



SAN PEDRO BAY PORTS
CLEAN AIR ACTION PLAN 2017

Final
Clean Air Action Plan Update

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San Pedro Bay Ports Clean Air Action Plan 2017 FINAL

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Preface

The Port of Long Beach and Port of Los Angeles (together, the “Ports”) hereby introduce the 2017 Clean Air Action Plan (CAAP) Update, which will serve as high-level guidance for continued emission reduction activities in collaboration with industry stakeholders, regulatory agencies, local communities, and environmental groups for the next 20 years.

This CAAP Update is the result of extensive public outreach that has taken place over the past two years combined with recent regulatory and statutory changes. The 2017 CAAP Update strategies have evolved over this period, from the concepts proposed in the 2017 CAAP Update Discussion Document (Discussion Document) released on November 17, 2016, to the Draft CAAP 2017 Update released July 19, 2017, to the final version presented here. All strategies continue to support our aggressive march toward clean air for the community.

Throughout development of this CAAP Update, the Ports have engaged in stakeholder outreach that has included multiple small focused meetings as well as three large public meetings that took place in October 2015, January 2017, and August 2017. The Ports have held more than 70 stakeholder meetings, conducted workshops drawing nearly 300 people, and received more than 400 comment letters from industry, environmental, neighborhood, and regulatory organizations. Comment letters are posted on the CAAP website at www.cleanairactionplan.org.

Additionally, these strategies have been guided by recent and ongoing regulatory agency planning efforts, chief among them the California Sustainable Freight Action Plan, which also provides the framework for State and regional control strategies under the Clean Air Act; as well as the South Coast Air Quality Management District (SCAQMD) 2016 Air Quality Management Plan (AQMP), approved by the SCAQMD Governing Board on March 3, 2017 and the California Air Resources Board (CARB) Governing Board on March 23, 2017. In addition, a series of regulatory and statutory changes have also occurred over the past year. These changes, which will be described later in more detail, have had an important impact on some of the new proposed CAAP strategies, in some cases offering opportunities for more aggressive and focused actions, and in other cases, imposing greater constraints.

On June 12, 2017, Mayor Eric Garcetti of the City of Los Angeles and Mayor Robert Garcia of the City of Long Beach announced a joint declaration for creating a zero-emissions goods movement future – with ultimate goals of zero emissions for cargo handling equipment by 2030, and zero emissions for on-road drayage trucks serving the ports by 2035. In the declaration, the mayors made a commitment to continue focusing on advancing clean technologies to reduce emissions and combat climate change. They identified that the CAAP Update should include expansion of

at-berth emission reductions; a pilot project to test zero-emission drayage trucks; establishment of a CAAP Implementation Stakeholder Advisory Group that would discuss and report on CAAP implementation progress and progress on related energy projects; development of a Green Ports Collaborative to advance similar goals with other climate mayors along the West Coast and throughout the nation; and, finally, a joint effort to secure funding to support necessary equipment purchases and infrastructure development. These goals have been captured in this 2017 CAAP Update.

Adoption of the 2017 CAAP Update by the two Boards of Harbor Commissioners is just the first step in a collaborative process in which details will be developed and refined in an ongoing dialogue with CAAP stakeholders prior to presentation of specific programs to the ports' Boards for approval. It is vital that all stakeholders continue to work together if we are going to be successful in achieving our shared vision of an economically competitive, efficient, and environmentally sustainable port complex.

Guiding Principles

Achieving the ambitious 2017 CAAP Update goals will require extensive collaboration among the Ports, regulatory agencies, industry, and the community, which has been the hallmark of the CAAP for more than ten years, and resulted in the CAAP's successful results. The Ports recognize that finding the balance between our environmental and economic goals will be critical to our ongoing success and long-term sustainability. To that point, the Ports commit to implementing these strategies in line with the guiding principles below:

- The Ports must work with our tenants and customers to expeditiously reduce our fair share of air emissions and associated health risk from port-related operations to support a healthy, thriving community and clean environment.
- The Ports are vital economic engines, supporting hundreds of thousands of local and regional jobs, and we must remain economically competitive and maintain our market position.
- The Ports must continue to support our vibrant workforce by avoiding job losses, by fostering new workforce opportunities associated with green goods movement, and by ensuring equity for the men and women who move cargo at the ports.
- The Ports must continue to develop and foster strong partnerships with all stakeholders, including regulatory agencies, our port-related operators, the broader goods movement industry, and local communities in order to achieve and sustain successful outcomes for all.

- The Ports must assure that the CAAP implementation process is transparent and responsive to stakeholder input.

Recent Regulatory and Statutory Actions: Challenges and Opportunities

Since the release of the CAAP Discussion Document in late 2016, several state and regional actions have prompted the Ports to re-evaluate the original concepts for several proposed strategies.

In some cases, these recent actions have aligned with the proposed CAAP strategies by identifying a process for developing statewide emission-reduction mandates for mobile sources. Those actions allow the Ports to focus efforts on implementation and acceleration of these statewide mandates in order to support successful implementation and generate near-term reductions. In other cases, however, the actions imposed new constraints on the Ports' strategies to address certain port-related sources. In those cases, the Ports modified the proposed CAAP strategy to reflect new realities while still pursuing emission reductions to the maximum extent possible within their jurisdiction.

The following actions have influenced the strategies in this CAAP Update document.

California Air Resources Board, 2016 State Strategy for the State Implementation Plan, Resolution No. 17-7. During the adoption of the State Implementation Plan in March 2017, the CARB Board directed its staff to take the following actions for Los Angeles Ports and Ports that are in or adjacent to disadvantaged communities in the top 10% of those defined as most impacted by CalEnviroScreen:¹

- Within 18 months, develop At-Berth Regulation amendments that achieve up to 100% compliance by 2030
- Within 24 months, develop cargo-handling equipment regulations to achieve up to 100% compliance with zero-emissions vehicles by 2030

With the State moving ahead on more stringent regulations for at-berth emissions and zero-emissions cargo-handling equipment, it is appropriate for the Ports to defer to, and participate in, the rulemaking process in order to provide comments consistent with our Guiding Principles and to ensure consistency with the regulatory approach. For that reason, the Ports will be

¹ CalEnviroScreen is a science-based screening tool developed by the California Office of Environmental Health Hazard Assessment. It helps to identify California communities that are disproportionately burdened by many sources of pollution.

engaged in the rulemaking process while we simultaneously focus our efforts on implementation and, where feasible, accelerate these regulations to facilitate compliance and generate emission reductions in the early years. This is entirely consistent with the approach used for the original 2006 and 2010 CAAP strategies, which relied on impending newly developed State regulations (Drayage Truck Rule, Shore Power Rule) and accelerated the compliance dates at the Ports, in an “early action” demonstration that promoted such regulatory implementation to great success.

State of California Senate Bill 1 (SB 1), signed into law April 28, 2017. SB1 develops a funding mechanism for transportation infrastructure in California. Within the statute, however, is a prohibition on new requirements to replace, retire, repower, or retrofit heavy-duty trucks before the truck has reached the earlier of either 800,000 vehicle miles traveled or 18 years from the engine model year. The language does not prohibit voluntary incentive and grant programs, including, but not limited to, those that give expedited access to a facility to a particular vehicle or class of vehicles. SB1 also requires CARB by January 1, 2025, to evaluate the impact of the provisions of SB1 on efforts to meet state and local clean air goals.

During the 2017 CAAP Update public outreach process, many stakeholders urged the Ports to mirror the proposed 2017 CAAP Update Clean Trucks Program (CTP) with the strategy of bans contained in the original CAAP CTP initiated in 2008. Importantly, however, the California truck regulatory status is different today than in 2008 and SB1 has helped to reinforce these differences. The original CTP relied upon the power of the State of California CARB Drayage Truck Rule to establish in-use requirements on all truck fleets at all ports and railyards throughout the state, and required them to turn over to 2007 US EPA compliant engines effective January 1, 2014.² The original CTP moved up implementation of CARB’s 2014 Drayage Truck Rule to a phase-in between 2008 and 2012. CARB’s inevitable Drayage Truck Rule requirement in 2014, combined with grants and incentives offered by the Ports starting in 2008, led to a voluntary early fleet replacement by industry years in advance of the State’s 2014 requirement.

Today, as a result of SB1, CARB is prohibited from adopting regulations to require state truck fleet replacement sooner than the Truck and Bus Rule (which replaced the Drayage Truck Rule) that requires 2010 US EPA Truck standard by January 1, 2023, or to implement new requirements for replacement of trucks with engines that are 2010 model year or newer prior to the earlier of 2028 or 800,000 miles.³ Therefore, unless and until CARB is able to adopt a new state truck

² CARB is the state air agency with regulatory authority, as delegated by the EPA and under state law, to set standards that require port trucks statewide to be replaced with cleaner trucks, as it did with the State Truck and Bus Rule.

³ SB1 contains language that supports the industry’s desire to maximize the useful life of their investment. U.S. Environmental Protection Agency (EPA) has authority to set nationwide standards for

standard requirement for port drayage trucks, the Ports are unable to follow the previous strategy of advancing a ban already established by an existing State truck regulation. Instead, in compliance with our jurisdiction and within the limitations of our own authority⁴, the Ports are proposing a suite of actions to encourage acceleration of new trucks entering the fleet to meet the cleanest standards, including near-zero emissions and zero-emissions. The Ports also have bolstered the incentive-based strategies to promote voluntary turnover to cleaner technologies.

Indirect Source Rule or Alternatives, 2016 State Strategy for the State Implementation Plan, Resolution No. 17-7 and South Coast Air Quality Management District 2016 Air Quality Management Plan. As defined under the Clean Air Act, an indirect source is "...a facility, building, structure, installation, real property, road, or highway which attracts, or may attract, mobile sources of pollution..."⁵

During the adoption of the State Implementation Plan in March 2017, the CARB Board directed its staff to take the following action:

- Return to the Board with concepts for an Indirect Source Rule to control pollution from large freight facilities, including ports, railyards, warehouses, and distribution centers, as well as any identified alternatives capable of achieving similar levels of emission reductions.

The CARB Board direction appears to be similar to the Indirect Source Rule concept in SCAQMD's 2016 AQMP Measure MOB-01 Emission Reductions at Commercial Marine Ports which calls for a process to evaluate facility-based emission-reduction options for various freight-related operations, including indirect source rules. In the AQMP, the SCAQMD describes a collaborative working group process through March of 2018 that would determine what feasible actions could be taken to reduce pollution from freight facilities, including ports. This process could include an exploration of mechanisms other than rules to ensure emission reductions. If, however, the

mobile sources (42 U.S.C. §7521, 7547). EPA has given authority to CARB to regulate heavy duty trucks and other mobile sources for the State of California, under so-called "Clean Air Act waivers" under Clean Air Act 42 U.S.C. §7543, which is how CARB issues its manufacturing standards for new engine technology, including future "near zero" or "zero emissions" manufacturing standards, as well as heavy duty truck regulations for trucks operating in California ports.

⁴ POLA jurisdiction and authority under the Los Angeles City Charter is solely to manage the Tidelands granted by the State and related assets and revenues to "promote maritime commerce, navigation and fisheries." POLB's jurisdiction and authority under the Long Beach City Charter is similar – to manage the Tidelands granted by the State and related assets and revenues to "provide for the needs of commerce, navigation, recreation and fishery in the Harbor District".

⁵ 42 U.S.C. § 7410(a)(5)(C)

SCAQMD Board does not believe that adequate progress has been made under the voluntary program, it may pivot to rulemaking.

The agencies may attempt to apply an Indirect Source Rule to cap maximum emissions or activity at a freight facility, according to the “Facility Based Approach” described in CARB’s April 2015 Sustainable Freight Pathways to Zero and Near-Zero Emissions Discussion Document.⁶

The Ports will be collaborating with CARB staff to provide input for its report to the CARB Board on this subject, just as the Ports have been collaborating with SCAQMD staff on its approach to the concept in working group meetings since the adoption of the 2016 AQMP.

In addition, the state legislature recently adopted AB 617 (Garcia), which calls for the development of community emission reduction programs to reduce exposure in neighborhoods most impacted by air pollution. Implementation strategies include community-level air monitoring, development of community-specific emission reduction plans, and accelerated control of emissions from equipment operating at facilities located near impacted communities. Under AB 617, CARB will develop a statewide strategy by October 2018, and within one year, districts encompassing impacted communities will be required to develop emission reduction programs. It is uncertain at this point how or if this program will relate to the Ports.

Mindful of these efforts, the 2017 CAAP Update includes strategies that are feasible and within the purview of our legal and jurisdictional authority while advancing the objectives of the ports’ Boards of Harbor Commissioners, each city’s mayor, the regulatory agencies, and other stakeholders, to reduce emissions.

⁶ <https://www.arb.ca.gov/gmp/sfti/sustainable-freight-pathways-to-zero-and-near-zero-emissions-discussion-document.pdf>, at pp 44-46.

Introduction

With the 2006 adoption of the CAAP, the Ports became worldwide leaders in efforts to reduce emissions associated with maritime goods movement. At the time, no other seaport complex in the world had attempted such a progressive and comprehensive program to reduce emissions from maritime goods-movement-related mobile sources. Even today, the CAAP remains the most successful seaport emission-reduction effort ever implemented.

Since 2005, San Pedro Bay port-related emissions of diesel particulate matter (DPM) have dropped 87%, nitrogen oxides (NO_x) are down 56%, and sulfur oxides (SO_x) have nearly been eliminated. Greenhouse gas (CO₂e) emissions have also dropped 18% during this period. The 2014 emission reduction goals for DPM, NO_x and SO_x, that were voluntarily set in 2010, were met and exceeded. These reductions are a testament to the CAAP's cutting-edge strategies and the collaborative approach taken with our industry partners and the regulatory agencies to meet shared goals.

The unprecedented success of the CAAP would not have been achieved without the support of the maritime industry and the other stakeholders. Investments in new equipment by the maritime industry since the CAAP was adopted have been significant, with nearly \$2 billion estimated to have been spent on cleaner trucks and cargo-handling equipment and strategies such as shore power for ships. The Ports do not own, operate, or contract for dispatch any of the vehicles or equipment used in maritime goods movement-related activities and thus must work cooperatively with private operators to bring about environmental change. The emission reductions achieved over the past decade would not have occurred if not for their efforts.

Much has changed since the Ports adopted the original CAAP more than 10 years ago and updated it in 2010. The strategies outlined in the first two CAAPs have been fully implemented or are well underway. Zero-emission technologies that once existed only in concept are becoming a reality, with significant development of zero emission prototypes underway by many larger Original Equipment Manufacturers. The Ports have engaged in Supply Chain Optimization efforts with a goal to improve efficiency in the freight system. Cleaner and more reliable sources of energy through energy planning activities by the Ports are also being pursued.

At the same time, these successes bring about new challenges. Substantial recent investments have been made by the industry in new cleaner technologies that still have useful life. Accelerated replacement of that equipment could result in stranded assets.

Further, as directed by Governor Brown's Executive Order B-32-15, the State of California (State) for the first time has defined a comprehensive multi-agency vision for cleaner goods movement through its Sustainable Freight Action Plan, which was finalized in July 2016. The Sustainable Freight Action Plan provides a long-term vision for the freight system and new targets to help the State meet its environmental, efficiency, and economic competitiveness goals over the next decade.

Although much progress has been made, the Ports recognize that additional work needs to be done to reduce the freight industry's impacts on local communities and to help the State and region meet their goals for air quality improvements and sustainable freight movement. As stated in the Sustainable Freight Action Plan, "success will require government, industry, labor, and environmental and community leaders to stand together on this vision."

The CAAP supports this vision by introducing specific emission reduction and efficiency improvement strategies that can be implemented locally to support the overarching goals and objectives outlined in the Sustainable Freight Action Plan. The CAAP also identifies the areas where significant investments will be needed, and the timelines for those investments, to inform upcoming funding allocation plans to be developed at the state and federal level.

Public Outreach

The strategies contained in this CAAP have been shaped by more than two years of outreach and engagement with our customers and operators, industry trade associations, the broader business community, environmental groups, technology developers, equipment and fuel vendors, regulatory agencies, elected officials, and the local communities. The outreach process for the development of this update to the CAAP has been more robust than previous efforts, with more direct engagement and input from a broader set of stakeholders, including regulators, port operators and business users, community and non-governmental organizations (NGOs), energy suppliers, and technology developers.

Additionally, the Ports used a wide array of outreach strategies to encourage input. These strategies included small focus groups, presentations to business organizations and neighborhood groups, calls for formal comment letters, and several presentations to each port's Board of Harbor Commissioners during which members of the public could make comments. Updates on CAAP progress and opportunities for community interaction were advertised through press releases, each port's website, the CAAP website, Facebook, and Twitter. Also, the Ports held three public workshops – one on October 14, 2015, to help formulate the concepts in the Discussion Document, another on January 24, 2017, following release of the Discussion

Document, and a final workshop on August 30, 2017, following release of the Draft CAAP. Together, these workshops drew more than 375 people. During two of these workshops, which included Spanish translation, the Ports used small breakout sessions to drive more focused and detailed discussions on the proposed CAAP concepts, thus providing valuable focused input and dialogue.

To date, the Ports have held more than 70 meetings with more than 30 groups representing thousands of stakeholders, and the Ports have received more than 400 letters totaling nearly 1,000 pages from our customers, business groups, regulatory agencies, neighborhood and community organizations, environmental groups, and technology providers.

Based on the input received throughout this process, the Ports have refined, clarified – and in some cases, modified – the CAAP strategies. This CAAP reflects years of public engagement, study, and discussion, and the Ports have taken very seriously the comments received from hundreds of stakeholders.

Comments Received on the Draft CAAP

The Ports have received numerous comments over the past two years; these comments, including the actual letters received, are posted on the CAAP website.

The majority of the comments received relate to the debate between transitioning to cleaner near-zero-emission trucks and equipment in a step-wise approach versus transforming to zero emissions in one big jump.

Many of the other comment themes related to cost, competitiveness and loss of market share, implementation timeline, and interim goals and commitments for how we will get there are related to the larger discussion and debate about transitioning versus transforming.

A listing of the overarching themes included in the comments is provided below, in no particular order.

- Support and praise for the inclusion of zero-emissions goals for trucks and cargo-handling equipment.
- The strategies could adversely impact the San Pedro Bay port complex's economic competitiveness and jobs.
- Near-zero-emission technologies will provide dramatic emission reductions and will cost significantly less than zero-emission technologies. On the basis of dollars spent per ton

of emissions reduced, these technologies will be much more cost effective. The Ports should consider near-zero-emission technologies as an end goal.

- Near-zero emission trucks can provide emission reductions in the near-term because the technologies are closer to commercialization. Many comments recommended turnover within the next 5 years.
- The infrastructure needed to support near-zero-emission trucks, specifically natural gas fueling infrastructure, has been expanding throughout the region and is largely in place. Further, as near-zero technologies are developed that use diesel fuel, this infrastructure is well established. Hydrogen fueling and electrical charging for heavy-duty trucks and equipment is not currently available.
- Zero-emission technologies are necessary to meet the emission reduction and community health needs; focusing attention on development of near-zero-emission technologies will divert from that path and slow or potentially stop our progress to getting to zero emissions.
- The Ports need to move away from continued dependence on fossil fuels like diesel and natural gas. Near-zero-emission technologies, which have combustion-based engines, continue to rely on fossil fuels. Other commenters have stated, however, that renewable fuels, from sources like landfill gas and dairies, are not fossil fuel based.
- If investments are made in near-zero technology and infrastructure, it will result in additional, unnecessary expenses, and the full value of those investments will not be available because of the timeline to convert to zero emissions.
- Significant progress has been made in advancing toward zero emissions, including the demonstration projects that both ports have underway. Those technologies will be available in the near-term and should be implemented prior to the 2030/2035 timelines.
- Zero-emission technologies do not exist today and are not expected to become feasible within timeframes identified.
- The cost to get to zero emissions is very high. The cost estimates are inaccurate and the level of expense is unsustainable. The industry is in no financial position to be able to take on those costs. As a result, shippers will find other, less expensive gateways to move their cargo which will result in loss of local jobs, regional economic impacts, and increased greenhouse gas emissions when the cargo is delivered through less efficient routes. Diversion is already happening - these ports are losing our market share - and the economic impacts of these environmental requirements will exacerbate that situation.
- Many truck owners are still paying off their trucks to comply with the first phase of Clean Trucks Program and the CARB regulation. Nearly half the trucks already have MY2010 engines in compliance with the state's requirement, which becomes effective in 2023 and they do not have the ability to pay for new, more expensive trucks. These expenses could push those truck owners out of the drayage business.

- Terminal operators have made investments in clean equipment in compliance with the state regulation and port lease requirements, and the timeline to replace with zero emissions by 2030 will make that equipment obsolete before its full useful life, resulting in stranded assets.
- The Ports must address the financial impacts and workplace inequities for truck drivers.
- The cost of doing nothing will result in continued health impacts that will have greater regional economic impacts that must be paid by the local communities, including from health care costs, hospitalizations, missed days of work and missed school days, and that those expenses will be greater than the cost to purchase cleaner equipment.
- The Ports need to identify their community impacts and prioritize public health.
- Action must be taken immediately. The community cannot wait until 2035 for cleaner trucks.
- Interim goals and milestones should be identified and tracked to provide certainty that the ports will take the necessary actions to ensure the cleaner equipment is introduced into port-related operations on the expected timeline.
- Development and implementation of the CAAP must be transparent and inclusive of stakeholders.

The Ports have received a lot of input from several perspectives. There are many strong opinions and concerns about the implications of decisions the Ports will be making in this update to the CAAP strategies, and there is not one consensus opinion about how to proceed.

The Ports have taken these comments seriously, and the strategies contained in this CAAP Update reflect this input. More details about how the Ports responded to comments for specific strategies can be found within the description of the respective strategy and in the accompanying document, “Summary of Major Comments and Responses.”

Supporting Documents

Additionally, in response to requests for further detail, the Ports have provided additional technical information and analysis to support the development of the strategies. These documents are also available on the CAAP website.

- “Framework for Feasibility Assessments”: A description of the process to be used, components to be analyzed, and proposed methodologies to be employed in developing the feasibility assessments for trucks and cargo-handling equipment.

- “Preliminary Cost Estimates for Select 2017 Clean Air Action Plan (CAAP) Strategies”: An analysis of the potential costs associated with the CAAP as a plan, with more detailed cost analyses to come during implementation of specific strategies.
- “CAAP Strategies: Economic and Jobs Effects Discussion Paper”: A discussion of the potential economic and jobs impacts associated with the CAAP strategies.
- “Draft Bay-Wide Ocean-Going Vessel International Maritime Organization Tier Forecast 2015-2050”: A forecast of the penetration of Tier 3 ships for various vessel types. This document will continue to be updated as new information becomes available.
- “Potential Emission Reduction Projections for Select CAAP Strategies”: A range of forecasted emission reductions for CAAP strategies related to trucks and cargo-handling equipment, where sufficient information exists to support such forecasts.

About the CAAP

The CAAP is a plan that provides guidance to help the region achieve its clean air goals and to support the statewide vision for more sustainable freight movement. The proposed strategies in this iteration of the CAAP are some of our boldest yet, and they will require continued cooperation from the goods movement industry and our regulatory agency partners.

As articulated in the Sustainable Freight Action Plan, to become greener – and to support the ultimate goal of zero-emissions goods movement – the Ports must develop strategies that include the introduction of clean vehicles and equipment, infrastructure, freight efficiency and energy planning. This approach is broader in scope than our previous efforts.

The CAAP supports this shift in the way we think about sustainable port planning while preserving our longstanding commitment to improve air quality for our communities.

As a result, parallel strategies are proposed in this CAAP. First, the Ports have identified near-term actions to produce air quality improvements within the next 5 years. These actions rely on accelerating the adoption of commercially available cleaner engine technologies and operational changes through incentives and new requirements. Next, and in parallel, the Ports are evaluating long-term strategies to be implemented over the next two decades and have defined a series of interim steps to lay the foundation for our ultimate goal – zero emissions and the reduction of our carbon footprint. Strategies with specific actions and timelines for technology development, infrastructure planning, and fleet turnover will be developed as part of the CAAP implementation process, and will help to lay the groundwork for our long-term vision of a clean maritime goods movement freight transport system.

The strategies contained in this Final CAAP have been shaped by extensive outreach and engagement with the goods movement industry, regulatory agencies, environmental groups, and the local communities. Additionally, these strategies have been guided by recent planning efforts, chief among them the California Sustainable Freight Action Plan, which also provides the framework for State and regional control strategies under the Clean Air Act, the South Coast Air Quality Management District (SCAQMD) 2016 Air Quality Management Plan (AQMP), approved by the SCAQMD Governing Board on February 3, 2017, and the CARB Governing Board on March 23, 2017, as well as new regulations and statutes coming into play over the last year. Lastly, these strategies are informed by numerous technical documents, including the Ports' Zero Emissions Roadmap,⁷ separate efforts by each of the Ports, including the Port of Los Angeles Zero Emission

⁷ <http://www.cleanairactionplan.org/documents/zero-emissions-roadmap-technical-report.pdf>

White Paper⁸, and a series of technology assessments developed by the California Air Resources Board.⁹

Based on the input received throughout this process, the Ports have modified, refined, and clarified the CAAP air emissions reduction strategies as planning guidelines that are feasible and consistent with the Ports' jurisdiction to provide for the needs of commerce, navigation, recreation and fisheries in their respective Harbor Districts.

It is also important to note that the Ports' approach to achieving emissions reductions has always been, and will remain, to establish goals in the CAAP and provide flexibility to the operators on how they can best achieve those goals. The Ports are not mandating a particular technology pathway or a certain type of operation – we are technology-neutral, fuel-neutral, and operations-neutral. Through the Ports' Technology Advancement Program, we will continue to support and demonstrate a variety of technology options so there can be more tools in the toolbox. We understand that there are no “one-size-fits-all” solutions. The industry is the expert on its business operations and is in the best position to identify the solutions that meet the goals, and at the same time, work best for its needs.

⁸ https://www.portoflosangeles.org/pdf/Zero_Emission_White_Paper_DRAFT.pdf

⁹ <https://www.arb.ca.gov/msprog/tech/report.htm>

Background

On November 20, 2006, the Ports took an unprecedented joint action to improve air quality in the South Coast Air Basin by adopting the CAAP, a sweeping plan aimed at significantly reducing the health risks posed by air pollution from port-related mobile sources, specifically ships, trains, trucks, terminal equipment and harbor craft, such as tugboats.

The CAAP was a landmark air quality plan that established the most comprehensive, far-reaching approach to improve air quality in the Ports region and to reduce health risks from maritime goods-movement-related activities. The CAAP's success allowed the Ports to continue development, job creation, and economic activity while ushering in a suite of air emission-reduction strategies including the ports' Clean Trucks Program and a series of vessel programs. The Ports believe it is important to continuously update the CAAP. Staff from both Ports meet regularly to evaluate progress towards meeting the CAAP goals, review status of existing control measures, evaluate new measures, and jointly develop updates to the CAAP as needed. This 2017 CAAP Update will be the third version of the CAAP.

Additionally, the CAAP is a plan that provides high-level guidance, and acceptance of the plan does not constitute approval to implement the individual strategies. Each port's Board of Harbor Commissioners retains its respective jurisdiction and authority to approve these strategies to be implemented at each port in future separate actions¹⁰, which would provide additional time for study, public participation and outreach, and refinement and consideration of the then-applicable facts and circumstances at the time of adoption.

Public Health – A Call to Action

Freight operations at the Ports generate toxic air emissions from ships, trucks, trains, tugboats, and terminal equipment, thus contributing to regional air quality issues and local health risk. According to the Environmental Protection Agency, air pollution can negatively impact public health by:¹¹

- Aggravating respiratory and cardiovascular disease
- Reducing lung function
- Increasing the severity and frequency of respiratory symptoms such as coughing and difficult breathing

¹⁰ Future separate actions by the Boards include but are not limited to adoption of programs, budgets, incentives, grants, tariffs, contracts, leases, and CEQA mitigation in port project environmental impact reports (EIRs).

¹¹ "Draft A Ports Primer for Communities." 2016. United States Environmental Protection Agency. <https://www.epa.gov/sites/production/files/2016-07/documents/420p16001.pdf>

- Increasing susceptibility to respiratory infections
- Impacting the nervous system, including the brain
- Increasing the risk of cancer
- Contributing to premature death

Certain sensitive populations are especially susceptible to the effects of air pollution, such as children, senior citizens, people with chronic illnesses, and pregnant women. Children are particularly vulnerable to air pollution due to the fact that children's bodies, including their lungs, are still developing and their exposure is greater due to quicker breathing speeds and more active hours spent outdoors.¹²

Such health impacts drove the development of the original CAAP more than 10 years ago. Today, as a result of the CAAP and various state regulations that have since come into effect, the communities around the Ports have seen dramatic reductions in health risk and air pollution. Since 2005, port-related NO_x and SO_x have dropped by 56% and 97% respectively, according to the Ports emissions inventories. Even more, port-related DPM – which is linked to cancer risk and other adverse health effects – has plunged 87% during that time, significantly reducing the public health risk associated with port-related emissions faced by neighboring communities. Figure 1 approximates the reduction in port-related health risk since 2005.¹³

In fact, the area around the Ports has seen a greater decline in air-related cancer risk than Southern California as a whole. According to the South Coast Air Quality Management District's Multiple Air Toxics Exposure Study IV (MATES-IV), between 2005 and 2012, cancer risk near the Ports dropped 66% compared to a 56% reduction for the rest of the region, demonstrating the accelerated rate of progress and the success of our CAAP and other goods movement-related initiatives¹⁴.

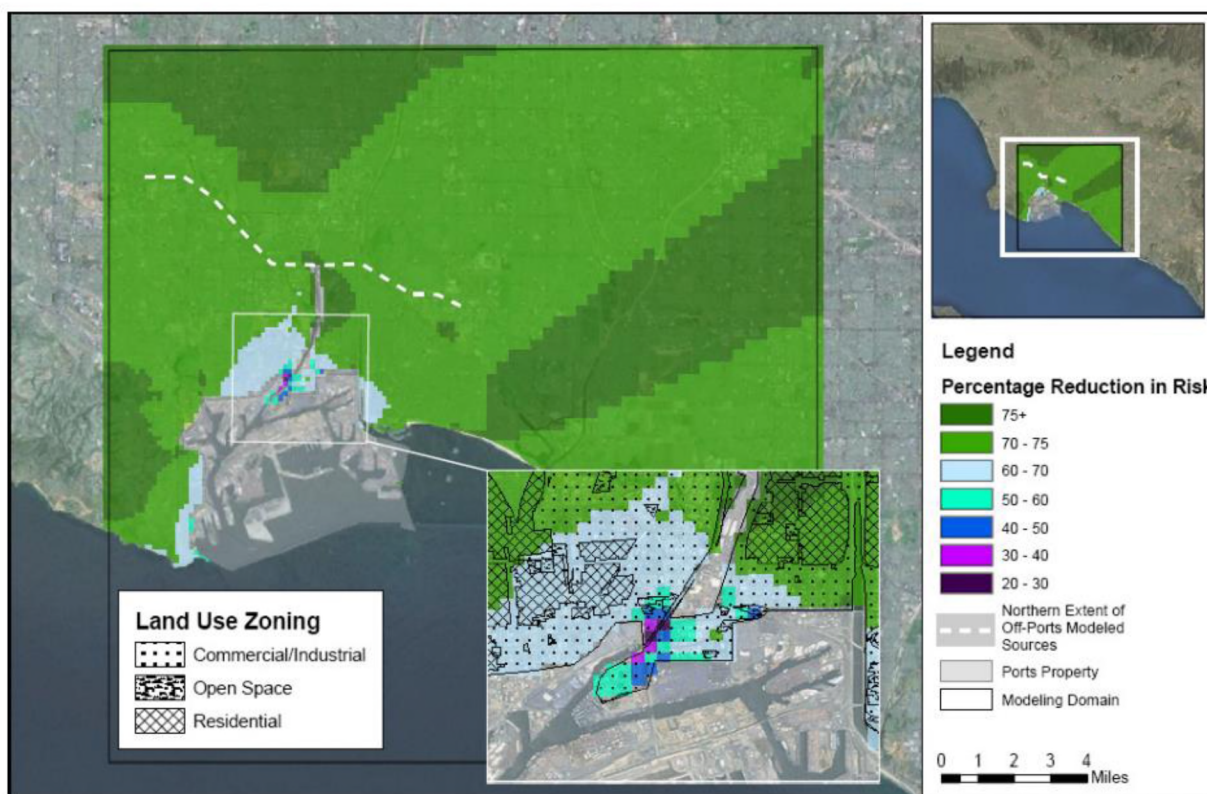
¹² "The Children's Health Study," 2015. California Air Resources Board.

<https://www.arb.ca.gov/research/chs/chs.htm>

¹³ In 2009, the Ports conducted a Bay-wide health risk assessment tool (BWHRA Tool) to project health risk reductions as a result of CAAP strategies. The BWHRA Tool used DPM emissions for the baseline year of 2005, forecasted DPM emissions for 2020, and determined health risk reductions that would result from an 85% reduction in Ports-related DPM by 2020. The Ports have achieved an 87% reduction in DPM as confirmed by the 2016 Annual Emissions Inventories for each Port. Thus, it is appropriate to use the 2020 forecasted health risk results to characterize the current impact of Port-related activity on the neighboring community.

¹⁴ "Multiple Air Toxics Exposure Study in the South Coast Air Basin, MATES IV." 2012. South Coast Air Quality Management District, p. 4-11. <http://www.aqmd.gov/docs/default-source/air-quality/air-toxic-studies/mates-iv/mates-iv-final-draft-report-4-1-15.pdf?sfvrsn=7>

Figure 1: Percent Reduction in Diesel Particulate Matter-Related Health Risk Since 2005 for Ports Region Based on 85% Reduction in Emissions¹⁵



Yet despite the improvements in air quality and health, more work needs to be done. Although health risk reductions have been significant, residents nearest the Ports still face higher pollution-related health risks than the rest of the Southern California population,¹⁶ and most of the neighboring areas are classified as “disadvantaged” communities pursuant to SB 535 (De León, Statutes 2012) using the California Communities Environmental Health Screening Tool (CalEnviroScreen).

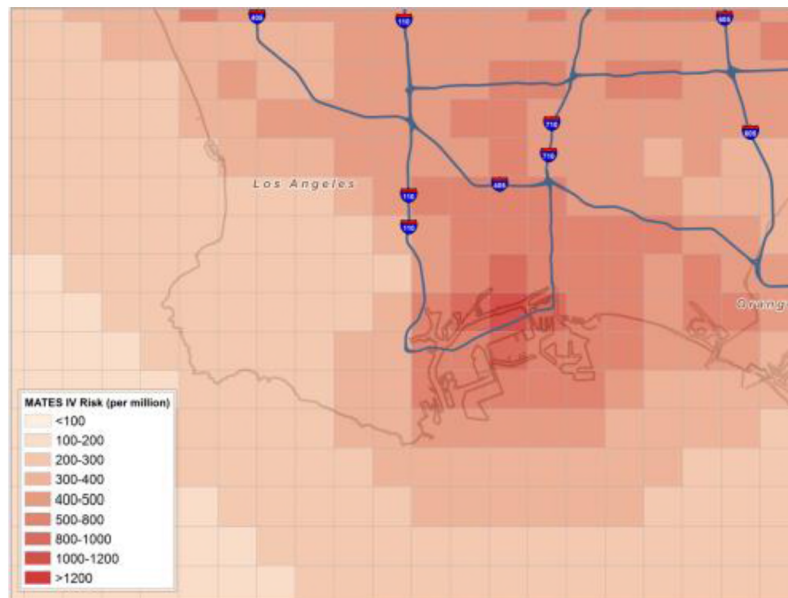
Health risk increases with proximity to the source of pollution, and as a result, communities closest to the Ports face greater public health impacts than those farther away. Figure 2 displays the high cancer risk near the Ports, according to MATES-IV.¹⁷

¹⁵ San Pedro Bay Ports Final 2010 Clean Air Action Plan Update, <http://www.cleanairactionplan.org/documents/2010-final-clean-air-action-plan-update.pdf>

¹⁶ “Multiple Air Toxics Exposure Study in the South Coast Air Basin, MATES IV.” 2012. South Coast Air Quality Management District. <http://www.aqmd.gov/docs/default-source/air-quality/air-toxic-studies/mates-iv/mates-iv-final-draft-report-4-1-15.pdf?sfvrsn=7>

¹⁷ MATES-IV

Figure 2: Ports Area Simulated Air Toxic Cancer Risk, MATES IV, 2012



In addition to cancer risk, port-related air pollution contributes to other acute and chronic health effects. About 15% of children in Long Beach suffer from asthma compared to 9% of children in the United States.¹⁸ The City of Long Beach Community Health Assessment (July 2013) further reflects the health burden on communities surrounding the Ports. According to the assessment, in 2011, about 55,000 Long Beach residents suffered from asthma. In 2007, about 1,200 hospitalizations in Long Beach were due to asthma and Chronic Obstructive Pulmonary Disease (COPD), which is also linked to poor air quality. Asthma hospitalization rates are greater in West Long Beach near the Ports and the 710 freeway than in East Long Beach.

In communities near the Port of Los Angeles, including San Pedro, Wilmington, and the Harbor Gateway, asthma-related emergency department visit rates exceed the city average in half of the zip codes. The Los Angeles rate of asthma-related hospital visits is 39 per 10,000 residents; in at least one zip code in the Harbor Gateway, that rate rose to 72 visits per 10,000 residents.¹⁹ Hospitalizations result in significant direct costs such as medications and services, and indirect costs including missed school and work. The average cost of an asthma-related hospitalization in 2010 according to the California Public Health Department was \$33,749.²⁰

¹⁸ "Health Statistics 2010." 2013. City of Long Beach Department of Health and Human Services. <http://www.longbeach.gov/health/media-library/documents/planning-and-research/reports/2010-health-statistics/2010-health-statistics/>

¹⁹ "Health Profiles – Harbor Gateway." Plan for a Healthy Los Angeles. <http://healthyplan.la/interactive/neighborhoods/#id=11>

²⁰ "Strategic Plan for Asthma in California 2015-2018." 2015. The California Department of Public Health. https://www.californiabreathing.org/images/SPAC2014_7-28-15APR.PDF

The South Coast Air Basin continues to be out of compliance with federal ambient air quality standards for ozone and particulate matter, pollutants correlated with breathing problems, exacerbation of asthma and other respiratory symptoms, and in the case of particulate matter, increased mortality due to cardiovascular or respiratory diseases.²¹ Goods movement-related sources generate roughly 40% of the NO_x emissions in the South Coast Air Basin, and although not all of these sources are tied directly to the San Pedro Bay port complex, the Ports recognize we have a responsibility to minimize our environmental and public health impacts.

With our community's health and quality of life at the forefront, the Ports offer our most aggressive CAAP yet.

²¹ "Final 2016 Air Quality Management Plan," South Coast Air Quality Management District.
<http://www.aqmd.gov/home/library/clean-air-plans/air-quality-mgt-plan/final-2016-aqmp>

CAAP Goals

This 2017 CAAP Update continues to move forward with the aggressive goals that were established in the 2010 CAAP Update, and identifies new long-term goals to continue to guide our progress. Establishment of these goals has been informed by efforts at the state level and by the mayors of the cities of Los Angeles and Long Beach, as described below, and by the two ports' continued commitment to reducing the impacts of port-related operations on the environment and our neighboring communities. The goals identified in this section provide overall direction for the ports' approach on individual strategies. The specific goals for each strategy are outlined in the Strategy section of this document.

Pursuant to Governor Brown's Executive Order B-32-15, California has established aggressive goals for more sustainable movement of goods to meet air quality and greenhouse gas reduction goals.

The Sustainable Freight Action Plan set the following targets for the goods movement sector:

- *For system efficiency:* Improve freight system efficiency 25 percent by increasing the value of goods and services produced (as measured by GDP) from the freight sector, relative to the amount of carbon that it produces by 2030.
- *To transition to zero-emissions technologies:* Deploy over 100,000 freight vehicles and equipment capable of zero-emission operation and maximize near-zero-emission freight vehicles and equipment powered by renewable energy by 2030.
- *To address economic competitiveness:* Establish a target or targets for increased State competitiveness and future economic growth within the freight and goods movement industry.

Additionally, the State has set targets for reducing greenhouse gas emissions (GHGs) through Assembly Bill 32, subsequent executive orders and Senate Bill 32 as follows:

- By 2020, reduce GHGs to 1990 levels;
- By 2030, reduce GHGs to 40% below 1990 levels (Governor's Executive Order B-30-15 and Senate Bill 32);
- By 2050, reduce GHGs to 80% below 1990 levels (Governor's Executive Order S-3-05)

The cities of Los Angeles and Long Beach also have greenhouse gas reduction and sustainability goals. In 2015, the City of Los Angeles adopted the Sustainable City pLAn, which called for reducing GHGs to 45% below 1990 levels by 2025 and to 60% below 1990 levels by 2035 in

addition to the Governor's 2050 target. Additionally, the plan seeks to increase the percentage of Port-related goods movement trips that use zero-emissions technology to at least 15% by 2025 and 25% by 2035. Both mayors have also signed on to the "Compact of Mayors," which requires cities to set greenhouse gas reduction targets and to address the impacts of climate change.

On June 12, 2017, the Mayors of the cities of Los Angeles and Long Beach publicly signed a joint declaration affirming the commitment to move toward zero emissions at the Ports, including setting goals of zero-emission cargo-handling equipment by 2030 and zero-emission drayage trucks by 2035. The Mayors committed to a CAAP that includes new investments in clean technology, expanded use of at-berth emission reduction technologies, and a zero-emissions drayage truck pilot program.

The declaration also puts in place a CAAP Implementation Stakeholder Advisory Group to bring together key public and private industry stakeholders to advise the Ports on details of CAAP implementation and further ongoing operational efficiency programs to move towards zero-emissions goods movement. The group will also report on progress with CAAP implementation and related issues such as energy efficiency improvements, onsite renewable energy generation and energy storage.

The declaration also called for the establishment of a Green Ports Collaborative to advance progress toward meeting shared goals for reducing emissions and protecting public health with other Climate Mayors along the West Coast and the nation. A core initiative of the collaborative will be to aggregate, demonstrate and create markets that grow the demand for zero-emissions goods movement vehicles and equipment to encourage investments in vehicle development by manufacturers. Finally, the declaration emphasizes the need to work together to secure public and private funding to support the purchase of cleaner equipment and development of the infrastructure needed to meet the goals of the CAAP.

Although the specific actions and numeric targets vary, all of these goals strive to advance zero-emissions and low-carbon goods movement. The strategies in the CAAP support these larger goals by accelerating the development and deployment of zero-emissions technologies and cleaner equipment, improving freight efficiency, and undertaking long-term planning efforts to help our cities and State meet their sustainability goals.

For freight efficiency, the Ports have proposed to study concepts to speed the flow of cargo through the terminals, such as off-dock staging yards and chassis facilities; to explore systemwide efficiencies, such as intelligent transportation systems; and to reduce truck visit times with a universal portwide reservation system that can integrate with existing terminal specific systems.

Such strategies are expected to have positive benefits for air quality. The State has set a metric to measure freight efficiency that considers GHG emissions in relation to the economic value of the goods movement industry. To support that effort, the Ports will continue to report emissions per container moved in our annual emissions inventories and to measure the progress over time in reducing the amount of freight industry emissions generated while moving cargo.

The bulk of the 2017 CAAP Update strategies, however, are designed to significantly advance the push toward zero emissions in support of the GHG reduction goals from the State and the mayors of Long Beach and Los Angeles.

To that end, the 2017 CAAP Update incorporates two new emission reduction targets:

- Reduce GHGs from port-related sources to 40% below 1990 levels by 2030
- Reduce GHGs from port-related sources to 80% below 1990 levels by 2050

In addition, the 2010 CAAP set emission reduction targets for 2014 and 2023 for diesel particulate matter, nitrogen oxides, and sulfur oxides, as compared to 2005 conditions:

- By 2014, reduce port-related emissions by 22 percent for NO_x, 93 percent for SO_x and 72 percent for DPM.
- By 2023, reduce port-related emissions by 59 percent for NO_x, 93 percent for SO_x and 77 percent for DPM.²²

The 2017 CAAP Update does not alter these goals, and the Ports pledge to continue to incorporate programs to meet or exceed the 2023 goals, which are now part of the 2017 CAAP Update goals. The CAAP includes strategies designed to achieve the necessary emission reductions and maintain the progress we have achieved over the past 10 years. Continued progress in reducing DPM, NO_x and SO_x remains an ongoing priority for the Ports.

The 2010 CAAP further established the following San Pedro Bay-wide health risk reduction goal, consistent with CARB's Goods Movement Reduction Plan goal, as compared to 2005 conditions:

- By 2020, reduce residential cancer risk from port-related DPM emissions by 85%

²² The Ports have achieved the 2014 targets. The Ports' 2016 Emission Inventories report DPM reduced by 87%, NO_x by 56%, and SO_x by 97%. We are well on our way to achieving the 2023 targets.

The initial CAAP also made reducing health risk from individual port development projects an important objective by setting an increment threshold of 10 in a million excess residential cancer risk for new projects.

For the 2017 CAAP Update, the Ports remain committed to this 10 in a million threshold to manage health risk from individual port development projects, as well as to achieving the 2020 Bay-wide health risk reduction goal. At the same time, the Ports will continue to work with State, regional and local regulators and stakeholders to determine how continued reductions in emissions and an ever-improving baseline, and recent changes made by the State Office of Environmental Health Hazard Assessment (OEHHA) to procedures for calculation of health risk, could affect the way these goals are evaluated by the Ports in the future. The Ports will continue to evaluate whether this health risk threshold should be modified on a case-by-case basis for future redevelopment projects, particularly if new information or guidance arises.

The Ports also remain committed to the 2023 emission reduction targets set by the initial CAAP. The CAAP includes strategies designed to achieve the necessary emission reductions and maintain the progress we have achieved over the past 10 years. Continued progress in reducing DPM, NO_x and SO_x remains an ongoing priority for the Ports.

Finally, it should be noted that strategies to reduce GHGs often help to reduce criteria pollutants, an approach that has been embraced by state and regional air agencies; thus, the strategies put in place to achieve the 2030 and 2050 GHG reduction goals will also help us achieve our 2023 NO_x, DPM, and SO_x emission reduction targets and continue to make further progress. More importantly, the GHG reduction goals align with local, regional, and State mandates and commit the Ports to a long-term path toward sustainability and improved air quality.

Looking toward 2050, there are several unknowns that will affect future GHG emission levels. These unknowns include grid power portfolios; maritime industry preferences of power sources for ships, harbor craft, terminal equipment, locomotives, and trucks; advances in cargo movement efficiencies; the locations of manufacturing centers for products and commodities moved; and consumer concern about the carbon footprint of goods to be purchased. The key factors that have led to operational efficiency improvements to date are the cost of energy, current and upcoming regulatory programs, and the competitive nature of the goods movement industry. We anticipate these factors will continue to have an effect on GHG emissions in the foreseeable future.

In order to reach the targets of 40% reduction in GHG emissions in 2030 and 80% reduction in GHG emissions in 2050, compared to 1990 levels, the Ports will need to overcome tremendous

challenges and will need to be prepared to address those challenges in new ways. The Ports will need a long-term vision and a coordinated, collaborative effort with both the industry and the regulatory agencies to realize the needed emission reductions from maritime goods movement-related sources.

Strategies

The CAAP strategies are aligned to broad State Agency Actions identified in Appendix C of the Sustainable Freight Action Plan:

1. Clean Vehicles and Equipment Technology and Fuels
2. Freight Infrastructure Investment and Planning
3. Freight Efficiency

Energy resource planning, which is a critical part of the path to zero-emissions, falls under “freight infrastructure investment and planning” in the Sustainable Freight Action Plan. Due to the importance of energy infrastructure and supply for implementing the CAAP actions, the Ports are identifying energy planning as its own action:

4. Energy Resource Planning

With a health risk reduction goal for 2020 and emission reduction goals for 2023, 2030, and 2050, the Ports will require near- and long-term approaches to achieve our goals.

In the next few years, there is still a need to develop and demonstrate the zero- and near-zero-emissions technologies that will be critical to helping us reduce emissions in the long term. Where cleaner engine technologies are already certified and feasible, the Ports will use a combination of incentives and requirements to support more widespread deployment.

In the long-term, as cleaner technologies are developed and become feasible and commercialized, the Ports will look to drive the pace of deployment of such equipment to produce the cleanest fleet possible. By necessity, some strategies, particularly those for ships, will have long timeframes to accommodate the limited availability of cleaner equipment and to ensure adequate notice and planning timelines for fleet turnover.

In addition to the specific strategies listed throughout this section, the Ports are committed to several overarching goals that cut across the categories of clean vehicles and equipment technology, freight infrastructure, freight efficiency, and energy resource planning:

- Technology Advancement
- Regulatory Advocacy
- Funding Advocacy

Technology Advancement

One important initiative that was established in 2007, soon after the adoption of the original CAAP, is the Technology Advancement Program (TAP) ²³. This program is a collaborative partnership among the Ports, regulatory agencies, and industry partners, including shipping lines, terminal operators and the trucking industry. Through the TAP, the Ports have led the way in advancing emission reduction technologies for the port sector.

Under the guidance of the TAP, the Ports fund the development and demonstration of promising emission-reduction technologies. Since its inception more than 10 years ago, the TAP has become a catalyst for identifying, evaluating, and demonstrating new emissions reduction technologies for potential commercialization and deployment throughout the port complex to help achieve the CAAP goals. The TAP has advanced cutting-edge technology in use today, such as pollution capture systems for ships at berth and hybrid-electric rubber-tired gantry cranes. The Ports have committed almost \$15 million for nearly 35 projects, many of which have resulted in commercialized technologies now deployed throughout the port complex.

This program will remain a critical component of our efforts going forward as we rely on the development and deployment of technologies to meet our CAAP goals. The 2017 CAAP Update reaffirms our commitment to technology development and demonstration. The TAP, which has focused mainly on technologies with criteria pollutant reductions, will evolve to include technologies and approaches with the potential to reduce GHGs in order to help us meet our new GHG reduction targets. TAP Guidelines will be modified to reflect a prioritization on focused solicitations for targeted source categories and emission goals, including GHG reduction. This will allow the Ports to direct our resources to supporting development of technologies where there is the greatest need.

Over the next few years, the Ports envision specifically targeting TAP investments toward technologies for harbor craft, ships, and zero-emissions cargo-handling equipment and trucks, as well as for technologies or operational approaches that improve freight efficiency in order to reduce fuel consumption, and thus, GHGs.

Regulatory Advocacy

The Sustainable Freight Action Plan highlighted the State's intention to advocate for new engine tier levels for locomotives and ships, and SCAQMD has petitioned the federal government for a national near-zero-emission engine standard for trucks. The Ports have supported these efforts

²³ More information about the TAP is available at www.cleanairactionplan.org/tap

and will continue to do so. Additionally, the Ports will continue to advocate for making source specific strategies developed at the local port level into state or federal mandates, in order to minimize diversion of cargo to other gateways with less restrictive environmental controls, potentially resulting in an increase in global emissions.

In support of the CAAP, the Ports propose to participate in, advocate for, and support regional, State, and federal efforts to move forward on the following regulations:

- Near-zero-emission engine standard for on-road trucks
- Tier 5 engine standard for locomotives
- Tier 4/particulate matter engine standard for vessels
- Statewide vessel speed reduction
- At-berth emission controls from non-regulated vessels
- New fleet turnover requirements for harbor craft
- Idling restrictions and fleet turnover requirements for cargo handling equipment

It is important to preserve access to state and federal funding to accelerate implementation of these strategies, in advance of any regulatory requirements.

Funding Advocacy

In the short term, early adoption of cleaner technologies will require financial support to offset higher incremental costs. Capital costs are likely to remain very high for both manufacturers and operators of the advanced technologies envisioned in the CAAP. Expanding on-dock rail infrastructure and installing emission-control technologies to reduce ship emissions at berth will require significant investments. Furthermore, it is anticipated that a substantial amount of electrical infrastructure must be installed at terminals, including major utility upgrades to bring additional power to the ports, in support of electrified zero-emissions cargo-handling equipment.

The Ports have estimated incremental costs between \$7 billion and \$14 billion for new technologies, infrastructure investments, and incentive programs to support the CAAP strategies.²⁴ This is in addition to Port investments in on-dock rail infrastructure. Outside of any state and federal funding that can be secured to support these efforts, these costs will be borne by the Ports themselves and private industry. Moreover, a large portion of these costs must occur within the next 5 to 7 years to ensure the necessary infrastructure is in place to support the

²⁴ For information on these cost estimates, please see the “Preliminary Cost Estimates for Select 2017 Clean Air Action Plan Strategies” at www.cleanairactionplan.org.

equipment transition; fleets cannot begin to convert to near-zero or zero emissions without adequate charging and fueling capabilities.

Keeping the Ports economically competitive amidst this transition to cleaner goods movement will be challenging, however it is necessary that we find this balance for these actions to be sustainable. By far, this 2017 CAAP Update represents the largest environmental investment ever undertaken by a port complex, and these strategies will place an enormous financial burden on the Ports and goods movement industry. The CAAP cannot be successful, and the industry cannot remain economically competitive, without the significant financial support of the state and federal government.

Federal, state and regional government incentives can help offset costs where production of this equipment is low due to the presence of less expensive alternatives and the resulting lack of widespread demand. Government subsidies are also needed in the near-term to install the critical infrastructure and to support additional research, development, and demonstration projects. The Ports have already begun to advocate for incentive funding from federal, state, and regional sources to assist with these efforts, and will remain actively involved in these discussions throughout the implementation of this CAAP.

The Ports will also serve in an advocacy role, between port operators and funding agencies, to help reduce barriers for applicants and to ensure funding awards will be targeted for priority projects in support of the CAAP goals. This includes advocating for streamlined application processes and flexibility on eligible costs, maximum funding levels, and timelines for implementation.

In addition, many small operators and tenants require assistance to apply for grant opportunities. The Ports will expand current efforts to make our tenants aware of upcoming grants and support them with the application process and reporting requirements. In some cases, as has already occurred, the Ports will take on the role of project partner and grant administrator.

1. Clean Vehicles and Equipment Technology and Fuels

Cleaner engine technologies are the cornerstone of more sustainable goods movement. The Ports are committed to advancing technologies that move our industry toward zero emissions and to ensuring that our fleets are among the cleanest in the world. The strategies below support the State's goal of deploying 100,000 zero-emission vehicles by 2030, the goals of the mayors of the cities of Los Angeles and Long Beach, and reinforce our continued push to reduce port-related air quality impacts. With a combination of requirements and incentives, the Ports aim to advance feasible, cutting-edge technologies and support deployment as expeditiously as possible. In addition, the Ports encourage operational changes that generate significant emission reductions for our communities.

Where cleaner technologies and certified engines already exist, the Ports are proposing near-term strategies to accelerate deployment. Where technologies do not exist, or where there is expected to be longer lead times required for adoption, particularly for ships, the Ports are proposing strategies with longer timeframes and incremental near-term milestones to get us to our ultimate outcome.

1.1. Clean Trucks Program

The Clean Trucks Program (CTP), adopted in 2007 and launched in October 2008, was a groundbreaking initiative to phase out the oldest, dirtiest trucks serving Port terminals by banning trucks older than 2007 engine model year (MY) between 2 and 6 years in advance of the State Drayage Truck Rule. The benefits of this program cannot be overstated. By 2010, just over two years from initiation of the program, more than 90% of the fleet was transformed to 2007 EPA compliant trucks, which have significantly lower emissions than their predecessors. By January 1, 2012, 100% of the fleet consisted of 2007 EPA-compliant trucks or newer, two full years before the State Drayage Truck Rule requirements went into effect in 2014.

Numerous challenges arose with implementing the original CTP. The Ports had never undertaken a program that was so transformational to a sector of the port industry. There were many concerns with the ability of the trucking sector to take on the costs of upgrading its equipment and uncertainty as to the availability of enough clean trucks to meet the operational needs of the Ports. Many of the trucks used in drayage were older, in some cases many decades old. Drayage is a low-margin industry and many of the truck owners were not well positioned to invest in newer, more expensive trucks. At the same time, however, new state and federal regulations provided opportunities for aggressive action. CARB was in the regulatory development process to establish requirements for trucks servicing ports and rail yards in California. This regulation

served as a basis for the Ports requirements that accelerated the state's requirements and timeline locally by between two and six years with financial support of grants, incentives, and bulk purchase pricing to help the industry to comply. Finally, the EPA had already promulgated emissions standards for new heavy-duty on-road truck engines manufactured in 2007 and 2010, providing assurances that truck engines meeting the emissions requirements would be available.

Through the combined efforts of the Ports, availability of grant funding to purchase new trucks, and the impending 2014 turnover requirements of the State Drayage Truck Rule, the transition of the older trucks serving the Ports was dramatic and very effective. Our latest emissions inventories show that truck-related DPM emissions have decreased 97% since 2005.²⁵

While this progress is remarkable and should be celebrated, there is still a need for further emission reductions, and more needs to be done. According to the 2016 port emissions inventories, trucks remain a significant source of emissions. Port trucks contribute 23% of the total NO_x emissions, making them the second largest source of NO_x emissions at the Ports. Further, port trucks are the largest contributor of port-related GHG emissions, representing 40% of total port-wide GHG emissions.

The issue of the best path to zero emissions was one of the most hotly debated issues during the Draft CAAP Update comment period. The Ports are fully committed to our goal of transitioning to zero emissions by 2035. The Ports will also work with the industry to deploy the cleanest available feasible technology in order to benefit the region's and state's emission reduction needs and to reduce health risks to the community in the near term. The many issues contributing to this choice are discussed further below. We believe that near-term deployment of cleaner transitional technologies will not detract from our ultimate zero-emissions goal.

In order to continue reducing NO_x and GHGs, through the strategies described below, the Ports' goal is to transition the current drayage truck fleet to near-zero technologies in the near-term and ultimately zero-emissions technologies by 2035. As of the end of September 2017, 53% of the engines in the Ports' drayage fleet met the 2007 EPA standard and 47% met the 2010 standard.

Importantly, zero- and near-zero-emissions trucks are not yet commercially available; however, several recent demonstration projects utilizing a variety of technology and fuel types, described in more detail below, have shown great promise.

²⁵ 2016 Emissions inventories

Near-Zero Emissions

A truck with an ultra low-NO_x engine, also known as a near-zero-emissions truck, is up to 90% cleaner than the cleanest trucks today. When paired with renewable fuels, the near-zero-emissions engine truck will also provide significant GHG reductions.

SCAQMD and other partners are working with Cummins Westport Inc. (CWI) to develop and demonstrate a natural gas-fueled 11.9L near-zero-emissions engine as a follow-on effort to CWI's recent certification and commercialization of its smaller 8.9L ISL G NZ near-zero-emissions engine. The most recently announced schedule anticipates the larger near-zero-emissions engine to be available in early-2018. The only near-zero-emissions engines to be available in the next few years are fueled by natural gas; however, CARB has projected²⁶ that diesel-fueled near-zero engines are likely to become available sometime after 2020.

Moreover, CARB's 2016 State Strategy for the State Implementation Plan²⁷ proposes to promulgate a new engine standard in 2019 that will require all new heavy-duty engines manufactured in 2023 to meet the near-zero-emissions level. The new standard will produce 90% less NO_x emissions than today's engines, however, agency staff have indicated that further evaluation is necessary to define the specific NO_x emissions rate. At this point, it is unknown what the final engine standard will be, although it is anticipated to be between 0.02 g NO_x/bhp-hr and 0.05 g NO_x/bhp-hr.

Zero Emissions

There are ongoing demonstrations of zero-emission truck technologies as part of the Zero Emission Cargo Transport programs (I and II) being led by the SCAQMD and financially supported by the Ports' TAP. These projects include battery-electric, fuel cell, and plug-in hybrid (both natural gas and diesel) trucks capable of operating in "zero emissions mode" for short distances from more than half a dozen manufacturers with several trucks already in service. Additionally, SCAQMD has received Greenhouse Gas Reduction Funds to develop and demonstrate 44 zero-emissions trucks, which are expected to enter service in late 2018.

Also, the SCAQMD is piloting an overhead catenary system to provide wayside power to electric trucks when connected to the system. The Ports are providing financial support for the project. The 1-mile demonstration test track is located near the Ports. The project includes retrofitting zero-emission trucks with devices to allow them to attach to the overhead electric lines to draw

²⁶ https://www.arb.ca.gov/msprog/tech/techreport/ta_overview_v_4_3_2015_final_pdf.pdf

²⁷ <https://www.arb.ca.gov/planning/sip/2016sip/2016sip.htm>

power from the grid while in motion. This demonstration has begun and results are expected in 2018.

By the end of 2019, there should be nearly 70 zero-emissions trucks in demonstration at the Ports and throughout the region.

Many stakeholders have urged that waiting for many years while zero-emission technologies can become commercially and operationally viable is not acceptable due to the urgent health impacts on local communities in Southern California. The Ports agree. As a result, the Ports propose a Clean Trucks Program that attempts to strike a balance between maximizing near-term benefits with available near-zero engine technologies while defining a clear path with concrete steps and a schedule toward achieving the ultimate goal of zero emissions.

There is still significant effort needed for these zero- and near-zero-emission technologies to become feasible and commercialized. One near-zero-emission truck is expected to be commercially available as soon as next year. Other near-zero and zero-emission technologies may take several years to become commercialized and feasible for drayage. The aim of this strategy is to identify a long-term schedule so that the trucking industry can know the expectations and can plan ahead for new equipment purchases. This strategy is also a signal for the truck manufacturers and technology developers to gauge the anticipated demand and timeline needed for these cleaner technologies and to develop more affordable options, especially for zero-emission units that are now two to three times the cost of conventional trucks, in order to fit within the existing business model. As a result, funding advocacy efforts to our state and federal legislators and agencies will be necessary to secure incentive dollars in order to urge early adopters to begin to use this equipment.

Stakeholder Input

Throughout the 2017 CAAP Update process, the Ports have met with numerous community, environmental and industry groups, and the regulatory agencies, and received many comments related to the strategy for trucks. In fact, more public comments have been received on the proposed strategy for trucks than for any other strategy included in this Plan. These comments, in addition to the legislative changes previously discussed and various modeling and forecasting analyses, have led to changes in the proposed truck strategy throughout the update process.

Many stakeholders lauded the inclusion of a deadline for zero-emissions trucks; however, stakeholders also expressed the need for interim milestones for near-zero-emissions and zero-emissions trucks in order to ensure introduction of cleaner trucks to the fleet earlier than 2035.

A significant number of comments were received from stakeholders supporting the ACT Now Plan²⁸, which called for immediate requirements to use trucks with engines that meet 0.02 g NOx/bhp-hr in order to replace all diesel-fueled trucks with natural gas-fueled trucks within 5 years, starting as soon as 2018.

The trucking industry has had significant concerns about near-term requirements that would come into effect prior to the current regulatory deadlines. Trucking companies develop their fleet replacement plans years in advance and have purchased trucks to be compliant with the State Truck and Bus Rule, which bans pre-2010 MY trucks in 2023; any acceleration of this timeline, according to some commenters, would not give these companies enough time to recoup their nearly \$1 billion investment to comply with the current requirements, or to plan and budget for replacements. Additionally, the industry expressed concerns about fees. An early proposal to implement a continuous fee on 10-year-old and older trucks starting in 2018 elicited objections based on assertions that properly serviced trucks can maintain low emission levels for many years and that a fee would arbitrarily diminish the value of these trucks without justification. The industry has also questioned the legality of a mechanism to impose a rate on all trucks with exemptions for trucks that meet certain emissions standards, claiming that such a strategy is likely preempted under federal law. Lastly, industry stakeholders expressed concern over the availability, viability and cost of near-zero and zero-emissions technologies, especially within the aggressive timeline proposed.

The regulatory agencies, specifically CARB and AQMD, identified a need to meet near-term emission reductions in order for the region to achieve the National Ambient Air Quality Standard (NAAQS) for 8-hour ozone in 2023. In order to meet this emission reduction requirement, they believe that near-zero-emission trucks will play a vital role and that significant numbers of these trucks will need to be in operation at the ports by 2023. To ensure this, both agencies commented that the truck rate should be initiated prior to 2023, or by at least 2020, if not sooner.

In addition, as mentioned previously, the recently approved Senate Bill 1 (SB 1) prohibits new regulatory requirements by the State to replace, retire, repower, or retrofit heavy-duty trucks before the truck has reached the earlier of either 800,000 vehicle miles traveled or 18 years from the engine model year. As a result, it is not anticipated that CARB will develop any new regulations that establish near-term requirements for trucks. Therefore, the Ports are unable to follow our previous CAAP strategy of advancing ban deadlines contained within a state truck in-use regulation.

²⁸ <http://cngvc.org/wp/wp-content/uploads/2017/04/ACT-Now-Plan-Final.pdf>

Lastly, many port drayage truck drivers have raised serious and legitimate concerns about the impact of expensive new technologies on the working conditions of the thousands of drivers who haul cargo to and from the ports. The problem arises due to the high cost of new technology being beyond what most drivers can afford. During the previous Clean Trucks Program, a widespread drayage industry practice was for licensed motor carriers to purchase the trucks and lease them to drivers with lease deductions taken directly from the payments to the drivers. Some have argued that this practice was highly successful for achieving the rapid replacement of trucks. Numerous drivers have complained, however, that these expenses and deductions left little remaining to cover living expenses. These issues were documented in a series of stories in the media, including a recent article in USA Today,²⁹ and elsewhere. The question of how to fund the billions of dollars required for the replacement of trucks to zero and near-zero emissions vehicles poses a significant challenge for the financial viability and long-term economic sustainability of a clean truck fleet. It should not fall solely on the drivers to fund the transition to a new truck fleet to serve the Ports. It is critical that the drivers, motor carrier companies, Ports, goods movement industry, cargo owners, agencies, and legislators all work together on solutions to address this problem in order to transition to a sustainable cleaner truck fleet and a drayage system that does not place an undue burden on any particular party.

The Ports have thoughtfully considered all of these factors, taking into account the need to reduce emissions for community health and to meet our criteria pollutant and greenhouse gas reduction goals, while minimizing economic impacts on the industry, and utilizing the Ports' authority within our jurisdiction. As described above, it is our intent to identify a long-term process and schedule so that the trucking industry can know the expectations and can plan ahead for new equipment purchases coupled with near-term actions for immediate public health benefits. To that end, key highlights related to the proposed new truck strategy are outlined below:

- immediately requires any new trucks entering the port drayage registries to meet the cleanest engine manufacturing standard,
- establishes an approach to accelerate the transition to near-zero-emission trucks in the early years, and zero-emission trucks in the later years,
- provides a long-term schedule for the drayage industry to budget and plan for the eventual transition to zero emissions,
- commits to an early action pilot of a state heavy-duty truck emission inspection program (e.g. Heavy-Duty Smog Check) to improve drayage truck repair rates and emissions performance and retire non-complaint trucks with excessive emissions,

²⁹ USA TODAY, "Rigged." June 16, 2017. <https://www.usatoday.com/pages/interactives/news/rigged-forced-into-debt-worked-past-exhaustion-left-with-nothing/>

- defines a stepwise transition to zero emissions, including incentives and pilot programs to introduce these trucks to the fleet prior to 2035, and
- includes frequent feasibility assessments to identify the state of near-zero and zero-emissions technologies, potential challenges for meeting the goals, opportunities for earlier penetration of the cleanest trucks, and to inform our progress throughout the implementation period.

The proposed Clean Trucks Program update is as follows:

- Beginning in mid-2018, new trucks entering the Ports' Drayage Truck Registry (PDTR) must have a 2014 engine model year (MY) or newer. Existing trucks already registered in the PDTR can continue to operate.
- Beginning in early 2020, following promulgation of the state's near-zero-emission heavy-duty engine standard, all heavy-duty trucks will be charged a rate to enter the ports' terminals, with exemptions for trucks that are certified to meet this near-zero standard or better.
- Starting in 2023, or when the state's near-zero-emission heavy-duty engine standard is required for new truck engine manufacturers, new trucks entering the PDTR must have engines that meet this near-zero emissions standard or better. Existing trucks already registered in the PDTR can continue to operate.
- Modify the truck rate so that by 2035 only trucks that are certified to meet zero-emissions will be exempt from the rate.

Immediate Requirements for 2014 Engine Model Year Trucks

Starting in mid-2018, the Ports will require that any new trucks entering port drayage service meet the State's 2010 emissions standard. Under the current requirements for the Ports' Clean Trucks Programs and the State Truck and Bus Rule, all trucks must have engines that, at a minimum, meet the federal 2007 engine emission standard of 1.2 g NO_x/bhp-hr. Based upon the most recent report from the PDTR, all trucks in operation at the Ports are compliant with that standard. Further, as of September 2017, 47% of the registered trucks in operation at the ports are already MY2010 or newer, well in advance of the State's regulatory requirement which requires trucks to have MY2010 engines by 2023. Ensuring that any new trucks entering the PDTR at least meet the 2010 engine emission standard will accelerate near-term reductions from port truck trips.

All trucks with pre-2010 engines entered into the PDTR before the 2018 implementation date will be allowed to continue providing drayage services until the state requires replacement in 2023.

The specific new registration requirement will be for trucks to have model year 2014 or newer engines. This was chosen for two reasons. First, a portion of the 2010 to 2014 model year truck engines are not compliant with the federal 2010 emissions rate of 0.2 g NO_x/bhp-hr due to credits that engine manufacturers received to build the engines. Second, the 2014 MY engines are equipped with On-Board Diagnostics that will assist with engine testing and maintenance compliance going forward. Therefore, trucks with 2014 MY engines provide the current cleanest engine emissions level coupled with on-board diagnostics to assist in maintaining that level.

Transition to Near-Zero-Emission Truck Engines

CARB's State Strategy for the State Implementation Plan³⁰ proposes to require a manufacturing standard for all new heavy-duty engines to meet a near-zero-emission standard starting in 2023. It is anticipated that this standard will be promulgated in 2019, and the NO_x emissions level will be established somewhere between 0.02 g/bhp-hr and 0.05 g/bhp-hr. The Ports intend to hasten the penetration of these CARB-certified near-zero-emission trucks into the drayage fleet with financial inducements for those trucks starting immediately.

Further, starting in early 2020, or following promulgation of the State's near-zero-emission heavy-duty engine standard, a rate will be charged to the beneficial cargo owners for all heavy-duty trucks to enter the ports' terminals, with exemptions for trucks with CARB-certified near-zero engines or better. Initiation of this rate will be contingent on several critical elements.

- Promulgation of a near-zero-emission standard: This is a very important step for the Ports to initiate a new truck rate. The state is expected to establish the allowable emission level for near-zero-emission truck engines in 2019. The state will also be responsible for certifying whether or not particular truck engines developed by various manufacturers meet this emission level. The Ports will rely on these certifications as the determination of whether or not particular engines are considered to be near-zero emissions.
- Economic study to establish the Clean Truck Fund rate: The Clean Truck Fund rate amount will be established based upon an economic study that will evaluate the capacity of the industry to absorb this expense in light of existing costs and other fees, including an assessment of how the rate will affect the Ports' economic competitiveness and the potential for cargo diversion. All funds collected through the assessment of the rate will be used for trucking initiatives, for example, for incentives to the trucking industry for purchase of near-zero and zero-emission trucks.

³⁰ <https://www.arb.ca.gov/planning/sip/2016sip/2016sip.htm>

- **Technology Feasibility and Commercial Availability:** The feasibility assessment for trucks, which will initially be developed in 2018 and updated periodically, will provide information about the feasibility of the technology, including confirmation of the availability of trucks suitable for drayage operations that meet this certification level.
- **Clean Truck Fund rate collection mechanism:** The Ports will need to establish a mechanism to collect the rate on individual truck calls and to assess the appropriate amount to the owner of the cargo being hauled by the truck.

In addition, the Ports have already begun early funding advocacy efforts with the goal of securing grants from state and federal programs to support early deployment of near-zero emission trucks. The Ports will work with the trucking industry to identify opportunities for early deployment of near-zero technologies, in partnership with technology manufacturers and fuel providers.

After January 1, 2023, when California's new engine manufacturing requirement is expected to come into effect, the Ports will only allow trucks with certified near-zero-emission engines or cleaner to be entered for new service into the PDTR. All trucks that are compliant with the requirements of the State Truck and Bus Rule that are entered into the PDTR before 2023, will be allowed to continue providing drayage services.

Under the previous Clean Trucks Program, which imposed a fee on older trucks, roughly 90% of the trucks were replaced within three years with cleaner models while 10% chose to pay the fee in the short term. Thus, the assessment of the truck rate could result in a significant turnover to near-zero-emissions trucks in the near-term while giving fleet owners flexibility and ample time to plan for new purchases. The Ports project that by 2024, as a result of the truck rate starting in 2020 and the 2023 requirement for any new trucks entering the service, near-zero-emission trucks could comprise roughly 70% to 90% of the drayage truck fleet.

Financial incentives will be critical to meet this rate of turnover. The Ports intend to work closely with the federal, state, and local governments to secure incentive funding for near-zero-emission trucks in the near-term.

Transition to Zero-Emissions Trucks

To support the goal of ultimately transitioning to a zero-emission truck fleet in 2035, the truck rate implemented initially in 2020 will gradually be modified so that by 2035 it will only provide exemptions for trucks that are certified by the state to meet zero-emissions specifications.

The initial effort to introduce near-zero emission trucks into the Ports' drayage trucking fleet is not intended to slow down the parallel ongoing effort to transition the entire truck fleet to zero emissions by 2035. This approach aims to balance the near-term emission reduction needs by using cleaner technologies that will be feasible in the next few years, and allowing time for the cleanest, zero-emission technologies to develop and become feasible in the future. Near-zero-emission technologies are expected to be commercially available and mass-produced in the next few years, while the zero-emission trucks may not be available for some time. Significant effort and advancement will be needed to manufacture a sizeable fleet of commercialized zero-emission trucks that are capable of meeting the challenging cargo drayage duty-cycle operational requirements, and that are reliable, durable and affordable. Providing fueling or charging infrastructure to support the use of zero-emission trucks throughout the region will take major planning and funding as well. Similar to the challenges of transitioning to near-zero-emission trucks, financial incentives will be critical to make the switch to zero-emission trucks. The cost to transition to zero-emission technologies is anticipated to be substantial. The Ports plan to work with federal, state, and local agencies to secure funding for the effort to help turn over the fleet to zero-emission. Finally, the Ports will continue to work with state and federal agencies to obtain regulatory support for the transition to zero emissions in order to strengthen the program and expand the requirements beyond just the San Pedro Bay area.

Based on the strategy outlined above, the Ports projected the truck fleet composition in key years: 2021, 2024, 2031, and 2036. To determine the composition, the Ports had to make assumptions about the number of near-zero and zero-emissions trucks that could enter the fleet at certain times in response to the truck rate or new registration requirements. Because of the uncertainty, the Ports tested a range of assumptions, resulting in seven possible scenarios. These scenarios and the complete methodology are described in detail in the document "Potential Emission Reductions from Select CAAP 2017 Strategies."³¹

Table 1 shows the projected distribution of the fleet in the key years. The "No Action" column presents the projected fleet distribution absent a new Clean Trucks Program, in other words,

³¹ Available at www.cleanairactionplan.org

“business as usual.” The “Clean Trucks Program” column presents the projected distribution under the new strategy, incorporating the following assumptions:

- In 2021, the Ports estimated that between 5% and 10% of the fleet could turn over to newer trucks in response to the rate beginning in 2020. Some of these trucks would have 2014+ engine model years; the remainder would be near-zero emissions.
- In 2024, 2031, and 2036, the Ports have provided a range of near-zero and zero-emission truck penetration based on a variety of assumptions regarding the effectiveness of the rate’s impact. On the low end, the Ports estimated that 25% of trucks would turn over to near-zero and then zero-emissions, and on the high end, the Ports estimated that 100% of trucks would turn over in response to the rate.
- In 2024, 2031, and 2036, the Ports varied the assumed penetration rate of zero-emissions vehicles based upon the projected availability of vehicles and financial incentives.
- The projections also take into account natural fleet turnover, that is, trucks that would normally be expected to leave the fleet and get replaced with newer trucks because they have reached the end of their useful lives.

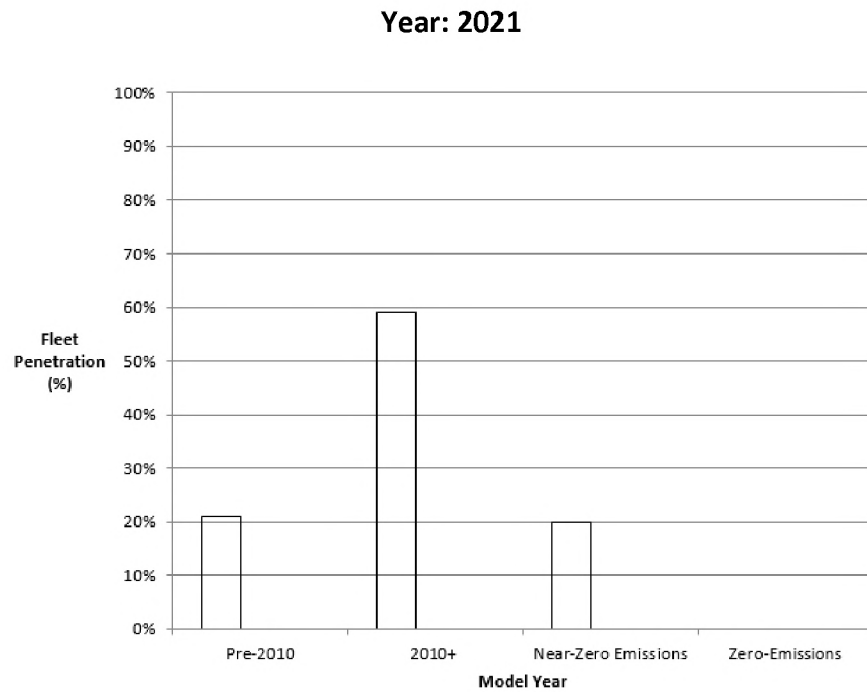
Based on the assumptions above, the Ports generated the projected fleet distribution, which is captured in the “Clean Trucks Program” column. These scenarios present a bounding analysis to understand what levels of fleet turnover will be needed, on what timeframe, in order to achieve various levels of near-zero and zero emissions trucks. These scenarios (including Tables 1 and 2 below) should only be considered initial planning estimates to guide Clean Truck Program development, including the economic study to establish the clean truck rate. These scenarios should not be considered commitments, as any such commitments would need to be evaluated by the Boards of Harbor Commissioners of the two Ports as part of initial program development and ongoing program performance.

Table 1: Projected Fleet Distributions in Selected Years (% of Trucks)

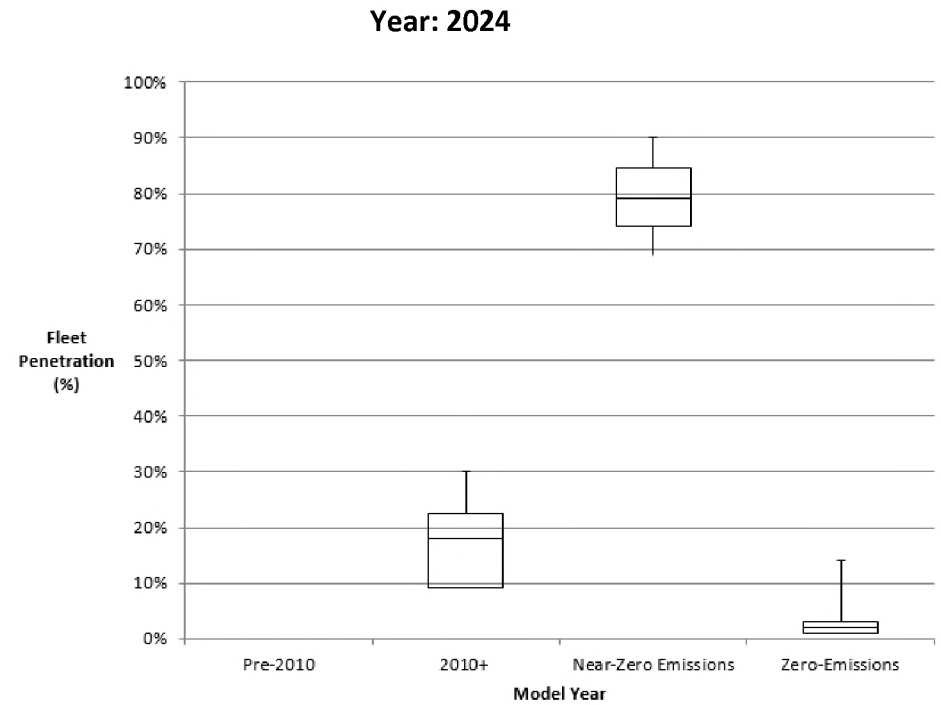
	No Action				Clean Trucks Program			
	2021	2024	2031	2036	2021	2024	2031	2036
Pre-2010	46%	0%	0%	0%	20-23%	0%	0%	0%
2010+	54%	100%	100%	100%	59-64%	9-30%	1-3%	0-1%
Near-Zero Emissions	0%	0%	0%	0%	13-20%	69-90%	55-90%	0-44%
Zero-Emissions	0%	0%	0%	0%	0%	1-14%	7-44%	55-100%

Figure 3 graphically represents the projected fleet distributions.

Figure 3: Projected Fleet Distributions, with Proposed Clean Trucks Program

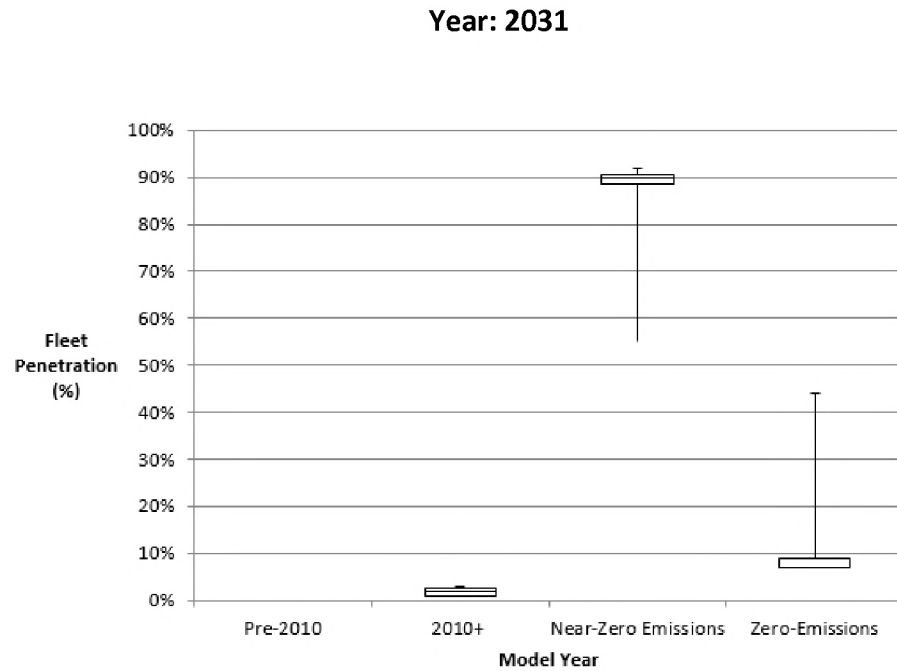


Note: In 2021, without the Ports' proposed Clean Trucks Program, the truck mix is expected to be 46% pre-MY2010 trucks and 54% MY2010+

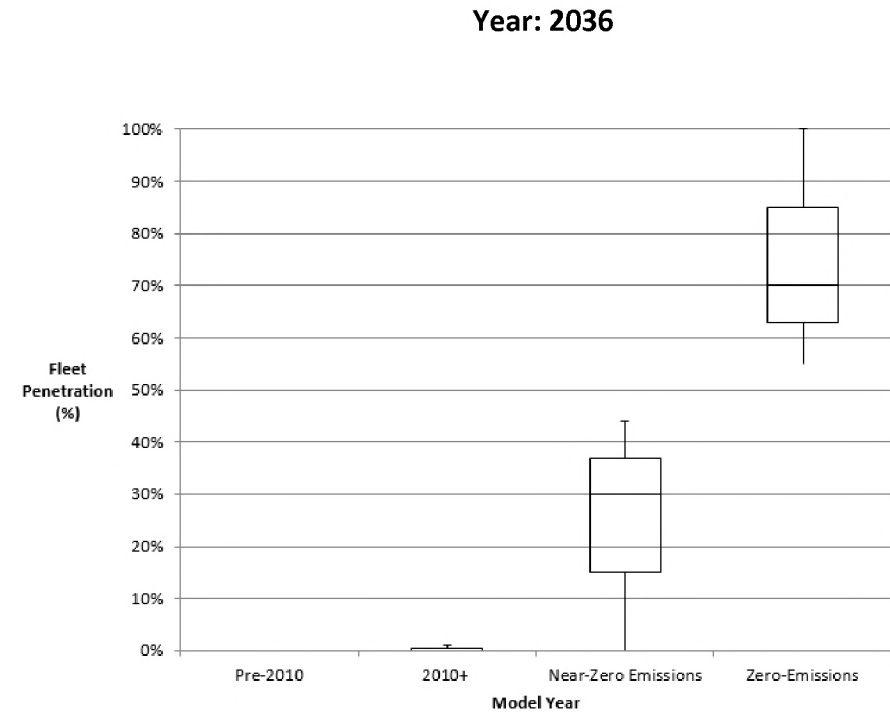


Note: In 2024, without the Ports' proposed Clean Trucks Program, the truck mix is expected to be 100% MY2010+

Figure 3 (continued): Projected Fleet Distributions, with Proposed Clean Trucks Program



Note: In 2031, without the Ports' proposed Clean Trucks Program, the truck mix is expected to be 100% MY2010+



Note: In 2036, without the Ports' proposed Clean Trucks Program, the truck mix is expected to be 100% MY2010+

These fleet penetration scenarios are based upon a set of assumptions related to the potential effectiveness of the specific details of the proposed Clean Trucks Program, including the most aggressive assumptions to get up to a 100% zero-emissions drayage fleet by 2035. Other efforts, chiefly the aggressive funding advocacy campaign that will be conducted by both Ports, are expected to result in accelerated turnover of trucks to near-zero through 2023, and zero-emissions through 2035. Substantial funding support by state and federal agencies will be critical to build upon the efforts of the Ports' CTP strategies to meet the ultimate goal of 100% zero-emissions trucks by 2035.

In support of the transition to cleaner trucks, the Ports would take additional actions, including:

- conducting feasibility assessments to evaluate the state of the technology development, infrastructure availability, and economic factors for deployment of zero-emissions trucks by 2035 and to provide interim progress reports on deployment of near-zero and zero-emission trucks;
- facilitating, supporting, and expanding upon the state's comprehensive heavy-duty vehicle maintenance, repair and inspection program currently under development by serving as the pilot location for implementation;
- waiving the Clean Truck Program annual registration fee for near-zero and zero-emission vehicles, effective upon adoption of each port's Clean Truck Program tariff; and
- conducting a larger-scale pilot deployment of zero-emission trucks to demonstrate the technology in targeted duty cycles.

These supporting efforts are described in more detail below.

Feasibility Assessments

In support of this strategy, the Ports will conduct a feasibility assessment by the end of 2018 with updates every 3 years or as new information becomes available. These studies will evaluate the technological, operational, and economic considerations as well as the cost-effectiveness of new truck technologies. These feasibility studies will inform the 2035 timeline for implementation and will identify potential challenges that need to be addressed in the intervening years to ensure the timeline is achieved. In addition, the feasibility studies may identify if there is a long-term need for near-zero-emission trucks in certain duty cycles. The scope and process for developing

these assessments is described in the accompanying document, “A Framework for Developing Feasibility Assessments.”³²

Heavy-Duty Vehicle Inspection Pilot Program

CARB’s Periodic Smoke Inspection Program (PSIP) and Heavy-Duty Vehicle Inspection Program (HDVIP) are designed to ensure that heavy duty trucks are well maintained and are working properly in order to achieve expected emission reductions. These programs are more than 20 years old and are being updated to address the newer modern engine technologies and after-treatment systems. For the PSIP, ARB is proposing to revise the current opacity threshold to assist in identifying heavy-duty trucks in need of repair due to malfunctioning diesel particulate filters.

For the HDVIP, CARB is developing a more comprehensive program that would be similar to the smog check program for passenger automobiles. Ongoing efforts to develop a comprehensive heavy-duty vehicle inspection and maintenance program are expected to be finalized by 2020.

The Ports intend to facilitate and support CARB with these efforts to amend and implement these updated programs. With over 17,000 heavy-duty trucks signed up in the PDTR, the Ports are in a unique position to carry out effective pilot programs. In initial discussions with CARB staff, the Ports have offered to facilitate pilot programs at agreed upon locations throughout the Port complex.

It is currently estimated that a small portion (< 5%) of the drayage fleet that services the ports has issues with its after-treatment devices resulting in additional emissions. The Ports account for those increased emissions through the application of the state’s emission modeling tools used in our annual emissions inventories. The Ports’ efforts to facilitate and support CARB will assist in identifying higher polluting trucks and ensuring they are repaired for improved performance or eliminating them from the fleet and thus lowering those emissions. Additionally, the program will be able to provide better data on the actual emission levels of the trucks in operating in port drayage. Finally, support for CARB’s maintenance and repair programs will ensure that the drayage trucking fleet at our Ports remains clean over time.

³² Available at www.cleanairactionplan.org

Annual Registration Fee Waiver

As an early incentive to purchase near-zero and zero-emission trucks, the Ports anticipate waiving the annual truck registration fee. These fees are used to cover the administrative costs associated with managing each port's Clean Trucks Program. Current practice by both ports has been to exempt the cleanest trucks from the fee on a case-by-case basis to support prototype demonstration projects.

Each port charges an annual fee of \$100 per truck registered in the PDTR. Assuming a truck stays 10 years in the PDTR, the owner would spend \$2,000 on fees per truck to operate at both ports. There are more than 40 trucking companies serving the Ports that have at least 100 trucks in their fleets, and the largest fleet has 1,250 trucks. Waiving the fees would equate to \$20,000 in savings for fleets of 100 near-zero or zero-emissions trucks over a 10-year span; the largest operator would save \$2.5 million in that time. Although seemingly insignificant on a per-truck basis, the aggregate savings could be substantial, particularly for larger fleets. By waiving these fees, the Ports could help incentivize and accelerate the transition to cleaner trucks. In future years, the Ports will evaluate the administrative expenses associated with the Clean Trucks Programs and the penetration of cleaner trucks to assess the long-term need for these fee waivers.

Pilot Deployment

Zero-emissions on-road drayage trucks, whether battery- or fuel-cell powered, face range limitations in the near term when compared to their diesel counterparts. They are also very dependent upon access to electric-charging infrastructure or hydrogen fueling. The infrastructure requirements are a key challenge in Southern California due to the long distances trucks must often travel to conduct business. Therefore, zero-emission on-road vehicles are likely to be focused on short-haul duty for the near term, often limited to trips to and from the near dock railyards, or other nearby warehouses or yards.

These short-distance runs are a prime candidate for early introduction of zero-emissions trucks. To that end, the Ports will seek to demonstrate 50 to 100 zero-emissions trucks in targeted duty cycles, using the results to assess whether additional incentives or programs may accelerate the penetration of zero-emissions trucks before 2035 in short-haul applications. Beginning in 2018, the Ports will work to identify potential partners for the pilot project, including licensed motor carriers, truck manufacturers, technology developers, utilities and/or fuel providers, and funding agencies, in order to develop a defined scope of work and project budget. Once project partners and funding sources have been confirmed, the Ports will proceed to implementation.

Potential Emission Reductions

The Clean Trucks Program strategy is expected to greatly increase the penetration of cleaner trucks into the fleet, particularly near-zero-emission trucks in the near term and zero-emission trucks in the long term, and lead to significant emission reductions. Table 2 shows the forecasted reductions of truck-related pollutants as a result of this strategy based on the projected fleet distributions presented in Table 1. These reductions are based on anticipated emissions in the selected years compared to the emissions that would have occurred in those years absent this strategy. A complete description of the projected reductions can be found in “Potential Emission Reductions from Select CAAP 2017 Strategies.”

Table 2: Forecasted Reductions of Truck-Related Pollutants from the Proposed Strategy

	2021	2024	2031	2036
NO _x	48-53%	77% -93%	84% - 96%	86% - 100%
CO ₂ e	8-9%	9% - 21%	10% - 46%	56% - 100%
DPM	48-53%	72% - 85%	70% - 82%	81% - 100%

* Range depends on the impact of the 2023 rate, zero-emissions trucks penetration, and the emissions standard (i.e., the Ports forecasted 0.02 gm/NO_x and 0.05 gm/NO_x)

To support the transition to the near-zero and zero-emission trucks, significant allocations of federal, state and local grant funding will be necessary, and workforce development programs will be needed to assist truck drivers and mechanics with the transition to new technologies. The Ports will help support these efforts as further described in the Implementation section.

Driver Conditions and Sustainability of the Clean Trucks Program

The Ports must ensure the long-term sustainability of the Clean Trucks Program. A program that relies solely on drivers to finance billions of dollars of new trucks is not a sustainable or fair model. As noted above, recent reports have highlighted the poor working conditions and financial hardships faced by many independent owner-operators who invested in new trucks under the original Clean Trucks Program. The Ports, SCAQMD and CARB (including Proposition 1B funds) have jointly funded clean truck program grants and incentives to help the industry purchase clean trucks, but they have no direct control over the drayage truck industry business practice of truck owners leasing trucks to drivers who want work but do not own their own trucks. Due to the high cost of new technology, well-capitalized motor carriers purchase new trucks and lease them to drivers, deducting the lease payments from their payments to the drivers. Concerns have been raised that many drivers do not make enough money to cover the high costs of these leases over the long term.

The trucks proposed under this new iteration of the Clean Trucks Program will be significantly more expensive than the previous models. Moreover, the transition to near-zero emissions and zero-emission will take place over nearly two decades, and thus, it is imperative the drayage industry develop practices that can sustain the cost transition to a clean trucking fleet and secure its workers over the long term.

The Ports, SCAQMD and CARB have committed to working together on securing grant and incentive funding, and to ensure that such funding is effectively used to benefit motor carriers and drivers alike to sustainably turn over truck fleets to achieve CAAP goals. However, the practices by which drivers are paid and the industry-developed driver leasing system are third-party contractual relationships between motor carriers and drivers that fall outside of the Ports' registration agreements with motor carriers. Nevertheless, the driver pay and truck lease issues must be addressed.

The Ports remain committed to a sustainable Clean Trucks Program that achieves our ambitious clean-air goals while supporting the workforce. To that end, in implementing the Clean Trucks Program, the Ports will be guided by the principles listed in the preface to this plan, including the need to support a vibrant workforce, with equity for the men and women who haul cargo to and from the ports each day.

The Ports will work with the industry, community, elected, funding, and regulatory partners to ensure that the Clean Trucks Program implementation aligns with these principles.

1.2. Terminal Equipment

Within the marine terminals, equipment is used to move the cargo in the yard, to and from ships, rail cars, and trucks. The majority of the cargo handling equipment in operation at the ports is used in the container terminals. Containerized cargo is handled by yard tractors, top handlers, side handlers, gantry cranes, reach stackers, and forklifts. Dozers, cranes, and front-end and other loaders are typically used to handle bulk material. In 2016, more than 3,760 pieces of terminal cargo-handling equipment (CHE) operated at the Ports, comprising 4% of the Ports' overall DPM emissions, 6% of NO_x emissions, and 17% of GHG emissions.

As a result of the original CAAP and the 2009 CARB cargo-handling equipment regulation, which requires phased-in replacement of older equipment, emissions from terminal equipment have dropped significantly since 2005 with DPM and NO_x emissions down 90% and 69% respectively. The state regulation and CAAP strategies have primarily focused on reducing criteria pollutants,

which is evident in the drastic reductions in DPM and NO_x emissions. Further reductions of criteria pollutant and greenhouse gas emissions into the future will require transition to even cleaner technologies.

Some near-zero and zero-emission technologies that can be used in marine terminals are either commercially available or currently being demonstrated in port operations as described in more detail below.

Near-Zero-Emission

Near-zero-emission terminal equipment is up to 90% cleaner than today's cleanest equipment, but to date, development of these technologies for cargo-handling equipment applications has been limited. The Port of Los Angeles will demonstrate 20 near-zero-emission yard hostlers powered by natural gas engines beginning in the second quarter of 2018. These yard hostlers are expected to meet the 0.02 g NO_x/bhp-hr emissions level. There is no active technology development for near-zero-emissions top handlers or rubber-tired gantry cranes. Hybrid technologies – which are cleaner than conventional equipment but may not meet the near-zero-emissions threshold – have been tested, and in some cases commercialized for some pieces of terminal equipment. For instance, hybrid-electric rubber-tired gantry cranes have been successfully deployed at the Port of Los Angeles' West Basin Container Terminal. Also, hybrid yard hostlers have been tested over the past 10 years at the Ports, but they have had inconsistent performance and the emissions reduction results are mixed. It is not clear whether hybrid technologies would be able to generate the NO_x reductions equivalent to near-zero emissions.

Zero-Emissions

In some cases, zero-emission terminal equipment is further along in development than near-zero technologies, and for some applications, commercialized. For example, ship-to-shore gantry cranes have been electrically powered in the Ports for decades. Electric-powered rail-mounted gantry cranes have also operated in various locations for several years, and electric rubber-tired gantry cranes powered by cable reel – allowing the operator to disconnect from the grid to move to other parts of the yard – are also commercialized. These electric rubber-tired gantry cranes often have a small diesel generator on board to power the crane as it moves to another container stack or to the maintenance yard. Over the next two years, the Port of Long Beach will demonstrate fully-electric rubber-tired gantry cranes that rely on batteries for short moves, eliminating use of the diesel generators. The TRAPAC terminal at the Port of Los Angeles uses electric stacking cranes. Electric forklifts are commercialized for smaller capacities, and development is underway for heavier forklifts. The use of electric cargo-handling equipment on

a mass scale was introduced with the opening of the Port of Long Beach Middle Harbor Terminal operated by Long Beach Container Terminal, using commercialized zero-emissions equipment such as automated guided vehicles and intermodal yard cranes. Zero-emissions technology also seems promising for traditionally operated yard tractors and top handlers. Both Ports have begun demonstrating electric yard tractors at multiple terminals with nearly 30 such tractors expected to be in testing or full use by the end of 2019. Additionally, the Port of Los Angeles will demonstrate two battery-electric top handlers beginning in 2019.

Transition to Cleaner Equipment

Terminal operators have made considerable capital investments in clean equipment over the past decade to comply with Port lease requirements and state regulation, which has resulted in significant emission reductions from Port terminal cargo handling operations. To get to zero emissions, it will be necessary to identify, demonstrate, and deploy technologies in port operations that will provide cost-effective options with durability and operational performance equivalent to traditional, diesel-powered equipment.

The Ports received numerous comments from stakeholders related to the strategy for cargo-handling equipment. Many stakeholders supported the aggressive timeline to get to zero-emissions operations to meet the needs for emissions reductions close to the local communities, in protection of public health. Other stakeholders had concerns about the feasibility of the timeline given the shortage of proven zero-emission equipment designed for use in terminal operations and the lack of available infrastructure to support those technologies. In addition, commenters identified that the aggressive timeline will not allow terminal operators to capture the full useful life for the equipment in which they have recently invested, resulting in stranded asset costs. Lastly, commenters suggested that the cost to achieve zero emissions is not cost effective compared to near-zero-emission equipment, which could result in significant emissions reductions at a fraction of the cost. All of these concerns must be taken into consideration.

In March 2017, the CARB Board directed its staff to develop amendments to the cargo-handling equipment regulation to achieve up to 100% compliance with zero emissions by 2030 in San Pedro Bay and other ports near environmental justice communities³³. Additionally, the Mayors have adopted a goal of zero emissions for all terminal equipment by 2030.

CARB anticipates amending the Cargo Handling Equipment Regulation by March 2019. With the State moving forward on new zero-emission CHE requirements, the Ports must align the CAAP strategy with this effort, and – consistent with our longstanding approach of supporting and

³³ California Air Resources Board, 2016 State Strategy for the State Implementation Plan, Resolution No. 17-7, p.6.

accelerating state regulations here in San Pedro Bay – advance the deployment of cleanest available terminal equipment.

Transitioning the terminal equipment fleet to zero emissions is an ambitious goal, one that is complicated by the current lack of commercially available cleaner technology and inadequate infrastructure to support widespread charging or use of alternative fuels. It is not simply a matter of swapping equipment; there must be years of design, engineering, and construction to install the necessary electric and alternative fuel terminal infrastructure. This infrastructure will be costly – as much as \$2 billion according to our estimates – and must be in place before the fleets can transition. Moreover, the longer it takes to install the infrastructure, the less time the operators have to purchase new equipment, which concentrates their costs into a few years and increases their financial burden.

In light of these challenges but cognizant of the need to reduce emissions now, the Ports commit to work closely with the marine terminal operators to implement the following strategy for terminal equipment:

- Starting January 1, 2019, terminals must submit to the Ports an equipment inventory and 10-year procurement schedule for new cargo handling equipment. Procurement plans will be updated annually.
- Beginning in 2020, marine terminal operators would be required to ensure that new equipment purchases are zero emissions, if feasible, or near-zero emissions if feasible, or cleanest available if zero/near-zero emissions are not yet feasible. Feasibility determinations would be made through a public and collaborative process through the Ports’ Feasibility Assessment, with exemptions for equipment with low operating annual hours.
- The Ports and marine terminal operators will work together to accelerate replacement of existing equipment with near-zero and zero-emissions equipment, through terminal leases and grant funding.

This approach is consistent with the vision of the State’s Sustainable Freight Action Plan, which calls for “zero emission equipment everywhere feasible, and near-zero emission equipment powered by clean, low-carbon renewable fuels everywhere else.”³⁴

³⁴ California Sustainable Freight Action Plan, July 2016, p.8.

Procurement Planning

Beginning in 2019, terminal operators will submit to the Ports an equipment inventory and 10-year procurement schedule. These procurement plans will help the ports identify opportunities for operators to invest in cleaner equipment for new purchases, particularly if there are state or federal incentive funds available to support the transition. These discussions will also allow the Ports and the operators to identify the appropriate turnover schedule in an effort to avoid equipment becoming obsolete before the end of its useful life. In addition, these discussions will allow the Ports and the operators to discuss long-term plans and any necessary terminal upgrades to support continued operations. Periodic updates to these procurement plans will be necessary to continue to forecast for a 10-year period and to understand any changes in the timeline or available technology. The Ports anticipate discussing upcoming equipment purchases with terminal operators on an annual basis.

These procurement plans will also allow for a better understanding of the demand for new equipment each year throughout the port complex, providing a signal for equipment manufacturers to develop new cleaner equipment to meet the demand, and will also allow the Ports, the terminal operators, and the equipment vendors to discuss opportunities for negotiating group rates or making bulk purchases that can reduce the costs for individual pieces of equipment.

The three pieces of port equipment with the greatest contribution to emissions are rubber-tired gantry cranes, yard hostlers, and top handlers. These pieces of equipment represent 62% of the population of equipment in operation, have some of the highest annual hours of operation, and contribute 86% of the DPM, 88% of the NO_x, and 91% of the GHGs. This equipment is typically diesel-fueled, however there are several yard tractors in operation that use gasoline or propane. The following table illustrates the typical life spans of these key pieces of terminal equipment and the average model year of equipment in San Pedro Bay:

Table 3: Life Span and Average Model Year for Equipment in Operation at Marine Terminals in San Pedro Bay

	Rubber-Tired Gantry Cranes	Yard Hostlers	Top Handlers
Typical Life Span ³⁵	15	8	15
Average Model Year (San Pedro Bay) ³⁶	2007-2008	2011	2008-2010

The Ports will work with the terminal operators, through the procurement planning process, to ensure that replacement schedules are in alignment with the anticipated equipment life spans.

Feasibility Assessments

Starting at the end of 2018, the Ports will conduct feasibility assessments and provide interim progress reports to evaluate the status of terminal equipment technologies and infrastructure as well as the operational and financial challenges associated with this transition. Updates to the feasibility assessments will be performed at least every 3 years but more frequently if new information becomes available.

These assessments will help the Ports determine whether zero emissions is feasible for a specific piece of equipment (e.g., RTGs, top/side handlers, yard trucks, etc.) and may evaluate distinctions by the type of terminal, operational mode, or duty cycle among other considerations, in order to ensure that a technology is feasible for widespread Bay-wide deployment. If zero emissions is not considered feasible at that time, the assessments will identify the cleanest feasible alternative currently available for purchase.

The scope and process for developing these feasibility assessments is described in the accompanying document, “A Framework for Developing Feasibility Assessments”³⁷, and takes into account technical viability, operational feasibility, commercial availability, infrastructure availability, and key economic considerations. For a piece of equipment to be deemed feasible, it must be proven to be comparable in velocity, useful life, cost, throughput, maintenance and labor costs compared to its diesel counterparts. As stated in the Port of Los Angeles Draft Zero Emission White Paper³⁸, “these vehicles must do more than just function; they must perform at the level of their conventional technology counterparts, which have well over a century of

³⁵ Typical life taken from Pacific Merchant Shipping Association’s report on the Sustainable Freight Strategy.

³⁶ From the Ports’ 2016 Annual Emissions Inventories

³⁷ www.cleanairactionplan.org

³⁸ Port of Los Angeles, DRAFT Zero Emission White Paper, July 2015, p. 14.

experience behind them. Zero emission vehicles at the port need to be able to execute the same tasks as their conventional combustion-based counterparts with a similar level of reliability, in the rigorous marine environment.”

Additionally, to be feasible for widespread deployment, a technology must have the infrastructure in place to support long-term fueling and/or charging. No part of this strategy would require terminal operators to purchase zero- or near-zero emissions equipment if there are any delays by Ports or utilities in installing the needed infrastructure to support such equipment, either inside or outside the marine terminal.

Requirements for New Equipment Purchases

Once a Feasibility Assessment has determined that cleaner equipment is feasible, the Ports would work with terminal operators to put that equipment in place in accordance with their procurement plans; any new equipment purchases would need to be the cleanest feasible, consistent with the schedule outlined in the terminal operator procurement plans and contingent upon having the infrastructure in place to support the equipment. The Ports will evaluate the most appropriate mechanism to implement this requirement, which may include but is not limited to leases or other agreements.

Further, this strategy allows for the following:

- Terminal operators will be allowed to use near-zero emissions or cleanest available for a period of time not to exceed the equipment’s useful life if that equipment is in place prior to zero-emission equipment being determined feasible.
- Terminal operators will not be penalized for purchasing near-zero emissions or cleanest available equipment if the infrastructure to support zero-emissions equipment is not in place at that terminal, recognizing that terminal design, permitting, financing, and construction may take years.
- Feasibility assessments will continue to be conducted at least every 3 years until a technology is deemed feasible. Once a technology is deemed feasible, a terminal operator would need to purchase that technology from that point forward assuming the supportive infrastructure is in place.

This approach secures emission reductions in the near term, allows time for the zero-emissions technologies to develop, for the supporting infrastructure to be installed, and for the terminal operators to avoid stranded assets and to recoup the value of their existing equipment, which is relatively new. As a result of rapid advancements in zero-emission technologies and the lifespan

of the equipment, it is anticipated that in most cases, if a zero-emission technology is not feasible at the time of purchase, it likely will be available by the next time that piece of equipment needs to be replaced. It also ensures a transition to cleanest available technology even for equipment that is unlikely to become zero emissions any time soon. For example, some of the more specialized equipment used in bulk terminals may not be developed commercially as a zero-emission product because the manufacturers may not see enough of a potential market; these operators would still be required to purchase the cleanest available equipment under this strategy.

The Ports also recognize that some pieces of terminal equipment may have very few operating hours in a given year. In those instances, a requirement for new zero- or near-zero-emission equipment may have high costs without a commensurate emission benefit. Thus, the Ports plan to evaluate potential exemptions for equipment with low operating hours, which is consistent with the state's current cargo-handling equipment regulation.

Incentives for Accelerated Deployment of Zero- and Near-Zero-Emission Equipment

In addition to working with the terminals on purchasing the cleanest feasible equipment, the Ports will also work with terminal operators to accelerate the replacement of existing equipment with the cleanest available equipment through terminal leases and by securing incentive funding for zero- and near-zero-emission technologies. These mechanisms provide more opportunities for near-term penetration because a technology that is not considered feasible for Bay-wide deployment could be feasible in narrow, terminal-specific applications.

To accelerate deployment, the Ports plan to engage in the following actions described in more detail below:

- Infrastructure planning and construction
- Technology demonstrations
- Pursuit of incentive dollars

Infrastructure Planning and Construction. To support the required transition to cleaner equipment, the Ports must ensure that terminals have the charging or fueling infrastructure in place. Availability of the supporting infrastructure will be a key factor in the determination of feasibility for the cleaner technology. To that end, the Ports will work with the utilities and technology manufacturers to develop port-wide infrastructure plans and budgets that will allow for timely construction of needed infrastructure to support zero-emission terminal equipment. The timing for the construction will need to be balanced with the ports' other significant near-

term capital improvements commitments. The Ports will also seek state and federal incentive funds to reduce costs and accelerate the timeline for implementation.

Technology Demonstrations. Through the Ports TAP and various grant-funded programs, the Ports have several technology demonstrations underway. The Ports have begun aggressively pursuing and have successfully received multi-million dollar grant awards being offered by federal, state and local government agencies to build, test, and deploy near-zero and zero-emissions cargo handling equipment.

To date, the Port of Los Angeles has received about \$25 million to test and demonstrate near-zero and zero-emissions equipment at two of its cargo terminals. The first cargo terminal, Pasha, received about \$15 million from CARB to fund nine pre-commercial zero-emissions electric vehicles (four yard tractors, two Class 8 on-road trucks, two high-tonnage forklift retrofits, and one top handler retrofit) in addition to other emission-reduction and energy-related technologies. The second cargo terminal, Everport, has received about \$10 million from the California Energy Commission (CEC) to fund 20 near-zero-emissions yard tractors, eight zero-emission yard tractors, and two zero-emission top handlers. These projects are underway and deployment of the various equipment is scheduled to begin over the next couple of years.

The Port of Long Beach has received more than \$9.7 million from CEC to repower nine rubber-tired gantry cranes (RTGs) to full electric power, making it the largest deployment of fully electric RTGs in the nation, and to demonstrate 12 battery-electric yard tractors at two container terminals. These projects are expected to be complete by the latter part of 2020.

Incentive Funding. There are several sources of funding available to accelerate early deployment of zero- and near-zero technologies and the infrastructure needed to support them, including Proposition 1B, Carl Moyer, SB-1 Transportation Funds, Diesel Emission Reduction Act (DERA) funds, and various incentive programs funded by the Greenhouse Gas Reduction Fund. Lastly, there are Volkswagen Settlement funds in the amount of \$800 million that will be made available for zero-emission projects in California. The Ports will continue to work together to advocate and apply for a sizable portion of any and all relevant funding opportunities that arise in the future.

A key approach to accelerating deployment will be the pursuit of grant funds. The Ports estimate it may cost upwards of \$1.8 billion to replace the existing fleet with zero-emissions equipment, plus up to an additional \$2 billion for supporting infrastructure. The Ports will work with the terminals and technology manufacturers to seek grant funds and incentives for additional deployment of near-zero and zero-emission cargo-handling equipment. The Ports will assist

terminals in applying for these funds and will advocate at the local, state, and federal level for more funding for this equipment.

Additionally, the Ports recognize that some terminal operators have already made significant investments in zero-emissions equipment well in advance of the 2030 goal and that other terminal operators may seek to do the same. The Ports want to encourage these early transformations. To that end, the Ports will work to recognize such near-term achievements through incentives, which may be financial or otherwise, and strong recognition programs. Further, the Ports believe these early adopters deserve statewide credit for helping to accelerate the introduction of zero-emissions technologies; as such, the Ports will work with our agency partners to recognize these achievements and the significant cost associated with the existing zero-emissions deployments as these agencies develop future regulations.

As noted above, zero-emissions equipment already operates at the ports, and more pieces are expected to be deployed in the next few years through our existing commitments. Table 4 shows the current penetration of zero- and near-zero-emission terminal equipment at the Ports as well as projections for 2020 and 2025, based upon commitments that have been made by terminal operators and funding that has already been secured from state and federal sources.

Table 4: Baseline Projections for Cleaner Terminal Equipment Based on Commitments Already Made

	2017 (actual)	2020	2025
Near-Zero-Emission Equipment	0	20	20
Zero-Emission Equipment	333	519	573
Total Equipment	3,766	3,972	4,026
% Near-Zero-Emission	0%	<1%	<1%
% Zero-Emissions	9%	13%	14%

With the strategy outlined above, the Ports expect to surpass these baseline percentages. The Ports will also work closely with CARB on developing and implementing the amendments to the cargo-handling equipment regulation for up to 100% compliance with zero-emission equipment by 2030 to meet the Mayors' goals.

1.3. Terminal Equipment Idling Reduction Program

Idling is defined as an engine running for non-operational purposes. The emission rate during idling is higher than when the engine is running while in motion or moving cargo. Extended idling

can also cause a build-up of soot in engines, resulting in black smoke. Diesel exhaust from idling engines can accumulate in and around the emission source and pose a human health exposure risk.

The purpose of a port-wide Terminal Equipment Idling Reduction Program is to ensure that unnecessary idling of vehicles and equipment does not occur on port terminals. Less idling contributes to a healthier work environment, reduces air and noise pollution, fuel consumption, and engine deterioration and wear. Currently, there is no regulation to limit idling for cargo-handling equipment.

Additional information will be necessary to understand when idling is occurring and where opportunities exist for reducing that idling without compromising safety or reducing operational efficiency. A study developing an inventory of equipment with idling limit devices and analyzing equipment data loggers will be necessary to develop recommendations.

The Ports envision that through this program, terminal operators would be required to develop plans to reduce or eliminate unnecessary idling of cargo-handling equipment. These plans would need to identify specific strategies and implementation actions to that end. Terminals would:

- Ensure that idle limiting technologies are installed on equipment internal combustion engines. An idling limiting device or software enables the engine to shut down automatically if it idles longer than the programmed time.
- Develop training and education programs for equipment operators to identify opportunities for idle reduction
- Make operational changes to reduce idling

The Ports would review these plans and provide suggestions to ensure the maximum use of idle reduction strategies.

1.4. Vessel Speed Reduction Program

When ships slow down, the load on the main engines decreases considerably as compared to operation at higher speeds. Operation at a slower speed typically decreases the total energy required to move the ship through water. This energy reduction translates to less fuel burned and fewer emissions.

The voluntary Vessel Speed Reduction (VSR) Program initially started under a multi-party Memorandum of Understanding in 2001. Starting in 2005, the Ports have provided financial

incentives to shipping lines that reduce their speeds to 12 knots within 20 nautical miles (nm) of Point Fermin. In 2009, the Ports expanded this program to provide additional incentives for ships slowing down within 40 nm of the Ports. This voluntary program has been extremely successful. Participation within the 20 nm zone is approximately 95%, and just under 90% within the 40 nm zone.

Owing to the significant emission reductions associated with vessel speed reduction, especially reductions in NO_x and GHG emissions, the Ports are seeking to build upon the already very high participation rate and maximize compliance at the 40 nm boundary.

A revised VSR incentive program to drive improved compliance and emission benefits is as follows:

- Maximize participation in VSR for all vessels transiting within 40 nm of Point Fermin

This revised VSR program would emphasize compliance out to 40 nm from the Ports. Program changes to be considered include reducing the 20 nm incentive to encourage all vessels to participate within 40 nm. The Ports will also consider increasing the incentive amount at the 40 nm distance.

In addition, some operators only participate within 20 nm because of operational issues, such as scheduling of the vessels for other destinations on the service string. In order to preserve the high participation levels, the Ports will continue to evaluate specific operational hurdles on a shipping line by shipping line basis.

The Ports will also evaluate changes to the program's payment structure. Currently, in order to qualify for the dockage rebate incentive, 90% of a fleet's calls for the year must slow down at the prescribed boundary; once a fleet has met this 90% mark, all of the fleet's calls receive a dockage rebate in the ensuing calendar year. The Ports may modify this structure to a per-call incentive, so each qualifying call may earn the incentive on its own. Such an approach could encourage participation on an individual call basis for shipping lines that would not otherwise participate in the 40 nm program today, because they are unable to meet the annual minimum to qualify.

The Ports also continue to require vessel speed reduction within 40 nm, where possible, through new or renewed leases, which provide another mechanism for ensuring compliance.

Additionally, for some vessel classes, a 12-knot vessel speed may not be the optimal speed from an emissions perspective. Some vessels are equipped with an emissions reduction technology

that requires higher speeds for optimum performance. For example, some vessels have large 'house' electrical loads like cruise ships, which have higher optimum emission reduction speeds. Thus, the Ports would continue to pursue the following strategy:

- Implement alternative compliance plans allowing vessel operators to maximize emission reductions for their fleet.

Under this strategy, the Ports will accept requests from shipping lines that propose alternative compliance plans where a different speed would result in the same or fewer emissions compared to the current speed limit. These alternative compliance options may enable a ship to travel faster than 12 knots without an associated emissions penalty, thus increasing the likelihood of compliance and operational efficiency.

1.5. Vessel At-Berth Emission Reductions

Emissions from ship auxiliary engines while loading and unloading cargo at berth are a significant contributor to total ship pollution. In 2016, 32% of DPM, 29% of NO_x and 53% of greenhouse gas emissions from ships in San Pedro Bay were emitted while the ships were at berth.

CARB's current regulation requires at-berth emission reductions from container, cruise and refrigerated cargo vessels ("reefers"), generally by plugging the ship into the electrical grid and turning off the auxiliary engines, which is known as "shore power." The Ports and our tenants have implemented hundreds of millions of dollars in capital improvements to our electrical infrastructure to ensure shore power capabilities at all necessary berths. The CARB regulation, which has been in place since 2014, ramps up the required shore power usage until 2020, when fleets must demonstrate an 80% reduction in at-berth emissions.

In March 2017 the CARB Board directed its staff to amend the At-Berth Regulation in order to achieve up to 100% compliance by all vessels by 2030 in San Pedro Bay and other ports near environmental justice communities. This action would require at-berth emission reductions from vessels not currently subject to the regulation, such as bulk, break bulk, tankers and auto carriers. These vessels contributed one-third of our total at-berth emissions in 2016.

With the state moving forward on additional at-berth controls by 2030, the strategy for at-berth emission reductions is as follows:

- Participate in the State's efforts to achieve up to 100% compliance with the At-Berth Regulation by 2030 and assist with implementation by demonstrating new at-berth emission reduction technologies, accelerating availability and utilization of technologies

through a concerted strategy to advocate for and secure state and federal funds, and accelerating use requirements through leases where possible.

CARB anticipates amending the At-Berth Regulation by September 2018.

Implementing At-Berth Emission Control Systems and Shore Power

Expanding the use of at-berth emission reduction technologies for non-regulated vessels is challenging as there are no CARB-approved technologies currently available for these vessel types. Technologies will need to be designed, developed, tested, certified, and implemented in a very short time frame to meet the schedule directed by the CARB Board. The Ports will take the immediate actions described in more detail below to support and to accelerate this timeline where possible.

Technology Demonstrations

CARB has approved two alternative technologies (AMECS and METS-I) for container vessels that can be used to comply with the at-berth regulation. Both of these technologies are barge-based systems that affix to the vessel's exhaust stack(s) to filter pollutants from auxiliary engines while the vessel is at berth. Currently, these technologies are approved only for container vessels meeting certain configurations; however, operators of both of these systems are working with CARB to expand approval to include other sizes and types of vessels. At least one additional technology manufacturer is developing a barge-based control system and likely will seek CARB approval as an alternative to shore power.

Additionally, the Ports see a need for land-based capture-and-control systems. Some vessel types – tankers, for example – may not be good candidates for barge-based technologies due to at-berth operational constraints and safety considerations. Furthermore, the Ports have limited wharf space and may be unable to provide berths for a substantial fleet of barges. Lastly, barges may impede waterway access and impose constraints on the safe passage of other vessel types depending on the quantity of barges. For these reasons, the Ports see a need for a mix of water- and land-based strategies. The Port of Los Angeles is currently funding the development and demonstration of a land-based system at a non-container terminal for bulk ships.

To augment the existing technologies and to stimulate the development of new technologies, the Ports plan to seek funding for the development and demonstration of at-berth emission control systems for non-container ships. The Ports, through the TAP, will issue a competitive

solicitation for capture-and-control technologies within the next 12 months in order to start development and/or demonstration by January 1, 2019.

Additionally, the Ports already provide financial incentives for shipping lines that participate in technology demonstrations; the Ports will explore whether or not to expand these incentives to increase participation in such demonstrations.

Accelerated Deployment of At-Berth Emission Control Devices

At present, there are two commercialized capture-and-control systems servicing the entire San Pedro Bay Ports complex. Other systems are under development; however, with the impending increase in demand for such systems, the Ports anticipate needing more at-berth control units. Thus, in addition to supporting technology development for new at-berth control systems, the Ports will support deployment of additional commercialized units by (1) conducting operational assessments, including consideration of the potential for other approaches for control of at-berth emissions, and (2) pursuing grant funds.

Operational and Infrastructure Assessments: Deploying enough emission-control systems to handle the entire fleet will not be easy. Limitations on berth space could limit the number of barge-based systems as there is little available space for these units to tie up when not in use. Conversely, limits on wharf area could impede land-based systems. Each terminal may require its own unique solution. Thus, the Ports will work with terminal operators and shipping lines, and conduct studies to determine how such emission-control devices could be deployed and to evaluate possible barriers to implementation, such as berth space, waterway access, piloting hazards, conflicts with bunkering, and backlands constraints. The Ports will further work with agencies and other CAAP stakeholders to consider whether other options exist for control of at-berth emissions. The assessment also will propose recommendations for addressing these impacts in order to maximize deployment. Lastly, the Ports will work with terminal operators and shipping lines to evaluate costs for proposed solutions in order to identify the most cost-effective approaches for each terminal's operating situation.

Pursuit of Grant Funds: A key factor to accelerating deployment will be the procurement of grant funds to assist with the development and deployment of at-berth emission control equipment. The Ports estimate it may cost upwards of \$144 million to provide enough emission-control systems for all of the non-container terminals.³⁹ The Ports will work with the terminals, shipping

³⁹ "Preliminary Cost Estimates For Select 2017 Clean Air Action Plan Strategies" available at www.cleanairactionplan.org

lines, and technology manufacturers to seek grant funds and incentives for additional deployment of these control systems. There are incentive programs available, including the Proposition 1B Goods Movement Emission Reduction Program. The Ports will assist terminals and shipping lines in applying for these funds and will advocate at the local, state, and federal level for more funding for capture-and-control systems. Ongoing expenses associated with the use of the equipment have not been estimated.

The Ports will also consider development of an incentive program to accelerate early use and adoption of the at-berth emission control technologies at non-container terminals, in advance of CARB's requirements. In addition, the Ports will continue to put requirements into leases, as feasible, for implementation and use of at-berth control technologies at container and non-container terminals.

The Ports anticipate an increase over the next 10 years in the number of vessel calls using alternative emission-control systems. As stated earlier, there are two systems in operation today. An additional land-based unit at Port of Los Angeles is expected to become operational at a non-container terminal in 2018, and Wan Hai Lines, a container line that calls at Port of Long Beach and is not currently subject to the State At-Berth Regulation due to below-minimum annual ship calls, has commissioned the development of a third barge-based system to service its vessels. This system is expected to debut in 2018. With this additional capacity, the Ports expect to see increased use of alternative emission-control systems by 2025.

At the same time, more ships will use grid-based shore power as the State Regulation ramps up to 80% fleet usage requirements in 2020. The shore power regulation applies only to container ships, cruise ships, and refrigerated cargo ships. Table 5 shows the percentage of the fleet currently controlling at-berth emissions and the percentage anticipated to control at-berth emissions in future years.

Table 5: Baseline Use of Alternative Emission Control Systems in Select Years

	2017	2020	2025
Vessel Calls Using an Alternative Emissions Control Device ¹	4%	5%	5%
Vessel Calls Using Grid-Based Shorepower	43%	49%	49%
All Vessel Calls Using At-Berth Emissions Controls	47%	55%	55%
Vessel Calls Using No At-Berth Emissions Controls	53%	45%	45%
Total Vessel Calls (include all vessel types)	3,970	4,241	4,526
¹ Mostly container calls because currently the two State-approved alternative emission control devices are certified only for container vessels.			

The Ports anticipate that in 2020 and 2025, roughly 2,000 calls will not use at-berth emission controls. These calls are largely from non-container ships not subject to the State At-Berth regulation, and as such, they are the primary target for this strategy. The Ports intend to work with the industry and technology partners to develop and deploy alternative systems for these 45% of projected ship calls. The Ports will also work closely with CARB on developing and implementing the amendments to the at-berth regulation for up to 100% compliance by 2030.

1.6. Green Ship Incentives

Ships are the largest source of maritime goods-movement-related NO_x emissions, comprising 51% of the NO_x emissions, according to the 2016 emissions inventories. Of those ship emissions, more than half are associated with ships transiting or maneuvering within approximately 100 nm of the Ports. The International Maritime Organization (IMO)⁴⁰ has established engine standards for ships that ratchet down the allowable NO_x emissions over time, which has a tremendous environmental benefit for ship emissions, including those incurred while in transit. Tier 2 engines, which were required to be installed on new ships beginning in 2011, are 15% cleaner than the previous generation of engines, and Tier 3 engines, which became available beginning in 2016, are 75% cleaner than Tier 2 engines.

Although the IMO requires manufacturing standards for newly built ships (post-2015) to have Tier 3 engines for ships serving the North American and Caribbean Emission Control Area (ECA), there are no requirements for shipping lines to purchase new ships with Tier 3 engines nor are there requirements on when to deploy these ships on services calling San Pedro Bay terminals.

The Ports have adopted incentive programs, namely the Environmental Ship Index in Los Angeles and the Green Ship Incentive Program in Long Beach, to encourage the deployment of cleaner ships to San Pedro Bay. In 2016, nearly 1 out of 5 vessel calls to San Pedro Bay qualified for the Tier 2 incentives. These incentive programs, however, do not fully recognize all the methods available for a vessel operator to reduce its vessel's emissions rate. Two key approaches to reducing ship-related emissions are through improvements in operational efficiencies and the introduction of emission reduction technologies.

⁴⁰ The governance of international ship pollution is preempted by the international shipping law, MARPOL, the International Convention for the Prevention of the Pollution from Ships, developed through the International Maritime Organization (IMO), a United Nations agency that deals with maritime safety, security, and pollution from ships. Annex VI of MARPOL addresses air pollution from ocean going vessels. The international air pollution requirements of Annex VI establish limits on nitrogen oxides (NO_x) emissions and require the use of fuel with lower sulfur content. The requirements apply to vessels operating in U.S. waters as well as ships operating within 200 nautical miles of the coast of North America, also known as the North American Emissions Control Area (ECA). MARPOL violations are addressed by the U.S. EPA and U.S. Coast Guard.

Operational efficiencies are either energy efficiency improvements or operational improvements on board a ship that otherwise reduce energy consumption and potentially reduce a wide range of pollutant and GHG emissions. Several lines have initiated efficiency improvement programs to reduce fuel costs, and these efforts also ultimately reduce emissions such as GHGs. Examples of energy efficiency improvements might be focused on propulsion system modifications of the bulbous bows, installation of improved propellers, de-rating of the main engines, and/or focused on reducing electrical loads such as higher efficiency reefer containers and upgrading the ship's lighting system to light-emitting diodes (LEDs), which reduces the related emissions from the generation of electricity. The Ports TAP is funding the testing of energy efficiency upgrades to several Maersk ships in order to quantify the emission reductions associated with these improvements.

Additionally, some shipping lines are beginning to install emission reduction technologies on their older ships, specifically cruise ships equipped with onboard scrubbers that reduce DPM and SO_x emissions. These emission reduction technologies are typically used as an alternative compliance approach for the low sulfur fuel requirements under the ECA, which permits use of higher sulfur fuel in conjunction with a scrubber because the overall emissions are the same or lower. Although California law continues to require low-sulfur marine distillate fuel usage regardless of the use of a scrubber, the ECA has motivated more shipping lines to consider scrubbers for their global fleets, and the Ports could take advantage of this natural opportunity for additional reductions.

Liquefied natural gas (LNG) also shows promise for reducing ship emissions. LNG-only engines eliminate DPM and have been found to reduce NO_x up to 88% over diesel engines. Dual-fueled engines – which can switch between distillate fuels or a fuel mix with LNG – can reduce DPM by up to 78% although the emission reduction benefits for NO_x are less clear.⁴¹ Several shipping lines have placed orders for LNG-fueled ships, including Matson Lines and Carnival Cruise Lines, in order to comply with the ECA. While some of these ships will be LNG-capable, they initially will not have all of the necessary tankage and fueling systems installed to be able to utilize the LNG fuel. It is also uncertain whether these ships will be placed into service here in San Pedro Bay. A key consideration is the availability of LNG fuel for bunkering, which is not currently offered in San Pedro Bay. The ports will continue to discuss interest in LNG fuel with the shipping lines to gauge potential demand for future bunkering capabilities. In addition, the Ports will continue discussions with fuel suppliers and bunkering companies to provide the fuel infrastructure to support that demand. There may also be benefits in enticing these ships to install all of the necessary fueling infrastructure and to call here.

⁴¹ Starcrest Consulting Group, LLC. "Liquefied Natural Gas (LNG) in the Maritime Sector: Environmental, Economic, and Infrastructure Considerations." August 2015.

In order to encourage these energy efficiency upgrades and emission reduction technologies to reduce ship emissions in the near term, the Ports would work to further incentivize these approaches, especially those that reduce NO_x and GHG emissions, by adding new incentive levels for ships with emission-reduction technologies, alternative fuels, and engines that perform better than Tier 2 levels. Thus, the Ports plan to:

- Modify our incentive programs to include a Tier 2+ level for ships that perform better than the Tier 2 emission levels through on-board technologies, alternative fuels, or as demonstrated by engine certificates.

The Ports also plan to launch an outreach campaign to raise the shipping industry's awareness of these incentive programs and potentially to coordinate with regulatory agencies and/or other ports on the same vessel service strings. If a shipping line can earn incentives from multiple ports along its route, it could provide a greater return on investment for these technology upgrades and make participation more attractive. The Ports have already started a dialogue with West Coast ports, including Port of Vancouver, Port of Oakland, and Port of Prince Rupert, to cooperate on ship incentive programs.

Additionally, the Ports will look to minimize the burden associated with applying and submitting requisite data for participating in the programs. Options might include a joint online registration web portal such that lines would only need to register and update data once, which could be developed within San Pedro Bay or even with other ports in order to streamline the process and thus enhance participation globally.

1.7. Clean Ship Program

Ship diesel engines are classified by the IMO from Tier 0, the oldest pre-regulated engines, to Tier 3, the newest – and cleanest – engines. Currently, Tier 3 engines are only required for ships that have a keel laid date post-2015 and for those that travel in the ECA. Operators are not required to upgrade their existing pre-2016 'grandfathered' fleets to the newest cleanest vessels nor are they required to deploy them to San Pedro Bay.

In 2016, roughly 79% of vessel calls to San Pedro Bay were made by Tier 0 or Tier 1 ships and 19% were made by Tier 2 ships, mostly larger container vessels. To date, no Tier 3 ships have called at San Pedro Bay terminals.

Several factors are affecting the order and deployment of Tier 3 vessels to San Pedro Bay. First, Tier 3 engines are significantly more expensive than their predecessors in both price and

operation, in part due to more complex emission control equipment, which could be contributing to fewer orders. Although Tier 3 engines are required for ships calling the ECA with keels laid starting on January 1, 2016, there were a significant number of ship keels laid prior to 2016 and yet to be constructed, essentially creating a large pool of grandfathered or Tier 3-exempt new ships. Looking at the number of keels laid but not constructed (as of August 2016) between 2005 and 2015, there are more than 1,400 grandfathered keels that are available for new ships with more than 1,200 of those laid in 2015.⁴²

For these reasons, the Ports do not expect to see significant numbers of Tier 3 ships in San Pedro Bay Ports any time in the next 10 years. The Ports conservatively project the first Tier 3 ship could arrive no earlier than 2026, with significant numbers not arriving until the mid-2030s to late-2040s depending on the vessel type.

Absent natural turnover to bring the ships with the cleanest engines into the San Pedro Bay service, to meet our emission reduction goals, the Ports will attempt to encourage earlier deployment of Tier 2 and Tier 3 vessels and discourage calls by Tier 0 and Tier 1 ships. Importantly, the Ports do not own or operate the vessels and thus have few tools to compel the introduction of newer vessels. Additionally, terminal operators do not control the deployment of specific vessels to their terminals. The Ports, however, do have control over rates charged to operators through the tariff.

In order to help accelerate the transition to a cleaner fleet, the Ports propose the following strategy:

- Implement a variable rate on ships according to engine tier level to encourage calls by cleaner ships and to discourage older ships. A higher rate would be applied initially to Tier 0 ships, later adding Tier 1 ships, and would begin no earlier than 2025. Any collected funds would be used to provide incentives directed at reducing emissions from ships.

There are examples of charging different rates for ships based on environmental characteristics. The Swedish Maritime Administration assesses lower fees on ships that generate fewer NO_x emissions, setting limits below which a ship's engine must emit to earn the discount. The government of Norway imposes a tax on NO_x emissions from ships (and other sources of NO_x) that do not qualify for an exemption and then uses the revenue to fund technologies that reduce NO_x emissions. One mechanism for shipping lines to qualify for an exemption is to commit to

⁴² Starcrest Consulting Group. "San Pedro Bay Ocean-Going Vessel International Maritime Organization Engine Tier Forecasts, 2015-2050." Draft. June 2017.

reducing their NO_x emissions. This tax has spurred heavy investment in liquefied natural gas (LNG) ships in Norway. Seven years ago, there were only 3 LNG-fueled ships serving the country; there are expected to be nearly 100 such vessels within the next few years. An important distinction, however, is that these programs were enacted by countries as a tax on all international ships, not by individual seaports through a tariff.

In 2016, about 14% of the roughly 3,900 calls to San Pedro Bay were made by ships with Tier 0 engines, primarily cruise vessels, which comprised nearly 6% of those calls. About 64% of the calls were made by Tier 1 vessels. Roughly 19% of the calls were made by Tier 2 vessels, and there were no Tier 3 visits. Table 6 provides a snapshot of the 2016 engine tier levels by vessel type:

Table 6: 2016 Vessel Arrivals to San Pedro Bay by Engine Tier and Vessel Type

Vessel Type	Count of Arrivals					Percent of Total Arrivals				
	Tier 0	Tier I	Tier II	Tier III	Steam	Tier 0	Tier I	Tier II	Tier III	Steam
Auto Carrier	59	190	17	0	0	1.5%	4.7%	0.4%	0.0%	0.0%
Bulk	12	177	108	0	0	0.3%	4.4%	2.7%	0.0%	0.0%
Container	178	1,550	430	0	94	4.4%	38.4%	10.7%	0.0%	2.3%
Cruise	226	150	0	0	0	5.6%	3.7%	0.0%	0.0%	0.0%
General Cargo	23	46	20	0	0	0.6%	1.1%	0.5%	0.0%	0.0%
Integrated Tug Barge	7	10	1	0	0	0.2%	0.2%	0.0%	0.0%	0.0%
Miscellaneous	11	0	0	0	0	0.3%	0.0%	0.0%	0.0%	0.0%
Reefer	16	4	0	0	0	0.4%	0.1%	0.0%	0.0%	0.0%
RoRo	2	0	24	0	0	0.0%	0.0%	0.6%	0.0%	0.0%
Tanker	39	465	174	0	0	1.0%	11.5%	4.3%	0.0%	0.0%
TOTAL	573	2,592	774	0	94	14.2%	64.3%	19.2%	0.0%	2.3%

In 2025, due to forecasted fleet turnover, calls from Tier 0 ships are expected to comprise less than 1% of the total, and calls from Tier 1 ships are expected to comprise roughly 35% of the total. Meanwhile, the percentage of calls by Tier 2 vessels is expected to more than triple to nearly 65% by 2025, as shown in Table 7.

Table 7: Forecasted Vessel Arrivals to San Pedro Bay in 2025 by Engine Tier and Vessel Type

Vessel Type	Count of Arrivals					Percent of Total Arrivals				
	Tier 0	Tier I	Tier II	Tier III	Steam	Tier 0	Tier I	Tier II	Tier III	Steam
Auto Carrier	0	157	226	0	0	0.0%	4.3%	6.2%	0.0%	0.0%
Bulk	0	73	196	0	0	0.0%	2.0%	5.4%	0.0%	0.0%
Container	0	445	1,069	0	0	0.0%	12.3%	29.5%	0.0%	0.0%
Cruise	12	136	379	0	0	0.3%	3.8%	10.5%	0.0%	0.0%
General Cargo	0	40	98	0	0	0.0%	1.1%	2.7%	0.0%	0.0%
Integrated Tug Barge	0	9	0	0	0	0.0%	0.2%	0.0%	0.0%	0.0%
Miscellaneous	0	11	0	0	0	0.0%	0.3%	0.0%	0.0%	0.0%
Reefer	0	5	15	0	0	0.0%	0.1%	0.4%	0.0%	0.0%
RoRo	0	16	23	0	0	0.0%	0.4%	0.6%	0.0%	0.0%
Tanker	17	363	328	0	0	0.5%	10.0%	9.1%	0.0%	0.0%
TOTAL	29	1,255	2,334	0	0	0.8%	34.7%	64.5%	0.0%	0.0%

By imposing a higher rate on Tier 0 vessels in 2025, the Ports would affect less than 1 percent of the calls. The rate, however, would most likely solely impact tankers and cruise ships as they are expected to be the primary Tier 0 vessels calling the Ports at that time. A differentiated rate on Tier 1 vessels, which could follow shortly after 2025, is expected to affect more than one-third of vessel calls, particularly auto carriers, smaller container ships, cruise vessels, and tankers. The larger container ships (i.e., greater than 10,000 TEU capacity) are expected to be largely Tier 2 by that time.

This variable rate strategy requires a long timeline in order to accommodate the projected dearth of Tier 3 ships and to give shipping lines ample time to modify deployment schedules and potentially to upgrade their fleets. Ships have long life spans, and operators will need time to project future availability. Further complicating fleet turnover are the investments already made on existing ships to meet CARB's at-berth regulations, which is taken into account by the shipping lines when analyzing the business cases for global fleet deployments.

The Ports are keenly aware that today's shipping industry is facing unprecedented financial hardship and consolidation. In 2016, one of the world's largest shipping lines, Hanjin Shipping, filed for bankruptcy. According to some experts, the shipping industry has overinvested in large ships, resulting in a glut of capacity that has driven shipping freight rates down to unsustainable levels and further hampering the pace of Tier 3 deployment.

Any money collected through the variable rate would be used by each Port to establish a Clean Ship Fund, which would provide incentives to reduce emissions from ships.

The Ports must balance these economic realities with the need to reduce air pollution impacts on our communities. Because it is impossible to predict what the shipping industry will look like in 2025 and how this strategy would affect it, the Ports propose to conduct a vessel forecast in 2020 that would update the projections for Tier 3 deployment. In addition, the Ports will conduct an economic assessment to evaluate the appropriate rate structure and implementation timeline to be adopted by both Ports through a tariff, also taking into account current costs of shipping through the San Pedro Bay complex, potential cargo diversion to other ports, and market competitiveness. One year before the proposed implementation start date, the Ports will update the assessment to identify any new considerations that may warrant changes to the implementation plan.

1.8. Harbor Craft

Harbor craft that operate at the Ports – tugboats, crewboats, and workboats – are among the cleanest in the world, thanks largely to the federal phase-in of more stringent marine engine emissions standards between 2014 and 2018 and state regulations that require accelerated turnover of all Tier 1 and older engines by 2023. Over the past few years, incentive funding from the Ports and state and federal programs have assisted to offset the incremental cost to accelerate the deployment of cleaner harbor craft by repowering or retrofitting marine engines operating in the San Pedro Bay. In addition, on port-owned properties, the Ports have funded the construction of electrical infrastructure improvements for tugboats to use shore power when they are tied up at berth. The main assist tug operators at the Ports, Crowley and Foss, have shore power capability at berth. It is also common practice to turn off engines when tugs are not working and at berth.

Today, harbor craft are our third largest source of particulate matter, comprising 21% of the port-related DPM emissions. Harbor craft also contribute 10% of our NO_x emissions and 6% of our GHG emissions. While emissions from port-related harbor craft have decreased over the last several years as a result of the implementation of the state's commercial harbor craft regulation, the relative contribution of emissions from harbor craft compared to emissions from other port-related sources has increased, and is projected to remain at this higher level in the future as a result of the long useful lives of marine engines. As the engines age and accumulate operating hours, they will continue to deteriorate absent new mandates for turnover.

Given the variety and individual characteristics of harbor craft, differences in work activities, engine horsepower, and usage, there is no 'one size fits all' emissions reduction technology applicable to harbor craft. A challenge associated with developing and deploying emissions reduction technologies for harbor craft, include the numerous possible engine combinations and configurations, as well as weight and space limitations on vessels. Given these challenges, it is not uncommon for design, modification, and installation costs to exceed the costs for new engines or emission reduction technologies. As a result, funding opportunities for harbor craft have been limited.

The Ports will continue to encourage and invest in technology development projects for harbor craft through the joint Technology Advancement Program. Such technologies may include scrubbers, selective catalytic reduction, or alternative fuels such as LNG. To stimulate the identification, demonstration, and validation of technologies that can achieve emissions reductions from harbor craft beyond current state and federal regulation, the Ports will seek proposals for harbor craft technologies that have the potential to achieve NO_x and DPM emission

levels cleaner than Tier 4 standards, or technologies that can be retrofitted to existing harbor craft to achieve Tier 3 or Tier 4 emission levels through the following action:

- Issue a Request for Proposals for harbor craft emission-reduction technologies by December 2017 with demonstrations to begin no later than mid-2018.

The Ports will also conduct periodic assessments of the status of harbor craft technology in order to identify ways of accelerating adoption.

Additionally, the Ports propose the following strategies to reduce harbor craft emissions and fuel consumption:

- Provide incentives for harbor craft operators to upgrade to the cleanest available (i.e. Tier 4) engines or low-emission hybrid systems in the short term, and to upgrade with advanced technologies (e.g. fuel cells and alternative fuels) in the long term. Incentives could be given through securing grants from federal, state or local agencies, a formal incentive program with financial rewards, or through more favorable lease terms, where applicable, for harbor craft operators that have cleaner fleets.
- Identify operational changes that could reduce emissions, for example, by reducing the wait time or slow speed movements of assist tugboats while they are waiting to assist a vessel or by optimizing tugboat berth locations to minimize unnecessary travel.
- Continue to provide and expand as necessary infrastructure that allows harbor craft operators to plug into shore power while at berth.
- As leases with harbor craft operators are opened or renegotiated, the Ports will assess whether it is possible to include requirements for harbor craft modernization, subject to the requisite negotiation process. Most harbor craft companies operate on private land and do not have leases with the Ports; however, the Ports will seek opportunities as they arise.

2. Freight Infrastructure Planning and Investments

Deploying the latest, cleanest technology will require significant investments in electrification and fueling infrastructure. Additionally, reductions in emissions can be achieved by shifting the way cargo is handled, for example, by maximizing on-dock rail where possible. The strategies defined below describe the planning and investment actions needed to transform the Ports' infrastructure over the next 10 years to support zero emissions and supply chain efficiencies.

2.1. Expand use of Rail Arriving to and Departing from the Port Complex.

In some cases, moving cargo by rail can be economically and environmentally superior to moving cargo by truck. The Ports estimate that one double-stacked train can eliminate roughly 750 truck trips, which makes rail transport an efficient and sustainable approach to goods movement, particularly if that cargo can be loaded onto rail within the marine terminal. Maximizing the use of rail infrastructure at the terminal – on-dock rail – eliminates intermodal cargo moving by truck along roadways to inland rail yards.

Any cargo that is moved by train from the port complex benefits the overall transportation system by reducing truck mileage and the associated congestion and emissions. In addition, loading cargo onto rail in a terminal can avoid the time and cost associated with an additional lift and drayage to an off-site facility. The CAAP reaffirms the Ports' commitment to investment in on-dock rail infrastructure and in programs that shift cargo to rail.

The Ports have made significant investments over the years, and will continue to make investments, to build rail infrastructure in the terminals and throughout the port complex, with the goal of accommodating 35% of all cargo leaving the port complex by rail. In 2016, 23.5% of all containerized cargo moving through the Ports went by rail. The Ports will also aim to push further. Over the long term, the Ports will seek to handle up to 50% of all cargo leaving the port complex by rail. To achieve this objective, operational changes are needed. For example, the Ports may explore the potential of short-haul rail to inland sorting facilities about 60 to 80 miles away from the Port area, which is described in more detail under Strategy 3.3.

Currently, on-dock rail infrastructure is available at nearly all container terminals at the Ports. Many non-container terminals are also served by rail in both Ports. Some existing on-dock rail facilities have physical limitations due to, for instance, the capacity of storage tracks. Additional tracks may be needed to optimize building blocks of rail cars to make destination trains.

In order to maximize the amount of cargo loaded onto rail in the terminals, the Ports also recognize the need to reduce constraints within the port-wide network that can affect utilization. To do this, the Ports need to invest in port-wide infrastructure improvements and on-dock rail support facilities, which can serve multiple terminals, such as the Port of Long Beach's proposed Pier B On-Dock Rail Support Facility.

Finally, in order to maximize emission reduction benefits, the Ports will continue to work with the rail operators and the state and federal regulatory agencies to seek utilization of the cleanest locomotives. Pacific Harbor Line, the rail company that provides switching services within the Ports (i.e., building trains and providing short moves) is the cleanest rail company in the country and has started to introduce locomotives with the lowest-emitting Tier 4 engines. Additionally, both Ports are funding the development and demonstration of a near-zero-emission locomotive manufactured by VeRail for use in switching operations within the Port complex. The Ports are also seeking funds to upgrade this locomotive with batteries in order to enable some zero-emission track miles. In the future, the Ports will continue to seek opportunities to work with rail operators and technology developers to demonstrate and deploy locomotive technologies that can achieve near-zero emissions and zero-emission track miles.

2.2. Charging Standards for Electric Terminal Equipment.

Successful deployment of commercially available electric terminal equipment will depend on compatible and accessible electrical charging infrastructure. Currently, manufacturers of electric terminal equipment are using different methods and equipment design specifications to charge the vehicles, resulting in different infrastructure requirements depending upon the equipment selected. This incompatibility will lead to potentially significant challenges in the long run. In order to deploy electric equipment on a large scale, the Ports must adopt charging standards so uniform infrastructure can be built throughout the port complex and so that a variety of equipment built by multiple manufacturers can be successfully deployed.

The design, siting, and construction of support infrastructure are very complex. Since 2015, the Ports have been working with regulatory agencies, technology developers and equipment operators to establish charging standards for yard tractors and other pieces of terminal equipment. These standards include technical specifications that consider design, cost and the complexity of charging a large fleet of equipment simultaneously. These standards are under development. The Ports have recently received grant funding to demonstrate several types of electric terminal equipment including yard tractors, top handlers, high tonnage forklifts, and rubber-tired gantry cranes. These demonstrations include various types of manual, automated, and inductive charging options. Final reports indicating the pros and cons of the various charging

options will assist the Ports, in cooperation with technology developers and regulatory agencies, in continuing to develop and refine the charging standards for the different types of terminal equipment. We anticipate similar standards will need to be developed for on-road applications; the Ports will also work with regional partners and standardization organizations to develop on-road charging standards. The Ports will continue these efforts to facilitate deployment of commercially available zero-emission or near-zero-emission equipment and trucks.

3. Freight Efficiency

The Ports recognize the value of moving goods efficiently in order to accommodate cargo growth without increasing emissions, and even better, by potentially reducing emissions. Operational efficiencies may also result in significant cost savings for the operators and cargo owners from reduced fuel costs and reduced time to move the cargo. In 2014, the Ports established the Supply Chain Optimization (SCO) strategy, bringing together representatives from across the goods movement industry to explore ways of enhancing freight efficiency. This ongoing effort will continue to support the State's goal of increasing freight efficiency by 25% as measured by trade value compared to greenhouse gas emissions.

While SCO discussions are still underway, there are several strategies that have risen to the top or that the Ports can explore expeditiously to accelerate potential benefits.

3.1. Green Terminal Program

The Ports will develop a voluntary recognition program to highlight the achievements of terminals working to enhance productivity while minimizing air quality impacts. There are several programs that could serve as models for how such a program could be structured, described below:

Leadership in Energy and Environmental Design (LEED) certification program. Under this program, buildings are rated Silver, Gold, or Platinum depending on the level of environmental sustainability. Terminals could voluntarily apply to be "certified" as a Green Terminal, with more efficient and sustainable terminals receiving higher levels of certification.

EPA SmartWay Program. The EPA's SmartWay Program is a voluntary program that provides supply-chain partners with tools, methodologies, and resources to operate more efficiently and to reduce emissions. SmartWay partners report information on their cargo movements and activities, which are then calculated into emissions. The program helps supply-chain partners identify more environmentally friendly approaches to moving goods. Such a program, perhaps with modifications, could provide tools or metrics for evaluating a terminal's efficiency.

Container Terminal Quality Index. This system encourages container terminals to benchmark their performance against 80 key performance indicators that take into account a terminal's unique configuration and operational profile. Such metrics include ship time at berth and crane productivity. The system provides tools by which terminals can audit their performance, report

these metrics, and obtain third-party certification for their efforts. The program is administered by the Global Institute of Logistics.

Green Marine. Under this program, terminals conduct a detailed self-assessment on a variety of environmental markers. The results determine the terminal's ranking, from mere compliance to leadership and excellence. This program also monitors a terminal's year-over-year improvements in the various performance indicators. Although Green Marine is focused exclusively on environmental achievements, this program could be a model for evaluating efficiency.

To develop a voluntary terminal recognition program for San Pedro Bay, the Ports would evaluate the programs described above as well as others and work with terminals to identify appropriate metrics. The discussions under the SCO effort have identified some of these metrics, which may include berth productivity, terminal dwell time, truck turn times, use of on-dock rail, and ship at-berth times.

The Ports may also structure the program to recognize improvements over time – that is, relative progress toward greater efficiency – rather than absolute standards. An example of such a metric could be emissions produced per TEU moved, which the ports currently track and report on a port-wide basis as a part of the annual emissions inventory. Terminals wishing to participate in this program would be required to report on their efficiency achievements to maintain or improve their certification level. The Ports also could adopt incentives to encourage terminal participation and to recognize their achievements.

3.2. Port Truck Reservation System

Of the 12 container terminals in San Pedro Bay, nine terminals use reservation systems for import containers and four of those terminals also use such systems for export containers. The remaining three terminals use an alternative pre-gate methodology to expedite the gate transaction process rather than reservation systems. For terminals with reservation or appointment systems, truckers who arrive at the gate with an appointment are expected to receive prompt service during that time window. For terminals that have implemented a pre-gate methodology, truckers who have complied with those requirement prior to arriving at the terminal are expected to receive prompt service and complete their terminal visit within one hour.

Currently, individual terminals and trucking companies use their own software systems to manage their gate operations. There is no consistent platform nor are there consequences for a trucker missing an appointment or reservation or a terminal failing to serve a truck on time. In

addition, while a few terminals schedule reservations for gate arrivals to pick up or drop off loaded containers, the majority of the terminals with such systems only schedule appointments for gate arrivals to pick up loaded containers for imports, and don't schedule chassis, the return of empty containers, or drop off of exports. If there were a uniform portal for securing all aspects of a truck transaction, it could improve the functionality of the system, help to alleviate congestion issues, and promote dual transactions (e.g. empty return coupled with a loaded pick-up). Further, efficiency improvements at the gate and throughout the terminal can reduce truck idling time.

Together, these improvements could improve traffic flow, and reduce truck turn times, vehicle miles traveled, and associated truck emissions. In order to improve overall efficiencies and achieve these goals, the Ports propose universal systematic integration of the reservation systems for all marine terminals in San Pedro Bay to be implemented by January 1, 2020. This integration would serve as an overlay to the existing terminal specific systems, providing one front end for the users to access all systems.

One of the Ports' goals for integrating reservation systems would be to achieve a visit time for trucks within the terminal (i.e. from in-gate to out-gate) of 1 hour for a dual transaction.

The Ports will also work with stakeholders to explore mechanisms to ensure compliance with the reservation system and maximum effectiveness in achieving our efficiency goals. Other ports around the world have adopted truck appointment systems coupled with financial penalties for terminals and trucking companies that fail to uphold their end of the appointment. For example, Port Botany, Australia's second largest container port, has instituted financial penalties for terminals that do not honor a trucker's appointment and for truckers who do not arrive during their scheduled appointment time. Port Metro Vancouver has implemented a system that imposes fees on terminals that exceed a specified truck turn-time threshold. Further evaluation would be needed to determine whether or not these approaches could work in the San Pedro Bay Ports, where chassis are managed differently and the truck fleet is four to 10 times larger than these other ports.

In addition, reservation systems should provide process and data flows that allow customers to effectively make drayage arrangements in anticipation of when a container will be ready for pick up. Currently, import containers cannot be scheduled for drayage until the container has been physically discharged from the vessel, updated with a finite location in the container yard, and cleared for pick-up, which can be days after the container arrived in the terminal. With advance notice of when a container will be ready, there will be more opportunity for advanced planning and more efficient scheduling for dual transactions.

In May of 2017, PierPass – a nonprofit company created by terminal operators to address issues of congestion, air quality, and security – announced plans to contract with a consulting firm to analyze two potential options for programmatic changes to the PierPass program designed to increase the efficiency of terminal gate transactions while preserving the core mission of mitigating traffic during peak hours. Those two potential options include a port-wide peel off program and a flat-fee structure. Based on the outcome of that analysis, the members of the West Coast Marine Terminal Operators Agreement (WCMTOA) will make the final determination regarding what changes, if any, will be made to the PierPass program. The Port will continue to coordinate with PierPass to understand if the proposed program can be structured in a way to achieve our goals.

Thus, the strategy for the Port Truck Reservation System is as follows:

- Implement reservation systems for the marine terminals in San Pedro Bay by end of 2020 that will integrate existing terminal operating systems and help to increase overall efficiency for cargo movement in the port complex.

The Ports would propose to conduct a pilot program prior to broader implementation in order to gauge the potential effectiveness and to ensure implementation can be optimized to meet the Ports' goals.

3.3. Systemwide Efficiencies

In order to improve the overall efficiency of freight movement, the Ports are looking beyond the terminals and the port complex. Transitioning to cleaner equipment is critical; however, further emission reductions can be achieved by changing the very way we do business. For example, moving cargo by rail as opposed to truck or handling containers at off-terminal yards, which was identified in the Sustainable Freight Action Plan, show promise in improving air quality.

Such efforts require study, and as such, the Ports propose to examine the feasibility of systemwide efficiency programs in order to identify potential emission reductions and to accelerate deployment. Several of these efforts, including emerging technology demonstrations for intelligent transportation systems and other pilot projects to enhance efficiency, have already begun and can be expanded upon:

Port of Los Angeles Information Portal: The Port of Los Angeles and GE Transportation are partnering to develop a first-of-its-kind port information portal, a unique approach to

demonstrate the benefits of digitizing maritime shipping data and making it available to cargo owners and supply chain operators through secure, channeled access. The digital platform will provide stakeholders with greater line-of-sight and planning capabilities to more effectively service ultra-large container vessels. From May to August 2017, the concept was piloted at the Port of LA's largest terminal, in partnership with two major liner shipping companies, shippers, and various service providers. Cargo data used in the two-month pilot project will include shipping line manifest data and filtered information from the U.S. Customs and Border Protection's Automated Commercial Environment (ACE) system. The pilot project confirmed the benefit of enabling next-level collaboration and coordination among the many stakeholders involved in the conveyance of waterborne cargo containers. The Port of Los Angeles is expanding the portal to other terminals, which will enhance supply chain performance by delivering fast, data-driven insights through a single portal to partners across the supply chain. Ultimately, the goal of the port information portal is to improve data flow between cargo owners, shipping lines and other stakeholders so that port and terminal operators have an extended window of time to track inbound cargo to more effectively service vessels, optimize cargo movement and improve the predictability and reliability of the supply chain.

Freight Advanced Traveler Information System (FRATIS) Demonstration: The Port of Los Angeles is using a nearly \$1 million grant from the California Energy Commission to support the ongoing large-scale testing of this technology. FRATIS is an intelligent transportation system that analyzes data from multiple sources to come up with the most efficient schedule, route and container information for drivers, dispatchers and cargo owners. Specific technologies that are being tested include: real-time traffic information obtained from the California Department of Transportation and the Los Angeles County Metropolitan Transportation Authority (Metro); automated estimated-time-of-arrival messaging to the terminals one day in advance of truck arrival; and deployment of an algorithm that will optimize drayage throughout the day and region. The system is designed to reduce travel times inside and outside the terminals, which in turn reduces congestion, emissions and fuel consumption. The demonstration phase of the existing project involves 200 trucks and several trucking companies. The project is also testing Geostamp, a Harbor Trucking Association/InfoMagnus application, which tracks real-time truck travel and terminal turn times via an automated mobile smart device app, and ECO-Drive, University of California, Riverside's Center for Environmental Research and Technology app, which uses traffic signal timing information to optimize acceleration/deceleration of trucks. The Eco-FRATIS demonstration will commence in late 2017.

Concept for the Harbor Performance Efficiency Center (HPEC): The conceptual HPEC is a proposed off-dock container staging and storage facility located in the Port of Los Angeles that could provide an outlet to relieve congestion in San Pedro Bay. The concept is expected to

increase efficiency, reduce costs, and lower emissions. Efforts will be made to ensure that zero- and near-zero-emission technologies are demonstrated and used to the greatest extent feasible at this facility, which will also be used to facilitate learning, collaboration, and new innovative ideas for the supply chain. This concept is currently in the environmental review process.

Short-Haul Rail Study: The Ports have begun researching the potential of inland ports, which involve shuttling cargo by rail between the port complex and warehousing and distribution centers within 100 miles of the Ports. Initial discussions with beneficial cargo owners along with distribution center and warehouse operators indicate significant interest in an inland port served by short-haul rail to serve the Inland Empire region, providing costs are comparable to a truck move. The Ports will be pursuing a more detailed review of the concept. Potential benefits could include reduced congestion at marine terminal gates, reduced congestion on local freeways, and reduced net emissions. Further study is necessary, however, to ensure that potential impacts are not just being shifted to a new location.

Advanced Transportation Management and Information System (ATMIS): The Ports began using this intelligent transportation system (ITS) technology for managing traffic conditions in the San Pedro Port Complex in 2012 and recently began exploring an upgrade of the system. ATMIS is composed of computer software communicating with various field devices including closed-circuit cameras, vehicle detectors, and changeable message signs connected to a central computer software to improve traffic flow and to enable management of roadway conditions. The initial phase of the upgrade includes integrating current traffic management functions with Virtual Port, a geographic information system (GIS)-based operations monitoring tool developed by the Port of Long Beach Security Services Division. Subsequent phases include potential enhancements to Virtual Port and Web Portal (the viewer-only version of the tool) to specifically aid traffic management functions, improved coverage of ATMIS field devices, coordination with the FRATIS, and continued data sharing with regional ITS managed by Metro and the California Department of Transportation (Caltrans).

There is a need for these efforts to be expanded. The Ports will coordinate with their industry and regulatory partners to identify and expand upon the areas of study, which may include:

- Short-haul rail (i.e., shuttle trains)
- Centralized off-dock chassis facilities
- Staging yards (i.e., peel-off yards)
- Truck appointment times and off-terminal queuing
- Intelligent transportation systems

4. Energy Resource Planning

Transitioning to zero emissions at the scale needed to support the two largest container seaports in the country will place a significant burden on the Ports' energy systems as well as the utility grid. Adding electric and alternative-fueled equipment will require additional infrastructure, and the Ports will be challenged to ensure reliable, predictable, and cost-effective power to maintain our operations. For these reasons, the Ports must think strategically about energy generation, storage, controls, and systems integration to ensure resiliency for our operations, capacity for these operations and those of the public, and to meet the 2050 GHG goal.

Since each Port receives its power from different utility providers (Southern California Edison for the Port of Long Beach and Los Angeles Department of Water and Power for Port of Los Angeles), each Port has embarked on its own detailed energy resources planning efforts. The goals of both Ports remain aligned and focused on the following key concepts:

- *Resiliency:* Ability of the Ports to maintain business continuity during power outages and resume operations after a catastrophic event.
- *Availability:* Access to sources of electricity necessary for present and future power demands of Port operations through generation, transmission, and distribution and access to alternative fuels such as hydrogen to support fuel cell powered equipment.
- *Safety:* Uphold high standards for equipment and infrastructure safety and work closely with utilities and contractors to design, verify, and maintain energy systems that keep workers and users safe.
- *Reliability:* Availability of high-quality, consistent electricity that minimizes voltage anomalies and harmonic distortion, and meets predicted peaks in demand.
- *Cost Stability:* Ensure that costs for energy are predictable into the future and cost effective.
- *Efficiency:* Adoption of, and incentives for, management practices and technologies that reduce energy demand, such as LED lighting at terminals and smart controls.
- *Sustainability:* Integration of energy management practices and renewable power generation to minimize the depletion of natural resources and provide economic, social, and environmental benefits.

In addition, the Ports plan to evaluate Energy Management Plans for Harbors and Port Districts (Pub. Res. Code §25990), which encourages ports and utility providers to develop joint energy management plans, to identify opportunities for collaboration and complementary initiatives. Through the respective energy planning efforts, the Ports are poised to become industry leaders

in the management of integrated energy systems that will provide safe, reliable, sustainable power and fuels for seaport operations.

4.1. Energy Infrastructure

The Ports understand that technology-driven design improvements and significant infrastructure planning are required to support the deployment of zero and near-zero-emission equipment. Collaboration between the Ports, manufacturers and regulators is required to evaluate and standardize infrastructure needed for emerging technologies. For example, as mentioned previously, the Ports have convened a working group to establish a charging standard for heavy-duty equipment and are evaluating various charging systems. Initial estimates indicate that supporting infrastructure could cost upwards of \$2 billion, so a thorough evaluation of alternatives is required. This research will be used to develop infrastructure plans, design criteria and specifications, and more refined cost estimates to support equipment electrification.

In addition, the ports will evaluate the need for electrical charging infrastructure for on-road trucks and additional alternative fuel infrastructure to support near-zero and zero-emission on-road trucks and equipment, including LNG for marine vessels, and will work with port operators, fuel providers, and regional stakeholders to support necessary deployments.

Both Ports are developing energy programs and are working to refine, demonstrate and implement various energy management strategies. These efforts will be undertaken in collaboration with other stakeholders, such as utilities and energy regulators, to ensure that all energy customers' power needs are met. More information about Port energy programs can be found at the following websites:

- Port of Long Beach: <http://www.polb.com/environment/energyisland.asp>
- Port of Los Angeles: https://www.portoflosangeles.org/DOC/DRAFT%20POLA%20E-MAP_July%202014.pdf

Supportive Efforts

For the CAAP to be successful, the Ports must engage in efforts that support the CAAP strategies even if those efforts are not tied directly to the strategies themselves. Specifically, the Ports commit to supporting efforts to evaluate and bolster economic competitiveness, augmenting workforce development initiatives that bolster the transition to zero emissions, and to cultivating innovation and supporting businesses, including entrepreneurs, that can assist in the development of new emission-reduction technologies.

Economic Competitiveness

The Ports have received many comments from the port-related industry and regional business community about the importance of these two Ports remaining economically competitive and maintaining our market share. The Ports share these concerns, as identified in one of the Guiding Principles for this 2017 CAAP Update that states “the Ports are vital economic engines, supporting hundreds of thousands of local and regional jobs, and we must remain economically competitive and maintain our market position.”

Both Ports have undertaken planning efforts to continue to develop our business and to position ourselves competitively to remain the premiere gateway for goods movement in and out of the United States. Our competitive position is influenced by a wide range of factors that go beyond the costs associated with environmental programs such as those included in the 2017 CAAP Update strategies; however, we recognize the need to study the potential impacts of these new environmental efforts on our ability to compete with other national gateways. An initial analysis on the potential economic effects of the 2017 CAAP was provided in the Economic and Workforce Considerations⁴³ document. Development of specific 2017 CAAP Update strategies will also be guided by economic analyses, including an economic study for the establishment of the truck rate, and the key economic considerations incorporated into the feasibility assessments for new technologies. In addition, the Ports need to continue to evaluate and plan for other potential upcoming challenges, including the financial state of the industry, infrastructure needs, labor negotiations, costs, chassis and equipment availability, etc. Therefore, the Ports will work with industry stakeholders to evaluate our competitive position and ways to sustain and increase that position as we continue to face a variety of challenges.

In addition, the Ports have been actively involved and will continue to work with the State agencies in their efforts to measure, evaluate, and support economic competitiveness of the freight industry throughout California. Evaluating economic competitiveness beyond the local

⁴³ <http://www.cleanairactionplan.org/documents/clean-air-action-plan-2017-economic-considerations-final.pdf>

level, and taking into account a broader perspective on the variety of state, national and international economic factors will provide a more robust analysis and understanding of the factors that affect the industry. A Guiding Principle of the California Sustainable Freight Action Plan, is to “grow the economic competitiveness of California’s freight sector.”⁴⁴ The State agencies committed to measure economic growth and competitiveness and to develop future targets for increased State competitiveness and economic growth within the freight and goods movement industry. These targets “will be developed in conjunction with an economic competitiveness working group comprised of State agency representatives, economists, industry representatives, and subject matter experts. As there is no single definition, application, or metric which applies to the concept of economic competitiveness across the many different modes, markets, and impacts associated with the freight sector, the targets will need to be based on a multi-pronged suite of metrics and models, which will indicate overall statewide progress in improving California’s economic competitiveness. Given the dynamic nature of the freight industry economy, the working group will need to continuously monitor and update these metrics.”⁴⁵ The Ports have provided input on the scope of work for the state’s consultant to prepare these metrics and targets. The Ports will continue to support this effort by the State and will participate as these discussions advance.

Workforce Development

The 2017 CAAP Update hinges on new emission-reduction technologies, particularly near-zero emissions and zero emissions for on-road and off-road vehicles. To support this transition, the Ports need a workforce that can operate and maintain natural gas, battery-electric, and fuel cell equipment; build the necessary infrastructure; and develop innovative approaches to improving efficiency. All this can be done while maintaining the vital jobs here in the port complex, but preparing for these changes must start now.

The Ports already actively engage in workforce development efforts, and in support of the CAAP, we commit to building upon them:

- **Zero-Emissions Workforce Development Working Group:** The Port of Long Beach has partnered with Long Beach City College to evaluate the workforce needs for a zero-emissions future and to develop recommendations for new training programs and curricula that address any gaps. The effort launched this year and the first phase – assessments and recommendations – is expected to wrap up in early 2019. Future phases will involve curriculum development and implementation of new programs. This work

⁴⁴ California Sustainable Freight Action Plan, July 2016, p.9.

⁴⁵ California Sustainable Freight Action Plan, Appendix B: Freight Targets, July 2016, p. B-4.

group builds upon the Port's longstanding partnership with Long Beach City College, which includes an award-winning training program for technicians servicing natural gas trucks.

- **Port Workforce Training Center:** Working under a High Road Training Partnership Grant from the state, the Port of Los Angeles is working in partnership with labor, industry, and other institutional partners to establish a Port Workforce Training Center. The partnership includes the International Longshore and Warehouse Union (ILWU), the Pacific Maritime Association (PMA), and the City of Los Angeles Economic Workforce Development Department (EWDD), along with oversight by the Office of the Los Angeles Mayor. Objectives of the Port Workforce Training Center include the "up-skilling" or "re-skilling" of incumbent longshore workers to facilitate transition to zero-emission and near-zero-emission operation.
- **Harbor Driver Training Program:** Since 2013, both Ports have partnered with the Harbor Trucking Association and Long Beach City College to train drayage truck drivers through the Harbor Driver Training Program. To date, this program has graduated more than 140 drivers with 70% of them placed into port truck driving jobs. As truck technologies evolve to near-zero emissions and zero-emissions, the Ports will continue to support driver training programs.
- **International Trade Education Programs™ (ITEP):** ITEP is a Southern California 501(c)(3) non-profit organization that prepares high school students for diverse career opportunities in ports, transportation, logistics, and related industries. ITEP develops programs that integrate internships and career mentoring with the curriculum of area high schools. ITEP serves more than 5,100 students in 21 academies across 15 high schools, many of them near the Ports.
- **Academy of Global Logistics (AGL) at Cabrillo High School:** The Port of Long Beach sponsors the AGL at Cabrillo High School in Long Beach, which combines academic curriculum with industry relevant training and information to support academic and career development. The Academy introduces high school students to career opportunities in global trade and logistics and shows them how to prepare for those careers through a wide range of training and education programs including certificates, certifications, and degrees offered by Long Beach City College and California State University, Long Beach.

Business Support

- **Technology Events and Entrepreneur Development:** As described earlier, the Ports support emerging technology manufacturers and developers through the TAP. The primary purpose of the TAP is to demonstrate promising emission-reduction technologies; however, in support of this ultimate goal, the Ports work closely with organizations that support entrepreneurs whose technologies may be applicable to port operations. In the past, the Ports have attended conferences and events that give entrepreneurs opportunities to pitch new ideas for emission-reduction technologies, and we have participated in “hack-a-thons” to stimulate innovations for supply chain efficiencies. The Ports plan to augment these efforts going forward.

Implementation

The 2017 CAAP Update is a high-level planning document. Following its adoption by the Boards of Harbor Commissioners, the Ports will begin implementing the individual strategies through separate actions considered by each Port's Board of Harbor Commissioners. All of the strategies will require further Board approval, such as grant and incentive programs, contracts, tariff amendments and budget authorizations, before they can be implemented. As these strategies come to each port's respective board for adoption through a public process, the staffs will share more implementation details, including feasibility assessments, specific timelines, cost estimates, and programmatic procedures, and stakeholders will have the opportunity to provide comments along the way.

CAAP Implementation Advisory Workgroup

Upon adoption of the CAAP, the Ports will establish a CAAP Implementation Advisory Group to advise the executive directors and staff regarding the specific details of CAAP implementation. This group will consist of a core list of regular invitees but will be open to all who want to attend and provide input. The workgroup will be formed in January of 2018 and the Ports plan to hold the first meeting soon after in February. This workgroup will meet initially on a quarterly basis to provide input and hear updates on CAAP progress.

Green Ports Collaborative

The two ports will work with their mayors, through their coordination with other Climate Mayors, initially along the West Coast and then expanded nationally, to launch the Green Ports Collaborative. Through the Collaborative, we will seek to advance similar goals to demonstrate zero-emission goods movement vehicles and equipment, and create larger markets that grow demand to encourage manufacturers to invest and produce equipment in large enough numbers to reduce the costs per vehicle. This Collaborative could coordinate on demonstration projects, peer-to-peer information sharing, regular communication, field and technology visits, and collaboration with key industry, government, and nonprofit partners.

Transparency and Reporting

The Ports commit to regularly communicating the results of our CAAP efforts to our Boards and all of our stakeholders through regular briefings at public Board meetings. To that end, the Ports plan to prepare Quarterly Status Reports which will include updates regarding the status of all

ongoing CAAP projects. The Ports will continue to prepare Annual Emissions Inventories to keep the stakeholders informed on our progress in reducing air pollution.

The Ports will post all related CAAP documents, including assessments and technology reports, on the CAAP Web site and on social media, and in working with the CAAP Implementation Advisory Workgroup, identify ways to make the CAAP Web site more user-friendly.

Lastly, regular reports providing feedback on the path forward will be prepared for the Mayors of Long Beach and Los Angeles.

Implementation Timeline

Upon adoption of the CAAP, there will be an immediate need to begin designing and implementing programs to meet the aggressive timelines. In the first year, the bulk of the effort will focus on conducting feasibility assessments and other studies to support the strategies; implementing tariff changes for the Clean Trucks Program, terminal equipment, and vessel programs; and pursuing grant dollars for accelerated deployment of near-zero and zero-emissions equipment.

Fully implementing the CAAP strategies will take years; however, the Ports commit to key actions in the near term specifically for trucks, terminal equipment, and vessel programs, as described below.

Additionally, for all the strategies, the Ports immediately will begin to develop and launch a funding advocacy campaign to secure incentives for demonstrations and accelerated deployments.

More details on implementation for specific strategies are provided in the appendix.

Appendix: Estimated Implementation Timelines

Clean Trucks Program: Implementation Actions 2018-2023, Estimated Timeframe

Program	2018				2019				2020				2021				2022	2023
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
Program																		
MY 2014 New Registration Requirement				✓														
Registration Fee Waiver for ZE Trucks				✓														
Truck Rate-Setting Study																		
State Adoption of NZE Standard																		✓
Truck Rate and NZE/ZE Exemptions											✓							
NZE New Registration Requirement																		✓
Pilot Smog Check Program with State												✓						
Truck Appointment System													✓					
State and Federal Funding Advocacy Campaign	✓																	
Incentive Funding for Early Deployment	✓																	
Technology																		
Feasibility Assessment																	✓	
Ports ZE Pilot Deployment																	✓	
SCAQMD Overhead Catenary Demonstration					✓													
SCAQMD GGRF ZE Truck Demo (43 trucks)						✓												
Reporting and Transparency																		
CAAP Advisory Group	✓																	
Quarterly Status Reports		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Annual Emissions Inventory				✓				✓				✓				✓	✓	✓

	Development, design, public comment
	Board approval
✓	Implementation begins

Terminal Equipment: Implementation Actions 2018-2021, Estimated Timeframe

	2018				2019				2020				2021			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Program																
Participation in State Regulatory Activities for ZE Equipment	✓															
State Amendment of Terminal Equipment Regulation					✓											
Terminal Procurement Planning Requirement					✓											
Terminal Procurement Plan Updates								✓				✓				✓
New Equipment Purchases Requirement									✓							
Terminal Infrastructure Planning														✓		
Terminal Equipment Idling Program												✓				
State and Federal Funding Advocacy Campaign	✓															
Incentive Funding Applications for Early Deployment	✓															
Technology																
Feasibility Assessments																
Port of Los Angeles Near-Zero Emissions Yard Trucks Demo						✓										
Ports Zero-Emissions Top Handlers Demo										✓						
Ports Zero-Emissions Yard Trucks Demos										✓						
Port of Long Beach Electric Rubber-Tired Gantry Cranes Demo										✓						
Reporting and Transparency																
CAAP Advisory Group	✓															
Quarterly Status Reports		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Annual Emissions Inventory				✓				✓				✓				✓

	Development, design, public comment
	Board approval
✓	Implementation begins

Vessel Programs: Implementation Actions 2018-2025, Estimated Timeframe

	2018				2019				2020				2021				2022	2023	2024	2025
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
Program																				
Vessel Speed Reduction Program Modification							✓													
Ship Incentive Programs Modifications					✓															
Participation in State At-Berth Regulation Process	✓																			
State At-Berth Regulation Amendments Adopted		✓																		
At-Berth Infrastructure Planning																	✓			
Clean Ship Differential Rate-Setting Study																				
Clean Ship Differential Rate Program																				✓
State and Federal Funding Advocacy Campaign	✓																			
Incentive Funding Applications for Early Deployment	✓																			
West Coast Ship Incentive Collaboration	✓																			
Technology																				
Maersk Ship Energy Efficiency Demonstration							✓													
Port of Los Angeles At-Berth Demo (Shorekat)					✓															
Ports At-Berth Emission Reduction Demonstration											✓									
Reporting and Transparency																				
CAAP Advisory Group	✓																			
Quarterly Status Reports		✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓					
Annual Emissions Inventory				✓				✓				✓								

	Development, design, public comment
	Board approval
✓	Implementation begins