Revised Draft
Seaport Air Quality
2020 and Beyond Plan

June 29, 2018

PORT OF OAKLAND

Volume I of II

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS

AB 617	Assembly Bill 617
ACTC	Alameda County Transportation Commission
AGV	Automated Guided Vehicle
AMS	Ancillary Maritime Services
B20	20% Biodiesel
B100	Pure Biodiesel (100% Biodiesel)
BAAQMD	Bay Area Air Quality Management District
BC	Black Carbon
CAAP	Clean Air Action Plan
CARB	California Air Resources Board
CARE	Community At Risk Evaluation
CBP	Customs and Border Protection
CEC	California Energy Commission
CES	California EnviroScreen
CHE	Cargo-Handling Equipment
CO2e	Carbon Dioxide Equivalents
CTMP	Comprehensive Truck Management Plan
CNG	Compressed Natural Gas
DPF	Diesel Particulate Filter
DPM	Diesel Particulate Matter
DERA	Diesel Emissions Reduction Act
EI	Emissions Inventory
ECA	Environmental Control Area
FAME	Fatty Acid Methyl Ester
GGRP	Greenhouse Gas Reduction Plan
GHG	Greenhouse Gas
HC	Harbor Craft
HRA	Health Risk Assessment
HVIP	State of California Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project
IA	Implementing Action
IMO	International Maritime Organization
LNG	Liquefied Natural Gas
MAQIP	Maritime Air Quality Improvement Plan
MARPOL	International Convention for the Prevention of Pollution from Ships
MMRP	Mitigation Monitoring and Reporting Program
NAAQS	National Ambient Air Quality Standard
NZE	Near-Zero Emissions
NZEV	Near-Zero Emissions Vehicle
NO	Nitric Oxide
NO2	Nitrogen Dioxide

OEHHA	Office of Environmental Health Hazard Assessment
OICT	Oakland International Container Terminal
OIG	Oakland International Gateway (railyard)
OEM	Original Equipment Manufacturers
OGRE	Oakland Global Rail Enterprise (railyard)
OGV	Ocean-Going Vessels
PETF	Port Efficiency Task Force
PG&E	Pacific Gas & Electric Company
PM	Particulate matter
PM2.5	Particulate matter less than 2.5 micrometers in diameter
PN	Particulate Number
ppm	Parts per million
RD	Renewable Diesel
RNG	Renewable Natural Gas
rpm	Revolutions per minute
RPS	Renewables Portfolio Standard
RTG	Rubber-Tired Gantry Crane
SCA	Standard Conditions of Approval
SCR	Selective Catalytic Reduction
SIP	State Implementation Plan
SPBP	San Pedro Bay Ports
SSA	Stevedoring Services of America
STEP	Secure Truck Enrollment Program
TAC	Toxic Air Contaminant
TEU	20-Foot Equivalent Units
TIGER	Transportation Investment Generating Economic Recovery
TMP	West Oakland Truck Management Plan
TOS	Terminal Operating Systems
TWG	Trucker Working Group
UTR	Utility Tractor Rig
VOC	Volatile Organic Compounds
VSR	Vessel Speed Reduction
USEPA	United States Environmental Protection Agency
USDOT	United States Department of Transportation
WOEIP	West Oakland Environmental Indicators Project
ZANZEFF	Zero- and Near Zero-Emission Freight Facilities
ZE	Zero Emissions
ZEV	Zero-Emissions Vehicle

GLOSSARY

Ancillary Maritime Services	Services such as federal Customs and Border Protection (CBP), agricultural inspection, truck repair, truck parking, fueling, and other services that support Seaport operations.
Applicability of the Plan	The Seaport Air Quality 2020 and Beyond Plan applies to emissions arising from the five major equipment categories in the Emissions Inventory and from Port-led development activities at the Seaport.
Assembly Bill (AB) 617	Making use of new air pollution monitoring technologies capable of detecting elevated exposures at a much more localized scale than conventional ambient air quality monitors, Assembly Bill (AB) 617 (C. Garcia, Chapter 136, Statutes of 2017), aims to establish a new community-scale emissions abatement program; updates air quality standards for certain stationary sources located in or contributing to non-attainment areas; and provides for improved enforcement, and ensures community participation in the process.[1] In response to AB 617, the California Air Resources Board (CARB) established the Community Air Protection Program (CAPP or Program) to develop a new community-focused action framework for community air protection. In addition, the State Legislature has appropriated AB617 funding to support early actions to address localized air pollution through targeted incentive funding to deploy cleaner technologies in these communities, as well as grants to support community participation in the AB 617 process. AB 617 also includes new requirements for accelerated retrofit of pollution controls on industrial sources, increased penalty fees, and greater transparency and availability of air quality and emissions data. These requirements will help advance air pollution control efforts throughout the State. (Source: CARB)
Call (or Vessel Call)	A visit by a ship to a port. A vessel may call a given port during a calendar year.
Cargo-Handling Equipment	Types of equipment used to move containers within a marine terminal. CHE in use at the Port of Oakland includes rubber-tired gantry cranes (RTGs), yard tractors, side-picks, and top-picks. The large ship-to-shore cranes that move containers from the vessel to the container yard and vice-versa are not included in the definition of cargo-handling equipment.
Co-benefit	A benefit derived from an action that addresses another concern. In the context of this Plan, reducing GHG emissions typically provides a co-benefit of reducing diesel particulate matter (DPM) emissions.

[1] Center for Clean Air Policy: California's AB 617: A New Frontier in Air Quality Management…if funded. August 2, 2017.

GLOSSARY (CONTINUED)

Community	The residents and businesses in West Oakland and in other areas near the Seaport.
Concrete Action	An implementing action that results in reductions in air emissions through deployment of equipment or construction of infrastructure (as opposed to studies and monitoring that would be required to plan or evaluate the concrete actions.)
Electrolysis	Electrolysis is the process of using electricity to split water into hydrogen and oxygen. Electrolysis using GHG-free electricity is a means of generating renewable hydrogen for use in hydrogen-fuel-cell powered vehicles and equipment.
Emissions Inventory	An emissions inventory is an estimate of the quantity of pollutants that a group of sources produces in a given area over a prescribed period of time.
Drayage Truck	A truck used to haul containers to and from the container terminals. It consists of the tractor unit and a semi-trailer consisting of the container on a chassis (wheeled base).[2]
Fiber Optic Communications Systems	Fiber optic communications systems transmit information from one place to another by sending pulses of light through an optical fiber. Optical fiber is used by many telecommunications companies to transmit telephone signals, Internet communication, and cable television signals.
Greenhouse Gas (GHG)-free energy	GHG-free energy is energy produced without emitting GHGs into the atmosphere. GHG-free energy includes, for example, solar power, wind power, geothermal power, and hydroelectric power.
GoPort Program	The GoPort (Global Opportunities at the Port of Oakland) Program is designed to improve truck and rail access at the Port Oakland. It includes three components designed to reduce congestion and increase efficiency to improve sustainability and economic competitiveness. The three components are the 7th Street Grade Separation East, 7th Street Grade Separation West, and the Freight Intelligent Transportation System (FITS). The GoPort program is being led and implemented by Alameda County Transportation Commission.
Harbor Craft	Smaller vessels, including tugs, survey boats, and work boats that are used in water-based Seaport operations.

[2] CARB defines a drayage truck as "…any in-use on-road vehicle with a gross vehicle weight rating (GVWR) greater than 26,000 pounds that is used for transporting cargo, such as containerized, bulk, or break-bulk goods, that operates: (A) on or transgresses through port or intermodal rail yard property for the purpose of loading, unloading or transporting cargo, including transporting empty containers and chassis; or, (B) off port or intermodal rail yard property transporting cargo or empty containers or chassis that originated from or is destined to a port or intermodal rail yard property." (CARB 2018a)

GLOSSARY (CONTINUED)

Heavy Duty Diesel	A heavy duty diesel truck is also known as a Class 8 truck. It has a gross vehicle weight rating of over 33,000 lbs. The typical 5-axle tractor-trailer truck combination, also called a "semi" or "18 wheeler", is a Class 8 vehicle. These are the most common trucks at the Seaport, and are also referred to as drayage trucks (see above).
Hybrid	An engine that runs partially on electrical power recovered from braking or other sources (e.g., when an RTG lowers a container) that is wasted in conventional engines. Hybrid equipment runs on battery power until the battery is exhausted, and may then use an internal combustion engine to either power the engine directly, or to recharge the battery.
Maritime Area	See Seaport Area.
Near-Zero Emissions	Near-zero emissions is a term that is used for many different types of equipment, including low-NOx trucks and hybrid equipment, that have relatively low emissions. As defined by the State of California in AB 1341 (Calderon, February 2017), "'near-zero-emission vehicle' means a vehicle that utilizes zero-emission technologies, enables technologies that provide a pathway to zero-emissions operations, or incorporates other technologies that significantly reduce criteria pollutants, toxic air contaminants, and greenhouse gas emissions, as determined by the State Air Resources Board in consultation with the State Energy Resources Conservation and Development Commission, consistent with meeting the State's mid- and long-term air quality standards and climate goals." Due to the variety of equipment that may be classified as "near-zero emissions," this Plan refers to these types of equipment by their specific type, such as low-NOx or hybrid.
Ocean Carrier	A company operating a vessel that visits the Port of Oakland.
Ocean-Going Vessel	Large vessel used in trans-oceanic commerce. The vast majority of the OGVs[3] visiting the Port of Oakland are container ships.
Partner	A business, public agency, non-governmental organization (NGO), community, or other organization working collaboratively with the Port to accomplish the goals of the Seaport 2020 and Beyond Plan.
Pool of IAs	The IAs that have passed Step 2 of the screening process and may be considered for implementation if they pass the feasibility evaluation.

[3] The CARB definition of Ocean-Going Vessel is as follows (CARB 2018 b): "Ocean-going Vessel (OGV)" means a commercial, government, or military vessel meeting any one of the following criteria: (A) a non-tanker vessel greater than or equal to 400 feet in length overall (LOA) as defined in 50 CFR § 679.2, as adopted June 19, 1996; (B) a non-tanker vessel greater than or equal to 10,000 gross tons (GT ITC) per the convention measurement (international system) as defined in 46 CFR 69.51-.61, as adopted September 12, 1989; (C) a non-tanker vessel propelled by a marine compression ignition engine with a per-cylinder displacement of greater than or equal to 30 liters; or (D) a tanker that meets any one of the criteria in subsections (A)-(C).

GLOSSARY (CONTINUED)

Renewable Electricity	Renewable electricity is electricity produced from renewable sources that may include solar power, wind power, and hydroelectric power from small sources. Electricity from large hydroelectric projects and municipal waste incineration is specifically excluded from this definition.[4]
Renewable Fuels	Renewable fuels are fuels produced from renewable sources. Examples include renewable diesel, renewable natural gas, hydrogen (if generated using GHG-free electricity), and biodiesel, among others. Renewable liquid fuels, primarily renewable diesel and biodiesel, can often be used directly in place of petroleum diesel in existing engines, or require only minor operating changes.
Residual Emissions	Implementation of the MAQIP has resulted in substantial emissions reductions from the 2005 emissions, but some emissions remain. The term "residual emissions" is used to refer to these (current) emissions.
Renewable Fuels	Renewable fuels are fuels produced from renewable sources. Examples include renewable diesel, renewable natural gas, hydrogen (if generated using GHG-free electricity), and biodiesel, among others. Renewable liquid fuels, primarily renewable diesel and biodiesel, can often be used directly in place of petroleum diesel in existing engines, or require only minor operating changes.
Seaport Area	Consists of the Seaport and immediately adjacent areas associated with the Seaport, including warehouses and truck support facilities, and ancillary maritime services. The Seaport Area includes tidelands under the Port's jurisdiction. The Seaport Area as used in this document excludes the UP Railyard, the Schnitzer Steel facility, and City-owned portions of the former OAB.
Semi-Trailer	A semi-trailer is a trailer having wheels at the back, but supported at the front by a tractor unit (the part of a truck that includes the cab). A semi-trailer does not have a front axle and associated front wheels. A large proportion of a semi-trailer's weight is supported by the front tractor unit (see Tractor Unit, below.)
Shipper	An ocean carrier operating a vessel that visits the Port of Oakland.

[4] The California Energy Commission defines renewable electricity as being produced by a facility that "…uses biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation of 30 megawatts or less, digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, or tidal current, and any additions or enhancements to the facility using that technology." (CEC 2018).

Stakeholder	An organization or individual with an interest in or potentially affected by, implementation of this Plan, including but not limited to residents, regulatory agencies, Port tenants, and Seaport- related businesses.
Tenant	A business renting land or facilities at the Seaport. Current tenant examples include Impact Transportation, GSC Logistics, Central Valley Agricultural, and PCC Logistics.
Terminal Operator	A company operating a terminal—a site where vehicles that transport materials empty and/or load cargo. Sometimes also known as a Cargo Terminal Operator or Marine Terminal Operator (MTO) for terminals located at ports.
Terminal Velocity	That rate at which containers can be moved into and out of a marine terminal. The higher the terminal velocity, the more efficient the marine terminal.
Throughput	The volume of cargo passing through a marine terminal over a given period of time. Seaports generally measure business activity based upon throughput volumes.
Tractor-Trailer	A tractor-trailer is the combination of a tractor unit and one or more semi-trailers to carry freight. A semi-trailer attaches to the tractor with a fifth wheel hitch, with much of its weight borne by the tractor.
Tractor Unit	A tractor unit (prime mover or traction unit) is a heavy-duty towing engine that provides the power to haul a towed or trailered load.
Yard Tractor	A tractor unit designed specifically for use in a container yard; also referred to as a yard truck, utility tractor rig (UTR), yard goat, yard hustler, or prime mover.
Zero-Emissions	Per AB 1341[5] (Calderon, 2017), zero-emissions equipment is defined as equipment that does not emit any criteria air pollutants, toxic air contaminants, or GHGs while stationary or in operation, as determined by the State Air Resources Board. However, the fuel source (e.g., electricity or hydrogen) may still generate emissions at the point of production or in transport).

[5] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB1341

INTRODUCTION: BUILDING ON MAQIP; PLANNING FOR THE FUTURE

Air quality improvement is a strategic and organizational priority for the Port of Oakland (Port). Since 2009, the framework for the Port's Seaport-related air quality efforts has been the Maritime Air Quality Improvement Plan (MAQIP). The Board of Port Commissioners (Board) adopted the MAQIP in April 2009.

The MAQIP is a master plan. As such, it established a vision, goals, strategies, and targets to reduce emissions from Seaport-related activities. The MAQIP established a 12-year time frame from 2009 to 2020 for implementation. Central to the MAQIP is the Maritime Air Quality Policy Statement: "Reduce excess cancer health risk related to exposure to diesel particulate matter (DPM) emissions by 85% from 2005 to 2020." The MAQIP expressed this goal as an 85% reduction in DPM emissions. Henceforth, this document will consistently refer to the MAQIP goal in terms of the 85% reduction in DPM emissions.

In pursuit of the MAQIP goal and to comply with State of California (State) regulations, the Port and the maritime industry undertook large-scale emissions reductions programs and projects. As a result, based on the Port's 2017 Seaport Emissions Inventory, DPM emissions at the Port have decreased 81% since 2005 (Ramboll 2018). To achieve the 85% DPM emissions reduction goal by 2020, the Port will continue to focus on existing programs as well as additional reduction measures beyond regulatory compliance.

At the same time, the Port is looking ahead and planning for the future. New factors and issues are shaping air quality planning. For example, the State has declared ambitious greenhouse gas (GHG) emissions reductions targets for 2030 and 2050. The community, regulatory organizations, and the public are concerned about localized exposure to air pollutants. Technology changes, including advances in batteries, are creating the prospect of zero-emissions equipment and operations. Business growth, revenue generation, and financial capacity constitute critical inputs for long term air quality planning.

The Port is responding to these factors by developing a new Seaport Air Quality 2020 and Beyond Plan (the "2020 and Beyond Plan" or "Plan"). The Plan builds on the foundation established by previous air quality programs and projects, primarily the MAQIP. It renews the MAQIP's focus on emissions reduction measures by placing these within the context of the State's GHG targets and zero-emissions initiatives.

Like the MAQIP, the 2020 and Beyond Plan provides a master plan framework to guide decision-making, policy, and action. Whereas the MAQIP focused on reducing emissions from existing maritime equipment, the 2020 and Beyond Plan addresses not only equipment, but also fuels, on-going operations (including efficiency improvements), and, significantly, infrastructure.

The Port released the Draft 2020 and Beyond Plan (Draft Plan) for public review and comment on June 29, 2018. This Revised Draft 2020 and Beyond Plan (Revised Draft Plan) reflects the results of technical studies and policy discussions conducted during the plan development process, as well as stakeholder review and comments on the Draft Plan. The Port invites public comment on this Revised Draft Plan, and intends to provide the Final 2020 and Beyond Plan in Spring of 2019.[1] This Revised Draft Plan presents the proposed plan concept in Part I and the implementation approach in Part II. Related and supporting information is provided in Appendices A through G.

PART I: CONCEPT

OVERVIEW OF PART I

Part I describes the overall 2020 and Beyond Plan structure. It describes the Plan's key elements, which form the master plan framework. Planning assumptions are provided in Appendix A; further details regarding the Plan's background and context are provided in Appendix B.

Vision

The vision of the 2020 and Beyond Plan is a pathway to zero-emissions Seaport operations through changes in equipment, operations, fuels, and infrastructure.

Purpose

The purpose of the 2020 and Beyond Plan is to provide a common structure and guidance for all stakeholders involved in moving towards a zero-emissions Seaport. While the Port intends that the overall framework remain stable, the Port expects to update the Plan in five years, with a focus on updating the Near-Term Action Plan, so that implementation can reflect changing conditions and perspectives, especially technology, financial resources, emissions reductions, and stakeholder input.

Guiding Principles

Guiding principles are the values that apply to all aspects of the Plan, including Plan development, stakeholder participation, and implementation. These are the guiding principles:

- Planning is a joint fact-finding and co-learning process.
- All stakeholders share the desire and intention to develop knowledge to promote informed decision-making.
- The pursuit of near-term "wins" delivers verifiable air quality benefits and adds value to long-term planning.
- Pragmatic and cost-effective solutions advance Plan progress.

[1] The Final Seaport Air Quality 2020 and Beyond Plan will reflect further stakeholder engagement and Board and stakeholder review and comments, where applicable.

- Strong partnerships among stakeholders are a critical element of Plan implementation.

Goals

The 2020 and Beyond Plan includes five goals:

- Goal #1: Keep the Port competitive, financially sustainable, and a catalyst for jobs and economic development.
- Goal #2: Minimize emissions of criteria air pollutants and toxic air contaminants (TACs), with a focus on reducing DPM emissions.
- Goal #3: Reduce GHG emissions.
- Goal #4: Build and strengthen partnerships among the Port, tenants, equipment manufacturers, owners and operators, community organizations, regulatory agencies, and the public.
- Goal #5: Provide opportunities for meaningful stakeholder engagement.

Strategies

The "building blocks" of the Plan are its strategies and implementing actions (IAs). The 2020 and Beyond Plan relies on six strategies to guide action and process. The six strategies consist of three strategies that focus on actions that the Port can take to reduce GHG and DPM emissions and three strategies that address the process of achieving the transition to a zero-emissions Seaport. Figure 1 summarizes the six strategies.

FIGURE 1: 2020 AND BEYOND PLAN STRATEGIES

#1 Continue Emissions Reductions

- Current MAQIP goals to 2020
- Emissions inventory-based
- Ongoing programs
- New measures

#2 Promote Pathway to Zero Emissions

- GHG emissions
- Local exposure
- Phased implementation
- Fuels

#3 Develop Infrastructure

- Electrical system upgrades
- Other power technologies
- Information technology
- Resiliency (i.e., back-up systems.)

#4 Strengthen Partnerships

- Between Port and its stakeholders
- Among Port tenants and other stakeholders
- Workforce Development

#5 Engage Stakeholders

- 2020 and Beyond Task Force
- Community Town Halls
- Working groups
- Directed outreach

#6 Pursue Funding

- Grants and incentives
- Collaboration with tenants and others
- Share information on available funding

Strategy #1: Continue Emissions Reduction Programs and Projects.
Strategy #1 focuses on continued reductions in Seaport-related DPM emissions to achieve MAQIP goals. Strategy #1 seeks to identify additional emissions reduction measures "above-and-beyond" regulatory compliance. Strategy #1 relies on the Seaport emissions inventory and the Plan's feasibility criteria to identify which additional measures or programs may contribute to further emissions reductions.

Strategy #2: Promote Pathway to Zero Emissions.
Strategy #2 focuses on programs and projects that promote the pathway to zero emissions, such as fully electric or hybrid-electric cargo-handling equipment (CHE) and trucks. Increased use of zero-emissions equipment will reduce GHG emissions and localized exposure to TACs. To support the transition, the Port will work with its tenants, equipment manufacturers, grant-making agencies, and truckers to identify projects for grant and incentive funding support. The key method to reduce GHG emissions is to reduce fossil fuel use and associated emissions by switching to fully electric or hybrid-electric equipment, cleaner fuels, alternative power sources such as hydrogen fuel cells, and GHG-free sources of electricity, and by implementing measures to increase the efficiency of Seaport operations.

Strategy #3: Develop Required Infrastructure to Support Pathway to Zero Emissions.
Strategy #3 focuses on the infrastructure required to transition to zero-emissions operations, with the presumption that the predominant source of power will be electricity. This will require the Port and its tenants to pay for upgrades to existing systems, increase system resilience (i.e., backup capacity), and build new infrastructure, including information technology systems to improve goods movement efficiency. The Port will plan and coordinate electrical system upgrades in areas served by the Port as a utility. The Port will work jointly with the terminal operators, off-dock tenants, and equipment owners located in these areas. The Port and its tenants will work with Pacific Gas & Electric Company (PG&E) in the PG&E-serviced areas. See Figure 2 for service areas. Strategy #3 provides flexibility for other technology options (such as hydrogen-powered equipment) to provide power for zero-emissions equipment and operations.

FIGURE 2: SEAPORT ELECTRICAL INFRASTRUCTURE

Source: Port of Oakland Revised Draft Seaport Air Quality 2020 and Beyond Plan (December 2018)

Strategy #4: Build and Strengthen Partnerships.

Strategy #4 focuses on building and strengthening partnerships among the Port, Port tenants, equipment owners, operators, other businesses, community organizations, original equipment manufacturers (OEMs), researchers, the community, and agencies as well as with other ports to achieve the 2020 and Beyond Plan goals. Strategy #4 also focuses on economic and workforce development, particularly Goal #1 (keeping the Port competitive, financially sustainable, and a catalyst for jobs and economic development).

Strategy #5: Engage Stakeholders.

The 2020 and Beyond Plan involves stakeholder participation opportunities to inform Plan development and implementation. Stakeholder participation for the 2020 and Beyond Plan engages stakeholders in the planning process and provides ongoing opportunities for meaningful input and authentic involvement as decision-making and Plan implementation progresses.

Strategy #6: Pursue External Funding.

Strategy #6 addresses costs associated with Plan implementation. It focuses on grants and other

incentive funding from external (non-Port) sources such as other public agencies to support the implementation of technology, equipment, fuels, and infrastructure. While grants and incentive funding from other sources will typically be sought for projects that have been identified as priorities, the availability of grants and other incentive funding from non-Port sources may also lead to projects being accelerated and/or new projects being implemented.

IMPLEMENTING ACTIONS

Implementing Actions constitute one of the core building blocks of the Plan. The Plan identifies IAs pertaining to all six strategies. Appendix C describes the potential IAs in detail. Table C-2: Potential Implementing Actions shows the IAs in each of the seven categories and cross-references the IAs by applicable strategy.

Some of IAs support multiple strategies. For example, any equipment converted to zero emissions (Strategy #2) will provide local DPM and criteria air pollutant reduction benefits in addition to GHG emissions reductions (Strategy #1). Similarly, educating Port partners about grant opportunities is both a partnership and a funding-related action (i.e., supports both Strategies #4 and #6).

FEASIBILITY CRITERIA

Each IA must satisfy six feasibility criteria: 1) affordability; 2) cost effectiveness; 3) priority; 4) commercial availability; 5) operational feasibility; and 6) acceptability. Depending on the IA under consideration, some feasibility criteria may not apply. Part II of the Plan describes the feasibility criteria.

FINANCIAL FEASIBILITY

Implementation of this 2020 and Beyond Plan will require substantial investments from the Port as well as many of its tenants and other business partners. The Plan will require investments in technology, equipment, fuels, and infrastructure, as well as in Plan management and workforce development, such as technical training. The Plan provides the framework to assist funding agencies, businesses, and the Port in ascertaining how to best apply their respective resources in support of Plan strategies and goals. Implementation of the Plan will proceed incrementally, as funding and resources for various actions become available and the cost of new zero-emissions or hybrid equipment comes closer to achieving cost parity with diesel-fueled equipment.

Zero-emissions equipment currently has high costs and limited commercial availability. Tenants and truckers will choose to acquire zero-emissions equipment as it becomes more affordable based upon their operational criteria. Over time, as zero-emissions equipment technology matures, costs are likely to decrease substantially.

When tenants plan to implement new zero-emissions equipment, the Port will coordinate with

the tenants on the tenants' estimates of specific power needs, development of designs, and costs. Where major systems upgrades are required, such as a substation or new transmission line, the Port would conduct a focused cost assessment, including the development of a specific financing strategy.

FUNDING

The Port and its business partners will consider a range of appropriate funding options to promote the Plan. Grants and other incentive funds, particularly from external sources such as regulatory agencies, are a critical factor in Plan implementation to address the cost premium associated with zero-emissions equipment that currently exists and will likely persist over the next decade or more. The Port will evaluate suitable financing options to fund major infrastructure improvements and select the one that is most favorable to the Port. Strategy #6 addresses the need for external (i.e., non-Port) funding. To support implementation of Strategy #6, the Port is identifying an internal grant funding team to strategically evaluate and pursue future grant funding opportunities, and to identify grant funding opportunities that may be of interest to its business partners.

TIMELINE

The transition to a zero-emissions Seaport will occur in phases over several decades. This Plan has three phases, which generally correspond to milestone years found in State policies and existing regulations: Near-Term (2019-2023); Intermediate-Term (2023-2030); and Longer Term (2030 -2050). The Near-Term Phase overlaps with and incorporates MAQIP implementation through 2020.

APPLICABILITY OF THE PLAN AND PLANNING ASSUMPTIONS

The 2020 and Beyond Plan applies to emissions arising from the five major equipment categories in the Emissions Inventory, and from Port-led development activities at the Seaport. Implementation of actions identified in this Plan will occur in the Seaport area, including Port owned areas of the Oakland Army Base (OAB). The Port is not proposing emissions reduction initiatives on OAB property owned by the City of Oakland (City), the Union Pacific rail yard, or Schnitzer Steel as part of this Plan. These areas fall under the primary jurisdiction of the City of Oakland.

A set of planning assumptions was used in the development of the Plan. These planning assumptions include, for example, the expected rate of Seaport cargo growth and the evolution of commercially available technology. Appendix A presents a detailed description of the planning assumptions.

STAKEHOLDER ENGAGEMENT

The Port is committed to stakeholder engagement in the 2020 and Beyond Plan. The Port is involving stakeholders in the planning process and will provide ongoing opportunities for engagement during Plan implementation. Appendix G contains the Draft Public Engagement Plan (Draft PEP), developed for the 2020 and Beyond Plan implementation process, that describes the stakeholder community, stakeholder concerns, and planned outreach and engagement activities.

The Port will also facilitate access to the decision process and decision makers. Stakeholders will be provided the opportunity to give input throughout the process, including providing comments on the Revised Draft Plan and the Final Plan (to be released in Spring 2019), and will receive direct feedback on how their input helped to influence the decisions. This Revised Draft Plan is accompanied by a Response to Comments document that documents all the comments received on the Draft Plan and provides a response to each comment.

Central to the stakeholder engagement process is the Seaport Air Quality 2020 and Beyond Plan Task Force, which is led by a steering committee of Co-Chairs. In their role, the Co-Chairs are assisting the Port in determining the recommended levels of engagement for development of the final Plan and Plan implementation. Co-Chairs will also support efforts to engage other stakeholders, including organizations and residents who may not have previously participated in the Port's air quality planning efforts, in the process. As part of the public comment process on the 2018 Draft Plan, stakeholders provided specific suggestions regarding other organizations that should be involved, as well as recommendations for how to best engage residents who are unable to attend Task Force meetings. The recommendations are reflected in the Draft PEP (see Appendix G).

The Port will use a range of stakeholder engagement activities, such as public information meetings, consultations, and social media, to seek input and advice and respond to input. Stakeholder engagement activities have taken place prior to and during development of the Revised Draft Plan (see Appendix B) and will continue to take place as the final Plan develops. Stakeholder input on the Draft Plan is reflected in this Revised Draft Plan, and stakeholder input on this Revised Draft Plan will be reflected in the Final Plan, which the Board will consider for approval.

The Port has held several Task Force meetings during the development of the Plan. Additional Task Force meetings are planned prior to the release of the Final Plan. Following the release of the Final Plan, the Port anticipates continued meetings of the Task Force and periodic Community Town Hall meetings.

MONITORING

Monitoring is central to ensuring that the Port meets its targets toward achieving Plan goals. Monitoring includes monitoring completion of IAs and progress toward achievement of the Plan's goals. For criteria air pollutants, DPM, and GHG, the Port will continue to monitor progress through periodic emission inventories.

REPORTING AND PLAN UPDATE

The Port will report on progress on Plan implementation through annual reports to the Board. The Port will also share information contained in the annual reports to the Board with the Task Force and with stakeholders at the Community Town Halls and other forums as appropriate.

In 2023 (the final year of the Near-Term phase of Plan implementation), the Port will update the 2020 and Beyond Plan to reflect changes in technology, lessons learned during implementation of this first phase, regulatory changes, and economic conditions.

PART II: IMPLEMENTATION

OVERVIEW OF PART II

Part II provides a detailed description of Plan implementation, with a focus on:

- Strategies
- Implementing Actions (IAs)
- Timeline and Phasing
- Action Plan
- Monitoring and Reporting
- Funding, and
- Plan Management

STRATEGIES

The "building blocks" of the Plan are its strategies and implementing actions. The 2020 and Beyond Plan relies on six strategies to guide actions and progress. Strategies #1-#3 focus on actions to reduce emissions. Strategies #4-#6 address the process of achieving emissions reduction.

Strategy #1: Continue Emissions Reduction Programs and Projects.

Strategy #1 applies primarily during the Near Term (Years 2019-2023) and Intermediate Term (Years 2023-2030). Strategy #1 IAs focus on programs and projects to achieve DPM emissions reductions to meet the MAQIP goal, and on compliance with State air quality regulations. The Port will continue to prioritize those actions that can be implemented in the Near-Term, contribute to attainment and maintenance of federal and State ambient air quality standards and to prevent significant deterioration of air quality, are cost-effective (see feasibility criteria in Table 1, below), and for which grant or incentive funding opportunities exist.

As discussed in more detail in Appendix B (see Emissions Estimates in Appendix B), combined residual DPM emissions from ocean-going vessels (OGV) and harbor craft (HC) account for 95% of the residual DPM emissions. The majority, 83%, of the residual Seaport-related DPM emissions are associated with OGV, primarily OGV in transit. The Port has limited control or influence over emissions reductions associated with OGV in transit or with harbor craft. While potential IAs for Strategy #1 focus on actions that can be taken by the Port, the Port will continue to track and support, where applicable, new standards for OGV, such as the recent GHG emissions reductions targets in the April 18, 2018 MARPOL guidance (IMO 2018).

Examples of potential IAs that support Strategy #1 include:

- Converting a portion of the Port's fleet to battery-electric vehicles
- Use of renewable diesel in the Port's diesel-powered equipment
- Retrofitting RTGs to hybrid equipment
- Voluntary or incentivized vessel speed reduction

Strategy #2: Promote Pathway to Zero Emissions.

Strategy #2 focuses on equipment, fuels, and operations to reduce GHG emissions and localized exposure to toxic air contaminants. Studies and further planning efforts are a crucial part of the Near-Term actions pursuant to Strategy #2. The actions to transition to zero emissions will contribute to reducing local exposure to criteria air pollutants and TACs. Strategy #2 IAs would occur during all three phases of Plan implementation. Potential IAs associated with Strategy #2 have GHG emissions reductions as their primary focus; however, the Port will give greater preference to IAs that also provide a higher level of associated TAC emissions reductions. Reductions in GHG emissions can be achieved through two means: (1) by reducing fossil fuel consumption; and (2) by replacing existing fossil fuels with lower carbon or carbon-free fuels, such as renewable liquid fuels, GHG-free electricity, and hydrogen from renewable sources.

Reduced fuel consumption results from more efficient engines and operations and from hybrid technologies involving recovery of energy normally lost during braking and other activities. Some lower-carbon renewable fuels are commercially available, cost-effective, and operationally feasible now.

The Port will give preference to IAs that provide immediate reductions in emissions and are consistent with a longer-term transition to zero-emissions operations, that provide localized emissions reductions, and that are needed to more fully understand the requirements for moving to a zero-emissions Seaport. Transitional solutions including use of hybrid equipment and fuel changes may provide very substantial emissions reductions benefits.

Examples of potential IAs that support Strategy #2 include:

- Engineering and operational feasibility studies for zero-emissions CHE
- Infrastructure assessment to evaluate the specific electricity demands that could occur at various tenant locations
- Battery-electric equipment demonstration projects funded by grants and/or equipment manufacturers
- Instituting use of renewable diesel for the Port vehicle fleet

Strategy #3: Develop Required Infrastructure to Support the Pathway to Zero Emissions.

Strategy #3 is designed to address the infrastructure needs of a zero-emissions Seaport. Foundational to a zero-emissions Seaport is adequate infrastructure to support power and any alternative fuel demands, as well as fiber optic communications lines for more efficient maritime operations. Strategy #3 focuses on infrastructure with the presumption that the predominant source of power will be electricity. Specifically, Strategy #3 focuses on investments in electrical systems to upgrade existing systems, increase resiliency[1] (i.e., system backup capacity), and construct new infrastructure. The Port will need to plan and coordinate electrical system upgrades in areas served by the Port as a utility. The Port will work jointly with the terminal operators, off-dock tenants, and equipment owners located in these areas. The Port and its tenants will also coordinate with Pacific Gas & Electric Company (PG&E) in PG&E's service area. Strategy #3 provides flexibility for other technological options (e.g., hydrogen-powered equipment) to provide power for zero-emissions operations.

Some examples of potential IAs to implement Strategy #3 include:

- Developing a guide for electric vehicle charging infrastructure projects in the Seaport area
- Performing engineering feasibility studies for container terminal electrification
- Tracking the development of uniform charging standards for zero-emissions equipment and advocating for Port-specific needs
- Expanding the electrical charging infrastructure for the Port's vehicle fleet
- Conducting feasibility studies for other alternative fuels, such as hydrogen fuel cells

Strategy #4: Build and Strengthen Partnerships.

Implementation of the 2020 and Beyond Plan requires collaboration with a wide range of parties and entities outside the Port. The Plan refers to these parties and entities as partners, and the collaboration as partnerships.[2] The Port will rely on agency, community, and business partners to help identify and pursue implementing actions. The Port's many partners have unique knowledge and perspectives to inform Plan development and aid in its implementation. Strategy #4 is designed to ensure that existing and potential partners: 1) contribute to Plan development, 2) engage in and contribute to Plan implementation, 3) provide subject matter expertise, and 4) make financial and other necessary organizational and operational commitments. Partners may collaborate with the Port on IAs or independently implement

[1] The more Port operations are dependent on electricity, whether for cargo handling equipment or smart technology/communications systems, the more important it becomes to have back-up systems in place to ensure that the Port can continue to operate if something happens to the electrical grid. Having adequate back-up is also referred to as resiliency.

[2] The terms "partner" and "partnership" as used in this document are not intended to convey a specific legal relationship among the parties and entities involved.

actions that support the goals of the 2020 and Beyond Plan, such as choosing to purchase zero-emissions equipment for their operations. As part of Strategy #4, the Port will expand existing partnership networks to increase Port-to-partner and direct partner-to-partner information exchange. In addition, pursuant to Strategy #4, the Port will inform partners about IAs they could implement.

Potential IAs that contribute to Strategy #4 include:

- Continuing to participate in working groups such as the Trucker Work Group (TWG) and the Port Efficiency Task Force (PETF)
- Conducting regular meetings with tenants as well as shipping lines and other customers, where feasible
- Collaborating with public agencies
- Partnering with other Ports on grant applications
- Advocating for cleaner OGVs and fuels

Strategy #5: Engage Stakeholders

Under Strategy #5, the Port will design and implement a stakeholder engagement program that continues to inform stakeholders about the progress of 2020 and Beyond Plan development and implementation, and that provides Stakeholders with opportunities to provide input into the development of the Plan and its implementation. Stakeholders suggested various ideas for the design of the stakeholder engagement process, including a working group to screen implementing actions and stakeholder independent review of emissions calculations. Strategy #5 includes specific outreach to organizations and residents who may not have previously participated in the Port's air quality planning efforts.

Examples of implementing actions that support Strategy #5 include:

- Conduct Task Force meetings
- Hold Community Town Hall meetings
- Engage stakeholders in the development of the Plan update in 2023

Strategy #6: Pursue External Funding

Strategy #6 focuses on external (non-Port) funding (i.e., grants and other incentives, such as the State of California Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project [HVIP]) to support the implementation of technology, equipment, fuels, and infrastructure. External funding sources will likely include public and regulatory agencies. Implementation of Strategy #6 will include developing a thorough understanding of the specific requirements of each grant or incentive funding program.

The following actions, among others, support Strategy #6:

- Track CARB, California Energy Commission (CEC), and BAAQMD websites for information on upcoming grant and incentive funding programs and become knowledgeable about grant and incentive program requirements
- Track the San Pedro Bay Ports' truck rate study
- Advocate for new or expanded State and federal grant opportunities

IMPLEMENTING ACTIONS

To put the six strategies into effect, the Port and its partners will identify and carry out Implementing Actions. An IA is a specific, time-bound and measurable action, activity, or initiative to promote a strategy on behalf of the Plan goals and vision.

The Plan includes Implementing Actions, organized into seven broad categories:

- Infrastructure
- Fuels
- Equipment
- Operations
- Partnerships
- Stakeholder Engagement
- External Funding

The process of selecting IAs for implementation follows the five-step process described in detail in Appendix D. The five-step process was used to identify the IAs for inclusion in the Near-Term (Years 2019-2023) Action Plan (NTAP). The NTAP presents Implementing Actions for 2019-2023, and associated timeframes. To be identified as a potential IA, a proposed activity must align with one of the six strategies. IAs must satisfy the following feasibility criteria: affordability, cost effectiveness, priority, commercial availability, operational feasibility, and acceptability.

Throughout the Plan implementation process, the Port and its stakeholders will continue to identify new Implementing Actions (see below) to be added to the IAs included in this Plan (see Appendix C, which provides a list and detailed description of potential IAs).

Feasibility Criteria

Table 1 summarizes the feasibility criteria. A more detailed description of the criteria, as well as the screening and evaluation process, are provided in Appendix D.

IAs that meet the feasibility criteria will be prioritized and implemented as funding becomes available.

TABLE 1: SUMMARY OF FEASIBILITY CRITERIA FOR IMPLEMENTING ACTIONS	
Criterion	**Description**
Affordability	Is the proposed action affordable for the Port or other organization implementing the action? Has the Board approved Port funds for the proposed IA? If the IAs will be implemented by an organization other than the Port, does that organization have sufficient funds available to implement the IA? Is grant or other incentive funding available? Would the IA potentially result in stranded equipment or infrastructure, or jeopardize usage requirements for any grant-funded equipment already in place?
Cost Effectiveness	Does the proposed IA provide cost-effective emissions reductions? Is the action a required infrastructure project or does it support required infrastructure?
Priority	Is the action required? For example, has equipment reached the end of its useful life or is electrical infrastructure needed to support increased electrical charging demands? How urgent is the action? For example, is lack of electrical infrastructure preventing further deployment of battery-electric equipment? Is the action part of planned program such as on-going investment in capital equipment? Will the action result in a delay or cancellation of other (non-air-quality-focused) priority projects? Will the action substantially advance experience with a certain type or class of equipment? If the action provides emissions reductions benefits, do the associated emissions reductions benefits accrue in the vicinity of the local community? Will the action build capacity (e.g., expand maintenance and repair services for battery-electric equipment, or provide training for electric vehicle mechanics)?
Commercial Availability[3]	Has the proposed technology or system reached commercial availability (Technological Readiness Level [TRL] 9), or at a minimum, the pre-production stage (TRL 7)? (Technological Readiness Levels are provided in Table D-2 of Appendix D.) Does sufficient experience with the technology/system exist to determine that its operational performance is acceptable?
Operational Feasibility	Is there sufficient experience with the technology or equipment to determine that its operational performance is acceptable? Are parts readily available and are repair and maintenance services available nearby? Does the existing workforce have sufficient training and experience to operate the new technology or equipment and can routine maintenance be performed in-house?
Acceptability	Is there a party or entity willing to undertake the implementing action, given the range of other considerations such as availability of land, constraints on current or future operations, or financial capability? Does the IA allow for continued reliable and satisfactory service delivery to customer(s)?

[3] This is the Port's working definition used in this Plan.

New Implementing Actions

Identification and Screening

The Port will continue to identify new potential IAs through various means including technology tracking and stakeholder input.[4] New technologies and innovative approaches to emission reductions are essential to achieve additional reductions in DPM and GHGs on the pathway to a zero-emissions Seaport.

The Plan implementation process includes identifying new IAs (i.e., IAs not contained in Appendix C), screening new IAs, and adding the new IAs to the pool of IAs associated with this Plan (the pool of IAs consists of IAs that have passed Step 2 of the screening process). The initial pool of IAs consists of the IAs in Appendix C. The Port will periodically evaluate and prioritize all IAs, and identify additional IAs (i.e., IAs not included in the Near Term Action Plan) for implementation. Funding IAs is a critical part of the implementation process. The discussion on external funding, below, describes the actions the Port intends to take in support of identifying sufficient funding to implement the IAs.

The Plan organizes the screening of new potential IAs into five steps. The first step is identifying new potential IAs. Step 2 is screening the new potential IAs against a pass/fail set of screening criteria intended to determine whether a specific potential IA will be added to the pool of IAs. The IAs in the pool will be evaluated according to the feasibility criteria shown in Table 1, and subsequently prioritized according to their relative performance on the feasibility evaluation. The highest performing IAs will be selected for implementation. This approach intends to move forward a wide range of potential new IAs by retaining IAs that are not initially selected for implementation for future consideration. A more detailed description of the process and the screening and feasibility criteria is provided in Appendix D. Some IAs may be screened out at the screening or feasibility evaluation steps because they do not provide sufficient benefits for Plan implementation, or they do not support the Plan goals. An IA that performs poorly in the feasibility evaluation due to a lack of funding, or other factors that may change in the future (e.g., operational feasibility), will remain in pool of IAs for reconsideration in the future.

During the development of the 2009 MAQIP, a working group screened numerous suggestions regarding various means of achieving DPM emissions reductions. The 2020 and Beyond Plan adapted the MAQIP screening process to reflect stakeholder engagement and the shift to zero-emissions technology. Table D-1 (Appendix D) presents screening criteria for new potential IAs. The Port anticipates that screening process may be refined further through stakeholder participation. In addition, the screening process may be revised as part of the five-year update of the Plan, depending on its effectiveness.

[4] For example, EarthJustice and BAAQMD provided lists of potential new IAs as part of their comments on the Draft Plan. These lists of potential new IAs are provided as Attachments to Appendix C.

Tracking Technology Development

Many potentially applicable technologies are still in the development or pre-commercialization phase (i.e., are not commercially available yet), which means that many IAs are not ready to be implemented at this time. Port staff will track IAs that pass the screening process but are not yet feasible for implementation. The tracking approach will depend on the specific technology and how close the technology is to being commercially available. Steps in the tracking process may include: 1) checking in with the original equipment manufacturer; 2) contacting other ports to determine the outcomes of pilot trials; and 3) reviewing scientific research. For example, the Port of Oakland is tracking the San Pedro Bay Ports' (SPBPs') feasibility studies for zero-emissions CHE.

TIMELINE AND PHASING

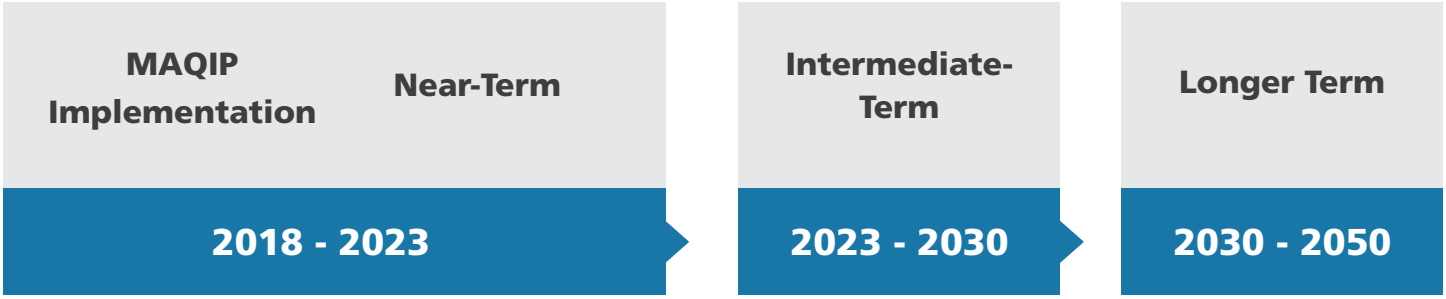
The current 2009 MAQIP has a planning horizon of Year 2020. This 2020 and Beyond Plan looks to Years 2030 and 2050 as its planning horizons. The Years 2030 and 2050 correspond to planning horizons established in the State's policies for GHG emissions reductions (i.e., 40% reduction in GHGs below the 1990 baseline by 2030 and 80% reduction in GHGs below the 1990 baseline by 2050).

The 2020 and Beyond Plan will be implemented in a phased manner, as determined by available funding and technology. This Plan proposes three implementation phases:

- Near-Term (2019-2023)
- Intermediate-Term (2023-2030)
- Longer Term (2030-2050)

The Plan anticipates that the pathway to a zero-emissions Seaport can begin almost immediately by deploying commercially available and operationally feasible equipment for which adequate infrastructure exists. Similarly, the Port can commence the needs assessment and feasibility studies related to the infrastructure required to support future deployment of zero-emissions equipment. Figure 3 shows the implementation timelines for the Plan.

FIGURE 3: TIMELINE AND ACTION PLAN PHASES



ACTION PLAN

The 2020 and Beyond Plan identifies potential implementing actions for each phase. Table 2 presents the Near-Term (Years 2019-2023) Action Plan (NTAP).

Near-Term Implementing Actions (Years 2019-2023)

Near-Term IAs include existing MAQIP programs as well as IAs identified pursuant to the 2020 and Beyond Plan. The Near-Term phase overlaps with and incorporates existing MAQIP implementation through the Year 2020 as well as new IAs commenced in 2018, such as the hybrid RTG project at the Oakland International Container Terminal (OICT) supported by a Carl Moyer grant program through BAAQMD.

Actions that are in progress or were recently completed include the following:

- Continued monitoring of shore power systems usage and compliance;
- Repower of existing RTGs to hybrid RTG cranes at OICT;
- Tracking grants and incentives and seeking partnerships;
- Emissions inventory (2017 completed in July 2018);
- Purchase of 10-passenger battery-electric van for Port vehicle fleet; and
- Seaport Air Quality 2020 and Beyond Task Force meetings (transitioned from MAQIP Task Force to 2020 and Beyond Task Force meetings in May 2018).

Near-Term (Years 2019-2023) Action Plan

The Port has identified 32 IAs for 2019 to 2023, and three Intermediate-Term equipment goals; these are shown in Table 2. Some of the IAs will be on going, such as monitoring shore power compliance, while others are specific projects. IAs in the NTAP fall into two categories: (1) programmed (for which required funding and staff resources are available or a commitment has been made to make them available) and (2) potential actions that have been prioritized for implementation and will be completed depending on available funding and staff resources.

Other IAs may be undertaken in addition to those shown in Table 2, depending on available resources and other factors. Priorities will be set based on the screening and feasibility evaluation process and the success of earlier IAs, including operational and equipment actions. The NTAP will be updated on an annual basis to reflect any changes in the IAs contained in the NTAP, for example as IAs are completed or new high-priority IAs are identified.

For each IA included in the NTAP, the NTAP provides a brief description, the type of action, the lead(s) for implementing the IA, and the proposed schedule (by year) for the IA.

Table 3 provides a summary of related projects to be undertaken in the Seaport area. These actions are focused on freight movement efficiency and safety, but are anticipated to have some ancillary air quality benefits through reduced idling.[5]

[5] These actions are being implemented under separate processes, and are not subject to 2020 and Beyond Plan's screening and monitoring.

TABLE 2. REVISED DRAFT NEAR-TERM (YEARS 2019 - 2023) ACTION PLAN											
No.	Specific Implementing Action	Appendix C IA Number and Name	IA Category	Lead	2019	2020	2021	2022	2023	Status	Summary of IA
1	SSA - 13 Hybrid RTGs	E-CHE-3. Expand Use of Hybrid Cargo-Handling Equipment Where Zero-Emissions Equipment is Not Commercially Available or Affordable	Equipment	Tenant						Programmed [1]	The BAAQMD awarded a Carl Moyer grant to SSA Terminals (SSAT), the terminal operator at the Oakland International Container Terminal (OICT) for the purchase of 13 hybrid RTGs. SSAT is using this grant to replace the diesel engines in its entire fleet of RTGs at OICT. Phase-in is expected to require approximately two years. Overall criteria air pollutant emissions from the hybrid RTGs are reduced 99.5% compared to the existing units.
2	90% Shore Power Use	E-OGV-1. Shore Power Improvements - Achieve 90% Shore Power Use	Infrastructure, Operations	Port						Programmed	As part of its grant requirements, the Port will continue to work with ocean carriers and tenants to improve plug-in rates to achieve an overall 90% plug-in rate in 2020.
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

[1] Programmed actions are those that have passed the feasibility screening and for which funding has been approved.

TABLE 2. REVISED DRAFT NEAR-TERM (YEARS 2019 - 2023) ACTION PLAN											
No.	Specific Implementing Action	Appendix C IA Number and Name	IA Category	Lead	2019	2020	2021	2022	2023	Status	Summary of IA
ZANZEFF Project Components											
3	10 Battery-Electric Class 8 Trucks plus Charging Infrastructure at Shippers Transport Express (STE)	E-T-4. Short-Haul Drayage Truck Demonstration Testing	Equipment	Tenant, Port						Programmed[2]	In collaboration with the Ports of Long Beach and Stockton, the Port was recently successful in obtaining a ZANZEFF grant from the California Air Resources Board. The Oakland component of the grant will include deploying 10 battery-electric drayage trucks at Shipper's Transport Express, and five battery-electric yard tractors and one battery-electric top-pick at the Matson Terminal. The testing will assess the performance of the various types of equipment, including operating time between charges, time required to recharge the vehicles, performance under load, maintenance requirements, and more.
4	1 Battery-Electric Top-Pick Plus Charging Infrastructure at Matson Terminal (SSA)	E-CHE-5. Demonstration Testing of Electrically-Powered Cargo Handling Equipment	Equipment	Tenant						Programmed	
5	5 Battery-Electric Yard Tractors plus Charging Infrastructure at Matson Terminal (SSA)	E-CHE-5. Demonstration Testing of Electrically-Powered Cargo Handling Equipment	Equipment	Tenant						Programmed	
Port Fleet Electrification											
6	10-passenger Electric Van	E-M-1. Port Fleet Conversion and Charging Infrastructure	Equipment	Port						Programmed	The Port recently purchased a 10-passenger battery-electric van for use at the Seaport. The Port is currently working with the vendor to resolve performance issues (the van is not charging due to software issues).
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

[2] The Port is in the process of allocating funding for the ZANZEFF projects; however, the Port Board of Commissioners has not yet approved funding for this effort.

TABLE 2. REVISED DRAFT NEAR-TERM (YEARS 2019 - 2023) ACTION PLAN											
No.	Specific Implementing Action	Appendix C IA Number and Name	IA Category	Lead	2019	2020	2021	2022	2023	Status	Summary of IA
7	Large Capacity Forklifts (1)	E-M-1. Port Fleet Conversion and Charging Infrastructure	Equipment	Port						Programmed	The Port used the Implementing Action feasibility screening process to assess the viability of purchasing battery-electric vehicles and equipment for its fleet. Although the battery-electric equipment is considerably more costly and did not pass the feasibility screening process, the Port decided to purchase six battery-electric vehicles and equipment as a pilot test in Fiscal Year 2019. Three of the battery-electric vehicles will be assigned to the Seaport area.
8	Work Trucks (2)	E-M-1. Port Fleet Conversion and Charging Infrastructure	Equipment	Port						Programmed	
Planned Charging Infrastructure											
9	Harbor Facilities	E-M-1. Port Fleet Conversion and Charging Infrastructure)	Infrastructure	Port						Programmed	The Port installed charging infrastructure at its Harbor Facilities building to charge fleet and personal vehicles. Additional charging infrastructure may be installed to accommodate the battery-electric equipment described above.
10	Impact Transportation	I-11. Future Infrastructure Modifications	Infrastructure	Tenant						Potential[3]	Impact Transportation has placed an order for a battery-electric yard tractor and will need to install charging equipment.
Other Demonstration Projects											
11	BYD Phase I: Battery-Electric Drayage Truck at GSC Logistics	E-T-4. Short-Haul Drayage Truck Demonstration Testing	Equipment	Tenant						Programmed	Since February 2018, GSC Logistics has been operating a first-generation battery-electric short-haul drayage truck. The truck worked well, but can only haul empty containers.
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

[3] Potential actions are actions that have passed the feasibility screening and have been prioritized for action (are "next in line"), but for which funding has not been identified.

TABLE 2. REVISED DRAFT NEAR-TERM (YEARS 2019 - 2023) ACTION PLAN											
No.	Specific Implementing Action	Appendix C IA Number and Name	IA Category	Lead	2019	2020	2021	2022	2023	Status	Summary of IA
12	BYD Phase II: Battery-Electric Drayage Trucks (up to 10 trucks total)	E-T-4. Short-Haul Drayage Truck Demonstration Testing	Equipment	Tenants						Programmed	Encourage the deployment of up to 10 battery-electric short-haul drayage trucks from BYD at Port tenant locations. The testing will assess the performance of the trucks, including operating time between charges, time required to recharge the vehicles, performance under load, maintenance requirements, and more. Phase II provides improved technology compared to Phase I.
13	Maritime Power Capacity Study for Terminal Electrification	E-CHE-2. Maritime Power Capacity Study for Terminal Electrification (Programmed)	Infrastructure	Port						Programmed	This study is assessing the infrastructure required to support a terminal using 100% battery-electric cargo-handling equipment (excluding RTGs). The scope of the study includes: • Existing system loads; existing distribution system model; and system needs of future • Terminal cargo handling equipment electrification needs. • Distribution system capacity and upgrade requirements • Transmission system capacity and upgrade requirements • PG&E transmission system capacity The target completion date is Spring 2019.
14	Future Infrastructure to Support Zero-Emissions Port Fleet	E-M-1. Port Fleet Conversion and Charging Infrastructure (Programmed)	Infrastructure	Port						Potential	The Port will continue to assess its infrastructure needs as it continues to convert its fleet to zero-emissions equipment over time.
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

TABLE 2. REVISED DRAFT NEAR-TERM (YEARS 2019 - 2023) ACTION PLAN											
No.	Specific Implementing Action	Appendix C IA Number and Name	IA Category	Lead	2019	2020	2021	2022	2023	Status	Summary of IA
15	Track Tenant Equipment Purchases and Respond to Tenant Needs for New Infrastructure	Technology Tracking and Performance Monitoring		Port						Potential	Monitor equipment used by tenants and encourage the purchase of least polluting options. As tenants decide to purchase zero-emissions equipment, the Port will work with the tenants to determine the need for any new supporting infrastructure. Tenants will need to work with PG&E at locations served by PG&E.
16	Electric Vehicle Infrastructure Guide for Port Tenants	I-5. Electric Vehicle Infrastructure Guide for Port Tenants (Programmed)	Infrastructure	Port						Programmed	To facilitate Port tenants' ability to install electrical charging infrastructure, the Port is preparing a guide that includes relevant information regarding permit and other requirements, and provides the necessary forms for permit applications.
17	Investigate Use of Renewable Diesel for Land-Based and Marine Equipment	F-4. Renewable Diesel Fuel	Fuels	Port						Potential	The Port is continuing to coordinate with CARB, fuel producer, and fuel users to assess the benefits of implementing use of renewable diesel for Port tenants and partners. Depending on the outcome of this assessment, the Port will work to educate appropriate users about the benefits of using renewable diesel.
18	Investigate Use of Renewable Diesel in Port-Owned Diesel-Powered Vehicles	F-4. Renewable Diesel Fuel	Fuels	Port						Programmed	The Port's fleet manager is currently evaluating the switching from petroleum diesel to renewable diesel for the Port's fleet. A new contract would have to be put in place to purchase renewable diesel.
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

TABLE 2. REVISED DRAFT NEAR-TERM (YEARS 2019 - 2023) ACTION PLAN											
No.	Specific Implementing Action	Appendix C IA Number and Name	IA Category	Lead	2019	2020	2021	2022	2023	Status	Summary of IA
19	Evaluate Vessel Speed Reduction Program	O-4. Evaluate Vessel Speed Reduction Program (Proposed)	Operations	Port						Potential	In consultation with the San Francisco Bar Pilots and other partners, the Port will evaluate the potential for a voluntary and an incentivized VSR program after the results of the BAAQMD pilot study are available. An incentivized VSR program could be included as part of an overall environmental incentive program. VSR in the outer Precautionary Zone would reduce Seaport-related DPM emissions by about 2 tons per year and GHGs by approximately 4,200 to 4,500 MT of CO2e per year in 2020 (Starcrest 2018).
Monitoring and Tracking											
20	Track Hybrid RTG Installation at Oakland International Container Terminal ("OICT")	Technology Tracking and Performance Monitoring	Equipment	Port						Programmed	The Port will coordinate with SSAT to track the performance of the hybrid RTGs as they are implemented at the OICT. Tracking will assess items such as fuel consumption, operability, and manufacturer performance.
21	Track Development of Uniform Charging Standards for Electrically-Powered CHE at San Pedro Bay Ports ("SPBP"), and Advocate for Specific Port Needs as Applicable	I-7. Uniform Charging Standards for Electrically-Powered Terminal Equipment and Drayage Trucks (Proposed)	Infrastructure, Equipment	Port						ProgrammedPrgPor	Manufacturers of electric terminal equipment are using different methods and equipment design specifications for equipment charging, resulting in different infrastructure requirements depending on the equipment and specific manufacturer selected. As more terminal equipment is transitioned to electric power, this transition may lead to significant challenges. The SPBPs have been working with regulatory agencies, technology developers and equipment operators to establish uniform charging standards for yard tractors and other pieces of terminal equipment. The Port will continue to track the development of the uniform charging standards, and assist with the review of the standards.
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

TABLE 2. REVISED DRAFT NEAR-TERM (YEARS 2019 - 2023) ACTION PLAN											
No.	Specific Implementing Action	Appendix C IA Number and Name	IA Category	Lead	2019	2020	2021	2022	2023	Status	Summary of IA
22	Monitor Shore Power Use	O-5. Monitor Shore Power Use	Operations	Port						Programmed	The Port tracks shore power usage on a monthly basis to identify problems and opportunities for increasing shore power use.
23	Track Port Tenant Incentive-Funded Zero-Emissions Equipment and Associated Infrastructure (e.g., Prop 1b and Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project [HVIP] Funding)	Technology Tracking and Performance Monitoring		Port						Programmed	The Port will continue to track the progress of tenant deployment of zero-emissions and other alternatively-fueled equipment and vehicles, and tenants' success with obtaining grant and incentive funding for their equipment and charger purchases.
24	Conduct Emission Inventories	Monitoring and Reporting	Operations	Port						Programmed	The Port conducted Seaport EIs in 2005, 2012 and 2015 and 2017. The Port will continue to conduct emissions inventories to evaluate the progress of emissions reductions efforts. The next EI will be completed for the Year 2020.
25	Continue to Coordinate with Port Efficiency Task Force (PETF) (or future equivalent) and Others to Identify and Implement Efficiency Measures	P-6. Participate in Industry Stakeholders Groups	Operations	Port						Programmed	The Port will continue to coordinate with the PETF and others to identify new potential efficiency measures to reduce the overall emissions per ton of cargo over time.
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

TABLE 2. REVISED DRAFT NEAR-TERM (YEARS 2019 - 2023) ACTION PLAN											
No.	Specific Implementing Action	Appendix C IA Number and Name	IA Category	Lead	2019	2020	2021	2022	2023	Status	Summary of IA
26	Track Clean Air Action Plan ("CAAP") Technology Advancement Program results	P-1. Track San Pedro Bay Ports' CAAP Progress and Technology Advancement Program	Partnerships	Port						Programmed	The Port will continue to proactively reach out to the SPBPs to stay informed regarding various initiatives under the CAAP, including incentive programs and technology demonstrations.
27	Track SPBP Zero/Near-Zero Emissions Feasibility Studies	P-1. Track San Pedro Bay Ports' CAAP Progress and Technology Advancement Program	Partnerships	Port						Programmed	The Port will track the CAAP feasibility studies.
28	Meet with Port Tenants Annually to Discuss Current Air Quality Measures and Room for Improvement	P-5. Meet with Port Tenants	Partnerships	Port						Programmed	On an annual basis the Port will meet with selected tenants (marine terminal operators, rail yards, and tenants with over 100,000 square feet of building space) to receive an update on the tenant's efforts to reduce air emissions associated with its operations and to provide an update to the tenant on recent technological improvements. The annual update will include an inventory update of all CHE from all tenants over 100,000 square feet.
29	Actively participate in Trucker Work Group (TWG), Harbor Trucking Association (HTA), and Western States Trucking Association (WSTA)	P-6. Participate in Industry Stakeholders Groups	Partnerships	Port						Programmed	The Port will continue to actively participate in trucker associations to share information on recent technological improvements and available grant and incentive programs, and to receive feedback on equipment cost and performance.
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

TABLE 2. REVISED DRAFT NEAR-TERM (YEARS 2019 - 2023) ACTION PLAN											
No.	Specific Implementing Action	Appendix C IA Number and Name	IA Category	Lead	2019	2020	2021	2022	2023	Status	Summary of IA
30	Port Environmental Office Hours for Trucking Companies and Truckers	P-3. Port Environmental Office Hours for Trucking Companies and Truckers	Partnerships	Port						Programmed	The Port has implemented weekly office hours to assist truckers with information pertaining to servicing modern trucks, grant and incentive programs for zero-emissions vehicles, and other questions.
31	Participate with PETF, Pacific Merchant Shipping Association, and Other Industry Stakeholders to Keep Informed and Provide Updates on Zero-Emissions Technologies	P-6. Participate in Industry Stakeholders Groups	Partnerships	Port						Programmed	The Port will continue to coordinate with industry stakeholders to receive and share updates on new technologies, equipment performance and operability experience, and costs.
32	Implement Workforce Development Plan	P-12. Workforce Development Plan	Partnerships	Port							Pursuant to Appendix E: Workforce Development Plan
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

TABLE 2. REVISED DRAFT NEAR-TERM (YEARS 2019 - 2023) ACTION PLAN											
No.	Specific Implementing Action	Appendix C IA Number and Name	IA Category	Lead	2019	2020	2021	2022	2023	Status	Summary of IA
I-1	Deployment 44 Pieces of Zero Emissions Cargo-Handling Equipment by 2025[4]	E-CHE-4. Electrically-Powered Cargo-Handling Equipment	Equipment	Tenants						Intermediate-Term Equipment Goal	The Port will work with its tenants to facilitate implementation of battery-electric and/or other zero-emissions cargo-handling equipment. This action assumes HVIP funding remains in place and is dependent on the actual development of technology and cost differential for zero-emissions CHE over time. Applies to equipment demonstrated, in demonstration, and/or in operation.
I-2	Deploy 21 Zero-Emissions Drayage Trucks by 2027[5]	E-T-4. Short-Haul Drayage Truck Demonstration Testing	Equipment	Tenants						Intermediate-Term Equipment Goal	The Port will work with its tenants and conduct outreach to truckers to facilitate implementation of zero-emissions drayage trucks. This action assumes HVIP funding remains in place and is dependent on the actual development of technology and cost differential for zero-emissions drayage trucks over time. Applies to equipment demonstrated, in demonstration, and/or in operation.
I-3	Infrastructure to Support Deployment of Zero-Emissions Equipment for Goals I-1 and I-2	I-10. Charging Infrastructure to Support Zero-Emissions Equipment	Equipment, Infrastruc-ture	Port						Intermediate-Term Equipment Goal	The Port will coordinate with tenants to provide supporting infrastructure for zero-emissions CHE and drayage trucks for equipment deployed pursuant to Goals I-1 and I-2. This may include installation of spare infrastructure where appropriate and opportunities arise (e.g., spare conduits, stubs outs, etc.).
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

[4] This goal includes equipment that has been demonstrated, is in demonstration, or in commercial operation.

[5] This goal includes equipment that has been demonstrated, is in demonstration, or in commercial operation.

TABLE 3. RELATED PROJECTS[1]											
Related Projects											
GoPort Project - 7th Street Grade Separation											
1	7th Street Grade Separation – East	Infrastructure	ACTC						Programmed		This project will replace the existing railroad underpass between I 880 and Maritime Street to increase clearance for trucks and improve the shared pedestrian/ bicycle pathway. In combination with the 7th Street Grade Separation - West project, this project will improve traffic flow in the Port area, thereby reducing truck idling times. Construction is expected to begin in 2020.
2	7th Street Grade Separation – West	Infrastructure	ACTC						Programmed		This project will realign and grade separate the intersection of 7th Street and Maritime Street and construct a rail spur underneath to improve access and minimize conflicts between rail, vehicles, pedestrians, and bicyclists. In combination with the 7th Street Grade Separation - East project, this project will improve traffic flow in the Port area, thereby reducing truck idling times. The expected construction duration is 2 to 2.5 years.
GoPort Project - FITS											
3	Project 1: Joint Transportation Management Center and Emergency Operations Center (TMC/EOC)	Equipment, Infrastructure, Operations	ACTC						Programmed		Reconfigure/modify existing TMC at the Port's Harbor Facilities building for the efficient operation of a Joint TMC/EOC, which will maintain and operate the ITS elements to be deployed by the FITS Project.
4	Project 2: Radio-Frequency Identification (RFID) Readers	Equipment, Infrastructure, Operations	ACTC						Programmed		Install RFIDs in and near the Seaport Facilities on existing and new poles to monitor truck movement, including truck turn-time within the Port. The readers will transmit the truck information to a central location that can be accessed through a server.
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

[1] Not subject to the 2020 and Beyond Plan's screening and monitoring process.

TABLE 3. RELATED PROJECTS[1]											
Related Projects											
5	Project 3: Advanced Traffic Management System (ATMS) - Phase 1	Equipment, Infrastructure, Operations	ACTC						Programmed		Install and/or implement the following: • Signal improvements including video detection (intersection only) • Advanced Rail Grade Crossing System (for determining train activity and delays) • Advanced Traffic Management System (ATMS) software platform • Changeable Message Signs (CMSs) • Queue Detection • Closed Circuit Televisions (CCTV) upgrade to high-definition (HD) • Communications (Fiber) • Center to Center (C2C) connection between the Port, the City of Oakland, and Caltrans • Additional RFIDs (not installed by Project No. 2) requiring communication network via a fiber backbone • Supplemental Vehicle Detection (for determining vehicle speeds and traffic patterns) • Weigh-in-Motion (WIM) Technology (for determining truck weights)
6	Project 4: Basic Smart Parking System	Equipment, Operations	ACTC						Programmed		Installation of software system/application that monitors parking availability that can be shared via GoPort Freight ITS Information System/App, CMS and other system technology, as well as provide parking payment options.
7	Project 5: Communications (WiFi)	Equipment, Infrastructure, Operations	ACTC						Programmed		Install WiFi capabilities in the Seaport area as a backup communication system and a means for addressing cellular dead spots and enhancing security and emergency response functions. Offers amenities to truckers in queue or within the PORT (e.g., Port traffic and gate queue videos and improved access to GoPort freight ITS information System/App).
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

TABLE 3. RELATED PROJECTS[1]											
Related Projects											
8	Project 6: System Integration and GoPort Application – Phase 1	Operations	ACTC						Programmed		A System Integrator (SI) will develop software to integrate existing and new ITS Applications. In addition, the SI will develop graphical user interface (GUI) application for the basic GoPort Application. The application will be made available for the end users (truck and other service providers) so that it can be used, for example, to find travel time, including turn-around time within the Port; find container information such as availability and yard information; make appointments for container pickups/drop-offs or parking within the Port complex; and pay fees.
	Implementation/Construction										
	Potential Implementation/Construction										
	Operation										
	On-going Activity										

Intermediate-Term Actions (Years 2023-2030)

Intermediate-Term actions will build on the Near-Term actions. Some Near-Term actions will have to be completed before certain Intermediate-Term actions can be implemented. For example, the Port will need to complete certain feasibility studies before infrastructure design and construction can begin. Some IAs that may occur in the intermediate term include:

- Upgrades and/or construction of Port-owned and PG&E-owned[6] substations;
- Expansion of electrical infrastructure on terminals;
- Increased use of hybrid and zero-emissions CHE;
- Continued conversion of Port-owned fleet to zero-emissions vehicles; and
- Continued use of grants and incentive funding to replace or convert existing CHE and drayage trucks to zero-emissions or hybrid equipment, as appropriate.

By 2030, the Seaport area will likely resemble an emerging mosaic of zero-emissions and hybrid technologies and associated infrastructure improvements on the pathway towards a zero-emissions Seaport. Based on the proposed CARB rule-making schedule pertaining to freight movement activities, the Port expects that CARB will promulgate numerous additional emission regulations during this time period (see Appendix B). The new regulations are likely to include regulations pertaining to OGV (expected to take effect in 2023), harbor craft (expected to take effect in 2023), drayage trucks at seaports and railyards (expected to take effect between 2026 and 2028), CHE (expected to take effect after 2026), and rail yard idling emissions restrictions (expected to take effect after 2025).

These new regulations will likely drive additional innovation in the regulated equipment sectors and operations. Also, zero-emissions technologies will continue to mature, and it is very likely that incremental costs will continue to decrease. This may change the feasibility of various technologies and equipment over time. Port staff will continue to track and screen new potential IAs and regularly reevaluate the priorities set for the IAs.

Longer-Term Actions (Years 2030-2050)

During the Longer-Term phase, construction of required infrastructure will continue to support the pathway to zero emissions. Port partners are expected to continue to replace fossil-fuel-based equipment with zero-emissions equipment as resources, regulations, equipment replacement cycles, and technological development allow. The availability of grants and incentives will continue to be an important factor affecting the rate at which zero-emissions equipment is adopted. For example, zero-emissions yard tractors are not expected to reach cost parity (considering equipment purchase costs and maintenance costs) with diesel-powered tractors until the late 2030s (see Appendix F). Port staff will continue to implement ongoing actions, track and pre-screen new potential IAs, and regularly reevaluate the priorities set for

[6] The Port does not have control over the PGE's infrastructure, so Port tenants served by PG&E will communicate their needs to PG&E.

the various potential IAs. The Port will also continue to advocate for cleaner OGVs, because OGVs in transit are likely to remain the largest source of Seaport-related DPM emissions.

MONITORING AND REPORTING

Monitoring and reporting are critical components of the implementation process for the 2020 and Beyond Plan. Compared to the MAQIP, the monitoring program designed for the 2020 and Beyond Plan includes a greater focus on lessons learned, in part because much of the needed technology has yet to be developed and made commercially available and in part because the Plan intends to build capacity and share knowledge for future actions.

Determining Emissions Reductions

The Port will conduct periodic emissions inventories to estimate the emissions reductions from the Seaport mobile sources. Development of a full inventory for sources at the Port is a time-intensive process involving collection of data on all emission-generating activities (ship calls, berthing times, truck trips, etc.), equipment (engine types and sizes, exhaust after-treatment devices, etc.), operating parameters (engine loads, travel speeds, idling times, etc.), and associated emissions factors. Emissions inventories will address criteria air pollutants, DPM, and GHGs. The Port will compare the results of the emissions inventories to the Year 2005 baseline. In addition, the Port will evaluate the trend in total DPM and GHG emissions relative to Port growth over time.

Monitor Execution and Results of Implementing Actions

The Port will monitor the execution and results of IAs. The Port may also choose to monitor certain IAs during implementation, for example, to understand the complexity of implementing new equipment. In addition, the Port may monitor the performance of certain IAs over time (e.g., the performance of zero-emissions equipment or certain types of chargers).

Monitoring Progress Toward Plan Goals

The Port will use the results of the emissions inventories and the monitoring of the IAs to assess its progress toward substantially reducing Seaport-related air emissions. The Port will provide the results of its emissions inventories to stakeholders and will consider the data generated by community-based monitoring and research efforts in its evaluation.

Reporting

The Port is committed to reporting on a regular basis to facilitate continued involvement of stakeholders and to update stakeholders on NTAP results. At least once per calendar year, the Port will assess the status of implementing the NTAP Plan. The Port will consider changes in equipment, improvements to infrastructure and operating processes, regulatory and other developments, and the overall trajectory of DPM and GHG emissions reductions associated with Seaport operations. The report will be presented to the Board and will be made available on the Port's website. In addition, the Port will share the update information at public meetings such as the Task Force meetings and the Community Town Halls described in the Draft PEP.

The Port will include data and information from other parties in the annual report. For example, tenants will be asked to report periodically on the status of air quality improvements. This data and information will inform the Port's annual report to the Board. Input provided by stakeholders through Task Force meetings and other channels and media will also inform the annual report.

EXTERNAL FUNDING

Implementation of this 2020 and Beyond Plan will require significant financial resources from the Port and its tenants and other businesses. Although implementation of the Plan will proceed incrementally, the Port, its tenants, and other businesses are unlikely to be able to provide all the required funding. External funding, in the form of grants and incentives from the State and other sources, will be key to Plan implementation for both equipment and infrastructure. Incentives and grant funding from local, State, and federal sources for zero-emissions and appropriate hybrid technology are essential to provide cost parity with conventional diesel-fueled equipment. For example, as shown in Appendix F, if HVIP funding continues to be available under the current terms, battery-electric yard tractors could reach cost parity with diesel-fueled equipment by 2027; if no incentive funding is available, cost parity may not be achieved until 2038 or later. Grants and incentives are the primary forms of external funding that are likely to be available for Plan implementation.

Grants and Incentives

The transition from current diesel-fueled equipment to zero-emissions equipment will take time. During the transition period, before anticipated new regulations, the State is encouraging new technologies through grant and incentive programs such as voucher programs. Grants and incentive funding are also available from the federal government, regulatory agencies, and potentially utility providers.

In some cases, the Port may apply for grants or incentive funding directly for its own electrical system upgrades and charging infrastructure. For example, the Port previously applied for and/

or received CARB, BAAQMD, and Transportation Investment Generating Economic Recovery (TIGER) grants (from the US Department of Transportation) to accelerate installation of electrical infrastructure to support implementation of shore power. The Port would also apply for grants and incentive funding directly if the Port were to be the lead applicant on behalf of multiple tenants or if the grant required the applicant to be a public agency.

For many potential grant recipients, the administrative burden and complexities that may accompany the grant process are important considerations with respect to the viability of grant funding. Some grant program requirements may be so burdensome and carry such high uncertainty that they fail to make economic or business sense. Factors that can impede pursuit of grants include application deadlines that are too short, complex applications that exceed the availability of resources that an applicant can devote, difficult reporting requirements, vague or onerous non-performance provisions, unclear guidelines, and excessively demanding cost effectiveness criteria. In addition, grant applicants will consider the emissions reduction benefits of the potential action funded by any grant. The amount of emissions reductions achievable will factor into the decision of whether to proceed with a grant application.

Joint Development of Grant and Incentive-Eligible Projects

Grant-making has been an integral part of the MAQIP implementation process (e.g., Proposition 1B Goods Movement grants for shore power, U.S. EPA grants for trucks, etc.). Port staff have focused efforts on meeting with Port tenants, equipment owners, and manufacturers to develop grant eligible projects. Port staff have identified and publicized numerous grant programs and other agencies' incentive programs at the Port's Trucker Working Group and the Port Efficiency Task Force, at ad-hoc meetings, the Port's office hours for truckers, and at recent events specifically targeted at truckers. These grant and incentive programs are potentially applicable to Port tenants, equipment owners, and/or manufacturers.

For incentives involving new equipment provided by external (non-Port) agencies, the Port is generally not the equipment owner. For these types of grants, the Port can play a role by identifying grant opportunities, conducting feasibility studies, preparing grant applications, and encouraging partnerships between tenants, equipment manufacturers, and grant-making agencies. Coordination and cooperation among the Port, tenants, and the agencies are essential for these grants to be successful and effective.

Grants to Tenants and Local Equipment Operators

Port tenants have also applied independently for State and BAAQMD grants. For example, CenterPoint Oakland Development, LLC, which entered into a 66-year lease with the Port covering approximately 27 acres of the Port-owned former Oakland Army Base (OAB), applied for a CEC grant to provide charging infrastructure for its future warehouse development. Similarly, several Port truckers have received Prop 1B grants from the BAAQMD for additional low-NOx and zero-emissions trucks.

Other Funding Opportunities

Some funding or equipment may also be available from equipment vendors or other proponents of specific technologies. For example, BYD is proposing to provide 10 Phase 2 battery-electric drayage trucks for evaluation by Port tenants. In general, these types of funding or equipment are linked to testing or demonstration of specific technologies. This type of funding or equipment would generally be applicable to equipment or systems that would be purchased and implemented by Port partners, and vendors may directly approach partners for opportunities to test their new technologies.

PLAN MANAGEMENT

Given the strategic importance of long-term air quality planning, a key element of successful implementation of this Plan is an implementation team tasked with Plan management and implementation. The implementation team will identify and screen new potential IAs for inclusion in the pool of IAs, and then evaluate IAs in the pool against the feasibility criteria and their ability to meet the goals of the Plan.

The implementation team will manage the Plan on an ongoing basis. Among other tasks, the implementation team will be responsible for:

- Tracking grant opportunities
- Applying for and managing grants for Port projects, acting as lead applicant for a group of applicants, or both
- Identifying/tracking new technologies
- Monitoring performance of existing actions (e.g., shore power and hybrid RTGs)
- Tracking regulatory requirements
- Coordinating and collaborating with potential partners
- Administering contracts in support of studies and other actions
- Conducting periodic emissions inventories

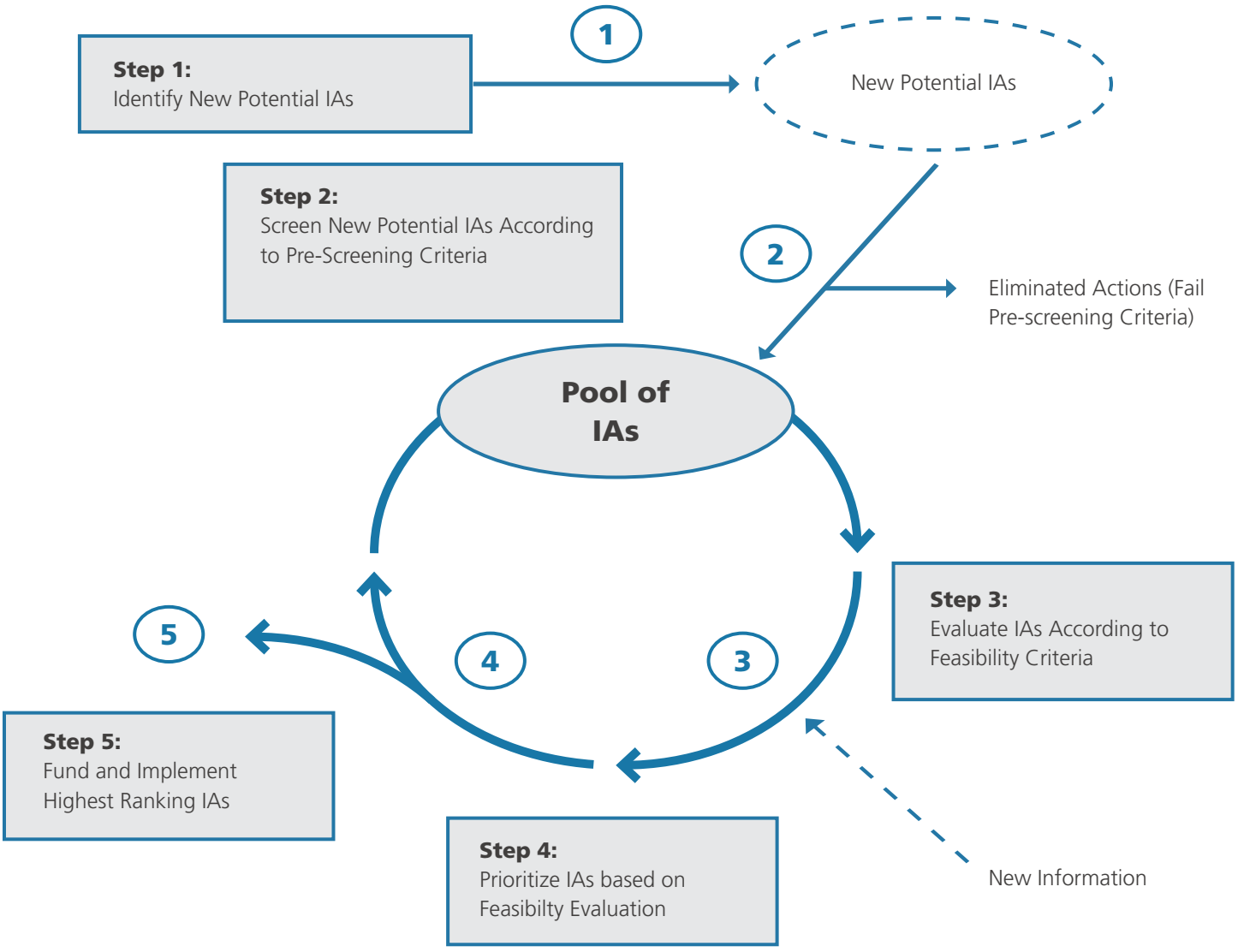
The implementation team will work with potential funding agencies and organizations such as CARB, PG&E, and equipment vendors and potential grant recipients (Port partners) to secure grants for eligible equipment, infrastructure upgrades, other IAs, and monitoring efforts, as available. This may include applying for grant funding to the Port, providing information, and assisting other grant applicants with the grant application. The decision to dedicate resources to pursuing a particular grant will be made based on the likelihood that a grant application will be successful, the value of the grant opportunity, and other business or organization priorities and constraints.

Due to the rapid changes in technology that are expected to occur in the coming years, the implementation team will update the list of potential implementing actions frequently.

New potential IAs that pass the screening process will be added to the pool and evaluated as part of the overall pool of potential IAs. The team will then manage or track (for IAs being implemented by Port tenants or others), as appropriate, the progress of the selected implementing actions.

This Plan is designed to be flexible and responsive to changing conditions. For example, it is likely that grant funding will become available for certain types of equipment, operational improvements, or infrastructure. In this case, the team will reassess IA priorities to determine whether the benefit of the available funding changes the priorities among implementing actions. A conceptual diagram of the implementation process is shown in Figure 4.

FIGURE 4: PROPOSED IMPLEMENTATION APPROACH



Information gathered and lessons learned will continually be incorporated into the overall implementation process for this Plan. As specific implementing actions are conducted, the team will use the lessons learned to plan and evaluate potential future IAs. Similarly, as new

technologies mature, it may become apparent that some assumptions made in this Plan need review, and the Port, in collaboration with its partners and stakeholders, will modify the approach outlined in this Plan to reflect the new information.

Data gathering, in the form of infrastructure needs assessment(s) and feasibility studies, led or coordinated by the implementation team, will be an important component of the initial implementation of this Plan. Currently, the Port has preliminary information to determine the full extent of infrastructure needs and the time and cost to construct the required infrastructure (Burns & McDonnell 2018). This information is required to appropriately prioritize various components of the overall infrastructure improvements.

In addition to executing potential implementing actions, the implementation team would also be responsible for monitoring the results of implementing actions, documenting and reporting the progress made pursuant to this Plan, and disseminating lessons learned.

Plan Update

As discussed previously, technology is changing rapidly, and State regulations and policy are increasingly targeting zero-emissions requirements and substantial reductions in GHG emissions. Regulations are also increasingly focusing on exposure in addition to emissions. These shifts in technology and regulations are expected to be more fully developed in five years. In addition, many of the Near-Term actions will have been implemented and data will be available to evaluate the benefits of these actions. Consequently, the 2020 and Beyond Plan will be updated in 2023 to reflect changes in technology and regulations, as well as lessons learned from implementing the initial set of actions.

As part of the Plan Update process in 2023, the Port will discuss changes to the 2020 and Beyond Plan with stakeholders and present the proposed update for the consideration and approval of the Board of Port Commissioners.

CONCLUSION

The 2017 Seaport Emissions Inventory indicates that Seaport-related DPM emissions have decreased by 81% relative to the 2005 baseline, and the Port is continuing to work towards the MAQIP target of an 85% reduction in DPM emissions. The 2020 and Beyond Plan builds on this foundation of emissions reductions and expands beyond the MAQIP by providing a framework for the transition to a zero-emissions Seaport. A zero-emissions Seaport will require a new technological operating basis built on new equipment, using renewable fuels, including GHG-free electricity, and new infrastructure. Commercially available measures, such as the use of renewable diesel and hybrid-electric RTGs, can provide emissions reductions in the near term. These near-term actions are an important component of this Plan. The full transition envisioned by this Plan will involve substantial financial and resource investments and resource

commitments by both the Port and its partners, and will occur over decades. The full transition to a zero-emissions Seaport will also require the sustained engagement and commitment of all stakeholders during all phases of Plan implementation.

REFERENCES

GLOSSARY

https://govt.westlaw.com/calregs/Document/I6B85127003A011E29D3D8A7B1E4D1070/viewType=Full&transitionType=Default&contextData=(sc.Default) . Accessed 11/2/18.

California Energy Commission (CEC). 2018. SB 2, Simitian 2011. Available at: https://www.energy.ca.gov/portfolio/documents/sbx1_2_bill_20110412_chaptered.pdf . Accessed November 2, 2018.

MAIN TEXT

Port of Oakland (Port). 2009. Final Maritime Air Quality Improvement Plan. April.

Environ International Corporation (Environ). 2013. Port of Oakland 2012 Seaport Air Emissions Inventory. November 5, 2013. Available at: https://www.portofoakland.com/files/PDF/environment/maqip_emissions_inventory.pdf.

. 2008. Revised Port of Oakland 2005 Seaport Air Emissions Inventory. March. Available at: https://www.portofoakland.com/community/environmental-stewardship/seaport-air- emissions-inventory-2005/.

Ramboll Environ (Ramboll). 2016. Port of Oakland 2015 Seaport Air Emissions Inventory Final Report. October. https://www.portofoakland.com/files/PDF/Port%20of%20Oakland%202015%20Seaport%20Emissions%20Inventory%20Final-11Oct2016.pdf.

Ramboll. 2018. Port of Oakland 2017 Seaport Air Emissions Inventory Final Report. August. Available at: https://www.portofoakland.com/files/PDF/Port_Oakland_2017_Emissions_Inventory.pdf.

San Pedro Bay Ports (SPBP). 2017. Clean Air Action Plan 2017 - Final Clean Air Action Plan Update. November.

APPENDIX A

California State Transportation Authority (CalSTA). 2018. SB 1 Provisions: Q&A. Available at: https://calstablog.files.wordpress.com/2017/04/sb-1-truck-provisions-q-and-a.pdf. Accessed April 4, 2018.

Port of Oakland (Port). 2017. Presentation: West Oakland Truck Management Plan, Community Meeting #1. October 11.

APPENDIX B

Apte, Joshua et al. 2017. High-Resolution Air Pollution Mapping with Google Street View Cars: Exploiting Big Data. Environmental Science and Technology, 51, 6999–7008. June 5.

Bay Area Air Quality Management District (BAAQMD). 2017. Spare the Air and Cool the Climate: A Blueprint for Clean Air and Climate Protection in the Bay Area - Draft Clean Air Plan, Volume 2. January. Available at: http://www.baaqmd.gov/~/media/files/planning- and-research/plans/2017-clean-air-plan/attachment-a_-proposed-final-cap-vol-1-pdf. pdf?la=en. Accessed May 1, 2018.

_____. 2018d. AB 32 Scoping Plan. January 8. Available at: https://www.arb.ca.gov/cc/scopingplan/scopingplan.htm. January 8. Accessed October 5, 2018.

_____. 2018e. Battery Electric Truck and Bus Energy Efficiency Compared to Conventional Diesel Vehicles. January. Available at: https://www.arb. ca.gov/msprog/actruck/docs/HDBEVefficiency.pdf . Accessed April 18, 2018.

_____. 2018f. CARB announces more than $200 million in new funding for clean freight transportation. September 26, 2018. Available at: https://ww2.arb.ca.gov/news/carb-announces-more-200-million-new-funding-clean-freight-transportation. Accessed December 3, 2018.

California Energy Commission (CEC). Undated. Driving Cleaner Transportation - Los Angeles Harbor Department. Available at: https://www.energy.ca.gov/transportation/tour/la_harbor/ . Accessed October 13, 2018.

California Office of the Governor. 2018. Governor Brown Takes Action to Increase Zero-Emission Vehicles, Fund New Climate Investments. January 26. Available at https://www. gov.ca.gov/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles- fund-new-climate-investments/. Accessed June 18, 2018.

Environ International Corporation (Environ). 2013. Port of Oakland 2012 Seaport Air Emissions Inventory. November 5, 2013. Available at: https://www.portofoakland.com/files/PDF/environment/maqip_emissions_inventory.pdf.

. 2008. Revised Port of Oakland 2005 Seaport Air Emissions Inventory. March. Available at: https://www.portofoakland.com/community/environmental-stewardship/seaport-air- emissions-inventory-2005/.

Hampstead, John Paul; Freighwaves (Freightwaves). Natural gas-powered trucks are well ahead of electrification. May 4. Available at: https://www.freightwaves.com/news/green-trucking/lng-cng-trucks-ahead-of-electric. Accessed October 24, 2018.

Harley, Robert A. (Harley). 2014. On-Road Measurement of Emissions from Heavy-Duty Diesel Trucks: Impacts of Fleet Turnover and CARB's Drayage Truck Regulation - Final Report, Contract No. 09-340. Prepared for: California Air Resources Board. November.

Hu, Shaohua, et al (Hu et al.). 2018. Development and Establishment of a Monitoring Network using Portable Emissions Acquisition System to Quantify Heavy-Duty In-Use Vehicles Emissions in California. Presented at Air Sensors International Conference (ASIC), September 12-14.

Intergovernmental Panel on Climate Change. 2018. Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments. October 8. Available at: https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/. Accessed October 3, 2018.

International Maritime Organization (IMO). 2018. UN body adopts climate change strategy for http://www.imo.org/en/mediacentre/pressbriefings/pages/06ghginitialstrategy.aspx. Accessed April 14, 2018.

Mace, Alan; Ballard (Ballard). 2017. Hydrogen Fuel Cell Trucks: An Innovator's Guide to Hydrogen Truck Refueling. November 16. Available at: https://blog.ballard.com/hydrogen-truck-refueling. Accessed October 13, 2018.

The Maritime Executive. Undated. Offshore Ship Designers launches near-zero emission tug.

Available at: https://www.maritime-executive.com/article/2008-05-272008-05-21-offshore-ship-designers-launches-near-zero-emission-tug. Accessed 10/14/18.

Moffatt & Nichol (M&N). 2018. Container Yard Electrification Feasibility Study, Version 2.0. February.

National Renewable Energy Laboratory (NREL). 2018. South Coast Air Quality Management District Truck Evaluation. Available at: https://www.nrel.gov/transportation/fleettest- electric-scaqmd.html. Accessed June 1, 2018.

Pocard, Nicolas; Ballard (Ballard). 2018. Hydrogen Fuel Cell Trucks: Solution to Heavy Duty Transport Emissions? May. 17. Available at: https://blog.ballard.com/fuel-cell-truck. Accessed October 24, 2018.

Port of Oakland (Port). 2009. Maritime Comprehensive Truck Management Plan - A MAQIP Program. June 16.

Preble, Chelsea et al. (Preble et al.). 2015. Effects of Particle Filters and Selective Catalytic Reduction on Heavy-Duty Diesel Drayage Truck Emissions at the Port of Oakland. Environmental Science and Technology, 49, 8864–8871. June 17.

. 2018a. Effects of Exhaust After-Treatment and Fleet Modernization on Port of Oakland

Drayage Truck Emissions. Presented at: MAQIP Meeting, Port of Oakland, February 23.

. 2018b. Plume Capture Method to Characterize On-Road Emissions by Heavy-Duty Diesel Trucks. Presented at ASIC Oakland September 14.

Ramboll Environ (Ramboll). 2016. Port of Oakland 2015 Seaport Air Emissions Inventory Final Report. October. Available at: https://www.portofoakland.com/files/PDF/Port%20of%20Oakland%202015%20Seaport%20Emissions%20Inventory%20Final-11Oct2016.pdf.

Todd Campbell; Advanced Clean Transportation News (Advanced Clean Transportation News). 2018. Near-Zero Emission Trucks Deployed in Busiest Port Complex. August 16. Available at: https://www.act-news.com/news/deploying-near-zero-emission-trucks/. Accessed October 13, 2018.

United Nations Climate Change (UNFCCC). 2015. The Paris Accord. Available at: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement. Accessed October 4, 2018.

APPENDIX C

Bay Area Air Quality Management District (BAAQMD). 2017. Renewable Diesel as a Major Transportation Fuel in California: Opportunities, Benefits, and Challenges. Prepared by Gladstein, Neandross & Associates for BAAQMD and SCAQMD. August 2017.

Burns and McDonnell. 2016. Port of Oakland Maritime Electric Strategic Assessment. June.

California Energy Commission (CEC). 2018. Diesel Fuel Data, Facts, and Statistics. Available at: https://www.energy.ca.gov/almanac/transportation_data/diesel.html Accessed 10/28/18.

International Maritime Organization (IMO). 2018. UN body adopts climate change strategy for shipping. Available at: http://www.imo.org/en/MediaCentre/PressBriefings/Pages/06GHGinitialstrategy.aspx. Accessed April 14, 2018.

Moffatt & Nichol (M&N). 2018. Container Yard Electrification Feasibility Study, Version 2.0. February.

Neste Corporation (Neste). 2018. Neste MY Renewable Diesel plays a significant role in the implementation of California's Climate Plan. Undated. Available at: https://www.neste.us/customers/products/renewable-products/neste-my-renewable-diesel. Accessed 11/2/2018.

San Jose Mercury News. 2018a. Nation's first hydrogen fuel-cell ferry to be built in Bay Area. July 17. 2018. Available at: https://www.mercurynews.com/2018/06/25/first-in-the-nation-hydrogen-fuel-cell-ferry-to-be-built-in-bay-area/ . Accessed October 28, 2018.

. 2018b. First-of-its-kind hybrid-electric ferry boat to take maiden voyage in San Francisco Bay. September 13. Available at: https://www.mercurynews.com/2018/09/13/first-of-its-kind-

hybrid-electric-ferry-boat-to-take-maiden-voyage-in-sf-bay/. Accessed October 28, 2018.

San Pedro Bay Ports (SPBP). 2017. Clean Air Action Plan 2017 - Final Clean Air Action Plan Update. November.

Scripps Institution of Oceanography (Scripps). 2016. Longitudinal study of the performance characteristics and environmental impacts of renewable diesel fuels in marine engines. March.

United States Environmental Protection Agency (USEPA). 2010. Designation of North American Emission Control Area to Reduce Emissions from Ships. March. Available at: https://nepis. epa.gov/Exe/ZyPDF.cgi/P100AU0I.PDF?Dockey=P100AU0I.PDF. Accessed May 28, 2018.

Personal Communications:

Lex (Alexander) Mitchell, CARB. 2018a. Personal communication with Susanne von Rosenberg (GAIA). May 2.

Lex (Alexander) Mitchell, CARB. 2018b. Personal communication with Susanne von Rosenberg (GAIA). October 30.

Nick Monroy, Neste. 2018. Personal communication with Susanne von Rosenberg (GAIA). November 2.

APPENDIX D

United States Department of Energy (DOE). 2011. Technology Readiness Assessment Guide. DOE G 413.3-4A. September 15.

APPENDIX E

Martin Associates (Martin). 2017. Economic Impact Report Port of Oakland. *Draft pending final review*

Viscelli, Steve (Viscelli). 2018. UC Berkeley Labor Center - Driverless? Autonomous Trucks and the Future of the American Trucker. September 4. Available at: http://laborcenter.berkeley.edu/driverless/.

APPENDIX F

Andrews, Michael. Terminal Manager, Everport Terminal Services. September 14, 2018. In-person interview with AECOM and Port of Oakland.

Bauer, Brian. Vice President, Operations, TraPac. September 4, 2018. In-person interview with AECOM and Port of Oakland.

Gagnon, Paul. Vice President, SSA Terminals. August 29, 2018. In-person interview with AECOM

and Port of Oakland and October 2, 2018 conversation with Port staff.

Gladstein, Neandross & Associates (GNA). August 2017. Renewable Diesel as a Major Transportation Fuel in California: Opportunities, Benefits and Challenges. Available at: https://www.gladstein.org/gna_whitepapers/renewable-diesel-as-a-major-transportation-fuel-in-california-opportunities-benefits-challenges/.

Kalmar Global. May 22, 2018. "Are you ready to be fully electric by 2021?" Available at: https://www.kalmarglobal.com/ news--insights/2018/20180522_are-you-ready-to-be-fully-electric-by-2021/.

Mitchell, Alexander. CARB. Pers. comm. 2018.

Mongelluzzo, Bill. "Gates Open for Imports." Journal of Commerce, October 2018.

Neste. Neste MY Renewable Diesel: High performing low carbon biofuel. Available at: https://www.neste.us/customers/products/renewable-products/neste-my-renewable-diesel.

New Energy Outlook (NEO) 2018. Bloomberg New Energy Finance (BNEF), June 2018.

Available at: https://about.bnef.com/new-energy-outlook/.

Pacific Maritime Association 2017 Annual Report. Available at: http://www.pmanet.org/annual-report

Piellisch, Rich. "Oakland and Renewable Diesel: 'Not a Single Downside'." NGT News, March 2018. Available at: https://ngtnews.com/oakland-and-renewable-diesel-not-a-single-downside.

Port of Oakland. Conversation between Port staff and Bill Aboudi, 2018.

Ramboll. August 2018. Port of Oakland 2017 Seaport Air Emissions Inventory Final Report. Available at: http://www.portofoakland.com/files/PDF/Port_Oakland_2017_Emissions_Inventory.pdfhttp://www.portofoakland.com/files/PDF/Port_Oakland_2017_Emissions_Inventory.pdf.

Ransom, Susan, Customer Support Manager, SSA Terminals and Jim Rice, General Manager of OICT, SSA Terminals. October 16, 2018 email to Port staff.

Taylor Zero-Emission Container Handler Preliminary Industrial Lift Truck Specification Sheet, September 2018.

Tioga. February 2016. Port of Oakland Truck Parking Report.

APPENDIX G

City of Oakland. Oakland Army Base Redevelopment Plan. Available at http://www2.oaklandnet.com/government/o/PBN/OurServices/Application/DOWD009157

City of Oakland. 2018. Draft West Oakland Truck Management Plan. November 16. Available at: https://www.oaklandca.gov/topics/west-oakland-truck-management-plan

City of Oakland, Department of Race and Equity. 2017. Inclusive Public Engagement Plan Guide. May 16.

City of Oakland, Planning and Building. Undated. General plan. Available at: http://www2.oaklandnet.com/government/o/PBN/OurServices/GeneralPlan/DOWD008821

City of Oakland, Planning and Zoning. 2014. West Oakland Specific Plan - Final Plan. June. Available at: http://www2.oaklandnet.com/Government/o/PBN/OurOrganization/PlanningZoning/OAK028334

Port of Oakland (Port). 2009. Final Maritime Air Quality Improvement Plan. April.

Environ International Corporation (Environ). 2013. Port of Oakland 2012 Seaport Air Emissions Inventory. November 5, 2013. Available at: https://www.portofoakland.com/files/PDF/environment/maqip_emissions_inventory.pdf.

APPENDIX A: PLANNING ASSUMPTIONS

APPENDIX A: PLANNING ASSUMPTIONS

TABLES

FIGURES

PLANNING ASSUMPTIONS

This 2020 and Beyond Plan serves as the Port's master plan for reducing Seaport-related air emissions and transitioning to a zero-emission Port. The 2020 and Beyond Plan was developed in the context of specific planning assumptions shown in Table A-1. Specific considerations regarding the transition from the MAQIP to the 2020 and Beyond Plan, as well as the geographic scope of the Plan, are provided below.

TABLE A-1. PLANNING ASSUMPTIONS

Planning Assumption	Basis for Assumption
Primary Geographic Area	Implementation of actions identified in this Plan will occur in the Seaport area, including Port owned areas of the Oakland Army Base (OAB). The Port is not proposing any emissions reduction initiatives on OAB property owned by the City of Oakland (City), the Union Pacific rail yard, or Schnitzer Steel as part of this Plan. These areas fall under the primary jurisdiction of the City of Oakland. The MAQIP and CARB's 2008 HRA focused on a specific geographic area, West Oakland (Figure A-1). The 2020 and Beyond Plan has benefits to a larger local area that may also be affected by Seaport-related air emissions (including downtown Oakland and Chinatown, as well as the City of Alameda).
Throughput* Growth and Net Revenue *The quantity or amount of containers moved through the Port within a given time	Per the Port's business projections, cargo volume is expected to grow at a rate of approximately 2% per year, based on the most current forecasts. Maritime growth is focused on net revenues.
Criteria Air Pollutant and Toxic Air Contaminant (TAC) Emissions	As a result of continued improvements in technology driven by existing and prospective regulations, absent any specific actions by the Port, emissions of criteria air pollutants and DPM will remain relatively flat compared to current emissions even though cargo volume is expected to increase (Starcrest 2018).
Greenhouse Gas (GHG) Emissions	Emissions of GHGs will increase with cargo growth, although at a lower rate than total growth, due to improvements in engine and operational efficiency.
Port Air Quality Funding Capability - Improvements Consistent with Growth and Net Revenue	Implementation of the 2020 and Beyond Plan will depend on available Port net revenues, which are partially dependent on overall cargo throughput. The Plan relies on identifying Port's resources to leverage grants, incentives, and partnerships. Following the retirement of the Port's current debt in 2033, additional Port funding may become available.
Technological Paradigm Shift Requires Phased Transition	The path to a zero-emissions Seaport is based on a transformative change in technology in contrast to the gradual changes in existing technology (such as implementation of improved diesel particulate filters) that have occurred over the past decade. A shift from fossil fuel combustion will be an important factor in continuing to reduce DPM emissions and the associated community health risks associated with Seaport operations and to achieve GHG reductions in support of the State's GHG reduction efforts.
Relationship of Emissions Reductions to Health Risk Reduction	Reductions in DPM emissions from Seaport operations will result in an associated reduction of community exposure to DPM. This reduction in exposure to DPM will in turn result in health risk reduction for the local community. The Port will continue to focus on DPM emissions reductions and will look to CARB and the Alameda County Department of Public Health to assess health risk.

TABLE A-1. PLANNING ASSUMPTIONS	
Planning Assumption	Basis for Assumption
Increased Efficiency through Use of Smart Technology	Use of "smart technology" to drive efficiency improvements is increasing at ports all over the world. As both data transmission and data management capabilities increase, use of smart technology is expected to increasingly drive the container management process and cargo operations, reducing fuel use, truck trips, and idling. Workforce training may be required to address the impacts of increased reliance on smart technology as well as the change in technology to zero-emissions equipment.
Flexibility and Adaptability	All aspects of technology required for the implementation of this Plan are evolving rapidly; there will be constant change throughout the life of this Plan. A flexible, adaptive approach is required to be able to meet the goals set out in this Plan.
Changing Regulatory Environment	The regulatory environment is expanding from a focus on criteria pollutants to an approach encompassing both GHG emissions and exposure to TACs. Many of the regulations currently contemplated by CARB would be approved in 2023 or later.
Building Knowledge and Capability	As the Port and its partners progress toward achieving a zero-emissions Seaport, increased knowledge will be developed regarding the performance, operability, and maintenance requirements of various types of equipment, as well as infrastructure needs and monitoring processes. This Plan explicitly seeks to increase the knowledge base of the Port and its stakeholders so that each step in the transition to a zero-emissions Seaport can be informed by the previous step, and so that the effectiveness of each step can be evaluated objectively.
Pragmatic and Results-Oriented Approach	The Port has always had a pragmatic, hands-on approach to getting things done with a focus on tangible results. For this reason, the Plan emphasizes technologies that are commercially available and demonstrated to perform maritime cargo handling operations.
Compliance with Regulatory Requirements	The Port and its partners comply with regulations regarding air pollutant emissions. Foundational to the 2020 and Beyond Plan is the Port's effort (i.e., the MAQIP focus) on regulatory compliance. The 2020 and Beyond Plan strives to identify actions above and beyond regulatory compliance in anticipation of future CARB regulations.
Continuous Learning through Monitoring	The Port will monitor the success of various actions in reducing air pollutants and track the implementation challenges associated with the IAs. The results of the monitoring and lessons learned from implementing various actions will help determine the most appropriate and successful future actions, and will inform the Plan Update.
Plan Update	It is foreseeable that technology will change and mature considerably during the life of the Plan. In addition, community-based science will progress and new regulations may be enacted. The Plan will be updated in five years (in 2023), with an emphasis on developing the Intermediate-Term actions.

Moving from the MAQIP to the 2020 and Beyond Plan

The 2009 MAQIP has been successful in substantially reducing DPM emissions originating from Seaport activities. As noted earlier, compared to the Year 2005 baseline, the Port's 2017 emissions inventory showed a decline in total DPM emissions of 81%. The 2020 and Beyond Plan builds on this foundation of emissions reductions from Seaport sources to provide a framework

for the transition to zero-emissions operations.

The MAQIP focused on incremental improvements to existing technology (diesel-fueled equipment) that relied on an existing infrastructure. The transition to a zero-emissions Seaport will include new technologies and, importantly, infrastructure. Thus, while the MAQIP focused primarily on compliance with regulations, the 2020 and Beyond Plan addresses both the equipment and infrastructure.

Table A-2 outlines the primary differences between the factors addressed by the MAQIP and the factors that are being addressed by the 2020 and Beyond Plan.

TABLE A-2. COMPARISON OF MAQIP AND 2020 AND BEYOND PLANS

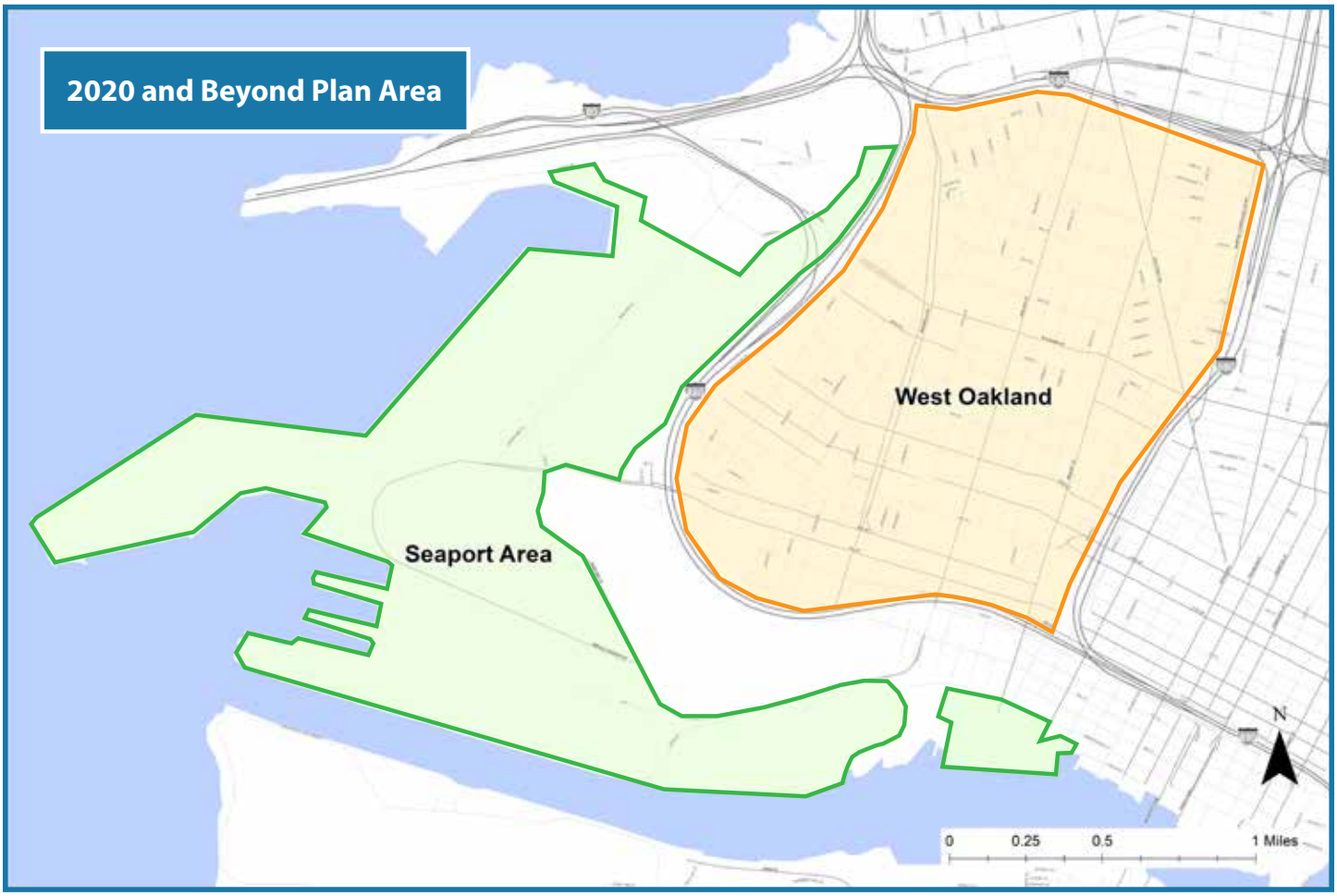
Item	MAQIP	2020 and Beyond Plan
Technology	• Incremental improvements to long-established existing equipment technology • Existing fuel source (diesel) • Known and well-defined control technology	• New and rapidly-changing technology; most equipment types not commercially available yet • Battery-and-grid-electric systems are the most likely future power sources, but need to maintain ability to include or change to a different fuel source if new technology dictates
Infrastructure	• Existing infrastructure • Shore power project focused on providing power to berths.	• Comprehensive improvements to electrical grid • Expansion of electrical grid throughout the terminals • Increased resilience of current grid • New/upgraded substations • Additional fiber communications line capacity • Likely need for advanced infrastructure solutions like distributed energy resources (DERs)[1] and microgrids • Need for other types of new infrastructure to support GHG free fuels use, such as hydrogen storage for hydrogen fuel cells
Targets	• 85% reduction in Seaport-related DPM relative to the 2005 baseline	• Pathway to zero-emissions Seaport • Programmed targets in NTAP • Intermediate-Term equipment targets • Alignment with State GHG goals
Scope of Effort	• Temporal: implement specific actions by 2020	• Temporal: implement specific actions within the timeframe of this Plan. • Spatial: 2020 and Beyond Plan applies to maritime area infrastructure (not just mobile sources/equipment). Improvements to or addition of new infrastructure, are foreseeable to deploy new equipment.
Regulatory Environment	• Regulatory requirements were driving technological innovation	• Few current regulatory drivers for new technology • New rules likely to be issued 2023 and later • Substantial new regulatory drivers expected between 2023 and 2028, with unknown final compliance deadlines.

[1] Distributed generation, also known as distributed energy, on-site generation (OSG), or district/decentralized energy, is electrical generation and storage performed by a variety of small, grid-connected devices referred to as distributed energy resources (DER).

Geographic Area

The MAQIP and CARB's 2008 HRA focused on a specific geographic area, West Oakland (Figure A-1). The 2020 and Beyond Plan recognizes that implementation of the Plan will have benefits to a larger local area that may also be affected by Seaport-related air emissions (including downtown Oakland and Chinatown, as well as the City of Alameda). Implementation of actions identified in this Plan will occur in the Seaport area, including Port owned areas of the Oakland Army Base (OAB). The Port is not proposing emissions reduction initiatives on OAB property owned by the City of Oakland (City), or the Union Pacific rail yard, or Schnitzer Steel as part of this Plan. These areas fall under the primary jurisdiction of the City of Oakland.

FIGURE A-1: SEAPORT AND WEST OAKLAND GEOGRAPHIC AREAS



APPENDIX B: BACKGROUND

APPENDIX B: BACKGROUND

TABLES

FIGURES

BACKGROUND

This appendix provides background information pertaining to the 2020 and Beyond Plan. It describes pertinent regulations, community research, existing Seaport emissions, the status of zero-emissions technology, and the challenges that may be encountered in implementing the Plan.

AIR QUALITY CONTEXT

The 2020 and Beyond Plan addresses emissions reductions for three categories of pollutants: criteria air pollutants, toxic air contaminants (TACs) - specifically diesel particulate matter (DPM) and greenhouse gases (GHGs).

Criteria Air Pollutants

The Clean Air Act requires the United States Environmental Protection Agency (U.S. EPA) to set National Ambient Air Quality Standards (NAAQS) for common air pollutants, known as criteria air pollutants. The Clean Air Act then requires states to establish regulations and other controls designed to maintain or achieve compliance with the NAAQS. Regulation of criteria air pollutants, which include oxides of nitrogen (NOx) and ozone among others, may include NAAQS pollutant precursors such as volatile organic compounds (VOCs) which react in the atmosphere to form ozone and organic particulate matter. Many criteria air pollutants contribute to regional air quality concerns (such as smog). U.S. EPA, the California Air Resources Board (CARB), and the Bay Area Air Quality Management District (BAAQMD) all regulate criteria air pollutants through different programs, depending on the source category.

Toxic Air Contaminants

TACs are associated with acute and chronic health effects, including increased risk of cancer. DPM is a TAC and is listed as a known carcinogen by the State of California. The reduction of DPM emissions is central to Port planning efforts.

Greenhouse Gases

GHGs contribute to global climate change and its attendant consequences such as sea level rise and increases in severe weather. In California, CARB and BAAQMD regulatory authority over GHG emissions. State executive orders and legislation have also set goals for GHG reductions to be achieved through CARB programs.

San Francisco Bay Area Air Quality

The San Francisco Bay Area Air Basin (Bay Area Air Basin) is currently not in attainment of federal and State ambient air quality standards for ozone and particulate matter (PM). The Bay Area Air Basin is designated as Marginal Nonattainment of the 8-hour ozone NAAQS, and Moderate Nonattainment of the 24-hour PM2.5 NAAQS.

The 2017 BAAQMD Clean Air Plan (CAP) states:

"On January 9, 2013, U.S. EPA issued a final rule to determine that the Air District attains [sic] the 24-hour PM2.5 national standard. This U.S. EPA rule suspends key State Implementation Plan (SIP) requirements as long as monitoring data continues [sic] to show that the Air District attains [sic] the standard. Despite this U.S. EPA action, the Air District will continue to be designated as non-attainment for the national 24 hour PM2.5 standard until the Air District submits a redesignation request and a maintenance plan to U.S. EPA, and U.S. EPA approves the proposed redesignation."

To achieve attainment with NAAQS, the BAAQMD adopts rules for stationary sources (such as refineries) of NOx, VOC, and PM. CARB regulates mobile sources (such as trucks and ships) of ozone precursors and PM through fuel and engine standards, as well as by requiring turnover to newer equipment through in-use fleet rules. Rulemaking is guided by the priorities and analysis of the SIP for each pollutant. Both CARB and BAAQMD may provide grant funding to incentivize actions, such as the purchase of cleaner equipment or the installation of retrofit devices, in advance of regulations or for source categories over which CARB and BAAQMD do not have regulatory authority, such as rail transportation and ocean-going vessels outside the jurisdictional waters of the United States.[1]

Ocean-going vessels (OGV) calling at the Port are subject to CARB regulation within 24 nautical miles of the California baseline.[2] CARB currently limits the type of fuel used by these vessels to distillate fuels containing less than 0.1% sulfur. The International Maritime Organization (IMO) North American Sulfur Emission Control Area (ECA) limits OGVs to no more than 0.1% sulfur within 200 miles of the US and Canadian coastlines. Starting in 2020, IMO regulations will limit the sulfur content of distillate fuels to 0.5%; however, the lower limit of 0.1% will still apply within the North American Sulfur ECA.

The Port develops and implements plans, programs and projects for regulatory compliance and, where feasible, to exceed regulatory compliance targets. The City of Oakland (City) regulates land use through zoning, including the location of industrial activities that may be sources of emissions. The City also has authority over truck routes, rules regarding where trucks can park on City streets, enforcement of truck routes and parking rules. As a landlord Port, the Port does not own or control most of the equipment working in the Seaport area. Therefore, it can only directly control a very small percentage of air emissions (those directly associated with its operations). Other reductions must be achieved through the Port's efforts to influence other businesses in the Seaport area.

The Port influences its tenants, shippers, truckers, and other Port-related businesses through education, lease terms, contractual requirements, and involvement in the regulatory process.

[1] States are pre-empted from issuing regulations that could affect interstate commerce. The Class 1 railroads that provide interstate rail transport are regulated at the federal level only.

[2] "Baseline" in this context means the lower low water line along the California coast.

The Port may also have access to a wider range of grants, or more favorable grant terms than private entities. For example, the Port is eligible for grant funding sources, such as EPA Diesel Emissions Reduction Act (DERA) grants, which private entities may not be able to access directly. In other cases, such as for a recent CEC grant, private entities may be required to provide a cost match, while public agencies are exempt from providing matching funding. As appropriate to achieve the targets set in the Near-Term Action Plan, the Port will consider using these grant opportunities as a possible means of supplementing grant opportunities that are accessible to private businesses.

WEST OAKLAND HEALTH RISK: CARB HEALTH RISK ASSESSMENT AND - RELATED STUDIES

As stated in the planning assumptions, the Port looks to CARB and the Alameda County Department of Public Health to assess health risk. Available information pertaining to community health risk is presented below.

CARB Human Health Risk Assessment (2008)

In 2005, the Port prepared a Seaport Emissions Inventory (EI) to identify and quantify air emissions from maritime activities. In 2008, CARB used the 2005 Seaport EI to conduct the West Oakland human health risk assessment (HRA). The 2008 HRA reported that West Oakland residents were exposed to high concentrations of DPM—almost three times higher than the average background levels in the Bay Area at that time. CARB's HRA attributed 16% of the DPM-related cancer risk in West Oakland to Seaport sources, while other sources (primarily over-the-road trucks not associated with the Seaport) and the Union Pacific Railroad operations accounted for 80% and 4% of the health risk, respectively.[3] Thus, the largest source of potential cancer risk was from non-Port trucks. A summary of the findings of the 2008 HRA is presented in Table B-1.

The 2008 HRA is the most recent CARB health risk assessment. Since 2008, emission standards have changed. Also, the Port of Oakland has conducted three additional Seaport Emissions Inventories since the baseline Seaport EI in 2005. The most recent (Year 2017) Seaport EI shows an 81% reduction in total DPM from Seaport mobile sources with Port trucks showing a 98% reduction in DPM.

[3] California Air Resources Board (CARB). 2008. Diesel Particulate Matter Health Risk Assessment for the West Oakland Community. December.

TABLE B-1. POPULATION-WEIGHTED POTENTIAL CANCER RISKS IN WEST OAKLAND COMMUNITY BY PARTS AND SOURCE CATEGORY (2005 BASELINE)				
Source Category	Part I (Port)	Part II (UP)	Part III (non-Port)	Combined
OGV Transiting, Maneuvering, & Anchoring	57	0	23	81
OGV Hoteling	57	0	10	67
Harbor Craft	15	0	78	93
Trucks	42	7	795	844
Cargo Handling Equipment	16	21	7	43
Locomotives	4	15	37	56
Others	0	0	2	2
Total	192 (16%)	43 (4%)	951 (80%)	1,186 (100%)

Notes: Total area for the community = 1,800 acres; total population = 22,000. Part III anchorage activities are included with impacts from Part III hoteling.

Source: CARB 2008

BAAQMD West Oakland Truck Survey (2009)

Following the 2008 HRA, BAAQMD conducted the West Oakland Truck Survey in 2009. The survey was conducted in partnership with Sonoma Technology, Inc. (STI), Wiltec, and the West Oakland Environmental Indicators Project (WOEIP). The study was intended to address uncertainties identified in the 2008 HRA. The 2008 HRA noted that there were significant uncertainties associated with (1) estimates of truck volumes and routes in West Oakland and (2) estimates of the percentage of truck traffic (and therefore emissions and risk) attributable to activity at the Port of Oakland. The 2008 HRA concluded that the *"data limitations may have led to potential overestimate of overall trucking emissions within the modeling domain and a potential underestimate of the overall fraction of trucking emissions that are attributable to the Port of Oakland."* [emphasis added].

The 2009 BAAQMD Truck Survey concurred with the 2008 HRA regarding the age distribution, average speed, and idling activity of trucks. The survey authors also concluded that the results of the survey confirmed the concerns raised in the HRA regarding an overall overestimate of trucking emissions and an underestimate of the fraction of trucking emissions attributed to the Port of Oakland. The main differences in traffic volumes found between the two studies were that:

- The 2009 survey found significantly fewer trucks on surface streets, but a higher

percentage of Port trucks;

- The 2009 survey counted fewer trucks on freeways I-980 and I-580; and
- The 2009 survey estimated a higher number of Port and non-Port trucks on freeway I-880.

BAAQMD used the information from the survey to develop revised estimates of cancer risks attributable to DPM from trucks. Table B-2 shows the revised estimates. Based on the truck survey, the overall cancer risk due to DPM was lower than estimated in the 2008 HRA; however, a higher fraction was attributed to the Port. BAAQMD did not rerun the HRA with the revised truck traffic estimates, but estimated that the Port's contribution to local health risk was 29% rather than 16% as concluded in the 2008 HRA.

TABLE B-2. SUMMARY OF THE ADJUSTED POPULATION WEIGHTED CANCER RISKS (CASES PER MILLION) BASED ON THE 2009 WEST OAKLAND TRUCK SURVEY

Source Category	Part I Port	Part II Union Pacific	Part III Non- Port and Non-UP	Combined
OGV Transiting, Maneuvering, and Anchoring	57	0	23	80
OGV Hoteling	57	0	10	67
Harbor Craft	15	0	78	93
Trucks	103 (42)	7	415 (795)	525 (844)
Cargo Handling Equipment	16	21	7	44
Locomotives	4	15	37	56
Others	0	0	2	2
Total	252 (192)	43	572 (951)	867 (1,186)
% Risk	29% (16%)	5% (4%)	66% (80%)	100%

Note: Revised risks are noted in bold text. The values in parentheses ( ) are the original population-weighted cancer risks presented in Table 7 of the 2008 HRA.

Source: BAAQMD 2009

The 2009 Truck Survey further concluded that the revised risk from all trucking operations decreased from 844 cases in a million to 525 cases in a million, and that truck emissions were the single highest source of diesel emissions in West Oakland. The survey further stated that compliance with regulations adopted by CARB was an essential mitigation strategy and that the Port also had a significant role to play in reducing these emissions.

As discussed further below, more recent studies show that the engine model year for diesel truck fleet serving the Port turned over on an accelerated basis due to incentives provided by

CARB, BAAQMD, and the Port. An updated HRA would be required to accurately assess the Port's current contribution to the overall DPM-related health risk to West Oakland residents. While the Port will continue to take action to reduce DPM emissions associated with Seaport operations, the Port looks to CARB and the Alameda County Department of Public Health to assess health risk.

California EnviroScreen

The California EnviroScreen (CES) model developed by California EPA (CalEPA 2012), which is used to identify "highly burdened" communities under Assembly Bill 617, uses a broader set of criteria to assess health impacts, and is not comparable to the 2008 CARB HRA. In addition to air quality, the CES includes a wide range of factors, such as socioeconomic and sensitive population indicators.

California EPA Office of Environmental Health Hazard Assessment

In 2015, the California EPA Office of Environmental Health Hazard Assessment (OEHHA) issued a report that changed the risk factors to be used in subsequent CARB HRAs. The 2015 risk factors reflect new data indicating that DPM is more toxic that previously thought. An updated HRA would use the updated risk factors; it would not be directly comparable to the 2008 HRA.

GREENHOUSE GAS (GHG) EMISSIONS, CLIMATE CHANGE AND CO-BENEFITS

In addition to reducing criteria pollutants, the 2020 and Beyond Plan focuses on reducing GHG emissions. Scientists understand greenhouse gas emissions to be the primary factor causing global climate change. Reducing GHGs is an urgent priority for the State of California. The most recent report from the Intergovernmental Panel on Climate Change (IPCC 2018) concluded that an average temperature increase of only 1.5°C would have significant adverse effects around the world. This level is below the 2°C target set by the 2015 Paris Climate Accord (UNFCCC 2015).

According to the IPCC, climate change is contributing to more severe weather (including both more severe and prolonged droughts, as well as higher intensity rainfall events), and increasing the risks of heat-related illnesses. Climate change is also resulting in adverse air quality effects due to both an increase in wildfires and increases in smog formation resulting from higher temperatures (State of California 2018). Coastal areas, like the Bay Area, are particularly vulnerable to sea level rise (SLR). As part of its climate change resiliency planning, the Port is currently working on its AB 691[4] resiliency assessment. The Port is evaluating the potential costs associated with infrastructure damage and replacement for three time horizons: 2030, 2050, and 2100. The completed SLR assessment is due to the State Lands Commission in July 2019. The initial assessment focuses on mapping of sea level rise effects (i.e., projected flooding), and identifying critical infrastructure.

[4] Assembly 691 -Proactively Planning for Sea-Level Rise Impacts (Muratsuchi) Chapter 592, Statutes of 2013.

Any zero-emissions technology that relies on GHG-free fuels from renewable or other non-carbon sources (i.e., that eliminates the use of diesel and other petroleum-based fuels) also eliminates DPM. Technologies and fuels that provide a reduction in GHGs (but do not completely eliminate GHGs) typically also result in reductions in DPM. Therefore, in the long term, reducing GHGs provides the co-benefit of further reducing DPM emissions in the West Oakland community.

EXISTING AND PENDING REGULATORY ACTION AND POLICIES

As discussed above, this Plan addresses three forms of air pollutants: criteria air pollutants, TACs (including DPM), and GHGs. While all three categories of air pollutants are associated with diesel engine emissions, they are subject to separate regulatory regimes. In the context of diesel emissions, criteria air pollutants and TACs are closely linked because DPM, which comprises a portion of the criteria pollutant PM, is a TAC. Similarly, GHG emissions are directly linked to fuel consumption by diesel engines. Engines fueled by compressed natural gas (CNG) or liquefied natural gas (LNG) also emit PM. However, the difference in the fuel source means that natural gas-fueled engines emit different constituents that do not pose the same types of health risks as DPM. Existing and pending regulations pertaining to the three types of air pollutants are briefly described below.

Regulatory Setting

Since the Port of Oakland approved the 2009 MAQIP, the regulatory setting has changed. As the Bay Area Air Basin gets closer to attainment of federal and State ambient air quality standards, CARB and BAAQMD regulations are increasingly focused on GHG and TAC reductions. Some of the relevant new policies are captured in Table B 3.

TABLE B-3. RECENT POLICY, STATUTORY, AND REGULATORY MEASURES

Executive Orders	
Executive Order B-30-15	Sets a statewide goal for a 40% reduction in GHG emissions from 1990 levels by 2030. This interim goal was adopted by CARB in its 2017 California Climate Action Plan approved December 14, 2017. The State's 2030 and 2050 GHG emission reduction goals create a long-term "frame" for implementation of this Plan.
Executive Order B-32-15 and the Sustainable Freight Action Plan	Interagency development of a guidance document to establish freight efficiency targets, transition to zero- emissions technologies, and increase the competitiveness of California's freight system. The Sustainable Freight Action Plan has three targets: 1) increase freight system efficiency 25% by 2030; 2) transition to zero-emissions technology; and 3) increase State competitiveness and future economic growth within the freight and goods movement industry. The targets are not mandates but rather aspirational measures of progress toward sustainability for the State to meet and try to exceed.

TABLE B-3. RECENT POLICY, STATUTORY, AND REGULATORY MEASURES	
Executive Order B-48-18	This EO is designed to boost the supply of zero- emissions vehicles and charging and refueling stations in California. It includes a new eight-year, $2.5 billion initiative to help bring 250,000 vehicle charging stations and 200 hydrogen fueling stations to California by 2025, and has the goal of 5 million zero-emissions vehicles by 2030. It also continues the State's clean vehicle rebates.
Legislation	
Senate Bill (SB) 1 (Beall, 2017)	Provides for transportation funding and restricts in-use truck fleet requirements to allow in-use equipment to remain in use for either 800,000 miles or 18 years.
SB 350 (de León, 2015) / SB 100 (de León, 2018)	Extends the Renewable Portfolio Standard to require 50% of California electricity be from renewable sources by 2030, requires building energy efficiency to double by 2030, and requires larger publicly owned utilities to develop Integrated Resource Plans and invest in transportation electrification. SB 100 increases the 2030 renewable content from 50% to 60% and requires 100% carbon free by 2045.
Assembly Bill (AB) 617 (Garcia, 2017)	"Requires community-focused air quality planning to reduce exposure to existing sources, through the Community Air Risk Evaluation program. AB 617 represents a fundamental shift in air quality regulation because it focuses on local health effects, with specific attention to communities affected by a high cumulative exposure to criteria air pollutants and TACs, including DPM. CARB requires local air districts to work with communities to select all areas in the region that have a "high cumulative exposure burden" and prioritize areas for community monitoring and/or action plans over the next six years. BAAQMD staff has identified West Oakland as a high-priority AB 617 community. The goal of the program is to eliminate air quality disparities and reduce health burdens. Port staff participated in BAAQMD's February 26, 2018, workshop and submitted comments requesting funding to promote the widespread proliferation of local electric drayage trucks. The Port serves on the West Oakland Clean Air Action Plan (WOCAAP) Steering Committee. Up to $50 million are available through a clean technology grant program in the Bay Area to address air pollution sources contributing to excess health risks in CARE[5] communities. The program requires an equipment owner cost share."
Regulation and CARB Policy	
State Strategy for the SIP, including the Mobile Source Strategy	While CARB's 2016 Mobile Source Strategy focuses on light-duty equipment, when adopting the State Strategy for the SIP for ozone and PM2.5 in 2017, CARB directed staff to revisit the At-Berth Regulation and the Cargo-Handling Equipment Regulation as well as to develop concepts for Indirect Source Rules. Staff returned in March 2018 with a proposed schedule for updating regulations regarding freight activity.
2030 Scoping Plan	Plans California's path to a 40% reduction in GHG emissions from 1990 levels by 2030 (CARB 2018d).[6]

Mobile Sources at Ports

In 2006, CARB announced its intention to establish emissions regulations and health risk goals

[5] CARE communities are communities that were identified under the Community Air Risk Evaluation (CARE) Program as experiencing higher air pollution levels than others.

[6] In 2006, the Legislature passed the California Global Warming Solutions Act of 2006 [Assembly Bill 32 (AB 32)], which created a comprehensive, multi-year program to reduce greenhouse gas (GHG) emissions in California. AB 32 required the California Air Resources Board (ARB or Board) to develop a Scoping Plan that describes the approach California will take to reduce GHGs to achieve the goal of reducing emissions to 1990 levels by 2020. The Scoping Plan was first approved by the Board in 2008 and must be updated every five years. The First Update to the Climate Change Scoping Plan was approved by the Board on May 22, 2014. In 2016, the Legislature passed SB 32, which codifies a 2030 GHG emissions reduction target of 40 percent below 1990 levels. With SB 32, the Legislature passed companion legislation AB 197, which provides additional direction for developing the Scoping Plan. ARB is moving forward with a second update to the Scoping Plan to reflect the 2030 target set by Executive Order B-30-15 and codified by SB 32.

to protect public health from the adverse impacts of ports and goods movement operations.[7] To achieve these goals, CARB promulgated new regulations for the five main mobile sources associated with ports and goods movement: 1) ships, 2) commercial harbor craft (HC), 3) container- handling equipment (CHE) at ports and intermodal yards, 4) heavy duty (Class 7 and 8 diesel trucks, and 5) non-exempt locomotives.

The Port responded to the new CARB air rules by developing and implanting its Maritime Air Quality Improvement Plan (MAQIP). The Board approved the MAQIP in April 2009. The MAQIP created a comprehensive 12-year policy and planning framework to reduce criteria pollutants from Port mobile sources, with a focus on reductions in diesel particulate matter (DPM).

In Southern California, the Port of Los Angeles and the Port of Long Beach (collectively "San Pedro Bay Ports" or "SPBP") developed a similar air quality plan—the Clean Air Action Plan (CAAP). The San Pedro Bay Ports developed the original CAAP in 2006, updated it in 2010, and approved significant updates to the CAAP in November 2017 (2017 CAAP, also referred to as CAAP 3.0).

New Air Quality Rules Being Developed by CARB

On March 23, 2017, CARB adopted Resolution No. 17-8, which requires CARB staff to take the following actions, among others:

- Within 18 months, develop amendments to the existing "At-Berth Regulation" to achieve up to 100% compliance by 2030 for SPBP ports and ports in or adjacent to the top 10% most impacted areas based on the CES.[8]
- Within 24 months, develop amendments to the Cargo Handling Equipment (CHE) regulations to achieve up to 100% compliance with zero-emission vehicle (ZEV) requirements by 2030 for the ports identified above.
- Within one year, return to the CARB with concepts for an Indirect Source Rule (ISR) to control pollution from large freight facilities, including ports, railyards, warehouses and distribution centers, as well as any alternatives to ISR capable of achieving similar levels of emission reductions.

On March 23, 2018, rather than proposing an ISR, CARB staff recommended a schedule of freight rulemaking. Amendments to the At-Berth Regulation are underway with the goal of presenting amendments to CARB in 2019. Amendments to the CHE regulation are anticipated to go to CARB in 2022, with the earliest implementation beginning no earlier than 2026. CARB staff did not recommend a state-wide ISR, but acknowledged that local air districts have authority to develop their own ISR. Table B-4 shows the proposed regulations and dates applicable to the Seaport area.

[7] State of California, Air Resources Board, Resolution 06-14, April 20, 2006.

[8] Although the Seaport is not in the top 10% pursuant to CES, Port staff assume that ships calling at Oakland would be subject to any new CARB At-Berth amendments

TABLE B-4. CARB ACTIONS TO FURTHER REDUCE EMISSIONS FROM FREIGHT SOURCES AND FACILITIES

Sector and/or Facility Type	Action	Potential Timeframe	
		CARB to Consider (Year)	Begin to Implement (Year)
Drayage Trucks at Seaports and Rail Yards	Drayage truck regulation to transition to zero-emission operation.	2022	2026-2028+
Commercial Harbor Craft at Seaports	Commercial harbor craft regulation amendments.	2020	2023+
Cargo Handling Equipment at Seaports and Rail Yards	Cargo handling equipment regulation to transition to zero emissions.	2022	2026+
Rail Yards, Rail Stations, Rail Sidings, Seaports, Warehouses, and Other Hubs	Evaluation and potential development of regulation to reduce idling emissions from all rail yard sources and emissions from other stationary locomotive operations.	2020	2023+
Locomotives	Evaluation and potential development of regulation to reduce emissions from locomotives not pre-empted under the Clean Air Act.	2022	2025+
Locomotives	Petition to US EPA for more stringent national locomotive (Tier 5) emission standards.	2017 (completed)	2023
Transport refrigeration units (TRU)	Transport refrigeration unit regulation to transition to zero emissions	2019	2020+
Trucks	Lower in-use performance level – multiple regulations (e.g., inspections, warranties)	2017-2020	2018-2024
Trucks	Heavy-duty on-board diagnostics amendments	2018	2019
Trucks	Heavy-duty vehicle zero-emission certification procedures	2018	2023
Trucks	Advanced clean local trucks regulation (last-mile delivery)	2018	2023
Trucks	Medium- and heavy-duty greenhouse gas phase 2	2018	2018+
Trucks	Low-oxides of nitrogen standard for truck engines	2019	2023-24
Ships	Ships at-berth amendments	2019	2023
Ships	Advocate for Tier 4 vessel standards	Ongoing	
Forklifts	Zero-emission forklift regulation	2020	2023
All	Low-emission diesel fuel requirement	2020	2023

Source: California Air Resources Board Staff: Update on Concepts to Minimize the Community Health Impacts from Large Freight Facilities ADVANCE MATERIALS (Revised)

AIR QUALITY PLANNING

Historically, air quality was regulated with a focus on individual constituents, such as criteria air pollutants and TACs. Regulations were designed to reduce excess levels of specific constituents identified as being of concern, with a goal of reducing ambient concentrations within a given region (air basin). Consistent with the regional approach to air quality, data collection typically occurred on a regional level as well. Monitoring stations were designed to detect a certain limited set of parameters, and the typical monitoring interval was hourly or daily, depending on the constituents. Health risk calculations (modeling) were then performed using the regional data. These health risk calculations provided regional estimates of excess cancer and non-cancer effects associated with the modeled constituents. There is one regional monitoring station located in West Oakland.

More recently, air quality-related regulations (such as AB 617) have begun to focus directly on localized health risks, and new dynamic data collection processes provide the ability to distinguish levels of pollutants on a scale as fine as one city block (Apte et al. 2017), and even to identify specific vehicles that may not be achieving expected emission standards (Harley 2014, Preble 2018a, b).

Community-Based Science and Research Initiatives

New community-based research and data provide important insights into exposures at increasingly refined scales. In recent years, there have been multiple data collection efforts conducted in or initiated by the West Oakland community. These efforts have added to the understanding of air quality and diesel truck emissions in West Oakland (as well as some other Oakland neighborhoods). The Port has provided support for some of these studies by providing access to Port property for placement of monitors and coordination with the researchers as needed. The recent studies included:

- Distributed Monitoring of Community Black Carbon Exposure (100 x 100 Study)
- Real-Time Truck Emission Monitoring
- Street-Level Air Monitoring (Google/Aclima Study)

These studies are briefly summarized below. Some of this new community-based science is in the developmental stage and protocols and processes for collecting quality, reliable data are not well established. Nevertheless, in the future, data gathered through community-based initiatives will continue to inform the air quality planning process.

Distributed Monitoring of Community Black Carbon Exposure (100 x 100 Study)

The University of California at Berkeley (UC Berkeley), in collaboration with the Environmental Defense Fund, West Oakland Environmental Indicators Project (WOEIP), and the University of Texas at Austin conducted a study of the distribution of black carbon (BC) in West Oakland and nearby Seaport areas. The study placed 100 BC sensors in various location and collected

data for 100 days. The data compiled were compared to the BAAQMD regional air quality sensor to provide relative concentrations. Except for monitoring locations within the Seaport area, average sensor concentrations were typically within a factor of 2 of the BAAQMD sensor. Concentrations in the Seaport area tended to be higher. Some locations in the southwest portion of West Oakland exceeded the regional average approximately 20 to 30% of the time.

Real-Time Truck Emission Monitoring

In 2011, 2013, and 2015, UC Berkeley, led by principal investigators Chelsea Preble and Robert Harley, conducted real-time air monitoring to assess the effects of diesel engine turnover and engine retrofits on total truck emissions (Harley 2014; Preble et al. 2015; Preble 2018a). The researchers were able to correlate the emission data collected for each truck with the applicable engine and retrofit information for that truck by photographing the license plate of the truck.

Data were collected from a bridge overpass on Seventh Street at the entrance to the Seaport Area by sampling emissions from trucks passing under the bridge. Nitrogen oxides (NOx), black carbon (BC), particle number (PN), and particle size distributions were measured in the exhaust plumes of more than 2,600 drayage trucks near the Seaport area. The researchers concluded that average NOx, BC, and PN emission factors for newer engines (2010–2013 model years) equipped with both diesel particulate filters (DPFs) and selective catalytic reduction (SCR) were reduced substantially compared to 2004–2006 engines without these technologies. NOx emissions were reduced 69 ± 15%, BC emissions were reduced 92 ± 32%, and PN emissions were reduced 66 ± 35%.

Overall NOx emissions decreased by 70% from 2009 to 2015. While NOx emissions declined overall, the NOx constituent NO2 increased,[9] and N2O also increased. The increasing percentage of trucks with SCR in the 2015 has led to a decline in NO2 emissions relative to the 2013 fleet, but trucks equipped with SCR emitted higher levels of N2O. N2O is a potent GHG; it has a warming potential of approximately 300 times that of CO2 (USEPA 2018).

As of 2013, BC emissions had decreased by 76% from the 2009 data. BC emissions, however, increased slightly between 2013 and 2015 to a total reduction 73% relative to 2009. The researchers noted that the 2015 data showed that BC emissions from model year 2007 through 2009 trucks had increased by 50% relative to the 2011 and 2013 data (Preble 2018a), and suggested that this increase may be due to deterioration of DPFs. If the emissions from all of the high-emitting trucks were brought into conformance with their engine model year requirements, 2015 BC emissions would have been reduced by 91% relative to 2009.

The studies concluded that increased deployment of advanced controls has resulted in a small number of high-emitting trucks emitting a disproportionately large fraction of total BC and NOx. Most recently, the researchers estimated that 7% of all trucks emitted 67% of the total

[9] NOx is composed of NO and NO2 (it does not include N20). NO comprises 82 to 97% of NOx emissions, which explains why NOx emissions can decrease even though NO2 is increasing.

BC (Preble 2018b). Emission factor distributions for BC and PN were more skewed than those for NOx. In 2013, the highest emitting 10% of trucks were responsible for 65% of total BC and 80% of total PN, and 32% of total NOx emissions. The researchers noted that the percentage of NOx emissions attributable to high-emitting trucks is increasing, and this trend is likely to continue as the number of engines equipped with SCR increases in future years. Other emissions data, collected by CARB from six locations throughout California between 2016 and 2017, indicated that 1.5% of all trucks emitted 50% of all BC, and 3.9% of the trucks in this data set emitted 50% of all NOx (Hu et al. 2018). The emissions sensors developed for the statewide studies are being optimized to make them more portable (Hu et al. 2018). The portable sensors are considered a "mid-grade" system compared to the laboratory quality van-deployed sensor systems used in the Preble and Harley work described above.

The 2013 Oakland data also demonstrated the effectiveness of the Port's incentive programs for DPF retrofits and engine replacement. The fraction of DPF-equipped drayage trucks increased from 2 to 99% and the median engine age decreased from 11 to 6 years between 2009 and 2013. By 2015, 25% of trucks were also equipped with SCR. Emission changes occurred rapidly compared to what would have been observed due to natural (i.e., unforced and unincentivized) turnover of the truck fleet serving the Seaport. The study authors concluded that these results provide a preview of more widespread emission changes expected statewide and nationally in the coming years.

Street-Level Air Monitoring (Google/Aclima Study)

Affordable portable air monitors are enabling researchers to obtain near instantaneous information on local air quality. The new data collection processes are accompanied by a rapid increase in computing power, allowing the analysis of very large volumes of individual data points. For example, a joint effort by the Environmental Defense Fund, Google, the University of Texas at Austin, and Aclima equipped two Google Street View vehicles with a fast-response pollution measurement system and repeatedly sampled every street in a 11.6 square-mile area of Oakland, including all of West Oakland.

Each 30-meter (98.4-foot) road segment was sampled on average 31 times during the six-month study period. Data were collected on weekdays, during mid-morning to afternoon hours. A total of 3 million data points were collected. Resulting maps of annual daytime NO, NO2, and BC revealed stable, persistent daytime pollution patterns with sharp small-scale variability, up to 2-8 times within individual city blocks and neighborhoods. The researchers attempted to link a subset of hot spots in West Oakland to local sources, and were able to identify potential sources for all but one of the 12 hot spots reviewed. The report also indicated that the median daytime concentration measured by this study differed from the values reported by the West Oakland BAAQMD regional monitoring location by approximately 1/3 for BC and NO2, and 2/3 for NO (Apte et al. 2017).

Initiatives by Other West Coast Seaports

Seaports along the entire West Coast, from Southern California to Canada, are typically visited by the same vessels, as most vessels from Asia have multiple ports of call. Therefore, the Port of Oakland has the opportunity to learn from the experiences of larger ports with greater operating budgets when those ports conduct pilot and demonstration tests of new technologies.

In their 2017 CAAP, the San Pedro Bay Ports commited to achieving fully electric CHE in both ports by 2030, and 100% zero-emissions drayage trucks by 2035. However, as noted in the CAAP, this commitment is subject to sufficient funding, feasibility, and availability of technology. The Ports of Seattle, Tacoma, and Vancouver, Washington, jointly developed the Northwest Ports Clean Air Strategy, which is currently being updated.

MAQIP (2009) Accomplishments and Current Actions

The Port has substantially reduced its DPM emissions from the 2005 baseline and continues to seek out actions that could contribute to further reductions. MAQIP programs and projects support this goal through regulatory compliance, early actions before regulations come into effect, and by targeting emission reductions that exceed legally mandated requirements. The Port calculates MAQIP progress through periodic EI updates. For 2017, the EI showed a 98% reduction in truck-related DPM emissions and 81% reduction in DPM for all Seaport sources from the 2005 baseline. The Port is continuing to implement the MAQIP and working to achieve an 85% reduction in DPM by 2020. Certain actions will be completed by 2020; other actions will continue as part of the 2020 and Beyond Plan's Near-Term Action Plan. Emissions inventories are discussed in more detail in the subsequent section of this appendix. Key efforts that are currently on-going are described below.

Shore Power Implementation

CARB's current regulations require at-berth emissions 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." In March 2017, CARB directed its staff to amend the At-Berth Regulation to achieve up to 100% compliance by all vessels by 2030. This new regulation would apply, if adopted, at the SPBP and at ports that are in, or adjacent to, areas defined as in the top 10% of the most impacted communities, as determined by the California EnviroScreen (CES) model. This action would require at-berth emission reductions from vessels not currently subject to the regulation, such as bulk and break bulk vessels, tankers, and auto carriers.

Shore power implementation (compliance with the CARB's "At-Berth Regulation" for OGV) is a priority because OGVs are the largest source category for DPM in the Port's emissions inventory. Shore power compliance has resulted in substantial emissions reductions. In 2005,

OGV emissions were calculated to be 208.5 tons DPM; in 2017, OGV emissions were 42.4 tons. This represents an 83% reduction in OGV DPM emissions between 2005 and 2017, with approximately 11.4 tons of those reductions attributable to shore power.

Although significant DPM emission reductions have been achieved using shore power, shore power compliance continues to constitute a challenge due to many factors. These are primarily tied to vessel capabilities outside the control of the Port, such as equipment damage and failure, vessel size, inconsistent positioning of cables on the vessel, and foremost, the absence of shore power equipment on certain vessels. As a result, data show a wide range of compliance performance by the fleets at the Port. For example, in 2017, some fleets achieved 100% plug-ins while other fleets were only at 50%. (Note: the CARB "At Berth" regulation does not apply to fleets with fewer than 25 vessel calls per year or steamships.)

Port staff track shore power usage monthly and work with shipping lines and terminal operators to identify factors that prevent plug-ins to overcome those factors and achieve increased shore power usage. For example, to overcome cable-positioning issues, the Port evaluated the possibility of extending the reach of a vault plug from a few feet to up to 100 feet from the nearest shore power outlet. The evaluation indicated that the equipment would cost at least $2 million per berth, not including construction and other likely costs. In addition, ILWU would need to approve the design. Monitoring shore power compliance and actions to improve plug-ins will continue as part of the Near-Term Action Plan of the 2020 and Beyond Plan. For January through November 2018, the Port has achieved 74% plug-ins, showing the value of the Port's consistent follow-up.

Hybrid RTG Cranes

Stevedoring Services of America (SSA), the terminal operator at the Oakland International Container Terminal (OICT), was awarded a Carl Moyer grant for the repowering of 13 hybrid RTGs. SSA is using this grant to repower its entire fleet of RTGs. Phase-in is expected to require approximately two years.

The hybrid RTGs use a battery-electric system. The battery stores recovered energy from lowering containers and receives supplemental charging from a small Tier 4 final diesel engine. Because of the significant energy recovery and the fact that the diesel engine is very clean and runs at a steady level, overall criteria air pollutant emissions from the RTGs are reduced 99.5% compared to the existing diesel engines.

Zero-Emission Yard Tractors and Drayage Trucks

The Port is participating in two initiatives to pilot test cargo-handling equipment and drayage trucks. The Port is a participant in a Zero- and Near Zero-Emission Freight Facilities (ZANZEFF) grant recently awarded to the Port of Long Beach. The Port's component will include deploying 10 zero-emissions drayage trucks at Shipper's Transport Express, and five zero-emissions yard tractors and one zero-emissions top-pick at the Matson terminal. The Port will receive

equipment, but will not receive any funding for the necessary infrastructure. Instead, the Port is committed to investing at least $1.25 million to install suitable charging infrastructure and chargers to support the zero-emissions drayage trucks slated for STE. In addition, the Port is facilitating the test of 10 zero-emissions drayage trucks from BYD at five Port tenant locations.

The testing will assess the performance of the various types of equipment, including operating time between charges, time required to recharge the vehicles, performance under load, maintenance requirements, and more.

STAKEHOLDER ENGAGEMENT FOR THE DRAFT AND REVISED DRAFT 2020 AND BEYOND PLAN

Stakeholders have been engaged in the development of the 2020 and Beyond Plan. Prior to presenting the Draft Plan at the July 12, 2018, Board Meeting, Port staff held three Task Force Meetings (February 23, 2018; May 9, 2018; and June 21, 2018). The February 23, 2018, meeting focused on identifying additional emissions reduction measures under the existing MAQIP (i.e., MAQIP Update). The May 9, 2018, meeting continued the MAQIP Update and included a briefing on the key elements of the proposed 2020 and Beyond Plan.

At the Seaport Air Quality 2020 and Beyond Plan Task Force meeting on June 21, 2018, the agenda included a briefing on zero emissions by the California Air Resources Board (CARB). The Port presented key policy issues associated with the Draft Plan. A professional facilitator, aided by Port staff, facilitated group discussions with Task Force meeting attendees on the key policy issues. The Port also presented the process for stakeholder engagement for the Final Plan.

Following the public comment period on the Draft Plan, the Port held a Task Force meeting on September 26, 2018 to summarize the major categories of comments received and present the Port's proposed approach to addressing those comments. At this Task Force meeting the Port announced that in response to public comments requesting the opportunity to review a revised draft of the Plan and to provide comments on additional appendices that were still in development, the Port would provide a Revised Draft Plan for public review in December, followed by the preparation of the Final Plan in the Spring of 2019. In addition, the Port compiled and responded to all comments received on the Draft Plan (see Responses to Comments on the June 29, 2018 Draft Seaport Air Quality 2020 and Beyond Plan posted concurrently with this Revised Draft Plan), and will do so for comments received on the Revised Draft Plan as well.

A second public comment period and additional Task Force meetings will follow the release of the Revised Draft Plan. The September 2018 Task Force meeting also included a presentation on equity relative to West Oakland health indicators, an industry panel discussing industry's perspectives on the Plan and the pathway to zero emissions, and Round Table discussions pertaining to four major comment areas (status of technology, funding, stakeholder engagement, and regulations and policy).

EMISSIONS ESTIMATES

DPM Emissions

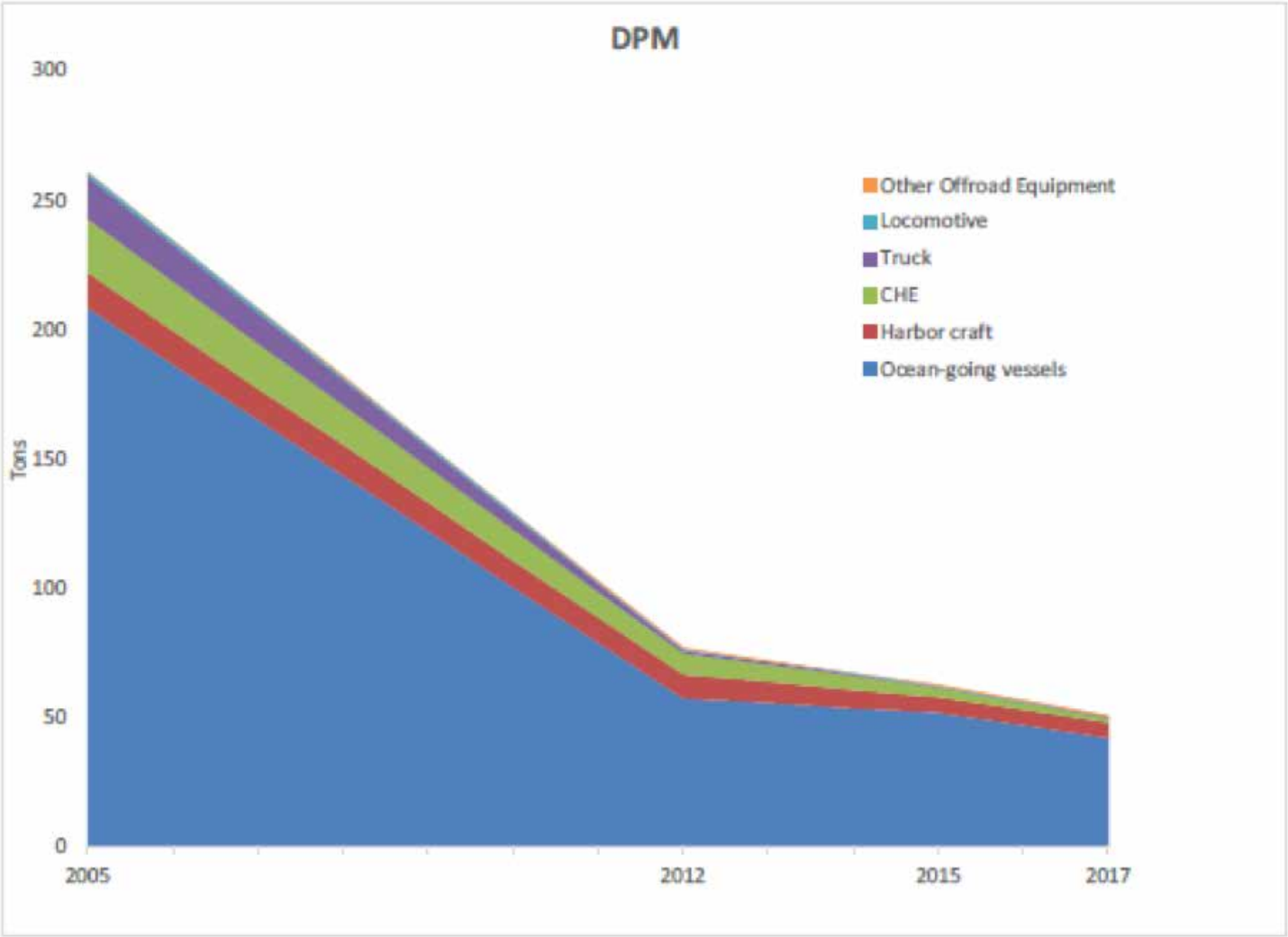
Baseline DPM Emissions

Since 2005, the Port has conducted three additional Seaport Emissions Inventories: for the years 2012, 2015, and 2017, respectively. The Port is planning to conduct another EI for the year 2020 (i.e., completion of the MAQIP) and 2023 (as part of the 5-Year Update for the 2020 and Beyond Plan). BAAQMD and CARB were involved with designing the protocol for the first EI in 2005. Each EI uses established methods of emissions estimation, such as those used by CARB in regulatory agencies development. To ensure that the 2017 emissions inventory reflected regulatory input, the Port convened a meeting with BAAQMD and CARB on January 25, 2018, to determine the inventory modeling protocol, which included determining the extent of the EI. The information used to develop emission estimates will continue to be refined as new information becomes available. Most recently (for the 2017 EI), the Port included emissions associated with bunkering operations[10] for the first time. In addition, the 2017 Port of Oakland "other off-road equipment" emission inventory includes construction and maintenance equipment at on-dock and off-dock terminals and the rail yard. Previous Port "other off-road equipment" emission inventories did not include other off-road equipment operated at off-dock terminals because activities at off-dock terminals are related to functions such as transloading that are not unique to Port tenants; such activities may occur at facilities that are on or off Port property. However, in an effort to expand the Port of Oakland maritime inventory to include activities at all Port maritime tenant facilities, emissions from "other off-road equipment" at off-dock terminals are included in the 2017 emission inventory.

The comparison between the 2005 and 2017 Seaport emissions shows a significant decline in total DPM emissions of 81%. As shown in Figure B-1 below, the two largest source categories are OGV (83% of residual emissions) and HC (12% of residual emissions). Port truck emissions declined by 98%, constituting 6% of DPM emissions in 2005 and just 0.6% of the residual emissions in 2017.

[10] Bunkering operation includes tugs to move the bunker barges and bunker fuel pumping, if necessary.

Figure B-1. DPM EMISSIONS BY EQUIPMENT CATEGORY



Projected DPM Emissions

The Port has forecasted Year 2020 and 2030 emissions to determine the additional reductions needed to achieve and maintain the MAQIP DPM reduction goal. The estimates were based on activity forecasts developed from a range of potential growth trajectories. The key findings of the modeling are:

- Emissions from vessels (OGV and HC/tugs) remain the largest sources of DPM emissions
- The Port will need to go above and beyond State regulatory requirements to reach its 85% reduction goal

After 2020, if cargo volume increases, the projections show a slight increase in DPM. This increase can be abated through additional regulation of OGVs and HC or changes in fuel (such as ultra-low sulfur fuel for OGV).

GHG Emissions

Baseline GHG Emissions

The first GHG emissions estimate for the Seaport was completed in 2012. Subsequent EIs also included GHGs; GHG emissions will be included in future EIs. The 2017 EI indicates that GHG emissions were reduced approximately 7% from 2005 (an estimate of 2005 GHG emissions was performed as part of the 2017 EI). CO2e emissions associated with shore power generation and transmission are included in the 2017 total; shore power was not used in 2005.

Projected GHG Emissions

While diesel engine improvements have resulted in substantial reductions in criteria air pollutants and DPM, diesel engine improvements only achieve limited reductions in GHG emissions. Improvements in diesel engine energy efficiency, improved ship hull design, and efficiencies created through use of larger vessels have reduced GHG emissions since 2005. However, GHG emissions are projected to increase again after 2020, assuming the cargo volume at the Port increases. (Two key actions to reduce GHG emissions are zero-emissions equipment and cleaner fuels, which are the focus of this Plan. Improved OGV design is another important contributor to GHG emissions reductions.)

RELATED INITIATIVES

In addition to activities performed specifically in relation to the MAQIP and the other actions proposed in this Plan, the Port and the City are engaged in several related initiatives to reduce adverse impacts from trucks, reduce GHG emissions from the redevelopment of the OAB, and minimize truck impacts to the West Oakland neighborhood.

The related initiatives include implementing the Port's Comprehensive Truck Management Plan (CTMP), developing and implementing the Joint Port and City of Oakland West Oakland Truck Management Plan (TMP), developing and implementing GHG Reduction Plans (required as a condition of redevelopment of the former OAB), implementing AB 617, and coordinating with Alameda County Transportation Commission to implement the GoPort program. The Port approved the CTMP in 2009.

Truck Management

As of October 2018, approximately 9,000 drayage trucks are registered in the Secure Truck Enrollment Program (STEP) and serve Port facilities. Of these, up to approximately 3,000 may be in operation on any given day. With the proposed new warehouses at the Port, more transfer of goods is expected to occur at the Port in the future. Nearby rail access will improve efficiencies and reduce truck trips and related emissions. The CTMP was successful in substantially reducing truck-related DPM emissions in West Oakland, both in advance of regulatory deadlines and overall. More detail regarding the CTMP is provided in Appendix C.

As part of implementing the CTMP, the Port has maintained the Trucker Work Group (TWG) that was initiated in 2007 and has provided interim truck parking and container staging areas at various locations throughout the Seaport. Currently, the City is working on development of a convenient 15-acre truck parking area on the former OAB with a gas station, food court, truck repair services, and bathrooms.

The Port and the City are currently preparing the West Oakland TMP to meet the requirements of Mitigation Measure 4.3-7 of the Standard Conditions of Approval/Mitigation Monitoring and Reporting Program (SCA/MMRP) for the 2012 Oakland Army Base Redevelopment Project. Mitigation Measure 4.3-7 states that "[t]he City and the Port shall continue to work together and shall create a truck management plan designed to reduce the effects of transport trucks on local streets." As of December 2018, five community workshops have been held to gather input for development of the TMP. The Port and the City released the Draft TMP for public review on November 16, 2018.

The goals of the TMP are:

- Reduce disruptions from truck circulation and truck parking on residents and businesses in West Oakland.
- Increase safety near designated truck routes.
- Have truck drivers know preferred routes to reach their destinations and know the City's parking restrictions.
- Monitor TMP implementation and modify implementation strategies to improve outcomes as needed.

The TMP contains ten strategies to achieve the goals. The strategies are:

- Improve Safety at Street Intersections near the Port
- Improve Truck Routing
- Update the Network of Truck Routes and Truck Prohibited Streets
- Improve Truck Route Signage
- Conduct Traffic Enforcement Spot-Checks
- Use Urban Design to Promote Use of Truck Routes
- Improve Training for Issuing Parking Tickets
- Change Parking Regulations
- Consider Increasing Truck Parking Fines
- Conducted Targeted Parking Enforcement

The TMP also provides a timeline for each of the strategies.

Greenhouse Gas Reduction Plans

The SCA/MMRP for the OAB Redevelopment Project also requires the development of a GHG Reduction Plan (GGRP) for each major development project at the former OAB. Developers, whether on Port or City property, submit a GGRP for Port or City review as a condition of development.

AB 617 West Oakland Community Air Action Plan

As discussed in the regulatory setting discussion above, AB 617 requires community-focused air quality planning to reduce exposure to existing sources, through the Community Air Risk Evaluation program. AB 617 represents a fundamental shift in air quality regulation because it focuses on local health effects, with specific attention to communities affected by a high cumulative exposure to criteria air pollutants and TACs, including DPM. AB 617 is intended to reduce exposure in communities most impacted by air pollution. The AB 617 West Oakland Community Air Action Plan for West Oakland (WOCAAP) among the first to be developed. A draft of the WOCAAP is expected to be available in March 2019.

The Port has strengthened its involvement in the AB 617 process. The Port serves on the West Oakland Clean Air Action Plan (WOCAAP) Steering Committee. The Port has also participated in workshops, and is providing data from the 2017 emissions inventory to BAAQMD for use in BAAQMD's health risk assessment. In the future, the Port intends to continue to be a source of data for the agencies responsible for health risk.

GoPort Program (Related Project)

The GoPort program is designed to improve the efficiency of freight movement in the Seaport Area. It is composed of three projects:

- 7th Street Grade Separation East (7SGSE): Replace the existing railroad underpass between I-880 and Maritime Street to increase clearance for trucks and improve the shared pedestrian/bicycle pathway
- 7th Street Grade Separation West (7SGSW): Realign and grade separate the intersection of 7th Street and Maritime Street and construct a rail spur underneath to improve access and minimize conflicts between rail, vehicles, pedestrians, and bicyclists.
- Freight Intelligent Transportation System (FITS): Apply ITS field systems along West Grand Avenue, Maritime Street, 7th Street, and Middle Harbor Road on the National and State Freight Network Systems, and other technologies to cost effectively manage Port roadways, provide truck traveler information, and improve incident management.

Although not designed as an air quality improvement program, by increasing freight movement efficiency, the GoPort program is likely to provide ancillary air quality improvements through reductions in congestion and idling. More detail regarding the elements of the GoPort program are provided in Appendix C.

STATUS OF CURRENT TECHNOLOGY FOR NEAR-ZERO AND ZERO-EMISSIONS EQUIPMENT

The Port has been tracking the development of near-zero and zero-emissions technology suitable for the maritime industry. While personal vehicle and solar collection technology is advancing rapidly, heavy power demands, a larger variety of equipment types, and challenging operating conditions in the maritime environment create greater challenges to progress for development of zero-emissions equipment for this sector. Furthermore, most zero-emissions technology based on electrical power currently has a limited operating range or duration. Charging battery-electric equipment takes considerably longer than refueling a comparable piece of equipment with petroleum-based fuel. Improved batteries (lighter weight, capable of holding a greater charge, with a longer lifespan, and able to be charged more rapidly) are likely to be required to make much of the electrically powered zero-emissions equipment feasible from a commercial and operational perspective.

Key considerations with regard to the feasibility of near-zero and zero-emissions technology are briefly described below. Key considerations include:

- Battery technology
- Charging process
- Ability to use grid electricity
- Commercial availability of hybrid, near-zero, and zero-emissions equipment

More detailed information pertaining to specific equipment and infrastructure considerations is provided in Appendix C.

Battery Technology Status

One important consideration for battery-electric equipment is the current state of battery technology. While battery technology is continuing to advance, it is impossible to predict at this point when the right types of batteries will become available.

Traditional car batteries (lead-acid batteries) were the batteries initially used by mobile CHE, such as electric Automated Guided Vehicles (AGVs). Lead-acid batteries are easy to manufacture at a low cost, reliable, and tolerate overcharging. However, they take relatively long to recharge, emit lead into the environment and present corrosion problems. In addition, lead-acid batteries produce acid fumes and suffer from reduced battery life due to sulfation (M&N 2018). Furthermore, these batteries are hazardous waste once their useful life has been exhausted.

Recently, CHE manufacturers have displayed an increasing preference for Lithium-Iron-Phosphate (LFP) batteries. While these batteries are more expensive than lead-acid batteries, they are a safe and secure technology. They are lighter and more compact, degrade gradually, have a long life, present less risk of thermal events (as found in less expensive Lithium-Ion batteries, which charge much faster), and have a low environmental toxicity. During Moffatt

and Nichols' review of vendors' equipment (2018), most equipment makers reported they are now producing LFP batteries and are moving away from lead-acid types. Alternately, Lithium-Polymer batteries (used in cell phones, tablets, and radio-controlled aircraft) provide higher energy densities and weigh less than LFP batteries, albeit at the expense of varied degradation rates and thermal activity.

In addition to technical performance and cost, the weight and size of batteries currently limit the range of battery-electric vehicles, as well as the types of equipment that can be powered by batteries. In general, the weight of the batteries means that battery-electric vehicles are heavier than conventional vehicles, and the extra weight limits the number of batteries that can be installed on a vehicle or other piece of equipment. Therefore, even the most advanced trucks are currently limited to only a short range (100 miles per charge, approximately); long-range trucks running on a single battery charge are currently not feasible. Similarly, top-picks, which require approximately 900 horsepower (hp), are in the early prototype stage due to challenges imposed by current battery technology (AECOM 2018).

Manufacturers and academia are constantly innovating and the cost, energy density, and lifespan of batteries are expected to improve over time. In addition to bringing new battery products to the market place, this innovation is expected to drive costs downward and result in improved reliability (M&N 2018).

Charging Considerations

The rate at which batteries can be charged is a significant consideration when using battery-powered equipment. In addition, sufficient charging infrastructure must be available to charge all battery-powered equipment. A 240-kW battery can be recharged (using a direct current charger) in about 1.5 hours, provided there is sufficient amperage. For yard tractors, the estimated power consumption rate is 15 kW/h, meaning that the battery would last approximately 16 hours without recharging. This would provide no margin of error for a two-shift operation, indicating that interim recharging (i.e., during the one hour shift change) would be required for a viable two-shift operation (AECOM 2018).

While sufficient electrical power could theoretically be provided to charge all equipment at a marine terminal at the maximum rate, doing so could be costly. Chargers would have to be installed for each piece of equipment, and the peak power demand would occur for only approximately 4% of any given day, potentially resulting in high demand charges.[11] It would be more economical to spread out charging over a longer period of time. This would also reduce the number of chargers that would have to be installed, as multiple pieces of equipment could be charged by one charging station. However, extending the charging period would mean

[11] Demand charges cover electric utilities' fixed costs of providing a certain level of energy to their customers. Energy costs are the variable-costs portion (charges by kWh). The challenge is that utilities have to maintain enough capacity to satisfy all their customers' energy needs at once. Utilities have to maintain enough power plants to supply all that energy at once, and this requires them to keep a vast array of expensive equipment on constant standby, including transformers, wires, substations, and generating stations. This capacity is extremely expensive to build, and demand charges help pay the costs.

that the equipment is unavailable for a longer period of time. This would prevent, or greatly limit, a three-shift operation. Consequently, the operating cycle for each piece of equipment becomes a critical factor in planning infrastructure and cost estimates.

Equipment using hydrogen fuel cells can be charged more rapidly, but would require more extensive infrastructure investments (i.e., either a hydrogen generating facility at the charging location, or a hydrogen pipeline to a manufacturer's location). One website suggests that a heavy-duty truck could be refueled in about 10 minutes (Ballard 2017). Hydrogen is highly flammable, and can pose safety concerns. While two equipment manufacturers have developed trucks powered by hydrogen fuel cells, development of new cargo-handling equipment powered by hydrogen fuel cell technology appears to be lagging the development of battery-electric equipment (M&N 2018). A more detailed discussion of hydrogen fuel cell technology is provided in Appendix C.

Use of Grid Electricity

Some electrical equipment can also be powered by grid electricity. However, this type of equipment is limited in its range as it either needs be connected to a fixed rail or a cable reel. Depending on the layout of the terminal, this type of equipment may also present operational challenges. Electric rails could limit yard tractor and truck movements within the terminal. Cables on cable reels are typically run in trenches; truck traffic on the terminal causes debris to enter the trenches, which can cause failure of the cable reel. As a result, some ports that operate their own terminals have gone to a fixed container yard layout to allow for a high level of automation in their terminals. The Port of Oakland is a land-owner port and does not operate its own terminals. In addition, any such changes are subject to port labor agreements.[12]

Availability of Near-Zero-Emissions Equipment

The term "near-zero emissions" (NZE) is applied to a wide range of equipment and has different meanings depending on the context in which it is used:

- Low-NOx equipment: defined as equipment that is powered by engines certified by the State of California to provide 90% NOx emissions reductions compared to Model Year 2007 or later diesel-powered equipment (Tier 4-compliant engines). These standards have been set only for truck engines. For clarity, equipment using these engines is referred to as low-NOx equipment. The California certification for low-NOx engines does not require any additional reductions in PM or other criteria pollutants (or GHGs) compared to Model Year 2007 or later engines. This Plan uses the term "low-NOx" for this type of technology.
- Tier 4 diesel engines: The literature at times refers to modern diesel engines (including engines for locomotives and harbor craft) meeting Tier 4 standards as near-zero emissions engines; this Plan refers to them as Tier 4 engines.

[12] Port labor agreements are entered into between the union and specific terminal operators, and do not involve the Port of Oakland directly.

- Hybrid Equipment: Hybrid technology recovers a portion of the energy used in braking or other equipment functions to charge a battery. The battery powers the vehicle until it is discharged, at which point a different power source, typically an internal combustion engine takes over. Hybrid technology is well-established for light-duty vehicles, and some medium-duty fleets (e.g., delivery vans), but is in the developmental stage for most heavy duty equipment. This Plan uses the term hybrid for this type of equipment.

Low-NOx and hybrid equipment are discussed in more detail below.

Low-NOx Engines

Depending on the fuel source, low-NOx engines may also reduce or eliminate emissions of TACs, including DPM. When low-NOx equipment is powered by a fuel other than diesel, emissions of DPM are eliminated, although the equipment may still emit particulate matter. In some cases, use of low-NOx equipment can be coupled with use of alternative fuels, resulting in reductions of GHGs as well as criteria air pollutants and TACs. For example, a natural-gas-powered low-NOx engine could be fueled by renewable natural gas, which would provide large reductions in GHG emissions (see discussion of renewable natural gas in Appendix C).

Currently, there is one heavy-duty (12-liter displacement) engine that is certified as meeting the low-NOx criteria; there are no heavy-heavy duty (15-liter displacement) engines that are certified to the low-NOx standard. Heavy-duty natural-gas powered trucks are available from multiple manufacturers (Freightwaves 2018). Much less is known about the performance of low-NOx natural gas engines in yard tractors. Low-NOx natural-gas-powered engines are currently being tested at the Port of Los Angeles and in a joint demonstration project by the SPBPs. The two ports are testing a total of 42 low-NOx natural-gas-powered yard tractors (CEC 2018, Advanced Clean Transportation News 2018).

Natural gas-powered low-NOx equipment relies on an infrastructure for natural gas fueling. This infrastructure is poorly developed in the vicinity of the Port of Oakland; there is only one CNG fueling station in the immediate vicinity of the Seaport. Nonetheless, based on the current status of equipment in maritime service (i.e., drayage trucks and yard tractors), it appears that use of natural-gas-powered low-NOx equipment is likely to be viable. The equipment must still be demonstrated in maritime use before it is considered commercially available. Additional natural gas fueling stations would also have to be developed in the vicinity of the Port. EBMUD has expressed some interest in developing renewable natural gas as a transportation fuel at its West Oakland wastewater treatment plant, and could potentially serve as a location for natural gas fueling.

Hybrid Equipment

Hybrid technology is becoming established for RTGs and at least one manufacturer is providing retrofit kits to convert conventional diesel trucks to hybrid trucks. In addition, hybrid natural gas/battery-electric and hybrid fuel cell/battery electric vehicles have also been developed by at

least one manufacturer each (Freightwaves 2018, Ballard 2018). In addition, hybrid technology is starting to be developed for tugs. There is at least one hybrid retrofit system that has been approved, and others are in development (Maritime Executive 2018, CARB 2018c). The maximum criteria air pollutant and GHG reductions for the approved hybrid tug system are on the order of 30% over existing engine technology. More novel designs may yield more substantial emissions reductions, primarily for criteria air pollutants. There are currently no commercially available hybrid options for OGVs in transit or at berth.

Some hybrid technologies achieve near-zero criteria air pollutant emissions and provide substantial GHG reductions due to the increased efficiency resulting from energy recovery. Thus, some hybrid equipment can be deployed now on a transitional basis to provide substantial emission reductions. As noted earlier, BAAQMD recently awarded a Carl Moyer grant to SSAT to help fund the installation of 13 hybrid RTGs at the Port of Oakland.

Availability of Zero-Emissions Equipment

Battery-electric technology is well-established for light-duty vehicles, and some medium-duty fleets (e.g., delivery vans), but is in the developmental stage for most heavy duty equipment.

Zero-emissions technology for mobile container handling equipment, harbor craft, and ocean-going vessels is in the demonstration stage or earlier stages.[13] Zero- and near-zero emissions CHE is currently in use (primarily in a demonstration-testing capacity) in portions of 18 ports around the world. The San Pedro Bay Ports are testing the greatest variety of mobile zero- and near-zero emissions CHE equipment (M&N 2018). Several types of grid-electric cargo-handling equipment are available; however, these types of equipment require either a fixed yard layout or a fully automated terminal, and are not suitable for current marine terminal operations at the Port of Oakland.

Cargo-Handling Equipment

Yard tractors are the most advanced type of mobile battery-electric CHE; nearly 60 battery-electric yard tractors are in demonstration testing or scheduled to be entering demonstration testing within the next year at various ports in California. Provided that adequate charging infrastructure is available, and sufficient incentive funding is provided to cover the large cost gap between battery electric and conventional diesel-powered equipment, battery-electric yard tractors may become commercially viable within the next several years. Given the large cost gap between conventional diesel-powered and battery-electric yard tractors, incentive funding is critical to their adoption in the short- to intermediate-term (see Appendix F).

Harbor Craft

Currently, there are no commercially available zero-emissions technologies suitable for HC. CARB is considering issuing additional tug engine regulations in 2020, which would likely drive

[13] See Appendix D, Table D-2 for a description of the technological readiness levels.

increased technology development in this sector. However, these regulations are not expected to take effect until 2023.

Ocean-Going Vessels

There are currently no commercially available zero-emissions options for OGVs in transit. The Port is continuing to work with the shipping lines to increase plug-in rates. Criteria air pollutant and DPM emissions could also be captured at the exhaust stack for vessels that are unable to use shore power (by use of a "bonnet" over the exhaust stack, coupled with filtration of the exhaust gases). However, a bonnet does not provide any GHG reduction benefits, and operation of the barge equipped with the bonnet and the operation of the bonnet itself may increase GHG emissions relative to not using a bonnet (see discussion of Barge-Based Exhaust Scrubber System [Bonnet] in Appendix C).

Reduction in OGV emissions from transiting vessel must come from improvements to OGVs. On April 13, 2018, the United Nations International Maritime Organization (IMO) agreed to set targets to reduce the carbon intensity of global transport. The goal is to reduce CO2 emissions per unit freight, as an average across international shipping, by at least 40% by 2030, compared to 2008, and moving toward 70% by 2050.

In addition, the IMO set a target to reduce the total annual GHG emissions by at least 50% by 2050, compared to 2008, while pursuing efforts towards phasing them out, consistent with the Paris Climate Agreement temperature goals (IMO 2018).

Drayage Trucks

Battery-electric drayage trucks are at a similar level of development as battery-electric yard tractors. Drayage trucks fall into two primary classes: those used for short hauls in the vicinity of the Seaport (to a rail yard or off-site container storage location), and those engaged in long-haul service. Battery electric short-haul drayage trucks may become commercially available in the near future; however, the cost differential compared to modern diesel-powered trucks will be substantial, and adoption of battery-electric drayage trucks will require substantial incentive funding.

The National Renewable Energy Laboratory (NREL), in collaboration with the South Coast Air Quality Management District (SCAQMD), is evaluating the in-service performance of electric drayage trucks compared to conventional diesel drayage trucks operated in and around the San Pedro Bay Ports. The Class 8 electric drayage trucks under study transport cargo containers between the port complex and local rail yards and distribution centers. According to NREL, by utilizing advanced batteries and high-efficiency components, electric drayage trucks can operate up to 100 miles on a single battery charge while handling gross vehicle weight loads of up to 80,000 pounds (NREL 2018).

Development of long-haul battery-electric drayage trucks will require development of

better batteries, and a State-wide charging infrastructure. Hydrogen-fuel-cell-powered long-range trucks may have a greater likelihood of becoming operationally viable in the near to intermediate term; however, a hydrogen fueling infrastructure would have to be developed. In addition, the hydrogen used in the fuel cells would have to be made from renewable source in order for a hydrogen-fuel-cell-powered truck to be a true zero-emissions vehicle.

Electrification of short-haul trucks may result in greater efficiency gains than previously expected. A recent CARB study (CARB 2018e) indicated that the expected efficiency gains from electrification of trucks are better than previously estimated, especially for low-speed duty cycles. The resulting GHG emissions benefits and fuel saving would therefore also be higher than previously estimated.

The energy efficiency ratio (EER) is used to determine how many credits an electric vehicle owner can receive for using electricity as a motor vehicle fuel. Potential updates to the Low Carbon Fuel Standard program to reflect the higher EER would result in higher credits per kilowatt hour (kWh)[14] used and would lower the total cost of ownership of a given electric vehicle.

Based on the CARB study, when compared to conventional diesel vehicles, the battery-electric vehicle EER is about 3.5 at highway speeds and 5 to 6 when operated at lower speed duty cycles where idling and coasting losses from conventional diesel engines are highest. The average daily speed for near dock drayage trucks, vans and yard tractors is commonly below 13 miles per hour (mph). The EER can be higher than 6 for yard tractors. CARB expects that in the next decade, battery-electric trucks and buses are more likely to be placed in service in slower speed operations because of battery range limitations and battery costs.

CHALLENGES

Achieving additional emission reductions and transitioning to a zero-emissions Seaport presents challenges, as follows:

Sources of Residual DPM Emissions: The majority of the remaining DPM emissions associated with Port operations arise from ocean-going vessels in transit (83%) and harbor craft operations (12%); the Port does not own, operate or control OGVs or HC. Few measures and only limited regulations address these sources. The recent GHG emissions targets set by the International Maritime Organization (IMO) suggest that OGV GHG emissions, and consequently DPM emissions, are likely to be reduced in the future. However, given the long life cycles of container vessels, the changeover is likely to be a decade or more in the future.

[14] A kWh is a measure of how much energy is used. It does not mean the number of kilowatts used per hour, but a measurement equal to the amount of energy that would be used to keep a 1,000-watt appliance running for an hour. For example, a lit 100-watt lightbulb would take 10 hours to use 1 kWh of energy.

Tenant- and Trucker-Owned and Operated Equipment: Most of the equipment operating at the Seaport is not owned by the Port. Thus, the Port's key role is to continue to maintain strong partnerships with tenants and truckers to promote cleaner equipment. The transition to cleaner equipment balances factors such as available grant funding and reduced fuel use with operational factors, such as equipment downtime, maintenance, and workforce development and training.

Infrastructure: The transition to a zero-emissions Seaport will require extensive improvements to infrastructure, primarily electric and potentially fiber optic communications systems. Major infrastructure improvements (e.g., new transmission capacity or new substations) would have to be constructed before zero-emissions equipment can operate; this means that design and construction of the required infrastructure may need to begin up to five years before putting new equipment and systems into operation.

Funding: Installing all of the equipment that would have to be replaced to achieve a zero-emissions Seaport is costly. For example, a retrofit to convert a diesel RTG to a hybrid-electric RTG may cost more than $500,000, and zero-emissions drayage truck may cost nearly three times as much as a comparable diesel-powered truck.

Technology Reliability/Failures: Once new technology is implemented, it must be monitored regularly to ensure that it is performing as intended. Equipment users are also concerned about the overall long-term performance of expensive equipment.

Operational Impacts: New technologies may require changes in operations that may or may not be compatible with existing operations at a terminal or other business. In addition, maintenance, labor, and safety may be significant considerations. Equipment users are concerned about the potential downtime caused by lack of available parts and near-by maintenance facilities.

Stranded assets: A stranded asset is equipment or infrastructure that has experienced unanticipated or premature write-downs, devaluations or conversion to liabilities. The Port, its tenants, and other businesses serving the Port have made substantial investments in new, cleaner equipment and infrastructure that have a long useful life. Abandonment or accelerated replacement of this equipment will not allow businesses to capture the full useful life for the equipment or infrastructure in which they have recently invested, resulting in waste.

APPENDIX C: DETAILED DESCRIPTION OF POTENTIAL IMPLEMENTING ACTIONS

APPENDIX C: DETAILED DESCRIPTION OF POTENTIAL IMPLEMENTING ACTIONS

TABLES

FIGURES

DETAILED DESCRIPTION OF POTENTIAL IMPLEMENTING ACTIONS

This appendix provides a description of potential implementing actions (IAs), including the IAs in the Near Term (Years 2019- 2023) Action Plan (NTAP). The amount of information currently available about each of these IAs varies. Typically, more information is available for IAs that are included in the NTAP. At the end of this appendix, Table C-2 provides a list of the potential IAs identified to date. Table C-2 also indicates the status of the IAs, the Port's level of control with regard to implementation of each IA, and the strategies associated with each IA.

Potential IAs pertaining to Strategies #1 through #3 fall into four primary categories:

- Infrastructure
- Fuels
- Equipment
- Operations

There is some overlap between these categories. For example, electrically-powered equipment is a measure that involves fuel, typically infrastructure, and equipment. Feasibility studies and evaluations, and needs assessments may be conducted for any of the four categories of actions, and may be the first step in potentially implementing an IA. IAs pertaining to Strategies #4 through #6 follow the IAs for Strategies #1 through #3, and are grouped by strategy.

This appendix also provides relevant background information regarding some categories of IAs.

SOURCES OF POTENTIAL IMPLEMENTING ACTIONS

As part of developing this Plan, the Port identified a range of potential implementing actions. These actions are described in this appendix. Additional (new) IAs are expected to be identified in the future. For example, as part of their comments on the Draft Plan, EarthJustice (on behalf of West Oakland Environmental Indicators Project) and BAAQMD provided listings of other potential IAs (see Attachments C-1 and C-2). In addition, the Port will continue to track the development of new technologies, fuels, and operational measures that could support the goals of the Plan.

Technology Tracking and Monitoring of Equipment IAs

Technology tracking and monitoring of zero-emissions and hybrid equipment performance are critical components of the Plan. Technology tracking will enable the Port to identify new potential IAs and to better understand the challenges associated with various technologies. Monitoring of the IAs being implemented at the Seaport, as described in the Plan, and sharing that information with local stakeholders and others will enable the Port to contribute to the overall advancement of hybrid and zero-emissions technology.

SELECTION OF IMPLEMENTING ACTIONS

The Port will maintain a pool of potential implementing actions, beginning with the IAs described in this appendix. Potential new IAs identified during the implementation of the Plan will first be screened according to the screening criteria in Appendix D. New IAs passing the screening will be added to the pool of IAs. IAs in the pool will be considered for implementation on a regular basis, likely annually to align with the Port's budget cycle. At that time, each IA will be evaluated according to the feasibility criteria summarized in Table 1: Summary of Feasibility Criteria for Implementing Actions and described in detail in Appendix D (see main body of the text) and prioritized based on its relative performance on the feasibility criteria.

Screening and Prioritization of Potential Implementing Actions

As stated above, the Port will screen all IAs in the pool against the feasibility criteria. The Port's five step screening process (see Appendix D) will include an initial assessment of supporting infrastructure needs for the potential IA. The highest-performing IAs will be chosen for implementation. The first step in implementation is to determine whether the IA can be funded solely by the Port (or other organization intending to implement the IA) or whether outside funding is required to implement the IA. If outside funding is required, for example, incentive funding for equipment to be owned by tenants, implementation of the IA would be delayed until outside funding can be obtained by the equipment owner. The Port will work with its partner(s) to determine funding needs, and seek grants and/or other sources of funding, if available.

As technologies or other IAs approach commercial availability, the Port will reassess the supporting infrastructure needs. If a technology or action is deemed operationally feasible and may be selected for implementation, the Port will also determine whether additional infrastructure is required to support implementation of that technology or action, and the time required to provide the infrastructure in advance of implementation of the new technology or action.

Some IAs are broad actions (e.g., expanding the use of hybrid cargo-handling equipment where suitable electrically-powered is not available). For these IAs, implementation may occur through multiple individual actions; for example, zero-emissions vehicles for the Port fleet will be acquired over time as existing equipment reaches the end of its useful life and suitable zero-emissions vehicles become available.

Structure of an Implementing Action

Information regarding Implementing Actions that are selected for implementation will follow a similar structure and will include the following components:

- Description of the proposed IA including its specific purpose and anticipated emission reductions benefits, where applicable

- Schedule of implementation with dates for completion of specific tasks, if applicable
- Parties involved in implementation and their respective roles and responsibilities
- Cost estimate and proposed funding source(s), including on-going operating and maintenance costs and the ability to pay for these
- Monitoring and Reporting

This information will be developed prior to the implementation of the IA, and will be used in managing, monitoring, and reporting on the IA.

As an example, the following shows the structure for use of renewable diesel in the Port's fleet (note that this is only an example, and a specific timeline, cost, and monitoring efforts have not been determined):

Implementing Action Description:

Replace conventional diesel used in Port diesel-powered fleet with renewable diesel (RD) to reduce GHG and DPM emissions. Emissions reduction benefit: 30-50% reduction in DPM and 60-70% reduction in GHG emissions, as well as a 15-20% reduction in NOx emissions.

Tasks and Schedule:

Identify preferred RD supplier, issue contract, receive fuel, monitor fuel performance, report to Board.

Participants:

Port staff, including facilities, environmental, and contracting; Board approval of procurement.

Cost Estimate, Operating and Maintenance Cost, and Funding Source:

Unit cost per gallon, Port budget amount, estimate of reduced maintenance cost

Monitoring:

Fuel use and frequency of routine and non-routine maintenance.

Reporting:

Compare performance to petroleum diesel and document findings and recommendations. Possible interim briefings to the Board and/or stakeholders.

USE OF FEASIBILITY STUDIES AND NEEDS ASSESSMENTS

The Port is conducting feasibility studies and needs assessments related to infrastructure and technology. Because zero-emissions technology is evolving rapidly, it is likely that additional studies will be required in the future to reassess infrastructure needs in support of certain technologies. The studies described in the subsequent sections are intended to show the range of engineering studies required to support implementation of the pathway to a zero-emissions

Seaport. The Port will determine the specific scope of any feasibility studies or other assessments to be conducted. Feasibility studies may also provide a neutral assessment of the state of equipment technology.

INFRASTRUCTURE IMPROVEMENTS

New or improved infrastructure in all categories (i.e., electrical, fueling, fiber, and physical improvements to roads within the Port, etc.) is an underlying requirement to promote the pathway to zero-emissions Seaport. Most types of electrical equipment will either need to plug into grid power or recharge at charging stations. The Port is currently conducting a study to determine the extent of any needed electrical system upgrades to support deployment of battery-electric equipment on the marine terminals served by the Port utility (Maritime Power Capacity Study for Terminal Electrification, described below). The Port anticipates that the existing grid capacity can support initial limited deployment of battery-electric equipment, although the specific capacity at each marine terminal and other tenants' location varies. Some improvements to the electrical infrastructure both on the terminals and to provide power to the terminals will be needed to support a zero-emissions Seaport.

With regard to drayage trucks, until a network of fast-charging stations and an established universal standard for electric truck charging are available locally and nationally, the feasibility of battery-electric drayage trucks will be limited. For equipment utilizing hydrogen fuel cells, a hydrogen supply and hydrogen charging infrastructure must be provided. Even for small uses of hydrogen (e.g., hydrogen fuel cell-equipped forklifts), the end user of the equipment must at minimum install a tank and charging equipment, and arrange for regular deliveries of hydrogen to the tank. Larger systems would require a hydrogen pipeline or on-site generation of hydrogen.

Other infrastructure improvements related to operational improvements at the Port, such as the GoPort program[1] currently in design, will promote more efficient circulation within the Seaport Area, and may yield ancillary emissions reductions through reduced idling. Additional infrastructure upgrades that may be needed include an expanded fiber optics communications system to support computers systems and related smart technology,[2] microgrids to serve specific terminals or areas within the Seaport, and other features to enable more efficient movement of containers from ships to trucks or rail. These types of infrastructure improvements may be required to meet the State's System Efficiency Target.[3]

---

[1] The GoPort (Global Opportunities at the Port of Oakland) Program is a related activity designed to improve truck and rail access at the Port Oakland. It includes three components designed to reduce congestion and increase efficiency to improve sustainability and economic competitiveness. The three components are the 7th Street grade separation east, 7th Street grade separation west, and the freight intelligent transportation system (FITS).

[2] See discussion of the FITS in the Operations subsection.

[3] The State's System Efficiency target, set in the Sustainable Freight Action Plan pursuant to EO B-32-15, is to "Improve freight system efficiency 25 percent by increasing the value of goods and services produced from the freight sector, relative to the amount of carbon that it produces by 2030."

The Port intends to play its part in the development of the infrastructure required to move to a zero emissions Seaport. Required infrastructure upgrades will have to be constructed over time, as needed by the Port's tenants. According to a recent engineering feasibility study conducted by the Port, the required electrical upgrades to provide sufficient capacity and localized infrastructure for the Seaport terminals alone are estimated to cost from $120 to $155 million[4] (Burns and McDonnell 2016), in addition to the $55 million already invested to provide shore power infrastructure. This estimate does not include any electrical infrastructure related to drayage truck charging or railyard conversion, nor does it include the other fiber communications systems and smart-technology-related infrastructure described above, nor future shore power infrastructure improvements that may be needed to achieve higher plug-in rates.

Infrastructure upgrades will need to be reviewed both on an individual IA (project) basis, and then from a system-wide perspective. For example, the Port may install additional electrical infrastructure at a terminal, but must also evaluate the impact of the additional load on the broader Port's electrical system capacity, and on future terminal operation.

Resilience of each system (also known as reliability) is another critical element of upgrading electrical, fuels and fiber communications infrastructure. Resilience in infrastructure systems refers both to the ability of the system to resist hacking, and the ability of the system to continue operating if part of it is disabled. Technology is increasingly integrated into the day-to-day activities associated with cargo movement and into management and operations of fuels infrastructure (electrical grid, pipelines), creating new vulnerabilities. Many organizations that are heavily reliant on smart technology systems have begun to install local electrical grids (known as microgrids) to ensure that their smart technology systems remain operational, whether or not the main electrical grid is functional.

The electrical grid in the Seaport area is composed of areas served by PG&E and areas served by the Port's utility (see Figure C-1). The Port's utility serves one large container terminal and the areas of the former Oakland Army Base now owned by the Port. Provided funding is available, the Port intends to upgrade the electrical infrastructure it controls. Table C-1 summarizes which features at the Seaport are served by PG&E's infrastructure and the Port's utility infrastructure. Electrical infrastructure controlled by PG&E must be upgraded by PG&E. The Port is only able to facilitate the work and to provide development permits for work on Port lands (electrical permits are provided by the City of Oakland as well as building permits if charging structures weigh more than 400 pounds). Work is also needed to upgrade PG&E's infrastructure.

[4] The cost to complete the upgrades was estimated to be approximately $42 to $56 million for the primary electrical lines and substation upgrades/construction, while electrification of the terminals was estimated to cost an additional $80 to $90 million (Burns and McDonnell 2016).

FIGURE C-1. SEAPORT ELECTRICAL INFRASTRUCTURE

Source: Port of Oakland Revised Draft Seaport Air Quality 2020 and Beyond Plan (December 2018)

TABLE C-1. SUMMARY OF ELECTRICAL INFRASTRUCTURE SERVICE PROVIDER BY AREA

	Shore Power		Crane Power		Lights, Reefer, Admin	
	Primary	Backup	Primary	Backup	Primary	Backup
Berths 20-21	N/A	N/A	PG&E	PG&E	PG&E	PG&E
Berths 22-26	Port	Port	Port	PG&E	PG&E	Port
Berths 30-32	Port	Port	PG&E	Port	PG&E	Port
Berths 35-38	Port	Port	PG&E	Port	PG&E	PG&E
Berths 55-59	Port	Port	Port	Port	Port	Port
Berths 60-68	PG&E	PG&E	PG&E	PG&E	PG&E	PG&E
OAB	N/A	N/A	N/A	N/A	Port	Port
JIT	N/A	N/A	N/A	N/A	Port	Port

Source: Burns and McDonnell, 2016

Charging infrastructure is composed of two elements: the electrical lines and other equipment delivering power to a location where chargers are installed, and the chargers themselves. This Plan considers the electrical lines and other infrastructure (e.g., transformers) to be an infrastructure element. The chargers themselves are classified as equipment because they are more closely associated with specific types of equipment, and can be relocated relatively easily.

Infrastructure-Related Feasibility Studies

Prior Study

In 2016, the Port conducted a study of projected electrical loads should all CHE be converted to battery-electric equipment (Burns and McDonnell 2016). The study determined that several levels of electrical system improvements would be required to first support improved shore power access, and then the potential conversion of the marine terminals to a fully electric operation. The study determined that the required improvements include some upgrades to the electric transmission and electric utility distribution system, including a new transmission line and new utility substation. Upgrades to the existing substations would also be required. Finally, specific upgrades and new electrical infrastructure would be required on the terminals (Burns and McDonnell 2016).

I-1: Engineering Feasibility Studies for Increased Cargo Movement Efficiency through Smart Technology

To gain efficiencies in cargo movement, shippers, terminal operators, and truckers will increasingly need to rely on smart technology. As described below in "Efficiency Measures," data collection and processing, and integration of various data systems will be vital elements of continuing to improve the efficiency of cargo movement. While it is unlikely that any terminal at the Port will be operating with 100% electrical equipment in the foreseeable future, certain elements, such as terminal gate truck processing functions, are likely to be operated by smart technology in the short-term. To function effectively, smart technology systems must be highly reliable. Any downtime can create significant delays and backups.

Fiber optic communication (fiber) infrastructure will be improved as part of the related Freight Intelligent Transportation Systems (FITS) projects described in the Operations section below. Further fiber infrastructure improvements may be required in the future. Once the FITS projects have been completed, the Port will consider whether it is necessary to conduct a study or studies similar to that currently being implemented for electrical infrastructure. The study(ies) could include assessing the adequacy of fiber communications lines and related facilities, establishing a common data management protocol across the entire Seaport, and assessing specific electrical supply needs, such as microgrids, to support smart systems.

I-2: Engineering Feasibility Studies for On-Road Electric Truck Charging Infrastructure

Trucks in short-haul drayage services (within the Seaport and its vicinity) may be commercially

available and operationally feasible within several years, if adequate charging infrastructure can be constructed. Fully electric trucks in long distance drayage service will require additional improvements in battery technology, charging speed, and the development of a State or national charging network. The existing charging infrastructure for these trucks is very limited. Equally critically, there are no national standards for heavy-duty electric vehicle chargers, which means that electrical chargers currently are only compatible with the specific manufacturer's chargers. Recent experience at the Seaport indicates that even when a charger plug has the correct shape, there may be software incompatibilities that prevent one manufacturer's equipment from charging at another manufacturer's charging station.

Widespread use of electrically-powered trucks serving the Seaport area will require high-speed charging infrastructure to accommodate thousands of trucks. While the Port is currently assuming that battery-electric drayage trucks will charge at their home location, some drayage truck charging infrastructure is still likely to be needed within the Seaport area. Trucks in short-haul service are likely to be domiciled in the vicinity of the Seaport, and would have adequate access to chargers at their home locations. For trucks based farther from the Port, some charging opportunities are still likely to be required. In addition, for trucks that are parked at the Port, charging would have to be provided at the parking location, depending on operational needs.

As battery-electric drayage trucks become more available, an assessment of truck charging options and associated power demands will likely need to be conducted to enable the Port to plan for tenant and Port charging infrastructure within the Seaport area. The study would be limited to the Seaport area, as the Port's charter prevents it from expending funds for facilities outside the Seaport. The costs for any such charging infrastructure are not included in the electrification infrastructure cost estimates described above.

I-3: Maritime Power Capacity Study for Terminal Electrification

Currently, the Port is conducting a study to assess the specific requirements to provide needed infrastructure to support container terminals using 100% electrically-powered equipment.

The study is scheduled to be completed in Spring 2019. The study is assessing the projected electrical demand, the electrical infrastructure needed to support that demand, location of and acreage required for the charging infrastructure within the terminal, proposed charging cycles, and the level of charging (slow-charging versus fast-charging) that might be used.

The specific terminal operations are a crucial component of any electrification and capacity study. The operational aspects of charging, including the location of the chargers, amount of space required to accomplish the charging, the timing and duration of charging, and the power demand during charging will greatly affect the feasibility of operating a fully electrified terminal. The study will consider the operational impacts of installing the necessary infrastructure within the terminal as well as utility infrastructure outside of the terminal.

The study will also develop estimated costs, as feasible, for implementing the electrical infrastructure. The process of installing necessary infrastructure may be very disruptive to terminal operations, and may require several years to complete. Consultation with terminal operators will be an integral component of this and any other engineering feasibility study.

I-4: Roadway and Other Hard Infrastructure Upgrade Studies

The Port regularly assesses the roadway system within and in the vicinity of the Seaport to identify bottlenecks. These studies would continue, as needed, to ensure that the road infrastructure in and near the Seaport area meets the long-term needs of the Seaport.

I-5: Electric Vehicle Infrastructure Guide for Port Tenants

To facilitate Port tenants' ability to install electrical charging infrastructure, the Port is preparing a guide that includes relevant regarding permit and other requirements, and provides the necessary forms for permit applications.

I-6: Develop Overall Implementation Plan for Infrastructure

As part of planning for electrical infrastructure changes, the Port can develop an overall implementation plan addressing both the electrical grid and charging infrastructure. While many of the initial infrastructure changes (i.e., installation of chargers for small numbers of yard tractors or drayage trucks) can likely be made without modifying the overall grid in the Seaport area, the Port will likely need to evaluate the overall demand from all of its tenants to determine the scope of infrastructure improvements that may be required. The evaluation will include the level of demand in the Port-served areas of the Seaport, the timing of that demand, and the need for new or upgraded infrastructure to serve that demand. An overall plan would be required to avoid the costs associated with both over-sizing and under-sizing key components. In the latter case, the Port may have to bear the expense of partially redoing work (e.g., installation of wiring or substations) that it had previously completed. The overall plan would be developed over a period of several years, as information about battery-electric technology, power storage, and tenant adoption of battery-electric equipment becomes more available.

I-7: Uniform Charging Standards for Electrically-Powered Terminal Equipment and Drayage Trucks

In their 2017 CAAP, the San Pedro Bay Ports noted that manufacturers of electric terminal equipment are using different methods and equipment design specifications for equipment charging, resulting in different infrastructure requirements depending on the equipment and specific manufacturer selected. The same issue exists with battery-electric drayage trucks. As more equipment is transitioned to electric power, this transition may lead to significant challenges. The San Pedro Bay Ports determined the need for charging standards so uniform infrastructure can be built throughout the SPBP complex to deploy a range of equipment types

built by different OEMs. Similarly, a uniform charging standard is also required for drayage trucks, and drayage trucks should be able to use the same chargers used to charge terminal equipment.

Since 2015, the San Pedro Bay 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, currently under development, simultaneously reduce the complexity and cost of charging a large fleet of equipment (SPBP 2017). The Port will continue to track the development of the uniform charging standards, and assist with the review of the standards, relative to their utility for local implementation.

7th Street Grade Separation East and West (Related Project)

The two 7th Street Grade Separation projects are part of the related GoPort program. The GoPort program is composed of three projects:

- 7th Street Grade Separation East (7SGSE): Replace the existing railroad underpass between I-880 and Maritime Street to increase clearance for trucks and improve the shared pedestrian/bicycle pathway
- 7th Street Grade Separation West (7SGSW): Realign and grade separate the intersection of 7th Street and Maritime Street and construct a rail spur underneath to improve the access and minimize conflicts between rail, vehicles, pedestrians, and bicyclists.
- Freight Intelligent Transportation System (FITS): Apply ITS field systems along West Grand Avenue, Maritime Street, 7th Street, and Middle Harbor Road on the National and State Freight Network Systems, and other technologies to cost effectively manage Port roadways, provide truck traveler information, and improve incident management (see discussion of FITS in Operations Section).

I-8: 7th Street Grade Separation West Project (Related Project)

The 7SGSW project includes the construction of an elevated 7th Street/Maritime Street intersection and a tail track extension for the Burlington Northern–Santa Fe (BNSF) Oakland Intermodal Gateway (OIG), also known as the Joint Intermodal Terminal (JIT). This will facilitate the expansion and reconfiguration of the OIG. The proposed project will reconstruct the segment of 7th Street between Maritime Street and Navy Roadway. The portion of 7th Street west of Maritime Street will be realigned to form a T-intersection at its junction with Middle Harbor Road and West Maritime Street. Maritime Street north of 7th Street will become a cul-de-sac with limited access to PG&E's Davis and Cuthberston Substations and the Regional Technical Training facility. Navy Roadway will be demolished and traffic on Maritime Street will use the proposed 7th Street T intersection to access West Maritime Street, and vice versa. The project also includes a rail spur that connects the OIG to Outer Harbor Intermodal Terminal (OHIT) and utility infrastructure upgrades along 7th Street.

I-9: 7th Street Grade Separation East Project (Related Project)

The 7SGSE project will widen the existing 4-lane underpass at the UPRR mainline tracks between Bay Street and Maritime Street to meet current seismic and geometric standards, increase vertical and horizontal clearances for trucks to current standards, and provide shoulders in each direction. The project also includes reconstruction of all related roadway elements, such as street lighting, storm drain infrastructure, signage, and striping, and installation of changeable message signs at the intersection of 7th and Maritime Streets. In addition, the 7SGSE will widen the existing multi-use bicycle and pedestrian path to a 10-foot pathway with 2 foot shoulders and a crash barrier separating the path from the roadway. On the rail side, the project will reconstruct railroad tracks, switches and related rail infrastructure.

I-10: Charging Infrastructure to Support Zero-Emissions Equipment

While zero-emissions long-haul drayage trucks are unlikely to be commercially available for a number of years, short-haul battery-electric drayage may be commercially available within five years, and some types battery-electric cargo-handling equipment may also become more commercially available during this time period, although at a considerably higher price than conventional diesel-powered equipment. The Port will coordinate with tenants on tenants' estimates of specific power needs, design, and systems costs for infrastructure needed to support planned zero-emissions equipment.

I-11: Future Infrastructure Modifications

The extent of necessary infrastructure modifications will be determined based on the feasibility studies described above, as well as other feasibility studies that may be conducted in the future and identified tenant needs. This is likely to be a somewhat iterative process as zero-emissions technology continues to mature. Once infrastructure needs have been adequately defined, capital costs can be programmed into the Port's annual budget cycle based on available funding. Expenditures will likely occur in the following areas:

- Electrical grid and container terminal electrical infrastructure upgrades, including improvements related to electrical grid resilience;
- Fiber optics communications systems infrastructure;
- Zero-emissions drayage and on-road truck charging infrastructure; and
- Port fleet vehicle charging infrastructure.

While the current direction of zero-emissions technology appears to be toward electrification, it is possible that shifts in technology could occur in the future. The Port will continue to monitor the trajectory of zero-emissions technology, and to assess proposed infrastructure modifications and the need for future infrastructure modifications in the light of technology evolution. Note that Strategy #3 provides flexibility for other technological options (such as hydrogen-powered equipment) to provide power for zero-emissions operations.

FUELS

This category of IAs includes alternative fuels and electricity. Shifting from petroleum diesel to alternative and enhanced fuels is the fundamental step in reducing or eliminating air emissions, including DPM and GHGs. Alternative fuels include electricity made from renewable sources, renewable hydrogen for use in hydrogen fuel cells, non-petroleum diesel, natural gas (CNG and LNG from fossil or renewable sources), and ultra-low-sulfur petroleum diesel.

Hydrogen and electricity are considered zero-emissions fuels, provided they are made from GHG-free sources.[5] Switching to a reliance on electricity and/or hydrogen as primary fuels in Seaport operations will require significant investments in infrastructure, as well as new equipment. In the meantime, the Port can increase the GHG-free percentage of the electrical power it provides within the Port's utility service area. The Port cannot control the GHG-free content of electrical power provided by PG&E to the areas PG&E serves. In addition, renewable diesel, natural gas (including renewable natural gas), and ultra-low-sulfur diesel all provide potential benefits without requiring new infrastructure, and may form part of the transition to a zero-emissions Seaport.

Seaport equipment that uses fossil fuel (gasoline, diesel, and natural gas from fossil sources) for fuel is covered under CARB's Cap and Trade program, meaning that through Year 2030, users of this equipment (such as tenants and truckers) are not required to take any further action to reduce GHGs. The Cap and Trade program makes up for GHG emissions reductions in this sector. Emissions reductions from switching away from these fossil fuels will result in GHG emissions reductions beyond those achieved through the Cap and Trade program.

F-1: Technology Assessment for Hydrogen and Hydrogen Fuel Cells

Hydrogen fuel cells are one of the potential primary alternatives to electricity and battery-electric technology. Fuel cell technology has significant potential for use in heavy duty trucks and other mobile applications, and for distributed generation.[6] A fuel cell works by passing streams of fuel (usually hydrogen) and oxidants (usually oxygen from air) over electrodes that are separated by an electrolyte. This produces a chemical reaction that generates electricity without requiring the combustion of fuel, or the addition of heat as is common in the traditional generation of electricity. When pure hydrogen is used as fuel and pure oxygen is used as the oxidant, the reaction that takes place within a fuel cell produces only water, heat, and electricity.

Fuel cells have the potential to offer maintenance and operating benefits. They are completely enclosed units, with no moving parts. In addition, they are quiet and safe sources of electricity. Fuel cells also do not generate electricity surges, meaning they can be used where a constant,

[5] GHG-free electricity or hydrogen produced by electrolysis using GHG-free electricity.

[6] Fuel cells can come in extremely compact sizes, allowing for placement wherever electricity is needed. This includes residential, commercial, and industrial settings.

dependable source of electricity is needed. Fuel cells have a much higher energy density than existing batteries, so that trucks equipped with fuel cells have a lower gross weight than equivalent battery-electric trucks. In addition, refueling is rapid, comparable to refueling with liquid fuels (on the order of 6 - 8 minutes for a car). The benefit of fuel cells in this application is partially off-set by the need to carry hydrogen, a flammable gas, on the vehicle. However, experience with compressed natural gas engines has provided an effective technology base for on-board storage of hydrogen.

While fuel cells can be powered by a variety of fuels, hydrogen is the preferred fuel for fuel cells in clean energy applications. Currently, hydrogen is typically generated by steam reforming of methane gas (SRM). This type of hydrogen, when used as a fuel, has a higher carbon intensity (ranging from 98 to 142) than petroleum diesel (95). Also, the cost for hydrogen is approximately 2 times the cost of diesel on a mileage basis. The National Renewable Energy Laboratory estimates that the cost of hydrogen will fall substantially in the near future, leading to cost equivalency in next 5 to 7 years (California Fuel Cell Partnership 2018). Hydrogen can also be made by electrolysis using renewable sources of energy. Currently, hydrogen made by electrolysis is approximately 2.5 to 3 times as expensive as hydrogen made by SRM; in other words, on a per-mile basis, renewable hydrogen is approximately 5 to 6 times as expensive as diesel.

Fuel cell technology has progressed in certain applications, including forklifts, but it is still in the development stage for heavy duty trucks and other heavy-duty vehicles. As of 2017, there were 19 fuel cell buses in service in California, with 30 more planned to be put into service. This compares to hundreds of battery-electric buses. The first demonstration-level fuel cell truck was put into service (also in California) in 2017. In addition, before hydrogen fuel cells can be considered commercially feasible in clean energy applications, the cost of generating hydrogen by electrolysis will have to drop significantly.

The technology assessment for hydrogen fuel cells needs to address both the source(s) of hydrogen and the fuel cell technology itself. The GHG content of hydrogen fuel depends on the way it is made.

F-2: Electricity Supply

The Port serves as the electric utility to a large container terminal in the Seaport as well as to several small Seaport support facilities, primarily those located on the Port's portion of the former Oakland Army Base. Other areas of the Seaport are served by PG&E or East Bay Community Energy (the local energy community choice aggregator serving Alameda County). At portions of the Seaport served by the Port, the Port purchases most of its electricity from the wholesale power market and resells the electricity to its end users. The Port also partners with other electric utilities on power purchase agreements to secure desirable rates. Pursuant to Senate Bill 100 (SB 100), the State-mandated Renewable Portfolio Standard (RPS) program requires investor-owned utilities, publicly-owned utilities, electric service providers, and

community choice aggregators to increase electricity procurement from eligible renewable energy resources to 60% of their retail sales by 2030 and to procure 100% of the electricity from carbon free resources by 2045. The Port, PG&E, and East Bay Community Energy will continue to increase the renewable content of the electricity they sell to comply with the RPS. Increases in renewable electricity due to the RPS will reduce GHG emissions from electricity use at the Seaport.

Electricity generation within and near the Seaport area is limited. Aside from the excess electricity generated by the East Bay Municipal Utility District Wastewater Treatment Plant and the Dynergy Oakland Power Plant (Dynergy) adjacent to Jack London Square, electricity is mainly transmitted from outside the Bay Area into the Seaport area through a network of transmission lines (transmission system) owned by PG&E. The Dynergy plant is more than 30 years old and is nearing the end of its useful life. If the Dynergy plant is retired, transmission system upgrades or new transmission lines or locally generated renewable energy will be required to meet the electrification needs of the region and provide transmission reliability.

F-3: Local Solar Power Generation

The Port and its tenants are considering installing solar panels on rooftops of large warehouses and other canopy-type structures to generate electricity within the Seaport. While the overall amount of electricity that could be generated within the footprint of the Seaport is likely to be small relative to the total demand (given that there are relatively few large buildings because Seaport uses are land-intensive), doing so would contribute toward moving the Port to a zero-emissions future.

F-4: Renewable Diesel Fuel

Renewable diesel (RD) is made by a different process and has a different chemical composition than biodiesel (see discussion of biodiesel, below). Made from a high percentage renewable content, RD is marketed at many locations by petroleum jobbers[7] throughout California and particularly throughout the Bay Area. RD is a fuel made partially or entirely from waste materials, such as animal fats, slaughterhouse waste, fish oils, and used restaurant vegetable oil. These waste sources are supplemented by virgin raw materials (non-petroleum oils). RD can reduce DPM emissions by 30 to 40% and GHG emissions by 50 to 80% (depending on the feedstock) relative to petroleum diesel (Neste 2018; Mitchell, pers. comm. 2018). RD shipped to or produced in California (as part of the State's Low Carbon Fuel Standard program) typically provides GHG reductions of 60% or greater, with the average being on the order of 67 to 68%. RD also provides NOx reduction benefits on the order of 10 to 20% (Mitchell, pers. comm. 2018a). Many OEMs have approved use of pure RD in their engines (BAAQMD et al 2017). RD is accepted by most engine manufacturers, meaning that there is no loss of warranty coverage with use of RD.

[7] People or companies that purchase refined fuel from refining companies either for sale to retailers or to sell directly to the users of those products.

The criteria air pollutant emissions reductions are for "engine-out" performance, meaning that they do not take into consideration the effects of exhaust after treatment (diesel particulate filters, diesel oxidations catalysts or selective catalytic reduction). CARB currently assumes that there is no benefit with regard to NOx emissions reductions when RD is used in an engine equipped with SCR. However, CARB indicated that DPM emissions reductions will be seen even when a DPF is in use. The benefit in terms of actual emissions reductions for any one vehicle is small. DPFs are installed on virtually all diesel trucks, and reduce exhaust DPM by 90%; when the engine-out DPM is reduced 30% due to use of RD, the DPF-out DPM reduction increases to 93.5%. Nonetheless, CARB believes that in the aggregate, use of RD in truck engines is beneficial (Mitchell, pers. comm. 2018b).

In terms of net emissions reductions per vehicle in, RD is likely to be most useful in off-road engines. Criteria air pollutant emissions reductions are hard to quantify for modern diesel engines; there are few studies and some of the data conflict. A study of RD in 200 in-use pieces of equipment is currently underway, and expected to be completed in 2019 (BAAQMD et al 2017). CARB is also conducting a study to assess criteria air pollutant emissions reductions in modern engines (Mitchell, pers. comm. 2018b); the study is expected to be completed in 2019. There are some indications that RD may reduce the overall toxicity of DPM, but more studies are needed before drawing firm conclusions (BAAQMD et al. 2017). The effects in marine and heavy off-road engines have not been studied. The GHG benefits are not affected by the type of equipment in which RD is used.

RD fuel is readily available and, due to LCFS subsidies, costs little or no more than regular diesel. It is completely interchangeable with traditional petroleum diesel fuel in engines and in storage tanks. The price for RD in California has routinely matched or been slightly lower than standard petroleum diesel. RD is a very low-carbon intensity fuel, with better combustion performance characteristics than petroleum diesel. Because RD burns very cleanly, experience has shown that it reduces the need to regenerate diesel particulate filters. CARB estimates that currently approximately 500 million gallons per year of RD are currently available to California. That is expected to increase to 1.5 billion gallons per year by 2030, or sooner (Mitchell, pers. comm. 2018a), which can be compared to the total 2015 California diesel use (including off-road diesel) of 4.2 billion gallons (CEC 2018).

Unlike biodiesel, RD does not have a "shelf life" issue because it is hydrogenated in the refining process (meaning it does not contain any oxygen). This greatly reduces the potential for microbial breakdown and keeps the fuel from gelling in cold temperatures.

Many cities, counties, and local and state agencies throughout California (including the City and County of San Francisco, City of Oakland, and City of Walnut Creek) now require only RD for use in their diesel vehicles and equipment. This measure has been made an important part of compliance with GHG emissions reductions requirements across the State. Fleet managers are interested in RD in part because of the reported (anecdotal) reduction in maintenance

from reduced DPF regeneration, especially forced regeneration (BAAQMD et al. 2017). The Port is currently investigating the use of renewable diesel for its fleet. The Port will also further evaluate the benefits for RD for on-road and off-road use and share the results of that evaluation with its tenants.

RD does not appear to pose any operability problems in marine applications. Pure RD and RD mixed with petroleum diesel both appear to be suitable for use in marine environments. A study conducted by the Scripps Institute of Oceanography (Scripps 2016) on its own research vessel found that the vessel operated well on RD. No problems were noted during more than 40 research cruises conducted over the period of more than a year (the vessel was at sea for a total of 89 days). The Scripps findings are consistent with laboratory research performed by the US Navy.

Recently, the Red and White Fleet (ferries) in the Bay Area switched to RD. The company reports near complete elimination of soot, and reduced maintenance problems, as well as reduced fuel odors (Monroy, pers. comm. 2018). A question remains as to whether RD provides criteria pollutant emissions reductions benefits when used in marine applications. The Scripps study found that emissions of DPM actually increased with use of RD, especially at high engine speeds. During the study, the four engines aboard the research vessel logged a total of 6,985 hours of engine time using 100% RD. The study showed that the total number and total mass of particles increased with use of RD. The increase in particle emissions was larger at higher engine speeds. At lower engine speeds (700 rpm), particle emissions were similar for both petroleum diesel and RD. However, the engines powering the Scripps vessel are old two-stroke diesel engines that are not representative of more modern engines found on OGV (Monroy, pers. comm. 2018). Further evaluation is required to determine if RD would provide emissions reductions benefits in marine applications. The Port will continue to track information pertaining to the performance of RD in marine applications and share the results with ocean carriers and harbor craft operators.

F-5: Biodiesel

Biodiesel is a renewable fuel typically made by reacting vegetable or animal fat feedstocks (the same types of feedstocks as for renewable diesel) with alcohol. Like RD, biodiesel can be made using waste fats or virgin fats. Pure biodiesel provides approximately a 55% reduction in DPM (also on an engine-out basis), and typically (depending on feedstocks, processing efficiency, etc.) reduces GHG emissions by 80% to 85%, compared to petroleum diesel (Mitchell, pers. comm. 2018a). In California, biodiesel has reached cost parity relative to petroleum diesel (when accounting for credits under the low carbon fuel standard) (BiofuelsDigest 2017). Biodiesel is typically used in a blended form (20% biodiesel with petroleum diesel, referred to as B20). However, it is also possible to operate on 100% biodiesel (B100). Pure biodiesel has proven successful in fleets and some trains (Wikipedia 2018). B20 delivers 20% of the emission reduction benefits of B100.

Biodiesel, sometimes referred to as fatty acid methyl ester (FAME), is made through a process

called transesterification. The transesterification process yields a fuel that contains more oxygen and is more polar than petroleum diesel. This results in mild surfactant (lowering surface tension of a liquid similar to the effect of soap) properties and a substantially higher water uptake capacity than petroleum diesel. As a result, there are three specific operating considerations associated with biodiesel in on-road diesel engines:

- Fuel filter plugging: When biodiesel is first introduced into an engine, its mild surfactant properties often cause it to solubilize existing fuel tank deposits. This can result in plugging of the fuel filter, and may require more frequent fuel filter replacements after initially switching to biodiesel. Operators who switch from petroleum diesel to biodiesel are more likely to experience this problem in older vehicles that have used petroleum diesel for many years as these are likely to have more deposits in the fuel tank.
- Cold weather gelling: Biodiesel will gel at higher temperatures than petroleum diesel, leading to the potential for cold-weather start-up challenges.
  - The amount of saturated fats in the feedstock determines the gelling point, which can range from a low of 15°F to a high of 60°F
  - The use of flow-improving additives and "winter blends" has proven effective at extending the range of operating temperatures for biodiesel fuel (Penn State 2018)
- Water carry-over: Most diesel fuel storage tanks have some water in the bottom of the tank. Because biodiesel is hygroscopic, a tank to be used for biodiesel storage needs to be cleaned, or a water filter needs to be installed prior to placing biodiesel into the tank.

Warranties may also be a consideration. Using a fuel that that is not approved by an original equipment manufacturer may void the warranty. Most manufacturers approve blends of up to 20% biodiesel (B20) when blended using biodiesel approved by the American Society for Testing and Materials.

All diesel fuel is subject to microbial breakdown in storage. However, because of its structure, biodiesel is more susceptible to biological breakdown than petroleum diesel or RD. If engines are expected to be out of service for a period of time, it may be necessary to drain the engine of all fuel before storage, change back to petroleum diesel before storage, or add a fuel stabilizer.

F-6: Natural Gas

Natural gas is a colorless, odorless gas that is easy to burn and typically consists mostly (90% or more) of methane. Natural gas generated from fossil sources has a lower carbon intensity[8] than diesel fuel, and renewable natural gas (see discussion below) has an extremely low to negative carbon intensity. In addition, engines using natural gas do not generate DPM, and may burn cleaner overall than diesel engines. According to the United States Department of Energy Alternative Fuels Data Center, due to increasingly stringent emissions regulations, there is less difference between tailpipe emissions benefits from natural gas vehicles and conventional

[8] In other words, it results in lower levels of GHG emissions compared to diesel.

diesel-powered vehicles with modern emissions controls. One advantage to natural gas vehicles is their ability to meet stringent emissions standards with less complicated emissions controls.

Natural gas technology is well established in certain applications, including for forklifts and light- to medium-duty vehicles. At least one 12-liter natural gas has been certified to the low NOx standard, and is available in trucks from a variety of truck manufacturers. Heavy-heavy-duty (15 liter) natural gas engines are in the pre commercialization stage.

Natural gas is typically used in a compressed natural gas (CNG) or liquefied natural gas (LNG) form. Compressed natural gas has a lower carbon intensity than LNG, due to the energy required to liquefy the LNG and keep it cooled. Natural gas can also be used to power fuel cells. Fuel cells convert the energy in fossil fuels into electricity much more efficiently than traditional generation of electricity using combustion (however, as discussed previously, fuel cells powered by fossil natural gas would not be considered a zero emissions technology).

F-7: Renewable Natural Gas

Renewable natural gas (RNG) is methane that is captured from landfills, wastewater treatment facilities, meat production, dairies, and other organic sources. It is fully interchangeable with fossil natural gas. The methane is collected, scrubbed to remove impurities, and injected into an available natural gas distribution pipeline. Similar to green electricity, the user contracts for and receives credit for using a certain volume of RNG, but receives the gas that is available at its location. RNG does not provide any particulate matter (PM) reduction benefits compared to conventional natural gas, but does provide substantial GHG reductions, ranging from 85% to 355% (where 100% GHG reduction is equivalent to eliminating the use of diesel fuel). In other words, depending on the source of the RNG, use of RNG in one engine may offset the GHG emissions from more than one engine using diesel fuel. EBMUD is currently considering providing RNG at its West Oakland treatment plant.

F-8: Low Sulfur Diesel Fuel in Ocean-Going Vessels

Ships maneuvering within the North American Environmental Control Area (ECA), including California, are required to use fuel that contains no more than 0.1% sulfur (USEPA 2010). Sulfur is a significant contributor to PM emissions. Based on fuel emission factors from the Port Authority of New York and New Jersey's 2016 Emissions Inventory, reducing the sulfur content of fuel used in OGV could reduce PM emissions by approximately 10.6% for fuel containing 0.01% sulfur, and 9.5% for fuel containing 0.02% sulfur (PA NYNJ 2017).

This approach has been proven in practice. The Port Authority of New York and New Jersey Clean Vessel Incentive (CVI) Program allows vessels to earn incentive payments for reducing emissions by traveling slower and using cleaner fuel than required. During 2016, 420 individual vessels making 1,058 calls (69% of vessel calls) earned incentive payments. Participating vessels switched to lower sulfur fuel than the 0.1% sulfur ECA requirement while calling at the Port Authority; sulfur content in fuel used by participating vessels ranged from 0.01 to 0.05% sulfur.

The SPBPs also have vessel incentive programs that reward shippers for using fuel containing less than 0.1% sulfur. The Port could investigate the feasibility of creating incentives for vessel operators to use ultra-low sulfur fuels in vessels calling on the Port of Oakland.

EQUIPMENT

Equipment actions are specific technologies applicable to a given category of equipment. Equipment actions have been identified for all six categories of equipment contained in the Port's emissions inventory. A critical factor in implementation of zero-emissions equipment is its operational performance. Equipment users are taking a risk when investing in equipment that does not have a proven history of reliable operation. Once equipment has been proven to be operationally feasible by one user, other Seaport businesses are likely to consider implementing similar technology when it makes sense economically and operationally, based on their planning and capital funding cycles.

Studies

E-CHE-1: Container Yard Electrification Feasibility Study

The Port recently commissioned a Container Yard Electrification Feasibility Study (M&N 2018). The study concluded that some electrically powered equipment is commercially viable, for example, RTGs and automated stacking cranes (ASCs) that connect to the electrical grid through a cable or bus bar; however, grid-electric equipment is not compatible with operations at the Seaport. Full battery electric solutions for these types of equipment are in the development or at the prototype stage.

The study also indicated that for CHE operating on the Seaport marine terminals, fully electric solutions are limited and primarily include early commercial technologies for yard tractors (driverless battery-electric Automated Guided Vehicles are in use, but are primarily suitable for fully-automated terminals, which do not exist at the Seaport). The battery power required to operate the types of CHE on the Seaport's marine terminals, and the required rapid recharging of the batteries is stretching the limits of current battery technology (see discussion of battery technology in Appendix B). Emerging technologies are providing battery solutions for electrified yard tractors. Battery-electric solutions for RTGs and top picks are in the development or at the prototype stage. These types of electrified CHE still need to be further developed.

E-CHE-2: Equipment Operations and Cost Assessment to assist with Electric Infrastructure Planning

As a follow-up to the container yard electrification feasibility study, the Port commissioned the Equipment Operations Cost Assessment to assist with Electric Infrastructure Planning (provided in Appendix F). The assessment corroborated the findings of the container yard electrification study. It found that yard tractors were the only type of zero-emissions CHE developed well enough to allow for long-term cost projections. In addition, the study concluded that hybrid

RTGs were developed enough to allow for a cost assessment. The remaining hybrid and zero-emissions CHE, as well as zero-emissions drayage trucks, are not developed enough to allow for a cost assessment. Figure F-2 below shows the status of commercialization for various types of CHE and for drayage trucks. As described in Appendix F, fully electric RTGs [eRTGs] are considered to be commercially available, but are not suitable for terminal operations at the Port of Oakland.

Ocean-Going Vessels

Options to reduce DPM and GHG emissions from ocean-going vessels are limited. Actions for OGVs focus both on emissions while at berth (hotelling) and in transit from outside the Outer Buoys. Substantial reduction in hotelling emissions have already been achieved through the Port's implementation of shore power requirements (constructing the electrical grid and plug-in infrastructure to supply OGV power needs while at berth). Over time, the majority of emission reductions for this category of equipment will come from voluntary engine improvements and technological changes implemented by the shippers.

For OGV, this Plan assumes that shippers have a financial incentive to implement more efficient engines, that the shipping lines calling on the Port are complying with the International Maritime Organization's (IMO's) fuel and engine standards,[9] and that they are adhering to CARB's requirement for lower sulfur fuels.[10] In addition to equipment options, some emission reductions from OGV could potentially be achieved through the use of ultra-low sulfur fuel (see discussion in fuels subsection, above), and through a vessel speed reduction programs (see Operations subsection, below).

The San Pedro Bay Ports are also considering measures to incentivize energy efficiency improvements and the use of cleaner technologies, and impose a differential rate system to incentivize newer, cleaner vessels. The Port of Oakland will track the SPBP's experience with these initiatives. Because the same vessels call up and down the entire West Coast, the Seaport and its workers and community are likely to experience the emissions reduction benefits from any successful SPBP incentives. If the incentive program proves effective, other West Coast ports, including the Port of Oakland, may consider a joint incentive program.

---

[9] MARPOL (The International Convention for the Prevention of Pollution from Ships) Annex VI, which governs pollution control regulations for vessel in international commerce, was amended in 2008, to set more stringent fuel sulfur limits and more stringent NOx emission standards, especially for vessel operation in designated Emission Control Areas (ECAs). The North American ECA for both fuel-sulfur and NOx emission includes most coastal waters up to 200 nautical miles from the coasts of the continental United States. Vessels operating in ECAs must meet the following requirements:

- Fuel-sulfur concentrations may not exceed 0.10 weight percent, or vessels may use an approved equivalent method (such as SOx scrubbers, also known as exhaust gas cleaning systems); and
- Engines above 130 kW installed on vessels built (or modified) since 2000 must be certified to meet appropriate emission standards corresponding to the vessel's build date (or modification date). As of January 1, 2016, engines installed on new and modified vessels are subject to the Annex VI Tier III NOx standards while those engines are operating in the ECA.

[10] CARB adopted the regulation, "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline" on July 24, 2008. The regulation is designed to reduce PM, oxides of nitrogen, and sulfur oxide emissions from OGV.

E-OGV-1: Shore Power Improvements - Achieve 90% Shore Power Use

Use of shore power eliminates criteria air pollutant and GHG emissions from vessels at berth within the Seaport. Although they do not need to run their main engines to power their propellers, ships need to continue to power lighting, ventilation, navigation equipment and other systems while at berth. These systems are typically powered by auxiliary engines while the vessels are at sea. Ships can either continue to run their auxiliary engines while at berth, or plug into shore power. Plugging into shore power avoids emissions from the auxiliary engines while the vessel is in port.

The Port and its tenants, and shippers have invested over $55 million to provide shore power at berths; in additions shippers invest approximately $1 million per vessel to retrofit the vessel to make it shore power capable. 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 power generation from auxiliary engines. Through grant commitments, the requirement for the use of shore power at most Port of Oakland berths is 80% through 2019 and 90% for 2020 and beyond.

From January through November 2018, 74% of all vessels used shore power while berthed at the Port - a substantial accomplishment given that 20% of vessel calls were by vessels that are not equipped for shore power (not shore power capable). Of the 20% of vessel calls from vessels that are not shore power-capable, 11% of the vessel calls were from vessels that were either not capable of being equipped for shore power (steamships) or are not required to be shore power capable (infrequent callers). For the ships that are shore power-capable, the plug-in rate was 92%. For ocean carrier/vessels subject to the At-Berth rule, virtually all 16 carriers achieved a 70% or higher plug-in rate (the lowest rate was 69%). Twenty-five percent of the ocean carriers achieved a 100% vessel plug-in rate.

For vessels that are shore power capable, the biggest obstacle to utilizing shore power is vessel equipment issues, which occurred for 3% of vessel calls between January and August 2018. Vessel equipment issues are the responsibility of the ocean carrier operating the vessel, and not under the control of the Port.

Additional modifications to infrastructure may lead to a higher percentage of shore power utilization. For example, providing extension systems to enable some additional vessels to connect to available shore power, as described in Appendix B, may increase shore power plug rates 1 - 2%. These potential gains are small compared to the substantial number of calls by vessels that are not shore power capable.

The Port is continuing to evaluate the obstacles that prevent maximum shore power use, and will make additional improvements as they are identified. While the current CARB requirement for each fleet is to reduce onboard auxiliary diesel engine power generation by 70% in 2018, meeting the Port's grant requirements to exceed the regulatory requirements by 10% (80% overall) requires additional coordination with the terminal operators and shippers.

E-OGV-2: Barge-Based Exhaust Scrubber System (Bonnet)

For vessels that are not able to plug into shore power, it may be possible to control criteria air pollutants by capturing and filtering the emissions from vessels' stacks (using a "bonnet" over the stacks). CARB has certified two alternative technologies (AMECS [Advanced Maritime Emission Control System] and METS-I) for container vessels that can be used to comply with the At-Berth Regulation (Starcrest 2018). Both technologies are barge-based systems. Currently, these technologies are approved only for container vessels meeting certain configurations. However, operators of both systems are working with CARB to expand approval to include other sizes and types of vessels.

A bonnet would only reduce criteria air pollutants; it would not provide any GHG reductions. On an average per-OGV call basis, use of a bonnet system will reduce DPM by 75% while at berth (Starcrest 2018). Assuming 75% emissions control efficiency of the barge-based system used during the entire at-berth stay for the 12% of the total calls[11] not currently required to use shore power,[12] there is potential to reduce approximately 3.5 to 3.7 tons of DPM in 2020. Total emissions reductions would depend on (1) the type of system, (2) system utilization, (3) the system's emissions capture and control efficiencies, (4) emissions from diesel generators needed to start up and shut down the barge system when the OGV is at-berth, and (5) emissions associated with maneuvering the barge that holds the system. Because the bonnet would be barge-based, use of a bonnet would result in increased GHG emissions as well as some DPM. These emissions would be due to fuel use by the barge's engines while maneuvering and while operating the barge when the bonnet is in use, as well as fuel used by auxiliary equipment on the barge itself.

Bonnet system services would be provided by a contractor. The barge operator would need to work with terminal operators and shipping lines and potentially conduct studies to determine how such emissions control devices could be deployed at the Seaport. The studies would have to evaluate possible barriers to implementation, such as berth space for the barges while not in use, piloting hazards, the ability to use a system at multiple terminals, and financing (the estimated cost of one barge is approximately $6 million). Because ships have different stack configurations and more than one vessel may be at berth at any time, several barge-based systems would be required to achieve 100% at berth control. Grant funding, if available, could partially offset this cost. AEG, the manufacturer and operator of the AMECS barge, has received Prop 1B funding from the BAAQMD to build a new barge for use at the Port of Benicia. The barge is intended to test the feasibility of the technology with auto carriers. Information on projected fees and the operating process is not yet available.

There are several operational feasibility concerns with implementation of a barge-based bonnet system. Storing the barge when not in use is an operational issue – the barge operator would

[11] 2017 data

[12] Smaller fleets are currently not required to comply with the shore power regulations.

have to make the necessary arrangements for berth and backland space. While the Port does have some space, space is limited and may not be available at the time a bonnet barge operator desires to locate at the Port. (The barge operator could also lease or purchase space for this use outside of the Port area; however, if the barge is located farther away, DPM and GHG emissions associate with use of the bonnet system would increase). Transiting vessel traffic may have to slow while the bonnet barge is being maneuvered alongside to or from the vessel it is servicing. In addition, the bonnet barge operator may have to compete with larger vessels for tug service. The greater the number of bonnets required to address various stack configurations, the more substantial the operational challenges.

E-OGV-3: Increased Shore Power Capability on Vessels

According to Port data, approximately 20% of vessels calling on the Port are currently not shore power-capable. Retrofitting a vessel to make it shore-power-capable costs approximately $1 million. New vessels are typically put into service on the Asia-Europe routes and are later transferred to the Asia-North America routes. The vessels are retrofitted for shore power when they are transferred to North American routes.

Steamships are not required to be shore-power-capable under the At-Berth rule. They represent approximately 6.6% percent of the vessel calls at the Port of Oakland. Steamships will be phased out by 2020 and will most likely be replaced by shore power capable vessels. Amendments to the CARB At-Berth Regulation will likely require that certain vessels that are infrequent callers must also be shore power capable by 2023, capturing another approximately 6% of vessels calling at the Port.

E-OGV-4: Enhanced Ship and Engine Design

Overall, GHG emissions on a unit (per ton of cargo) basis have decreased as vessels have gotten larger and more efficient; however, most of those gains have been off-set by increased cargo volume. Ship and engine design is driven by economics and international environmental agreements, such as the International Convention for the Prevention of Pollution from Ships, known as MARPOL 73/78. As long as operating characteristics of the vessel are not affected, reducing fuel use provides great economic benefits to shippers. Therefore, economic and environmental drivers are in alignment. With the recent goals for GHG emissions reductions announced by IMO (IMO 2018), it is likely that on a per-unit-cargo basis, future vessels will have substantially lower emissions than current vessels. At this point, it is impossible to predict whether the ambitious targets set by IMO will be met, and when more energy-efficient vessels would be put into service in the Asia-North America trade. Nonetheless, it is clear that emissions from OGV while in transit will continue to decline over time. This is critical as vessels in transit represent by far the greatest residual source of DPM in the Seaport Emissions Inventory.

Harbor Craft

Harbor Craft (HC) are the second largest contributor of DPM in the Port's emissions inventory, behind OGV. In 2017, HC contributed 6.1% of total DPM emissions. HC are forecasted to contribute 10% of total DPM in 2020 and 8% to 10% of total DPM in 2030. An estimated 12 to 13 tugs serve the Seaport. Based on normal attrition and CARB's in-use fleet regulation, close to 50% of the HC engines at the Port will meet Tier 3 or Tier 4 standards in 2020, with most of the remaining fleet meeting the Tier 2 emissions standard. EPA maintains emission standards for marine engines, with higher tier numbers indicating increasingly stricter standards for NOx, hydrocarbons, PM, and CO. The tier standards for commercial HC are not the same as those for cargo-handling equipment or OGV.

E-HC-1: Provide Harbor Craft Engine Retrofit Incentives

CARB has proposed to update the Commercial Harbor Craft regulation by 2020, but new regulatory measures would not be implemented until after 2023. Under this IA, the remaining HC with Tier 2 engines would be repowered with Tier 4 engines, resulting in an 85% reduction in DPM on a per-engine basis. In advance of an updated regulation, engine replacement must rely on incentives and is limited by the amount of incentive funding that can be obtained. For example, Port tenant AMNAV has applied for Carl Moyer Program funding to retrofit two of its tugs with Tier 3 engines.

Repowering costs are estimated at $1.4 million per engine or $2.8 million per tug, as most tugs are equipped with two engines. On average, DPM emissions per engine will be reduced by 85%, which is approximately between 2.7 and 3.2 tons in 2020 for the entire Bay Area HC fleet that services the Port. On a per tug basis, the average DPM reduction would be between 0.23 to 0.24 tons. Due to cost and operational considerations, including the downtime required to retrofit engines, it is very unlikely that all 12 or 13 tugs serving the Seaport could be retrofitted. Therefore, the actual DPM emissions reductions achievable through tug retrofits cannot be predicted. The only reductions in GHGs by implementation of this measure will occur as a result of improvements in efficiency. GHG reductions will depend on tug efficiency improvements (Starcrest 2018).

E-HC-2: Hybrid Harbor Craft Retrofit

It is possible to reduce emissions from existing tug engines by retrofitting them to hybrid technology. In 2013, Foss Maritime Company (Foss) received verification from USEPA for their XeroPoint Tugboat Hybrid Retrofit system (Starcrest 2018). According to the EPA verification letter, the hybrid technology will reduce DPM emissions by at least 25% and GHGs measured as carbon dioxide equivalents (CO2e) by at least 30%, based on the duty cycle provided by Foss. The letter states that fuel savings and emission benefits are dependent on reduced operation of the main propulsion engines and operation with the XeroPoint system while in transit, idling, and stopped.

Actual emission reductions will vary depending on the engine selection, duty cycle, and battery selection. While the verification letter requires the highest available tier engine to be used as the replacement engine, it also states that greater emission reductions could be attained with Tier 3 and Tier 4 engines. The technology is certified for harbor tugboat vessels with auxiliary generator engines (rated horsepower range between 100 and 750 hp) and main propulsion engines (up to 5,000 hp each). In 2017, Wärtsilä launched new eco-friendly tug designs based on hybrid technology that reduces criteria pollutants as well as GHG emissions (Starcrest 2018). The company's website does not provide any specific emissions reductions performance.

There is little operating experience with hybrid tugs in the US. Only two hybrid tugs have been built in the US (at the Ports of Los Angeles and Long Beach), although Baydelta Maritime plans to build a hybrid tug that is anticipated to begin operations in San Francisco Bay in early 2019 (Starcrest 2018), and the Port of Long Beach is working with Harley Marine under a ZANZEFF grant to develop a hybrid tug as well. Unless retrofits or equivalent engine performance are required by future CARB regulations, hybrid tug technology would also have to be implemented through an incentive program.

On average, DPM emissions per vessel would be reduced by 25% (approximately 1 ton per year in 2030 if all 12 to 13 in-use tugs are hybridized by 2030). On average, GHG emissions per vessel would be reduced by 30% (approximately 4,400 to 4,600 MT of CO2e per year in 2030 if all in-use tugs are hybridized by 2030). However, as for tug engine retrofits, it is highly unlikely that, given the costs and operational considerations associated with the retrofit, all tugs serving the Seaport would be retrofitted (Starcrest 2018).

E-HC-3: Plug-in Hybrid Harbor Craft

In September 2018 the Red and White Fleet put a new plug-in hybrid ferry into service. The ferry uses shore power to initially charge the ferry's batteries and then transitions to diesel fuel (Red and White Fleet uses renewable diesel) to supplement the battery. Red and White partnered with Cummins Engines to re-purpose a hybrid electric bus motor for use in a maritime environment and worked with BAE Systems to design the propulsion system. Currently, the ferry can run for an hour on one charge; longer-term, the battery system is supposed to be capable of recharging in nine minutes. The ferry was between 10 and 15 percent more expensive to build than a similar-sized vessel with a diesel engine. Maintenance costs are projected to be lower than typical diesel engines, he said. All the data about the ferry boat's operations will be released publicly (San Jose Mercury News 2018b). This type of technology is likely to be transferable to tugs in the future.

E-HC-4: Fuel Cell Harbor Craft

CARB recently awarded Golden Gate Zero Emission Marine a $3 million grant to construct the first US ferry powered solely by hydrogen fuel cells. The grant follows several years of feasibility studies by Sandia National Laboratories in Livermore. When the ferry is built, the Red and White

Fleet will operate it. No dock-side fueling stations will be needed; a hydrogen fueling truck will be able to drive onto the dock and refuel the vessel straight from the truck. Maintenance is expected to less expensive than for diesel-powered vessels. Construction of the ferry began in November 2018. The ferry is expected to be completed at the end of 2019. Following completion, the ferry will undergo a three month demonstration and analysis period. It will be tested at various speeds and for various uses. The designers believe that the technology will be adaptable to a wide range of vessels, including tugs (San Jose Mercury News 2018a).

E-HC-5: LNG-Powered Tugs

Natural gas-powered tugs are available to order or in development from several manufacturers. At the current time, a very small number of LNG powered tugs are in service at various locations around the world. Developing reliable engines and gas storage systems for natural-gas-powered tugs requires meeting several challenges that are unique to tugs. Tugs are specifically intended to be capable of high-power performance in assisting, towing or re- positioning a vessel. At the same time, while assisting a vessel, the majority of a tug's time is spent waiting on stand-by with the engines idling or operating at extremely low power. Tugs must also be able to transition from idling to maximum output in an extremely short time. Finally, space for fuel storage is limited on tugs.

A natural-gas-powered tug can either rely solely on natural gas as fuel for starting, running without load, and operating continuously at any engine load, or it can be designed or retrofitted to be a dual-fuel vessel. A dual-fuel vessel may be able handle longer trips. In addition, requiring less LNG storage can reduce capital expenditures for retrofits projects, and/or preserve the ability to sell the vessel to users who may not have access to LNG. Given the state of the technology for natural-gas-powered tugs, a dual-fuel system can also increase reliability, should the natural gas system fail to perform.

E-HC-6: Shore Power for Tugs

Like OGV, tugs could also plug into shore power while at berth. The Port currently provides berthing to one tug company, AMNAV. AMNAV already uses shore power for its tugs, and other tug operators are based outside of the Port of Oakland. Thus, there is little opportunity for reducing local DPM emissions from expanding shore power capability for tugs. This IA has been eliminated from further consideration.

Cargo-Handling Equipment

As discussed previously, the Port has commissioned two studies to evaluate the status of zero-emissions CHE. While the studies showed that a majority of the different types of CHE is available as electrically-powered equipment, much of the equipment is still in the demonstration or pilot stages. Some types of electrically-powered CHE can only be used in fully automated terminals (M&N 2018). Appendix F provides an overview of the cargo-handling process at Oakland marine terminals.

E-CHE-3: Expand Use of Hybrid Cargo-Handling Equipment Where Zero-Emissions Equipment is Not Commercially Available or Affordable

Terminal operator SSAT has secured Carl Moyer program grant funding to repower all of its existing RTGs in use at the OICT with new hybrid-electric engines. The hybrid system uses a small diesel-hybrid engine to power a battery that is used to operate the crane. The hybrid engine is equipped with an energy recovery system that captures energy released when a container is lowered. A small diesel engine provides additional energy to the battery as needed. Due to the smaller engines, energy recovery from lowering containers, and the smoother operation of the smaller engines, converting to these hybrid engines will reduce the criteria air pollutant emissions from the RTGs by 90 to 99%. The reduction in fuel consumption will also reduce GHG emissions. Additional GHG emissions reductions could be achieved by using renewable diesel instead of petroleum diesel to power the diesel engine. Provided the hybrid cranes are determined to have satisfactory operating performance at the OICT, other container terminals at the Seaport could convert their RTGs to hybrid cranes as well.

Over time, other types of hybrid-container handling equipment may become available. Depending on the availability and cost of suitable zero-emissions equipment, it may be appropriate for tenants to implement hybrid equipment on an interim basis. Tenants would make the determination as to which type of equipment is most suitable to their operation based on their criteria for equipment purchases and regulatory compliance (as future regulations are put in place).

E-CHE-4: Electrically-Powered Cargo-Handling Equipment

Progress is being made with development of electrically powered CHE. In addition, at its March 23, 2017, meeting, CARB directed its staff to amend the CHE regulation to require 100% zero-emissions CHE by 2030 (Starcrest 2018). CARB staff currently proposes to update the CHE Regulation by 2022, with new measures for zero-emissions CHE not being implemented until after 2026. Implementation of a new CHE regulation would help drive innovation in this equipment sector. The 2017 SPBP CAAP calls for those ports to replace all CHE with zero-emissions equipment by 2030, if feasible (Starcrest 2018; CAAP 2017). This momentum will encourage the continued development of the technologies needed for this implementing action.

If yard operations permit, and if required electrical infrastructure is in place, replacement of existing CHE with electric equipment may become an option for most of the CHE in use today in the foreseeable future. However, none of the equipment currently meets the feasibility criteria for commercial availability, and operational feasibility has not been determined. As described in Appendix F, yard tractors are the CHE type that is most likely to become commercially available in the near future; however, further pilot-scale testing is still required to refine designs and evaluate operational issues, and costs will remain substantially higher than for comparable diesel-powered equipment for the foreseeable future. HVIP funding, which is currently

available to help fund the acquisition of battery-electric yard tractors, would be critical to speed purchases of zero-emissions yard tractors. A similar program, the Clean Off-Road Equipment Voucher Incentive Program (CORE), is currently being developed by CARB.

The terminal operators will continue to evaluate operational and infrastructure needs, and then develop a plan to replace CHE with commercially available electric alternatives over time, where feasible. The Port will continue to work with tenants to identify and apply for grants and other incentive funding.

E-CHE-5: Demonstration Testing of Electrically-Powered Cargo-Handling Equipment

The Port, in collaboration with the Ports of Long Beach and Stockton, was recently successful in obtaining a ZANZEFF grant (CARB 2018f). As part of that grant, SSAT will be testing five battery-electric yard tractors and a battery electric top-pick at the Matson terminal. Because none of the equipment is commercially available, all of it will be built specifically for the test.

Heavy-Duty Trucks

Any measures intended to reduce emissions from drayage trucks need to consider the social and economic factors associated with implementing potential IAs. For example, the 2017 CAAP acknowledges the move to cleaner trucks resulting from previous versions of the clean truck program led to serious and legitimate concerns about the impact of expensive new technologies on the working conditions of the drivers who haul cargo to and from the ports. The problem arose due to the high cost of new technology being beyond what most drivers could afford. At the Port of Oakland, most drayage trucks are owned by independent owner operators with limited means. In addition, a substantial number of owner-operators have limited English proficiency.

The question of how to fund the billions of dollars required for the replacement of trucks to 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 owner-operators to fund the equipment and manage the technological challenges associated with transition to a new truck fleet to serve the Port. It is critical that all stakeholders work together on solutions to address this problem to transition to a sustainable cleaner truck fleet and a drayage system that does not place an undue burden on any particular party.

E-T-1: CTMP Implementation/Clean Truck Program (Related Project, Completed)

The Comprehensive Truck Management Plan (CTMP) is an element of the MAQIP. The CTMP consists of five primary elements:

- Truck Ban Ordinance: The Port adopted a truck ban Ordinance (October 2009) for non-compliant drayage trucks seeking access to Port terminals. This Ordinance goes "above and beyond" the CARB regulation's reporting requirements and bans non-compliant drayage trucks at all Port of Oakland maritime terminals, including rail yards.

- Drayage Truck Retrofit Project: The Port, CARB, BAAQMD, and EPA provided a combined $38 million in grant funds to help truckers purchase diesel particulate filters or a newer truck. The funding provided grants for 1,319 diesel particulate filter retrofits and for 587 replacement trucks.
- Idling Restrictions: The Port installed "No Idling" signage along Port roadways.
- Truck Parking: The Port provides Seaport land for drayage truck parking. This parking allows drayage truck drivers to leave their trucks in the Seaport area, lessening the likelihood that truckers will use local streets as parking areas, and allows drayage truck drivers a place to rest during the day while awaiting dispatch.
- CTMP Web Page: The Port developed a CTMP web page on the Port of Oakland's public website dedicated to informing the trucking community about CARB regulatory requirements, a CTMP overview, STEP[13] Registry requirements, a restroom facility map, webcams, and other trucker resources.

In addition, the Port conducted studies on parking supply and demand, and conducted West Oakland truck parking surveys every year from 2015 through 2017. Although implementation of the CTMP is considered to be complete, the measures described above will continue to remain in effect. The Port is currently collaborating with the City of Oakland to complete the joint City of Oakland-Port of Oakland West Oakland Truck Management Plan (TMP, see Appendix B).

E-T-2: Truck Emissions Control Equipment Repair Facilities

As discussed in Appendix B, according to the 2017 Seaport Emissions Inventory, DPM emissions from trucks have dropped by 98% since 2005. These emissions reductions are attributable in part to use of diesel particulate filters (DPFs) and, increasingly, selective catalytic reduction (SCR) as well. When emissions control equipment fails, especially on older model year trucks, emissions from that truck can increase by more than a factor of 10. Consequently, to maintain emissions reductions that have already been achieved, it is critical for truckers to have ready access to qualified repair facilities that can service the emissions control equipment. Furthermore, modern trucks have on-board monitoring equipment that does not allow the engine to run if the emissions control equipment is out of specification range. Emissions control repair facilities are available in Oakland and near-by communities. At least one provider also offers a mobile DPF repair service.

E-T-3: Incentives to Upgrade to Zero-Emissions Drayage Trucks

The truck-related emissions attributed to the Seaport have been reduced greatly, and currently only make up 0.6% of the total DPM emissions (see Appendix B). While upgrading the drayage truck fleet to zero emissions trucks would effectively eliminate all emissions from this category in the Seaport, it is unlikely that the entire drayage truck fleet would be converted. Furthermore, converting to zero-emissions drayage trucks at a significant scale is not

[13] The STEP (Secure Truck Enrollment Program) is designed to ensure that all licensed motor carrier serving the Seaport are complying with the Port's security requirements.

technologically feasible at the current time. Zero-emissions short haul drayage trucks[14] are not commercially available yet and are not expected to be commercially available for several years (2023 or later). Long-haul zero-emissions drayage trucks are not expected to be commercially available until 2027 or later.

Converting the entire drayage truck fleet would result in very high costs due to the need to convert thousands of trucks and the cost of installing the necessary infrastructure (see below). Nonetheless the benefits of converting drayage trucks to zero emissions would extend beyond the Seaport when those trucks are engaged in business not related to the Seaport ("halo" effect). The Port anticipates that grant funding that may be available under AB 617 in the future would be used to convert a number of trucks operating in and around the West Oakland area, including some trucks serving the Seaport area, to zero emissions vehicles. In addition, HVIP funding is currently available to aid in the purchase of zero-emissions drayage trucks.

Electric drayage trucks have not been proven in commercial service (they are considered to be in the demonstration phase), and the performance of these trucks in port drayage operations is being studied by the National Renewable Energy Laboratory (NREL 2018). Electrical charging time for battery-electric trucks is currently considerably longer than fueling time for diesel- or hydrogen-fueled equipment. Electrical charging also requires the truck to return to base or dock at a charging station along each route.

The total cost per truck for 10 zero-emissions drayage trucks is estimated to be approximately $470,000. This cost includes charging infrastructure costs estimated at $200,000 per truck (this cost can vary depending on the on location and available power) (Starcrest 2018). The incremental cost of replacing the entire drayage fleet of approximately 9,000 trucks would be approximately $2.4 billion. The actual percentage of trucks that might ultimately be converted to battery-electric operation is unknown, and will depend on the truck owners' decisions.

Replacing all 9,000 (approximate) drayage trucks would eliminate all DPM associated with drayage trucks (approximately 0.07 to 0.11 tons in 2030). Even accounting for the greater exposure associated with emissions located closer to the community, it is highly unlikely that these emissions reductions could be made cost-effective until battery-electric trucks have reached complete cost and range parity with diesel-powered equipment. Replacement of all drayage trucks in the STEP registry with zero-emissions vehicles would also result in 100% reduction of tailpipe GHG emissions. After accounting for PG&E grid emissions, overall GHG emissions would be reduced by 88%, which is equivalent to approximately 15,000 to 24,000 MT of CO2e per year in 2030. The actual emissions reductions that could be achieved through conversion of a portion of the trucks serving the Seaport to battery-electric operation is unknown.

[14] Short-haul drayage trucks are those that cover less than 100 miles per day.

E-T-4: Short-Haul Drayage Truck Demonstration Testing

A Port tenant is currently evaluating a Phase 1 electric drayage truck, and the manufacturer is currently working with five other Port tenants to deploy 10 Phase 2 battery-electric drayage trucks. The ZANZEFF grant discussed above provides funding for an additional 10 battery-electric drayage trucks. These trucks are being constructed by a different vendor, and will be used by Shippers Transport Express. All of the test trucks are being used in short-haul service (between marine terminals and near-dock railyards, warehouses, or container storage yards) due to the limited range of the electric trucks. The Port will track the results of the testing.

E-T-5: Incentives for Low-NOx Drayage Trucks

Low-NOx trucks (90% cleaner than current NOx standards) are currently available and CARB is working on a regulation to introduce low-NOx truck standards. However, those standards are targeted only toward NOx and will not help in reducing DPM and GHG emissions. The Port is not proposing any measures to implement low-NOx trucks. This IA has been eliminated from further consideration.

E-T-6: High-Emitting Truck Detection System

As discussed in Appendix B, studies have shown that a small fraction of trucks with apparent emissions control systems failures emits a greatly disproportionate amount of air pollutants. The studies have also shown that it is possible to identify these high-emitting trucks. For this IA, a permanent emissions sensor would be installed at key entry point to the Port. When a high-emitting truck is detected by the sensor, the sensor's reading along with the identifying truck information (such as a photo of the license plate), would be transmitted to an enforcement agency such as CARB or DMV for follow-up.

Locomotives

The Oakland International Gateway (OIG) rail yard and the Oakland Global Rail Enterprise (OGRE) are on Port land[15] and the emissions from locomotives operating in these yards are included in the Seaport emissions inventory. OIG is a Class 1 railway and as such CARB can only regulate certain elements of its locomotive operation, such as idle time. OGRE is a Class 3 railway and is subject to CARB rulemaking. The UP railyard, located adjacent to the Seaport, is also a Class 1 facility. It is not on Port land, and not included in the Port's emissions inventory. Although the Port has little influence with the railyards, CARB requested that the 2020 and Beyond Plan include IAs for line-haul locomotives. Several IAs for line-haul locomotives were added, as shown below. Line-haul locomotives generally face some of the same issues as long-haul drayage trucks - development of wide-ranging charging infrastructure, the need to rapidly charge engines versus the potential demand charges associated with rapidly charging such a large battery. In addition, rail yards operate 24-hours per day, 7 days per week. Consequently,

[15] The City of Oakland recently cancelled the lease with the rail operator who is leasing the property to OGRE.

developing alternatively fueled line-haul locomotives is extremely challenging. All line-haul locomotive test engines are retrofits onto existing locomotive assemblies, changing out only the engine system.

E-L-1: Switcher Locomotive Replacement (Upgrade to Tier 4)

Several switcher locomotives are assigned to the OIG and OGRE yards, with the total hours of operation at both yards averaging approximately 9.6 hours per day, seven days a week. Replacing the existing Tier 0 switcher locomotives with Tier 4 switcher locomotives would provide DPM and GHG emissions reductions. Tier 4 engines provide 95% control of PM compared to Tier 0 engines. Because the activity of the switcher locomotives at OIG and OGRE is relatively low, their emissions are relatively low, although it is worth noting that the total current emissions from locomotives exceed the total current diesel truck emissions. Both yards have several switcher locomotives sharing the switching duties. Unless the operators of the yard can operate the new Tier 4 locomotive exclusively (with a few of the older locomotives as backups or used in cases where more than one locomotive is needed), several of the switchers would need to be replaced. In addition, switchers are not necessarily tied to one yard, so upgraded switchers may not stay in the yard at all times.

Incentives or grants could be used to encourage replacement of the OIG and OGRE switcher locomotives. In February 2018, OGRE was granted Carl Moyer Program and EPA Diesel Emissions Reduction Act (DERA) funding to replace one diesel switcher locomotive engine. The grant requires that the project be completed by June 14, 2019. Moyer grants have been used by other railroads (e.g., Pacific Harbor Lines) to replace locomotives. A new Tier 4 switcher costs approximately $2 to $2.5 million (Starcrest 2018). Replacing one switcher engine and using it for the majority (greater than 90%) of the switching would yield a more than 90% reduction of DPM (approximately 0.13 to 0.37 tons per year in 2030). GHG emission reductions are expected to be approximately 40%,[16] resulting in emission reductions of approximately 250 to 750 metric tons of CO2e per year in 2030 (Starcrest 2018).

E-L-2: Support CARB Petition for Tier 5 Line-Haul Locomotives

In an effort to reduce emissions from line haul locomotives, CARB petitioned EPA to issue Tier 5 emissions standards for line haul locomotives.

E-L-3: Battery-Electric Switcher Engines

The Ports of LA and Long Beach are collaborating with CARB and SCAQMD to test a lithium-ion battery electric switcher engine. The two ports have the heaviest duty switching operations in the U.S. At 2,100 hp, the engine is unusually large for a switcher. It has a design 12-hour running-time target, and is equipped with a 2,800-kWh battery pack. The locomotive is currently being built. It is scheduled for battery installation and testing from January through

[16] www.nre.com

April of 2019, and to be delivered to the ports in June 2019. Grant conditions require that the switcher complete 900 operating hours by the 4th quarter of 2019.

E-L-4: Battery-Electric Locomotive for Hybrid Consist

BNSF teamed with San Joaquin AQMD on a ZANZEFF grant to develop a battery-powered locomotive that would be used in combination with diesel locomotives in what is termed a "hybrid consist.[17]" The concept includes replacing the engine and associated equipment in a locomotive with an approximately 2,400 kWh battery pack and developing software to optimize the operation of the overall consist. The optimization software is essential, as improper use of the engine could increase fuel costs. The hybrid consist will be tested on the Stockton to Barstow run, as well as on within-yard movements. BNSF is assessing the new technology for safety, operational fit, total cost of ownership, and reliability. BNSF anticipates overall fuel savings of 10 to 15% on the Stockton to Barstow run. However, even on a given run, it is typically for fuel costs to vary up to 10% due to the variability in the specific freight, the aerodynamics of the train, wind conditions, etc.

E-L-5: Request Railroads to Use Cleanest Engines in Oakland

The Class 1 railroads have discretion over the locomotives that are used in their Oakland yards, as well as the line-haul locomotives that are used to haul trains into and out of Oakland. Existing locomotives have variable emissions, depending on their emissions tier. Tier 4 engines are the cleanest engines. For this measure, the Port would seek to work with the railroads to encourage them to use locomotive with Tier 4 engines for both their line-haul locomotive coming through Oakland, and in their switcher locomotives located at the Oakland railyards.

Miscellaneous Off-Road Equipment

Miscellaneous off-road equipment consists of construction equipment and equipment used at warehouses, as well as maintenance and related vehicles in the Port's own fleet. In addition to the specific measures outlined below, diesel-fueled equipment could easily be converted to use renewable diesel, which would result in immediate DPM reductions of 30% to 40% and GHG emissions reductions of 60% or more.

E-M-1: Port Fleet Conversion and Charging Infrastructure

The Port is committed to evaluating the conversion of its own vehicles to battery-electric or other zero emissions technology as the equipment is replaced at the end of its useful life. The evaluation includes as assessment of the feasibility of zero-emissions equipment from a commercial and operational perspective, using the feasibility criteria presented in this Plan. The Port recently evaluated thirteen types of fleet equipment for replacement by battery-electric or other alternatively-fueled equipment. Of the thirteen types of equipment, only one had a positive ROI compared to equivalent diesel-powered equipment.

[17] A "consist" is combination of locomotives used to power a train.

Equipment purchase costs for the alternatively-fueled vehicles ranged from 136% to 218% of equivalent diesel-powered equipment. In addition, none of the equipment met the Carl Moyer criteria for cost-effectiveness for zero-emissions equipment ($100,000/ton of emissions reduced, or less). Nonetheless, the Port is proposing to invest in a variety of battery-electric equipment, including four different types of work trucks specifically being purchased as pilot test vehicles. Thirteen vehicles are designated for maritime use. Three of the thirteen pieces of equipment proposed for maritime use would be battery-electric. In addition, the Port recently purchased a battery-electric passenger van that was the first of its kind to be produced by the selected manufacturer, and has encountered a significant operating challenge. Implementation challenges provide valuable feedback to the manufacturer and will result in improved products in the future. The Port will continue to evaluate the feasibility of replacing diesel powered equipment with alternatively fueled equipment as each piece of diesel-fueled equipment reaches the end of it useful life.

The Port has available capacity to support up to 6 electric vehicle charging plugs at its Harbor Facilities building. In the future, the Port will have to evaluate the existing electrical system serving the Harbor Facilities building to determine the additional infrastructure required to support proposed electric vehicle purchases. In addition, the Port may evaluate the feasibility of charging stations in Port parking areas to encourage the transition of personal vehicles to zero-emissions or hybrid-electric vehicles.

E-M-2: Highest Engine Tier Construction Equipment on Port Projects

Lower-tier diesel engines emit considerably more DPM and other pollutants than the highest tier engines. If construction conducted within the Seaport were to use only the highest tier equipment, DPM emissions would be reduced and some reductions in GHGs would also occur, as newer engines are typically more efficient.

E-M-3: Retrofit Older Construction Equipment with Emissions Control Devices

Older construction equipment with lower-tier diesel engines (i.e., not equipped with emissions control devices) could be retrofit with these devices to reduce emissions.

E-M-4: Zero-Emissions Loading and Unloading Equipment

Mobile equipment used at warehouses, maintenance facilities, and other support services within the Seaport area could be converted from their existing fuel sources (typically diesel, and propane or LNG/CNG) to battery-electric service. Battery-electric forklifts are considered to be commercially available. Also, hydrogen fuel cell-powered forklifts are commercially available. The Cool Port facility will use battery electric equipment in its operation and provide electrical plug-ins for refrigerated containers. (As noted previously in the Fuels section, hydrogen fuel cell technology only provides reductions in GHG emissions if the electricity used to generate the hydrogen is from renewable sources.)

Operations

Efficiency Measures

Broadly speaking, efficiency measures fall into two categories: direct energy efficiency measures, and measures designed to improve operational efficiency, thereby reducing fuel consumption and associated air emissions.

O-1: Fixed Asset Energy Efficiency Measures Studies and Implementation

Buildings and other infrastructure can be made more energy-efficient through energy-efficient lighting, insulation, low-carbon intensity building materials, painting to reduce heat absorption, and related improvements.

O-2: Freight Intelligent Transportation System (Related Project)

As discussed in Appendix B, the GoPort program is a Related Program being implemented by Alameda Country Transit Commission in collaboration with the Port. The Freight Intelligent Transportation System (FITS) Project is one of the three main components of the GoPort program. The FITS Project consists of six individual projects that are primarily aimed at traffic management and operations of arterial roadways in and adjacent to the Seaport Facilities, and regional traveler information dissemination to and from the Port to improve safety, reduce traffic congestion, provide reliable travel time, and improve quality of life.

The FITS Project consists of non-ground disturbing, system-based improvements in addition to trenching for fiber optics, upgrading signals, constructing foundations, removing vegetation and trees, and other related equipment installations that maximize the operation of the Port's overall roadway system and provide traffic management and associated air quality benefits. The first tier of the FITS projects is in design, and scheduled to be constructed/implemented over the next 2 to 3 years. The six FITS projects are summarized below.

1. Joint Transportation Management Center and Emergency Operations Center (TMC/EOC): Reconfigure/modify existing TMC at the Port's Harbor Facilities building with interior space upgrades, new communications, and other amenities for the efficient operation of a Joint TMC/EOC to maintain and operate the ITS elements to be deployed by the FITS Project.

2. Radio-Frequency Identification (RFID) Readers: Install RFIDs in and near the Seaport Facilities on existing and new poles to monitor truck movement, including truck turn-time within the Port. The readers will transmit the truck information to a central location that can be accessed through a server.

3. Advanced Traffic Management System (ATMS) - Phase 1: Install and/or implement the following:

- Signal improvements including video detection (intersection only)
- Advanced Rail Grade Crossing System (for determining train activity and delays)
- Advanced Traffic Management System (ATMS) software platform
- Changeable Message Signs (CMSs)
- Queue Detection
- Closed Circuit Televisions (CCTV) upgrade to high-definition (HD)
- Communications (Fiber)
- Center to Center (C2C) connection between the Port, the City of Oakland, and Caltrans
- Additional RFIDs (not installed by Project No. 2) requiring communication network via a fiber backbone
- Supplemental Vehicle Detection (for determining vehicle speeds and traffic patterns)
- Weigh-in-Motion (WIM) Technology (for determining truck weights)

4. Basic Smart Parking System: Installation of software system/application that monitors parking availability that can be shared via GoPort Freight ITS Information System/App, CMS and other system technology, as well as provide parking payment options.

5. Communications (WiFi): Install WiFi capabilities in the Seaport area as a backup communication system and a means for addressing cellular dead spots and enhancing security and emergency response functions. Offers amenities to truckers in queue or within the PORT (e.g., Port traffic and gate queue videos and improved access to GoPort freight ITS information System/App).

6. System Integration and GoPort Application – Phase 1: A System Integrator (SI) will develop software to integrate existing and new ITS applications. In addition, the SI will develop a graphical user interface (GUI) application for the basic GoPort application. The application will be made available for the end users (truck and other service providers) so that it can be used, for example, to find travel time, including turn around time within the Port; find container information such as availability and yard information; make appointments for container pickups/drop-offs or parking within the Port complex; and pay fees.

O-3: Overall Seaport Operating Efficiency (Studies and Implementation)

Efficiencies at a container terminal and within a Seaport are achieved through a more rapid and smoother cargo loading and unloading process, including the process of moving the containers onto or off the container yard. The more the various elements of a seaport operation are working well together, the more efficient the overall cargo movement process becomes. Higher efficiencies result in a reduction in air pollutant emissions per unit amount of cargo. Terminal velocity is the term used to describe the speed at which containers can be moved in and out of the terminal en route to their next destination.

Terminal velocity provides an overall measure of the relative efficiency of each terminal within a Seaport. While individual elements of the cargo movement process can be optimized, the greatest efficiencies are achieved when the various elements are integrated. For example, accelerating the rate at which containers can be loaded without ensuring that trucks can be processed quickly enough to provide sufficient containers for loading would limit the value of the improved loading process. Truck turn time data (the amount of time it takes a truck to enter the terminal and load or unload a container) can identify bottlenecks in the system; as described above, the FITS will provide turn-time information when it is implemented.

Based on consultation with Port maritime staff and reflecting their close working experience with Seaport tenants, optimal operations would include all the following:

- Arriving vessels receive a pilot, enter the harbor, dock and begin off-loading as soon as they arrive
- Containers are off-loaded at a steady rate and placed in areas where they are quickly loaded onto and hauled away by trucks
- Trucks enter the terminal without delays due to having to wait on paperwork to be processed or a container to become available, and
- Vessels are reloaded rapidly and cleared for departure as soon as they are fully loaded

Port of Oakland Seaport terminal tenants and operators are constantly working on and investing in increasing efficiency. For example, the optimal operating scenario includes a steady flow of containers, where CHE is working consistently at a steady state, and sufficient trucks that can move through the terminal to pick up containers and deliver them to their next destination. Idling by trucks and CHE is avoided because the container loading and unloading operations are synchronized with the rate at which trucks can enter the terminal to unload or retrieve a container. In addition, a truck would both drop off and pick up a container during each trip to the terminal. This is a challenging goal because of the many factors that must be integrated to provide for smooth operation. Currently, this occurs for roughly 25% to 35% of truck trips. For example, a vessel would have to provide the information on the containers that it will be off-loading prior to arriving at the Port, including their ultimate destination. This information, in turn, could then be used by the container terminal operator to set up truck appointments.

To facilitate coordinated operations requires terminal operating systems (TOS), which help avoid bottlenecks through proper planning, thereby increasing productivity. While each container terminal has its own TOS, they are currently unable to communicate with each other. A secure community network is required to optimize terminal and Seaport operations. The Port Efficiency Task Force will continue to meet and identify potential efficiency improvements.

O-4: Evaluate Voluntary Vessel Speed Reduction Program

Under a voluntary Vessel Speed Reduction (VSR) program, participating ocean-going vessels voluntarily reduce their speed while transiting. When OGVs slow down, the load on the main engines decreases considerably compared to the engine load when transiting at higher speeds. This leads to a decrease in the total energy required to move the OGV through the water. The energy reduction in turn reduces emissions for this segment of the transit. Since the load on the main engines affects power demand and fuel consumption, this strategy can significantly reduce all pollutants including PM (including DPM), NOx, SOx, and GHG emissions. Experience shows that incentivizing these programs increases participation rates from around 70% to near 100% (Starcrest 2018).

In San Francisco Bay, OGVs already transit at a relatively slow speed east of the Sea Buoy, where the Bar Pilot boards. The Port is consulting with the San Francisco Bar Pilots (SFBP) to identify and discuss issues and concerns associated with a voluntary VSR program within the Precautionary Zone outside San Francisco Bay. The Port would consider a voluntary VSR only with SFBP consultation and support. A voluntary VSR could provide emissions reduction benefits inside the Precautionary Zone between the outer buoys and the Sea Buoy. In its 2018 VSR pilot program, BAAQMD in collaboration with other air districts is incentivizing lower transit voyages through the Precautionary Zone, which is included in the Port's emission inventory.

The potential DPM reduction benefits of a voluntary VSR in the outer Precautionary Zone would be approximately 2 tons per year in 2020. The potential GHG benefits in the outer Precautionary Zone would be approximately 4,200 to 4,500 MT of CO2e per year in 2020 (Starcrest 2018). The Port will evaluate the potential for a voluntary VSR program after the results of the BAAQMD pilot study are available. An voluntary VSR program could be included as part of an overall environmental incentive program.

O-5: Monitor Shore Power Use

Under CARB's At-Berth regulation, shipping lines calling on the Port are required to reduce onboard auxiliary diesel engine power generation by 70% (2018 requirement) on a fleet-wide basis while at berth. To date, all shipping lines that visit the Port have chosen to plug into shore power, although in the future some vessels may use a barge-based emission reduction system (bonnet; see discussion in Ocean-Going Vessel section). Port staff have been monitoring the success of shore-power plug-ins to determine the issues preventing plug-ins, and to enhance usage. For issues that are identified, the Port works with the shipping lines and marine terminal operators to evaluate potential solutions.

O-6: Combined Environmental Performance Incentive Program for Shipping Lines

A combined environmental performance incentive program provides an opportunity for shippers to earn incentives for each vessel call depending on specific types of actions they take to meet performance requirements in two or more categories incentivized actions. Depending

on the type of program implemented, shippers may be incentivized at different levels for achieving certain levels of environmental performance. For example, a program that includes an incentive to use ultra-low sulfur diesel fuel (see discussion in Fuels section) may award different levels of incentive award points depending on the specific sulfur content of the fuel, with the lowest sulfur fuel resulting in the highest incentive points. Other environmental performance measures that could be added to a combined incentive program include vessel speed reduction, use of vessels with cleaner engines, shore-power plug-in performance, and potentially use of alternative fuels such as renewable diesel (if beneficial in marine use), or, longer-term, natural gas. A combined incentive program could be similar to the Environmental Ship Index current used by the Port of Los Angeles.

O-7: Track Other Incentive-Based Programs

The SPBP are considering measures to incentivize energy efficiency improvements and use of cleaner technologies and impose a differential rate system to incentivize newer, cleaner vessels. The Port will track SPBP's experience with these initiatives along with implementation of the 2017 CAAP in general. Oakland is likely to benefit from any successful incentives, as will other ports along the West Coast. It will be important to track the benefits of any such program against the improvements in ship emission reductions pursuant to the most recent MARPOL guidance (IMO 2018).

The SPBP are also planning to develop a Green Terminal program. The Port of Oakland will continue to track various efficiency and incentive measures tested at the SPBP. Successful programs will be evaluated for their applicability to the Port of Oakland, consistent with the screening process described in Part II.

Partnership Actions

As described in Strategy #4, effective partnerships are crucial to the successful implementation of the Plan and realizing the Plan vision of a zero-emissions Seaport. Partnership IAs focus on information exchange and development of joint funding opportunities. The Port is continually working to strengthen its partnerships with tenants, truckers, other Port-related businesses, other Ports, regulatory agencies, and the community.

P-1: Track San Pedro Bay Ports CAAP Progress and Technology Advancement Program

The San Pedro Bay Ports currently provide progress updates to their CAAP online (http://www.cleanairactionplan.org/) with specific quarterly reporting. Port staff will continue to track CAAP progress using this online resource as well the Port of Oakland connections with SPPB staff. Likewise, the SPPB also provide annual reports on their TAP program online (http://www.cleanairactionplan.org/technology-advancement-program/) and the Port will continue to check in on TAP progress directly with SPBP staff.

P-2: Participate in Trucker Worker Groups

Three primary trucker groups represent the interests and concerns of truckers serving the Seaport: the Port of Oakland-specific Trucker Work Group ("TWG"), the Harbor Trucking Association ("HTA"), and the Western States Trucking Association ("WSTA"). The TWG meets every other month and allows an organized forum for Port staff, marine terminal operators, chassis equipment providers, regulatory agencies, Oakland Police Department, logistic/drayage software developers, trucking associations, and others to provide updates to each other and those in the trucking community. Port staff will continue coordinating, attending, and using the working group as a forum for sharing updates on Plan implementation as well as receiving feedback on implementing actions. In addition, Port of Oakland staff receive regular email updates multiple times a week from the HTA and weekly newsletters from the WSTA. Port staff will continue tracking information provided and concerns expressed by each respective trucking association.

P-3: Port Environmental Office Hours for Trucking Companies and Truckers

Port Environmental staff currently have weekly standing environmental office hours at the Maritime Harbor Facilities building in order to be accessible to various trucking companies (Primary Motor Carriers and Licensed Motor Carriers) as well as independent owner-operators to assist with truck compliance and potential grant funding for newer diesel equipment, as well as incentive funding for low-NOx and zero emissions equipment. Port staff also use the Port Environmental Office Hours to distribute information from BAAQMD. The Port will continue standing environmental office hours and work with BAAQMD staff on how best to provide information on and assistance with grant opportunities for those in the trucking community.

P-4: ZANZEFF Grant Partnership with Port of Long Beach

Port staff will manage the Port of Oakland-related component of the ZANZEFF grant project with the Ports of Long Beach and Stockton. This will include providing project updates and coordinating data collection/monitoring by consultants as needed to meet the ZANZEFF grant reporting requirements. The Port will use this partnership opportunity to strengthen its relationship with the Ports of Long Beach and Stockton.

P-5: Meet with Port Tenants

As part of the Port's lease agreement with tenants, annual meetings are held between Port Environmental staff and tenants to review tenant environmental responsibilities with regard to air quality. Port Environmental staff will continue having annual meetings with Port tenants to jointly look for opportunities to improve air quality (e.g., by upgrading equipment, implementing efficiency measures, and pursuing grant project partnering opportunities).

P-6: Participate in Industry Stakeholders Groups

Port industry stakeholder groups provide an opportunity to share information about port air quality improvement initiatives. As invited, Port Environmental Staff will continue to participate in the Port Efficiency Task Force (PETF) to provide the PETF updates regarding Port air quality initiatives and use the PETF to continue building relationships with the PMSA and other industry stakeholders. In addition, the Port is in weekly contact with PMSA with regard to air quality initiatives and technologies.

P-7: Attend Industry Trade Conferences

In 2018, Port Environmental staff attended and participated in numerous industry trade conferences focused on clean technology. The conferences included the Advanced Clean Transportation (ACT) Expo, the American Association of Port Authorities (APPA) Green Ports conference, the NorCal Clean Technology Summit, and the West Coast Collaborative. Port staff spoke at VERGE, a conference and expo for accelerating clean energy, and participated on a Clean Truck Panel for an Intermodal Association of North America (IANA) conference-related event. In addition, Port staff regularly participate in industry trade webinars as organized by such agencies as CalStart and the Hydrogen Business Council. Port Environmental staff will continue to attend conferences for both learning and to connect with those associated in clean energy and zero-emissions technology.

P-8: Collaborate with Public Agencies

The Port of Oakland can collaborate can collaborate with other public agencies in identifying opportunities for shared implementing actions and grant opportunities.

P-9: Collaborate with Regulatory Agencies

In 2018, the Port of Oakland, BAAQMD, CalStart, and CARB hosted two grant and incentive funding workshops for truckers and trucking companies to learn about opportunities for cleaner equipment. The Port plans to continue hosting such events and evaluate other outreach events that may be held in the future.

P-10: Outreach Regarding Potentially Applicable Grants and Incentives

In addition to the Port Environmental Office Hours held at the Maritime Harbor Facilities building and the 2018 Grant and Incentive Funding Workshops, the Port will continue to reach out to tenants and marine terminal operators to inform them about potential grant and incentive opportunities. Outreach may be through events and informally during other meetings such as the annual meetings with tenants. Additionally, Port staff can connect successful grantees with others in the community seeking the same grants to share grant application information and lessons learned.

P-11: Provide Support During Development of Grant Applications

For marine terminal operators or Port tenants developing grant applications, the Port can provide letters of support and initial evaluation of projects if requested and deemed appropriate.

P-12: Develop a Workforce Development Program

The Port will continue its workforce development program with adjustments to account for zero-emissions technology as described in Appendix E: Workforce Development Plan.

P-13: Partner with other Ports on Grant Applications

In 2018, the Port successfully partnered with the Ports of Long Beach and Stockton in developing a grant project and submitting an application for the ZANZEFF grant. The Port will continue identifying future opportunities for joint grant applications with other Ports as time and resources allow.

P-14: Advocate for cleaner OGVs and fuels.

Ocean-going vessels are regulated at the international level, and Class 1 railroads are regulated at the federal level. The Port will continue to advocate for cleaner vessels and locomotives with the appropriate agencies.

Stakeholder Engagement Actions

SE-1: 2020 and Beyond Task Force Meetings

The Port intends to hold 2020 and Beyond Task Force meetings during Plan implementation as described in Appendix G: Public Engagement Plan.

SE-2: Community Town Hall Meetings

A Community Town Hall Meeting can be a method of reporting to the community regarding the progress of the 2020 and Beyond process as described in Appendix G: Public Engagement Plan. Community Town Halls would be scheduled at times and on dates when more stakeholders are able to attend, such as during the evening or on weekends.

SE-3: Conduct Directed Outreach

While the 2020 and Beyond Task Force has engaged a wide range of stakeholders, it is likely that there are community members and some organizations that are either not aware of, or not engaged in the 2020 and Beyond process. As described in Appendix G, the Port intends to do directed outreach these community members and organizations. Directed outreach may occur via social media, telephone, and direct contact, announcements and information at locations that community members frequent, such as faith groups, grocery stores, and laundromats. Other directed outreach includes public workshops and tours and community and business surveys, questionnaires, and polls as described in Appendix G: Draft Public Engagement Plan.

SE-4: Respond to Comments on the 2020 and Beyond Plan in Writing

Several commenters requested that the Port provide specific, written responses to all comments received. The Port has developed the Responses to Comments on the June 29, 2018 Draft Seaport Air Quality 2020 and Beyond Plan document that provides responses to all comments (emails and comment letters, etc.)

SE-5: Outreach to Individuals with Limited English Proficiency

Meaningful engagement with the whole community requires outreach to community members with limited English proficiency. Informational materials for those with limited English proficiency will be developed using graphics, minimal text with simple language, and as well as appropriate languages.

Funding Actions

FG-1: Estimate Overall Costs Associated with the 2020 and Beyond Plan

An overall cost estimate is required to assess funding needs relative to Plan goals, and to be able to develop a conceptual approach to implementation of the overall Plan. The Port has conducted several feasibility studies for infrastructure and equipment to date. The Port is currently preparing a cost estimate to implement marine terminal electrification. Information from these studies will be used to develop an overall cost estimate for the Plan, knowing that the total estimated Plan cost is highly dependent on the rate of zero-emissions technology maturation.

FG-2: Financing Mechanisms and Sources

A wide-range of potential financing mechanisms could be used to advance the goals of the Plan. In addition to self-funding and external grants and incentives, the Port will consider a variety of potential debt financing mechanisms for larger-scale infrastructure improvements. These improvements would be planned and constructed when warranted by tenants' plans for zero-emissions equipment purchases. Identification of suitable mechanisms will include tracking grant and incentive opportunities. For example, in 2018, Port of Oakland staff attended the Funders Forum meeting in Sacramento. The Funders Forum gathered representatives of multiple agencies (state agencies, air districts and utilities) to exchange information and best practices for vehicle and infrastructure incentives. As the 2018 Funders Forum was the second meeting of its kind, the Port hopes that this meeting or a like meeting of its kind will continue. In addition, the Port staff currently receive email updates from the various funding sources including the California Energy Commission, CARB, and BAAQMD. Another potential funding or support mechanism is collaborating with OEMs. OEMs can provide equipment for operational testing or demonstration use, and can financially support required ancillary equipment such as chargers and supporting infrastructure (e.g., transformers).

FG-3: Grant and Incentive Funding Program Requirements

Port staff will continue to become educated on established grant and incentive funding programs to strategically pursue the most appropriate opportunities, and to provide general guidance and direction on opportunities for Port tenants and truckers.

FG-4: Track SPBP Truck Rate Study

In addition to tracking the SPBPs CAAP progress and TAP program, Port staff will track the SPBPs' current truck rate study to understand the projected benefits and effects of implementing a truck rate, as well as the mechanics of implementing such a rate. The results of the SPBPs' study can help inform the feasibility and suitability of a similar program at the Port of Oakland.

FG-5: Evaluate the Feasibility of Providing Incentives

Provided funding allows, the Port could evaluate incentives for voluntary vessel speed reduction to increase participation (provided BAAQMD's vessel speed reduction pilot program shows that VSR would provide net emissions reductions benefits) and/or implement a combined environmental incentive program such as the Environmental Ship Index. A combined environmental incentive program typically awards points to each vessel depending on its performance on certain environmental indicators such as fuel sulfur content and shore power use. The feasibility evaluation would consider both the costs involved with providing a meaningful level of incentives and the administrative requirements of implementing such a given incentive program.

FG-6: Advocate for New or Expanded State and Federal Grant and Incentive Funding Programs

Through the identification of a full range of financing mechanisms and sources, the Port may identify additional needs for grant and incentive funding programs. Port staff participate in agency working groups to provide feedback on grant programs. Through its stakeholder engagement process the Port may also become aware of barriers to use of existing grant or incentive programs, and could advocate for changes in the programs to make them more accessible to potential applicants.

TABLE C-2. POTENTIAL IMPLEMENTING ACTIONS[1]

No.	Technology or Implementing Action (List from Draft Plan)	Implementing Action Category	Location	Status	Port's Level of Control (Note 1)	Retained?	Associated Strategy or Strategies					
							1	2	3	4	5	6
	Infrastructure											
I-1	Engineering Feasibility Studies for Increased Cargo Movement Efficiency through Smart Technology	Infrastructure	Seaport		Control		●	●	●			
I-2	Engineering Feasibility Studies for On-Road Electric Truck Charging Infrastructure	Infrastructure	Seaport		Control		●	●	●			
I-3	Maritime Power Capacity Study for Terminal Electrification	Infrastructure	Terminals	In progress	Control		●	●	●			
I-4	Roadway and Other Hard Infrastructure Upgrade Studies	Infrastructure	Seaport		Control/ Influence		●	●	●			
I-5	Electric Vehicle Infrastructure Guide for Port Tenants	Infrastructure	Seaport	In progress	Control		●	●	●			
I-6	Develop Overall Implementation Plan for Infrastructure	Infrastructure	Seaport		Control		●	●	●			
I-7	Uniform Charging Standards for Electrically-Powered Terminal Equipment and Drayage Trucks	Infrastructure	Terminals		Influence		●	●	●			
I-8	7th Street Grade Separation West (Related Project)	Infrastructure	Seaport		Influence/ Control		●					
I-9	7th Street Grade Separation East (Related Project)	Infrastructure	Seaport		Influence/ Control		●					
I-10	Charging Infrastructure to Support Zero-Emissions Equipment	Infrastructure	Seaport		Influence/ Control		●	●	●			
I-11	Future Infrastructure Modifications	Infrastructure	Seaport	Completed	Control		●	●	●			
	Fuels											
F-1	Technology Assessment for Hydrogen and Hydrogen Fuel Cells	Fuel	Seaport		Control		●	●				
F-2	Electricity Supply	Fuel	Seaport	On-going	Control		●	●	●			

[1] The actions listed in this table could be implemented at any time during the life of the Plan. The Near-Term Action Plan described in the main body of the report and summarized in Table 2 in the main report describes the actions are proposed to be taken in the next five years.

Notes:

1. The Port may have direct control ("control"), be able to influence the likelihood that the initiative or action will occur ("influence") or may have no control over the action, although the action would affect air emissions within the emission inventory area of the Seaport ("concern").
2. Seaport include the container terminals, warehouses, AMS, Port-owned rail yards, and certain roadways

TABLE C-2. POTENTIAL IMPLEMENTING ACTIONS[1]

No.	Technology or Implementing Action (List from Draft Plan)	Implementing Action Category	Location	Status	Port's Level of Control (Note 1)	Retained?	Associated Strategy or Strategies					
							1	2	3	4	5	6
F-3	Local Solar Power Generation	Fuel	Seaport		Influence/ Control		●	●	●			
F-4	Renewable Diesel Fuel	Fuel	Seaport		Control/ Influence		●					
F-5	Biodiesel	Fuel	Seaport		Control/ Influence		●					
F-6	Natural Gas	Fuel	Seaport		Influence		●					
F-7	Renewable Natural Gas	Fuel	Seaport		Influence		●					
F-8	Low Sulfur Fuel in Ocean-Going Vessels	Fuel	Waterways		Influence		●					
	Equipment											
	Studies											
E-CHE1	Container Yard Electrification Feasibility Study	Equipment	Terminals	Completed	Control		●	●	●			
E-CHE2	Equipment Operations and Cost Assessment to Assist with Electric Infrastructure Planning	Equipment	Terminals	Completed	Control		●	●	●			
	Ocean-Going Vessels											
E-OGV1	Shore Power Improvements - Achieve 90% Shore Power Use	Infrastructure	Terminals	In planning	Control		●	●	●			
E-OGV2	Barge-Based Exhaust Scrubber System (Bonnet)	Equipment	Waterways		Influence		●					
E-OGV3	Increased Shore Power Capability on Vessels	Equipment	Waterways		Concern		●	●				
E-OGV4	Enhanced Ship and Engine Design	Equipment	Waterways		Concern		●	●				
	Harbor Craft											
E-HC1	Provide Harbor Craft Engine Retrofit Incentives	Equipment	Waterways		Influence		●					
E-HC2	Hybrid Harbor Craft Retrofit	Equipment	Waterways		Influence		●					
E-HC3	Plug-in Hybrid Harbor Craft	Equipment	Waterways		Influence		●	●				
E-HC4	Fuel Cell Harbor Craft	Equipment	Waterways		Influence		●	●				
E-HC5	LNG-Powered Tugs	Equipment	Waterways		Influence		●					
E-HC6	Shore Power for Tugs	Equipment	Seaport lands		Influence		●		●			

TABLE C-2. POTENTIAL IMPLEMENTING ACTIONS[1]

No.	Technology or Implementing Action (List from Draft Plan)	Implementing Action Category	Location	Status	Port's Level of Control (Note 1)	Retained?	Associated Strategy or Strategies					
							1	2	3	4	5	6
	Container Handling Equipment											
E-CHE3	Expand Use of Hybrid Cargo-Handling Equipment Where Zero-Emissions Equipment is Not Commercially Available or Affordable	Equipment	Terminals	13 RTG repowers in progress	Influence		●	●	●	●		
E-CHE4	Electrically-Powered Cargo Handling Equipment	Equipment	Terminals		Influence		●	●	●	●		
E-CHE5	Demonstration Testing of Electrically-Powered Cargo-Handling Equipment	Equipment	Terminals		Influence		●	●	●	●		
	Trucks											
E-T1	CTMP Implementation/Clean Truck Program (Related Project, Completed)	Operations	Seaport	On-going	Influence/ Control		●					
E-T2	Truck Emissions Control Equipment Repair Facilities	Equipment	Seaport and West Oakland	Existing	Influence/ Concern		●					
E-T3	Incentives to Upgrade to Zero-Emissions Drayage Trucks	Equipment	Seaport		Influence		●	●				
E-T4	Short-Haul Drayage Truck Demonstration Testing	Equipment	Seaport	In Progress	Influence/ Control		●	●	●			
E-T5	Incentives for Low-NOx Emissions Drayage Trucks	Equipment	Seaport and West Oakland		Control	No						
E-T6	High-Emitting Truck Detection System	Equipment	Seaport		Influence/ Concern		●					
	Locomotives											
E-L1	Switch Locomotive Replacement (Upgrade to Tier 4)	Equipment	Railyards		Influence		●					
E-L2	Support CARB Petition for Tier 5 Line-Haul Locomotives	Equipment	Railyards		Control		●			●		
E-L3	Battery-Electric Switcher Engines	Equipment	Railyards		Concern		●	●				
E-L4	Battery-Electric Locomotive for Hybrid Consist	Equipment	Railyards		Concern		●	●				
E-L5	Request Railroads to Use Cleanest Engines in Oakland	Equipment, Partnership	Railyards		Concern/ Influence		●			●		
	Miscellaneous Equipment											

TABLE C-2. POTENTIAL IMPLEMENTING ACTIONS[1]

No.	Technology or Implementing Action (List from Draft Plan)	Implementing Action Category	Location	Status	Port's Level of Control (Note 1)	Retained?	Associated Strategy or Strategies					
							1	2	3	4	5	6
E-M1	Port Fleet Conversion and Charging Infrastructure	Equipment	Seaport	In progress	Control		●	●	●			
E-M2	Highest Engine Tier Construction Equipment on Port Projects	Operations	Seaport		Control		●					
E-M3	Retrofit Older Construction Equipment with Emissions Control Devices	Operations	Seaport		Influence/ Control		●					
E-M4	Zero-Emissions Loading and Unloading Equipment	Equipment	Warehouses	In planning	Influence		●	●				
	Operations											
O-1	Fixed Asset Energy Efficiency Measures Studies and Implementation	Operations, Infrastructure	Warehouses		Influence		●	●	●			
O-2	Freight Intelligent Transportation System (Related Project)	Equipment, Operations, Infrastructure	Seaport	In progress	Influence/ Control		●		●	●		●
O-3	Overall Seaport Operating Efficiency (Studies and Implementation)	Operations	Warehouses		Influence		●		●			
O-4	Evaluate Vessel Speed Reduction Program	Operations	Waterways		Influence/ Control		●					
O-5	Monitor Shore Power Use	Operations	Waterways/ Terminals	In progress	Control		●					
O-6	Combined Environmental Performance Incentive Program for Shipping Lines	Operations	Waterways		Influence/ Control		●	●				
O-7	Track Other Incentive-Based Programs	Operations, Equipment	Waterways, Seaport	In progress	Control/ Influence		●	●				
	Partnership											
P-1	Track San Pedro Bay Ports' CAAP Progress and Technology Advancement Program	Partnership	NA	In progress	Control				●	●		
P-2	Participate in Trucker Worker Groups	Partnership	NA	In progress	Control					●	●	
P-3	Port Environmental Office Hours for Trucking Companies and Truckers	Partnership	NA	In progress	Control		●	●		●	●	●
P-4	ZANZEFF Grant Partnership with Ports of Long Beach and Stockton	Partnership	NA	In progress	Control			●		●		●
P-5	Meet with Port Tenants	Partnership	NA	In progress	Control		●	●	●	●	●	

TABLE C-2. POTENTIAL IMPLEMENTING ACTIONS[1]

No.	Technology or Implementing Action (List from Draft Plan)	Implementing Action Category	Location	Status	Port's Level of Control (Note 1)	Retained?	Associated Strategy or Strategies					
							1	2	3	4	5	6
P-6	Participate in Industry Stakeholders Groups	Partnership	NA	In progress	Control					●	●	
P-7	Attend Industry Trade Conferences	Partnership	NA	In progress	Control					●		
P-8	Collaborate with Public Agencies	Partnership	NA		Influence					●	●	
P-9	Collaborate with Regulatory Agencies	Partnership	NA		Influence					●	●	
P-10	Outreach Regarding Potentially Applicable Grants and Incentives	Partnership	NA	In progress	Control			●		●	●	●
P-11	Provide Support During Development of Grant Applications	Partnership	NA		Control			●		●		●
P-12	Develop a Workforce Development Program	Partnership	NA	In progress	Control					●	●	
P-13	Partner with other Ports on Grant Applications	Partnership	NA		Influence					●		●
P-14	Advocate for cleaner OGVs and fuels	Partnership	NA	In progress	Control		●			●		
	Stakeholder Engagement											
SE-1	2020 and Beyond Task Force Meetings	Stakeholder Engagement	NA	In progress	Control						●	
SE-2	Community Town Hall Meetings	Stakeholder Engagement	NA		Control						●	
SE-3	Conduct Directed Outreach	Stakeholder Engagement	NA		Control						●	
SE-4	Respond to Comments on the 2020 and Beyond Plan in Writing	Stakeholder Engagement	NA	In progress	Control						●	
SE-5	Outreach to Individuals with Limited English Proficiency	Stakeholder Engagement	NA		Control						●	
	Funding and Grants											
FG-1	Estimate Overall Costs Associated with the 2020 and Beyond Plan	Funding and Grants	NA		Control							●
FG-2	Financing Mechanisms and Sources	Funding and Grants	NA		Control							●
FG-3	Grant and Incentive Funding Program Requirements	Funding and Grants	NA									●
FG-4	Track SPBP Truck Rate Study	Funding and Grants	NA	In progress	Control		●	●				●

TABLE C-2. POTENTIAL IMPLEMENTING ACTIONS[1]												
No.	Technology or Implementing Action (List from Draft Plan)	Implementing Action Category	Location	Status	Port's Level of Control (Note 1)	Retained?	Associated Strategy or Strategies					
							1	2	3	4	5	6
FG-5	Evaluate the Feasibility of Providing Incentives	Funding and Grants	NA		Control		●					●
FG-6	Advocate for New or Expanded State and Federal Grant and Incentive Funding Programs	Funding and Grants	NA		Control							●

ATTACHMENT C-1: POTENTIAL NEW IMPLEMENTING ACTIONS INCLUDED IN BAAQMD COMMENTS ON THE DRAFT SEAPORT AIR QUALITY 2020 AND BEYOND PLAN

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

ALAMEDA COUNTY
Pauline Russo Cutter
Scott Haggerty
Rebecca Kaplan
Nate Miley

CONTRA COSTA COUNTY
John Gioia
David Hudson
(Vice Chair)
Karen Mitchoff
Mark Ross

MARIN COUNTY
Katie Rice
(Secretary)

NAPA COUNTY
Brad Wagenknecht

SAN FRANCISCO COUNTY
Edwin M. Lee
Hillary Ronen
Jeff Sheehy

SAN MATEO COUNTY
David Canepa
Carole Groom
Doug Kim

SANTA CLARA COUNTY
Margaret Abe-Koga
Cindy Chavez
Liz Kniss
(Chair)
Rod G. Sinks

SOLANO COUNTY
Pete Sanchez
James Spering

SONOMA COUNTY
Teresa Barrett
Shirlee Zane

Jack P. Broadbent
EXECUTIVE OFFICER/APCO

Connect with the Bay Area Air District:

November 3, 2017

Joan H. Story
President, Board of Port Commissioners
Port of Oakland
30 Water Street
Oakland, CA 94607

Subject: **Ordinance and Resolution to approve Lease with CenterPoint-Oakland Development I, LLC for a Transload and Distribution Facility on the Former Oakland Army Base**

Dear Ms. Story and Members of the Board of Port Commissioners (Board):

The Bay Area Air Quality Management District (Air District) has reviewed Agenda item 5.1 on your November 9, 2017 meeting and is requesting that the Board:

- Delay approval of any resolution or ordinance on this item until the Port of Oakland (Port) has developed and funded the emission reduction programs (in concert with the City of Oakland (City)) identified by the former Oakland Army Base (OAB) Environmental Impact Report (EIR) Standard Conditions of Approval/Mitigation Monitoring and Reporting Program (SCA/MMRP); and

- Developed criteria via a public process to determine when low emission equipment or strategies are "readily available" or "cost effective."

As currently drafted, Agenda item 5.1 seeks to authorize the Port of Oakland (Port) Executive Director to enter a ground lease with CenterPoint-Oakland Development I, LLC, (the Developer) for the design, construction, finance, operation, and maintenance of a transload and distribution facility (Project). The proposed Project seeks to build a 440,800-square foot facility with approximately 140 dock doors, and parking for 365 autos and 70 trailers for warehouse, storage, other maritime trade and logistics uses. The proposed location is approximately 27 acres at the former Oakland Army Base (OAB) land the Port has named the Seaport Logistics Complex.

As stated in the Board's Agenda Report, this and any project on the former OAB is required to comply with the OAB Environmental Impact Report (EIR) Standard Conditions of Approval/Mitigation Monitoring and Reporting Program (SCA/MMRP). As you may recall, the SCA/MMRP was adopted by the Oakland City Council (City) and the Port to mitigate the significant health and air quality impacts expected to occur in the West Oakland community and impacts to regional air quality resulting from the build out of the OAB. However, many the SCA/MMRPs require the City and the Port to develop emission reduction programs that have not been developed, such as:

- MM 4.4-3a: "The Port shall develop and implement a criteria pollutant reduction program aimed at reducing or off-setting Port-related emissions in West Oakland from its maritime and rail operations to less than significant levels..."

- MM 4.4-4 "The City and the Port shall jointly create, maintain and fund on a fair share basis, a truck diesel emission reduction program. The program shall be sufficiently funded to strive to reduce redevelopment related contributions to local West Oakland diesel emissions to less than significant levels ...."

- MM 4.4-5: "Major developers shall fund on a fair share basis BAAQMD – recommended feasible Transportation Control Measures (TCMs) for reducing vehicle emissions from commercial, institutional, and industrial operations, as well as all CAP [Clean Air Plan] TCMs the BAAQMD has identified as appropriate for local implementation ...."

- MM 4.4-6: "...the City and Port shall implement sustainable development policies and strategies related to new development design and construction..."

- MM 5.4-1: "The City and the Port shall encourage, lobby, and potentially participate in emission reduction demonstration projects that promote technological advances in improving air quality..."

- MM GCC-1: "The project applicant shall retain a qualified air quality consultant to develop a Greenhouse Gas (GHG) Reduction Plan for City review and approval. The applicant shall implement the approved GHG Reduction Plan..."

- Some of the mitigation measures include language that would require emission reduction actions only if low emission equipment or strategies are "readily available" or "cost effective".

To date, neither the City nor the Port has developed or funded the emission reduction programs identified above or developed any criteria to determine when low emission equipment or strategies are "readily available" or "cost effective." The Air District recommends that the Port develop the emission reduction programs and guidance identified above in a forum that seeks public input prior to acting on this Project. The Air District believes that any resolution adopted by the Board relative to this project should include clear language and direction to staff and the proposed tenants/operators that ensures the maximum use of zero and near zero emission equipment at the time of building permit issuance, and requires upgrades into the future as fully zero emissions equipment options become available.

To assist the Board, City and Port in determining what is "readily available" or "cost effective," the Air District has attached its draft "BAAQMD Emissions Reductions Actions for the Port of Oakland/Former Oakland Army Base," (August 2017) document. The Air District is currently finalizing this document in consultation with both Port and City staff and expects some minor changes to it based on those discussions. However, the technology suggestions in this document

have been reviewed by the California Air Resources Board and represent what the Air District believes to be most protective of community health and air quality relative to equipment that is currently and reasonably available.

West Oakland remains the most disproportionately impacted community in the Bay Area due in part to its proximity to the Port. Since 2001, the Air District has invested over 80 million dollars of public funds to reduce diesel particulate matter (DPM) emissions from Port truck, maritime and rail operations and over $50 million to reduce emissions on adjacent highways. In 2018, the Air District projects another approximately $70 million dollars in incentive funds will be available for the purchase of zero and near zero emission equipment and technologies that could be used at the Port and OAB. The Air District stands ready to assist current and prospective tenants/operators at the Port and OAB in taking advantage of these funds.

However, these incentives alone cannot address the air quality related health issues in the West Oakland community. It is important that the Board play a leadership role in reducing the impacts of the Port's operations by directing its staff to honor the spirit and letter of the mitigation measures required in the SCA/MMRP. This includes specifying requirements for zero and near zero equipment and operations as part of new leases and ordinances.

Air District staff is available to assist the Board or Port staff with questions about these comments. If you have any questions, please contact Alison Kirk, Senior Planner, at (415) 749-5169 or akirk@baaqmd.gov.

Sincerely,

Damian Breen
Deputy Air Pollution Control Officer

Attachment: BAAQMD Emissions Reductions Actions for the Port of Oakland/Former Oakland Army Base – Draft Document (August 2017)

cc: BAAQMD Director Pauline Russo Cutter
BAAQMD Director Scott Haggerty
BAAQMD Director Rebecca Kaplan
BAAQMD Director Nate Miley
Cynthia Marvin, California Air Resources Board
Claudia Cappio, City of Oakland
Richard Grow, EPA
Matt Lakin, EPA
Ben Machol, EPA

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

ALAMEDA COUNTY
Pauline Russo Cutter
Scott Haggerty
Rebecca Kaplan
Nate Miley

CONTRA COSTA COUNTY
John Gioia
David Hudson
(Vice Chair)
Karen Mitchoff
Mark Ross

MARIN COUNTY
Katie Rice
(Secretary)

NAPA COUNTY
Brad Wagenknecht

SAN FRANCISCO COUNTY
Edwin M. Lee
Hillary Ronen
Jeff Sheehy

SAN MATEO COUNTY
David Canepa
Carole Groom
Doug Kim

SANTA CLARA COUNTY
Margaret Abe-Koga
Cindy Chavez
Liz Kniss
(Chair)
Rod G. Sinks

SOLANO COUNTY
Pete Sanchez
James Spering

SONOMA COUNTY
Teresa Barrett
Shirlee Zane

Jack P. Broadbent
EXECUTIVE OFFICER/APCO

Connect with the
Bay Area Air District:

November 28, 2017

Joan H. Story
President, Board of Port Commissioners
Port of Oakland
30 Water Street
Oakland, CA 94607

Subject: **November 30, 2017, Port of Oakland (Port) Board of Port Commissioners Meeting Agenda Item 2.9**

Dear Ms. Story and Members of the Board of Port Commissioners (Board):

The Bay Area Air Quality Management District (Air District) is providing you with comments on Agenda Item 2.9, on your November 30, 2017, meeting to:

- Confirm its understanding of the California Environmental Quality Act (CEQA) mitigation commitments made by the Board at your November 11, 2017 meeting; and
- Provide you with the Air District's perspective on emissions and health risk from Port operations.

Background

The Air District submitted a letter on November 3, 2017, and gave testimony at the November 11, 2017 Port Board meeting regarding the Ordinance and Resolution to approve a lease with CenterPoint-Oakland Development, I, LLC for a Transload and Distribution Facility on the former Oakland Army Base (Project) (Agenda Item 5.1). The purpose of that letter and testimony was to request the Board:

- Delay approval of any resolution or ordinance on this item until the Port has developed and funded the emission reduction programs (in concert with the City of Oakland (City)) identified by the former Oakland Army Base (OAB) Environmental Impact Report (EIR) Standard Conditions of Approval/Mitigation Monitoring and Reporting Program (SCA/MMRP); and
- Develop criteria via a public process to determine when low emission equipment or strategies are "readily available" or "cost effective."

Port CEQA Mitigation Commitments

In response to the Air District's letter, staff received a letter from the Port on November 8, 2017. In this letter, the Port commits itself to future actions to meet the CEQA mitigation requirements as follows:

Table 1. Status of Select SCAs/MMRPs

SCA/Mitigation Measure	Schedule	Status
MM 4.4-3a (air emissions reduction program for maritime and rail operations)	Prior to starting operations	Air emissions program previously developed, funded, and under implementation. MAQIP Task Force to be reconvened in late Fall 2017-Winter 2018 to review and consider additional emissions reduction strategies.
MM 4.4-4 (truck diesel emissions reduction program)	Prior to operations	The Maritime Comprehensive Truck Management Program (CTMP.) The CTMP is already developed, funded, and under implementation.
MM 4.4-5 (recommended Transportation Control Measures [TCMs])	Prior to operations	Many individual measures, such as preferential parking for carpools, are responsibility of the developer to implement. CenterPoint lease requires compliance with all applicable MMS and SCAs, including MM 4.4-5, and the Port will coordinate with CenterPoint on incorporating and implementing appropriate TCMs. The Port and the City are jointly evaluating the feasibility and implementation approach for TCMs such as shuttle to and from West Oakland BART station.

Table 1. Status of Select SCAs/MMRPs		
SCA/Mitigation Measure	**Schedule**	**Status**
MM 4.4-6 (energy-conserving new construction)	Prior to issuance of a demolition, grading, or building permit	Measure addresses compliance with Title 24 of the Building Code regarding use of energy-conserving fixtures and designs. In addition, the CenterPoint lease includes specific energy efficiency requirements as well as compliance with LEED 2009 Core and Shell certification requirements (See Exhibit E to Agenda Item 5.1). LEED addresses energy and water efficiency, waste reduction, indoor air quality, materials and resources, and sustainable site management. Energy efficiency and LEED features will be incorporated into building/site design prior to issuance of a grading or building permit; their implementation will be verified during the construction monitoring process.
MM 5.4-1 (encourage, lobby, and potentially participate in emission reduction demonstration projects)	Pre-operations; operations	Since 2002, the Port has participated in emission reduction demonstration projects, some of which provided the foundation for the Port's broader emissions reduction programs. These include the 2007 LNG Trucks (Clean Air Logix), funded through V2K Air Quality Mitigation Program; the 2008 Alternative Shore Power System "Proof of Concept" (with Clean Air Logix); and the current GSC Logistics electric truck pilot. The Port is also working actively with BAAQMD to identify future emission reduction demonstration projects, such as the seven emissions reduction measures the Port proposed to the BAAQMD on October 18, 2017.
SCA GCC-1 (develop a GHG reduction plan)	Prior to approval of PUD	The Port will not have a PUD at the OAB and has interpreted the schedule to require completion of the GHG reduction plan prior to issuance of a building permit. The CenterPoint lease requires compliance with all applicable SCAs and MMs, including SCA GCC-1. A GHG reduction plan will be prepared for review, approval, and implementation for this project.

The letter also states that: ...*"The proposed CenterPoint lease requires the developer to comply with the*... OAB Environmental Impact Report (EIR) Standard Conditions of Approval/Mitigation Monitoring and Reporting Program ...*(SCA/MMRP). After the execution of the lease, the developer must implement applicable measures. Parallel to the ports complying with the SCA/MMRP, the port is working with the BAAQMD to evaluate and identify feasible, readily available, and cost effective strategies, including potential zero and near zero emissions equipment, to further reduce air emissions. It should be noted that the SCA/MMRP do not specifically require zero or near zero emissions equipment, but were developed to provide flexibility to identify and implement the most effective*

measures over time. The Port values public input and will use the reconvened MAQIP Task Force to provide a public forum to review and consider feasible, readily available and cost-effective measures.

The Air District believes that on November 11, 2017 the Board agreed and committed to moving the Project forward in a manner that prevents emission increases and deteriorating air quality for West Oakland residents. The Air District also believes that the West Oakland community's health will be best protected by full and stringent implementation of the SCA/MMRP required by the OAB EIR. The Air District particularly appreciates the Board's direction to staff that they continue to seek industry and community input on preventing emission increases from new development and on reducing emissions from current operations.

It is important for the Board to recognize that the Air District and the California Air Resources Board (ARB) have identified significant numbers of zero and near zero emissions equipment that the Air District believes can be deployed immediately to prevent increases in emissions and health risks in the West Oakland community. The Air District expects that these technologies will be specified by the Port as part of the CEQA mitigation measures required in the lease for operations at the Project and that this technology will also be deployed in the pre-operation phases of the Project. The Air District will monitor these efforts and commits to reporting back to the Board regarding progress on these items.

Emissions and Health Risk

At the November 11, 2017 meeting the Board questioned its staff regarding the Port's contribution to the overall cancer risk in the West Oakland community. At that meeting, Port staff cited the ARB 2008 report, *Diesel Particulate Matter Health Risk Assessment for the West Oakland Community* (2008 Report), which concluded that Port operations contribute 16 percent to the overall cancer risk in West Oakland. However, the report noted that there were significant uncertainties associated with (1) estimates of truck volumes and routes in West Oakland and (2) estimates of the percentage of truck traffic (and therefore emissions and risk) attributable to activity at the Port. The report concluded that the:

"[D]ata limitations may have led to potential overestimate of overall trucking emissions within the modeling domain and a potential underestimate of the overall fraction of trucking emissions that are attributable to the Port of Oakland."

To address this issue, the Air District, Port and local community conducted the *West Oakland Truck Survey* in 2009. This work found that a larger proportion of the truck traffic in West Oakland was attributable to Port operations and concluded **the Port's contribution to the overall cancer risk in the West Oakland community is approximately 29 percent**. The Air District is currently updating its regional Toxic Air Contaminant (TAC) inventory and expects this effort to be completed by mid-year in 2018. However, current projections show that health risk may have increased in the West Oakland Community (see section below on Health Risk versus Emissions) and that the relative contribution of the Port to that risk remains approximately 29%.

Understanding Health Risk Vs Emissions

At the November 11, 2017 Board meeting, Port staff cited its latest 2015 inventory regarding a projected 76% reduction in toxic diesel particulate matter (DPM) versus a 2005 baseline. While the Air District agrees that there have been significant reductions in emissions from Port operations, there are a number of areas where the Port's current inventory either overstates these reductions or fails to capture emissions from Port operations. These are as follows:

- **Truck Emissions:** The current Port inventory claims that emissions have been reduced by 98% from drayage trucks (from 15.9 tons per year of DPM in 2005 to 0.4 tons per year in 2015). However, both the ARB's EMFAC 2014 emissions model and independent work conducted for the Air District and ARB by UC Berkeley show that the emissions are significantly higher than the Port inventory claims. (EMFAC 2014 shows approximately 2.5 tons per year of DPM emissions for the 2015 drayage fleet – **over 6 times higher than the current Port emissions estimate** – and the UC Berkeley study indicates emissions may be even higher than this prediction).

- **Refrigerated Container Units:** ARBs 2015 Technical Assessment: Transport Refrigerators indicates that: *There are approximately 7,800 TRU gensets operating in California at any given time, emitting 322 tons of NOx and 9 tons of PM per year.* ARB has noted in the past that the Air District is subject to approximately 20% of the total emissions for goods movement and there is little doubt that emissions from these TRUs occur within Air District boundaries and at the Port. The Air District is currently working with ARB to quantify these emissions and their significance relative to health risk in the West Oakland community.

This means that while these emissions may have decreased, more work is needed to understand by how much. In addition, the science that surrounds the health risk associated with the remaining emissions has changed significantly. In 2015, the State of California's Office of Environmental Health Hazard Assessment (OEHHA) updated its recommended methodology for determining the health risks from TACs, including diesel particulate matter. These changes show that exposure to diesel particulate matter can increase cancer risk by 2 to 3 times what was previously calculated under the old methodology. As mentioned above, the Air District is currently updating its regional TAC inventory and modeling to reflect these new OEHHA methods. We anticipate that the new methodology will show that despite current emission reductions from sources near and in West Oakland, the health risks remain unacceptably high in West Oakland. In fact, the Air District believes that West Oakland continues to be the community most impacted by toxic diesel particulates in the Bay Area due in part to its proximity to the Port.

Conclusion

Considering this health risk, the Air District is particularly concerned and reiterates that no additional significant pollution burden should be imposed on the West Oakland community as part of the redevelopment of the former OAB. The Air District stands ready to assist the Port with additional guidance on determining what technology is readily available and cost effective for new development.

Additionally, in 2018, the Air District projects that approximately $70 million dollars in incentive funds will be available for the purchase of zero and near zero emissions equipment and technology that could be used at the Port to further reduce emissions from current operations. We look forward to working with Port tenants and operators who wish to use these funds to implement these new zero and near zero technologies and equipment.

Air District staff is available to assist the Board or Port staff with questions about these comments. If you have any questions, please contact Alison Kirk, Senior Planner, at (415) 749-5169 or akirk@baaqmd.gov.

Sincerely,

Damian Breen
Deputy Air Pollution Control Officer

cc: BAAQMD Director Pauline Russo Cutter
BAAQMD Director Scott Haggerty
BAAQMD Director Rebecca Kaplan
BAAQMD Director Nate Miley
Cynthia Marvin, California Air Resources Board
Claudia Cappio, City of Oakland
Richard Grow, U.S. EPA
Matt Lakin, U.S. EPA
Ben Machol, U.S. EPA

Oakland Seaport Facilities

Siting or expanding seaport facilities, in, or near, communities already highly impacted by diesel pollution, carries a responsibility to build and operate a state-of-the-art facility with emissions as close to zero as technologically possible. Future port projects should include emerging zero emission technology for the trucks, locomotives, ship, tug boats, transport refrigeration units and support equipment that may serve, or operate, at ports. The City of Oakland (City) and Port of Oakland (Port) should take advantage of the planned construction and operational expansion to introduce changes that will lay the foundation for this technology and reduce regional emissions, minimize criteria pollutants and toxic air contaminants as well as the localized health risk from the Port's current and future operations. All projects should require the use of the cleanest technologies, support and encourage the development and demonstration of advanced technologies, with the ultimate goal of requiring the use of zero and near-zero emission technologies as soon as they are available. This requirement for the cleanest equipment is consistent with the City and the Port commitments made in the 2010 document, *A Bold Vision: Redeveloping the Former Oakland Army Base* ("*A Bold Vision*") and the 2009 *Maritime Air Quality Improvement Plan* (MAQIP).

The following actions need to be taken to ensure that Port operations or construction activities do not increase cumulative air quality impacts now or in the future.

1. Port-Wide Actions

    1.1. Require that all tenants and onsite construction contractors comply with and monitor compliance with all applicable air quality regulations for heavy duty-diesel trucks, including the Air Resources Board's (ARB) Tractor-Trailer Greenhouse Gas Reduction Regulation, Period Smoke Inspection Program, Off-Road Regulation, and Statewide Truck and Bus Regulation. To document compliance, require that fleets provide ARB Certificates of Compliance for the equipment regulations and copies of annual smoke test results.

    1.2. Incorporate contractual language into tenant lease agreements to ensure that tenants comply with all applicable air quality regulations, are using the cleanest technologies for their equipment (in both construction and operations) and understand their responsibilities of building and maintaining a green facility as well as compliance with diesel regulations.

    1.3. Require that the cleanest possible construction practices and equipment are utilized. This should include eliminating idling of diesel powered equipment, requiring the use of zero and near-zero emission equipment and tools to the greatest extent feasible, and providing the necessary infrastructure, like electric hookups, to support that equipment.

    1.4. Implement and plan accordingly for the necessary infrastructure to support zero emission and near-zero emission technology vehicles and equipment at

the Port. This includes physical, energy, and fueling infrastructure for construction equipment, on-site vehicles, and equipment, and medium-heavy and heavy-heavy duty trucks. ARB's Technology and Fuels Assessments provide information on the current and projected development of mobile source technologies and fuels, including current and anticipated costs at widespread deployment. The assessments can be found at http://www.arb.ca.gov/msprog/tech/tech.htm.

At a minimum, both the Port and City should adopt targets for electric raceway circuit installation as part of initial facility construction. This will ensure sufficient electrical power is available for EV charging at sites under development and minimizes future costs to install infrastructure for zero and near zero emissions vehicles.

1.5. Develop a Sustainable Leasing Program whereby the Port and City shall work with tenants to develop and implement a policy incentive-based sustainable leasing program to attract the cleanest ships, ships that utilize shore power, zero and near-zero technologies, and otherwise incorporate technological and operational practices that reduce freight related emissions.

1.6. Require tenants to use cleaner technologies over time as they become available and feasible. This can be accomplished by requiring tenants to develop an annual Technology Review Program to identify any new emissions-reduction technologies that may reduce emissions at the Port, including the feasibility of zero and near-zero emissions technologies for heavy-duty trucks, yard equipment, tugs, vessels, and bulk handling equipment. If the technology review demonstrates the new technology will be effective in reducing emissions and the Port or City determines that installation or use of the technology is feasible, the tenant shall implement such technology within 12 months of the Port or City's determination (see Appendix A for examples of possible Technology Review Program projects).

1.7. Ensure existing and future tenants are compliant now and in the future with ARB's Transport Refrigeration Regulation. If not already implemented, incorporate operating practices that eliminate the amount of time that a transport refrigeration system powered by a fossil-fueled internal combustion engine can operate utilizing the combustion system at the Port. Furthermore, plan and design cold storage facilities that incorporate zero emission all-electric plug-in transport refrigeration systems, hydrogen fuel cell transport refrigeration, and cryogenic transport refrigeration sufficient to meet Port growth.

1.8. Require the use of cargo handling equipment (CHE), including yard trucks, handlers, gantry cranes, fork lifts, that is the cleanest available technology (LPG/LNG, renewable diesel, electric, hydrogen, electric hybrid) and use zero and near- zero emission technology for equipment that is commercially

available now and in the future, as more zero-emission equipment becomes commercially available, as committed to in *A Bold Vision*. ARB's Technology Assessment: Mobile Cargo Handling Equipment, provides information on current and projected development of CHE, including current and anticipated costs at widespread development. This assessment can be found at https://www.arb.ca.gov/msprog/tech/techreport/che_tech_report.pdf. Additionally, tenants should be required to demonstrate how their yard lay out maximizes their ability to use zero emissions equipment such as electric rail mounted gantry cranes.

1.9. Require the use of commercial harbor craft (CHC) technologies that exceed the Tier 2 or 3 requirements of CARB's CHC Regulation. There are some zero and near- zero emissions technology for equipment that is commercially available now, and additional projects are underway demonstrating the capability of CHC to achieve emission lower than Tier 4 marine and off-road emission standards. Some of these solutions may require retrofit with aftermarket emission control devices. ARB's Technology Assessment: Commercial Harbor Craft, provides information on current and projected development of CHC, including current and anticipated costs at widespread development. This assessment can be found at https://www.arb.ca.gov/msprog/tech/techreport/draft_chc_technology_assessment.pdf.

1.10. Require that all medium-heavy and heavy-heavy duty on-road and yard trucks, including any alternative fuel vehicles, meet or exceed the 2010 emission standards. Support the deployment of zero and near-zero technologies including utilizing zero emission (such as battery electric or fuel cell electric) forklifts, electrified rail mounted gantry cranes, and battery electric and hybrid electric medium-duty trucks to the fullest extent feasible. At a minimum, all forklifts should be required to meet a zero emission standard. As it becomes available, require that medium-heavy and heavy-heavy duty trucks traveling within 100 miles of the site use zero and near-zero technology and require that yard trucks with similar duty cycles (less than hundred miles daily) convert to zero and near-zero technology. ARB's Technology and Fuels Assessments provide information on the current and projected development of mobile source technologies and fuels, including current and anticipated costs at widespread deployment. The assessments can be found at http://www.arb.ca.gov/msprog/tech/tech.htm.

1.11. During all construction activities, require that off-road construction equipment meet Tier 4 engine standards, if not available, require equipment that meets Tier 3 engine standards. Tenants shall keep a list of available equipment and submit to the Port or City upon request.

1.12. Require that all on-site service vehicles, light-duty vehicles and equipment (operational and during construction activities), and property maintenance

equipment use zero emission technology and, if zero-emission technology is unavailable, that all vehicles and equipment meet the cleanest applicable emission standard.

1.13. Require that all projects include a robust traffic plan that moves truck traffic away from residents reducing truck traffic in neighborhoods, reduces and enforces truck speeds to reduce exposure to noise and increase safety, and discourages new development near truck routes. Coordinate and consult with the West Oakland community on site-wide truck traffic circulation.

1.14. Properly integrate truck parking, terminal parking, security systems, electronic gates systems, and other freight transport infrastructure to maximize achievable efficiencies.

1.15. Require future project design plans include operational support to demonstrate and deploy zero and near-zero emission freight equipment.

1.16. Require ships that enter the Port area pay emissions-based berthing fees or other user fees. The fees shall be used to reduce emissions and exposure in West Oakland.

1.17. Require that ocean-going vessels comply with fuel requirements for both the California Ocean-Going Vessel Regulation and the North American Emission Control Area Requirements.

1.18. Provide support (logistical and financial) for demonstration projects to encourage the use of alternative and/or advanced technologies. ARB's Technology and Fuels Assessments provide information on the current and projected development of mobile source and port equipment technologies and fuels, including current and anticipated costs at widespread deployment. The assessments can be found at http://www.arb.ca.gov/msprog/tech/tech.htm.

1.19. Utilize concepts to enhance community engagement as outlined in the U.S. Environmental Protection Agency Draft Environmental Justice Primer for Ports, "The Good Neighbor Guide to Building Partnerships and Social Equity" released in July 2016. This document provides a road map to assess current community engagement and outlines strategies to assist the City and the Port to enhance neighboring community relationships. The document can be found at https://www.epa.gov/ports-initiative/draft-environmental-justice-primer-ports

1.20. Utilize grant funding from Federal, State and local programs to reduce air pollution emissions and health risk from diesel exhaust. Incorporate a collaborative process between tenants and the Port and/or the City to apply for funding to support zero-emission freight related diesel equipment technologies.

1.21. Require that all recycling facilities and metal melting facilities that include re-

melting furnaces for the melting of alloys, within the Port, the OAB project area, and within 1,000 feet of the West Oakland community meet the best available control technology (BACT) standards as defined by the BAAQMD.

2. Former OAB – Both City of Oakland and Port Owned Areas

Below are measures that will help the City and Port meet the requirements of the Oakland Army Base 2013 Standard Conditions of Approval and Mitigation Monitoring and Reporting Program (SCA/MM). *Note:* the City and Port must reduce emissions at the OAB property *beyond* what is required by CARB regulations to meet the requirements of the SCA/MM. These measures also are consistent with measures in the *Maritime Air Quality Improvement Plan* (MAQIP), A Bold Vision, the City of Oakland's Standard Condition of Approval, and air quality mitigation measures in the Environmental Impact Report for 2013 *Plan Bay Area*. When measures are adapted from specific sources, these sources are noted in parenthesis.

The City and Port shall implement all measures listed under Item 1 Port-Wide Activities as applicable, and in addition shall implement the following measures:

2.1. All trucks shall be prohibited from idling more than two minutes when loading and unloading, staging or when not in active use for extended periods of time. Exemptions from the two-minute idling rule would be allowed when required for safety or when equipment is in use. (Plan Bay Area)

2.2. An appointment/ITS system shall be implemented that minimizes truck idling and queuing for the movement of containers.

2.3. Prior to implementation of zero-emission harbor craft described in Item 1.9 above:

2.3.1. Prior to 2023, all CHC accessing the new OAB port facilities will meet USEPA Tier 4 standards (or cleaner) for both propulsion and auxiliary engines, or zero emissions technologies such as: batteries, shorepower, or hydrogen fuel cell.

2.3.2. NOx emissions can be controlled with selective catalytic reduction systems. For example, implement emission reduction control measures to replace tugboat engines with low NOx technology (for example, through the expansion of the existing cargo handling equipment re-powering and retrofitting program, part of the Berths 55-58 Project air quality mitigation program).

2.4. All the mobile cargo handling equipment will be electric equipment. (MAQIP) The Air District suggest this be broadened to allow for other zero emissions fuels

(Hydrogen) and for near zero emissions equipment in the event that full zero emissions equipment in not commercially available.

2.5. Buildings shall meet LEED Platinum certification standards. All buildings shall provide sources of energy. Solar, wind, mechanical, tidal or solar generated hydrogen systems will be investigated to determine their feasibility.

2.6. The developer shall be required to plant trees and/or vegetation throughout the OAB. Trees that are best suited to trapping PM shall be planted, including one or more of the following: Pine (Pinus nigra var. maritima), Cypress (X Cupressocyparis leylandii), Hybrid popular (Populus deltoids X trichocarpa), and Redwoods (Sequoia sempervirens). (Plan Bay Area)

2.8. All existing land uses serving sensitive receptors within 1,000 feet of the Project boundaries shall be equipped with HEPA air filtration systems rated MERV 13 or better. The Port and City will establish a fund and contribute on a fair share basis to the cost of installing and maintaining the MERV 13 systems and provide educational materials to owners and occupants explaining how to maximize the benefits of these systems.

2.9. Consistent with SCA/MM 4.4-5, when redevelopment activity generates more than 20,000 square feet of employment-generating land uses, or generates 100 or more local jobs, the City, Port and developers will fund on a fair share basis Transportation Control Measures (TCMs) for reducing vehicle emissions from commercial, institutional, and industrial operations. See SCA/MM 4.4-5 for a full list of TCMS and include the following:

2.10. Commute Benefits Program

2.10.1 To design and implement a Commute Benefits Program, the City, Port, and private developers need to form a committee and assign a representative to the committee. Committee representatives will include two West Oakland community members, an employee representative, and a representative from the Port and from the City. (Note that all employers with 50 or more full-time employees in the Bay Area are subject to the Bay Area Commuter Benefits Program [BAAQMD regulation 14, Rule 1]. For more information, please see https://commuterbenefits.511.org)

2.10.2 Design and locate buildings to facilitate transit access, e.g., locate building entrances near transit stops, and eliminate building setbacks. Construct transit facilities such as bus turnouts/bus bulbs, benches, shelters, and improving transit bus service to the area. Provide on-site services, such as cafeterias, banks, dry cleaners, and convenience market so that employees can walk to these services. Include bicycle and pedestrian facilities in the design.

2.10.3 Transit, Bicycle and Pedestrian Access: Include sidewalks, multi-use paths and bike lanes in the project design. Provide secure, weather-protected bicycle parking for employees, Provide showers and lockers for employees bicycling or walking to work. Provide safe, direct access for bicyclists to adjacent bicycle routes. Provide direct, safe, attractive pedestrian access from project to transit stops and adjacent development.

2.10.4 Mange Travel Demand and Provide Transit Service: Encourage OAB tenants to use carpools, vanpools, and public transit by providing incentives. Provide a shuttle to and from the West Oakland BART station. Establish mid-day shuttle service for worksite to food service establishments/commercial areas. Provide preferential parking for carpool and vanpool vehicles. Implement parking fees for single occupancy vehicle commuters.

2.11. New Stationary Sources

2.11.1 On the OAB property, new stationary sources that are added as part of the project must reduce emissions beyond what is required by CARB and BAAQMD, whenever possible. For example, the cleanest available stand-by diesel generators and portable generators will be required. The City and Port shall fund this on a fair share basis.

3. Former OAB -City of Oakland Owned Areas

West Gateway Bulk Terminal (Marine Terminal and Rail Expansion)

3.1. Implement all applicable site-wide actions based on specific operations in this subject area.

3.2. Specify the public review release date and expected content for each of the remaining Subject Plans for this project, subject to Mitigation Measure PO-1 (Stakeholder Review of Air Quality and Trucking Plans). It is expected that the remaining Subject Plans will be released in a timeframe that will allow for meaningful public review and response by the City of Oakland, or project developer, prior to when they are scheduled according to the approved SCA/MM. The list of Subject Plans can be found on page 46 in SCA/MM at http://www2.oaklandnet.com/oakca1/groups/ceda/documents/report/oak042281.pdf

3.3. Require that berths providing shore power now or in the future, can accommodate changes to vessel sizes and various berthing configurations. The ARB At-Berth Regulation currently requires 80% compliance of ocean going vessels by 2020. Vessel operations should meet 100 percent shore power compliance rate for all vessels or incorporate other technologies, such as emissions capture and control systems, to maximize emission reductions from

all vessels in advance of the regulation. ARB's Sustainable Freight: Pathways to Zero and Near-Zero Emissions Discussion Document has identified the development and proposal of amendments to the At-Berth that could expand the regulation to include smaller fleets and/or additional vessel types to the current At Berth Regulation. Additionally, hybrid technologies have shown success at achieving emission reductions in certain tugs based on duty, engine size, and location and should be incorporated into operations, where possible.

Accelerate the turnover of line-haul locomotives servicing the Port to Tier 4 line-haul, ARB proposed Tier 5, or Zero emissions locomotives as expeditiously as possible, with the goal of 95 percent of operations to be performed at a minimum Tier 4 standard by 2023. In addition establish standards that require:

3.4.1. All diesel switch engines to have 15-minute idling limit devices installed and operational; and to use emulsified fuels or other equivalently clean alternative diesel fuel.

3.4.2. No non-essential idling. Class 1 helper locomotives will be turned off while on OAB properties. If, for safety reasons, helper locomotives need to be on then they will meet similar control requirements as line haul locomotives.

3.4. The Port, Union Pacific (UP) Railway, and/or BNSF Railway should commit to providing co-funding, facility access, and operational support for the development and demonstration of interstate line-haul locomotive technology with zero-emission capability. This would include, but is not limited to, a hybrid-electric locomotive with all electric capability. ARB's Technology Assessment: Freight Locomotives, provides information on current and projected development of freight locomotives, including current and anticipated costs at widespread development. This assessment can be found at https://www.arb.ca.gov/msprog/tech/techreport/freight_locomotives_tech_report.pdf

3.5. Incorporate conditions into lease agreements with BNSF and/or UP to ensure that switch locomotives meet a minimum Tier 4 emissions level by 2023.

3.6. Phase in the replacement of diesel powered switcher locomotives with electric rail car movers, within the Port or City owned rail properties.

Prologis East and Central Gateway (Ambient Transload/Warehouse/Truck Services)

3.7. Implement all applicable site-wide actions based on specific operations in this subject area.

North Gateway (Recycling and Rail Right Of Way Expansion)

3.8. Implement all applicable site-wide actions based on specific operations in this subject area.

4. Former OAB Port of Oakland Owned Areas

Central Gateway (Ambient Transload/Warehouse/Rail Yard /Port Logistics/Warfs)

4.1. Implement all applicable site-wide actions based on specific operations in this subject area.

4.2. Specify the public review release date and expected content for each of the remaining Subject Plans for this project, subject to Mitigation Measure PO-1 (Stakeholder Review of Air Quality and Trucking Plans). It is expected that the remaining Subject Plans will be released in a timeframe that will allow for meaningful public review and response by the City of Oakland, or project developer, prior to when they are scheduled per the SCA/MM. The list of Subject Plans can be found on page 46 in SCA/MM at http://www2.oaklandnet.com/oakca1/groups/ceda/documents/report/oak042281.pdf.

5. Port of Oakland (Non-Former OAB Areas)

Cool Ports Oakland, LLC (Temperature Controlled Transload/Warehouse/Rail Expansion)

5.1. Implement all applicable site-wide actions based on specific operations in this subject area.

5.2. Ensure existing and future tenants are compliant now and in the future with ARB's Transport Refrigeration Regulation. Incorporate operating practices that eliminate the amount of time that a transport refrigeration system powered by a fossil-fueled internal combustion engine can operate utilizing the combustion system while at the Port. Require the use of zero emission all-electric plug-in transport refrigeration systems and ensure the design plan includes the necessary infrastructure. ARB's Technology Assessment: Transport Refrigerators, provides information on the current and projected development for transport refrigerators, including current and anticipated costs at widespread deployment. This assessment can be found at https://www.arb.ca.gov/msprog/tech/techreport/tru_07292015.pdf.

5.3. Accelerate the turnover of line-haul locomotives servicing the Port to Tier 4, ARB proposed Tier 5, or Zero emissions locomotives as expeditiously as possible, with the goal of 95 percent of operations to be performed at a minimum Tier 4 standard by 2023. Furthermore, the Port, Union Pacific (UP) Railway, and/or BNSF Railway should commit to providing co-funding, facility access, and operational support for the development and demonstration of

interstate line-haul locomotive technology with zero-emission capability. This would include, but is not limited to, a hybrid-electric locomotive with all electric capability. ARB's Technology Assessment: Freight Locomotives, provides information on current and projected development of freight locomotives, including current and anticipated costs at widespread development. This assessment can be found at https://www.arb.ca.gov/msprog/tech/techreport/freight_locomotives_tech_report.pdf.

5.4. Incorporate conditions into lease agreements with BNSF and/or UP to ensure that switch locomotives meet a minimum Tier 4 emissions level by 2023.

5.5. Phase in the replacement of diesel powered switcher locomotives with electric rail car movers, within the Port or City owned rail properties.

5.6. Plan and design for the necessary infrastructure to ensure 100 percent, plug-in equipped, to accommodate future growth volumes of TRU's or expansion of this area.

5.7. Implement a policy that limits the amount of time that a transport refrigeration system powered by a fossil-fueled internal combustion engine can operate utilizing the combustion system while on Site.

5.8. Encourage the use of zero emission all-electric plug-in refrigeration systems, hydrogen fuel cell and cryogenic transport refrigeration systems.

5.9.

Port Terminal/Maritime Operations (Inner, Middle, Outer Harbors, and Seventh Street)

5.10. Implement all applicable site-wide actions based on specific operations in this subject area.

5.11. Accelerate the turnover of line-haul locomotives servicing the Port to Tier 4, ARB proposed Tier 5, or Zero emissions locomotives as expeditiously as possible, with the goal of 95 percent of operations to be performed at a minimum Tier 4 standard by 2023. Furthermore, the Port, Union Pacific (UP) Railway, and/or BNSF Railway should commit to providing co-funding, facility access, and operational support for the development and demonstration of interstate line-haul locomotive technology with zero-emission capability. This would include, but is not limited to, a hybrid-electric locomotive with all electric capability. Incorporate conditions into lease agreements with BNSF and/or UP to ensure that switch locomotives meet a minimum Tier 4 emissions level by 2023.ARB's Technology Assessment: Freight Locomotives, provides information on current and projected development of freight locomotives, including current and anticipated costs at widespread development. This

assessment can be found at https://www.arb.ca.gov/msprog/tech/techreport/freight_locomotives_tech_report.pdf.

5.12. Phase in the replacement of diesel powered switcher locomotives with electric rail car movers, within the Port or City owned rail properties.

5.13. Require that berths providing shore power now or in the future, can accommodate changes to vessel sizes and various berthing configurations. The ARB At-Berth Regulation currently requires 80% compliance of ocean going vessels by 2020. Vessel operations should meet 100 percent shore power compliance rate for all vessels or incorporate other technologies, such as emissions capture and control systems, to maximize emission reductions from all vessels in advance of the regulation. ARB's Sustainable Freight: Pathways to Zero and Near-Zero Emissions Discussion Document has identified the development and proposal of amendments to the At-Berth that could expand the regulation to include smaller fleets and/or additional vessel types to the current At Berth Regulation. Additionally, hybrid technologies have shown success at achieving emission reductions in certain tugs based on duty, engine size, and location and should be incorporated into operations, where possible.

Appendix A

Technology Review Program

Development of a Technology Review Program is consistent with the requirements of Mitigation Measures in the Oakland Army Base 2013 Standard Conditions of Approval and Mitigation Monitoring and Reporting (SCA/MM) Program. Below are recommended Technology Review Programs that can be implemented to reach the goals of the SCA/MM.

In consultation with regional agencies and stakeholders, the City and Port shall implement Technology Review Programs, such as:

- The City and Port should administer a minimum of a one year demonstration project, prior to 2020, of zero and near-zero emission truck technology. This demonstration project shall be conducted in cooperation with regional and state agencies and stakeholders.

- Research and funds shall be used to identify and test hybrid diesel electric locomotives and conduct a demonstration of locomotive DOC or DPF retrofits.

- Feasibility studies of electrification of freight/passenger rail from Port intermodal yards to the Bay Area Air Quality Management District's boundaries conducted in conjunction with the Metropolitan Transportation

Commission, Capital Corridor JPA, Union Pacific, and Burlington Northern Santa Fe railroads.

- Investigation of renewable energy generation via mechanical systems that utilize truck weight to generate electricity.

- Study of a "virtual container yard" system that integrates truck movements with container moves to minimize emissions and maximize efficient use of trucking fleets.

Example TAP Studies

As a possible framework for the Technology Review Program, consider the work of the San Pedro Ports Technology Advancement Program (TAP). TAP is a joint program of the Ports of Long Beach and Los Angeles through the Ports' joint Clean Air Action Plan (CAAP) adopted in 2006. The CAAP guides the Ports in their commitment to reduce the health risks and air emissions associated with port-related operations, while allowing port development and growth to continue. The CAAP focuses on near-term strategies, targeting significant reductions in diesel PM, nitrogen oxides (NOx), and sulfur oxides (SOx). The following is a selected list of demonstration projects completed through the TAP program:

- Balqon E-30 Electric Terminal Tractor Development and Demonstration Project

This vehicle was built as a demonstration vehicle and designed specifically for drayage operations. The prototype E-30 all-electric terminal tractor successfully completed cargo terminal tests in 2008.

Following the completion of cargo terminal tests during 2008, the Los Angeles Harbor Commission approved the purchase of 20 electric trucks from the manufacturer as part of the "Green Terminal" program. The Green Terminal program will also include the production of five on-road electric trucks.

This demonstration project was followed with a project to evaluate and demonstrate a lithium-ion battery as a technological upgrade to the lead-acid battery pack used in the previous TAP demonstration. The advanced technology lithium-ion batteries were anticipated to provide more than double the vehicle range, without adding additional weight. A one-day demonstration of the Nautilus E30 confirmed a range of over 150 miles on a single charge with unloaded conditions at 80% depth of discharge. However, this project was never completed.

- Capacity Plug-In Hybrid Electric Terminal Tractor (2010)

The TAP program conducted a three-week trial of a diesel-electric plug-in hybrid terminal tractor that uses a small diesel generator and a large lead-acid battery pack to provide power for vehicle operation. While this demonstration showed a 44

percent reduction in NOx emissions and a 56 percent reduction in PM emissions, compared to 2009 diesel yard tractors, the demonstration utilized a Tier 4-interim generator drive engine, and therefore does not meet CARB's Cargo Handling Equipment regulation of Tier 4 engines.

- Hybrid Yard Tractor Development & Demonstration (2010)

This TAP study investigated the feasibility and commercial viability of using advanced technology drive systems in cargo handling equipment. The three hybrid yard hostlers underwent six months of operation and in-use testing and could perform all the tasks required of yard hostlers in real-world port operations, and were well accepted by drivers and maintenance staff. Fuel economy and emissions benefits were evaluated, but a difference discovered in the mechanical specifications of the vehicles limited comparability. Based on all the evaluations and analyses conducted, the hybrid system is estimated to provide a 12 percent to 18 percent improvement in fuel economy. Further development of the hybrid system is underway to improve fuel economy and emissions reductions. A follow-up study was conducted entitled "Hybrid Yard Tractor Development and Demonstration – Beta Test".

- Alternative Petroleum Technologies (APT) Emulsified Biodiesel Fuel Demonstration (2011)

To demonstrate the viability and effectiveness of the emulsified biodiesel fuel in cargo handling equipment, APT performed a two-phased demonstration that consisted of an evaluation of the emulsified fuel with and without a diesel oxidation catalyst (DOC) in a laboratory setting and a real-time demonstration of the fuel in yard equipment at a port terminal.

The demonstration successfully proved that APT's emulsified B-20 blend mitigated an increase in NOx emissions, while also providing additional reductions in PM when coupled with a verified diesel emissions control system. This provides port drayage operators an alternative fuel selection for their existing fleet of container yard equipment.

As of April 2014, APT planned to pursue CARB verification of the emulsified biodiesel fuel for sale to existing cargo handling equipment fleet operations in the State.

- Liquefied Natural Gas Yard Tractor Demonstration (2007)

This Project was designed to develop, test and design a business case for LNG yard tractors. Phase 1 focused on development of LNG yard tractor specifications, procurement, and installation of temporary LNG refueling. Phase 2 included operation of the LNG yard tractors at a marine terminal for a period of eight months. Phase 3 of the project was the development of a business case assessment to

determine the cost effectiveness and return on investment of using LNG equipment as opposed to diesel.

During emissions testing, the LNG yard tractor produced lower PM emissions than on-road diesel engine equipped with a diesel oxidation catalyst and closed crankcase ventilation system. However, NOx emissions from the LNG yard tractor were approximately 21 percent higher than NOx emissions from this same on-road diesel engine configuration.

- ACTI Advanced Maritime Emission Control System (AMECS) Project (2008)

ACTI developed the AMECS as an alternative pollution control method for ocean-going vessels that are not configured to use shore power, also known as “cold ironing”, while at berth. The goal was to demonstrate pollution reduction efficiencies equal to cold ironing for nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter (PM). The AMECS was demonstrated at Metropolitan Stevedore/Port of Long Beach on multiple vessels with varying exhaust stack configurations. During the demonstration period, two full-scale emission reduction efficiency tests were conducted, the results of which were independently verified by two testing laboratories. During emissions testing, NOx and PM emissions were reduced by 99 percent and 95.5 percent, respectively. In addition, sulfur oxides (SOx) were reduced by 99 percent, and volatile organic compound (VOC) emissions were reduced by greater than 97 percent. Further demonstration of this technology is necessary to determine how it functions in day-to-day operations, including evaluation of costs, durability, integration into operations.

- APL Singapore Slide Valve & Water-In-Fuel (WiFE) Emulsion Demonstration Program (2009)

Two emission control technologies were demonstrated - the use of slide valves in the vessel’s main engines, and water-emulsified bunker fuel using an innovative onboard water in fuel emulsifier. The primary objectives of the demonstration projects were to a) evaluate the particulate matter (PM) emission reduction effectiveness of retrofitting OGV main engines with an improved injector design known as a slide valve; and b) demonstrate demand-based onboard water in fuel emulsification system and measure the NOx reduction effectiveness of varying the water content.

Project test conditions resulted in an evaluation that indicated the benefits of slide valves appear to be limited. Testing of the WiFE system aboard the APL Singapore showed water concentrations as high as 48 percent were successfully demonstrated, yielding NOx reductions on the order of 30 percent. A further study was completed in 2012.

- Bluefield Holdings Krystallon Ocean Going Vessel Scrubber (2013)

The primary focus of this project was to demonstrate the reduction of emissions of sulfur oxides (SOx) from an Ocean Going Vessel using an exhaust gas cleaning device to meet the International Maritime Organization (IMO) fuel sulfur limits in Emission Control Areas (ECA) and further to reduce particulate matter (PM), and volatile organic compound (VOC) emissions. This project demonstrated the potential for PM and SOx reductions that can be achieved through OGV retrofit using commercially available scrubbing technology. Additional research is needed further evaluate the potential for OGV engine emission reductions from scrubbers on main engines to comply with IMO ECA regulations.

- Foss Maritime Green Assist™ Hybrid Tugboat (2010)

Foss Maritime developed this diesel electric hybrid tugboat and named it the *Carolyn Dorothy*. The *Carolyn Dorothy* became a full working member of the Foss Maritime tug fleet on March 1, 2009. Since this time, the hybrid tug demonstrated performance comparable to a conventional Dolphin Class tugboat. The hybrid tugboat achieved emission reductions that exceed original targets (to reduce both NOx and PM by approximately 44 percent) when compared with the Dolphin tugs currently operating in the San Pedro Bay. The *Carolyn Dorothy* reduced PM, NOx and CO2 emissions by 73 percent, 51 percent and 27 percent, respectively. Based on this evaluation, there is evidence that this technology reduces fuel consumption by approximately 20 to 30 percent.

- OGV Slide Valve Low-Load Emissions Evaluation (2013)

This project is a follow up to the 2008 demonstration of a slide-type fuel values, and sought to test a new type of OGV main engine fuel valve (SV C36) designed to improve combustion properties by eliminating sac volume (i.e., fuel drips) at the valve nozzle. The elimination of the sac volume results in lower fuel oil consumption. In addition, slide valve nozzles incorporate an optimized spray pattern designed to improve the combustion process - this is intended to reduce overall emissions, including hydrocarbon, NOx and particulate matter. The visible smoke level is also greatly reduced because of the improved combustion. Among other findings, results showed that SV C26 nozzles did emit less diesel particulate matter (DPM) at low loads compared to the two conventional fuel valve configurations. At low loads, SV emits up to 50 percent less DPM than conventional C3 and C11 fuel valves and up to 65 percent less DPM for cylinder-lubrication-corrected particulate-emission results. Overall, SV C26 nozzles emit over 90 percent less total hydrocarbons compared to the two conventional fuel valve configurations.

California Energy Commission Projects

In addition to the emissions reduction studies that are being undertaken as part of the TAP, the California Energy Commission (Energy Commission) released a Grant Solicitation for “Sustainable Freight Transportation Projects” under the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP). This grant

solicitation funded projects that demonstrate medium- and/or heavy-duty advanced vehicle technologies at California seaports. The three projects selected as part of this solicitation propose to demonstrate:

- 9 zero emissions rubber tired gantry cranes
- 15 battery electric yard tractor's
- 7 natural gas hybrid electric trucks
- 3 zero emissions top handlers
- 20 near zero natural gas trucks

Results of these demonstrations should inform the Technology Review Program established as part of the Oakland Army Base 2013 SCA/MM Program.

ATTACHMENT C-2: POTENTIAL NEW IMPLEMENTING ACTIONS INCLUDED IN EARTHJUSTICE (WEST OAKLAND ENVIRONMENTAL INDICATORS PROJECT) COMMENTS ON THE DRAFT SEAPORT AIR QUALITY 2020 AND BEYOND PLAN

EARTHJUSTICE

December 8, 2017

VIA ELECTRONIC MAIL to ryan.fitzpatrick@dot.gov and farrell.ericka@epa.gov

Ryan Fitzpatrick
Departmental Office of Civil Rights
U.S. Department of Transportation
1200 New Jersey Avenue, S.E.
Washington, D.C. 20590

Ericka Farrell
External Civil Rights Compliance Office
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Re: Investigation of West Oakland Title VI Administrative Complaint (DOT# 2017-0093, EPA File Nos. 13R-17-R9 (City of Oakland) and 14R-17-R9 (Board of Port Commissioners and Port of Oakland).

Dear Mr. Fitzpatrick and Ms. Farrell:

On our last call, your agencies invited Complainants, West Oakland Environmental Indicators Project, to offer ideas on the types of actions that the City and Port of Oakland should be taking to address the disproportionate impacts suffered by the community of West Oakland as a result of the City and Port's discriminatory development actions. We have taken that invitation seriously and compiled a list of recommended actions that must be taken to end these discriminatory practices and address the harms that have resulted. This list was compiled from actions being taken in other port communities, recommendations and actions by local and state agencies, and the community's own experience with the decisionmaking process in Oakland.

The attached list organizes these recommendations under three broad goals: (1) moving freight sources to zero-emission technologies; (2) addressing the current freight-related impacts in the West Oakland community; and (3) creating a meaningful process for community engagement in future decisionmaking. Below we have organized this list into those actions that can be started immediately with no significant resources and those that are longer term efforts.

Immediate Actions	Near-Term Actions	Long-Term Actions
• Create a Mayor's Sustainable Freight Advisory Committee to provide input and oversight on Port and City planning efforts. The Committee should include designated seats for community members. • Engage in a community-based effort that brings stakeholders together to create a shared vision of the future of West Oakland. Establish standing, facilitated meetings with all stakeholders including representatives from the City, Port, other local, state and federal agencies, businesses, unions, and impacted residents, and connect with broader planning efforts underway with the Alameda County Transportation Commission. • End practice of piecemealing mitigation planning between construction and operation air quality reviews. • Provide notice and at least 30 days of comment period on all relevant planning or land-use decisions. • End practice of conditional use permitting to allow incompatible freight operations in the community. • Use zoning authority and incentives such as small business loans and subsidies to move freight and supporting service activities away from disadvantaged communities and to appropriate locales.	• Conduct new environmental review (EIR) for current proposed development of Oakland Army Base. Include alternatives that support moving freight activities and services out of the surrounding communities onto Port and OAB properties. • Prepare Clean Air Action Plan with interim targets for replacing all port equipment and drayage trucks with zero-emissions vehicles and equipment. • Prepare new traffic and transportation plan to route truck traffic away from disadvantaged communities. • Use parking, route, and idling restrictions to move incompatible freight activities out of the community. • Improve signage to avoid any confusion over such parking, route, and idling restrictions. • Provide supportive services within Port properties. • Work with community to design and install network of air monitoring sensors, and commit to using data to design and assess impacts of mitigation measures. • Work with utilities to develop electrical infrastructure plans to support port electrification by 2018. Maximize use of distributed renewable and storage resources at the Port. • Commit to renewable energy projects to mitigate impacts and facilitate transition of trucks and other equipment to zero-emission technologies.	• Replace all cargo handling equipment with zero-emissions equipment by 2030 • Allow only zero-emission drayage trucks to service the port by 2035

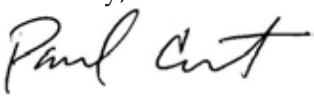
• Enforce truck parking, route, and idling restrictions. This includes training enforcement personnel, taking enforcement delegation as necessary to enforce specific requirements, and providing funding for enforcement personnel. • Continue ARB spot inspection program by collecting and reporting information on trucks with excess smoke, improper emissions control labels, evidence of tampering, and noncompliance with regulations requiring soot filters on trucks and transport refrigeration units. • Deny Port access to, or report, any truck not in compliance with ARB regulations. • Provide regular reporting on progress and compliance with emission reduction requirements.	• Set aside land for green infrastructure and truck charging stations. • Implement a 100 zero-emission truck commercialization pilot program by 2023 • Require all ships to use shore power or at-berth emission reduction technology by 2023 • Require electrification of locomotives that do not leave port facilities and require emission capture technologies for other locomotives while at port facilities. Adopt strategies for encouraging turnover of all Tier 3 and older locomotives by 2020. • Adopt indirect source emission caps by 2020 to encourage efficiency and emission reductions within the port.	

To support these actions, we have also attached a collection of resources to validate the feasibility of these requests. A large part of the frustration with the City and Port of Oakland is their resistance to the clear tide of change that is happening at ports and in the freight sector. Their consistent decisions to do the bare minimum and to ignore opportunities for advanced technologies would never stand in other communities, and are in stark contrast to the activities happening in other port communities. We are concerned that the current Truck Management Plan process initiated by the City will be yet another example of the City artificially limiting the scope of its efforts in order to promote the appearance of progress while avoiding the real change necessary to address impacts in the community.

We do not offer this list as a menu from which the City or Port should select individual actions, but instead encourage your agencies to use this list as a roadmap or vision for what must be done to finally address the systematic neglect of the West Oakland community. We are happy to discuss any and all of these recommendations.

Thank you for this opportunity to share the community's perspective and expertise on these issues.

Sincerely,



Paul Cort

ATTACHMENT

Actions for Addressing West Oakland Civil Rights Complaint

The Port of Oakland Must Move to Zero-Emissions

State and local air agencies in California have acknowledged the need to move our freight system to zero-emissions in order to reduce air toxics, achieve air quality standards, and meet our greenhouse reduction targets. The Ports of Los Angeles and Long Beach, led by the mayors of those cities, have embraced zero-emission goals as part of their long-term Clean Air Action Plan. Yet the City and Port of Oakland continue to focus on emission reduction targets that are based on outdated health risk assessment data and that are no longer adequate to address the health crisis in the surrounding community. A true vision for addressing the legacy of the Port's pollution must start with the goal of zero emissions from all Port equipment and the mobile sources that serve the Port. The following demands are based on commitments, agency recommendations, and projects underway at other ports, and technologies already available

(1) Commit to replace all cargo handling equipment with zero-emissions equipment by 2030.

(2) Commit to allow only zero-emission drayage trucks to service the port by 2035.

(3) Prepare a Clean Air Action Plan with interim targets for achieving these 2030 and 2035 commitments.

(4) Implement a 100 zero-emission truck commercialization pilot program by 2023.

(5) Require all ships to use shore power or an at-berth emission reduction technology by 2023.

(6) Adopt indirect source emission caps by 2020 to encourage efficiency and emission reductions within the port.

(7) Work with the relevant utilities to develop electrical infrastructure plans to support port electrification. Such plans should maximize the use distributed renewable and storage resources at the Port. Initial plans should be presented for Board consideration in 2018.

(8) Require electrification of locomotives that do not leave port facilities and require emission capture technologies for other locomotives while at port facilities. Adopt strategies for encouraging turnover of all Tier 3 and older locomotives by 2020.

(9) Provide space for truck supportive services within Port properties.

(10) Set aside land for green infrastructure and truck charging stations.

(11) Provide regular reporting on progress and compliance with emission reduction requirements.

(12) Continue ARB spot inspection program by collecting and reporting information on trucks with excess smoke, improper emissions control labels, evidence of tampering, and noncompliance with regulations requiring soot filters on trucks and transport refrigeration units.

(13) Report or deny access to any truck not in compliance with ARB regulations.

The City and Port Must Address Port Impacts on the Community

The City must take steps to address the harmful environmental legacy that has been created in the surrounding communities by the Port. In addition, going forward, the City must ensure that Port development and Community development are coordinated to avoid spillover effects on the community and take advantage of opportunities that can be achieved by redevelopment at the Port. The following demands are all within the authority of the City to address:

(1) Conduct new Environmental Impact Review for current proposed development of Oakland Army Base. Include alternatives that support moving freight activities and services out of the surrounding communities onto Port and OAB properties.

(2) End practice of piecemealing mitigation planning between construction and operation air quality reviews.

(3) Commit to renewable energy projects to mitigate impacts and to facilitate transition of trucks and other equipment to zero-emission technologies.

(4) Prepare new traffic and transportation plan to route truck traffic away from disadvantaged communities.

(5) Use zoning authority and incentives such as small business loans and subsidies to move freight and supporting service activities away from disadvantaged communities and to appropriate locales.

(6) End practice of conditional use permitting to allow incompatible freight operations in the community.

(7) Use parking, route, and idling restrictions to move incompatible freight activities out of the community.

(8) Improve signage to avoid any confusion over such parking, route, and idling restrictions.

(9) Enforce truck parking, route, and idling restrictions. This includes training enforcement personnel, taking enforcement delegation as necessary to enforce specific requirements, and providing funding for enforcement personnel.

(10) Work with community to design and install network of air monitoring sensors, and commit to using data to design and assess impacts of mitigation measures.

The City and Port Must Create More Meaningful Processes for Community Input on Decisionmaking

(1) The Mayor should create a Sustainable Freight Advisory Committee to provide input and oversight on Port and City planning efforts. The Committee should include designated seats for community members.

(2) The City should engage in a community-based effort that brings stakeholders together to create a shared vision of the future of West Oakland. The process should include standing, facilitated meetings with all stakeholders including representatives from the City, Port, other local, state and federal agencies, businesses, unions, and impacted residents.

(3) Planning should connect with broader planning efforts underway with the Alameda County Transportation Commission.

(4) The City should provide notice and at least 30 days of comment period on all relevant planning or land-use decisions.

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

April 10, 2018

Paul Cort
EARTHJUSTICE
50 California Street
San Francisco, CA 94111

Subject: EARTHJUSTICE Letter of December 8, 2017 Regarding the West Oakland Title VI Administrative Complaint and Subsequent Meeting on February 7, 2018.

Dear Mr. Cort:

Bay Area Air Quality Management District (Air District) staff has reviewed the list of recommended strategies that EARTHJUSTICE has developed to reduce toxic air contaminants (TAC) and particulate matter (PM) emissions in the West Oakland community on behalf of the West Oakland Environmental Indicators Project (WOEIP). As we discussed at our meeting on February 7, 2018, Air District staff overall supports the recommended strategies with a few minor modifications to some of the recommendations. We have provided our recommended modifications, in **bold** and *italic* text, in the list of strategies EARTHJUSTICE provided in the attachment to this letter.

The Draft Environmental Impact Report (DEIR) for the Oakland Army Base (OAB) identified significant air quality impacts associated with the proposed development of the property. In approving the OAB project, both the City of Oakland and Port of Oakland adopted a comprehensive list of mitigation measures that would be required of new development to reduce the air quality impacts from this project in the West Oakland community. As you are aware, the West Oakland community is the most disproportionality impacted community for TACs and PM in the Bay Area, and the location of substantial efforts by the Air District to reduce public exposure to these pollutants. Air District staff believes that all the recommended strategies you have identified are technically feasible to implement and are consistent with the requirements of the Mitigation Monitoring and Reporting Program for the OAB DEIR and the requirements listed in the Lease Disposition and Development Agreement for the City's portion of the OAB.

Air District staff is available to discuss any of our suggested edits to the list of recommended strategies and we look forward to working with EARTHJUSTICE, WOEIP, the City of Oakland and the Port of Oakland in the implementation of these and other emission reduction strategies. The Air District has available grant funding available to assist with the projects proposed in this letter and is happy to work with the City, Port and local community to determine how these funds could

be applied to reduce emissions and health risk in West Oakland. If you have any questions please contact Dave Vintze, Air Quality Planning Manager, at 415-749-5179, or at dvintze@baaqmd.gov.

Sincerely,

Damian Breen
Deputy Air Pollution Control Officer

Gregory Nudd
Deputy Air Pollution Control Officer

cc: BAAQMD Director Pauline Russo Cutter
BAAQMD Director Scott Haggerty
BAAQMD Director Rebecca Kaplan
BAAQMD Director Nate Miley
Libby Schaff, Mayor, City of Oakland
Cynthia Marvin, California Air Resources Board
Ryan Fitzpatrick, U.S. DOT
Ericka Farrell, U.S. EPA
Darin Ranelletti, City of Oakland
Chris Lytle, Executive Director, Port of Oakland

ATTACHMENT

(The list of strategies outlined below were developed by EARTHJUSTICE and contained in a letter to federal agencies to resolve the Title VI Administrative Complaint between WOEIP and the City of Oakland and Port of Oakland. Air District staff were asked by WOEIP and EARTHJUSTICE to review the list of strategies and assesses their feasibility of implementation and effectiveness in reducing air pollution from future development at the Oakland Army Base on the West Oakland Community. Air District staff responses are immediately below each numbered strategy in "bold" and "*italic*" text.)

Actions for Addressing West Oakland Civil Rights Complaint

The Port of Oakland Must Move to Zero-Emissions

State and local air agencies in California have acknowledged the need to move our freight system to zero-emissions in order to reduce air toxics, achieve air quality standards, and meet our greenhouse reduction targets. The Ports of Los Angeles and Long Beach, led by the mayors of those cities, have embraced zero-emission goals as part of their long-term Clean Air Action Plan. Yet the City and Port of Oakland continue to focus on emission reduction targets that are based on outdated health risk assessment data and that are no longer adequate to address the health crisis in the surrounding community. A true vision for addressing the legacy of the Port's pollution must start with the goal of zero emissions from all Port equipment and the mobile sources that serve the Port. The following demands are based on commitments, agency recommendations, and projects underway at other ports, and technologies already available

(1) Commit to replace all cargo handling equipment with zero-emissions equipment by 2030.

Based on recent regulatory recommendations by the ARB, existing zero emissions yard hostler, forklift and crane technology, the Air District believes that current technologies exist to meet this requirement by 2030.

(2) Commit to allow only zero-emission drayage trucks to service the port by 2035.

This requirement should be phased in with 20% by 2025, 60% by 2030 and 100% by 2033

(3) Prepare a Clean Air Action Plan with interim targets for achieving these 2030 and 2035 commitments.

Mitigation measures for the OAB require to City and Port to develop, fund and "continually update" emission reduction plans, which to date have not been prepared.

(4) Implement a 100 zero-emission truck commercialization pilot program by 2023.

Air District grants are available to partially fund this recommendation and the technologies exist to make this a robust demonstration.

(5) Require all ships to use shore power or an at-berth emission reduction technology by 2023.

The California Air Resources Boards at berth regulation currently requires that 70% of emissions from engines on cargo container and ocean liner at berth be reduced and that by 2020, 80% of emissions from those engines be reduced. The Air District believes that this regulation should be extended to cover bulk, tanker and rolloff/roll-on vessels at all California ports.

However, due to operational constraints on some older vessels it may not be possible for them to use shore power. Use of "bonnets" or other capture technology may allow for capture of emissions from some of these vessels. The Air District would recommend that this language be modified to state: "to the maximum extent possible" all emissions from vessels at berth be reduced to zero by 2030.

(6) Adopt indirect source emission caps by 2020 to encourage efficiency and emission reductions within the port.

Indirect source emission caps should be included in the Clean Air Action Plan identified in recommendation # 3 above. Projects above the emission caps should pay into a local emission offset fund.

(7) Work with the relevant utilities to develop electrical infrastructure plans to support port electrification. Such plans should maximize the use distributed renewable and storage resources at the Port. Initial plans should be presented for Board consideration in 2018.

Air District staff recommends that electrical infrastructure plans be incorporated into the Clean Air Action Plan identified in recommendation # 3 above.

(8) Require electrification of locomotives that do not leave port facilities and require emission capture technologies for other locomotives while at port facilities. Adopt strategies for encouraging turnover of all Tier 3 and older locomotives by 2020.

While electrification of captive locomotives, such as switchers at railyards would offer the maximum heath protection to the West Oakland community, such a project would likely take multiple years and require significant investment to implement. In the interim, Air District staff believes that significant emissions reductions and health benefits can be achieved by the use of Tier 4 and California Air Resources Board proposed Tier 5 locomotives in switcher and rail service at the current Oakland railyard.

Additionally, while capture systems can reduce emissions from locomotives, the Air District has found, through its work in support of the pilot emissions capture system deployed at the Roseville railyard, that:

- *Emissions capture systems are difficult to move across multiple railyards tracks; and*
- *They are difficult to position correctly in order to have significant emissions benefits.*

Therefore, the Air District would only recommend such devices in a very limited number of applications - where locomotives stop in the same exact spot on each of their trips or where the emissions capture device could be relocated to capture 100% of the emissions from the locomotives stack.

(9) Provide space for truck supportive services within Port properties.

Consistent with OAB mitigation measures to reduce emissions from trucks in the West Oakland Community.

(10) Set aside land for green infrastructure and truck charging stations. Provide regular reporting on progress and compliance with emission reduction requirements.

Consistent with OAB mitigation measures to reduce emissions from trucks

(11) Continue ARB spot inspection program by collecting and reporting information on trucks with excess smoke, improper emissions control labels, evidence of tampering, and noncompliance with regulations requiring soot filters on trucks and transport refrigeration units.

Consistent with OAB mitigation measures to reduce emissions from trucks.

(12) Report or deny access to any truck not in compliance with ARB regulations.

Consistent with OAB mitigation measures to reduce emissions from trucks.

<u>The City and Port Must Address Port Impacts on the Community</u>

The City must take steps to address the harmful environmental legacy that has been created in the surrounding communities by the Port. In addition, going forward, the City must ensure that Port development and Community development are coordinated to avoid spillover effects on the community and take advantage of opportunities that can be achieved by redevelopment at the Port. The following demands are all within the authority of the City to address:

(1) Conduct new Environmental Impact Review for current proposed development of Oakland Army Base. Include alternatives that support moving freight activities and services out of the surrounding communities onto Port and OAB properties.

Air District staff recommends that if the City and Port cannot meet the mitigation

requirements that they agreed to when they approved the OAB project and certified the FEIR, new environmental review should be prepared for all new development in the OAB. Environmental conditions have changed substantially since the previous environmental analysis was prepared in 2012. There are new more stringent particulate matter and ozone national ambient air quality standards that will be more difficult to attain with build out of the OAB as currently envisioned. In addition, new State planning requirements to improve local community health were approved through AB 617, which includes the West Oakland Community that will be adversely impacted with development at the OAB.

(2) End practice of piecemealing mitigation planning between construction and operation air quality reviews.

Air District staff recommends that the OAB mitigation measures requiring development of emission reduction plans and the funding of strategies to reduce truck emissions should be completed in a public process before any additional development plans or tenant improvements are approved.

(3) Commit to renewable energy projects to mitigate impacts and to facilitate transition of trucks and other equipment to zero-emission technologies.

Consistent with OAB mitigation measures to reduce emissions from trucks.

(4) Prepare new traffic and transportation plan to route truck traffic away from disadvantaged communities.

Air District staff recommends that this measure be completed prior to approving any new development or occupancy permits for the OAB.

(5) Use zoning authority and incentives such as small business loans and subsidies to move freight and supporting service activities away from disadvantaged communities and to appropriate locales.

Consistent with OAB mitigation measures to reduce emissions/exposure from trucks.

(6) End practice of conditional use permitting to allow incompatible freight operations in the community.

Consistent with OAB mitigation measures to reduce emissions and exposure from trucks.

(7) Use parking, route, and idling restrictions to move incompatible freight activities out of the community.

Consistent with OAB mitigation measures to reduce emissions and exposure from trucks.

(8) Improve signage to avoid any confusion over such parking, route, and idling restrictions.

Consistent with OAB mitigation measures to reduce emissions and exposure from trucks.

(9) Enforce truck parking, route, and idling restrictions. This includes training enforcement personnel, taking enforcement delegation as necessary to enforce specific requirements, and providing funding for enforcement personnel.

Consistent with OAB mitigation measures to reduce emissions and exposure from trucks.

(10) Work with community to design and install network of air monitoring sensors, and commit to using data to design and assess impacts of mitigation measures.

Air District staff supports this recommendation

The City and Port Must Create More Meaningful Processes for Community Input on Decision Making

(1) The Mayor should create a Sustainable Freight Advisory Committee to provide input and oversight on Port and City planning efforts. The Committee should include designated seats for community members.

Air District staff supports this recommendation

(2) The City should engage in a community-based effort that brings stakeholders together to create a shared vision of the future of West Oakland. The process should include standing, facilitated meetings with all stakeholders including representatives from the City, Port, other local, state and federal agencies, businesses, unions, and impacted residents.

Air District staff supports this recommendation. The current OAB stakeholder process does not accommodate meaningful input from the community stakeholders on proposed development within the OAB. A new stakeholder process should be initiated and integrated with the stakeholder process currently being developed for the AB 617 Community Health Protection Action Plan underway for the West Oakland Community.

(3) Planning should connect with broader planning efforts underway with the Alameda County Transportation Commission.

Air District staff supports this recommendation.

(4) The City should provide notice and at least 30 days of comment period on all relevant planning or land-use decisions.

Air District staff supports this recommendation

APPENDIX D: SCREENING AND EVALUATION OF IMPLEMENTING ACTIONS

SCREENING AND EVALUATION OF IMPLEMENTING ACTIONS

TABLES

SCREENING AND EVALUATION OF IMPLEMENTING ACTIONS

Implementing Actions (IAs) are the building blocks of the Plan. As described in the Plan and Appendix C, the Port has identified the IAs in Appendix C as the initial pool of IAs for the Plan. The Port will screen potential new IAs for inclusion in the pool (the pool of IAs consists of the IAs that have passed Step 2 of the screening process) and for implementation. The Port, its tenants, and other Port partners may be responsible for implementing IAs.

The Plan provides a five-step process (see part II, Figure 4: Proposed Implementation Approach) to screen and evaluate potential implementing actions.

- Step 1: Identify. Identify new potential implementing actions (IA).
- Step 2: Screen. Apply Screening Criteria (see Table D-1, below). If the IA passes the screening criteria, it moves into the pool. (See Appendix C: Detailed Description of Potential Implementing Actions)
- Step 3: Evaluate. Apply Feasibility Criteria shown in Table 1 of Part II and described in more detail below.
- Step 4: Prioritize. Compare IAs based on the results of the feasibility evaluation.
- Step 5: Fund and Implement. Identify funding for the preferred IAs, and implement the IAs once funding is available.

The IAs included in Appendix C have passed Step 2; the IAs included in the Near-Term Action Plan are in Step 5.

Step 1 - Identify

The initial pool of IAs for the Plan is described in Appendix C. As discussed in Part II of the Plan and in Appendix C, the Port anticipates that new potential IAs will be identified throughout the Plan implementation. For example, Attachments C-1 and C-2 to Appendix C provide new potential IAs suggested by EarthJustice (on behalf of the West Oakland Environmental Indicators Project) and BAAQMD. Port staff will also be tracking development of zero-emissions technology and other actions that may contribute to the Port's pathway to zero emissions. This technology tracking effort is likely to be another source of new potential IAs.

Step 2 - Screen

The screening criteria presented in Table D-1 determine whether a new potential IA contributes to Plan goals. The Port will maintain a list of potential new IAs and screen the potential new IAs annually or more frequently. When an IA successfully passes the screen (the IA must pass all applicable screening criteria; not all screening criteria will be applicable to all IAs), it moves into the pool. A potential new IA that fails the screening criteria will not be considered further. Not all criteria are applicable for all potential IAs; for example, evaluating the feasibility of vessel speed reduction would not provide immediate DPM or GHG emissions reductions benefits.

TABLE D-1. SCREENING CRITERIA FOR NEW POTENTIAL IMPLEMENTING ACTIONS	
Screening Criterion	Description
1. Surplus Emissions Reductions (Avoid Regulatory Duplication)	Does the proposed action achieve "surplus" emission reductions, defined as emissions reductions in advance of new proposed regulations, or "above and beyond," an existing regulation or Port commitments (for example, an existing MOU?)
2. Criteria Air Pollutants	Does the proposed action contribute to criteria air pollutant emissions reductions?
3. GHG Reduction Benefit	Does the proposed initiative contribute to GHG emissions reductions?
4. Contribution to Zero- Emissions Pathway	Does the proposed IA contribute to the Port's pathway to a zero-emissions Seaport by: • Developing designs or collecting data in support of infrastructure improvements and/or deployment of zero-emissions or hybrid equipment? • Delivering infrastructure in support of zero-emissions equipment? • Deploying zero-emissions equipment? • Deploying hybrid equipment that substantially reduces criteria air pollutants and GHGs, or • Creating fiber optic communications systems infrastructure required to operate some zero-emissions equipment?
5. Side Effects	Does the proposed technology or other action avoid or minimize foreseeable negative environmental, economic, or social side effects?

Step 3 - Evaluate

The next step in the process is to evaluate each IA in the pool relative to the Feasibility Criteria (Part II, Table 1). The Port anticipates evaluating all IAs in the pool of IAs on an annual basis.

Affordability

Factors to consider:

- Availability of Funding
  - Can the Port, tenant or operator afford the IA?
  - Has the Port's Board approved the use of Port funds for the IA, and do projected net revenues support any longer-term associated costs?
  - If the IAs will be implemented by an organization other than the Port, does that organization have sufficient funds available to implement the IA?
  - Does the IA deliver a return on investment (ROI)?
  - Use of grants

    - > Is grant or other incentive funding available?
    - > What is the level of effort needed to pursue and implement grants or other incentive funding?
- Other Factors
  - Would the IA result in stranded equipment or infrastructure?
  - Does the proposed action jeopardize usage requirements for any grant-funded equipment already in place?

Discussion: The first component of the affordability criterion is available funding and projected long-term availability of funding for those IAs for which expenditures would occur over an extended period of time (e.g., operations and maintenance costs). Affordability includes the actions' return on investment (ROI) for those actions for which an ROI can be calculated. Calculation of ROI for equipment IAs may include considerations such as:

- Cost of charging or other fueling infrastructure (e.g., hydrogen storage tanks and dispensing equipment)
- Operational costs compared to conventional diesel-powered equipment (i.e., labor required to operate and charge the equipment, electricity cost including any demand charges, etc.)
- Cost of maintenance compared to conventional diesel-powered equipment, including any reductions in maintenance time or extra downtime and other costs incurred due to limited availability of parts and/or service

In addition, this criterion considers whether the proposed IA would result in problems with meeting grant compliance requirements for grant-funded equipment or infrastructure. IAs that conflict with usage or other requirements for grant funded equipment or infrastructure would fail this criterion, but could be reconsidered when the grant-related requirements expire.

Another factor in the evaluation of affordability is the possibility of stranded equipment. Stranding of equipment would occur if an IA replaces existing equipment that still has remaining useful life with new equipment.

Cost Effectiveness

Factors to consider:

- Does the action provide cost-effective emissions reductions?
- Is the action a required infrastructure project or does it support required infrastructure?

Discussion: For actions involving equipment, the Port intends to use the Carl Moyer criteria for cost effectiveness. While the Carl Moyer criteria focus on criteria air pollutants, the cost effectiveness threshold in the Carl Moyer guidance is much greater for zero-emissions equipment, effectively addressing the benefits of GHG emissions reductions. The projected

duration of the emissions reductions[1] will be part of the evaluation. Typically, if two actions are both affordable and provide emissions reductions that are cost-effective using the Carl Moyer criteria, the action providing the higher level of cost effectiveness (i.e., a lower cost per tons of emissions reduced) would perform better on this criterion. The Carl Moyer cost effectiveness criteria weight PM more heavily than other criteria air pollutants (PM emissions reductions are multiplied by 20 in the calculation).

For actions that do not provide direct emissions reductions but that may involve cost recovery, such as infrastructure construction, cost effectiveness would be based on the Port's or other agency's ability to recover its cost within the time typically accorded similar projects. In addition, infrastructure IAs would be evaluated to determine the level of demand for the infrastructure (e.g., do tenants have specific plans for their battery-electric equipment purchases?) and would not be constructed until a clear need is defined. Finally, for IAs that do not have any measurable means for assessing cost effectiveness, such as feasibility studies, the cost effectiveness criterion does not apply directly. However, the Port will consider the importance of the study (e.g., is the study required to determine specific near-term infrastructure needs?) relative to its cost.

Priority

Factors to consider:

- Is the action required? For example, has equipment reached the end of its useful life or is electrical infrastructure needed to support increased electrical charging demands?
- How urgent is the action? For example, is lack of electrical infrastructure preventing further deployment of battery-electric equipment?
- Is the action part of planned program such as on-going investment in capital equipment?
- Will the action result in a delay or cancellation of other (non-air-quality-focused) priority projects?
- Will the action substantially advance experience with a certain type or class of equipment?
- If the action provides emissions reductions benefits, do the associated emissions reductions benefits accrue in the vicinity of the local community?
- Will the action build capacity (e.g., expand maintenance and repair services for battery-electric equipment, or provide training for electric vehicle mechanics)?

Discussion: Priority is a qualitative assessment of the overall importance of the IA to the organization that would be implementing the IA. The priority assessment includes the important consideration of the trade-offs between allocating funds to air-quality-related projects versus projects that support other Port functions and do not provide an air quality benefit, and the implications of delaying or choosing not to implement the latter projects. The consideration of trade-offs is critical to meeting Goal #1: Keep the Port competitive, financially

[1] The projected life of various pieces of equipment differs, leading to different projected durations of emissions reductions.

sustainable, and a catalyst for jobs and economic development.

Commercial Availability

Factors to consider:

- Has the proposed technology or system reached commercial availability (Technological Readiness Level [TRL] 9), or at a minimum, the pre-production stage (TRL 7)?
- Does sufficient experience with the technology/system exist to determine that its operational performance is acceptable?

Discussion: Commercial availability will be evaluated in part using the U.S. Department of Energy (DOE) nine-level scale (DOE 2011), adapted by the Port to equipment rather than processes. The nine levels, as adapted for application in this Plan, are summarized briefly in Table D-2: *Technological Readiness Levels*. The Port expanded the scale to consider availability of parts and maintenance services.

TABLE D-2. TECHNOLOGICAL READINESS LEVELS (TRL)

Relative Level of Technology Development	Technology Readiness Level	TRL Definition	Description
Technology Operations	TRL 9	Actual technology or equipment operated over the full range of expected operating conditions.	The technology or equipment is in its final form and has operated under the full range of operating conditions. Parts and maintenance are readily available.
Technology Commissioning	TRL 8	Actual equipment completed and qualified through test and demonstration.	The technology or equipment has been proven to work in its final form and under expected operating conditions. In almost all cases, this TRL represents the end of true equipment development. Parts and maintenance are available on a limited basis.
	TRL 7	Full-scale, similar (prototypical) equipment demonstrated in relevant environment	This represents a major step up from TRL 6, requiring demonstration of an actual equipment or technology prototype in a relevant environment. Examples include testing equipment in the field with a range of operating conditions. Final design is virtually complete. Parts are custom-made or adapted, and maintenance is available only from the equipment developer or a very limited group of providers.

TABLE D-2. TECHNOLOGICAL READINESS LEVELS (TRL)			
Relative Level of Technology Development	Technology Readiness Level	TRL Definition	Description
Technology Demonstration	TRL 6	Engineering/ pilot-scale, similar (prototypical) equipment or technology validation in relevant environment	Engineering-scale prototypes are tested in a relevant environment. This represents a major step up in a technology's demonstrated readiness. Examples include testing an engineering scale prototype with a range of potential operating conditions. TRL 6 begins true engineering development of the technology as operational equipment. The major difference between TRL 5 and 6 is the step up from laboratory scale to engineering scale. The prototype should be capable of performing all the functions that will be required of the operational equipment. The operating environment for the testing should closely represent the actual operating environment. Parts and maintenance are not available because each piece of equipment is custom-built.
Technology Development	TRL 5	Laboratory scale, similar system validation in relevant environment	The basic technological components are integrated so that the equipment configuration is similar to (matches) the final application in almost all respects. The major difference between TRL 4 and 5 is the increase in the fidelity of the equipment and test environment to the actual application. The system tested is almost prototypical.
Technology Development	TRL 4	Component and/or system validation in laboratory environment	The basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared with the eventual complete equipment. TRL 4-6 represent the bridge from scientific research to engineering. TRL 4 is the first step in determining whether the individual components will work together as a system.
Research to Prove Feasibility	TRL 3	Analytical and experimental critical function and/or characteristic proof of concept	Active research and development (R&D) is initiated. This includes analytical studies and laboratory-scale studies to physically validate the analytical predictions of separate elements of the technology. Components of the technology are validated, but there is no attempt to integrate the components into a complete system. Modeling and simulation may be used to complement physical experiments.
Basic Technology Research	TRL 2	Technology concept and/ or application formulated	Once basic principles are observed, practical applications can be invented. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions.
	TRL 1	Basic principles observed and reported	This is the lowest level of technology readiness. Scientific research begins to be translated into applied R&D.

Full commercial availability follows achievement of TRL 9, and includes the following additional factors:

- Equipment is readily available (can be ordered from a number of vendors and delivery schedules are comparable to conventional diesel equipment).
- Parts are readily available (addressed by the operational feasibility criterion, see below).
- Skilled maintenance and service facilities available nearby (equipment is locally serviceable).

- Day-to-day operating costs are in line with conventional diesel equipment (no more than 120% of conventional diesel-powered equipment).
- Purchase costs are comparable to conventional diesel-powered equipment.
- The equipment has a normal life span (similar to that for conventional diesel equipment).

Operational Feasibility

Factors to consider:

- Is there sufficient experience with the technology or equipment to determine that its operational performance is acceptable?
- Are parts readily available, and are repair and maintenance services available near-by?
- Does the existing workforce have sufficient training and experience to operate the new technology or equipment, and can routine maintenance be performed in-house?

Discussion: Operational feasibility considerations are applicable to equipment and operations IAs. For actions to be taken or equipment to be used by tenants or other Port partners, it is the Port partner who will make the operational feasibility determination.

For mobile equipment, the equipment should perform as well as comparable diesel-powered equipment and be able to serve the full number of shifts required by the equipment owner. To be effective, equipment must have similar handling characteristics and provide the same or better level of power as conventional diesel-powered equipment. The equipment must also be reliable; equipment that is prone to breakdowns would typically be unacceptable in terms of operational feasibility. The equipment must integrate with the conventional diesel equipment already in use. For example, zero-emissions equipment that requires operators to park in a different area of the container terminal during work breaks than they normally would with conventional diesel powered equipment may not be operationally feasible. The level of maintenance typically performed for conventional diesel equipment at the owner's location should be feasible for the zero emissions equipment. Special requirements for zero-emissions equipment should not be unduly burdensome and should be offset by operational benefits in other areas. Fuel supplies must be reliable.

Operational measures must not be unduly burdensome in terms of training, on-going implementation of the measure, and administration of the measure.

Acceptability

Factors to consider:

- Is there a party or entity willing to undertake the implementing action, given the range of other considerations, such as availability of land, ability to densify operations or financial capability?
- Does the IA allow for continued reliable and satisfactory service delivery to customer(s?)

Discussion: Acceptability will generally be evaluated on a qualitative basis. Each organization will determine acceptability according to its own criteria. Acceptability considerations may include:

- Physical considerations, such as available land and available infrastructure locations;
- Infrastructure availability;
- Schedule considerations for delivery of equipment and/or installation of required infrastructure;
- Equipment operators' openness to the new technology or equipment;
- The level of disruption associated with installing required infrastructure to support the proposed zero emissions equipment;
- The level of overall risk associated with investing in relatively unproven equipment or technology; and
- Availability of trained personnel to service and/or maintain the equipment.

Step 4 - Prioritize

The results of the feasibility evaluation will be used to compare IAs to each other. IAs that perform highly against the feasibility criteria will receive the highest priority for implementation. IAs that perform less well will remain in the pool for future evaluation. The performance of the IAs relative to the feasibility criteria may improve in the future as actions become more cost-effective, the level of technological development improves, or certain actions (such as replacing existing equipment that is at the end of the its useful life) become more urgent. Alternatively, ratings could also decline; for example, a technology that initially appears promising may remain relatively costly compared to other technologies that provide similar emissions reductions benefits, resulting in a lower performance in future years.

Step 5 - Fund and Implement

The best-performing IAs will be selected for implementation. Once an IA has been selected for implementation, the organization responsible for implementing the action will review available funding, seek additional funding if needed, and then implement the IA once adequate funding is available. The results of the IAs will be monitored and the status will be reflected in the annual report to the Board.

APPENDIX E: WORKFORCE DEVELOPMENT PLAN

APPENDIX E: WORKFORCE DEVELOPMENT PLAN

TABLES

WORKFORCE DEVELOPMENT PLAN

Introduction

The Seaport Air Quality 2020 and Beyond Plan (2020 and Beyond Plan) positions the Port to expand upon its years of community and education commitment to identify, analyze, and assess potential workforce needs in collaboration with our community stakeholders including training partners and industry leaders. Aligned with the Port of Oakland 5-year Strategic Business Plan 2018 – 2022, this workforce plan will complement and strengthen the overall objectives of community engagement; Port access for the community; minimize adverse community impacts; and ensure that as the Port thrives, the community thrives. The Port's commitment to Oakland and the East Bay remains central to this workforce plan to ensure job growth and to provide economic opportunity.

As a critical economic partner in the region generating more than $2.2 billion annually in trade through the seaport, the Port will continue to promote training programs that prepare candidates for careers in transportation, logistics or the building and construction trades. With more than 11,000 jobs generated by cargo handled at the Port's maritime terminals (Martin 2017, in review), coupled with record high trade growth through the seaport, the future of job growth is promising. In addition, strong community partnerships remain a key element of the Port's commitment towards strengthening community support.

Community outreach, employer engagement, educational partnerships with local schools, summer internships, and local training and apprenticeship programs are all a part of the Port's long history connected to community and economic development. The Port remains committed to promote programs that train local candidates for careers in transportation, logistics or the construction building trades and will continue to provide resources to support job training and skills development to ensure Oaklanders and Californians are prepared for Port and Port-related industries. As a strong workforce partner, the Port plays a vital role as an economic engine for Northern California, supporting more than 84,000 jobs throughout the region (Martin 2017, in review).

Background

As the Port continues to manage programs, policies, and initiatives that promote access to Port and Port-related careers, ensuring a viable and skilled workforce is of great importance. With the advancement of smart technology, electrification, and hybrid equipment, upgrading of skills for new and incumbent workers is a critical priority. Supporting a pathway to a zero-emissions Seaport and new clean air technologies will affect workforce in the various sectors of Seaport operations and goods movement.

Partnership development with industry leaders, training partners, and other community stakeholders will continue to be central in the development of a comprehensive Workforce Plan

to better understand the effects of clean air technologies and meet the needs of our workforce demands. Ultimately, an expansive workforce development plan is part of the Port's vision of economic growth and financial stability. Equally important, the Workforce Plan will be directly aligned with the 2020 and Beyond Plan stated goals:

- Keep the Port competitive, financially sustainable, and a catalyst for jobs and economic development.
- Minimize emissions of criteria air pollutants and toxic air contaminant (TACs)—with a focus on reducing diesel particulate matter (DPM) emissions.
- Reduce greenhouse gas (GHG) emissions.
- Build and strengthen partnerships among the Port, tenants, equipment manufacturers, owners and operators, community organizations, regulatory agencies, and the public.
- Provide opportunities for meaningful stakeholder engagement.

Existing Port workforce policies and initiatives serve as a foundation for building deeper partnerships with existing stakeholders and expansion of those partnerships to ensure the Port's Workforce Plan is part of a collective effort. Key examples of existing workforce policies and initiatives that support job growth and local hire commitments are highlighted below:

- Port's Maritime and Aviation Project Labor Agreement (MAPLA): The Port's and Building Trades' agreement for construction projects, the MAPLA provides economic opportunities to local small businesses, contributes workforce training dollars to community training programs, and supports local hire careers in construction.
- Operations Jobs Policy: The Policy (specific to lease with CenterPoint Oakland Development, LLC) incorporates a community benefit agreement that creates construction jobs and future permanent, living wage warehouse positions allowing long-time residents to remain in Oakland. The Policy also commits to working with a local community-based organization to support community outreach, job training and placement.
- California State Workforce Development Board – High Road Training Partnership (HRTP): The Port serves as advisory partner on the development of a warehouse-to-California Commercial Driver's License state-registered apprenticeship training program. The training program is an "earn as you learn" model that provides access to entry level warehouse jobs with training certifications that lead to commercial driver's license. Partners include the West Oakland Job Resource Center, Teamster's Joint Council 7, Department of Apprenticeship Standards, and California Federation of Labor.

Purpose

As part of a larger framework aligned with Strategy #4: Build and Strengthen Partnerships of the Plan, this Workforce Development Plan (Workforce Plan) will serve to guide the Port's economic and workforce development to support the Near-Term Action Plan (Years 2019-2023) of the 2020 and Beyond Plan which will provide an opportunity to revisit and update

the Workforce Plan as new technologies emerge. The Port, in developing and expanding partnerships with industry leaders, training partners, and other community stakeholders, will collaborate on efforts to better understand workforce needs, upgrading of skills, and training required for new and or incumbent workers to support a pathway towards a zero-emissions Seaport. Building on the Port's historical partnership with the local community, the Workforce Plan will review the Port's workforce and education initiatives, and programs including zero and near-zero demonstration projects currently underway and or pending implementation. Moreover, the Workforce Plan will serve as a framework that allows for growth, change, and innovation to support a pathway to a zero-emissions Seaport. Preparing the current and future workforce for a zero-emissions Seaport, as well as the interim technological steps along the way, will require the Port to play a central role in the convening of partners, including state, local, and educational institutions.

Finally, this Workforce Plan is meant to serve as tool to engage industry leaders and community stakeholders in a discovery process to support workforce needs and identify upgrading of skills for incumbent workers along with education and training programs to develop career pathways for the future workforce of near zero and zero emissions seaports.

Workforce Methodology

This Workforce Plan offers a framework to conduct a workforce analysis in partnership with industry stakeholders as part of the planning process to understand current and future workforce needs to support a pathway towards a zero-emissions Seaport. It is equally important to understand that industry partners and labor organizations may have tools to measure current workforce needs, training, and or skills development. This workforce methodology is meant to compliment and or enhance current models of workforce needs assessments. For example, the Port is keenly aware that Pacific Maritime Association (PMA) is the premiere trainer for one of the seaport's largest workforce represented by International Longshore and Warehouse Union (ILWU). The value added in creating a workforce analysis methodology demonstrates the Port's vested interest to support industry needs and moreover, its commitment to ensuring local education and training providers are preparing Oaklanders for Port and Port-related jobs.

This Workforce Plan will also provide a framework that will mitigate unnecessary workplace disruptions and maintain a steady-workforce. One of the major components of Port's development and expanding partnership with industry leaders is to establish clear baseline data on their current workforce. The data obtained will be analyzed through a workforce methodology framework to align with future organizational goals and objectives.

The primary elements of a workforce analysis methodology involve the gathering of organizational human resource data to address the following:

- **Identify** – mission critical occupations and competencies
- **Supply** – evaluation of the current workforce including anticipated retirements,

separations, and identify current skills and competencies.

- **Demand** – forecast the optimal number of workers and competencies need in mission-critical occupations required of the future workforce.
- **Gap Analysis** – evaluate the gap between supply and demand. The Gap Analysis identifies the current number of workers and competency surplus and deficiencies. From the Gap Analysis the following are derived:
  - Future workforce gap
  - Future competency gap

Based on the workforce methodology presented, it is critical that the Port work directly with its industry leaders and training partners in developing training programs that include a sector-specific labor market analysis to better understand industry trends, workforce projections, and competencies that are adaptable to new and emerging technologies towards a pathway to zero-emissions Seaport. The workforce Gap Analysis will serve as the basis for the development and implementation of a workforce transition plan.

Workforce Transition Plan

The Port in partnership with industry leaders will track and monitor performance outcomes of demonstration projects as part of managing the transition of a workforce over time to ensure the workforce:

- Is able to adapt to the new environment
- Understands new processes, programs, equipment, and technology associated with transformation
- Demonstrates high levels of efficiency and effectiveness in their new roles
- Meets needs and requirements of employer/customer
- Is able to work with new colleagues as a high performing team

The performance outcomes of each demonstration project play a critical role in understanding scalability, required resources for upgrading of skills, new equipment, and potential occupational changes. Near-term Implementing Actions (IAs) 2019-2023: Workforce demonstration projects may apply to:

- Carl Moyer Grants – retrofit of two tugs with Tier 3 engines and the replacement of 13 existing Rubber Tire Gantry cranes with hybrid cranes.
- Zero and Near-Zero Emission Freight Facility grant (ZANZEFF) to support 10 electrical Class 8 drayage trucks at Shippers Transport Express (STE; a Port off-dock tenant) and up to six pieces of electric cargo handling equipment at the Matson Terminal.

Tracking and monitoring of the above-mentioned demonstration projects are critical components to understanding future workforce needs, required competencies for implementation, operations and maintenance of equipment. Each project workforce can be analyzed by utilizing the workforce methodology:

Example: Workforce Gap Analysis

Critical mission occupation and competencies: Identify critical equipment needs.

- Supply: Identify the current number of workers and their current skill level
  - # of workers (Each worker must be assigned to critical equipment)
  - # of workers by skill set/competencies (Industry and or Labor may train, track, and monitors skill level by worker)
  - # of workers expected to retire and or separate (Industry and or Labor human resource data projects)
- Demand: Identify the number of workers required and competencies to support future jobs
  - # of workers required to support future workforce
  - # of workers with skill set required for future workforce
- Workforce Gap Analysis: Upon completion of the supply and demand analysis, a workforce analysis will emerge to identify if there is a surplus or deficiency of required workers. The analysis will also identify a skills surplus or deficiency.

The Workforce Plan is based on three major recommendations:

i. Partner with industry leaders to conduct sector labor market analysis to complete a Workforce Gap Analysis.
ii. Identify resources to off-set employer investment in upgrading of skills and certifications for near-zero and zero-emissions equipment. Example: Employment Training Panel – State of California provides funding to employers to assist in upgrading skills.
iii. Coordinate and seek continuous feedback from stakeholders through the Port's Public Engagement Plan (PEP) and ensure communications are reaching intended audience.

Initial Workforce Analysis

To understand the workforce needs and impacts of a zero emissions Seaport, a workforce Gap Analysis of the jobs related to anticipated changes in technology, equipment, fuel, infrastructure and operations must be cross-referenced with actual job categories shown below in Table I. This table was developed by Martin Associates as an update to their 2011 report titled the "The Economic Impact of the Port of Oakland —2010" through interviews with hundreds of firms, representing the universe of firms that provide services at the Port of Oakland Seaport, Oakland International Airport as well as the tenants of the Port's Commercial Real Estate Division. The updated Martin Report is currently in draft form. However, the job categories and direct job numbers are not anticipated to change from its current draft state to the final report. As the table indicates, the largest number of jobs are held by truckers serving the Port's marine terminals, followed by warehousing and distribution center/cross dock operations, ILWU members, and freight forwarders.

As an initial workforce assessment of Port's pathway toward a zero-emissions Seaport, it is premature to predict whether the current workforce will experience a reduction and or increase in the number of jobs, changes to job functions, and the types of training/certifications required. This level of workforce detail will need to be developed in partnership with all employer/industry stakeholders as part of the workforce Gap Analysis referenced above, however a deeper review of the job classifications below provides initial insight about the sheer number of workers potentially impacted because of new technologies towards creating a zero emissions seaport.

Workforce Job Classifications

Of the 11,393 job classifications, truckers made up the largest number of workers (3,912) servicing the Port with implications for near-term technologies shifting to hybrid and or electric trucks. As Steven Viscelli suggests in his research report, "Driverless?" (Viscelli 2018), the most vulnerable segment of truckers to be impacted by automation are long-haul drivers with the potential elimination of 294,000 trucking jobs nationwide. At the same time, it is expected that more freight-moving jobs will be created than are lost in trucking. These new freight-moving jobs will likely emerge as local drivers and as last-mile delivery demands increase. As the Port continues to expand its Seaport warehouse and distribution centers, this scenario seems plausible.

The second largest workforce is made up of warehouse workers (1,980) and with the new construction of the Cool Port and Seaport Logistics Complex, the number of warehouse workers is expected to grow. A key element to consider as part of the workforce Gap Analysis will be the development of technology to support warehouse equipment and logistics data management systems. With new technology, a need for training and retraining incumbent workers will be essential and working directly with our industry partners will help prepare the current and future warehouse workers.

The third largest workforce serving the seaport are ILWU workers (1,808), who may be active participants in the Port's demonstration projects referenced above. As with any large employer, it will be extremely beneficial to include a workforce Gap Analysis as part of all demonstration projects. Again, this is a recommendation to the Port's industry partners and further discovery may unveil the current workforce analysis models or methods in use. As part of the workforce analysis, clearly identifying current levels of workers, job classifications and competencies are a critical component of the workforce Gap Analysis.

One example of further exploring the current use of workforce assessment needs, may lie within the Pacific Maritime Association (PMA), and according to their 2017 Annual Report, the ILWU and PMA initiated a comprehensive training center at the Port in 2017 inclusive of crane training simulator, classrooms, and clerk testing areas. The monitoring, tracking, and evaluation of competencies managed by PMA will provide much needed data to complete the workforce Gap Analysis.

Table I below provides a broader view and more complete picture of the Seaport's diverse workforce which will serve as a strong baseline for capture a workforce Gap Analysis.

TABLE I. DIRECT JOBS BY DETAIL CATEGORY

IMPACT CATEGORY	DIRECT JOBS
SURFACE TRANSPORTATION	
RAIL	203
TRUCK	3,912
SUBTOTAL	**4,115**
MARITIME SERVICES	
TERMINAL	216
ILWU	1,808
TUG ASSISTS	114
PILOTS	48
STEAMSHIP LINES/AGENTS	90
MARITIME SERVICES/SURVEYORS	532
FREIGHT FORWARDERS	1,613
WAREHOUSE/DISTRIBUTION CENTERS	1,980
GOVERNMENT	441
MARINE CONSTRUCTION/SHIP REPAIR	287
BARGE	0
SUBTOTAL	**7,130**
DEPENDENT SHIPPERS/CONSIGNEES	**88**
PORT AUTHORITY	**60**
TOTAL	**11,393**

Source: Martin 2017, in review.

RECOMMENDATIONS AND STRATEGIES

Recommendation I. Conduct Workforce Gap Analysis: Partnerships and Advisory Roles

In partnership with a complex makeup of stakeholders as part of the transition to a zero emissions Seaport, the Port will support a series of strategies including a workforce Gap Analysis to better understand the changing conditions of new technologies and resources required to support a pathway to a zero-emissions Seaport.

The Port's Workforce Development Plan will be informed by the completion of a comprehensive workforce analysis that is guided by a strategic workforce methodology. Industry leaders along with education and training partners are critical stakeholders in developing competencies that will be needed in the future. An initial framework is presented below to help guide and start a deeper discussion and analysis.

Strategy I. Training

- Develop incumbent worker training for container handling equipment (CHE) to support near-ZE and ZE equipment, operations, and maintenance.
- Provide training to local workforce preparedness programs on new clean air technologies (i.e., hybrid and electric vehicles)
- Develop curriculum with industry partners to address identifiable workforce needs.
- Develop maritime career pathways in partnership with research institutions, community colleges, UC and CSUs, and K-12 Linked Learning pathways to connect high school students with meaningful internships as part of career exploration.

Strategy II. Meeting Sector and Regional Workforce Needs

- Develop and implement actionable plans in partnership with regional employers, labor unions, workforce development boards and other economic & community partners to align with the 2020 and Beyond Plan.
- Create education programs for emerging, high-growth and hard-to-fill occupations in partnership with local education and training providers.
- Implement interlinked K-12, adult education, and apprenticeship pathways.
- Partner with program and services to address employer workforce development priorities.
- Translate national standards and certifications into model competency-based curricula.
- Construct and disseminate sharable workforce development resources.

Strategy III. Revitalize Communities and Connect Residents to Meaningful Career Opportunities

- Partner with intermediary workforce agencies, community colleges, workforce development boards, chambers of commerce, etc. to support regional and state zero-

emissions Seaport projects/policies/initiatives.

- Ensure the developing zero-emissions Seaport workforce represents the community it serves via outreach and recruitment of local impact area (LIA) residents into workforce development programs.
- Build gateway programs including pre-education and pre-employment preparation, support services, and work-based learning experiences to increase education and employment success.

The categories listed are meant to serve as an initial framework to guide conversations, inquiry and actionable plans that will inform a robust workforce plan to support employer's needs for their current workforce as well as long term plans for the future workforce needs.

Recommendation II. Resources to Support Equipment, Infrastructure, and Training

Through anticipated demonstration projects such as the ZANZEFF grant the completion of a workforce Gap Analysis, further exploration with educational partners will provide a deeper understanding for identifying new areas of skills and learning. As part of the letter of commitment from Oakland Unified School District (OUSD) and the Peralta Community College District (PCCD), the Port will receive technical assistance from the Port of Long Beach, Long Beach Community College and Long Beach (Center for International Trade and Transportation [CITT]). An initial framework to guide this partnership with high schools and postsecondary partnerships is shown below:

- Oakland Unified School District
  - ZANZEFF Letter of Commitment
  - Oakland Unified School District – Linked Learning
  - Revamping Linked Learning Pathway aligned to community college career pathway.
    - Advanced Transportation & Logistics
    - Global Trade
    - Energy, Construction & Utilities
- Peralta Community College District
  - ZANZEFF letter of commitment to support workforce assessment and alignment to current/future education and training priorities.
  - Community College Sector Priorities
    - Advanced Transportation & Logistics
    - Global Trade
    - Energy, Construction & Utilities
  - Community College Strong Workforce Initiative (Resource to enhance CTE in partnership with industry)

Collaboration with local training partners as mentioned above could be instrumental in establishing stronger partnerships with local schools and community colleges to support career

pathways and continued education in the maritime sector.

In addition to collaborating with other ports to secure grants, the State of California Employment Training Panel (ETP) serves as a funding agency to support job creation through upgrading skills of workers. This type of funding is specifically used to reimburse the cost of employer-driven training for incumbent workers and could prove beneficial in off-setting training cost associated with any of the categorical jobs at the Seaport that call for retraining. Seaport employers eligible for ETP funding must meet requirements as mandated by a special Employment Training Tax (ETT), paid by California employers, and only employers subject to this tax directly benefit from the program. These training funds are underutilized by employers and could serve as a catalyst to deepen relationships with employers, strengthen training standards, increase worker productivity, and promote a safe and healthy workplace.

ETP PROGRAM OVERVIEW	HOW ETP FUNDING WORKS
ETP targets firms threatened by out-of-state competition or that compete in the global economy.	Employers make decisions about their training needs.
For incumbent worker training, employers contribute to the cost of training.	Training Investments help companies become more profitable locally and globally.
Additional incentives are provided to assist small businesses and employers in high unemployment areas of the state.	Employers are encouraged to assume greater responsibility for training.
Partnerships allow ETP to provide funds from alternative source for industry-specific training programs.	Performance-based contracting helps to ensure success.

ETP funding opportunities are a great resource to employers to offset or supplement investments in anticipated training needs for their incumbent workforce. ETP also offers employer incentives to support new workers which could prove beneficial as emerging technology for alternative fuels, and hybrid and zero-emissions equipment continues to be developed.

Recommendation III. Coordinated Efforts with Education and Business Community

As part of California's strategy for reducing its climate change impact, its dependency on foreign energy, and growing a green economy, the California Community College Chancellor's Office (CCCCO) identified "10 Top Sector Priorities" of which two, Advanced Transportation & Logistics (ATL) and Global Trade Sector programs, are in alignment with identifying curriculum and programs that support DPM and GHG reductions at seaports. Through the CCCCO system, state-level "Sector Navigators" work with regional "Deputy Sector Navigators" that assist with research, curriculum development, employer outreach and sector-base coordination with the business community. Formalizing a relationship with state-level Sector Navigators could provide significant support in convening Seaport employers, local education partners (including high schools and community colleges), and other key stakeholders as part of coordinated efforts

toward establishing an advisory group.

The role of the advisory group could identify business needs, assist with securing state funding such as ETP funds for worker training and further develop education partnerships leading to career pathways in the maritime area. The ATL Sector developed the following programs which directly align with the 2020 and Beyond Plan:

- Electric Hybrid, and Hydrogen Fuel Cell Program
- Gaseous Fuel Programs for Heavy Duty Vehicles
- Gaseous Fuel Programs for Light Duty Vehicles
- Intelligent Transportation Systems Programs
- Railroad Operation Programs
- Aeronautics and Flight Technology Programs
- Automotive Clean Air Car, Emissions Programs

Fortifying partnerships with education leaders, community colleges and local school districts could also serve to inform a robust workforce plan that will continue to complement the 2020 and Beyond Plan over time. Given that the largest number of jobs at the Port is in trucking followed by warehousing, ILWU, and freight forwarders, this could provide an opportunity to collaborate with training and education partners to better understand actual jobs supported at the Seaport and assist with local training and education programming that lead to those specific careers. OUSD is interested in exploring career pathways in Global Trade & Logistics, which could be aligned to the local community colleges as part of continued education opportunities and ultimately leading to four-year degrees. The Port currently, through its college internship program, provides over twenty-five college students and five high school students with summer internships. This program can be strengthened through coordinated efforts as mentioned above and aligned to major at the California Maritime Academy (Cal Maritime). Cal Maritime 4-year undergraduate majors and minors include:

- Business Administration (International Business and Logistics)
- Global Studies and Maritime Affairs
- Marine Transportation
- Mechanical Engineering
- Facilities Engineering Technology
- Marine Engineering Technology
- Power Generation

CONCLUSION

A broad alliance with key stakeholders inclusive of industry, community, local education/training agencies, labor, and the Port is required as part of identifying changes in workforce skills, types of anticipated occupation shifts and or new occupations, and working together to set standards for new and or existing occupations. As new technologies continue to emerge to support zero emissions, the more informed all stakeholders will become preparing a stronger workforce for the future.

Finally, as new hybrid and zero-emissions technologies continue to emerge for maritime applications, the Port is strategically poised to serve as a convener that aligns industry, training institutions and community stakeholders to assess and elicit input to better understand workforce implications, training/re-training needs, certifications and anticipated costs. In order to pursue a near zero and zero-emissions operational environment at the Seaport, it is paramount that the Port's Workforce Plan remain flexible and responsive to the emergence of new technologies, initiatives, regulations, and or policies that serve to inform industry changes that impact workforce needs for the Seaport.

APPENDIX F: EQUIPMENT OPERATIONS AND COST ASSESSMENT TO ASSIST WITH ELECTRIC INFRASTRUCTURE PLANNING

APPENDIX F: EQUIPMENT OPERATIONS AND COST ASSESSMENT TO ASSIST WITH ELECTRIC INFRASTRUCTURE PLANNING

TABLES

FIGURES

ACRONYMS

CARB	California Air Resources Board
CHE	Container Handling Equipment
CO2	Carbon Dioxide
DAC	Disadvantaged Community
DPM	Diesel Particulate Matter
EBCE	East Bay Community Energy
HVIP	State of California Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project
IAM	International Association of Machinists and Aerospace Workers Union
ILWU	International Longshore and Warehouse Union
kWh	Kilowatt-hour
kV	Kilovolt
MTO	Marine Terminal Operator
NOx	Nitrogen Oxides
NZE	Near-Zero Emission
OEM	Original Equipment Manufacturer
OICT	Oakland International Container Terminal
OpEx	Operating Expenditures
PG&E	Pacific Gas and Electric Company
PM10	Particulate matter less than 10 micrometers in diameter
PMA	Pacific Maritime Association
RPS	Renewables Portfolio Standard
RTG	Rubber Tired Gantry
STS	Ship to Shore
TEU	Twenty-Foot Equivalent Units
ZANZEFF	Zero and Near Zero Freight Facilities Grant (CARB)
ZE	Zero-emission

OBJECTIVES

The objectives of this appendix are:

- Identify near-term (2019-2023) commercially available equipment for a high-level (planning level) analysis of costs needed to transform current land-side sources of petroleum-based emissions (container handling equipment and drayage trucks) at the seaport to near-zero and zero-emissions (NZE and ZE) goods movement.
- Estimate timing of initial efforts for each land-side equipment type based on cost, incentive funding, charging rhythms and other relevant factors.

Rather than estimate the capital costs to replace the entire inventory of land-side equipment at the Port of Oakland, this report analyses capital and operating costs of battery-electric yard tractors and hybrid rubber-tired gantry (RTG) cranes which have achieved or are nearing commercial availability. This analysis is intended to demonstrate the potential capital and operating costs associated with these more widely available near-term NZE and ZE equipment technologies, as compared to traditional pure petroleum fueled equipment, and to demonstrate how costs may trend over time.

EXECUTIVE SUMMARY

Key planning assumptions for this study include:

- No change in status quo seaport operations (e.g. operations remain primarily manual);
- No equipment is discarded before the end of its typical life span (no stranded assets);
- Costs of electric vehicles decline over time due to falling battery costs and increasing production scale;
- Existing voucher programs remain in place indefinitely; and
- No infrastructure costs are included (equipment costs only, not including charging equipment).

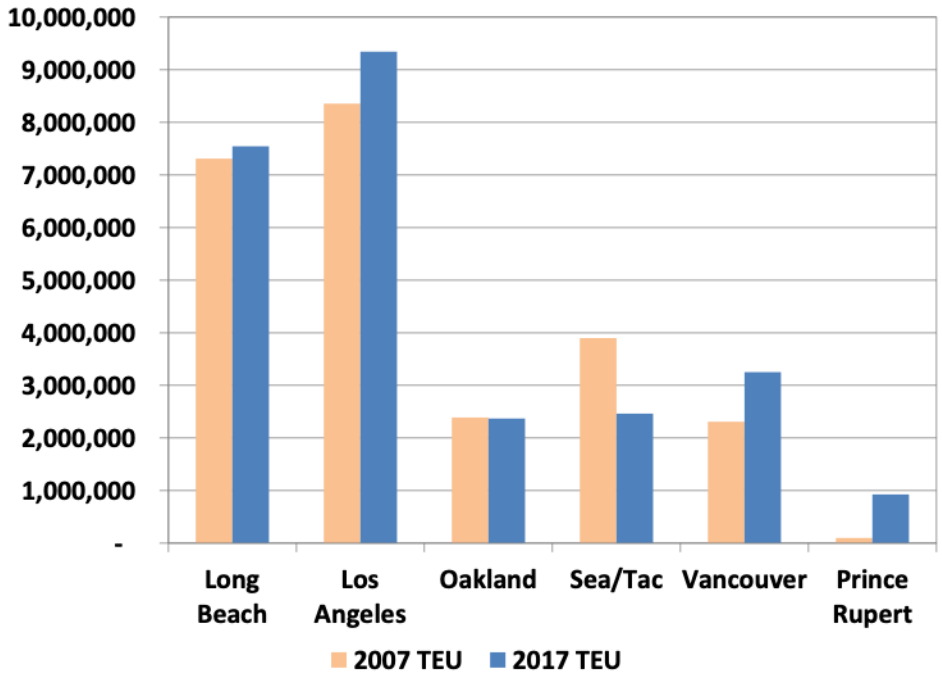
This report focuses on the analysis of the near-term equipment technologies with sufficiently developed commercial availability to allow for cost analysis, primarily electric yard tractors and hybrid lift equipment. Intermediate-term technologies without substantial cost information yet available are discussed qualitatively, including electric top-picks and electric drayage trucks. Overall results show that voucher programs to offset higher ZE and NZE equipment purchase prices (in contrast to conventional diesel equipment) will be critical to facilitating their adoption, particularly in the near-term while vehicle purchase costs remain much higher than those of traditional petroleum-based equipment. Hybrid lift equipment such as RTGs, Reach Stackers and Sides Picks are commercially available, and may save 40% in fuel compared to a conventional diesel lift.

BACKGROUND

The Port of Oakland, a container-only cargo port, is a second port of call (second-tier) seaport compared with the Southern California ports of Los Angeles and Long Beach, which handled nearly half of all US containerized imports from Asia during the first half of 2018 (Source: "Gates Open for Imports," Bill Mongelluzzo, Journal of Commerce October 1, 2018). Oakland also competes for rail cargo destined for the US interior with other ports along the North American West Coast up to and including Prince Rupert, Canada. All of these ports are landlord ports (as opposed to operating ports); all container-handling equipment (CHE) is owned by terminal operators rather than the Port. All West Coast US ports use International Longshore and Warehouse Union (ILWU) labor to operate equipment at marine terminals. The International Association of Machinists and Aerospace Workers (IAM) Union also provides longshore labor to marine terminals at the Port of Oakland.

Figure F.1 shows the volume in twenty-foot equivalent units (TEU) at West Coast container ports for 2007 and 2017. This chart shows the dominant market position of the Ports of Los Angeles and Long Beach, which are adjacent to each other in San Pedro Bay.

Figure F.1: Container Volume (TEU) for North American West Coast Ports



The Port of Oakland handled effectively the same amount of container cargo in 2017 as it did a decade earlier. The Ports of Los Angeles and Long Beach showed modest growth during this time period, while East Coast ports grew substantially in terms of both actual volume and market share. In the Pacific Northwest, there was a strong shift of cargo from Seattle and Tacoma (shown as "Sea/Tac") across the U.S. border to Vancouver and the new container terminal, Prince Rupert, which opened in 2007.

The first port of call volumes and correspondingly high revenues at the San Pedro Bay ports (Ports of Los Angeles and Long Beach) allow more access to capital for investment relative to the Port of Oakland, and the higher volumes result in higher levels of utilization per vehicle for CHE. Higher per-unit equipment usage at the San Pedro Bay Ports, in terms of both hours of operation and container moves, results in a more favorable business case for switching to ZE and NZE equipment that costs the same to buy as in Oakland, since higher utilization results in more operating cost savings. Because the Ports of Oakland, Los Angeles, and Long Beach are in the state of California, they are subject to the same California Air Resources Board (CARB) regulations.

Seaport activities at the Port of Oakland include transfer of cargo between vessels and container yards at marine terminals, where cargo is also delivered and taken off-site by drayage trucks. The Seaport area at the Port of Oakland is served by two Class I Railroads, one operating on Port-owned property (BNSF), and one on private property adjacent to the seaport (Union Pacific). Furthermore, the seaport includes off-dock tenants such as transloading and distribution businesses.

Seaport Air Quality 2020 and Beyond Plan

The Seaport Air Quality 2020 and Beyond Plan is in development and will include three timeframes: Near (2018-2023), Intermediate (2023-2030), and Long (2030-2050). The Seaport is also currently awaiting new regulations under development that will have a significant impact on the plan going forward (see the following section, Regulatory Setting).

Due to a combination of regulatory uncertainty and limited availability of current ZE equipment, an overall cost number to convert all landside equipment and drayage trucks to ZE has not been predicted in this study, as there is insufficient information available to develop a meaningful cost estimate. For example, current electric drayage truck prototypes are priced at around $300,000 each, so complete replacement of the about 8,750 trucks in the Port's Drayage Truck Registry would have a total cost of about $2.6B. However, this figure has very little meaning for a variety of reasons, including: current electric drayage truck models are not developed enough to be capable of replacing all duty cycles performed by the current diesel drayage truck fleet, when the technology is fully developed it should be somewhat closer to the costs of conventional equipment with potential operational savings factored in, and ZE truck production capabilities are not yet sufficient to replace the entire drayage truck fleet in any reasonable amount of time.

Overall equipment replacement costs were not analyzed in detail as this was also not expected to yield a meaningful result due to a variety of technical, commercial, and regulatory uncertainties. For example, the Seaport has 386 pieces of diesel CHE onsite. If Tier 4 diesel replacements were ordered tomorrow, the total replacement cost would be on the order of $125M, plus tax & freight. If terminal operators instead ordered whichever demo ZE equipment is available today, it would amount to perhaps $350M plus tax & freight (about 3 times higher).

This is not a feasible or reasonable cost for operators, so this analysis focused instead on individual case studies for the equipment most likely to be feasible within the next five years. While the Seaport awaits regulation, we would not expect investment in large amounts of new equipment (either clean diesel or ZE models) given the stranded assets concern (i.e. getting rid of equipment with useful life remaining). Furthermore, while demo equipment models are available for purchase in small quantities, current ZE equipment does not have the production capability to replace all petroleum Seaport equipment with ZE models.

Infrastructure costs are also not included in Appendix F as these are the responsibility of the Port; they will be developed independently of this report.

Regulatory Setting

CARB regulates mobile sources of emissions. Relevant regulations include the Mobile Cargo Handling Equipment (CHE) Regulation at Ports and Intermodal Rail Yards amended in October 2012, and the Drayage Truck Regulation dated November 2011. The CHE Regulation requires new equipment to have either a Tier 4 Final off-road engine or a model year 2010 or newer on-road engine. Yard tractors were required to be fully compliant with the CHE Regulation by December 31, 2017, and non-yard equipment (top picks, RTG cranes, etc.) were required to be fully compliant by December 31, 2013. In March 2017 the CARB Governing Board directed CARB staff to develop new regulations for CHE that will require up to 100% ZE equipment by 2030. New regulations may be adopted as soon as 2022 with implementation starting as early as 2026.

Whether or not the proposed 2030 ZE regulations will be feasible will depend heavily on how the rule is structured and how stranded assets are treated. A rule which requires all equipment in operation be fully ZE by 2030 is unlikely to be feasible, as this will require terminal operators to get rid of significant quantities of equipment with useful life remaining. However, if the rule is structured such that all new purchases from 2030 onward are required to be ZE, the feasibility of meeting this schedule will improve significantly, although still may present substantial technical challenges. See Figure F.2 later in the report for a summary of the technical and commercial status of various ZE and NZE equipment types.

Under the Drayage Truck Regulation, since January 2014, drayage trucks, which are Class 8, must have a 2007 or newer model year engine, and by January 2023 must have a 2010 or newer model year engine. Senate Bill 1 (SB1) prohibits CARB from implementing new requirements before a truck has reached the earlier of 800,000 vehicle miles or 18 years from the engine model year. CARB has published that it will consider new drayage truck regulations in 2022 with implementation in 2026-2028.

Incentive Funding

The most readily accessible incentive funding is CARB's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) administered by CALSTART on a first come first served basis. The program provides incentives (up to 80% of the capital cost differential between diesel and

NZE/ZE equipment) for Class 8 (down to Class 2B) on-road non-passenger vehicles. Yard tractors, although generally used off-road, can be purchased via HVIP with a $150,000 (+ $15,000 if in a disadvantaged community [DAC]) voucher. Currently, one off-dock City tenant operates an electric yard tractor at the former Oakland Army Base, and more off-dock yard tractors are on order—all purchased using the HVIP voucher.

Yard tractors operating within marine terminals must be designed to support heavier loads than those that have been purchased for off-dock use. A yard tractor suitable to serve vessels at a marine terminal (on dock) is in the demonstration phase. CARB plans to unveil its off-road equivalent to HVIP, the Clean Off-Road Equipment incentive program, in mid-2019. There is one ZE battery electric drayage truck available for purchase via HVIP which is also in the demonstration phase.

EQUIPMENT AND VEHICLE TECHNOLOGIES CONSIDERED

This analysis considered two categories of land-side equipment: CHE and on-road drayage trucks. CHE consists primarily of yard tractors, RTG cranes, and top-picks. Locomotives operating at near-dock railyards were not analyzed in this study as they only generate a small fraction of total seaport emissions and not all locomotives can be regulated by CARB (Class I rail is not regulated by CARB).

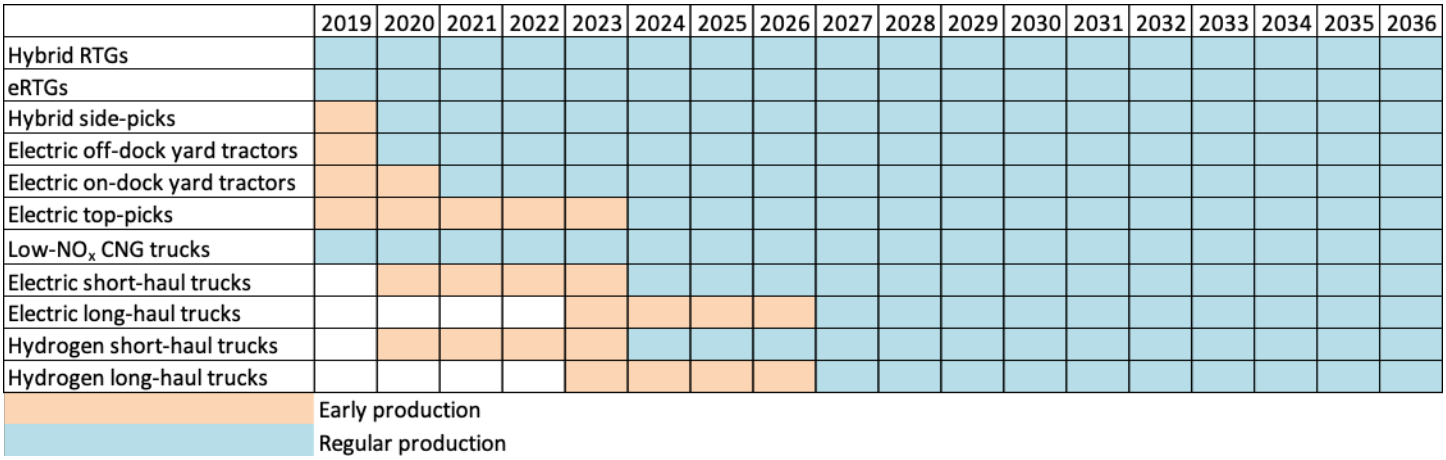
On-road drayage trucks were divided into two categories: short-haul and long-haul. Short-haul trucks stay within the seaport for lower-speed moves such as railyard trips and therefore need less range to be viable. These lower-speed moves are often referred to as "shuttle" or "land-bridge" moves. Long-haul trucks are often domiciled (i.e. stored when not in-use) away from the Port and travel longer distances at highway speeds, thus any non-petroleum replacement requires long-range capability and fast-recharging to be operationally feasible. Currently, about 10-15% of all containers moving through the marine terminals go to and come from the railyards (Source: Port of Oakland Truck Parking Study, Tioga, February 2016).

Advanced technologies to replace conventional equipment vary considerably in their current state of development. Current options for replacement include hybrid NZE equipment, alternative fuel (e.g., natural gas engines, renewable natural gas) engines that allow NZE operation, battery-electric vehicles, hydrogen fuel cell vehicles, and terminal equipment that can be connected to the electricity grid through cables or busbars. For example, hybrid RTGs, which use a battery with a small engine for repowering when energy recovery is insufficient to keep the battery charged, are part of the regular offering list from multiple large equipment vendors (e.g. Kalmar, Kone, Paceco). On the other end of the spectrum, battery-electric top-picks or long-haul drayage trucks are expected to be a few years away from even early production. The necessary charging infrastructure for long-haul trucks is also unknown at this point. Furthermore, there are potential issues associated with the electrical vehicle charging equipment including City electrical permit and inspector safety certification requirements,

standardization of electric plug design between manufacturers, and the technological advancement of master controllers (power management) to charge vehicles sequentially and reduce peak demand.

Figure F.2 shows a conceptual view of the availability of each type of equipment analyzed in this appendix. Early production indicates prototypes exist and individual units may be available for purchase and testing by interested parties, but large-scale production and purchases are not available. These early units will also generally be effectively custom-made as ordered, and thus have much higher purchase costs and lead times than fully commercially available vehicles, as full commercial production requires much more robust manufacturing infrastructure and speed of delivery. Regular production means vehicles are fully commercially available and fleets of vehicles can be purchased as needed from equipment manufacturers. With the exception of battery hybrid RTGs and side-picks, all of these refer to fully electric battery vehicles; other technologies such as hydrogen fuel cell drayage trucks are in the demonstration phase and have not yet reached early commercialization.

Figure F.2: CHE and Truck Technology Maturity Status



Yard tractors offer the most detailed data as there are four worldwide manufacturers (Orange EV, BYD, Kalmar and Terberg) with battery-electric models as of late 2018, although the total number of units produced to date is low, and most units are lighter-specification machines suitable for off-dock use only, not for heavier marine terminal applications which comprise 90% of the Port's yard tractor fleet. A comprehensive cost analysis of these machines shows that they may save money compared to diesel today and cost savings likely improves over time as the price of electric vehicles is expected to drop due to decreases in battery prices and increasing economies of scale of production. The availability of HVIP vouchers to offset the purchase price of electric yard tractors is critical and will remain critical to users since high capital costs are a barrier to widespread adoption.

While the overall amount of electric power needed for CHE charging will be low compared to the current power used at the Port in the near term due to the relatively small number of units

that will be deployed, the peak power delivery capacity required for charging on busy days may become significant in the intermediate term. This can potentially be mitigated by pairing chargers with a battery buffer to limit the draw on the electric grid. Any such buffer (or other energy storage system) would increase infrastructure costs related to implementing battery-electric equipment.

Hurdles to initial adoption of battery-electric yard tractors include operator concerns about either battery range and maximum allowed cargo handling weight (ability to move up to 170,000 pounds), and uncertainty about the role of ILWU and IAM labor in plugging and unplugging vehicles. As these issues are better understood, electric yard tractors may become a more appealing option in the intermediate term.

This appendix focuses on battery-electric yard tractors as the most appealing zero emissions CHE at marine terminals, as the state of battery-electric yard tractor development is advanced enough to allow a preliminary cost analysis. Other options exist including hydrogen fuel cell vehicles or internal combustion vehicles using alternative and renewable fuels, but these have downsides in terms of current development status, cost, fuel availability, local emissions, or upstream emissions, compared to battery-electric vehicles. There is also an ongoing effort to increase renewable power to the California electric grid, which may eventually allow electric equipment to be paired with zero-emissions electricity for true zero-emissions operations. Regardless of if or when the California electric grid becomes 100% renewable, the fraction of renewable power is expected to increase every year for the foreseeable future, which will make electric CHE holistically cleaner every year.

Container Terminal Operations

Four primary types of container handling equipment (CHE) are used at the Seaport to handle containers within the marine terminals:

a. Ship-to-shore (STS) cranes;
b. Rubber-tired gantry cranes;
c. Top-picks (and side picks); and
d. Yard tractors.

Figure F.3 shows a schematic of how this equipment is used for a typical import container move. For imports, an STS crane removes the container from the vessel and places it on a yard tractor. A top pick moves the container from the yard tractor to the stacked containers in the yard. When a drayage truck is ready to receive a container, an RTG crane moves the container from the stack onto the truck. Note that unlike imports, only top-picks are used for export moves, for both vessel and gate (drayage truck) work. The top-pick moves the container from the truck to the stack, and later from the stack to a yard tractor. This practice is why top (and side)-picks are far more numerous than RTGs at US West Coast container terminals and why availability of ZE top-pick models is crucial to transitioning the US West Coast to fully zero-emission terminal

operations.

Figure F.3: Import Container Move Schematic Example

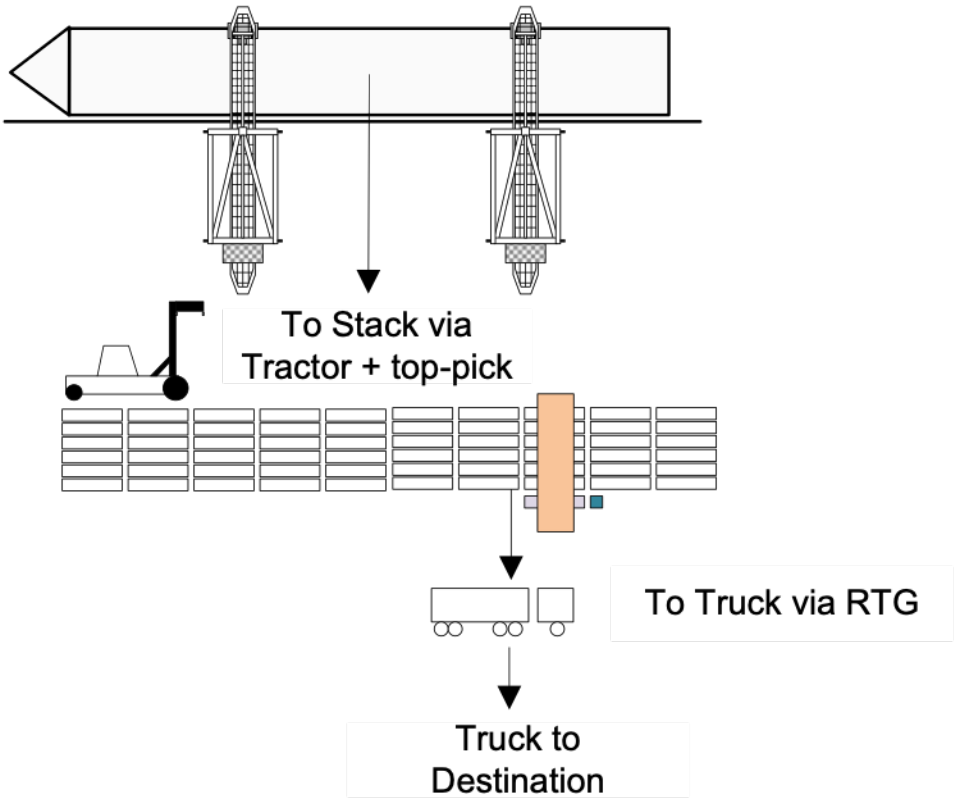
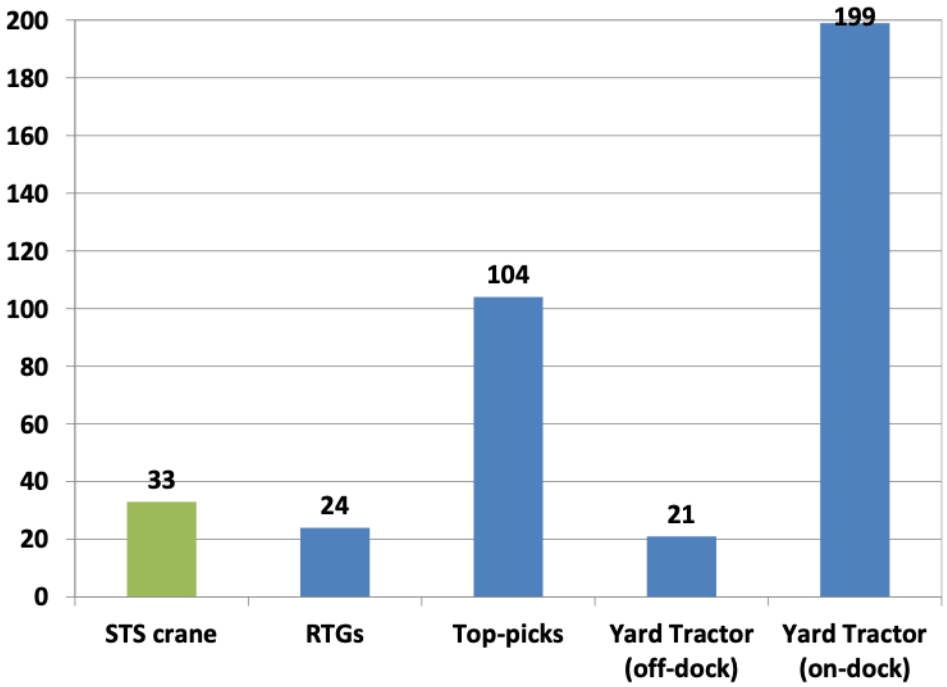


Figure F.4 shows example images of top-picks and RTGs.

Figure F.4: Top-pick (left) and RTG (right)

Figure F.5 shows the 2017 inventory of each piece of CHE at the Port.

Figure F.5: Port-wide CHE Equipment Inventory



Current State of Zero-Emissions Vehicle Technology

The STS cranes in Oakland are powered by electricity delivered via high-voltage cables. All the STS cranes are 100% electric and no batteries are involved with their operation.

While approximately 25% of the global fleet of RTGs also runs on electric power delivered by cable or busbar, this type of landside infrastructure is incompatible with the standard stevedoring practice on the US West Coast, which uses top-picks to place import containers into a stack and RTGs to extract containers for drayage trucks (see Figure F.3). For this reason, hybrid-electric RTGs appear to be the most appealing option to reduce emissions from this class of CHE in the near to intermediate term. Hybrid RTGs are currently available from multiple equipment vendors (e.g. Kalmar, Kone, Paceco), and existing diesel RTGs can also be repowered as hybrids. SSA Terminals, which operates Oakland International Container Terminal (OICT) and Matson Terminal, is in the process of replacing thirteen 1000hp engines with 142hp engines via the hybrid-electric RTG project at OICT (refer to Appendix C).

As described above and as Figure F.5 shows, top-picks are a much more common CHE than RTGs in Oakland. At present there are no commercially available battery-electric top-picks. A few top picks have been developed as custom conversions for demonstration purposes, but the cost of these machines is not likely to be indicative of what original equipment manufacturers (OEMs) will offer in the future. Fully battery-electric top-picks are under development. Hybrid-electric side-picks exist, but are only suitable for lighter applications (empty containers). No hybrid top-picks are commercially available. Development of fully battery-electric top-picks is driven largely

by interest in transitioning to fully zero-emissions operations in California. Therefore, there is a greater interest in developing a fully electric top-pick, versus an interim step of hybridizing. Because they are not currently commercially available nor under development, hybrid top-picks costs were not analyzed in detail.

There are indications that fully electric top-picks will be available in the intermediate term (2023-2030). Through a variety of grant funding sources, the Port of Long Beach plans to test five electric top-picks at three separate facilities in the near-term. One of these same grants will fund demonstration of an electric top-pick at the Port of Oakland's Matson terminal in 2020. In addition, the Kalmar website states:

"Kalmar announced that our full offering will be available as electrically powered versions by 2021. Why have we taken such a leap with our entire product portfolio? Because the industry demand is there, and it's growing much faster than anyone could have anticipated only a few years ago."[1]

As previously mentioned, operating hours per charge and labor rules regarding plugging in equipment is a major issue limiting marine terminal operator (MTO) enthusiasm for electric yard tractors.

Figure F.6 shows the standard working hours for the ILWU, the union responsible for stevedoring operations (loading and unloading of ships) on all US West Coast marine terminals (IAM also operates at OICT and Matson but is not directly involved in stevedoring).

Figure F.6: ILWU Work Hours

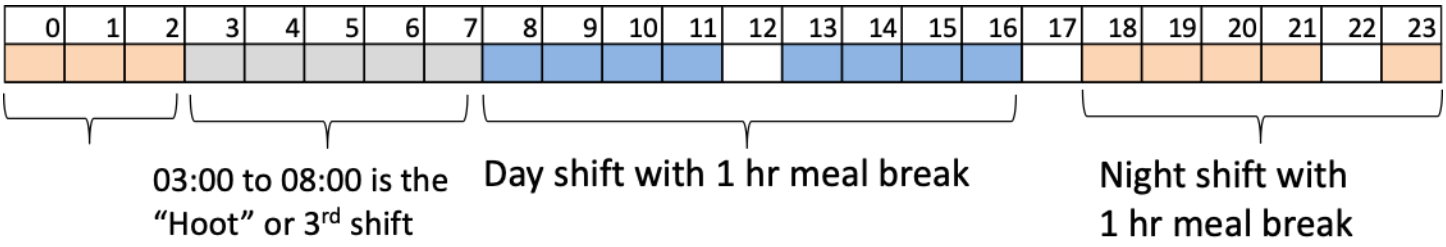
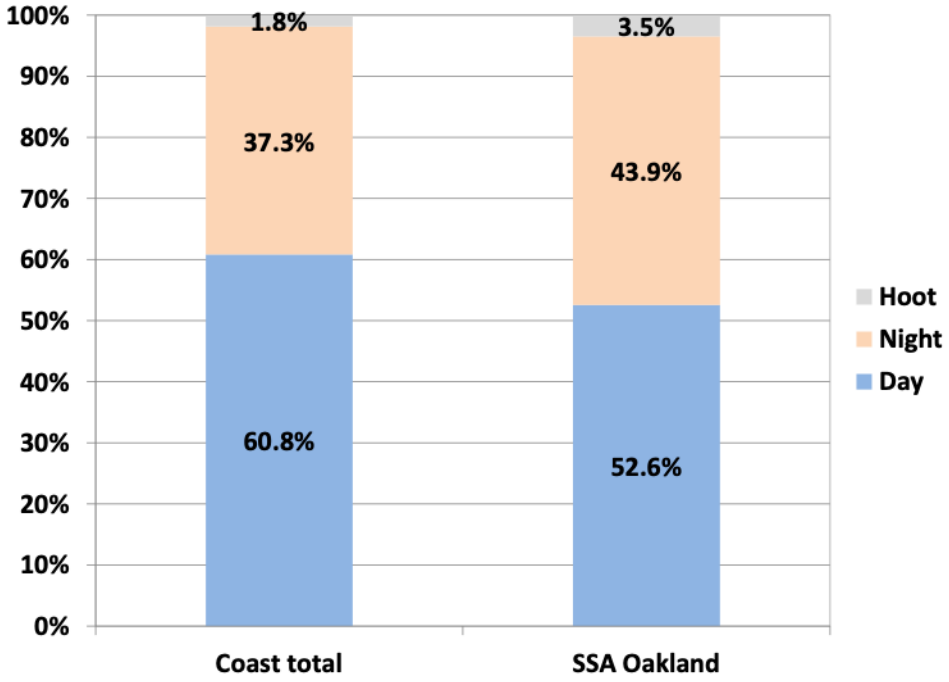


Figure F.7 shows a breakdown of total 2017 shifts worked by the entire US West Coast versus at OICT in Oakland, showing that hoot shifts are worked occasionally, but vessel operations are dominated by day and night shift activity.

[1] Source: https://www.kalmarglobal.com/news--insights/2018/20180522_are-you-ready-to-be-fully-electric-by-2021/

Figure F.7: OICT vs. US West Coast Container Terminals



Sources: Pacific Maritime Association (PMA) 2017 Annual Report, communications with SSA Marine (Susan Ransom & Jim Rice)

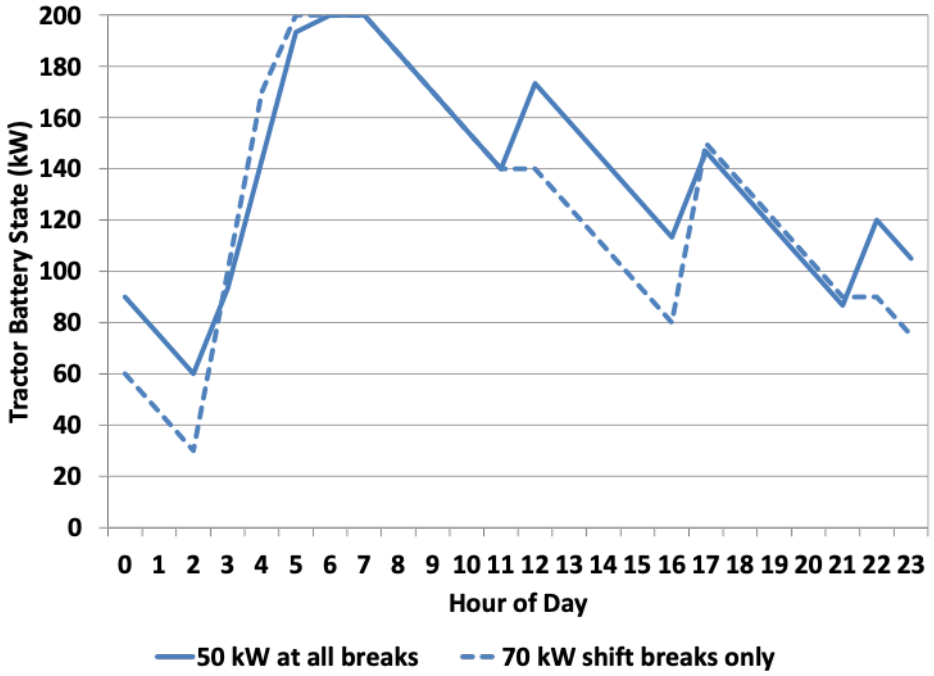
The primary opportunity for electric vehicle charging is the five hour "hoot" shift between 3am and 8am. An ideal equipment specification for the Oakland market would have a battery large enough to last 20 operating hours. If a marine terminal (on-dock) yard tractor uses perhaps 15 kilowatt-hours (kWh) per hour, roughly three times more than an off-dock yard tractor (source: conversation between Port staff and Bill Aboudi, owner of AB Trucking, 2018), a battery of about 220 kW would be sufficient if the vehicle could be charged between the day and night shift breaks. This is approximately equal to the maximum battery sizes currently offered from manufacturers. There are days in which all three shifts are worked—this analysis considers an average day knowing that in reality electric yard tractor charging solutions must be able to accommodate the maximum usage scenario.

Figure F.8 shows two potential battery use and recharge rhythms during a two-shift work day for a nominal 200 kWh battery. A 200 kWh battery was selected as a value near the top-end of current electric yard tractor models for sale. For 16 hours of work at 15 kWh per hour, an electric yard tractor will require a total of 240 kWh per day if required to work a full two shifts. With a 200 kWh battery size, this means some recharging over hour-long shift and lunch breaks may be required during peak operating conditions.

Both cases in Figure F.8 assume the battery drains at a rate of 15kWh per hour of operation, and any hour break would result in a net 40 minutes of actual recharge time. The solid bar shows a recharge rate of 50 kW over each shift break, meal break, and the hoot shift. The dashed line shows a recharge rate of 70 kW during shift breaks and the hoot shift only (meal breaks are

excluded due to uncertainty about whether vehicles can effectively be recharged during meal breaks, based on current operations wherein yard tractors may not be parked in locations with charging stations over meal breaks). Either rhythm shows that electric yard tractors have the potential to operate through a typical two-shift workday, with recharging as needed over shift changes and/or breaks.

Figure F.8: Yard Tractor Battery State during a Two-Shift Workday



ELECTRICAL SYSTEM STATUS

Utility Operations and Territory

The Port of Oakland has been serving as a municipal utility since 1985, at a portion of the seaport and the Oakland International Airport. The TraPac Terminal, Ben E. Nutter Terminal, the Outer Harbor Terminal, Matson Terminal, and Howard Terminal all have Pacific Gas and Electric Company (PG&E) or East Bay Community Energy (EBCE) as their utility. The main Port utility customers include tenants at the former Oakland Army Base, OICT, Cool Port, and BNSF. In addition, shore power (cold ironing) is also served by the Port utility with the exception of the Matson Terminal and Howard Terminal.

The Port and PG&E are on target to meet the requirements of the Renewable Portfolio Standards (RPS) and California legislative mandates such as the recently passed Senate Bill 100 (SB 100) which updates the RPS requirements to 60% eligible renewable by 2030 and 100% carbon-free electric supply to end-use customers by 2045.

Transmission and Distribution

As the Seaport moves towards zero-emissions operations, unless there is a breakthrough with hydrogen or other currently unknown zero-emissions sources of energy, it will likely become necessary to upgrade the transmission infrastructure, although the exact tactics and timing are difficult to predict. All Port power is delivered through the main PG&E Substation C located at 115 Martin Luther King Jr. Way in Oakland. The main line (115 kilovolts [kV]) is fed into two substations (which convert power from 115 kV to 12 kV) which are operated and maintained by the Port. The electrical distribution infrastructure downstream of these substations is also maintained by the Port.

A significant new load from the Port will necessitate additional upgrades both at Substation C and all downstream infrastructures owned and maintained by the Port, and which may also include a completely new transmission line and substation. The cost of these upgrades is not developed here because it was not part of AECOM's scope.

CHE COST AND EMISSIONS ANALYSIS

AECOM analyzed the two cost recovery scenarios presented below, for equipment types that have early-commercial advanced technology replacement options. Evaluations are also included for drayage trucks and renewable diesel as a replacement fuel. This analysis includes equipment only, not infrastructure.

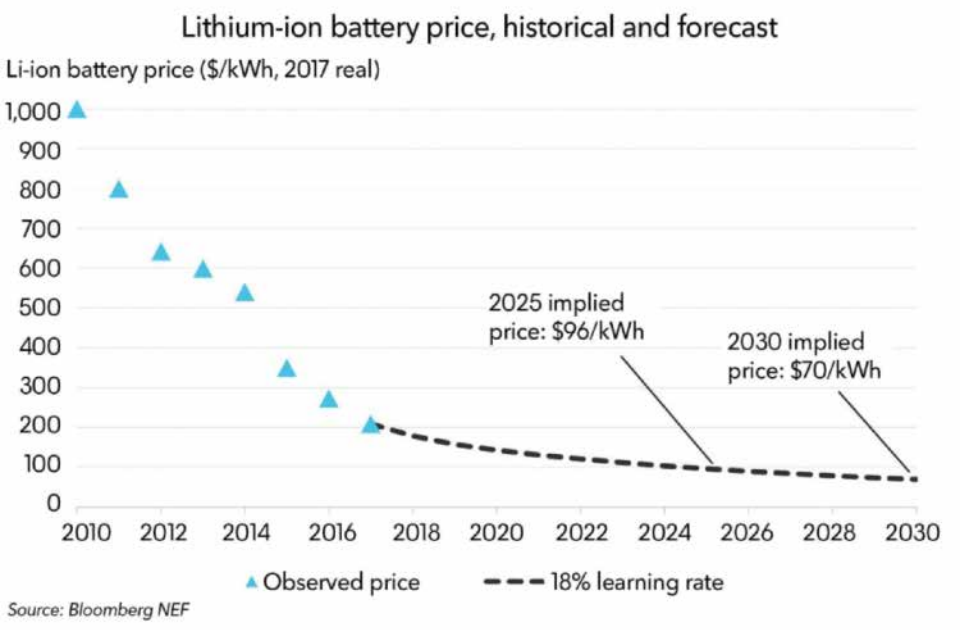
Electric versus Diesel Yard Tractors

In the near to intermediate term, electric vehicles will cost more to buy than diesel equivalents, but will likely save on maintenance and fuel cost. Subsidy programs in California can defray most of the difference in purchase price between diesel and electric vehicles. The HVIP program, for example, has $78 million in funds for this purpose from California's Cap-and-Trade revenue with the stated goal of reducing the purchase cost difference in zero-emissions and conventional equipment by 80%.

An electric yard tractor may cost more than double what a comparable new diesel yard tractor does in 2018. This is due to the relatively high cost of batteries and the very low production volume that increases the design and manufacturing cost per unit. In addition to the higher up-front costs, these yard tractors have a longer time to delivery than their diesel counterparts and are not available from the lot. However, it is expected that the price of lithium ion batteries powering the electric yard tractors will continue to decline for the foreseeable future.

Figure F.9 shows a chart of future predicted price generated by Bloomberg New Energy Finance.

Figure F.9: Predicted Lithium Ion Battery Price



According to Figure F.9, a 200 kW-hr battery that costs $40,000 or more in 2018 may cost as little as $14,000 (in 2017 dollars) in 2030. This trend, along with increasing scales of commercial production over time, will drive down the prices, and price premium versus diesel machines, of electric yard tractors over time.

As an example of this, consider the comparison of costs in 2018 versus 2025 for yard tractors. A new diesel yard tractor will cost $115,000 (in 2018 dollars) for both years. With 12% tax and fees included a new diesel yard tractor will cost approximately $129,000 to purchase. An electric yard tractor currently costs $300,000, but includes an HVIP voucher of $150,000 (+$15,000 if in a DAC) for a net retail price of $150,000 (or $135,000 if in a DAC). The buyer will pay 12% tax and fees on the original price of $300,000 ($36,000) which brings the total purchase price to $171,000 for a difference of $42,000 in capital cost if in a DAC.

By 2025, the retail price of an electric yard tractor is expected to decline to approximately $217,000 for reasons of battery cost and commercialization scale. The rebates available will decline along with the difference in price between diesel and electric so the 2025 voucher is expected to be $82,000, for a net price of $135,000 and an all-in price including tax of $161,000, with is about $33,000 higher than a diesel yard tractor. In a DAC with an additional $15,000 voucher, this $33,000 difference may reduce to $18,000. It is unknown if HVIP vouchers will continue to be available after 2023, which may have a significant impact on cost trends; without them, the 2025 example case will cost equipment buyers $82,000 extra per yard tractor.

Electric yard tractors will generate savings in both maintenance and energy compared with diesel yard tractors, based on preliminary operating data from existing in-use electric yard tractors, as well as current diesel fuel and electricity costs. They will however likely incur some

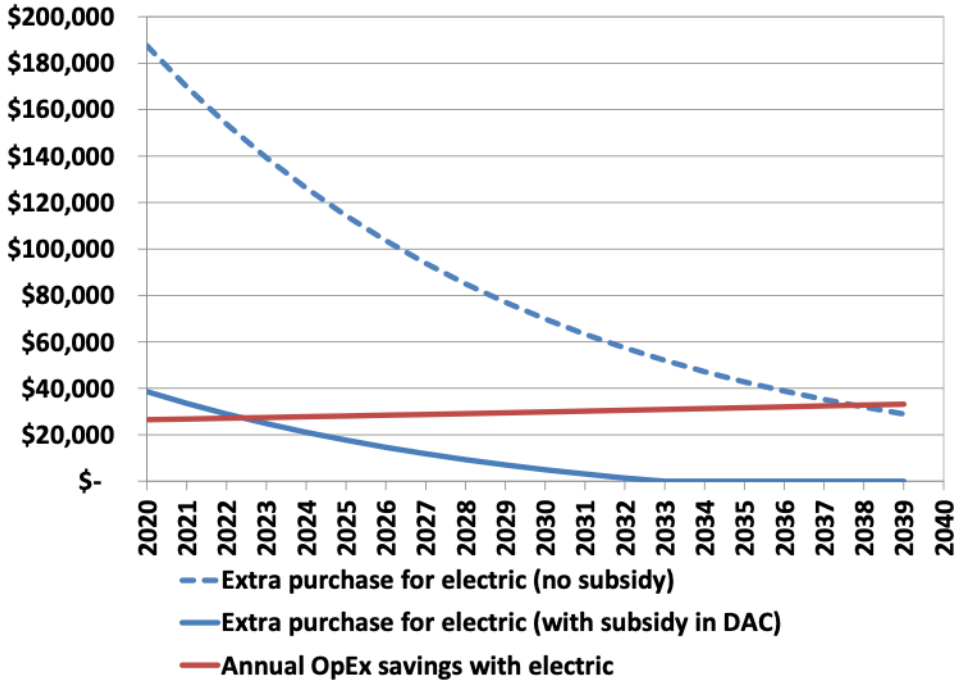
operating cost for labor to plug and unplug the vehicles as drivers of electric yard tractors likely cannot plug and unplug their own vehicles; potential labor cost has not been accounted for in this study due to uncertainty about future equipment charging strategies, including the potential for future automated charging systems such as pantographs (apparatus mounted on the roof of a piece of equipment that collects electricity through a connection to overhead wires).

The following assumptions were used to derive operating expense (OpEx) savings for electric yard tractors:

- 1,600 yard tractor operating hours per year, growing at 1.2% per year (half of the projected Port growth rate used in other recent Port study documents)
- $30 maintenance cost per operating hour for diesel yard tractors
- $20 maintenance cost per operating hour for electric yard tractors
- 2.5 gallons of diesel burned * $3.50 cost per gallon = $8.75/hr fuel cost
- 15 kW electricity used at a mean rate of $0.15/ kW-hr = $2.25/hr electricity cost

Figure F.10 shows the projected difference in purchase price between electric and diesel yard tractors, as well as the expected annual savings in operating costs with electric yard tractors. When the red and blue lines cross, it means the additional upfront capital required to purchase an electric yard tractor will be recouped in one year via OpEx savings (i.e., less fuel and maintenance). Note there are two purchase cost trends presented in Figure F.10: with and without subsidies (note the 'with subsidy' case includes an additional up to $15,000 for being in a DAC). In the case with subsidies available indefinitely, the lines cross around 2022. Without any subsidies, the lines do not cross until about 2038. This underscores how crucial vouchers will be to encouraging adoption of electric yard tractors, not only in the near-term but for many years. Yard tractors need to be financially appealing to terminal operators to be adopted on a large scale. Note that Table F.10 shows vehicle cost trends only; there will be additional costs for charging infrastructure and potentially additional labor costs to plug in and unplug yard tractors.

Figure F.10: Yard Tractor Cost Trends over Time

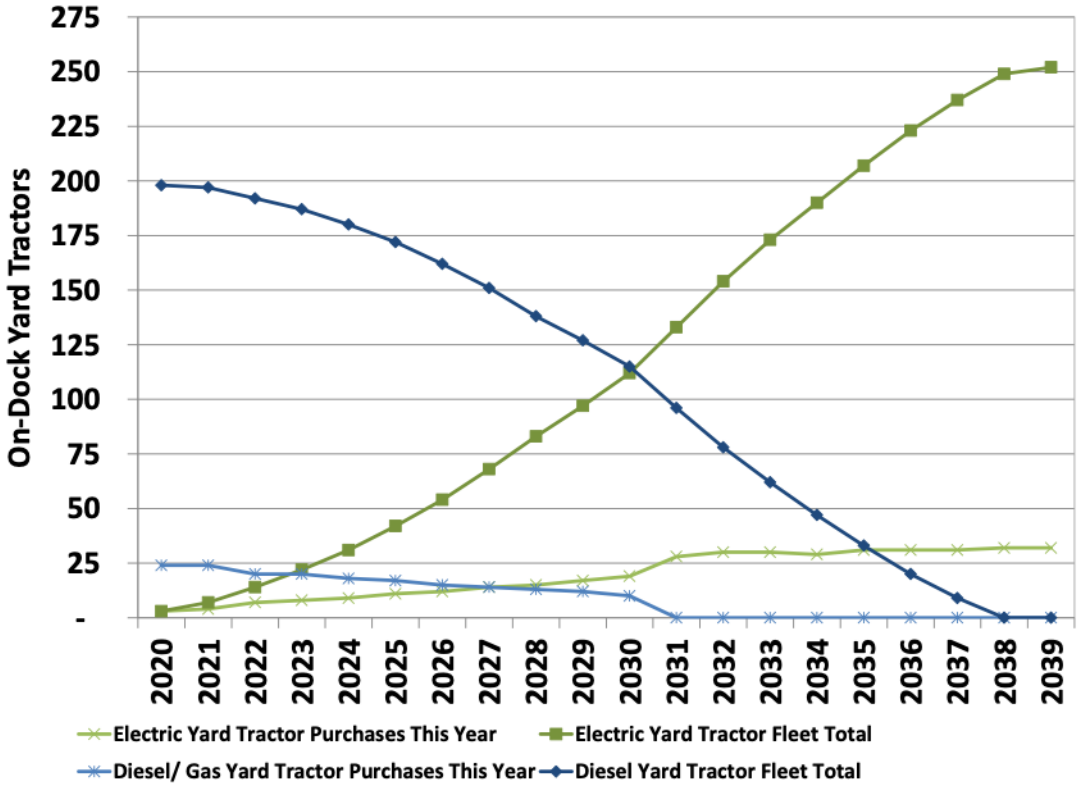


On a purely financial basis, electric yard tractors seem appealing at present with subsidies, and will get more so over time. Despite this, it is difficult to predict the rate at which operators will adopt this equipment. Operators are concerned about the lack of real-world data in marine terminals with regard to battery range, load capacity, and durability (how long the vehicle will actually last), as well as uncertainty about plug in/unplug labor protocols and availability of parts and repair service. For businesses that typically purchase used equipment, the higher capital expenses (CapEx) may be more of a deterrent, even if the operating expenses are lower and current equipment may not be fully amortized yet. Smaller operators may not be able to afford the equipment, and/or banks may be unwilling to provide financing for equipment that does not have a proven track record.

The makeup of the overall fleet of vehicles at the Port will change gradually because a typical diesel yard tractor has a useful life of approximately eight years per interviews with each of the MTOs. It is unlikely that operators will replace equipment before the end of its useful life, so it is assumed that 1/8 of the Port fleet of 199 on-dock yard tractors will be replaced each year on average.

Figure F.11 shows the assumed electric (versus diesel or gasoline) yard tractor fleet sizes at the Port over the next 20 years. This analysis assumed that beginning in 2030, all new yard tractors purchased will be electric. Prior to that, the fraction of yard tractors bought as electric ranges from about 10% to 60%. New purchases to accommodate volumes growth are also included, hence the larger total yard tractor fleet size expected in 2039 versus 2020.

Figure F.11: Assumed Fraction of Port Yard Tractors using Electric Power versus Diesel or Gasoline

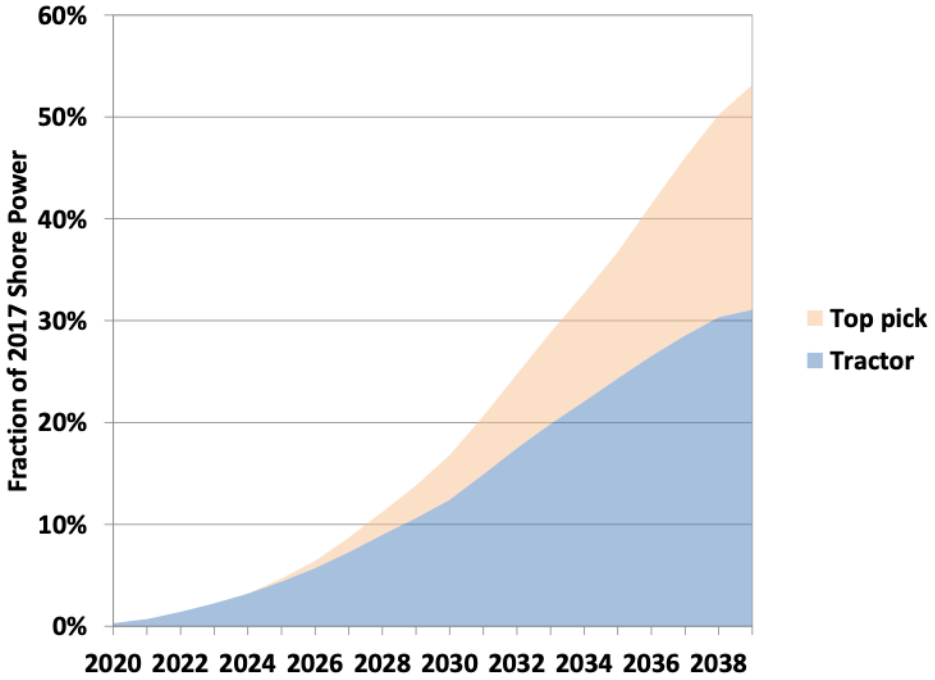


Power Use for Near-Term Electric Yard Tractors and Intermediate-Term Electric Top-Picks

Figure F.12 shows a projected annual power used by both yard tractors and top-picks, the two equipment types expected to have electrically powered models requiring charging from the grid. Top-picks were assumed to lag yard tractor adoption by five years, and to use approximately the same amount of energy as a total fleet for a given level of market penetration.

As Figure F.12 shows, the total power demand for CHE charging in 2040 is expected to be about 53% of what the Port currently uses annually for vessel shore power (about 24 MWh in 2017 per Port of Oakland staff) or about 12 MWh. Shore power is used as a baseline to compare to existing seaport electricity usage, and because in the near-term some electrical capacity may be available from recent shore power infrastructure upgrade projects. Based on this gradual rate of increase, it is not expected that the adoption of battery-electric CHE will require significant infrastructure upgrades within the next decade, but further site-specific study is required to confirm this. Eventually, a transition to fully electric terminal equipment may require significant and costly electrical capacity upgrades, but the exact timing and cost of these upgrades is unknown and may vary among different parcels of Port property.

Figure F.12: Total CHE Power vs Current Vessel Shore Power



Emissions savings for electric yard tractors at marine terminals

Table F.1 summarizes total tons of emissions reductions expected per yard tractor at existing average tractor utilization (i.e. annual hours of operation) and fuel burn rates, based on information provided by marine terminal operators. As there are currently 199 diesel or gasoline yard tractors operating at the marine terminals, electric tractors can lead to on-port emissions savings, particularly if paired with zero-emissions electricity sources. No grid emissions are accounted for in Table F.1, as the trend in California is towards an increasingly zero-emission grid over time. Total reductions may trend upward over time as yard tractor fleet sizes grow and as volumes increase and enable more annual operating hours per yard tractor.

TABLE F.1. ANNUAL EMISSIONS SAVINGS PER ELECTRIC ON-DOCK YARD TRACTOR

	PM10	NOx	CO2
Annual Short Tons of Emissions Saved per Electric Yard Tractor versus Diesel	0.002	0.12	45.3
Annual Short Tons of Emissions Saved with all Existing 199 Yard Tractors replaced by Electric Yard Tractors	0.45	23.1	9,022

Hybrid versus Pure Diesel Equipment

RTGs

AECOM developed a cost analysis for hybrid RTGs, presented below. Hybrid RTGs (as opposed to fully electric) were included because they are both commercially available and compatible with existing operations at the seaport.

Note that RTGs are a very different type of equipment than the yard tractors analyzed in previous sections (see example Figure F.4). RTGs lift containers out of stacks and place them onto yard tractors, resulting in very high power loads and thus requiring a grid-connected system for fully electric operations (typically a cable-reel or busbar). While fully electric RTGs are also widely available worldwide, they are not compatible the US West Coast practice of placing imports coming off a vessel into stacks with a top-pick and retrieving them with an RTG (see previous section Background: Container Terminal Operations).

Key assumptions used to analyze the cost of hybrid vs. pure diesel RTGs were:

- A new hybrid RTG costs $150,000 more than a pure diesel RTG ($2.15M vs. $2.00M, respectively);
- 20-year machine life for both diesel and hybrid;
- Diesel RTGs burn on average 6 gallons of diesel per operating hour;
- Hybrid RTGs reduce fuel consumption by 40% (to 3.6 gal/hr);
- $3.50 cost per gallon of diesel and associated diesel exhaust fluid;
- 1,200 hours per year mean current RTG utilization; and
- No difference in annual hybrid vs. pure diesel maintenance costs.

Note this analysis is based on purchasing new hybrid RTGs, not retrofitting existing equipment, as the latter is a much more costly tactic, at roughly $500,000 per retrofit. Retrofits would only be feasible if supported by grant funding, as done by SSA Terminals at OICT, but additional grant funding for hybridizing may not be available. Hybridizing RTGs through regular ongoing equipment replacement schedules would take on the order of two decades to complete, as some of the remaining eleven pure diesel RTGs at the seaport are relatively new and will likely not be replaced for many years. The typical life of an RTG is about 20 years, more than twice the average life of a yard tractor.

Figure F.13 compares total annualized RTG purchase and fuel costs for hybrid vs. pure diesel machines, at 1,200 operating hours per year. The chart shows little difference in annual cost between the two cases. Note RTGs at the seaport are currently operated at fairly low level of utilization which limits the potential cost savings that can be generated by reduced hourly fuel usage. Over time as volumes are expected to increase, additional savings with hybrid RTGs may be recouped through increased utilization and thus more annual fuel savings.

Figure F.13: Hybrid versus Pure Diesel RTG Cost Comparison

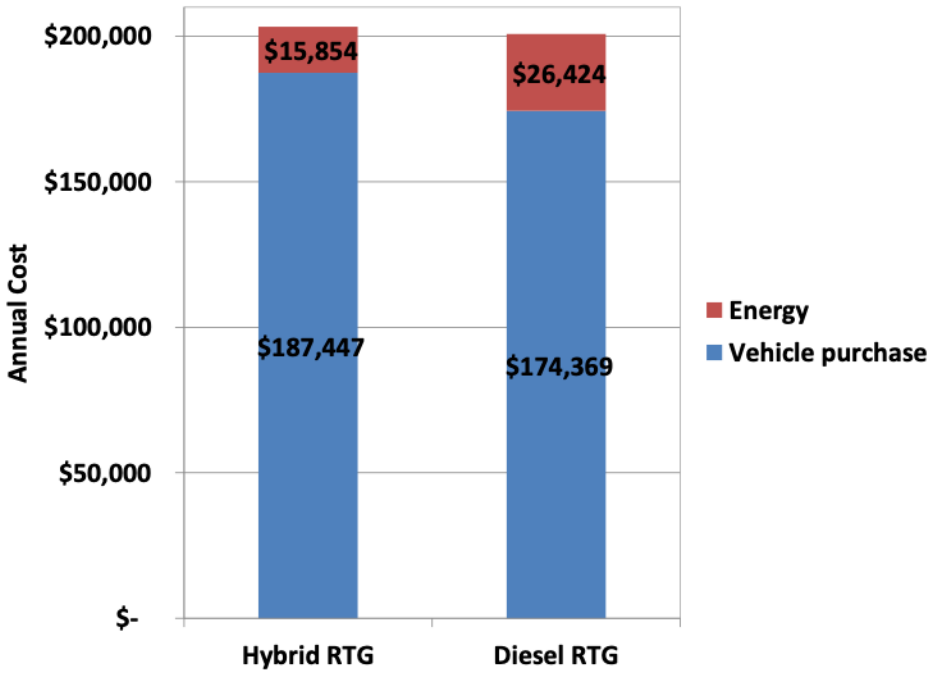


Table F.2 summarizes total annual emission reductions per hybrid RTG versus pure diesel, based on existing equipment and operating conditions. Note this applies to the eleven RTGs at the TraPac and Everport terminals only, as SSA Terminals is already in the process of having hybrid RTGs at OICT in 2020 and there are no RTG cranes at Matson Terminal. These figures are also based on 2018 utilization rates. Total reductions may trend upward over time as volumes increase and enable more annual operating hours per RTG.

TABLE F.2. ANNUAL EMISSIONS SAVINGS WITH HYBRID RTGS VERSUS DIESEL ONLY RTGS

	PM10	NOx	CO2
Annual Short Tons of Emissions Saved per Hybrid RTG versus Pure Diesel	0.01	0.99	33.8
Annual Short Tons of Emissions Saved with all remaining 11 RTGs hybridized	0.06	10.9	372

Other Hybrid Lift Equipment

Other commercially available hybrid lift equipment includes reachstackers from Konecranes and side-picks manufactured by CVS Ferrari. Reachstackers are similar to top-picks with rotation and multiple row stacking capability, while side-picks lift only empty containers. Reachstackers are not used in regular operation at any seaport container terminal, so hybrid reachstackers were not analyzed as part of this study. No hybrid top-picks (which have heavier duty cycles than side-picks as they handle loaded containers) are currently commercially available.

Due to the expected regulatory push toward requiring ZE equipment in CA, there are several

tests of fully electric top-picks planned in CA in the near-term supported by grant funding. There has been comparatively little interest in development of hybrid top-picks vs. fully electric, as hybrid models may not meet ZE regulations under development. Hybrids top- and side-picks may also be less financially appealing, as they will not generate the same level of OpEx savings to offset increased purchase costs as fully electric models.

Drayage Trucks

On-road or drayage trucks have a much more demanding duty cycle than yard tractors, since they must reach higher operating speeds. Long-haul trucks may have to climb typical highway gradients. They may also need to cover long distances in order to be viable. For these reasons development of feasible long-range battery-electric trucks is expected to lag yard tractor development by several years (see Figure F.2).

There are approximately 8,750 drayage trucks in the Port's Drayage Truck Registry; a majority of these are domiciled off Port property. Marine terminal operators will not be able to accommodate external trucks charging on site due to a combination of space constraints and labor rules regarding plugging and unplugging activity. External drayage trucks will charge at their home base, at client warehouses, or at public charging stations. The cost and utility impact of external truck charging are largely beyond the control and responsibility of the Port, although the Port will be responsible for providing power to trucks domiciled at the Port-provided parking areas.

Another difference between yard tractors and drayage trucks is that external drayage truck companies often purchase used trucks whereas terminal operators nearly always buy new yard tractors. It will be some time before there is an effective second-hand market for electric drayage trucks, so in the near to intermediate term the relevant up-front cost comparison is between a new electric truck and a used diesel truck. This will result in a substantially larger cost difference for drayage trucks than for yard tractors. Drayage trucking companies are often small businesses with less ability to finance large purchases compared with marine terminal operators so this cost differential may prove a significant hurdle to adoption of electric drayage trucks.

The overall cost picture for over the road trucks is similar to yard tractors. The business case revolves around investing more capital to save on operating costs. As battery prices fall over time, the cost comparisons for electric trucks will become increasingly favorable versus diesel.

Renewable Diesel Cost and Emissions Impact

One potential near term emission-reduction strategy in advance of electrification or other ZE/NZE technology implementation is to fuel existing diesel yard tractors, RTGs, and top/side-picks with renewable diesel rather than traditional diesel. Renewable diesel is made from organic biomasses and requires no special infrastructure to be utilized; it can be used directly in existing traditional diesel engines.

For example, the City of Oakland has implemented a program to fuel all city vehicles with renewable diesel, and reports that the switch has been effectively cost-neutral, due to California's Low Carbon Fuel Standard (LCFS), which provides credits equalizing the price difference between renewable and petroleum diesel.[2]

However, it is important to note that global supplies of renewable diesel are limited, so the switch could have minimal impact globally if supplies cannot be increased, i.e., if increased usage in Oakland comes at the expense of another existing renewable diesel user.

Overall emissions reductions with renewable diesel could be significant. Greenhouse gas reductions will be dependent on the production and shipping methods of whichever fuel provider might be selected. Renewable diesel shipped to or produced in California (as part of the LCFS program) typically provides GHG reductions of 60% or greater compared to traditional petroleum diesel (Source: Alexander Mitchell, CARB). Renewable diesel may also eliminate 30-40% of DPM and 10-20% of NOx (Source: Neste).

[2] Source: https://ngtnews.com/oakland-and-renewable-diesel-not-a-single-downside

TIMING OF IMPLEMENTING ACTIONS

Table F.3 summarizes the current expectations around timing of new vehicles, and the potential role of the Port of Oakland.

TABLE F.3. EXPECTED TIMING OF ZE/NZE VEHICLES AND EQUIPMENT

Vehicle or Strategy Type	Target Time Frame	Port of Oakland Role
Renewable diesel	2018 onward	Facilitate renewable diesel fuel purchasing program
Off-dock electric yard tractors	2018 onward	Conduct tenant outreach, encourage the purchase of electric tractors using HVIP vouchers and potentially stacking grants, and track power usage, customer satisfaction, etc. Develop Port Electric Vehicle Supply Equipment (Charging) Procedures for tenants.
RTG (hybrid) crane	2019 -2020	Track SSA's repowering of 13 RTG cranes at OICT funded by BAAQMD's Carl Moyer grant; no infrastructure required
On-dock yard tractor (electric)	2019-2021	Track SSA's project at Matson Terminal as part of CARB's ZANZEFF grant.
	2021+	Facilitate grants and install charging infrastructure based on tenant demand
Top-pick (hybrid)	2019-2021	Track commercial development of hybrid top-picks, if any, and encourage the purchase of near-term hybrid picks if they become commercially available prior to fully electric models.
Top-pick (electric)	2019-2023	Track SSA's project at Matson Terminal as part of CARB's ZANZEFF grant.
Local (short-haul) drayage truck (electric)	2019-2020	Encourage BYD deployment of 10 Phase II trucks at the seaport.
	2019-2021	Install charging infrastructure at Shippers Transport Express for 10 trucks as part of CARB's ZANZEFF grant.
RTG (electric) crane	2020-2023	Track POLB's test of 9 eRTGs through CEC grant funding. If tests demonstrate US West Coast eRTG feasibility, facilitate grants and install charging infrastructure based on tenant demand. Local Oakland ILWU work rules are not exactly the same as those in Long Beach, affecting the feasibility of the eRTG operating model in Oakland.
Long-haul drayage truck (electric)	2023-2026	Track on-going commercial development of electric drayage trucks; facilitate grants; perhaps lease property and coordinate utility upgrades with 3rd party charging companies

APPENDIX G: PUBLIC ENGAGEMENT PLAN

APPENDIX G: PUBLIC ENGAGEMENT PLAN

TABLES

PORT OF OAKLAND

Public Engagement Plan

Prepared by: Surlene Grant, Principal
Envirocom Communications Strategies, LLC

December 2018

1.0 Introduction and Purpose

The Port of Oakland is developing a new draft air quality plan to address emissions from equipment and operations at the Seaport- the Seaport Air Quality 2020 and Beyond Plan (2020 and Beyond Plan). The 2020 and Beyond Plan is focused on reducing emissions from seaport operations, which also necessarily impacts several local stakeholders – including business operators and residents from the surrounding local community. This Public Engagement Plan (PEP) provides a guide for involving the stakeholders and the public in the development of the 2020 and Beyond Plan, including the engagement of stakeholders and the public in the implementation of the Near-Term (Years 2018-2023) Action Plan (NTAP). The PEP recommendations will serve to further enhance the Port's communications and community relations with local community and neighborhood groups, community-based organizations (CBOs), residents, as well as Port-related business interests and tenants, and regulatory agencies. This PEP was prepared by Envirocom Communications Strategies, LLC (Envirocom) on behalf of the Port of Oakland (Port) to present strategies and best management practices (BMPs) to inform, consult, collaborate and empower the stakeholders in the development and implementation of the NTAP of the 2020 and Beyond Plan.

This PEP outlines the Port's strategies and actions to engage ethnic minority and traditionally underserved and limited-English proficient (LEP) populations and all others who live or work in West Oakland so that they have active, fair, and meaningful access to authentically participate in the preparation of the 2020 and Beyond Plan. Authentic participation means that the engagement is two-way and meaningful. The PEP outlines the various opportunities for stakeholders to be involved in the development and review of the 2020 and Beyond Plan and in the implementation of the NTAP. The PEP details how information about the plan may be shared and distributed with the public, and the points of engagement for evaluating and weighing in on the plan's implementing actions.

In developing the PEP, Envirocom consulted with representatives of local environmental groups,

government agencies, local business operators, members of the Seaport Air Quality Task Force, and staff from the Port of Oakland. The primary departments of the Port of Oakland which were consulted for this PEP are Administrative Division, Social Responsibility Division, Government Affairs, Environmental Programs and Planning, and Legal Division. Much of the information that is foundational to the PEP was gathered and aggregated from confidential one-on-one interviews and assessments; in addition, input was gleaned through interactive Task Force meetings on June 21, 2018 and September 26, 2018 hosted by the Port, and from comments submitted in response to the initial release of the Draft Seaport Air Quality 2020 and Beyond Plan (See Section 9.0 for information). The information culled from these sources is reflected in the project background, community profile and recommendations of the PEP.

2.0 Document Organization

This document is organized in the following manner:

- Background of the Seaport Air Quality 2020 and Beyond Plan
  - From MAPQIP to 2020 and Beyond
  - Vision
  - Timeline for 2020 and Beyond Implementation
- Community Profile
  - Racial Impact Analysis
  - Racial and Social Equity Benefits
- Approach for Development of the Public Engagement Plan
  - Guiding Principles
  - Stakeholders
  - Summary of Stakeholder Comments
  - Best Practices for Public Engagement
- Public Outreach Activities for this Plan
- Meeting Components and Logistics
- Schedule of Public Engagement Activities
- Performance Measures and Evaluation of Public Engagement
- Summary and Resources

3.0 Background of the Seaport Air Quality 2020 and Beyond Plan

3.1 From MAQIP to 2020 and Beyond

The Port of Oakland operates Aviation, Maritime, and Real Estate Divisions in Oakland. The Port of Oakland is responsible for the Oakland International Airport, the Oakland Seaport, among the top ten container ports in the U.S. handling 99% of all containerized goods in Northern California, and approximately 20 miles of waterfront. Away from the airport, the most public facing part of the Port's operations is the very accessible entertainment, retail, residential and commercial area of Jack London Square. In addition to the public areas, the Port manages

freight, warehousing and other maritime- related business operations that most people casually refer to as "the Port." These operations are seldom seen by the public, yet they have a great economic impact on the region and unintended consequences of environmental impacts. The Port of Oakland's maritime operations are located less than 2 miles from the residential area referred to as West Oakland.

The Port of Oakland's Board of Commissioners previously approved the Maritime Air Quality Improvement Plan (MAQIP) in April 2009 to help reduce emissions from Seaport sources. The MAQIP provided a comprehensive plan with goals, strategies and targets to reduce air emissions from maritime operations. Implementation of the MAQIP was intended to be from 2009 to 2020 and reflects the Port of Oakland's long-term commitment to reducing the air quality emissions and contributing to the abatement of elevated cancer health risks in West Oakland. The main goal of the MAQIP focused on reducing diesel particulate matter (DPM) from ships, trucks and freight operations as well as from other Seaport-related sources.

The guiding principles of the MAQIP were:

- Seek economic growth
- Promote public and environmental health
- Apply the concept of fair share
- Exercise the Port's authority
- **Engage stakeholders**
- Promote environmental justice
- Build knowledge

A robust public engagement process resulted in the formation of a 35-member MAQIP Task Force. This Task Force was key in developing and monitoring implementation of the MAQIP. Over the years, the Port worked with the Task Force, and the 4-member de facto Steering Committee appointed by the Port Board of Commissioners as the Co-Chairs, tenants, freight operators, and others to develop an action plan that would reduce the level of emissions released in the air from Port operations. The overarching goal of the MAQIP was to reduce DPM emissions by 85 percent from 2005 to 2020. Based upon its most recent Seaport Emissions Inventory (2017), the Port calculated an -81% reduction in DPM emissions.

The MAQIP had been fully launched by the Port with most of its programs and projects implemented. However, advances in environmental science and technology indicated that changes would be forthcoming regarding emissions reductions goals. New information and policies began shaping environmental planning for air quality improvements and GHG reductions. By January 1, 2014, government agencies such as California Air Resources Board (CARB) and the Environmental Protection Agency (EPA) began announcing rule changes. The focus on improving air quality began to shift from that of reducing emissions to that of preventing human exposure to localized air pollutants. Because of the regulatory changes and emerging technologies, and other new developments, the focus of the recommendation

and actions of MAQIP was re-evaluated. In Spring 2018, the Port of Oakland responded to the changes by announcing that it would continue the actions and recommendations of MAQIP while launching a new effort to create a new plan: The Seaport Air Quality 2020 and Beyond Plan.

The MAQIP focused on reducing emissions from existing equipment, as evidenced by one of its most referenced implementation actions – the Port clean trucks program. The 2020 and Beyond Plan is a more broader planning effort than the MAQIP as it includes more categories such as fuels, equipment, operations, and infrastructure. Using the MAQIP as its foundation, The Seaport Air Quality 2020 and Beyond Plan proposes a "pathway to zero emissions" for maritime operations.

3.2 Vision Statement

The Plan proposes the following Vision:

"The vision of the 2020 and Beyond Plan is a pathway to zero-emissions Seaport operations through changes in equipment, operations, fuels, and infrastructure."

Because of the broad reach of the 2020 and Beyond Plan into areas such as infrastructure, fuel, operations and technologies, and because of the focus on localized exposure on impacted communities, stakeholder interests are more far-reaching than in the MAQIP. The 2020 and Beyond Plan maintains the focus on emissions reduction while aligning with the State of California's GHG reduction targets for 2030 and 2050, as well as responding to State grant and incentive funding programs.

The purpose of the 2020 and Beyond Plan is to provide a common structure and guidance for all stakeholders involved in moving towards a zero-emissions Seaport. The Plan proposes three phases from 2018 to 2050. The Port anticipates that the plan will be a "living document" and will need to be updated in 5 years (2023) based on anticipated State regulations and technology development. The updates and phases will allow for incorporating changing conditions, especially regarding technology, financial resources, emissions reductions and stakeholder input.

3.3 Timeline for 2020 and Beyond Implementation

The timing and schedule of the updates also directly affect this PEP, which will most likely need updating with even more frequency than the 2020 and Beyond Plan document. The chart below melds the development and evaluation of the plan over the years with the public's and stakeholders' role in the process, and the level of public engagement in italics.

TABLE G.1: TIMELINE FOR 2020 AND BEYOND IMPLEMENTATION			
Time frame	Air Quality Plan development and implementation	Public Engagement Plan Development	Level of Engagement
Spring 2019	Revised Draft Plan comments reviewed and incorporated into Final Plan, where applicable. Final Plan approved	Development and initiation of public engagement. Outreach focused on development and feedback of the Revised Plan	Consult / Shared Decision Making
Near-term 2018-2023	Near term implementation 5-year revision	Public Engagement to review and evaluate progress on the Plan; inform and educate regarding new policies and technologies. Plan evaluation focused on IAs, availability of funding, monitoring, etc.	Inform / Collaborate / Shared Decision Making
Intermediate Term 2023-2030	Intermediate revision and updates. Review of new technologies, new Port developments	Public Engagement to update and evaluate the plan, inform and educate regarding new policies and technologies. Plan Evaluation for emissions reductions, availability of funding, monitoring, etc.	Inform / Consult / Collaborate / Shared Decision Making
Longer Term 2030-2050	Evaluation of success and meeting State policy targets and regulations	Public Engagement evaluate the plan, inform and educate regarding new policies and technologies. Plan for next phases - future	Inform / Consult / Collaborate / Shared Decision Making

4.0 Community Profile – Geographic Area and Affected Communities

The geographic area for the 2020 and Beyond Plan is the Port of Oakland's Seaport operations, including its shipping terminals, freight yards, and warehouses.

Close to the Seaport is the area defined as West Oakland, which is located between I 880 and I-980 to the west and east, respectively, and I-580 and I-880 to the north and south. As the focus for air quality planning shifted from regional emissions reductions to the abatement of local exposure to toxic air contaminants, West Oakland was designated by the California Air Resources Board as a community bearing a disproportionate air quality burden.

Demographic data for West Oakland is shown in Table 1 below, along with demographic data for the City of Oakland and Alameda County. The data is from the 2015 American Community Survey for Alameda County, Oakland, and West Oakland. The West Oakland data is composed of the following 13 census tracts: 4014, 4015, 4016, 4017, 4018, 4022, 4024, 4025, 4026, 4027, 4105, 9819, and 9820.

TABLE G.2: DEMOGRAPHIC DATA FOR WEST OAKLAND						
2015 Census Estimates	West Oakland (13 Census Tracts) 2015 Estimates		Oakland 2015 Estimates		Alameda County 2015 Estimates	
Population:	26,061		408,073		1,584,983	
Race						
Caucasian	19.80%		26.90%		33.00%	
African American	45.30%		25.40%		11.30%	
Asian	12.60%		16.00%		27.50%	
Hispanic	16.10%		26.10%		22.60%	
Pacific Islander	0.50%		0.60%		0.80%	
Native American	0.70%		0.40%		0.30%	
Two or more races	5.00%		4.60%		4.40%	
Housing Units	11,495		171,087		589,858	
Owner-occupied	20.60%		36.80%		50.00%	294,644
Renter-Occupied	69.70%		55.80%		44.80%	264,263
Vacant	9.60%		7.40%		5.20%	30,951
Median Income	$18,589		$56,589		$75,619	
% of families at or below poverty	32.90%		19.80%		12.50%	
Educational Attainment for residents age 25+	17,659		255,467		1,013,784	
High School	38.60%		27.7		16.80%	
College w/o degree	33.70%		21.7		12.90%	
College with degree	27.70%		50.6		34.20%	
Language Spoken 1	24116		382,120		1,487,370	
English Only	69.40%		60.50%		56.50%	
Spanish Only	6.10%		10.80%		7.40%	
Chinese	5.80%		5.30%		4.90%	

1. Primary language spoken at home

4.1 Racial Impact Analysis

a. The census data for West Oakland show that approximately 80 percent of the population of West Oakland is comprised of people of color, including African Americans, Hispanics, and Asians, compared to approximately 73%in Oakland and 67% in Alameda County.
b. The census data show that approximately 70% of West Oakland residents are renters, which is a notably higher percentage than throughout the City of Oakland and Alameda County.
c. The census data show that approximately 33% of the residents live below the federal poverty levels. The median income of residents of West Oakland is approximately one-third of the median income for City of Oakland residents and about one-quarter of the median income for Alameda County residents.
d. Based on this census data, the public outreach for far reaching activities will be designed to prioritize reaching the African American, Hispanic, and Asian residents of West Oakland. It will also be focused on effectively reaching low income residents and renters.
e. A report by the Alameda County Public Health Department entitled "Asthma & Cumulative Health Risks in West Oakland" to the MAQIP Task Force in February 2018 revealed health disparity data that showed that West Oakland residents' life expectancy is 6 years less than the rest of the county, and that African American residents of West Oakland have a 14-year shorter life expectancy than that of white residents of the Oakland Hill neighborhoods.
f. According to the Alameda County Public Health Department report "Asthma & Cumulative Health Risks in West Oakland" West Oakland residents are exposed to higher concentrations of diesel particulate matter than the average background levels in the Bay Area.

4.2 Racial and Social Equity Benefits

a. The public engagement process will help strengthen relationships, understanding, and respect between the Port, its tenants and business partners, and the West Oakland communities.
b. Through the public engagement process there will be an opportunity for public education and awareness of pollution, health and other equity impacts of West Oakland, and new and developing technologies and science.
c. Implementation of the 2020 and Beyond Plan will further reduce DPM emissions affecting nearby neighborhoods. The Port and many of the stakeholders for this process acknowledge that there are other mobile and stationery sources that contribute to the air quality of West Oakland; however, the Plan's emissions reduction measures are expected to contribute to an abatement of health impacts on local residents.
d. The public engagement process will inform and involve West Oakland residents, especially longer-term residents. This will reduce impacts from the Port on the areas of West Oakland where the impacts are the most significant on African American, Hispanic,

and Asian residents/workers.

5.0 Approach for Development of the Public Engagement Plan

The MAQIP was developed in conjunction with a public engagement process dependent on the recommendations and actions of the Co-Chairs and a Task Force. As the Port of Oakland transitioned from the MAQIP to the 2020 and Beyond planning process, the Co-Chairs and the Task Force agreed to transition in their role to support the public engagement efforts of the 2020 and Beyond planning effort. As the planning effort gets underway, the Co-Chairs and the Task Force are key stakeholders for the initial preparation and implementation of public involvement and public engagement activities.

Each Co-Chair represents a significant stakeholder affiliation:

- Community Based Organization / Environment: West Oakland Environmental Indicators Project (WOEIP)
- Regulator / Government Agency: Bay Area Air Quality Management District (BAAQMD)
- Industry / Port-related Business and Tenants: GSC Logistics
- Port of Oakland

The Task Force has representation from the following stakeholder groups:

- Industry and Freight (including shipping, trucks and freight)
- Regulatory Agencies
- Government Agencies
- Environmental and Land Use Focused CBOs and NGOs
- Community Health Organizations
- Residents / Elected Officials
- Organized Labor
- Maritime Developers
- Port of Oakland
- City of Oakland

See Section 5.2 regarding participation of new stakeholders on the Task Force.

Any of the policies and implementing actions that come from the 2020 and Beyond planning process will directly impact those stakeholders with interests in the maritime industry and the businesses and operations that they support as well as tenants of the Port properties. In addition, any change to Port operations will also impact the quality of life for West Oakland residents.

The overall approach for public engagement is based on a series of public education and consultation activities that engage the stakeholder groups. This PEP and the recommendations presented were informed through one-on-one confidential interviews with the Co-chairs and key participants from the Task Force representing the County Health Department, trucking

industry, and the Environmental community from July through October 2018; broad-based West Oakland residents, workers, stakeholder roundtable discussions on September 26, 2018 and from comments submitted to the Port as part of the solicitation of comments to the Draft Seaport Air Quality 2020 and Beyond Plan.

The public engagement is designed to involve them in a consultative manner at every key juncture throughout the process. It is anticipated that public engagement will:

- promote equity and bring representation of under-represented communities into the process;
- help with the design of agenda and process before and during public interfacing workshops, meetings and events; and
- provide avenues for the stakeholders to advise on revising the public engagement if needed during the process; and to develop draft recommendations

5.1 Guiding Principles

Guiding principles are the values which apply throughout the 2020 and Beyond planning process, including plan development, public participation and implementation. These guiding principles were accepted by the Co-Chairs and Task Force in Spring 2018:

- Planning is a joint **fact-finding** and **co-learning process**
- All stakeholders share the desire to develop knowledge and capacity to promote informed **decision-making**
- The pursuit of near-term "wins" **adds value** to long-term planning
- Pragmatic and **practical solutions** advance Plan progress
- **Strong partnerships** are a critical element of Plan implementation

5.2 Stakeholders in This Process / Target Audience

During the one-on-one interviews and other discussions, participants were asked "who is missing who should be at the table?" The following entities or individuals were suggested:

i. Local utilities – including Pacific Gas & Electric (PG&E), and alternative energy providers such as MCE (My Choice)
ii. Alameda County Transportation Commission (ACTC)
iii. City of Oakland Department of Transportation
iv. Mayor of Oakland
v. Oakland City Administrator's office
vi. Oakland Planning Department
vii. Prologis terminal operators
viii. CenterPoint terminal operators
ix. Rail
x. East Bay Municipal Utility District (EBMUD)

xi. US Postal Service (West Oakland offices)
xii. U.S. Customs
xiii. California Department of Transportation (Caltrans)
xiv. Bay Area Rapid Transit (BART) West Oakland Station

The following is a list of some of the known stakeholders and groups that would be interested in the broader outcomes of the 2020 and Beyond planning process. These are the groups that may be invited to a larger, annual Town Hall type event to receive information about 2020 and Beyond Plan. Because of the proximity to West Oakland, those who represent racial and ethnic minority groups who live or work in the project area are key. (Note: those highlighted in bold are participating members of the Task Force.)

a. CBOs, including neighborhood groups, business groups, advocacy groups, and non-profit agencies. To date, the list of identified CBOs includes the following.

i. West Oakland Business Alert group
ii. West Oakland Community Advisory Group ("WOCAG") (Generally meets on the 4th Thursday of each month, 6-8pm, West Oakland Senior Center; group has a specific charge regarding the OAB project.)
iii. West Oakland Commerce Association
iv. West Oakland Environmental Indicators Project
v. West Oakland Economic Development Working Group
vi. Jack London Improvement District
vii. Jack London District Association
viii. West Oakland Merchants
ix. West Oakland Neighbors
x. Prescott Neighborhood Council
xi. Lower Bottoms Neighborhood Association
xii. Village Bottoms Neighborhood Association
xiii. South of the Nimitz Improvement Council ("SONIC")
xiv. East Bay Asian Local Development Corporation ("EBALDC"/Mandela Gateway Tenants, California Hotel, San Pablo Area Revitalization Collaborative ("SPARC")
xv. Oakland Unified School District ("OUSD") Community Liaison
xvi. OUSD: West Oakland Middle School, Hoover School, MLK Jr. School, PLACE at Prescott School, Lafayette Elementary
xvii. Student Program for Academic and Athletic Transitioning ("SPAAT") at McClymond's High School
xviii. Ralph Bunche Academy (High School)
xix. Oak Center Neighborhood Association
xx. Hoover Resident Action Council
xxi. Acorn Tenants Association

xxii. City Towers Tenants Association
xxiii. Sylvester Rutledge Tenant Association
xxiv. Neighborhood Crime Prevention Council ("NCPC") Five on the West Side Beat 2X/5X Lowell/Acorn
xxv. NCPC Beat 7X and West Oakland Neighbors
xxvi. NCPC Beat 2Y/5Y Prescott
xxvii. Acorn Safety Meeting
xxviii. West Oakland Core Team
xxix. Oakland Housing Authority
xxx. St. Mary's Center
xxxi. Port of Oakland Trucker Work Group
xxxii. West Oakland Senior Center
xxxiii. Center for Independent Living of Oakland
xxxiv. West Oakland Green Initiative
xxxv. Green for All
xxxvi. Ella Baker Center
xxxvii. Attitudinal Healing Connection
xxxviii. Prescott Joseph Center
xxxix. West Oakland Community Collaborative
xl. Office of Alameda County Supervisor Keith Carson, D5
xli. West Oakland Teen Center
xlii. St. Vincent de Paul
xliii. West Oakland Urban Farm and Park (City Slicker Farms)
xliv. Civicorps
xlv. People's Community Market
xlvi. Vincent Academy
xlvii. West Oakland Jobs Resource Center
xlviii. Rose Foundation for Communities and the Environment
xlix. Oakland Climate Action Coalition

b. Private sector businesses in the affected area

i. Equipment owners such as marine terminal operators, trucking entities, and logistics companies.
ii. Businesses in the area that serve the Port, serve customers of the Port, or serve residents of the area
iii. Rail and Freight, such as BNSF and Amtrak.
iv. Trucking businesses that operate in West Oakland and Jack London Square.
v. Lease holders and current and future tenants at the Port-owned portion and City-owned portion of the former OAB, including Prologis, CCIG, Oakland Maritime Support Services (OMSS), Custom Alloy Scrap Sales (CASS), California Waste Solutions

(CWS), Lineage/Dreisbach and CenterPoint. (Some are participating, some are not).

vi. Employers in the area (Some are participating, some are not).

5.3 Summary of Stakeholder Comments

In addition to identifying who is missing from the table, in the process of developing this Public Engagement Plan, various stakeholders stated the following concerns or desires for the process.

These comments are also included in the Response to Comments section of the revised Draft 2020 and Beyond Plan that documents all comments received and provides a response to each comment.

Public Involvement –

- Co-Chairs to work collaboratively with the facilitator to plan meetings and agenda.
- Task Force to include representatives from the different affiliations and stakeholder interest groups, primarily those that are tenants and business partners of the Port and those who have a role with emerging technology, such as utility companies, as well as residents.
- Establishment of advisory group that follows the process and ensures that the plan(s) are being followed. That the 2020 and Beyond Plan ties into some of the other planning endeavors that are happening in the area.
- Support for a working group to assess feasibility of the Implementing Actions with the inclusion of a marine terminal and / or shipping line representative.
- To the key question of expanding the Task Force to include as many individuals as possible, opinions were split with the majority stating that if all the interests are represented, the current size of the Task Force seems to work well. It was suggested that periodic larger town hall community meetings could be held to inform "everyone" of the work.
- As the plan develops, the Port needs to communicate with operators with clear goals, and there should be consideration for other sources that contribute to the impacts, including weather and wind.
- Public recognition and awards for entities that are doing something.
- Stakeholders must be educated about what we are trying to accomplish and empowered with that information to participate in the on-going monitoring of progress.
- Recommendation that there be some type of "town hall" like meeting(s) to include a broader audience that may not be able to make the daytime meetings. Include elected officials across Oakland in this process, and even consider having the elected officials host this discussion with their constituents. The Port's Good Neighbor Breakfast concept would be a good model.
- Develop a timeline with annual meetings and check in for input and to receive updates on the process, annual emissions inventory of updates and health risk assessment updates.

- Be transparent. Acknowledge what has happened to the input received. Post all comments and the response to the comments on the website.
- Engage and provide feedback on for the implementation phase, feedback on the feasibility criteria and decision making.

Equity –

- Job training and education to keep up with the new technology. Training, education and awareness especially for jobs that the new implementation actions may bring.
- "Ports are in "equity sensitive areas"
- "Can't hold people accountable for non-achievable goals."
- The process should provide for an opportunity to inform the Port of what can and cannot be done.
- Manage the process so that it is not so Port-centric. Seems like a Port-driven process versus a collaborative process.

Planning and Implementation / Monitoring–

- Concerns regarding how the 2020 and Beyond efforts overlap and are complimentary with the State (and West Oakland community) AB 617 process and recommendations.
- Presentation of metrics and the modeling assumptions that are being used in the report.
- As clean technologies are advancing, there could be emission reduction measures implemented in the immediate term, versus over a 5-year horizon. There should be an annual review.

Grants and funding assistance

- Concern that the process will get ahead of new technology that is available – what will inform the Ports plan, the promise of the technology or the availability of the technology

6.0 Public Outreach Activities for this Plan

The goals of the PEP which are derived directly from the guiding principles, are:

- Fact Finding and Co-learning process: to inform, educate and build a common baseline of knowledge among the community and policy makers about air quality concerns and environmental planning.
- Informed decision making: through consultation and collaboration all stakeholders will work jointly to build capacity, share knowledge and discuss options, prioritize and identify solutions.
- Near term wins and value added: to use public input in a collaborative way to create the best options and recommendations for the 2020 and Beyond Plan.
- Practical solutions: To be responsive to ideas and suggestions in a manner that evaluates and weighs options through shared decision making.
- Strong partnerships: to be inclusive and actively facilitate the involvement of the West

Oakland community, especially racial and ethnic groups and people that are traditionally hard to reach, yet are the most impacted.

The desired outcome of public engagement is to have a more educated and informed community base who will recognize the benefits of this plan. There is no simple solution, or one size fits all approach to identifying an effective engagement method. To be most effective, there will be a range of complementary methods so that we engage a wide range of stakeholders and make the planning and implementation efforts as accessible as possible.

Public awareness and education are key for all stakeholder interests. This is specifically valid for new research and data on health disparities and availability of new technologies that will lessen the impacts. Public participation will have a high degree of stakeholder involvement in the planning and implementation processes and will facilitate direct input into decision making practices.

Throughout the planning and implementation efforts, stakeholders will have multiple ongoing opportunities for input into the decision-making process and access to decision makers. This will include input on the final document and during implementation of the NTAP. Stakeholders will receive direct feedback on how their input helped to influence final decisions, and will be provided with the rationale behind the outcomes and decisions.

Public participation for the 2020 and Beyond Plan will involve the Co-Chairs, Task Force, Town Halls and other ongoing opportunities for input into decision-making as the foundational activities of public engagement for the Seaport Air Quality 2020 and Beyond Plan including the Near-Term Action Plan.

a. Routine Co-Chair meetings.
b. Meetings of the Task Force (there are 6 planned between June 2018 and July 2019).
c. Town Hall Information Meetings.
d. Public workshops and Tours.
e. Community and business surveys, questionnaires, and polls. Internet-based engagement
    i. Dedicated webpage for Air Quality planning process (already exists), including schedule of meetings and materials presented at each meeting
    ii. Use of social media and e-mail to announce events and items, and to encourage people to go to the Port's websites, to attend public meetings, and to provide their input
    iii. Online community surveys and polls

The activities will be carried out by engaging in the following Best Practices.

6.1 Best Practices to be used in this Public Engagement Process

Throughout the development of the Seaport Air Quality 2020 and Beyond Plan, and the three phases (Near-Term, Intermediate-Term, and Long-Term) of evaluation and implementation,

various best practices will be used to foster and build on the Public Engagement Process.

a. Clearly communicate the decision making processes and the role of the public in those processes.
b. Provide transparency and communicate to the public outcomes and decisions including the rationale behind them.
c. Clearly identify the problems/issues the stakeholders are attempting to solve. Based on early input and feedback, this could initially involve target and goals, and funding.
d. Clearly identify the decisions that stakeholder knowledge and insight can influence, for example the infrastructure study will be greatly influenced by the utility companies.
e. Consult with the Co-Chairs and the Task Force on a regular basis for refinement and adjusting of the public engagement process.
f. Evaluate annually for effectiveness and adapted to meet the potentially changing audience, demographics, Port operations and technology.
g. Use outreach strategies that are varied and tailored to meet the needs of the area by: meeting people where they are and when they are available; providing information and materials that are easy to understand, in the appropriate languages and format; and using outreach staff that can communicate effectively with the various communities of the area.
h. Based on where the effort is on the timeline, public engagement may require a large town hall meeting to share information or a small focused conversation among an industry sector. For whichever type of meeting, there will be a variety of potential tactics to reach stakeholders and the public to inform and invite them to participate. Some examples of tactics to reach people may be online/social media; public repositories (e.g., libraries and community centers); through CBOs and their outreach methods; attend CBO meetings; through government agency meetings such as those related to AB 617.
i. Use public television, radio, newspapers, and other media outlets that are specific to the cultural groups and LEP populations of the affected area.
j. Use a variety of engagement methods: public meetings and events, individual meetings with community leaders and groups, targeted interviews, and surveys.
k. Start the broad range of engagement methods early; build relationships with stakeholders between meetings. Start early with multiple ways for communicating and for providing input.
l. Use a variety of methods to accept input, such as online, email, telephone, letters, and meetings.
m. Remove barriers to participating in the engagement process and create a welcoming environment. This includes accommodating the languages of the stakeholders and removing barriers to participation, such as location, time, transportation, childcare, inaccessibility, and power dynamics.
n. Informational materials should have graphics, minimal text using simple language, and be in the appropriate languages for this community. Consider the LEP, disability, and

hard to reach populations when preparing these materials.

o. Informational materials should be distributed at locations frequented by residents and businesses.

p. Use technology (e-mail, social media, apps, and websites) appropriately and as a supplement to other outreach.
   - Do not rely too heavily upon it. It is often not effective at reaching low-income, elderly, and LEP populations.
   - E-mailed public meeting/workshop announcements to each CBOs standard e-mail address, to representatives of each CBO, and to all others who request such notification.
   - Use e-mail as an educational tool and to encourage attendance at public meetings/ other events.

q. Ensure that outreach to community-based organizations includes a broad range of groups representing diverse participants and viewpoints.

r. Evaluate throughout the process if the public engagement is working by assessing, not only the number of participants, but also their diversity. If not, make changes to the engagement strategies.

s. Summarize input and key themes and share them with decision makers.

t. Acknowledge receipt of input and comments, ask follow-up questions, give input serious consideration and follow-up, and respond to suggestions by showing how input and comments were incorporated or explaining why they were not. Respond back to stakeholders.

u. Build relationships and maintain contact with the community and report back throughout the process, for example by maintaining a list of stakeholders who have made comments or expressed interest and ensuring they receive information on an ongoing basis.

v. Printed materials that are user-friendly.

w. Targeted mailings/flyers to residents.

x. Use of maps and photographs of the project area to solicit input on issues, concerns, and improvements people would like to see. Post these maps and graphics on-line.

y. Development of short surveys/questionnaires that can be completed by attendees at festivals, tenant meetings, or outside grocery stores and at places of worship.

z. Posting notices of public meetings with information on other ways to participate, and project information at community centers and public buildings in West Oakland, shops and stores, public transit stations and vehicles, and key locations frequented by residents and businesses, such as the West Oakland Branch library, West Oakland Senior Center, DeFremery Park, and places of worship.

aa. Materials distributed to CBOs to encourage them to announce meetings at their upcoming meetings and post the meeting notices and informational materials on their websites.

bb. Outreach to managers of apartments; attend monthly home owners or residential association meetings; distribute materials at the entries to large housing complexes.
cc. City Council, specifically, District 3, newsletters, electronic outlets, and list serves.
dd. Use of local newspapers and KTOP public television and public radio to announce public meetings, provide background information, and spread the word on ways to participate.
ee. Use of multiple easy ways to provide input, including an email address, a phone number with voicemail, and a mailing address.

6.2 Meeting Components and Logistics

Task Force: The Task Force is an open environment for which the public could attend and learn more about the 2020 and Beyond process. The Task Force meets on a schedule that is set by collaborative effort between the Co-Chairs and the Port of Oakland Environmental Planning and Programs and Social Responsibility Division. The role of the Task Force is to be advisory and to provide information on industry sectors, government updates, and technology that may benefit and inform the process.

In recent months, through public input from Task Force members and the Co-Chairs, it has been determined that the Task Force meetings will have an educational component to each convening. At the September meeting there was a discussion about Race and Equity and how that intersects with the planning of 2020 and Beyond. In a future meeting, the Task Force members and members of the public who attend can learn about some of the latest and emerging clean air technologies.

From 2018 through 2019, six task force meetings are anticipated.

The Task Force meeting are developed by the Port's neutral facilitator who works with both the Port and the Co-chairs to determine the subject of the meeting, develop the agenda and collaborate with all about the roles, responsibilities and needed presenters. The meetings are set up to present something new – such as the Equity presentation – as well as review the latest version of the Draft Seaport Air Quality 2020 and Beyond Plan. There is also a period built in for small group and / or roundtable discussion among the Task Force members.

During the Near-Term Action Plan (Years 2018-2023), the Task Force will continue to be engaged on technical issues including equipment, infrastructure, fuels, and funding and resources,

While the Task Force meetings are public meetings, they are not posted or advertised like many other government agency meetings. The Port staff and the Facilitation consultant both maintain database list for the dissemination of meeting notes and other information.

Town Halls: This can be a method of reporting annually to the community regarding the progress of the 2020 and Beyond process; information and receiving input regarding new technologies and ensuring that the great West Oakland community and other stakeholders are aware of the plan. Additionally, the Port and the Task Force could provide an annual summary

of the community and stakeholder engagement process and report card at this forum using best practices for public participation.

Joining existing meetings: There will be times when the project team members should attend and make updates to other organizations that have related topic meetings. These organizations may be related to the AB 617 efforts or to a community health initiative.

Workshop logistics

In planning, designing and hosting workshops, the following Best Practices will be considered:

a. Hold workshops on weekday evenings or Saturday mornings. Sunday afternoons can be considered. This will be discussed with CBOs and key stakeholders to pick dates and times which are convenient for as many people as possible.
b. Coordinate dates with other key events: Council meetings, Board of Port Commissioners meetings, major public events like holidays, public school calendar, and large sporting events.
c. Must insure: Americans with Disabilities Act accessibility, convenience for residents and businesses to attend, language accessibility including interpreters if needed and translation of key documents, if requested. Languages for announcement of public meetings and interpreters will be determined based on community demographics. Information will be translated, based on requests. If material is not printed in a language, there will be, for example, a statement in the predominant languages that says, "If you would like this information in (language XX) please contact (510) ###-####."
d. Notify participants on meeting announcements about the availability of disability and language services. Such notification could include, for example:

The Port and the City of Oakland comply with Title VI of the Civil Rights Act of 1964 and related statutes and regulations in all programs and activities. Key workshop materials a can be made available in alternative languages or accessible formats for people with disabilities, if requested. Interpretation of meetings in Spanish and Chinese, sign language, or other languages can be provided on request 72 hours in advance, with contact information provided to request this service. The project webpage contains Port contact information for staff directly related to the Seaport Air Quality 2020 and Beyond Plan.

Possible Locations

Choose locations which are accessible to people with disabilities, are close to and easy for the stakeholders to get to, are convenient to public transportation, are large enough for the expected turnout, have good acoustics, and have an appropriate layout and equipment to meet as one large group and in smaller breakout groups. Potential locations include the following.

a. West Oakland Public Library Auditorium
b. West Oakland Teen Center

c. West Oakland Senior Center
d. Oakland Housing Authority meeting room
e. DeFremery Center
f. Taylor Memorial United Methodist Church
g. West Oakland Urban Farm and Park
h. Lincoln Family Center
i. Oakland City Hall
j. Waterfront Hotel
k. Port of Oakland Administrative Building Meeting facilities

Increasing Participation and Noticing

The Port will make use of multiple strategies to advertise the workshops and encourage participation. Applicable strategies from among the following will be considered.

a. E-mail meeting announcements/flyers to CBOs, other stakeholders, anyone who requests receiving such announcements, and the official "Stakeholder list" per MMPO-1.
b. Attend the recurring meetings of the CBOs.
c. Direct outreach to CBOs to encourage their attendance at the workshops.
d. Post workshop notices on City and Port websites with webpages specific to the TMP.
e. Post notices on approved social media outlets.
f. Use KTOP, Oakland's public TV channel, to announce meetings and how to participate.
g. Place newspaper announcements, including in minority-language papers.
h. Distribute materials at locations in the area that residents and businesses frequent, including shops and stores, libraries, senior centers, housing offices, and other key locations.
i. Announce the workshops on City Administrator's weekly announcement, if possible.

7.0 Schedule for Public Engagement Activities

TABLE G.3: SCHEDULE FOR PUBLIC ENGAGEMENT ACTIVITIES

Time frame	Air Quality Plan development	Public Engagement Plan Development	Level of Engagement
Spring 2019	Final Plan developed Final Plan recommended for approval	Development and initiation of public engagement. Outreach focused on development and feedback of the Air Quality Plan	Consult / Shared Decision Making
June 2018 – June 2019		Co-Chairs meetings (6-8) Task Force meetings (6)	Inform/ Consult/ Collaborate / Shared Decision Making
Fall / Winter 2018/19 and on-going		Refinement of the PEP	Inform/ Consult Shared decision making (w/ Co-chairs)

TABLE G.3: SCHEDULE FOR PUBLIC ENGAGEMENT ACTIVITIES			
Time frame	Air Quality Plan development	Public Engagement Plan Development	Level of Engagement
Spring 2019 (And subsequent years)	Plan Adopted First Year Observance of work on this effort	Town Hall to report to the broader community	Inform
Near term 2018-2023	Near term implementation 5-year revision	Public Engagement to update and evaluate the plan; inform and educate regarding new policies and technologies. Plan Evaluation availability of funding, monitoring, etc.	Inform / Collaborate / Shared Decision Making
Intermediate Term 2023-2030	Intermediate revision and updates. Review of new technologies, new Port developments	Public Engagement to update and evaluate the plan, inform and educate regarding new policies and technologies. Plan Evaluation for results availability of funding, monitoring, etc.	Inform / Consult / Collaborate / Shared Decision Making
Longer Term 2030-2050	Evaluation of success and meeting State requirements	Public Engagement evaluate the plan, inform and educate regarding new policies and technologies. Plan for next phases - future	Inform / Consult / Collaborate / Shared Decision Making

8.0 Performance Measures and Evaluation of Public Engagement

The Port will evaluate public engagement to assess the effectiveness of outreach in terms of number of people attending, geographic areas, diversity including race and ethnicity, language of attendees, disability, and other factors. After each public engagement, be it a small group meeting or the larger community meetings, the team will evaluate what went well and what needed improvement (if anything) and adjust accordingly. An evaluation will be done to assess the effectiveness of the engagement process and methods after acceptance of reports, announcement or issuance of a grant; completion of a related program, etc.

The assessment will: report on implemented methods of outreach and engagement; identify the areas in which we are achieving our targets; and identify areas where there are gaps. Public engagement methods will be refined to address areas of outreach deficiency.

Additionally, a summary of the community and stakeholder engagement process and activities will be provided annually to facilitate feedback from stakeholders and will serve to enhance our engagement methods.

Specific performance evaluation techniques may include one or more of the following.

a. Outputs (e.g. number of meetings held; number of ads placed; number of publications

in which notices are distributed; number of visits to TMP website; number of language and disability access requests honored; number of comments acknowledged; number of comments summarized and raised with decision makers; number of comments incorporated)

b. Inputs (e.g. number of comments; quality of comments; number of new commenters/ attendees)
c. Numbers of participants (e.g. workshop attendees, commenters)
d. Representativeness (e.g. participation from residents, business owners, workers, community organizations, public sector organizations)
e. Diversity of participants (e.g. age, race, language, disability, income, geography)
f. Which types of outreach reached people and encouraged them to attend (how they heard about it; which venue they attended; how they submitted input)
g. Which methods people used to submit input (in person, email, online, phone, individual meeting)
h. Whether community input corresponded to, and was coordinated with, key milestones and phases in the planning process
i. Whether potential stakeholders were fully identified and whether their interests became known and were acted upon
j. Participant satisfaction (e.g., with convenience [location, time, accessibility, etc.] of meetings/communications; effectiveness [clarity, adequacy, timeliness] of communications; variety of communications; ease of input; respect for input demonstrated; level of consideration of and responses to input; fairness), evaluated potentially through paper and/or online surveys
k. Whether the results of public participation are communicated to people who were involved in public planning process and to relevant decision-makers, to demonstrate how public input is used

9.0 Summary and Resources

The overall approach for public engagement for the 2020 and Beyond process is based on a series of Task Force meetings complemented by detailed work of the Co-Chairs. These efforts will be supplemented with an annual large-format Town Hall type meeting. In addition, as the plan rolls out and implementation actions are launched there may be small group meetings with sector specific individuals, regulators, special interests and others to explore or find solutions related to regulatory requirements, health assessments, funding, technical developments, etc.

Individuals who responses contributed to the development of this PEP include the following.

- Greg Nudd, Bay Area Air Quality Management District
- Andy Garcia, GSC Logistics
- Brian Beveridge, West Oakland Environmental Indicators Project
- Ms. Margaret Gordon, West Oakland Environmental Indicators Project

- Chris Lytle, Port of Oakland
- John Driscoll, Port of Oakland
- Bill Aboudi, AB Trucking
- Anna Lee, Alameda County Public Health

A partial list of participants in the Roundtable discussions on September 26, 2-18 is provided below.

- (Ms.) Alex McBride, City of Oakland
- Ken Larson, SSA Terminals
- Bill Aboudi, AB Trucking
- David Quiros, California Air Resources Board
- Ana Lee, Alameda County Health Department
- John Berge, Pacific Merchant Shipping Association
- Michelle Ghafar, Earthjustice
- Paul Cort, Earthjustice
- Kevin Bulger, Apex Maritime Co, Inc.
- Ben Machol, US Environmental Protection Agency
- Anthony Fournier, BAAQMD
- David Quiros, California Air Resources Board
- John Coleman, Bay Planning Coalition
- David Wooley, UC Berkeley, Graduate School of Public Policy
- Andy Katz, Sierra Club
- Margaret Gordon, Co-Chair and WOEIP
- Ray Kidd, West Oakland Neighbors
- Steve Lowe, West Oakland Commerce Association,

Port of Oakland Staff that served as an additional resource include:

- Amy Tharpe: Director, Social Responsibility
- Laura Arreola: Community Engagement Liaison, Social Responsibility Division; Port community engagement lead
- Richard Sinkoff: Director, Environmental Programs and Planning; management and oversight

Documents that served as an additional resource include:

- City of Oakland Department of Race and Equity Inclusive Public Engagement Planning Guide
- City of Oakland General Plan
- West Oakland Specific Plan
- 2009 Maritime Air Quality Improvement Plan
- Draft West Oakland Truck Management Plan
- Oakland Army Base Redevelopment Plan