

A *Heavy* LIFT

Policy Solutions to Accelerate Deployment of Zero-Emission Cargo Handling Equipment at the Ports of Long Beach and Los Angeles and Beyond

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Policy Report

Climate Change
and Business
Research Initiative



ABOUT THIS REPORT

This policy report is part of a series on how specific sectors of the business community can drive key climate change solutions and how policymakers can facilitate those solutions. Each report results from workshop convenings that include expert representatives from the business, academic, policy, environmental, and labor sectors. The convenings and resulting policy reports are sponsored by Bank of America and produced by a partnership of UCLA School of Law's Emmett Institute on Climate Change and the Environment and UC Berkeley School of Law's Center for Law, Energy & the Environment (CLEE). The UC organizers select topics and participants based on outreach to both public- and private-sector experts for a small-group, facilitated discussion format.

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The Emmett Institute on Climate Change and the Environment is among the leading environmental law programs in the country, with faculty members renowned for their public service, teaching excellence, and scholarship in state, federal, and international law. Located in Los Angeles, the Emmett Institute provides J.D. and LL.M. students unmatched opportunities for mentoring, career placement, and experiential learning. Through groundbreaking research and public interest initiatives, the Emmett Institute helps shape climate change and environmental law and policy in California, the United States, and jurisdictions around the world.

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The Center for Law, Energy & the Environment (CLEE) channels the expertise and creativity of the Berkeley Law community into pragmatic policy solutions to environmental and energy challenges. CLEE works with government, business, and the nonprofit sector to help solve urgent problems requiring innovative, often interdisciplinary approaches. Drawing on the combined expertise of faculty, staff, and students across the University of California, Berkeley, CLEE strives to translate empirical findings into smart public policy solutions to better environmental and energy governance systems.

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EXECUTIVE SUMMARY

America’s major ports—the Ports of Los Angeles and Long Beach (“the Ports”)—are at a crossroads. As both an economic driver and an air quality burden to local communities, the Ports are grappling with immense cargo volumes, while simultaneously making strides toward ambitious decarbonization and public health goals. Among these goals is a commitment by the Ports, embodied in their Clean Air Action Plan—a voluntary plan undertaken by the Ports after years of community advocacy—to transition all cargo handling equipment to zero-emission models by 2030.

Cargo handling equipment, which is equipment that moves cargo around port terminals such as yard trucks, container handlers, forklifts, and cranes, is a significant source of criteria pollutants, air toxics, and climate pollution. For decades, communities living near the Ports, which experience high rates of asthma and other respiratory illness, cancer, and lower life expectancy, have been organizing and advocating for stronger environmental and public health protections. Transitioning cargo handling equipment to zero-emission models reduces the Ports’ climate impact and improves environmental and health conditions for nearby communities.

In 2006, the Ports set a goal to transition to 100 percent zero-emission cargo handling equipment by 2030. Meeting this goal could set a groundbreaking precedent for ports throughout the U.S. and globally, as the Ports have long been leaders in modeling sustainable practices. It would also meaningfully advance the achievement of California’s climate and clean air commitments. According to the South Coast Air Quality Management District, the Ports are “the single largest fixed source of air pollution in Southern California,”¹ and cargo handling equipment is the third largest source of maritime industry-related greenhouse gas emissions from the two Ports, accounting for approximately 17.5 percent of their respective climate emissions.²

Thus, as California leaders chart a path to a net-zero carbon economy and work to meet clean air obligations, transitioning fossil-fuel powered cargo handling equipment to zero-emission models can play a key role. The time is ripe for action. The availability of public funding for infrastructure projects, coupled with quickly approaching deadlines, could make 2024 an optimal time to install zero-emission charging and refueling infrastructure and purchase

zero-emission cargo handling equipment. However, concerns about the costs and efficacy of this equipment, grid capacity, utility rate increases, and job loss, as well as a lack of enforceable deadlines, are delaying transition efforts.

To consider these challenges, UCLA School of Law’s Emmett Institute on Climate Change and the Environment and UC Berkeley School of Law’s Center for Law, Energy & the Environment (“CLEE”) convened experts in April 2023 to identify the key barriers to deployment of zero-emission cargo handling equipment at the Ports and develop recommendations for policy actions that could overcome them. This report outlines the vision these participants discussed for transitioning to 100 percent zero-emission cargo handling equipment; key barriers to achieving this vision; and a set of policy solutions to overcome those barriers. This report focuses on the Ports of Los Angeles and Long Beach, which are the largest in the United States, because of their outsized influence in California and beyond. However, both the barriers and solutions identified in this report will likely be applicable to other ports throughout the country. As one of the country’s largest port facilities, the combined operations of the Ports can serve as an important model for the international goods movement industry.

BARRIER #1: INADEQUATE GRID AND CHARGING INFRASTRUCTURE TO SUPPORT ZERO-EMISSION CARGO HANDLING EQUIPMENT AND LACK OF SUBSTANTIAL PLANNING AND FUNDING TO INSTALL NECESSARY AND TIMELY INFRASTRUCTURE.

Solutions:

- The Ports and utilities, chiefly Southern California Edison and Los Angeles Department of Water and Power, could proactively deploy “no regret” infrastructure, including increasing grid capacity and upgrading distribution networks that will be needed regardless of how zero-emission cargo handling equipment is powered.
- Utilities and local government entities, including the Los Angeles Department of Building and Safety and the Ports’ harbor engineers, could evaluate permitting processes for charging infrastructure installations at the Ports to reduce inefficiencies and delays and streamline approvals.

NOTE ON THIS REPORT’S SCOPE

This report and its recommendations center on the challenges and opportunities associated with increased electrification at the Ports, which was the primary focus of discussions at the convening. Hydrogen-powered technologies may also be part of Port decarbonization efforts, but because convening participants were both less specific and more divided about the nature of hydrogen’s role, the barriers and solutions discussed here largely relate to electrified cargo handling equipment. However, this report does not endorse a particular technology or mix of technologies in the transition to zero-emission cargo handling equipment.

BARRIER #2: EVOLVING ZERO-EMISSION TECHNOLOGY FOR SOME TYPES OF CARGO HANDLING EQUIPMENT AND HIGH UPFRONT COSTS.

Solutions:

- The California Legislature; the Air Resources Board; and/or the South Coast Air Quality Management District, using their existing authority grounded in air pollution control, could create technology-forcing mandates and clear, enforceable implementation deadlines, with penalties for non-compliance, to catalyze the zero-emission cargo handling equipment transition. Where technology is not readily commercially available, regulations could incorporate adequate flexibility and sufficient lead time for entities to meet the mandate.
- The federal government, led by the U.S. Maritime Administration and the U.S. Environmental Protection Agency, could create a national strategic goods movement plan to facilitate the transition to zero-emission cargo handling equipment at ports across the United States. By developing national standards and guidelines for sustainable port operations, such a strategy could help alleviate burdens for early-adopters and port communities.
- Federal, state, and local government agencies, including the U.S. Department of Transportation, U.S. Environmental Protection Agency, California Energy Commission, California Air Resources Board, and South Coast Air Quality Management District, could provide additional and more accessible grant funding, incentives, and financial support to ease the transition to zero-emission cargo handling equipment technology. In particular, they could increase funding for research and development to improve the performance of zero-emission technologies.

BARRIER #3: FEAR AMONG COMMUNITIES AND WORKERS OF JOB LOSS AND OF INCREASED EMISSIONS FROM EXPANDED PORT ACTIVITIES.

Solutions:

- State and local government could implement policies to promote job preservation, local job creation, and worker training, such as programs that encourage Ports and terminal operators to partner with local training organizations to upskill and reskill the workforce to use the new vehicles and technologies.
- State and local agencies could improve their planning processes to better ensure frontline community members have a voice in planning for and implementing the zero-emission cargo handling equipment transition.

WHAT IS CARGO HANDLING EQUIPMENT?

Cargo handling equipment refers to an array of motorized machinery that is used to load, unload, and transport cargo and perform routine maintenance at industrial ports.³ Much of this equipment is powered by diesel, gasoline, propane, and liquefied natural gas, although some types of cargo handling equipment, such as rubber-tired gantry cranes, have been powered by electricity for decades. Zero-emission models of other equipment types have also become available in the last few years, with new and improved models in development. However, not all forms of cargo handling equipment are produced in commercially available, zero-emission models that meet performance requirements.⁴ At the Ports, the main equipment types are yard tractors, top handlers, rubber-tired gantry cranes, and large capacity forklifts.⁵

Yard tractors (also known as yard trucks, utility tractor rigs, or yard hustlers) are the most common type of cargo handling equipment found at industrial ports.⁶ They move cargo containers within port terminals and intermodal rail yards.⁷ At the Port of Los Angeles, yard tractors make up 48 percent of the Port's total cargo handling equipment inventory.⁸ Most yard tractors are fueled by diesel fuel, although some are powered using liquefied petroleum gas or natural gas.⁹ As of 2022, 1,569 yard tractors were in operation at the Ports, 81 percent of which were powered by diesel.¹⁰ A 2021 feasibility report, produced to assess progress toward achieving the Ports' Clean Air Action Plan goals, found that zero-emission technology, such as battery-electric yard tractors, is commercially available and technically viable, but charging infrastructure is lacking.¹¹

Top handlers, or top picks, are off-road vehicles that move, lift, and stack cargo containers.¹² Around 420 top handlers are currently used at the Ports of Los Angeles and Long Beach, 99 percent of which are powered by diesel internal-combustion engine technology.¹³ In 2020, the world's first zero-emission top handlers were unveiled as part of



YARD TRUCK



TOP HANDLER



RTG CRANE



FORK LIFT

a pre-commercial demonstration project at the Port of Los Angeles, and these units are still being used as demonstration equipment while improvements to range and duty requirements are being undertaken. Development of fuel cell and hydrogen models is also underway. As of 2021, zero-emission top handlers were being demonstrated at the Ports, and major manufacturers had plans to produce battery-electric top handlers prior to 2024.¹⁴

Rubber-tired gantry cranes are also used to lift and move cargo containers.¹⁵ Of the 174 rubber-tired gantry cranes in operation at the San Pedro Bay Ports, 94 percent are powered by diesel internal combustion engine technology.¹⁶ However, about 23 percent of them have advanced internal combustion or hybrid technology, achieving reduced emissions and improved efficiency.¹⁷ As of 2021, a total of 9 conventional rubber-tired gantry cranes at the Ports were converted to zero-emission electric models.¹⁸ Grid-electric rubber-tired gantry cranes, commonly known as rail-mounted gantry cranes, are “fully commercial products” and have been in use in port operations for decades.¹⁹ Additionally, the Port of Long Beach’s Long Beach Container Terminal has replaced all of its rubber-tired gantry cranes with 69 electrified stacking cranes and uses electrified transport vehicles to transfer containers between the ships and stacking cranes. This deployment illustrates that in addition to replacing conventional equipment with zero-emission models, utilizing other types of zero-emission equipment in place of existing equipment can achieve zero-emission goals.

Forklifts are diverse in their size and cargo handling capabilities and are used to hoist and move cargo containers and materials at marine terminals by inserting steel forks beneath the load.²⁰ Forklifts are generally powered by internal combustion engines, although they can run on electric motors.²¹ There are approximately 90 models²² of zero-emission forklifts with a rated capacity of over 12,000 pounds. According to the San Pedro Bay Ports’ 2018 Feasibility Assessment for Cargo-Handling Equipment, “small-capacity forklifts with [zero-emission] platforms (primarily battery electric) have been commercially available and technically viable for many years.²³ In addition, the Ports concluded in their Clean Air Action Plan 2021 Feasibility Assessment for Cargo-Handling Equipment that “multiple [original equipment manufacturers] have made significant recent progress to develop and demonstrate [zero-emission] large-capacity forklifts as additions to their commercial product lineups.”²⁴

I. OVERVIEW

Los Angeles has notoriously poor air quality and consistently fails to meet federal air quality goals.²⁵ Goods movement through the Ports of Los Angeles and Long Beach is a significant contributor to this pollution. The Ports are responsible for substantial emissions of criteria pollutants and greenhouse gases,²⁶ representing the “largest fixed source of smog-forming emissions in the basin.”²⁷ Those emissions produce a plethora of negative health and environmental impacts. At the same time, the Ports are also an economic driver, providing significant employment opportunities and playing a key role in California’s economy, which is the fourth largest in the world.²⁸

Transitioning operations at the Ports to zero-emission cargo handling equipment and more sustainable systems while creating healthy, stable job opportunities could improve the environment, local communities, workers’ prospects, and the overall economy. And as the busiest port complex in the country, the Ports of LA and Long Beach have a critical role to play in demonstrating and creating demand for zero emission technologies that can be adopted by ports across the country.²⁹

Greenhouse gas emissions from the Ports come from three main sources: ships, heavy-duty vehicles, and cargo handling equipment. As the third-largest source of maritime industry-related greenhouse gas emissions, cargo handling equipment accounts for approximately 14 percent of emissions from the Ports.³⁰ Most cargo handling equipment runs on diesel, a particularly harmful pollutant that impacts communities near the Ports, which are predominately low-income communities of color. Cargo handling equipment includes a variety of motorized equipment types that are used to load, unload, and transport cargo, and perform routine maintenance at industrial ports.³¹ The term can refer to many different types of equipment depending on the type of cargo handled at a particular port but most commonly includes yard tractors, container handlers, forklifts, and several varieties of cranes.³² The exact makeup of cargo handling equipment at any given port can vary widely depending on what type of cargo is handled there.³³ The majority of the Ports’ 3,493 individual pieces of cargo handling equipment are concentrated among four categories: yard tractors, top handlers, rubber-tired gantry cranes, and large capacity forklifts.³⁴ Of all the equipment, the heaviest emitters are generally powered by diesel-fueled internal combustion engines,³⁵ as well as gasoline, propane, and liquefied natural gas.³⁶

In theory, cargo handling equipment is the “low hanging fruit” of port emissions. Unlike ships, trucks, and heavy-duty vehicles that travel long distances, this equipment operates within port terminals, making it easier to power with electricity and to charge batteries. Additionally, the California Air Resources Board expects electric cargo handling equipment technologies “to transfer and accelerate the deployment of zero-emission operations in other freight and heavy-duty applications,”³⁷ which could catalyze significant emission reductions from other sources at ports, as well as from heavy duty equipment in other sectors, such as transportation and warehousing. For these reasons, transitioning to zero-emission cargo handling equipment is an important step to decarbonizing port operations and protecting communities and is likely easier than transitioning ships and heavy-duty vehicles to zero-emission options.

EXISTING REGULATORY LANDSCAPE

Given these dynamics, several ongoing efforts are now aimed at transitioning cargo handling equipment to zero-emission models. First, the Ports’ Clean Air Action Plan includes a goal to transition all equipment to zero-emission by 2030.³⁸ The Clean Air Action Plan was intended to serve as a comprehensive air quality plan for both Ports, including specific information on ships, trucks, trains, cargo handling equipment, harbor craft, and energy.³⁹ Its goals are not legally enforceable but have nonetheless helped to drive improvements in port operations. Since the adoption of the original Clean Air Action Plan in 2006, diesel particulate matter emissions from mobile sources in and around the Ports have decreased by 87 percent as a result of efforts by the Ports and terminal operators. These efforts have included the investment of almost \$2 billion in new equipment, such as cleaner trucks and cargo handling equipment, and strategies including powering ships using onshore electricity when docked.⁴⁰

Yet greenhouse gas emissions at the Ports have been steadily rising for decades. At the Port of Long Beach, greenhouse gas emissions have increased 22 percent since 2005.⁴¹ Greenhouse gas emissions from the Port of Los Angeles have increased 23 percent since 2005 and 57 percent from 1990 levels.⁴² And in recent years, localized emissions have also increased as record cargo volumes inundated the Ports, causing an uptick in cargo handling equipment, truck, ship, and harbor craft activity, as well as unprecedented congestion. In 2021, the Port of LA’s nitrogen oxides (NOx) and diesel particulate matter (DPM) emissions were higher than at any time in the past 10 years.⁴³ At the Port of Long Beach in 2021, increases include particulate matter (PM₁₀) by 55 percent, NOx by 35 percent, sulfur oxides (Sox) by 38 percent and greenhouse gas emissions by 39 percent compared to 2020.⁴⁴

AIR POLLUTION FROM THE PORTS

In addition to tracking greenhouse gas emissions from the Ports, the Ports and air regulators monitor emissions of several common air pollutants.

Nitrogen Oxides or “NOx” are highly reactive, poisonous gases that are created when fuel is burned at high temperatures.⁴⁵

Diesel Particulate Matter or “DPM” is “very small carbon particles, or “soot” coated with numerous organic compounds.” DPM contains cancer-causing particles and is considered a toxic air contaminant.⁴⁶

Particle Matter 10 or “PM₁₀” refers to inhalable particles, measuring 10 micrometers or fewer in diameter. PM₁₀ can contribute to and exacerbate lung and heart illnesses.⁴⁷

Sulfur Oxides or “SOx” refers to gaseous sulfur oxide compounds, including SO₂ and SO₃. SOx can exacerbate asthma and impact the human respiratory system and decrease plant growth.⁴⁸

A 2017 joint Executive Directive of the Mayors of Los Angeles and Long Beach directed the Ports to develop a Clean Air Action Plan that would achieve 100 percent zero emission cargo handling equipment by 2030.⁴⁹ This joint directive and the subsequent 2017 Clean Air Action Plan Update followed decades of community advocacy and frontline residents' growing demands for equitable access to clean air, water, and soil regardless of zip code. The 2017 Clean Air Action Plan's emission reduction targets included goals to decrease port-related emissions by 59 percent for NOx, 93 percent for SOx, and 77 percent for DPM by 2023; and decrease greenhouse gasses from port-related sources to 40 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050.⁵⁰ As discussed above, the Ports were not on track as of October 2023 to reach these greenhouse gas reduction goals, and in fact emissions have continued to rise. Reducing emissions from cargo handling equipment will be a significant part of achieving the goals outlined in the 2017 Clean Air Action Plan Update.

While the Ports are already home to one of the cleanest cargo-handling fleets in the country, substantial room remains for increased adoption of zero-emission technologies.⁵¹ To make progress on the goals set forth in the Clean Air Action Plan, the Ports of Long Beach and Los Angeles, as well as many terminal operators, have undertaken infrastructure master planning to prepare the Port facilities for zero-emission equipment. Additionally, the Ports have secured significant grant funding for zero-emission demonstration, pilot, and infrastructure projects. In 2021, the Ports conducted a comprehensive feasibility study to determine the opportunities for

deploying zero emission and near-zero equipment at the Ports.⁵² The feasibility study assessed several technologies that demonstrated “the most promising platforms for near-term incorporation into heavy-duty [cargo handling equipment],”⁵³ while acknowledging that the most important factor in reaching the Clean Air Action Plan's ambitious emissions reductions goals for cargo handling equipment will be statewide regulatory amendments from the California Air Resources Board.⁵⁴

In 2020, Governor Newsom issued an executive order that would transition the state to 100 percent zero-emission cargo handling equipment by 2035.⁵⁵ The California Air Resources Board has regulated mobile cargo handling equipment since 2005,⁵⁶ and following the Governor's order had been expected to adopt a new regulation amending the existing rules. Publicly released California Air Resources Board documents suggested that the regulation would include “an implementation schedule for new equipment and facility infrastructure requirements,” and “consider opportunities to prioritize the earliest implementation in or adjacent to the communities most impacted by air pollution.” The California Air Resources Board also noted that it would consider return on investment, zero emission potential, planning and funding for infrastructure, labor, and automation issues when drafting the proposed regulation.⁵⁷ However, the board has now delayed that rulemaking, instead prioritizing a rulemaking related to ocean-going vessels.⁵⁸ According to the agency's website, board staff are currently assessing “the availability and performance of zero-emission technology as an alternative to all combustion-powered cargo

equipment” and evaluating “additional solutions that may include efficiency improvements.”⁵⁹

Meanwhile, the South Coast Air Quality Management District (“SCAQMD”), Southern California’s regional regulator of stationary sources, is developing an indirect source rule for ports that may include provisions to electrify the equipment. Proposed Rule 2304 would create a facility-based mobile source measure for commercial marine ports.⁶⁰ District staff have developed a preliminary rulemaking concept, and SCAQMD leaders are currently soliciting feedback from stakeholders, including community members. The preliminary concept includes creating enforceable and quantifiable emission reduction standards to ensure compliance with federal and state air quality regulations but does not include emission reduction targets or implementation deadlines. The concept also prioritizes diesel particulate matter reductions, which are particularly dangerous to public health, and increasing zero emission implementation. The draft rule concept’s key elements include: 1) a cap on each Port’s NOx emissions, 2) a cap on each terminal’s emissions, 3) mandatory reporting requirements, and 4) additional charging and fueling infrastructure.⁶¹ While the district designed this rule to produce meaningful environmental and public health benefits, it has generated significant controversy. Adoption is not guaranteed, and if adopted, implementation will take time.

KEY CONSIDERATIONS IN THE TRANSITION TO ZERO-EMISSION CARGO HANDLING EQUIPMENT

A significant amount of work is needed to transition to 100 percent zero-emission cargo handling equipment by 2030. While some zero-emission technology is still evolving and is not commercially available, there are commercially available and viable electric options for some equipment types. Providing resources and support to help stakeholders deploy viable zero-emission options more quickly could move Port operations closer to the zero-emission transition, even if stakeholders are not able to fully transition their fleets yet.

For the Ports to transition to zero-emission cargo handling equipment, it will be important for the Ports and utilities, along with the terminal operators, to invest in and install the necessary infrastructure including substations, transformers, and conduits in the ground. A substantial amount of infrastructure needs to be installed to power equipment and increase grid reliability. Questions remain regarding who will pay for the deployment of the needed zero-emission infrastructure; for example, terminal operators could pay for on-site chargers and hookups, while the Ports and utilities could pay for retrofits on the Port properties as a whole.

Additional improvements to zero-emission cargo handling equipment technology will also be needed, even as equipment efficiency continues to improve with each subsequent generation. Because cargo handling equipment at the Ports operates on a heavy-duty cycle, meaning the equipment runs for long periods of time at an energy-intensive level, one-to-one replacements for some types of existing fossil fuel-powered equipment are not yet feasible. Many types of zero-emission cargo handling equipment models need to be charged or have

their batteries changed more frequently than fossil-fuel powered models need to be refueled. Improving battery capacity and performance requirements to align with duty cycles will be necessary for efficient terminal operation, but terminal operations will also likely need to shift to accommodate operating with cleaner technologies. However, once deployed, battery-powered vehicles should create more efficiencies and require less maintenance than traditional diesel.

Finally, the transition to zero-emission cargo handling equipment is likely to impact port workers and nearby communities unless proper commitments and investments are made for upskilling and reskilling. Some zero-emission equipment demonstrations at the Ports have utilized automated technology, eliminating the need for an equipment operator. Community members and labor representatives have accordingly raised concerns about job losses in these sectors. However, the transition to zero-emission equipment can also lead to the creation of new, higher-skill, higher-paying jobs, including for equipment mechanics and technicians. Some terminals have made significant investments in job training to enable and grow the workforce. As a result, preserving employment opportunities at the Ports is a critical part of the political solution. A transition to zero emissions does not necessitate automation, and adoption of zero-emission technology could be paired with strategies to minimize impacts on port workers.

To achieve the Ports' goal of transitioning to 100 percent zero-emission cargo handling equipment by 2030, state and local leaders will need to overcome barriers related to costs, technology, and infrastructure, as well as develop protections for frontline communities. More stringent regulations and enforceable deadlines; additional, accessible funding for zero-emission technology and infrastructure; concrete and implementable plans to purchase, deploy, and install the equipment and charging infrastructure; protections for communities; and the expansion of job training programs can all help overcome barriers to transitioning this equipment and make the state and port goals a reality.



II. VISION FOR ACCELERATING THE TRANSITION TO ZERO-EMISSION CARGO HANDLING EQUIPMENT

Participants at the April 2023 convening outlined a vision for achieving the transition to 100 percent zero-emission cargo handling equipment at the Ports by 2030, in line with the Ports' existing goal articulated in the Clean Air Action Plan.

Key components of this transition will include:

- **Thriving and cost-competitive port operations that continue to boost the local economy.** The Ports represent a major economic center for the L.A. region and the state as a whole and serve as an important player and model in the national and international goods movement industry. Maintaining the productivity and profitability of the Ports, while reducing environmental and public health impacts, will be essential for bringing benefits to the region and demonstrating the viability of more sustainable goods movement activities for the rest of the country and the world.
- **Continued technological innovation.** Some of the available zero-emission cargo handling equipment models do not currently serve as one-to-one replacements for conventional fossil fuel-powered versions. Ongoing improvements to the battery and equipment technology and duty cycles will be needed to align technological feasibility with operational needs.
- **More grid and charging infrastructure.** Current infrastructure at the Ports is inadequate to support 100 percent zero-emission cargo handling equipment. Large-scale installation of charging and refueling infrastructure capable of supporting a mix of technologies will be required. Such infrastructure includes increased grid capacity; substations, electrical circuits, transformers, conduits, and hookups; and charging stations, charging ports, and connectors. Additionally, port leaders will need to address resiliency and grid capacity to make

sure the Ports do not become more vulnerable to power outages as they electrify, which would otherwise discourage business.

- **Worker protections.** Transitioning to zero-emission cargo handling equipment may result in some automation, which eliminates port jobs. While some port workers may be able to be retrained to adapt to new technologies and systems, participants described a goal of preserving existing port jobs. Conditions on funding for non-human powered cargo handling equipment, along with efforts to preserve job security and boost job training programs to help workers learn to operate and maintain new technology will be critical for many important stakeholders.
- **Public health and economic benefits for local communities.** Ports-adjacent communities have long borne the environmental and health burden of goods movement that benefits others across California and the nation. Policy makers could take those negative externalities into account when considering costs associated with the transition to zero-emission cargo handling equipment. Federal, state, and local government officials and agency staff, as well as the Ports of Los Angeles and Long Beach, could be attentive to strategies that keep the Ports cost-competitive while achieving improved health outcomes through decreased port emissions. Forty percent of the goods that are delivered to American businesses and consumers pass through the Ports of Los Angeles and Long Beach. The health burdens associated with this goods movement, including respiratory illnesses, cancer, and premature death, impose significant costs that are borne exclusively by port-adjacent communities in Long Beach, Wilmington, Carson, and San Pedro. Transitioning to zero-emission cargo handling equipment will reduce those burdens, and policymakers could explore strategies to more fairly allocate harm-reduction costs among the many Americans who benefit from the Ports' operations.

The result of this vision would be a fully zero-emission fleet of cargo handling equipment that supports robust and efficient port operations and local labor, while reducing the health and environmental burdens on local environmental justice communities.



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III. BARRIERS AND PRIORITY POLICY SOLUTIONS

Convening participants identified numerous barriers to achieving their vision for accelerating the transition to zero-emission cargo handling equipment at the Ports. The group then discussed potential policy, workforce, and financial solutions to address challenges impacting infrastructure deployment, technological innovation, and transition-related effects on workers and local communities.

Participants described how meeting existing and planned goals by transitioning to 100 percent zero-emission cargo handling equipment will be a difficult undertaking. In part, this difficulty is due to the relatively high upfront cost and uncertainty about the long-term performance of the equipment, as well as the infrastructure necessary for the transition. Moreover, many societal costs associated with traditional goods movement practices (and benefits associated with goods movement electrification) are not accounted for in traditional cost calculations, which can skew cost-benefit analyses in ways that suggest sustainability efforts are prohibitively expensive. The health costs to communities living near the Ports and the environmental costs of port operations have been externalized and passed onto community members, taxpayers, and state and local governments. Internalizing and fairly attributing the externalities associated with goods movement could help shift economic decisions to prioritize investments that are socially, environmentally, and economically sustainable.

Barriers identified by participants centered on three themes:

- Grid and charging infrastructure to support zero-emission cargo handling equipment is currently lacking, and substantial planning and funding are needed to install necessary infrastructure in time to meet ambitious transition goals.
- Zero-emission technology for some types of cargo handling equipment is still evolving upfront costs are high.
- Communities and workers fear job loss and increased emissions from expanded port activities.

This section describes those barriers and details the top-priority policy solutions participants identified to overcome them, although not all participants agreed with all solutions identified.

BARRIER #1: INADEQUATE GRID AND CHARGING INFRASTRUCTURE TO SUPPORT ZERO-EMISSION CARGO HANDLING EQUIPMENT AND LACK OF SUBSTANTIAL PLANNING AND FUNDING TO INSTALL NECESSARY AND TIMELY INFRASTRUCTURE IN TIME TO MEET AMBITIOUS TRANSITION GOALS.

Many terminals and port facilities lack charging and refueling infrastructure and will need to be retrofitted or redeveloped to accommodate and power zero-emission equipment. Such charging and refueling infrastructure include, for example, substations, electrical circuits, transformers, conduits, hookups and charging stations, charging ports, and connectors. Grid capacity also needs to be increased at several terminals to run equipment and charge batteries. Terminal operators need to be able to charge or refuel the equipment on-site because much of the equipment is too large to routinely transport to off-site charging stations. Some terminal operators may need to acquire additional land to accommodate charging infrastructure, although vacant land at and near the Ports is limited. Renovations, retrofits, and infrastructure installations are also expensive and will temporarily disrupt terminal operations, which may impact annual productivity and profits.

Additionally, the Ports need to ensure resilience and reliable power supplies, both now and as power demands increase. Terminal operators have reported significant reliability and power quality issues, which impact the ability to operate and charge electric equipment. Disruptions in terminal operations can be costly and problematic for consumers. If the Ports become more vulnerable to power outages as they electrify, the gateway will appear unreliable. Outages could cause cargo to shift to ports outside of California, many with less ambitious greenhouse gas policies, which could lead to both negative economic consequences for Californians and increased greenhouse gas emissions.

Industry leaders have also identified a timing/sequencing problem. Generally, in order to get electricity and charging infrastructure deployed, customers (in this case, the terminal operators) need to request service from the utility. The Port of Los Angeles is served by Los Angeles Department of Water and Power, while Southern California Edison serves the Port of Long Beach. If a customer has not finalized its zero-emission transition plan, they may not be able to request service to support it. But without the electricity and charging infrastructure already deployed, they may not view purchasing the equipment to be a sound investment. Currently, utility companies are working with the Ports to make proactive infrastructure improvements, including through the Ports' ongoing infrastructure master planning efforts. However, the utilities have long project queues and priority project, such as projects that address safety concerns, and new projects are added to the bottom of the list, which can contribute to delays.

Solution: The Ports and utilities, chiefly Southern California Edison and Los Angeles Department of Water and Power, could proactively deploy “no regret” infrastructure, including increased grid capacity and upgraded distribution networks, that will be needed regardless of how zero-emission cargo handling equipment is powered.

While stakeholders are still assessing how much zero-emission infrastructure they will need to power and charge all zero-emission equipment, new infrastructure that is necessary to meet anticipated baseline electricity needs and prepare for the zero-emission transition should be installed in the near-term, so that power and charging infrastructure will be plug-in ready. Thus, the Ports and utilities, chiefly Southern California Edison and Los Angeles Department of Water and Power, could deploy “no regret” infrastructure investments, such as electrical circuits and conduits, to prepare areas for zero-emission charging stations, charging ports, and connectors.

The utilities are developing plans to expand zero-emission infrastructure and service within their service areas, and they will need to install public electrical infrastructure and additional connections to the Ports. The utilities can undertake some of this work on their own, but for projects that take place at the Ports, the Ports or their tenants will need to request utility work. Ideally, efforts to transition to zero-emission power sources at the Ports will be completed by the Ports, in collaboration with the utilities (chiefly the Los Angeles Department of Water and Power and Southern California Edison) and the terminal operators. As the property owners and master planners for port facilities, the Ports have the ability to install infrastructure, make capital improvements, and estimate energy demands. Terminal operators, as lessees, will need to provide information regarding their energy and infrastructure needs and help with the funding and installation of infrastructure. Additionally, the Ports will need to do much of this work holistically, considering of the needs of other port tenants, including shipping and trucking companies, which in turn requires strategic planning by entities with larger purviews and technical expertise. Terminal operators can play an important role in providing feedback and insights into how equipment needs to function, while focusing their investments on zero-emission cargo handling equipment itself.

The utility companies are particularly well-suited to undertake large-scale infrastructure efforts. At the distribution system level, electric utilities generally manage resilience within local systems. The Los Angeles Department of Water and Power

WHAT DOES INSTALLING CHARGING INFRASTRUCTURE ENTAIL?

The time and complexity of charging infrastructure installations varies based on the size of the facility and the electricity needs, among other factors. The following timeline reflects the charging infrastructure installation process for a small deployment. The terminals’ power needs are growing from a few megawatts to thirty to sixty megawatts in a fully electrified future. From a utility perspective, this could mean a customer-dedicated substation just to support the transition of a single terminal.

It can take 2 to 7 years to deploy charging infrastructure once site hosts request it, depending on the complexity of the deployment. For projects under 10 megawatts, the timeline could be up to 2 to 3 years if sites require system upgrades. Any project over 10 megawatts (the rough capacity of a single circuit) requires a study, which helps to determine customer dedicated assets. Without any time delays, a full substation build-out would take 3 to 5 years. But unknowns like licensing proceedings at the California Public Utilities Commission and California Environmental Quality Act review could add to that timeline.

oversees distribution infrastructure at the Port of Los Angeles⁶² while Southern California Edison oversees distribution infrastructure at the Port of Long Beach.⁶³ While both of these utilities intend to continue building infrastructure to foster resilience as charging infrastructure expands, this deployment may require significant lead time, based on existing queues for infrastructure development, rate base considerations, and—in the case of Southern California Edison—California Public Utilities Commission approval. Through their ongoing development of planning scenarios for the Ports, the utilities are potentially well-positioned to identify infrastructure that will be necessary regardless of the composition of the future mix of zero-emission cargo handling equipment technologies. Utility planning processes could bring stakeholders together for early engagement and master planning to determine the implications of deploying this equipment. Several participants suggested that the Ports could submit their zero-emission master plans by 2024 or 2025 in order for utilities to know what will be needed.

Solution: Utilities, the Ports, and local government entities, including the Los Angeles Department of Building and Safety and the Ports’ harbor engineers, could evaluate permitting processes for charging infrastructure installations at the Ports to reduce inefficiencies and delays and streamline approvals.

Deployment of charging and refueling infrastructure will vary in terms of cost, installation time, permitting requirements, and complexity, particularly as installation complexity increases. Developers may require terminal retrofit and renovation projects to create space for charging and refueling infrastructure, as well as upgrades to electrical panels and the grid, which can further complicate infrastructure installations. Additionally, the utilities and regulators involved in these projects have large project pipelines and working through these queues can add time to installation processes.

While each project can come with its own set of challenges, a common source of delay at the Port of Los Angeles is the interface between the design and engineering teams that are reviewing infrastructure project permits. For example, the Port and terminal operators have to submit construction plans and specifications to both the Los Angeles Department of Building and Safety and the Port’s Development Bureau at multiple points in the process, which can extend project timelines. Small design changes can take months or require re-reviews. Additionally, while participants shared that Los Angeles Department of Water and Power staff are willing to support zero-emission projects, they have a long project pipeline, with numerous priority safety projects. The Department is not able to move zero-emission projects to the top, even when grant deadlines require installations to occur in a specific timeframe.

To address these issues, the Los Angeles Department of Building and Safety and the Port’s Development Bureau could work with stakeholders, including the Port and terminal operators, to identify the major points of delay. Then in consultation with these stakeholders and community members, the permitting agencies could develop a plan to expedite the permitting process. Additional staff or resources may be needed to reduce review periods, but

agency leaders could also consider other measures that increase efficiency, such as fewer reviews or simultaneous reviews.

Utilities, including the Los Angeles Department of Water and Power, could create a dedicated team to handle zero-emission infrastructure for heavy-duty and large-scale public infrastructure projects. Utilities have priority projects related to safety and grid maintenance that cannot be delayed, but electrification projects are also important and can be time-sensitive, especially when entities risk having to return grant funding if they cannot complete a project in a set timeframe. These two categories of utility work should not have to compete. Rather, utilities could dedicate teams to manage zero-emission projects. These teams would require funding to promote, hire, and/or train employees.

BARRIER #2: EVOLVING ZERO-EMISSION TECHNOLOGY FOR SOME TYPES OF CARGO HANDLING EQUIPMENT AND HIGH UPFRONT COSTS

The high upfront costs of zero-emission cargo handling equipment, which, according to convening participants, can be four to six times more expensive than fossil fuel-powered equipment, can be a substantial barrier for terminal operators. Port operators also have to consider taking a loss on stranded assets when they have invested in diesel-powered equipment with a useful life extending beyond 2030. These costs can be daunting, notwithstanding the potential longer-term cost savings that can come from fuel and maintenance savings from the transition to zero-emission equipment.

The performance of some new types of cargo handling equipment is another barrier. Many zero-emission cargo handling equipment models are still in demonstration phases; some do not yet meet performance requirements, and stakeholders do not know when the equipment will be commercially available. Port operations are considered a “heavy duty application,” meaning the demands on the equipment are often higher than in other settings such as warehouses. Zero-emission cargo handling equipment is not always a one-to-one replacement for fossil-fuel powered models, meaning there is potential for varied performance, lost productivity, and/or potential downtime to charge batteries and equipment. On the other hand, diesel, propane, and gasoline powered-equipment also experiences servicing downtime, lessening the difference between fossil fuel and zero-emission models’ downtime requirements. Battery technologies are also evolving and may change the longer-term cost benefit analysis.

Additionally, the limited number of domestic zero-emission cargo handling equipment manufacturers makes it difficult to procure new models. Under the federal Build America Buy America Act, federal funding can only be granted to infrastructure projects that use “iron, steel, manufactured products, and construction materials” produced in the United States.⁶⁴ In order to utilize federal and state funding programs to subsidize the costs of zero-emission cargo handling equipment, purchasers face limitations on which manufacturers they can buy from, reducing purchasing options and potentially creating supply

shortages relative to demand. In addition to manufacturing a greater volume of equipment, international companies are also making different equipment types and models that could be beneficial in the U.S., yet port operators cannot purchase them if they need to use government subsidies to offset costs.

Solution: The California Legislature; the Air Resources Board; and/or the South Coast Air Quality Management District, using their existing authority grounded in air pollution control, could create technology-forcing mandates and clear, enforceable implementation deadlines, with penalties for non-compliance, to catalyze the zero-emission cargo handling equipment transition. Where technology is not readily commercially available, regulations could incorporate adequate flexibility and sufficient lead time for entities to meet the mandate.

While transitioning all cargo handling equipment to zero-emission models by 2030 is a goal in the Ports' Clean Air Action Plan, many participants questioned the viability of this deadline, given the uncertainty of the timing of technology development and infrastructure availability. Clear requirements, deadlines, and penalties for non-compliance could remove ambiguity and catalyze action. Without clear requirements, equipment manufacturers, the Ports, terminal operators, and other leaders in this space cannot properly plan for implementation. Otherwise, the Ports will require quick work to make meaningful progress toward the 2030 deadline. More stringent, technology-forcing requirements and penalties for non-compliance could ensure action by all the stakeholders. Policy makers have long utilized technology-forcing regulations to catalyze innovation and adoption of new technologies. Where technology is not readily commercially available, regulators could incorporate adequate flexibility and sufficient lead time for entities to meet the mandate. And increased funding for research and development, along with other incentives, could help industry meet these goals.

Stronger regulatory actions by the California Air Resources Board and the South Coast Air Quality Management District may be on the horizon, although legislators may need to prompt California Air Resources Board rulemaking to amend existing cargo handling equipment regulations. At the regional level, the South Coast Air Quality Management District may adopt an indirect source rule for Ports aligned with achieving 100 percent zero-emission cargo handling equipment by 2030. District leaders are considering this action as part of the draft rule concept for Proposed Rule 2304, a facility-based mobile source measure for commercial marine ports. However, these efforts are in the early phases; District staff are still gathering data and stakeholder feedback and have not released draft regulatory language.

The Ports could also change their policies and operating procedures to accelerate the transition. For example, terminal operators typically lease land from the Ports. Going forward, the Ports could include lease provisions requiring procurement of only zero-emission cargo handling equipment or that terminal operators complete their infrastructure master plans for the transition in order to renew their leases. The Ports can also update their Port Master Plans to require alignment with 100 percent zero-emission cargo handling equipment by 2030 and plan for infrastructure installment. These kinds of

Port policies will be most successful when paired with some of the other strategies discussed above, such as technology-forcing sales mandates, infrastructure installation requirements, and funding to support the development and purchase of zero-emission equipment.

Solution: The federal government, led by the U.S. Maritime Administration and the U.S. Environmental Protection Agency, could create a national strategic goods movement plan to facilitate the transition to zero-emission cargo handling equipment at ports across the United States. By developing national standards and guidelines for sustainable port operations, such a strategy could help alleviate burdens for early-adopters and port communities.

U.S. goods movement impacts local air quality in port cities across the country and U.S. greenhouse gas emissions, creating national environmental concerns. Because they are subject to California's stringent environmental regulations, the Ports are leaders among U.S. ports in greening port operations. But additional zero-emission equipment implementation costs unique to the Ports may put them at a competitive disadvantage to other U.S. ports, even though taxpayers and consumers nationwide benefit from the Ports' operations and efforts to decarbonize. And higher costs at the Ports could cause leakage, which can occur when a pollution source moves from a jurisdiction with strong environmental regulations to a jurisdiction with lower standards.

A strategic goods movement plan at the federal level could help all U.S. ports transition to zero-emission equipment and create an even playing field for ports. Approaching these issues federally could help address the current geographical imbalance between the costs (both economic and public health) and benefits associated with goods movement and could impose a more uniform regulatory approach to the transition to zero-emission equipment. A national strategic plan for goods movement would include both regulations for phasing out fossil fuel-powered equipment and incentives and subsidies for zero-emission alternatives, helping domestic goods movement become more sustainable as a whole.

At the federal level, eighteen departments and agencies manage port operations, covering safety and national security, commerce, and environmental protection.⁶⁵ The U.S. Department of Transportation's Maritime Administration and the U.S. Environmental Protection Agency could be well-suited to serve as lead agencies for a national strategic goods movement plan that focuses on secure and sustainable goods movement. The Maritime Administration governs the maritime transportation system, focusing on the technical components of the infrastructure system, while meeting economic and national security needs.⁶⁶ The U.S. Environmental Protection Agency creates and enforces federal environmental regulations, including the National Ambient Air Quality Standards and provides resources to support sustainable port operations.⁶⁷ Both entities also administer grant programs to award funding for port infrastructure and zero-emission equipment.

In addition to a voluntary goods movement plan, the Environmental Protection Agency could promulgate a regulation requiring the deployment of

zero-emission cargo handling equipment. This regulation could be particularly helpful in light of the California Air Resources Board's postponement of its zero-emission cargo handling equipment rulemaking. It would also provide the added benefit of creating a level playing field for all U.S. ports by setting a uniform cargo handling equipment standard.

Solution: Federal, state, and local governments, including the U.S. Department of Transportation, U.S. Environmental Protection Agency, California Energy Commission, California Air Resources Board, and South Coast Air Quality Management District, could provide additional and more accessible grant funding, incentives, and financial support to ease the transition to zero-emission cargo handling equipment technology and supplement industry investments. In particular, they could increase funding for research and development to improve the performance of zero-emission technologies.

Grant funding, subsidies, and rebates serve as incentives that can ease the financial burdens Ports and terminal operators can experience when transitioning to zero-emission alternatives. While significant public funding is currently available for zero-emission port operations, competition for funds will likely lead to funding gaps. Additional financial incentives and subsidies for both technological development and equipment purchases would be beneficial, particularly in the short-term.

First, because there remains a need for more zero-emission equipment types and models that meet port performance requirements, funding for research and development efforts would help accelerate the pace of technological development and innovation. Several programs exist or will begin accepting funding applications next year, so manufacturers should take advantage of these opportunities. For example, the Ports of Los Angeles and Long Beach administer a Technical Advancement Program, which provides funding for zero-emission cargo handling equipment development and demonstrations, among other types of clean air technologies for other port equipment.⁶⁸ In the next year, an unprecedented volume of federal funding will become available for ports to meet climate goals, with large amounts of funding coming from the Inflation Reduction Act and the Bipartisan Infrastructure Law, including \$17 billion for port infrastructure efficiency improvements and environmental mitigation.⁶⁹ The Environmental Protection Agency's new Clean Ports Program, which will be funded by a \$3 billion Inflation Reduction Act allocation, will launch in 2024 and provide funding for zero-emission port equipment and technology.⁷⁰ Funding program details are still being finalized, and these programs are expected to cover both research and development and procurement. Still, additional research and development funding will be needed, and existing funding streams are time-limited, requiring state and federal government officials to give thought to the provision of ongoing funding support through the transition period.

Second, policy makers earmarked electric vehicle procurement incentive and subsidy programs exclusively for transitioning to zero-emission equipment and reducing the climate impacts of goods movement, which can serve as models for developing more robust incentives and subsidies. These types of

procurement funding programs can help with the acquisition of commercially available zero-emission technology, while reducing vehicle replacement costs. For example, federal, state, and local regulators could offer or expand tax credits and rebates for entities that purchase zero-emission cargo handling equipment. Several government programs provide rebates and subsidies for the retirement of passenger diesel vehicles and the purchase of passenger electric vehicles. The federal Car Allowance Rebate System (“Cash-for-Clunkers”) and California’s Consumer Assistance Program offer rebates up to \$1,500 to consumers who scrap old vehicles that fail smog tests.⁷¹ California also administers a scrap-and-replace program, Clean Cars 4 All (CC4A), which offers low-income households financial incentives to scrap and replace their vehicle with a cleaner alternative.⁷² Incentive amounts vary depending on the participant’s household income and type of replacement vehicle, and some local air districts provide additional incentive funding, up to \$9,500.⁷³ Using these programs as models, the federal and state governments could develop a trade-in program for fossil fuel equipment to help terminal operators transition to zero-emission models. In the cargo handling equipment context, because fossil fuel-powered cargo handling equipment may not be at the end of its usable life at the time of transition, scrapping programs could seek to reimburse owners for the cost of that piece of equipment in the open marketplace.

In addition to insufficient funding, some convening participants felt requirements associated with current funding opportunities can be burdensome. Creating more flexible requirements or exceptions that reflect the significant role California ports play in national and international goods movement could make California more competitive. Other factors that policy makers could consider are health and environmental conditions near the Ports and the Ports’ role in national and international goods movement.

Federal funding, as required under the Build America Buy America Act, also typically requires the submission of multiple bids and the purchase of American-made products. But because only one American-made company exists that makes zero-emission cargo handling equipment, purchasers may not currently be able to solicit multiple bids. The federal government could amend these requirements to require fewer bids or allow bids from foreign companies to help increase access to funding for the technology, which otherwise cannot be funded under these criteria. Reducing barriers to accessing the funding could help existing dollars be used more effectively, while increasing efficiency and emissions reductions.

BARRIER #3: FEAR AMONG COMMUNITIES AND WORKERS OF JOB LOSS AND OF INCREASED EMISSIONS FROM EXPANDED PORT ACTIVITIES.

While the transition to zero-emission cargo handling equipment should improve health and environmental conditions for nearby workers and communities, this transition, and other port decarbonization efforts, could negatively impact them in the absence of sufficient safeguards. Participants shared concerns

about job loss, job changes, and shifting pollution burdens as a result of increased cargo movement or an expansion of goods movement infrastructure.

In some cases, the transition to zero-emission cargo handling equipment has been accompanied by automation. Notably, automation is neither necessary for the transition to zero-emission cargo handling equipment (most such equipment can be manually operated) nor limited to that transition (some operators have automated fossil-fuel powered equipment in order to cut labor costs). But any major investment in new equipment and infrastructure may invite automation.

Solution: State and local government could implement policies to promote job preservation, local job creation, and worker training, such as programs that encourage Ports and terminal operators to partner with local training organizations to upskill and reskill the workforce to use the new vehicles and technologies.

A number of stakeholders pressed for protecting existing jobs and providing additional upskilling and training programs to help workers find new opportunities to work with zero-emission technology. Examples of such policies include labor protection bid requirements currently included in some federal and state bidding and procurement processes. Additionally, one of the main reasons terminal operators choose to automate is to reduce operational costs; thus, the solutions discussed above aimed at making zero-emission equipment more affordable also could promote job retention and growth.

Participants shared the importance of preserving Port jobs, which are often high-quality jobs that community members rely on to support themselves and their families. The Ports currently provide training programs for workers, and earlier this year, the state awarded the Ports \$110 million to build a permanent workforce training center that will focus on preparing workers for the zero-emission transition.⁷⁴ Training programs could help workers learn to operate and maintain zero-emission technologies and cover the longshore, trucking, warehousing, and logistics sectors. Long Beach City College administers job training and workforce development programs. The Maritime Center of Excellence, which is sponsored by the Port of Long Beach, provides individuals interested in supply chain and logistics with professional development resources and classes. The program also offers job placement services to help students find employment opportunities.⁷⁵ Policy makers could expand this model to other city colleges and Cal State Universities near the Ports. Workers will need training programs that cover the use of alternative fuels and equipment, as well as how to repair zero-emission equipment. Policy makers could also consider increasing local hire programs, including local jobs in and near the zip codes where operations and construction projects are happening.

Solution: State and local agencies could improve their planning processes to better ensure frontline community members have a voice in planning for and implementing the zero-emission cargo handling equipment transition.

Creating community engagement processes with input from environmental non-profit organizations, community-based organizations, and community members

themselves will be critical to ensuring planning processes for zero-emission infrastructure are inclusive and foster meaningful community participation. All state and local agencies that have authority to approve zero-emission infrastructure projects could work to improve public participation, but the Ports of Los Angeles and Long Beach, Los Angeles Department of Water and Power, Southern California Edison, and local planning departments could be particularly focused on this goal because these entities will play crucial roles on Port infrastructure projects. In particular, these entities could focus on creating processes that require early and frequent public participation and solicit feedback on the location, size, and type of zero-emission infrastructure.

While public participation and community engagement are part of public planning processes, including the Clean Air Action Plan, community-informed planning will be particularly important for technology deployment; infrastructure siting; and community investments, such as green infrastructure, housing, and new employment opportunities. Recently, South Coast Air Quality Management District improved its community engagement process to feature facilitated breakout groups that allowed for deeper and more open conversations. After providing an overview of the issues or project to be discussed, agency staff sat with small groups of community members to discuss issues, answer questions, and gather feedback. This model can foster meetings that are more inclusive than the traditional one- to two-minute public testimony model by creating space for community members to discuss the issues and have conversations with agency staff. Policy makers could further improve public meetings by hosting them in well-known community spaces at multiple times to accommodate different work schedules, providing translation services and funding to community-based organizations that host meetings, and compensating community members for participating in public meetings and workshops. After meetings, agency staff could post minutes in multiple languages or summaries to inform community members who were not able to attend.

Government entities could also solicit feedback from community members on the location, size, and type of zero-emission infrastructure. Different types of zero-emission infrastructure have different community impacts, and community members should have a voice in how these projects impact their communities.



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IV. CONCLUSION

The Ports are well-suited to lead the transition to zero-emission cargo handling equipment given California's role as a major goods movement hub and a climate and environmental leader. A successful transition at the Ports could provide an effective model for ports across the country and the world. While progress has been made, much work still needs to happen quickly to make progress toward the goal of 100 percent zero-emission cargo handling equipment by 2030, as set forth in the Ports' Clean Air Action Plan.

Most importantly and urgently, stakeholders need to commit to technology and develop concrete, enforceable plans for purchasing and deploying equipment and installing charging and fueling infrastructure. Collaboration among stakeholders, including meaningfully engaging frontline communities and workers in transition plans and implementation, will be essential to ensure success. As 2030 quickly approaches, the time to start installing infrastructure and purchasing zero-emission cargo handling equipment is now.

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