN and its members are committed to centering environmental justice communities, workers, and local voices in the broader movement for a just transition to zero emissions.

Economic and Jobs Benefits of Zero-Emission Freight

Given the breadth and complexity of the U.S. freight sector, the MFN compiled multiple analyses that examine the economic benefits of zero-emission technologies for different aspects of the system. Where available, MFN gathered economic analysis to demonstrate known economic growth opportunities surrounding a zero-emission freight system, focusing on commercially available technologies. While MFN's approach does not quantify the full extent of the potential job growth, cost savings, or macroeconomic benefits from zero-emission freight systems, it does provide an important directional snapshot of the positive growth opportunities from a nationwide commitment to zero-emission freight. The clear positive impacts identified in this brief indicate there is an immense additional economic benefit for zero-emission freight that remains yet unaccounted for. The U.S. is in a strong position to rebuild our economy and protect our environment by investing in local manufacturing growth and zero emissions infrastructure development, which will result in both energy and operational cost savings from zero-emission technologies. The U.S. Department of Energy and the Biden administration have underscored the critical economic opportunities in developing a robust clean transportation manufacturing sector.

Labor and Worker Perspectives for a Just Transition

Labor and those working in and adjacent to the freight sector (including truckers, equipment operators, warehouse and logistics workers, local repair shops, and others) are essential constituents in the movement for a just transition to a cleaner energy economy, air quality improvements, zero emissions, and climate mitigations. Many workers not only work in industries (such as trucking) that expose them to toxics and impact their health but also live in communities disproportionately bearing the burdens of pollution. As part of this report, MFN engaged key labor and workers' rights partners to gather their perspectives on how to advance zero-emission commercial vehicles and technologies, while equitably addressing the needs of the workforce and advancing a just transition. The brief includes some critical considerations from labor and workers in the goods movement sector, which lift up focus on: the misclassification of workers; fear of automation and job loss as a result of electrification; the need for tax incentives and subsidies; the movement for a just transition to create healthy, quality jobs; and the need for long-term relationship building across labor, workers, environmental justice and environmental groups.

Policies for Promoting Zero Emissions in Freight

Achieving a zero-emission future for our freight system will require concerted efforts on a diversity of fronts. Communities demand action by holding political leaders and industries accountable, pressuring polluting companies through boycotts and direct action, and by changing the laws and policies that allow polluting activities to continue. The brief provides a menu of promising policy tools that have been pursued to drive the freight industry to transition to zero-emission operations. Such tools include: Zero-Emission Mandates; Use Restrictions; Charging Infrastructure Mandates; Planning Activities; Project Environmental Review and Mitigation; Emission Financial Incentive Programs; and Emission Standards for Freight Equipment.

Moving Forward Network

The Moving Forward Network is a national network of 50 plus member organizations that center grassroots, frontline-community knowledge, expertise, and engagement from communities across the U.S. that bear negative impacts of the global freight transportation system. MFN's vision is to see that negatively burdened communities become healthy, sustainable places by reducing and ultimately eliminating the negative impacts of that system. MFN works to transform the global trade system by supporting the organizing, advocacy, education, and research toward improving public health, quality of life, environmental integrity, labor conditions, and environmental justice. MFN is deeply committed to advancing environmental justice, equity, economic justice, and a just transition.



Introduction

“There needs to be more focus on elevating the work of environmental justice communities already advocating for zero emissions and pollution reductions in their communities.” - **David Flores, Environmental Health Coalition, San Diego, CA**

The Moving Forward Network’s Voices for Zero Emissions Solutions project centers community voices and led solutions to the environmental, health, labor, and climate impacts of the U.S. and the global freight transportations system.

Freight Transportation System Harms

The U.S. freight transportation system issues a double whammy, throwing a simultaneous one-two punch with local toxic exposures that profoundly impact environmental justice communities and sector workers, while also seriously contributing to global emissions and climate pollution, which, in the throes of climate change, impacts us all and our planet.

The freight transportation system generates a significant amount of pollution that contributes to the health crisis in environmental justice communities and the climate crisis across the globe. Freight movement relies upon platoons of ships, trucks, trains, and cargo handling equipment to move huge volumes of cargo and goods from places of manufacturing origin to the marketplace to local businesses, governments, communities, and the homes of consumers.

Global, National, and Local Impacts

Moving freight globally and through local neighborhoods produces unacceptable levels of diesel particulate, nitrogen oxides, and other harmful pollution, as well as climate pollutants that disproportionately harm communities of color and the broader environment. Exposure to diesel exhaust has been associated with adverse health impacts such as increased rates of asthma, exacerbation of respiratory illnesses, decreased lung function, heart disease, increased cancer risk, and premature death.¹ Roughly 39 million U.S. residents live in close proximity to ports and approximately 45 million individuals live within 300 feet of a highway or close to large goods distribution centers.² The health risks and impacts from freight transportation pollution are not equally distributed across our nation. Communities living in the shadow of freight operations are often working class, poor communities of color that are caught at the dangerous intersection of toxic pollution, racism, poverty, political imbalance, and climate disaster.³

Environmental Justice Communities

The added burden of port and freight pollution exacerbates the existing health inequities already faced by environmental justice frontline communities and workers in the sector. These communities also contend with climate vulnerability and devastating climate change related impacts such as flooding, extreme heat, increasingly intense storms, and exacerbation of existing health conditions.⁴ They are disproportionately exposed to harmful air pollution from ships, trucks, trains, and cargo handling equipment.⁵



Image 1. Crosswalk in Los Angeles, CA

Source: Clarence Williams III, East Yard Communities for Environmental Justice

Climate Change Impacts

The carbon footprint of the freight transportation system is a significant driver of climate change.⁶ Although freight is often ignored in the debates over climate change, the steady growth of the goods movement, which is reliant on fossil fuel combustion, is a concerning and growing source of emissions and climate impacts.⁷ The freight transportation sector currently accounts for roughly 9% of U.S. greenhouse gas emissions⁸ and within the next 29 years, cargo ships alone will account for roughly 17% of all human-made carbon dioxide emissions worldwide.⁹

It is clear that pollution from the freight transportation system is both harmful to public health while significantly contributing to climate change. These dual impacts from freight need urgent attention by policymakers, industry, and impacted communities. The U.S. can no longer ignore the role the freight system plays in the climate crisis and environmental racism.

Making the Case for Zero Emission Solutions in Freight

The *Making the Case for Zero Emission Solutions in Freight* brief is a working document that centers community knowledge and expertise and identifies local solutions that call for community, industry, labor, government, and political action with the goal of advancing equity, environmental justice, and a zero-emissions focused just transition. In this report, MFN outlines the ways that freight emissions jeopardize the health of communities of color and low-income communities, while also significantly contributing to climate change. The brief also provides community envisioned solutions, policy tools, technological considerations, and key recommendations.

Moving Forward Network

The Moving Forward Network (MFN) is a national network of over 50 member organizations that centers grassroots, frontline-community knowledge, expertise, and engagement from communities across the U.S. that bear negative impacts of the global freight transportation system.

MFN's vision is to see that negatively-burdened communities become healthy, sustainable places by reducing and ultimately eliminating the negative impacts of that system. MFN works to transform the global trade system by supporting the organizing, advocacy, education, and research efforts of its partners around the U.S. toward improving public health, quality of life, environmental integrity, labor conditions, and environmental justice.

MFN builds partnerships between community leaders, academia, labor, big green organizations, and others to protect communities from the impacts of freight. Its diverse membership facilitates an integrated and geographically dispersed advocacy strategy that incorporates organizing, communications, research, legal and technical assistance, leadership development, and movement building. This strategy respects multiple forms of expertise and builds collective power.

MFN is deeply committed to advancing environmental justice, equity, economic justice, and a just transition and upholds the following core principles as central to its work:

- The Principles of Environmental Justice¹⁰
- Frontline Community Power
- Transparency, Inclusivity, and Accessibility
- Equity in Allyship and Coalitions
- Prevention of Health Disparities
- Equitable Distribution of Funding and Resources
- Workforce Development Opportunities and a Just Transition
- Strong Regulatory Frameworks with Enforcement Mandates
- Renewable Energy,¹¹ Zero Emissions and Sustainable Solutions



Image 2. MFN Washington D.C. Delegation
Source: Moving Forward Network

Making the Case for Zero Emissions in Freight

The Impacts of Freight Pollution on Public Health and the Environment

Over thirteen million Americans live in neighborhoods where they are exposed to deadly diesel emissions from ships, trains, and trucks that carry freight into and out of ports, rail yards, and warehouses throughout the U.S.¹² Another forty-five million live along the highway corridors used for the same purpose.¹³ On a daily basis, doctors serving these communities treat children struggling for breath as asthma attacks their lungs, and adults for diseases resulting in premature deaths from lung cancer, heart disease, stroke, and neurological disorders. Numerous studies show that diesel-powered freight transportation vehicles, that emit fine particulate matter and nitrogen dioxide correlated to elevated levels of such illnesses, are major sources of greenhouse gas emissions. Today, global freight transport accounts for about 36% of overall transportation emissions, which account for about 24% of direct CO² emissions overall.¹⁴

Coined by environmental justice activists, “diesel death zones” in impacted communities are among the most urgent EJ issues of our times. With political will, changes in industry practices, funding to support appropriate actions, and the adoption of already readily available zero-emission vehicles and technologies, diesel death zones in communities can be effectively eradicated and the incidents of alarming disease and the health disparities facing communities can be eliminated.

The Problem

More than a decade ago, EPA recognized that more than 13 million people, predominantly low-income African-Americans and Latinos (including 3.5 million children, live near major marine ports or railyards, and are thereby exposed to substantially increased health risks from freight transport-related air pollution.¹⁵ These figures do not include the approximately 45 million individuals who live within 300 feet of a highway¹⁶ or close to large distribution centers where diesel emission sources congregate and impact air quality.

Conventional cargo movement relies on diesel-powered ships, trucks, trains, and equipment that emit dangerous particulate matter (PM) and nitrogen oxides (NOx). These operations often are located in communities and regions that already violate federal clean air standards. As many as 40% of U.S. ports and many other freight facilities, such as rail yards, freight corridors, and logistics centers, are in areas that are not meeting the National Ambient Air Quality Standards for ozone and PM.¹⁷

Epidemiological studies have consistently demonstrated that children and adults living in close proximity to sources of air pollution, such as busy roadways, have poorer health outcomes, including but not limited to: asthma, respiratory diseases, poor lung development, cardiovascular diseases, lung cancer, preterm births, and low birth weight infants, premature deaths, and other negative health impacts and disparities.

Communities near freight facilities experience increased illness and death, emergency room visits, doctor visits, hospital admissions, and missed school days. In June 2012, the World Health Organization's International Agency for Research on Cancer classified diesel engine exhaust as carcinogenic to humans after determining that there was "sufficient evidence that exposure is associated with an increased risk for lung cancer."¹⁸ The Environmental Protection Agency (EPA) has listed diesel particulate matter as a mobile source of air toxicity.

Freight operations are also a major contributor to the climate crisis. The freight system relies predominantly on diesel-powered equipment, which produces diesel exhaust. Diesel exhaust creates CO₂, a major greenhouse gas. Freight transport worldwide contributes approximately 3 billion tons of CO₂. Black carbon is also emitted by diesel exhaust. Black carbon is a fine particulate matter and short-lived climate pollutant that has very high global warming potential, some estimate over 600 times higher than CO₂. The freight transportation sector accounts for roughly 9% of U.S. greenhouse gas emissions. Over the next couple of decades, it is expected that ocean-going vessels alone will account for about 17% of all human-made carbon dioxide emissions worldwide.¹⁹

Low-Income Communities of Color are Disproportionately Exposed to Freight-Generated Emissions

In 2007, ICF International conducted a study for EPA looking at the demographic composition of those living near U.S. ports and rail yards.²⁰ The study analyzed which populations and communities are exposed to significant levels of diesel particulate matter (DPM), defined as levels that exceed 2.0 ug/m³.²¹ ICF found that of households and populations living near U.S. ports and railyards in 2000, a greater proportion of people earned lower incomes (less than \$10,000 and \$10,000-\$29,999) and a larger proportion were people of color as compared to the nation as a whole. Another study, which examined demographic disparities in exposure at U.S. ports,²² suggests that based on data from 43 ports and 2000 Census figures, that over 4 million people in the U.S. are exposed to port-related DPM concentrations that exceed a 100-per-million carcinogenic health risk if the exposure concentration was maintained for 70 years.²³ With respect to income and race the study revealed the following:

For Income (of the population exposed to concentrations exceeding a 100-per million carcinogenic health risk):

- Almost two times more low-income households (i.e. 1999 incomes less than \$10,000) are exposed to dangerous levels of DPM than the proportion of low-income households in the U.S. population as a whole.
- In Oakland, CA, and Nashville, TN, the proportion of low-income households facing this high risk is more than 5 times the proportion of low-income residents in the metropolitan area.
- In Cincinnati, OH, the proportion of low-income households facing this high risk is more than 4 times the proportion in the metropolitan area.
- In Cleveland, OH, and Paulsboro, NJ, the proportion of low-income households facing this high risk is more than 3 times the proportion in the metropolitan area.

For Race/Ethnicity (of the population exposed to concentrations exceeding a 100-per million carcinogenic health risk):

- African-Americans made up a proportion of the high-risk population that was 3 times their proportion of the U.S. population.
- Latinos made up a proportion of the high-risk population that was twice their proportion of the U.S. population.
- In Oakland, CA, the proportion of African-Americans exposed to these concentrations was more than 7 times the proportion in the metropolitan area.
- In Gary, IN, the proportion of African-Americans exposed to these concentrations was more than 5 times the proportion in the metropolitan area.
- In Chicago, IL, and Nashville, TN, the proportion of African-Americans exposed to these concentrations were more than 4 times the proportion in the metropolitan areas.
- In Paulsboro, NJ, the proportion of Hispanics was more than 6 times the proportion in the metropolitan area.
- In Cleveland, OH, the proportion of Hispanics was more than 5 times the proportion in the metropolitan area.

Further, a demographics analysis of people living near busy terminals at the Port of New York/New Jersey shows that there is a higher share of minority and low-income households living near that port than in the state of New Jersey and the New York/New Jersey metropolitan area. Specifically, 88% of the individuals living within 300 meters of the Port of Elizabeth, Port of Newark, and Howland Hook, and the New York container terminals are considered “minority,” in comparison to 41% in the state of New Jersey and 51% in the NY/NJ metropolitan area.²⁴

Community Voices for Zero-Emission Solutions

“As environmental justice organizations, we want to see outcomes from the transition to zero-emission really benefit our communities, reduce air pollution, improve health and bring cleaner jobs to the community and the workforce.”

- Humberto Lugo Martinez, Clean Air Now, Kansas

Environmental justice communities that bear the brunt of the environmental and health impacts of compound sources of pollution, including diesel exhaust, understand the severity of the issues they face and also the solutions necessary to confront these issues to demand health and safety for their communities. Community voices and on the ground expertise, along with community engagement and activation, are essential to ensure the development of equitable, just solutions and policies that genuinely meet the needs of communities to improve environmental conditions and public health outcomes. This section features community perceptions from five MFN regions of the public health impacts and disparities associated with freight emissions and poor air quality and also lifts up grassroots solutions for zero-emission advancements. MFN regional leaders from the Southeast, the Northeast, the West, and from the Southwest are featured here. MFN members are committed to centering environmental justice communities, workers, and local voices in the movement for a just transition to zero emissions.

Through a series of informal interviews conducted by Dr. Patricia Boston, the Principal at Goldenrod Consulting, it became evident that regional environmental justice leaders perceive that health disparities and outcomes are worsening in their communities due to poor air quality and freight emissions and that there are significant barriers for their communities

to secure a good quality of life. These leaders expressed the need for more research and greater evidence linking freight emission and public health impacts, and the need for local health departments to support and cooperate with communities by sharing local public health data. They also point to the need for intensified community education and engagement and resources to ensure frontline communities understand what is meant by zero emissions and climate mitigation, and that they are prepared to participate in actions to demand zero-emission solutions.

Included below is a snapshot of five leaders' stories and perspectives, drawn from MFN's 2021 report, *Voices for Zero-Emission Solutions! Public Impacts from Freight Operations Engaging Community Voices*.²⁵ Analysis of the report's data finds five important themes: (1) sources of diesel emissions; (2) public health impact perceptions of diesel emissions; (3) zero-emission perceptions; (4) zero-emission benefits; and (5) zero-emission solution ideas.

Each region's profile below also includes county and state-specific data from the University of Wisconsin Population Health Institute's County Health Rankings program,²⁶ which provides key measures detailing the current overall health of each county in the selected regions. Included by county and state are the following measures: (1) premature death; (2) low birthweight; (3) income inequality; and (4) air pollution. The data show how a diversity of factors shape community conditions, while also highlighting the stark differences in health that stem from injustices and barriers to opportunity.²⁷ Communities use this ranking data to better understand the impacts of diesel pollution on their regions, to inform community members, and to garner support for local public health initiatives by engaging government agencies, health care providers, community organizations, business leaders, policymakers, and the public.

Newark, Essex County, New Jersey



Kim Gaddy
Environmental Justice Director,
Clean Water Action (CWA)

Kim Gaddy is the Environmental Justice Director at [Clean Water Action](#) (CWA) in Newark, New Jersey. CWA is a one-million-member organization of diverse people and groups across the U.S. joined together to protect the environment, health, economic well-being, and community quality of life. CWA is an active member of the New Jersey Environmental Justice Alliance, a statewide alliance of organizations and individuals focused on environmental justice issues.

CWA also plays a pivotal role as chair of the [Coalition for Healthy Ports](#) (CHP), a broad coalition of environmental, labor, faith, community, environmental justice, and business organizations that seek to create sustainable ports in New York and New Jersey. CHP's mission is to improve the air quality, safety, security, and working conditions for all workers that support port commerce and to assure environmental justice, and prevent harm in affected communities. Recognizing that the ports are an economic driver for the region and a major component in the global economy, CHP believes that strong environmental, labor, and community standards will enhance the port's position for growth.

Public Health Impact Perceptions of Freight Pollution

An important category of the perceived public health impacts of freight emissions is premature death. The regional leadership described both personal experiences and the experiences of community members who have died connected with diesel exhaust and environmental pollution in their communities. Kim Gaddy shared her personal experience with asthma and how pollution has impacted her family directly:

“I have a brother-in-law and a cousin who died of asthmatic attacks who lived in the South Ward in Newark, New Jersey. I attribute that to the cumulative impacts of pollution, that we suffer from over a lifetime, just because of the zip code and the neighborhoods we live in which are heavily impacted by diesel exhaust and other pollution.”

Social Determinants of Health

A social determinant that was pointed to numerous times as impacting health is the normalization of pollution and environmentally poor conditions. Kim Gaddy about this in the following statement,

“When you are so accustomed to smelling and or seeing trucks and having trouble breathing in and out, you think that that's just the norm. So, you think that's a sense of normalcy, and that this is something that I will always have to deal with. But that's not the case! Pollution shouldn't be the norm for our communities.”

Zero Emission Benefits

Kim Gaddy discussed how shifting to zero-emission technology will create substantial benefits for children’s health and their ability to freely play outdoors in neighborhood parks:

“Children who are recreating at nearby parks, won’t be coughing when trucks drive by or be harmed by trucks emitting toxic diesel exhaust. I think individuals will begin to have faith that people believe their lives are valuable, and they’re just not disposable, and that your life doesn’t matter. With zero-emission technologies, we will see that our lives do matter.”

County & State Data Comparison

The following table provides current overall measures for premature death, low birthweight, income inequality, and air pollution (particulate matter) for Essex County, where the city of Newark is located, and for the state of New Jersey. According to the data, Essex County’s measures are higher than New Jersey in all categories with the exception of air pollution (9.9) in comparison to the state of New Jersey (10.9).

COUNTY & STATE DATA 2020		
	Essex County	New Jersey
Premature death (Age-Adjusted Rate per 100,000)	7300	5900
Low birthweight (percentage of live births with low birthweight (< 2,500 grams))	10%	8%
Income inequality (ratio of household income at the 80th percentile to income at the 20th percentile)	6.8	5.2
Air pollution particulate matter (Average daily density of fine particulate matter in micrograms per cubic meter (PM2.5))	9.9	10.9

Table 1. Essex County & the State of New Jersey - 2020 Data

Savannah, Chatham County, Georgia



Dr. Mildred McClain:
Executive Director,
[Harambee House](#)

Dr. Mildred McClain is the Executive Director of [Harambee House](#) in Savannah, Georgia. Harambee House’s mission is to educate, inspire, organize and build the capacity of African Americans and other communities of color to create and sustain safe, economically vibrant, healthy neighborhoods that promote healthy living, wellness, environmental justice, and green sustainability. Harambee House is a community-based organization that works collectively with organizations, families, and youth in its neighborhoods to promote civic engagement, environmental justice, and social change.

Source of Freight Pollution

Oftentimes, the sources of diesel emissions are not readily seen and there are discoveries of diesel emissions sources by community leaders. One example of a discovery of diesel emission sources is shared by Dr. McClain:

“It wasn’t until we were getting ready this past year to look at placing air monitors on the Westside of Savannah that we discovered a railway path. We didn’t know it was on the backside of Ogeecheeton, Hudson Hill, Woodville, West Savannah impacting local communities with train exhaust and not knowing the content of the container box cars”

Zero-Emission Solutions

Increased education and training for community members are needed as a zero-emission solution in communities facing disproportionate burdens. This was emphasized by Dr. McClain as follows:

“It is important that we explain, inform and make ready our communities to participate in this crucial discussion. Zero-emissions will lead us to the preservation and the protection of Mother Earth. If we are not engaged in those types of actions, strategies, tactics, policies, and practices, in the zero-emission work, then by 2030 we’re in a hell of a fix now, but certainly, if we don’t get the masses of our people to understand, first of all, what zero emissions mean it will be worse”

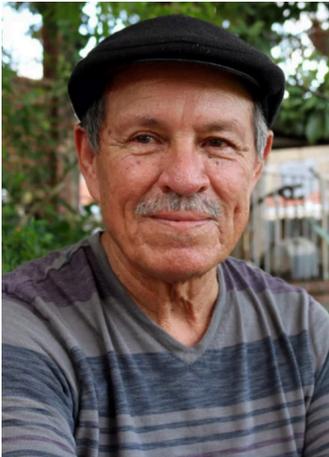
County & State Data Comparison

The following table provides current overall measures for premature death, low birthweight, income inequality, and air pollution (particulate matter) of Chatham County, where the city of Savannah is located. It also includes the same measures for the state of Georgia. According to the data below, Chatham County's measures are higher than Georgia's in all categories except for air pollution (at 9.9).

COUNTY & STATE DATA 2020		
	Chatham County	Georgia
Premature death (Age-Adjusted Rate per 100,000)	8300	7700
Low birthweight (percentage of live births with low birthweight (< 2,500 grams))	10%	6%
Income inequality (ratio of household income at the 80th percentile to income at the 20th percentile)	4.7	4.9
Air Pollution Particulate Matter (Average daily density of fine particulate matter in micrograms per cubic meter (PM2.5))	9.9	10.9

Table 2. Chatham County & the State of Georgia - 2020 Data

Houston, Harris County, Texas



Juan Parras
Executive Director of Texas Environmental Justice
Advocacy Services (TEJAS)

Juan Parras is the Executive Director of [Texas Environmental Justice Advocacy Services](#) (TEJAS) in Houston, Texas. The TEJAS district surrounds the Houston Ship Channel, which is the busiest international port in the country, and home to the largest petrochemical refinery complex in the western hemisphere. Because of the lack of safety within industrial facilities along the ship channel, Houston communities have been subjected to decades of uncontained toxic pollution.

TEJAS is dedicated to providing community members with the tools necessary to create sustainable, environmentally healthy communities. TEJAS educates the community on the health concerns and implications arising from environmental pollution, empowering individuals with an understanding of applicable environmental laws and regulations and promoting enforcement. TEJAS also offers community-building skills and resources for effective actions and greater public participation.

Public Health Impact Perceptions of Freight Pollution

One of the leading categories of perceived public health impacts of diesel emission is respiratory illnesses. Juan Parras draws the link between diesel exhaust and health issues:

“We know that diesel exhaust is loaded with particulate matter, and it’s obviously toxic to breathe. It thus has an impact on our communities, especially in Environmental Justice communities in the Greater Houston Area. However, the City of Houston has done very little to address how communities are impacted by diesel exhaust. Studies show that communities living right next to freeways in major cities are exposed to a lot of diesel exhaust, and have a lot of health issues, asthma and respiratory illnesses.”

Zero Emission Perceptions

Juan Parras shares his thoughts about the importance of addressing the multitude of diesel emissions sources in his community. He points out that having so many sources is a barrier to achieving the best air quality possible:

“Aside from vehicle emissions and truck emissions, we also have one of the largest industrial corridors of chemical and refineries plants in the U.S. Comparing vehicle emissions to refinery emissions, if one goes down, and the other one stays up, no actual headway is made. We’ve got to address the entirety of diesel emissions and cumulative air toxic emissions from industries facing communities. We’ve got to established a Regional Air Toxins Plan for the Greater Houston Area. Otherwise, while people may not be exposed to as much, they still haven’t gotten away from the emissions and the resulting health impacts.”

County & State Data Comparison

The following table provides current overall measures for premature death, low birthweight, income inequality, and air pollution (particulate matter) of Harris County, where the city of Houston is located, and for the state of Texas. According to the data, Harris County's measures are higher than Texas in all categories with the exception of premature death (6500) and much higher for air pollution (12) in comparison to the state of Texas (8.8).

COUNTY & STATE DATA 2020		
	Harris County	Texas
Premature death (Age-Adjusted Rate per 100,000)	6500	6700
Low birthweight (percentage of live births with low birthweight (< 2,500 grams))	9%	8%
Income inequality (ratio of household income at the 80th percentile to income at the 20th percentile)	5	4.8
Air pollution particulate matter (Average daily density of fine particulate matter in micrograms per cubic meter (PM2.5))	12	8.8

Table 3. Harris County & the State of Texas - 2020 Data

Los Angeles, California



mark! Lopez
Community Organizer
East Yard Communities for Environmental Justice

mark! Lopez is a Community Organizer with [East Yard Communities for Environmental Justice](#) (EYCEJ) in Los Angeles, California. EYCEJ is an environmental health and justice organization working towards a safe and healthy environment for communities that are disproportionately suffering the negative impacts of industrial pollution. EYCEJ's members are residents living on the frontlines of toxic polluters. EYCEJ has been fighting for decades to improve the air quality and the public health of local communities along the I-710 Highway corridor out of the ports of Long Beach and Los Angeles. EYCEJ is also a leader on the San Pedro Bay Ports Clean Air Action Plan.

Source of Freight Pollution

Although a leader in California's statewide EJ movement, Lopez organizes in the LA area where he was born, raised, and continues to live. Though with a breath of regional knowledge, Lopez is still learning about the extent of freight emissions sources impacting his community:

"...we have tons of warehousing [a significant source of freight emissions] that range from huge buildings that we don't even know the names of, and we don't even know what they're moving in there. One of the issues is that we have blocks and blocks and blocks of food distributors [polluting our communities], but there's no market in the community."

Lopez lifts up the problem of widespread diesel use as a broadly entrenched wide system, which our economy is currently reliant on, and the resulting emissions and health impacts facing communities:

"If we are talking about ending diesel, then we are talking about ending the shipment of diesel, then we're talking about ending the production of diesel, ending the piping of diesel, and ending the extraction of diesel, right? All of that comes to an end. So, it's not just about 1 truck, or that we want a 5% reduction of [diesel-using] trucks. We want to end the system [entirely]."

Zero-Emission Solutions

Lopez shared his perspectives on the full life cycle of fossil fuels impacted his community and the need for integrated structural change as a key driver towards zero-emission solutions:

“[We must] end diesel, end its use, end its production! It is not just about the trucks, it’s not just trains. Here in our community [in Los Angeles], you can literally see them pull the fossil fuels out of the ground, pipe it to production facilities, produce fossil fuel products and the gas, take it on tankers to gas stations, where the trucks fill up their tanks and burn those fuels all in the same neighborhood. And so we [and the health of our communities] are impacted by the full life cycle of fossil fuels...”

County & State Data Comparison

The following table provides current overall measures for premature death, low birthweight, income inequality, and air pollution (particulate matter) for Los Angeles County and the state of California. According to the data below, Los Angeles County’s measures are higher than California in the categories for income inequality (5.4) and significantly higher in air pollution (14.2), but at the same level for low birth weight (7%) and less for premature death (5,000).

COUNTY & STATE DATA 2020		
	Los Angeles County	California
Premature death (Age-Adjusted Rate per 100,000)	5000	5300
Low birthweight (percentage of live births with low birthweight (< 2,500 grams))	7%	7%
Income inequality (ratio of household income at the 80th percentile to income at the 20th percentile)	5.4	5.3
Air pollution particulate matter (Average daily density of fine particulate matter in micrograms per cubic meter (PM2.5))	14.2	9.5

Table 4. Los Angeles County & the State of California - 2020 Data

Kansas City, Wyandotte County, Kansas



Rachel Jefferson
Executive Director
Groundwork Northeast Revitalization Group

Rachel Jefferson is the Executive Director at [Groundwork Northeast Revitalization Group](#) in Kansas City, Kansas. As a national network with deep local roots, Groundwork helps communities to become healthier places to live, work, and play. The mission of the Groundwork is to sustain and revitalize the beloved Kansas City community through forward-looking and inclusive action rooted in the principles of equity, community cohesion, institutional transparency, and environmental justice.

Groundwork engages everyday people and communities to tangibly improve their environmental, economic, and social conditions, increase the likelihood of upward mobility, and improve health and overall quality of life. Core focus areas include: Equity and Inclusion, Healthy Communities, Climate Resilience Transforming Brownfields, Urban Waters, and Youth Development.

Zero Emission Benefits.

When discussing perceived zero-emission technology benefits, the leaders featured here shared their hopes and visions. Rachel Jefferson expressed the dual benefit for companies and improved public health for workers in the goods movement sector and for communities:

“I would hope that people will be able to see that by adopting zero-emissions technologies, it can be a money saver for both companies and also a health saver for truck drivers, who are probably the most affected by the health pollution of diesel emissions because they’re sitting in their truck constantly breathing the exhaust...”

Zero-Emission Solutions.

Carbon sequestering through tree planting for and by communities is a proactive zero-emission solutions approach being used in Kansas City. Jefferson shared:

“We’ve tried to figure out what locations we need to be monitoring for pollutants. The public housing site right next to the highway is a highly impacted location at which we thought we could probably see some improved air quality results after planting about 25 carbon sequestering cedar trees. These trees will also serve as an important buffer between the housing site and the highway and the nearby railyards.”

County & State Data Comparison.

The following table provides current overall measures for premature death, low birthweight, income inequality, and air pollution (particulate matter) for Wyandotte County, where Kansas City is located, and for the state of Kansas. According to the data below, Wyandotte County's measures are higher in all categories in comparison to that of Kansas.

COUNTY & STATE DATA 2020		
	Wyandotte County	Kansas
Premature death (Age-Adjusted Rate per 100,000)	9600	7000
Low birthweight (percentage of live births with low birthweight (< 2,500 grams))	9%	7%
Income inequality (ratio of household income at the 80th percentile to income at the 20th percentile)	4.4	4.3
Air pollution particulate matter (Average daily density of fine particulate matter in micrograms per cubic meter (PM2.5))	10.1	8.1

Table 5. Wyandotte County & State of Kansas - 2020 Data

Community Voices for Zero Emissions Takeaways

As illustrated by the insightful perspectives of the MFN leaders included above, while diesel emissions impact all communities, low-income communities of color adjacent to sea and inland ports and along highway corridors dense with diesel truck traffic, are the most severely and disproportionately affected. In collecting solutions for zero emissions, a community engagement framework, which values the voices, local knowledge, and positions of environmental justice frontline and fenceline communities, was used. MFN recommends that these voices for zero-emission solutions be further engaged to develop and implement proactive policies that eliminate sources of air pollution (such as diesel exhaust), support the adoption of zero-emissions technologies, improve health outcomes and lessen health disparities, and promote a better quality of life, particularly for communities disproportionately burdened by environmental harms.

Global Freight and the Climate Crisis



Image 3. Railyard in Los Angeles, CA

Source: Angelo Logan, East Yard Communities for Environmental Justice

Today, global freight transport accounts for about 36% of overall transportation emissions, which accounts for about 24% of direct CO₂ emissions overall, significantly contributing to climate change.²⁸ From a climate perspective, the trend is more worrisome than current figures indicate as global freight traffic is accelerating substantially and emissions levels are therefore continuing to increase at an alarming rate.

Demand Growth is Driving Emissions

The key challenge is the rapid increase in demand for global freight movement. Based on current demand pathways, total freight demand globally is projected to triple between 2015 and 2050.²⁹ Increased demand is driven by multiple factors, including rising Gross Domestic Product (GDP) in non-OECD (Organization for Economic Co-operation and Development) nations, and the emergent dominance of e-commerce. E-commerce shifts freight activity from business-to-business paths to business-to-consumer paths, which increases convenience and frequency of purchases and returns.³⁰ This, in turn, increases freight transport demand. Unfortunately, increased business-to-consumer

trade increases freight activity in the two most carbon-intensive transportation segments: air transport and urban road transport operations.³¹ In the U.S., a substantial rise in road freight demand is also projected for the coming decade. The American Association of State Highway and Transportation Officials forecasts that for every two trucks on the road today, there will be one more additional truck by 2030.³² By 2040, U.S. truck freight transportation is expected to expand by 43 percent.³³

Implications for Climate Emissions

As a result of increased demand, freight transport is expected to be the fastest growing source of greenhouse gas emissions globally in the coming decades.³⁴ Under scenarios where current and announced mitigation policies are implemented worldwide, global CO₂ emissions from transport are projected to grow 60% by 2050, “driven mainly by increased demand for freight and non-urban passenger transport, both of which are projected to grow 225% by 2050.”³⁵ More ambitious policy scenarios—including an assumption that 30% of new vehicles sold worldwide by 2030 are electric—could lower freight emissions by 45% in 2050 while leaving demand relatively stable, but this would still fail to deliver required reductions to align with the Paris Agreement.^{36 37} It is important to underscore that even proactive scenarios that combine optimized logistics supply chains, improved efficiency, electric zero vehicle emissions (ZEV) adoption, and modal shifts would at best only curb a future growth in emissions, but are unlikely to mitigate or eliminate emission levels seen today.

Accordingly, significantly more ambitious mitigation policies are urgently needed.³⁸ If our future is to include both global trade and a livable planet, then zero-emission technology must be deployed at unprecedented speed and scale. It will be difficult to reconcile the rapid growth of freight activity with global climate goals unless the world sees the adoption of low-carbon, zero-emission technologies at scale in the very near term.

Accelerating Action by Focusing on Road Freight

On the positive side, several studies point to increasing and accelerating uptake of zero-emission vehicles as a primary axis along which ambitious scenarios could be strengthened. Road transport makes up only 18 percent of total freight activity, but 57 percent of freight-related CO₂ emissions, so its decarbonization has disproportionately large climate benefits.³⁹ This is also the transport sector with the most advanced zero-emission solution (namely, battery-electric vehicles), and is relatively easier to regulate by state and national governments compared to air and maritime transport. As a result, the International Transport Forum found that “scaling up decarbonization measures for road freight transport that have already been tested and are comparatively easy to introduce is one of the most immediate actions required.”⁴⁰ A variety of complementary measures will be required to achieve complete decarbonization, but stringent ZEV mandates, in particular, have been found to be key. More than fuel standards and subsidies, ZEV mandates have been found to drive the largest proportion of emissions reductions from freight and thus have the largest promise.⁴¹

Cost and Benefits of Zero Emissions

Economic and Jobs Benefits of Zero-Emission Freight

Given the breadth and complexity of the U.S. freight sector, MFN has compiled multiple analyses that examine the economic benefits of zero-emission technologies for different aspects of the system.

Where available, MFN has compiled economic analysis to demonstrate known economic growth opportunities surrounding a zero-emission freight system, focusing on commercially available technologies to inform this brief. While MFN's approach does not quantify the full extent of the potential job growth, cost savings, or macroeconomic benefits from zero-emission freight systems, it does provide an important directional snapshot of the positive growth opportunities from a nationwide commitment to zero-emission freight. The clear positive impacts identified below indicate there is an immense additional economic benefit for zero emission freight that remains yet unaccounted for, and that the U.S. is in a strong position to rebuild our economy and protect our environment by investing in local manufacturing growth, infrastructure development, energy cost savings, and operational cost savings from zero-emission technology.

Available and Emerging Zero-Emission Vehicles and Technologies

For freight transport over the road vehicles (including last-mile delivery, short-haul trucks, and long-haul tractors), zero emissions vehicle technology is already commercially available. There is robust research on the costs, viability, and investments needed to transition this fleet to zero emissions, and MFN is therefore able to project job growth associated with these investments. Battery-electric yard hostlers are already commercially popular cargo handling equipment purchases, with clear economic benefits. Similarly, electric forklifts and shore power are established commercial products, and known cost pathways enable clear macroeconomic benefit modeling. Some emerging technologies, including high-capacity hydrogen fueling, zero emission rail, zero emission container shipping, and some container handling equipment, are in earlier commercial stages. However, given the cost and commercialization curves for first-mover zero emission freight technologies, MFN anticipates similar economic benefits throughout a full zero-emission freight supply chain over time.

Zero Emission Commercial Trucks

Recent studies completed by the North American Council on Freight Efficiency (NACFE) in partnership with Rocky Mountain Institute (RMI), underscore the current lifecycle cost savings across all medium-duty vehicle sectors, including regional haul, for electric trucks.⁴² Their work also identifies lifecycle cost parity or benefits over diesel by 2030 for all Class 7-8 commercial electric and fuel cell freight-hauling tractors.⁴³ These lifecycle cost savings have real-world benefits for businesses and consumers. In California, the state’s anticipated deployment of 300,000 zero-emission medium- and heavy-duty zero-emission trucks under its Advanced Clean Truck⁴⁴ rule will save the state’s economy \$5.8 billion through 2040,⁴⁵ even after accounting for the higher upfront costs of vehicles and the infrastructure expenses associated with zero-emission technology adoption.

While lifecycle fuel cost and maintenance cost savings from zero-emission vehicles and equipment will provide significant long-term economic benefits to the trucking industry, the infrastructure investments to develop nationwide charging and hydrogen refueling networks will also create and sustain new industries. The report estimates the direct and indirect job creation associated with the freight-trucking infrastructure build-out, starting with the International Council on Clean Transportation (ICCT)’s projections of the number and type of charging stations and hydrogen refueling stations needed to support a national zero-emission commercial freight fleet through 2050.⁴⁶ ICCT’s order-of-magnitude estimate and cost assessment draw on existing research and from a Zero-Emission Commercial Freight Infrastructure Model it developed to support MFN.

Starting with the assumption that by 2040 all sales of medium- and heavy-duty trucks and buses are zero-emission vehicles, ICCT estimated the following infrastructure needs:

	2035	2050
Overnight chargers (100 kW)	200,000	1,667,000
Fast chargers (350 kW)	9,000	51,000
Ultra-fast chargers (1 MW)	20,000	96,000
Sub-total of charging points	229,000	1,814,000
Hydrogen refueling stations (4800 kg/day)	1,700	3,500
Cumulative charging and refueling points	230,700	1,817,500
Cumulative total investment	\$23.1 Billion	\$95.4 Billion

Table 6. Infrastructure Needs of a 100% Zero-Emission Medium and Heavy-Duty Vehicle Fleet in the United States

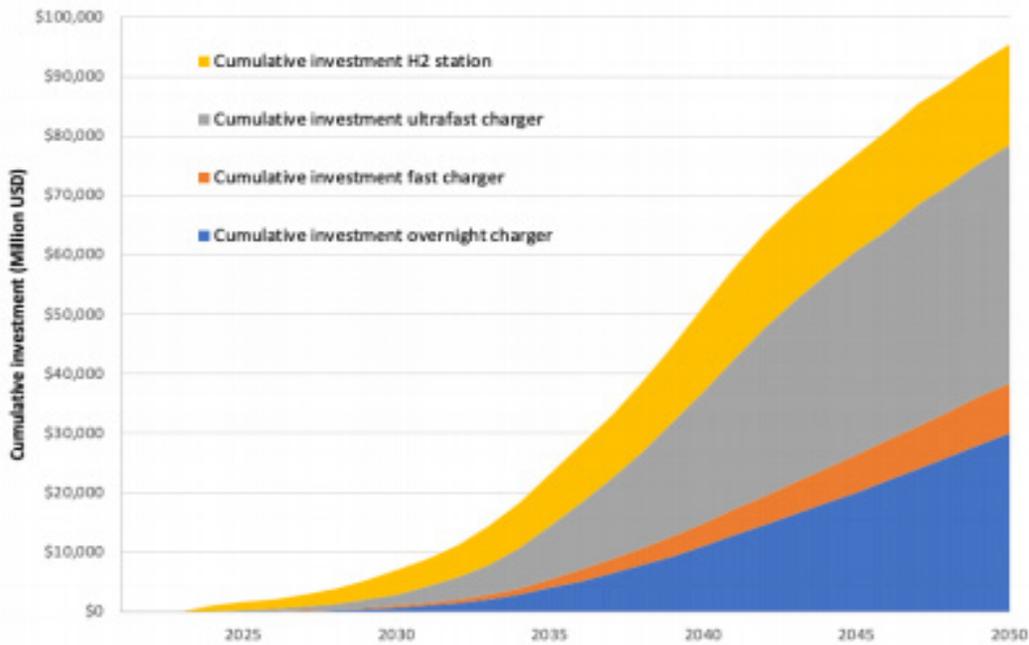


Figure 1. Projected growth in investment needed to support a zero-emission medium and heavy-duty vehicle fleet in the United States, 2020-2050

MFN’s analysis of the resulting job impacts from the electric charging portion of this investment builds on the work done by the Political Economy Research Institute (PERI) at the University of Amherst to model jobs associated with battery-electric bus transit infrastructure investment.⁴⁷ This approach is in line with the California Air Resources Board’s economic impact analysis for commercial trucking electric infrastructure under its Advanced Clean Truck Regulation, which utilizes electric transit bus research and agency deployment data.⁴⁸ PERI’s employment projections were modeled using IMPLAN 2019 software data to estimate the number of jobs associated with infrastructure changes for transit agencies adopting battery-electric buses, and MFN applied these job multipliers to the electric charging infrastructure projections completed by ICCT.

Because the type of infrastructure needed will vary widely from fleet to fleet, PERI modeled two scenarios for the charging station investments and depot upgrade investments, accounting for the potential complexities of interconnections and site realities. Without knowing the specific infrastructure needs of commercial fleets, MFN, therefore, applied investment assumptions evenly across all four scenarios, using ICCT’s cost, deployment timeline, and learning rate assumptions. The resulting job impact, from the required battery-electric infrastructure development alone, is in the range of 625,000 jobs created through 2050 (390,000 direct jobs and 235,000 indirect jobs).

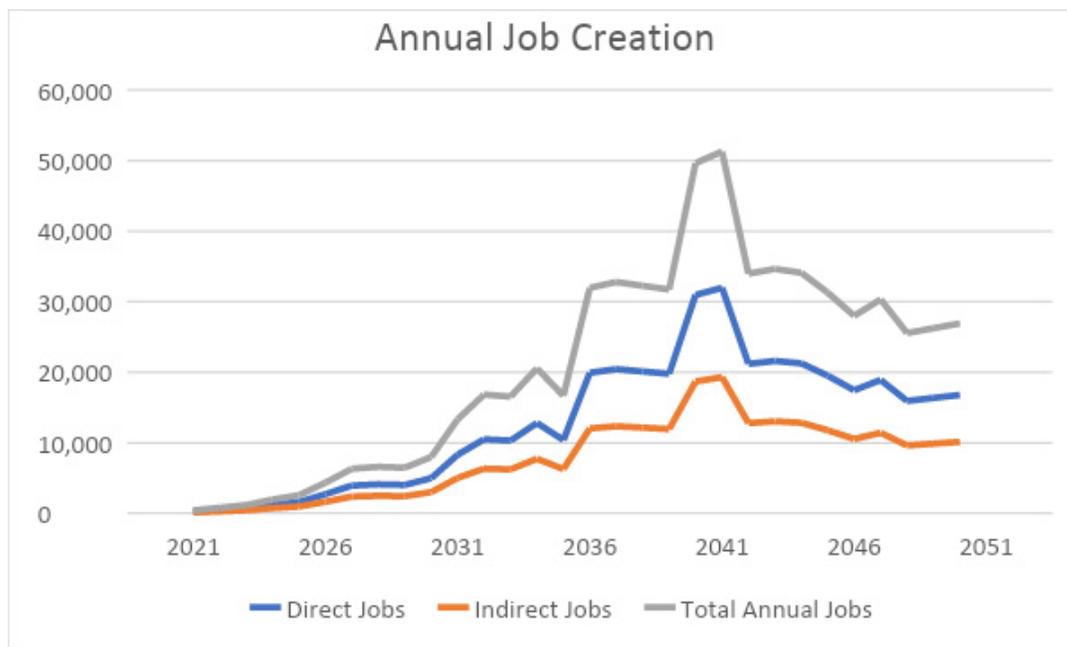


Figure 2. Job Creation per \$1M invested in MHD Commercial Fleet EV Infrastructure

Zero-Emission Cargo Handling Equipment (CHE)

Cargo-handling equipment includes a wide set of off-road freight equipment with ideal operations, commercial technologies, and cost profiles for electrification, including forklifts, yard hostlers, RTG cranes, and airport ground equipment. Cargo handling equipment supports operations up to 24 hours a day across the nation’s seaports, airports, inland ports, intermodal facilities, and warehouses. Identifying electric pathways for this sector is critical, considering their local emissions impact and the anticipated growth in freight traffic and equipment purchases. Guidehouse Insights 2021 market data indicates that “sales of global electric cargo handling equipment are expected to exceed 1.5 million pieces and account for 60% of total equipment sales by 2030. Compared with non-electric cargo handling equipment, the price of electric powertrains can be more costly upfront, but lower fuel costs of electricity, reduced maintenance costs, and reduced equipment downtime can significantly decrease operating expenses for fleets.”⁴⁹

Recent feasibility assessments and macroeconomic analysis bear out the economic case for electric CHE. Calstart’s total cost of ownership analysis in 2020 found that electric yard hostlers will achieve diesel cost parity on purchase costs by 2030, and overall cost savings to diesel, based on fuel and maintenance, between 2025 and 2030.⁵⁰ With incentives, electric yard hostlers and electric RTGs already achieve a lower total cost of ownership over diesel equipment,⁵¹ and with battery prices projected to continue falling, the non-incentivized economics will continue to improve.

The macroeconomic benefits of fuel switching can also deliver society-wide benefits as expenditures move from fossil fuel to electricity, as fuel savings are passed along to customers and investors, and as capital investments occur in local economies. A 2018 analysis by Energy and Environmental Research Associate (EERA) assessed the total economic benefits of freight electrification, even beyond fuel, also accounting for the capital expense of equipment, chargers, batteries, and maintenance expenses. In a mid-market electric penetration scenario

(~830,000 Class 1 and 2 forklifts in 2030) the U.S. could see employment impacts of an additional 156,000 job-years and an increased economic output of \$36.4 billion. In a high penetration scenario (80% market penetration of Class 1 and 2 forklift sectors, or nearly 1 million electric forklifts by 2030) the benefits would rise to 469,200 job-years and \$60 billion in economic output.⁵²

Shore Power Electrification

EERA also completed a macroeconomic analysis of fuel switching for the use of shore power at 25 U.S. ports (accounting for 45% of the annual vessel calls in 2015). Shore power allows vessels to plug in while at dock and use the local electricity grid instead of on board engines. The mid-level market scenario assumes that by 2030, California will maintain its 80% penetration (due to current regulations) and the rest of the country will achieve 50% penetration. This would result in 14,600 jobs by 2030 and fuel shifts due to the use of shore power could increase national economic output by up to \$4.6 billion per year by 2030.⁵³

Zero-Emission Manufacturing Jobs

The U.S. Department of Energy and the Biden administration have underscored the critical economic opportunities in developing a robust clean transportation manufacturing sector. At a March 2021 event hosted by Securing America's Future Energy (SAFE), Secretary of Energy Granholm noted that carbon-reduction technologies, including batteries, are expected to create a \$23 trillion market over the next decade, and that "DOE is going to invest billions of dollars over the next few years in the technologies that are going to make the EV future a reality."⁵⁴

In the U.S., the automotive industry supports nearly 10 million jobs, dispersed across the country, with at least 100,000 jobs in 24 different states.⁵⁵ The automotive and broader manufacturing sector plays a crucial role in the American economy, with each U.S. manufacturing job indirectly supporting approximately 1.4 indirect jobs throughout the economy.⁵⁶ Today, the U.S. controls less than 10% of global EV manufacturing and, as the world increasingly commits to zero-emission transportation, the U.S. manufacturing sector is therefore increasingly at risk if it does not significantly increase zero-emission innovation and production capacity.

Investments in freight-sector electrification would have a direct benefit in the local companies and factories investing in innovation. A new report from SAFE highlights the potential for more than 270,000 jobs "through investment in transportation manufacturing grants and tax incentives" and nearly 154,000 jobs through "incentives that make it cheaper to buy medium- and heavy-duty electric vehicles, like trucks and buses."⁵⁷ Expanding this to the broader freight equipment manufacturing sector could have a significant impact on both emissions reductions and economic opportunity. A sample of U.S. companies with zero-emission freight products includes Ford, Tesla, Cummins, Peterbilt, Workhorse, Autocar, Kalmar, Orange EV, Taylor, and Wabtec. International truck companies with established presences in the U.S. are expanding local electric truck manufacturing, with Volvo investing \$400 million in Virginia factory focusing on its electric trucks⁵⁸, and Daimler Trucks North America expanding its Portland, Oregon facilities to produce the e-Cascadia line.⁵⁹

The Health and Economic Cost of Freight Pollution

Freight sector emissions have a devastating public health impact, especially for communities located alongside diesel-powered freight operations. Diesel is carcinogenic to humans⁶⁰ and there is no “safe level” of exposure to particulate or ozone pollution⁶¹ produced by fossil fuel combustion. As freight operations continue to expand, this continues to accelerate the public health impacts from freight pollutants such as particulate matter (PM) and ground-level ozone (NO_x).⁶² PM triggers heart attacks, strokes, and asthma causes cancer, exacerbates obesity and diabetes, and contributes to cognitive challenges, including Alzheimer’s, dementia, and mental health disorders.⁶³ Even low levels of ozone can cause irreparable harm, including permanent lung damage, asthma, heart attacks, strokes, heart disease, and reproductive and developmental harm during pregnancy.⁶⁴

This pollution extracts a heavy human toll on communities and families at every step of the freight supply chain. On-road vehicles alone cut short 58,000 lives each year in the U.S.,⁶⁵ with heavy-duty commercial diesel vehicles exacting an outsized impact on this suffering, especially relative to their population. While heavy-duty trucks and buses only use 19% of the nation’s transportation fuel,⁶⁶ they produce 50% of its on-highway PM_{2.5} and 43% of on-highway NO_x pollution.⁶⁷ The global commerce system is dependent on ocean vessel container shipping. ICCT found that the shipping emissions associated with global trade were responsible for 1,300 deaths in the U.S. in 2015.⁶⁸ And the expanding warehouse operations that support e-commerce are powered by forklifts, yard trucks, transport refrigeration units, and truck visits that harm communities nearby.

The South Coast Air Quality Management District recently completed a socio-economic impact study of the pollution from Southern California warehousing operations, finding that communities within half a mile of warehouses experience elevated asthma rates and heart attacks. The agency also estimates that a regulation focused on zero-emission truck adoption in these communities would result in 300 fewer deaths, 4,500 fewer asthma attacks, and 18,000 fewer work loss days from 2022-2031.⁶⁹

It is imperative to underscore that these pollution burdens are not felt evenly. While the entire nation is exposed to air pollution from cars, trucks, and buses, the numbers are clear: communities of color are exposed to notably higher levels of pollution than white communities. The Union of Concerned Scientists recently modeled nationwide exposure to air pollution by race, finding that, on average “Asian Americans are, exposed to 34 percent higher levels of PM2.5 from vehicles than the average for the total U.S. population. Other groups also have higher than average exposure: African Americans are burdened with 24 percent higher than average exposure, and Latinos have 23 percent higher exposure. On the other hand, exposure of whites to PM2.5 from vehicles is, on average, 14 percent lower than the average exposure for everyone.”⁷⁰

In addition to the tragic loss of human life, particularly in environmental justice communities, the everyday health challenges, hospital visits, lost workdays, and mortality extract a steep economic price. Reduced-form Benefit per ton (Bpt) analysis can estimate the economic value associated with these health and mortality costs, specifically due to the emissions burdens from individual pollution sectors. In 2019, researchers from the U.S. EPA developed a Bpt analysis for each mobile source emission sector, as well as total projected U.S. emissions from mobile sources in the year 2025.⁷¹ MFN estimated the freight-associated emissions from the relevant mobile source categories, to identify the total nationwide freight-related emissions burden 2025, under a business-as-usual scenario.

Mobile Sector	Primary PM _{2.5}	NO _x	SO ₂
Marine vessels			
Marine Diesel	4534	152,708	397.5
Ocean Going Vessels	5647	537,038	14,004
Nonroad			
Commercial	3703.8	44,792	107.4
Onroad			
Heavy duty diesel	30201	946522	3748
Heavy duty gas & CNG	1164	30095	197
Rail	11,863	513,839	337.0588235
All Mobile Source Emissions (17 Sectors)	195,548	4,371,692	90,648
Freight-Related Emissions Total	57,113	2,224,994	18,791
Freight-Related Emissions as Percent of All Mobile Source Emissions	29%	51%	21%

Table 7. Projected 2025 Emissions (tons) from Mobile Source Freight Sectors

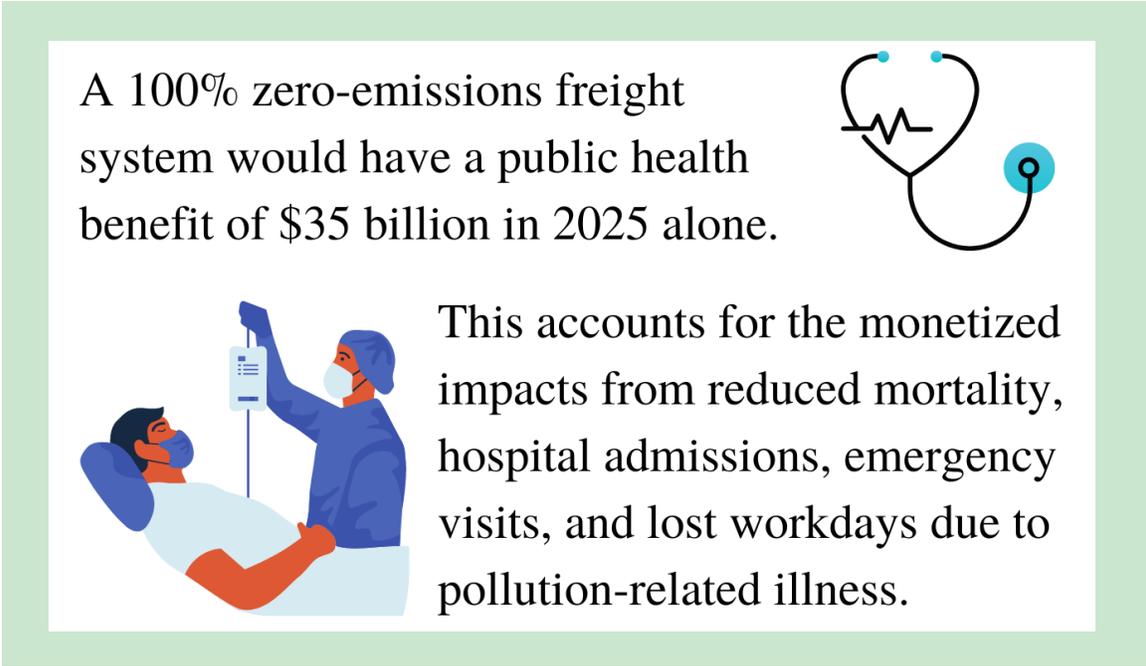


Figure 3. Health Benefits of Zero Emission Freight System by Rebecca Schenker

The economic impact of the public health burden from freight emissions is immense, ranging from \$250,000 in benefits from eliminating one ton of rail emissions to \$930,000 for one ton of diesel truck emissions. The total single-year monetized health burden from the freight sector is at least \$35 billion. While it is impossible to truly quantify the impact from the passing of family members or the daily suffering and lost opportunity from chronic illness, these numbers can benchmark the burdens imposed on communities impacted by freight emissions. They also provide a signpost for the economic and human potential that a zero-emission transition could unlock for the millions of people living in and around a port, railyards, warehouse, and highway locations.

A recent study by the Environmental Defense Fund (EDF) illustrates how these health and economic benefits could roll out and accumulate over time, with an in-depth analysis of zero-emission vehicles. Implementing national policies to achieve 100% medium- and heavy-duty zero-emission vehicle sales by 2040 would result in an estimated 1,557-2,613 fewer premature deaths and nearly 140,000 fewer lost workdays each year by 2040. By 2050, EDF estimates that a total of 57,214 fewer Americans would have died prematurely and that the cumulative pollution-based savings would reach \$418 billion.⁷²

Labor Perspectives + Policy Recommendations

Labor and Worker Perspectives for a Just Transition

“The system puts all the compliance for zero emissions technologies on the backs of drivers, making poverty wages because they’re shouldering their boss’s operating costs. It’s wrong to put drivers in this position, and it undermines environmental progress and works to reach our climate emissions goals when we’re not holding the companies responsible.” - **Jessica Durrum, Los Angeles Alliance for a New Economy**

Labor and those working in the freight sector (including truckers, equipment operators, warehouse and logistics workers, and others) are essential constituents in the quest for a just transition to a cleaner energy economy, air quality improvements, zero emissions, and climate mitigations. Many workers not only work in industries (such as trucking) that expose them to toxics and impact their health, but they also live in communities disproportionately bearing the burdens of pollution. As part of this report, MFN engaged key labor and workers’ rights partners⁷³ to gather their perspectives on how to advance zero-emission commercial vehicles in the sector, while equitably addressing the needs of the workforce and advancing a just transition. This section includes some critical considerations and perspectives from labor and workers in the goods movement sector.

Misclassification of Workers and Individual Financial Burden

“An important challenge in the push for electric zero-emission trucking is that truckers in the workforce often face no other options other than finding ways to finance their own cleaner vehicles and to assume all the risk, which really should be the obligation of the companies instead of on the backs of workers.” - **Christy Veeder, Ph.D., Jobs to Move America**

According to the 2019 UC Berkeley Labor Center report, [Truck Driver Misclassification](#),⁷⁴ the low road labor practice of misclassifying workers in the trucking industry undermines climate action by shifting the costs of emission reductions from companies onto the most economically vulnerable in the industry: contract truck drivers. The common trucking industry practice of often misclassifying truck drivers as independent contractors rather than employees is a major barrier to a successful implementation of new clean truck standards and zero-emission vehicles. Contracting out truck driving shifts the costs of truck ownership and operation from trucking companies to individual truck drivers. Contract truck drivers, particularly those misclassified as contractors, earn low incomes and face high capital costs. While regulatory compliance costs for large trucking firms represent a small percent of total revenue, contract truck drivers can face compliance expenses far above their yearly income. Under the contractor model, truck drivers are the least equipped financially to buy and maintain clean vehicles. And yet they are often the first targets to bear the financial burden of attaining collective climate goals.⁷⁵

Due to this misclassification, the cost of clean trucks is shifted to driver contractors and away from trucking companies. Drivers are often in the position of absorbing the costs of upgrading to new technologies, while trucking companies externalize their costs. Truck operators are often unable to afford or keep up with the latest, cleanest technology which causes further financial burden.

Solutions for Misclassification

In order to both secure worker justice and equity and also advance a just transition, the underlying misclassification of drivers as independent contractors must be resolved. The burdens of upfront clean zero-emission truck cost investments and maintenance must shift back to corporations rather than being borne by individual truckers. The freight sector industry must take responsibility for the transition to clean technology as it is the corporate sector that is ultimately profiting. Several policy measures would support this, including ensuring that state and federal standards are in place to protect drivers from misclassification which is, in effect, a form of indentured servitude. Worker rights groups want to see support for the passage of the Protecting the Right to Organize (PRO) Act of 2021,⁷⁶ which would address the issue of worker misclassification and protect the right of workers to organize. They would also like the restrengthening of the Obama era, the Fair Labor Standard Act,⁷⁷ with regards to employee and contractor classifications, which the Trump administration weakened.

Fear of Automation and Job Loss as a Result of Electrification

“We often see the industry framing the need for automation to meet ambitious zero emissions goals, but this is a false framing. Electrification does not automatically equal automation. There are certainly ways to get to cleaner standards and zero emissions without turning all the jobs into robots. What fuels the truck and what it takes to drive the truck are two different conversations.”
- Jessica Durrum, Los Angeles Alliance for a New Economy

The movement towards automatization and robotics in the freight sector is a real concern for workers regarding their jobs and livelihoods. Labor advocates see that a job loss trend is associated with the constant need for greater output and productivity, which has led to the push for the adoption of automatization and robotics. Freight sector industries, companies, and ports often promote a false framing of the importance of automation to assure growth while also working to reach zero emissions. Truck companies themselves are trying to bring automation into their business models to advance electrification. Zero emissions in the freight and logistics sectors does not necessarily mean automation, nor does MFN support practices or technologies that would negatively impact frontline workers. The advocates noted that it is important to build relationships and coalitions between labor and environmental organizations and to advocate for policies to prevent comprehensive automation and job loss in the freight industry. They further encourage the Biden-Harris Administration to create a position to specifically assess the impact of automation and address labor concerns in the transition to a clean economy. It was noted that job loss through automation could also potentially lead to opportunities for upskilling warehouse workers to new jobs that result from electrification.

Tax Incentives and Subsidies

Tax incentives, subsidies, and vouchers are important publicly financed tools that can help increase the rate at which zero-emission vehicles and technologies are purchased and adopted by individual drivers, companies, warehouses, agencies, and corporations. For example, Jobs to Move America's [U.S. Employment Plan](#) is a policy tool that provides technical support and language that transit agencies can use in their request for proposals by their contractors to incentivize the purchasing and use of zero-emission vehicles and equipment. The contributors cautioned that frameworks must be in place to ensure that companies that benefit from government subsidies related to decarbonization must also meet good employer and labor standards.

A Just Transition and Mitigating Against Job Loss

The Labor and Network for Sustainability define a just transition as:

“...a holistic approach encompassing both the need to end the extractive economy and a vision for healthy, thriving, and connected local economies in its place – a view that included, like the original just transition definition did, the needs of workers and impacted communities in the transition. It moved them from a reactive approach to one that’s more proactive and visionary.”⁷⁸

Transitioning to decarbonization and away from extractive and polluting practices provides the opportunity to build an economy that is visionary, thriving, and regenerative. However, the U.S. faces the challenge of simultaneously creating quality jobs and mitigating against job loss, while also advancing decarbonization of the economy, reducing greenhouse gas emissions, and addressing the disproportionate pollution and health disparities burdens facing environmental justice communities. As harmful industries are phased out, just pathways for workers in those industries must be developed to support a transition to new high road jobs and careers in new regenerative economies that provide dignified, productive, and ecologically sustainable livelihood.⁷⁹

“We have to have a just transition but not just to protect workers who have lost their jobs. We also have to be thinking about creating good new jobs during the transition. We must work in coalition to create jobs and use policy to decide how to do that to open opportunities with unions. This would be propositional rather than oppositional.” - **Elizabeth Bunn, National Policy and Maryland State Director at the Labor Network for Sustainability**

The labor and worker rights contributors to this report lifted up concerns from worker groups and unions, representing workers in the manufacturing and the freight sectors, that there will be substantial job loss in the transition to a cleaner economy. This potential loss underscores the need for a thoughtful just transition to a zero-emission economy. In addition to truckers and warehouse and logistics workers, the transition will impact a range of workers, from those who maintain diesel fuel, gas-powered vehicles to gas station operators to even convenience store workers. It will be essential to develop strategies and new jobs that enable displaced workers to transition to jobs in the new economy. Likewise, it is critical that these new jobs offer quality careers providing high pay, strong benefits, job training, health care, pension, retirement security, and opportunities for workers to move into new employment sectors. The contributors urge attention to actively recruiting, training, and supporting the transition of Black, Indigenous, and People of Color (BIPOC), women, people from low-income communities into the new green jobs and sectors.

Electrification and Healthy, Quality Jobs

“Warehouse work is so undervalued, and that’s one of the big reasons why corporations treat these workers as disposable. As we move towards a Just Transition, adding skills and trade value to warehouse work might bring those workers to a medium-income, which could, in turn, benefit the broader community.” - **Andrea Vidaurre, formerly with Warehouse Worker Resource Center**

Holding the considerations and challenges noted above, labor advocates see the move towards electrification as good for workers’ health. Driving electric trucks and vehicles and operating electric equipment is much healthier, cleaner, and less noisy. Advocates would

like to see the move towards electrification address the issues of job loss and equity to ultimately bring gains for workers’ health, job security, benefits, and wages, while also bridging important environmental and public health benefits through decarbonization. They would like to see new policies, programs, and incentives be developed to support a Just Transition and to bring new high road, healthy, quality job opportunities for displaced workers. Training and long-term commitment to workers will also be essential to support the transition.

How We Win: Building Long-term Relationship

The labor advocates underscored the need to thoughtfully invest in building trust and long-term relationships and coalitions between labor, workers, environmental justice groups, environmental organizations, and manufacturers to find common ground and advance a just transition, job security and high road jobs for workers, air quality improvements for impacted communities, and climate benefits. As the freight sector adopts zero-emission technologies and moves towards decarbonization, it must not hurt unionized and other workers across the freight sector. Coalitions must work together to lift up standards so that all workers have a secure place in the new economy and workers must have a seat at the table in the movement for a Just Transition.

In the move towards zero-emission technologies and electrification, the labor advocates urge coalitions to hold three overarching principles: (1) drivers must not bear the costs; (2) companies must be responsible for bearing the cost and assuring the transition; and (3) frontline communities needs must be prioritized.

Policies for Promoting Zero Emissions in the Freight Sector

Achieving a zero-emission future for our freight system will require concerted efforts on many different fronts. Communities may demand action by holding political leaders accountable, pressuring polluting companies through boycotts and other forms of direct action, and/or by changing the laws and policies that allow polluting activities to continue. This section provides a menu of policies that have been pursued in various areas to drive the freight industry to transition to zero-emission operations. This is not meant to be seen as an exhaustive list. It instead identifies promising significant policy tools that have been used, provides examples of what those policies might look like, and highlights important issues to consider in pursuing these approaches.

MFN's broader [Menu of Policies for Promoting Zero-Emission Freight](#) document considers and describes each policy tool in greater detail, including: policy tool description, jurisdiction and authority, legal barriers, technical feasibility, unintended consequences, and equity considerations, and examples of where the policy has been implemented.

This section and the linked document are not intended to be seen as a set of definitive recommendations, but rather as a resource on policy options for strategic consideration as MFN member groups push for the adoption of zero-emission technologies centered in equity and environmental justice in their regions and at the federal level.

As with many advocacy strategies, political considerations will be important. The openness of policymakers to promote the transition to zero-emission freight is greatly influenced by industry perspectives, worker and labor perspectives, advocacy by the environmental and environmental justice communities, and developments in and affordability of zero-emission technologies themselves. As zero-emission technologies mature and become less expensive and improve lifecycles economics, it is anticipated that the freight industry will become more open to these alternatives and political opposition may diminish. All indications are that zero-emission technologies are the future and are inevitable. The question is not *whether* this transition will happen, but *when*, *where*, and *how*.

Promising Policy Tools to Advance Zero Emissions:

- A. Zero-Emission Mandates** are laws or regulations that mandate zero-emission trucks and equipment. These mandates could apply to the companies that manufacture the trucks and equipment, requiring them to make zero-emission products, to the purchasers of those trucks and equipment, or to companies that hire those trucking or equipment services.
- B. Use Restrictions** are policies that limit where, when, or how vehicles can be used. These restrictions or preferences could be applied based on whether a vehicle is zero-emissions or not. These restrictions could be imposed by any entity, government or private businesses, that controls transportation infrastructure, parking, or access on a given site or jurisdiction.
- C. Charging Infrastructure Mandates** can be in the form of building codes that require new facilities to be built ready for zero-emission trucks or equipment. Another infrastructure mandate is public utilities/services commission policies requiring utility investments to develop charging infrastructure.
- D. Planning Activities** and tools are available at the local, regional, and state-level that could be used to advance zero-emission systems. Long-term planning can be used to set goals, coordinate infrastructure planning, and require zero-emission measures to be incorporated in future projects. Planning can also be used to address siting of freight facilities and mitigation measures for their negative impacts on communities.
- E. Project Environmental Review and Mitigation** can be engaged in multiple ways for new projects to secure environmental benefits and the adoption of promoting zero-emission technologies. One tool available to secure environmental mitigation is to use environmental review statutes, such as the National Environmental Policy Act (NEPA) and state mini-NEPAs. Community benefits agreements present another way to secure zero-emission measures as part of individual projects.
- F. Zero Emission Financial Incentive Programs** are designed to encourage the purchase or use of zero-emission vehicles (ZEV) by making them cheaper to own or operate. Incentives can also be used to encourage the scrapping of older vehicles to trade in for the purchase of ZEVs instead. Incentives can also be used to encourage operators to pilot emerging technologies.
- G. Emission Standards for Freight Equipment** increase the stringency of allowable emissions from trucks and equipment. Standards that phase out older internal combustion engines and require new engines to meet lower emissions limits can promote public health while indirectly supporting zero-emission alternatives by leveling the playing field and making polluting technologies more costly. These standards, like zero-emission mandates, can target the manufacturers, the purchasers, or the companies hiring trucking or equipment services.

Technology and Policy Survey Data

MFN recently conducted zero-emissions technology availability and policy landscape surveys inform this report. This section includes short summaries of the two surveys, along with links to the more detailed data and reports.

Technology Survey: Zero-Emission Freight and Truck Availability

[MFN's Zero-Emissions Freight and Truck Availability Survey](#) documents the availability of several types of zero-emission heavy-duty vehicles and freight equipment. The status of commercialization and technical specifications (e.g., battery capacity, range, or operating time) are included when available. While the number of models is encouraging, most of these vehicles and equipment are currently being produced in small quantities and policy actions are needed to increase their commercial availability and to facilitate wider adoption.

Electrification is currently already viable for several classes of medium- and heavy-duty vehicles based on their operating characteristics, the range of today's battery technologies, and similar if not cheaper total costs of ownership despite the higher upfront purchase costs. Electrification of freight equipment is also underway with today's technology and benefits from operating in confined areas with on site charging infrastructure.

Vehicle parking lots, ports, railyards, and warehouses will need charging infrastructure to support electrification. Fleets and electric utilities should begin planning and building the necessary electrical infrastructure as soon as possible given the inherent duration of

such projects. The build out and upgrade of infrastructure needed to charge vehicles and equipment represent a significant opportunity for jobs, particularly in electrical construction.

Availability of Heavy-Duty Electric Vehicles

The availability of heavy-duty electric vehicles has grown rapidly in recent years. In 2014, eight manufacturers offered 26 models of electric trucks and buses. In 2019, that number reached 19 manufacturers offering 68 models, with transit buses and vocational trucks showing the widest range of model availability (HVIP 2019). While the number of models is encouraging, most of these vehicles are currently being produced in small quantities and much more must be done to increase their commercial availability.⁸⁰

In the transit bus industry, four manufacturers (BYD, Gillig, New Flyer, and Proterra) offer vehicles with ranges up to, if not beyond, 200 miles, depending on the operating conditions. All three major manufacturers of school buses (Blue Bird, IC Bus, and Thomas Built) offer electric versions, as do new entrants (Lion, Motiv). Twelve different manufacturers offer electric trucks in the delivery truck and straight truck categories.⁸¹

While semi-trucks are often considered more challenging to electrify, every major manufacturer and several new entrants are developing and are testing such vehicles, many in real-world operations. These demonstrations are proving it is possible to electrify a vehicle segment once considered a moonshot.

Manufacturer	Model	Type	Manufacturers' Estimated Range (miles)	Availability
BYD	8TT	Battery	125	Early commercial
Freightliner	E-Cascadia	Battery	250	Early commercial
Volvo	VNR Electric	Battery	150-300	Early commercial
Peterbilt	579 EV	Battery	150	Early commercial
Kenworth	T680E	Battery	150	Early commercial
Lion	Lion8	Battery	Up to 250	Early commercial
Tesla	Semi	Battery	300-500	In development
Hino/Toyota	XL7 Electric	Fuel Cell	Unknown	In development
Nikola	Two Tre	Battery Fuel Cell		In development
Hyundai	XCIENT	Fuel Cell	240	In development
XOS	ET-One	Battery	300-360	In development

Table 8. Heavy-Duty Electric Freight Vehicles

The Economic Case for Heavy-Duty Electric Vehicles

Fuel and maintenance savings can offset the higher upfront costs of heavy-duty electric vehicles, making them cheaper than a diesel or natural gas vehicle over their lifespan. This is especially the case for higher mileage truck applications, where more than half the cost of owning the vehicle can come from the cost of diesel fuel, compared to roughly a quarter of the cost coming from the price of the vehicle itself. Depending on vehicle efficiency, annual vehicle mileage, and fuel prices, electricity can reduce fuel costs by a promising 30 to 75 percent compared with diesel.⁸²

The lower total cost of ownership is expected for nearly every type of battery-electric truck and bus for vehicles purchased within the next 10 years. Recent analyses indicate similar if not lower total costs of ownership even for electric semi-trucks within the next five to ten years compared with diesel, whether operating in long haul or regional contexts⁽⁸³⁾⁽⁸⁴⁾⁽⁸⁵⁾⁽⁸⁶⁾⁽⁸⁷⁾. Results from three studies that investigated the costs of short-haul electric semi-trucks are summarized in the figure below.

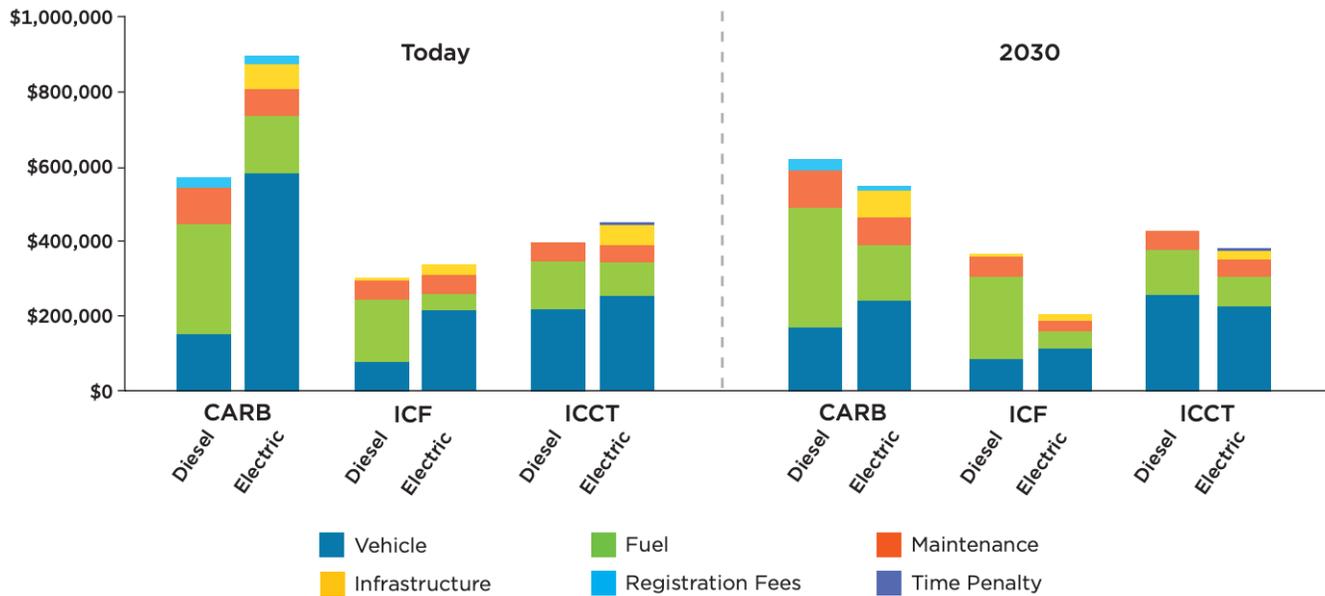


Figure 4. The Cost Summary of Short-Haul Electric Semi-Trucks

The total cost of ownership for Class 8 electric short-haul/drayage trucks can be lower than diesel today with financial incentives (not shown) and is estimated to be lower for diesel trucks within the next decade without such incentives. Note, in the ICCT study, “today” corresponds to 2020; in the CARB and ICF studies to 2018. Vehicle costs in the ICF and CARB analyses account for the residual value of the vehicle at the end of its assumed period of ownership.⁸⁸

As the prices of batteries and fuel cells decrease and the prices of diesel and natural gas engines increase to meet clean air standards, the economics shift even further in favor of electric vehicles. Even in analyses that assume battery-electric truck purchase prices will remain higher than diesel trucks through 2030, total ownership costs are estimated to be significantly lower. Overcoming the higher purchase cost of electric trucks is an important strategy for increasing their adoption.



Image 4. Trucks driving through the Ironbound district in Newark, NJ, 2015
Source: Yana Paskova, *The Washington Post*

Policy Landscape Survey: Voices for Zero Emissions

MFN's Tech Team conducted a landscape survey of existing policies that advance zero-emission goods movement across the U.S. The survey aims to serve as a useful resource for MFN members outlining the landscape of opportunities to advance zero emissions in their respective states. The complete [MFN Zero-Emission Policy Survey](#) can be found on the MFN website.⁸⁹

The landscape survey is summarized in the linked spreadsheet that tracks zero-emission freight policies at the federal, multi-state, and state levels (organized by EPA regions). It reflects policies related to: medium-and heavy-duty trucks, delivery trucks, cargo

handling equipment (including forklifts, rubber-tired gantry (RTG) cranes, top handlers, yard tractors), ships, locomotives, buses, and supporting infrastructure (i.e., shore power for ships to plug-in, charging stations for trucks and buses, etc.). The research and data were collected from government websites.

To date, the MFN Tech Team has researched policies at the federal level, and in the following states: EPA Region 2 (New York, New Jersey), EPA Region 4 (Florida, Georgia, North Carolina, South Carolina), Region 5 (Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin), EPA Region 6 (Texas, Arkansas, New Mexico, Oklahoma, Louisiana), EPA Region 10 (Washington, Oregon, Idaho). The Tech Team has also collected partial information on policies for EPA Region 7 (Nebraska, Iowa, Missouri, Kansas).⁹⁰



Image 5. Logistics in Wilmington, CA
Source: California Department of Transportation

The survey data is available in this [online spreadsheet](#) which is accessible on MFN's website. The Tech Team acknowledges that policies will change over time. It is important to note that while presenting this data, MFN does not recommend any specific policies or speak to their effectiveness. The Tech Team understands that community perspectives and needs may often differ from the summaries put forward by government agencies. MFN members are encouraged to consider whether other local policies can advance their campaigns, which are not currently reflected in the spreadsheet, and members are invited to add their perspectives and recommendations to this living document.

Appendices

Appendix A: Images

Image 1. Crosswalk in Los Angeles, CA. Photo Credit: Clarence Williams III- East Yard Communities for Environmental Justice

Image 2. MFN NEPA D.C. Delegation. Photo Credit: Moving Forward

Image 3. Railyard in Los Angeles, CA. Photo Credit: Angelo Logan - East Yard Communities for Environmental Justice

Image 4. Trucks are seen driving through the Ironbound district in Newark, NJ, 2015. Photo Credit: Yana Paskova - The Washington Post

Image 5. Logistics in Wilmington, CA. Photo Credit: California Department of Transportation

Appendix B: Tables

Table 1. Essex County & the State of New Jersey - 2020 Data

Table 2. Chatham County & the State of Georgia - 2020 Data

Table 3. Harris County & the State of Texas - 2020 Data

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Table 5. Wyandotte County & State of Kansas - 2020 Data

Table 6. Infrastructure Needs of a 100% Zero-Emission Medium and Heavy-Duty Vehicle Fleet in the United States

Table 7: Projected 2025 Emissions (tons) from Mobile Source Freight Sectors

Table 8. Electrify Vehicle Segment

Appendix C: Figures

Figure 1. Projected growth in investment needed to support a zero-emission medium and heavy-duty vehicle fleet in the United States, 2020-2050

Figure 2. Job Creation per \$1M invested in MHD Commercial Fleet EV Infrastructure

Figure 3. Health Benefits of Zero Emission Freight System

Figure 4. The Cost Summary of Short-Haul Electric Semi-Trucks

Appendix D: Relevant Resources

- [“Truck Driver Misclassification: Climate, Labor, and Environmental Justice Impacts”](#) By Carol Zabin and Sam Appel at the UC Berkeley Labor Center, August 22, 2019
- [U.S. Employment Plan by Jobs to Move America, April 10, 2020](#)
- [The Evergreen Action Plan by the Evergreen Collaborative](#)
- [Just Transition Listening Project by Labor Network for Sustainability 2021](#)

Appendix E: Report Contributors

The Moving Forward Network engaged in a collaborative process with its membership, technical partners, staff, and consultants to develop this report. The following individuals and organizations contributed significant time, expertise, and content to this project. MFN Advisory Board Members are indicated with asterisks*.

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Zully Juarez, MURP is from Los Angeles, CA, as an urban planner and research and policy analyst she has extensive experience working on environmental and transportation initiatives, community economic development, and housing equity policy. Zully incorporates the intersection of urban planning and public health to advance people-powered planning and policy solutions to create equitable communities. She holds a B.A. from the University of California Berkeley in Gender & Women’s Studies and Ethnic Studies, and a Master of Urban & Regional Planning from the University of California, Los Angeles.

Endnotes: Works Cited

- 1 Sydbom, A., A. Blomberg, S. Parnia, N. Stenfors, T. Sandström, and S-E. Dahlén. “Health Effects of Diesel Exhaust Emissions.” *European Respiratory Journal* 17, no. 4 (April 1, 2001): 733–46. <https://doi.org/10.1183/09031936.01.17407330>.
- 2 US EPA. “Near Roadway Air Pollution and Health: Frequently Asked Questions.” US EPA, August 2014. https://www.epa.gov/sites/default/files/2015-11/documents/420f14044_0.pdf.
- 3 Rosenbaum, Arlene, Seth Hartley, and Chris Holder. “Analysis of Diesel Particulate Matter Health Risk Disparities in Selected US Harbor Areas.” *American Journal of Public Health* 101, no. S1 (December 1, 2011): S217–23. <https://doi.org/10.2105/AJPH.2011.300190>.
- 4 US EPA. “Climate Change and Health Factsheets.” Overviews and Factsheets, January 19, 2017. <https://19january2017snapshot.epa.gov/climate-impacts/climate-change-and-health-factsheets>.
- 5 Office of Transportation and Air Quality. “NATIONAL PORT STRATEGY ASSESSMENT: Reducing Air Pollution and Greenhouse Gases at U.S. Ports.” US EPA, September 2016. <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/420r16011.pdf>.
- 6 DePillis, Lydia. “Ports Are the New Power Plants — At Least in Terms of Pollution.” *Washington Post*, November 24, 2015. <https://www.washingtonpost.com/news/wonk/wp/2015/11/24/ports-are-the-new-power-plants-at-least-in-terms-of-pollution/>.
- 7 Bureau of Transportation Statistics. “DOT Releases 30-Year Freight Projections.” Bureau of Transportation Statistics. Bureau of Transportation Statistics, March 3, 2016. <https://www.bts.gov/newsroom/dot-releases-30-year-freight-projections>.
- 8 Office of Transportation and Air Quality. “Fast Facts U.S. Transportation Sector Greenhouse Gas Emissions 1990-2014.” US EPA, June 2016. <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1000NBL.pdf>.
- 9 Comes, Martin; Graichen, Jakob; Siemons, Anne; Cook, Vanessa. “Emission Reduction Targets for International Aviation and Shipping.” Policy Department A: Economic and Scientific Policy European Parliament, November 2015. [https://www.europarl.europa.eu/RegData/etudes/STUD/2015/569964/IPOL_STU\(2015\)569964_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2015/569964/IPOL_STU(2015)569964_EN.pdf).
- 10 National People of Color Environmental Leadership Summit. “Principles of Environmental Justice.” EJ Net, October 27, 1991. <http://www.ejnet.org/ej/principles.html>.
- 11 Renewable energy may have many definitions based on the source of energy. MFN considers solar and wind to be renewable energy. However, there are important EJ and equity implications that come from these “cleaner” energy sources (i.e siting, manufacturing, shipping, etc). All of these must be considered with EJ leadership before endorsing specific renewable energy recommendations.
- 12 Office of Transportation and Air Quality. “Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder.” US EPA, May 2008. <https://nepis.epa.gov/Exe/ZyPDF.cgi/P10024CN.PDF?Dockey=P10024CN.PDF>.
- 13 Ibid.
- 14 IEA. “Tracking Transport 2020.” IEA, 2020. <https://www.iea.org/reports/tracking-transport-2020>.
- 15 Office of Transportation and Air Quality. “Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder.” US EPA, May 2008. <https://nepis.epa.gov/Exe/ZyPDF.cgi/P10024CN.PDF?Dockey=P10024CN.PDF>.
- 16 Office of Transportation and Air Quality. “Near Roadway Air Pollution and Health: Frequently Asked Questions.” US EPA, August 2014. https://www.epa.gov/sites/default/files/2015-11/documents/420f14044_0.pdf.
- 17 Clean Air Act Advisory Committee. “Ports Initiative Workgroup Report: Recommendations for the U.S. EPA.” US EPA, September 2016. https://www.epa.gov/sites/default/files/2016-09/documents/ports_workgroup_report_for_epa_9_15_16.pdf.

18 International Agency for Research on Cancer. "IARC: Diesel Engine Exhaust Carcinogenic [Press Release]." World
Health Organization, June 12, 2012. https://www.iarc.who.int/wp-content/uploads/2018/07/pr213_E.pdf.

19 Office of Transportation and Air Quality. "Fast Facts U.S. Transportation Sector Greenhouse Gas Emissions 1990-
2014." US EPA, June 2016. <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1000NBL.pdf>.

20 ICF International. "Comparison of Medium- and Heavy- Duty Technologies in California." ICF International, October
2019.

21 Office of Transportation and Air Quality. "2014 DERA Ports RFP List of Areas of Poor Air Quality." US EPA, September
10, 2014. <https://19january2017snapshot.epa.gov/sites/production/files/2015-11/documents/fy14-ports-county-area-list-9-10-14.pdf>.

22 Rosenbaum, Arlene, Seth Hartley, and Chris Holder. "Analysis of Diesel Particulate Matter Health Risk Disparities in
Selected US Harbor Areas." *American Journal of Public Health* 101, no. S1 (December 1, 2011): S217–23. <https://doi.org/10.2105/AJPH.2011.300190>.

23 Ibid.

24 Based on the 2010 Census (population, race, ethnicity) and 2006-2010 American Community Survey (income,
poverty).

25 Moving Forward Network. "Voices for Zero Emission Solutions! Public Impacts from Freight Operations Engaging
Community Voices.," 2021. https://docs.google.com/document/d/1q_6XSLwiY6HW8fERHfPTHbt4Gwh1Pim_/edit?usp=embed_facebook.

26 County Health Rankings. "Los Angeles, California - County Health Rankings & Roadmaps." County Health Rankings,
2020. <https://www.countyhealthrankings.org/app/california/2020/rankings/los-angeles/county/outcomes/overall/snapshot>.

27 MFN recognizes that there are census tracts and neighborhoods with more air pollution that are not captured by
overall country rates included in the charts below.

28 IEA. "Tracking Transport 2020." IEA, 2020. <https://www.iea.org/reports/tracking-transport-2020>.

29 TF. "ITF Transport Outlook 2019." Paris: OECD, May 22, 2019. https://www.oecd-ilibrary.org/transport/itf-transport-outlook-2019_transp_outlook-en-2019-en.

30 Ibid, 170.

31 Ibid, 171.

32 Goetz, Andrew, and Serena Alexander. "Urban Goods Movement and Local Climate Action Plans: Assessing
Strategies to Reduce Greenhouse Gas Emissions from Urban Freight Transportation." Mineta Transportation Institute
San Jose State University, April 2019. https://transweb.sjsu.edu/sites/default/files/1796_Goetz_Alexander_Urban-Goods-Movement-Greenhouse-Gas-Emissions.pdf.

33 US Department of Transportation. "Beyond Traffic 20145." US Department of Transportation, n.d. https://www.transportation.gov/sites/dot.gov/files/docs/BeyondTraffic_tagged_508_final.pdf.

34 Goetz, Andrew, and Serena Alexander. "Urban Goods Movement and Local Climate Action Plans: Assessing
Strategies to Reduce Greenhouse Gas Emissions from Urban Freight Transportation." Mineta Transportation Institute
San Jose State University, April 2019. https://transweb.sjsu.edu/sites/default/files/1796_Goetz_Alexander_Urban-Goods-Movement-Greenhouse-Gas-Emissions.pdf.

35 ITF. "ITF Transport Outlook 2019." Paris: OECD, May 22, 2019. https://www.oecd-ilibrary.org/transport/itf-transport-outlook-2019_transp_outlook-en-2019-en.

36 UNFCCC. "The Paris Agreement." United Nations Climate Change, 2021. <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>.

37 It is worth noting that while some OECD nations ought to pursue even faster paces of electrification, a global sales
average of 30% electric vehicles in 2030 would still be extremely ambitious.

38 Transport & Environment. "How to Decarbonize the UK's Freight Sector by 2050," December 2020. https://www.transportenvironment.org/sites/te/files/publications/Study_How%20to%20decarbonise%20the%20UKs%20freight%20sector%20by%202050.pdf.

39 ITF. “ITF Transport Outlook 2019.” Paris: OECD, May 22, 2019. https://www.oecd-ilibrary.org/transport/itf-transport-outlook-2019_transp_outlook-en-2019-en.

40 Ibid, 157.

41 Hammond, William, John Axsen, and Erik Kjeang. “How to Slash Greenhouse Gas Emissions in the Freight Sector: Policy Insights from a Technology-Adoption Model of Canada.” *Energy Policy* 137 (February 1, 2020): 111093. <https://doi.org/10.1016/j.enpol.2019.111093>.

42 North American Council for Freight Efficiency. “Electric Trucks: Where They Make Sense,” May 2018. <https://nacfe.org/emerging-technology/electric-trucks/>.

43 North American Council for Freight Efficiency. “Viable Class 7/8 Electric, Hybrid, and Alternative Fuel Tractors,” 2019. <https://nacfe.org/emerging-technology/electric-trucks-2/viable-class-7-8/>.

44 O’Dea, Jimmy. “The Biggest Step To-Date on Electric Trucks.” *Union of Concerned Scientists The Equation (blog)*, April 29, 2020. <https://blog.ucsusa.org/jimmy-odea/the-biggest-step-to-date-on-electric-trucks/>.

45 California Air Resources Board. “Attachment C: Updated Costs and Benefits Analysis for the Proposed Advanced Clean Trucks Regulation.” California Air Resources Board, 2019. <https://ww2.arb.ca.gov/sites/default/files/classic/regact/2019/act2019/30dayattc.pdf>.

46 We (MFN) acknowledge that hydrogen has the potential to be problematic and that there are environmental justice concerns. We have not yet developed a formal position from the network on its viability as a recommended energy alternative.

47 Veeder, Christy. “How Battery-Electric Buses Can Benefit the Environment, the Economy, and Public Transit.” *Jobs to Move America Transforming Transit, Realizing Opportunity (blog)*, July 18, 2019. <https://jobstomoveamerica.org/resource/transforming-transit-realizing-opportunity/>.

48 California Air Resources Board. “Advanced Clean Trucks Regulation Standardized Regulatory Impact Assessment (SRIA).” California Air Resources Board, August 8, 2019. <https://ww2.arb.ca.gov/sites/default/files/classic/regact/2019/act2019/appc.pdf>.

49 Guidehouse Insights. “Market Data: Cargo Handling Equipment Electrification.” Guidehouse Insights, 2021. <https://guidehouseinsights.com/reports/market-data-cargo-handling-equipment-electrification>.

50 Welch, Dan, Cristiano Facanha, Rob Kroon, David Bruil, Floris Jousma, and Harm Weken. “Moving Zero-Emission Freight Toward Commercialization.” CALSTART White Paper, 2020. <https://globaldrivetozero.org/site/wp-content/uploads/2020/12/Moving-Zero-Emission-Freight-Toward-Commercialization.pdf>.

51 Port of Long Beach The Green Port. “Charging Ahead: The Port Community Electric Vehicle Blueprint.” Port of Long Beach The Green Port, May 2019. <https://sustainableworldports.org/wp-content/uploads/Port-Community-Electric-Blueprint-Port-of-Long-Beach.pdf>.

52 Winebrake, James J., Erin H. Green, and Edward W. Carr. “An Assessment of Macroeconomic Impacts of Medium- and Heavy-Duty Electric Transportation Technologies in the United States Achieving Employment and Output Gains through Petroleum Displacement, Fuel Cost Savings, and Increased Demand for Related Industries.” Energy and Environmental Research Associates, LLC, April 11, 2018. <https://caletc.com/assets/files/EERA-MHDV-Macroeconomic-Impacts-of-Electrification.pdf>

53 Ibid.

54 Walton, Robert. “DOE Will Spend Billions on Electric Vehicle R&D in Jobs Fight with China, Granholm Says.” *Utility Dive*, March 10, 2021. <https://www.utilitydive.com/news/doe-will-spend-billions-on-electric-vehicle-research-in-jobs-fight-with-china/596441/>.

55 Auto Alliance. “Economic Insights.” Alliance for Automotive Innovation, 2018. <https://www.autosinnovate.org/resources/insights>.

56 Scott, Robert E.. “The Manufacturing Footprint and the Importance of U.S. Manufacturing Jobs.” Economic Policy Institute, January 22, 2015. <https://www.epi.org/publication/the-manufacturing-footprint-and-the-importance-of-u-s-manufacturing-jobs/>.

- 57 Securing America's Future Energy. "The Commanding Heights of Global Transportation." Securing America's Future Energy, n.d. <https://2uj256fs8px404p3p2i7nvkd-wpengine.netdna-ssl.com/wp-content/uploads/2020/09/The-Commanding-Heights-of-Global-Transportation.pdf>.
- 58 Hirsch, Jerry. "Volvo to Put \$400 Million on Factory, Add Electric Line." Trucks.com, June 28, 2019. <https://www.trucks.com/2019/06/28/volvo-upgrades-virginia-factory/>.
- 59 We Build Green Cities. "Daimler Truck Expansion to Advance Battery-Electric Vehicles in Portland." We Build Green Cities, August 15, 2019. <https://webuildgreencities.com/daimler-truck-expansion-to-advance-battery-electric-vehicles-in-portland/>
- 60 International Agency for Research on Cancer. "IARC: Diesel Engine Exhaust Carcinogenic [Press Release]." World Health Organization, June 12, 2012. https://www.iarc.who.int/wp-content/uploads/2018/07/pr213_E.pdf.
- 61 Di, Qian, Yan Wang, Antonella Zanobetti, Yun Wang, Petros Koutrakis, Christine Choirat, Francesca Dominici, and Joel D. Schwartz. "Air Pollution and Mortality in the Medicare Population." *New England Journal of Medicine* 376, no. 26 (June 29, 2017): 2513–22. <https://doi.org/10.1056/NEJMoa1702747>.
- 62 Perera, Elizabeth M., and Todd Sandord. "Rising Temperatures, Worsening Ozone Pollution." Union of Concerned Scientists, June 2011. <https://www.ucsusa.org/sites/default/files/2019-09/climate-change-and-ozone-pollution.pdf>.
- 63 American Lung Association. "Particle Pollution." American Lung Association. Accessed March 2021. <https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/particle-pollution>.
- 64 US EPA. "Integrated Science Assessment (ISA) for Ozone and Related Photochemical Oxidants." US EPA, 2013. <https://www.epa.gov/isa/integrated-science-assessment-isa-ozone-and-related-photochemical-oxidants>.
- 65 Caiazzo, Fabio, Akshay Ashok, Ian A. Waitz, Steve H.L. Yim, and Steven R.H. Barrett. "Air Pollution and Early Deaths in the United States. Part I: Quantifying the Impact of Major Sectors in 2005." *Atmospheric Environment* 79 (2013): 198–208. <http://dx.doi.org/10.1016/j.atmosenv.2013.05.081>.
- 66 Davis, Stacy C., and Robert G. Boundy. "Transportation Energy Data Book Edition 39." Oak Ridge National Laboratory, February 2021. https://tedb.ornl.gov/wp-content/uploads/2021/02/TEDB_Ed_39.pdf.
- 67 Ibid, 13-6.
- 68 Annenberg, Susan, Joshua Miller, Daven Henze, and Ray Minarjes. "A Global Snapshot of the Air Pollution-Related Health Impacts of Transportation Sector Emissions in 2010 and 2015." International Council on Clean Transportation, 2019. <https://theicct.org/publications/health-impacts-transport-emissions-2010-2015>.
- 69 South Coast Air Quality Management District. "Draft Socioeconomic Impact Assessment for Proposed Rule 2305 – Warehouse Indirect Source Rule – Warehouse Actions and Investments to Reduce Emissions (WAIRE) Program and Proposed Rule 316 – Fees for Rule 2305." South Coast Air Quality Management District, March 2021. <https://www.aqmd.gov/docs/default-source/planning/fbmsm-docs/pr-2305-draft-socioeconomic-impact-assessment.pdf?sfvrsn=8>.
- 70 Reichmuth, David. "Air Pollution from Cars, Trucks, and Buses in the US: Everyone Is Exposed, but the Burdens Are Not Equally Shared." *Union of Concerned Scientists The Equation (blog)*, October 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/>.
- 71 Wolfe, Philip, Kenneth Davidson, Charles Fulcher, Neal Fann, Margaret Zawacki, and Kirk R. Baker. "Monetized Health Benefits Attributable to Mobile Source Emission Reductions across the United States in 2025." *Science of the Total Environment* 650 (2019): 2490–98, <https://doi.org/10.1016/j.scitotenv.2018.09.273>.
- 72 Environmental Defense Fund. "Clean Trucks, Clean Air, American Jobs: Eliminating Pollution from All New Truck and Buses by 2040 – and Urban and Community Applications by 2035 – Will Save Thousands of Lives, Cut Climate Pollution, and Result in Shared Economic Benefits." Environmental Defense Fund, March 2021. https://www.edf.org/sites/default/files/2021-03/HD_ZEV_White_Paper.pdf.
- 73 The labor and workers rights partners interviewed for this project are the Labor Network for Sustainability, Los

74 Angeles Alliance for a New Economy, Jobs to Move America, and the Warehouse Worker Resource Center.
Appel, Sam, and Carol Zabin. "Truck Driver Misclassification: Climate, Labor, and Environmental Justice Impacts." UC
Berkeley Labor Center, August 2019. <https://laborcenter.berkeley.edu/pdf/2019/Truck-Driver-Misclassification.pdf>.

75 Ibid.

76 Education & Labor Committee. "Protecting the Right to Organize Act Section by Section." Education & Labor
Committee, 2021. <https://edlabor.house.gov/imo/media/doc/Section%20by%20Section%20-%20PRO%20Act.pdf>.

77 Office of Financial Management. "Fair Labor Standards Act (FLSA)." Office of Financial Management, 2019. <https://ofm.wa.gov/state-human-resources/compensation-job-classes/compensation-administration/fair-labor-standards-act-flsa-washington-minimum-wage-act-wmwa/fair-labor-standards-act-flsa>.

78 Labor Network for Sustainability. "'Just Transition' - Just What Is It?," July 6, 2016. <https://www.labor4sustainability.org/uncategorized/just-transition-just-what-is-it/>.

79 Regenerate California. "Just Transition [Factsheet]." Regenerate California, 2016. <https://www.sierraclub.org/sites/www.sierraclub.org/files/program/documents/Just%20Transition%20Factsheet.pdf>.

80 O'Dea, Jimmy. "Ready for Work Now Is the Time for Heavy-Duty Electric Vehicles." Cambridge, MA: Union of
Concerned Scientists, 2019. <https://www.ucsusa.org/resources/ready-work>.

81 Ibid.

82 Ibid.

83 California Air Resources Board. "Advanced Clean Trucks Total Cost of Ownership Discussion Document." California
Air Resources Board, February 22, 2019. http://ww2.arb.ca.gov/sites/default/files/2019-02/190225tco_0.pdf.

84 Di Filippo, James, Colleen Callahan, and Naseem Golestani. "Zero-Emission Drayage Trucks Challenges and
Opportunities for the San Pedro Bay Ports." UCLA Luskin Center for Innovation (LCI), October 2019. https://innovation.luskin.ucla.edu/wp-content/uploads/2019/10/Zero_Emission_Drayage_Trucks.pdf.

85 Hall, Dale, and Nic Lutsey. "Estimating the Infrastructure Needs and Costs for the Launch of Zero-Emission Trucks."
The International Council on Clean Transportation, August 2019. https://theicct.org/sites/default/files/publications/ICCT_EV_HDVs_Infrastructure_20190809.pdf.

86 ICF International. "Comparison of Medium- and Heavy- Duty Technologies in California." ICF International, October
2019. <https://www.atlasevhub.com/resource/comparison-of-medium-and-heavy-duty-technologies-in-california/>.

87 Phadke, Amol, Aditya Khandekar, Nikit Abhyankar, David Wooley, and Deepak Rajagopal. "Why Regional and
Long-Haul Trucks Are Primed for Electrification Now," 2021. https://eta-publications.lbl.gov/sites/default/files/updated_5_final_ehdv_report_033121.pdf

88 Ibid.

89 Moving Forward Network. "Zero-Emission Freight and Truck Availability." Google Docs, May 2021.
https://docs.google.com/spreadsheets/d/1FVVAiKe3HM6sTkKH311SG1jsOyUsaKjNYXU3HaaPd40/edit?usp=embed_facebook.

90 Moving Forward Network. "MFN Zero Emissions Policy Survey." Google Docs, May 2021. https://docs.google.com/spreadsheets/d/16gyRPLQPdBmSY36y7gbEXbJZX30h4m1t7Va9mPCPiiY/edit?usp=embed_facebook.