INVEST CLEAN

Infrastructure, Vehicles, and Equipment Strategy for Climate, Equity, Air Quality, and National Competitiveness

April 1, 2024

Climate Pollution Reduction Grant

U.S. Environmental Protection Agency

South Coast Air Quality Management District

ENVIRONMENTAL PROTECTION AGENCY (EPA)
Climate Pollution Reduction Grants Program:
Implementation Grants General Competition
EPA-R-OAR-CPRGI-23-07

Applicant Information: South Coast Air Quality Management District
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Type of Application: Individual Application

Funding Request: $499,997,415 (Tier A)

Application Title: INVEST CLEAN - Infrastructure, **V**ehicles, and **E**quipment **S**tra**t**egy for **Cl**imate, **E**quity, **A**ir Quality, and **N**ational Competitiveness

Brief Description of GHG Measures: This proposal focuses on four (4) transportation measures from the Climate Pollution Reduction Grant (CPRG) Priority Climate Action Plans (PCAP) for the Los Angeles – Long Beach – Anaheim and Riverside–San Bernardino – Ontario Metropolitan Statistical Areas (MSA) as well as the state of California, to decarbonize goods movement in partnership with cities, counties, local and State agencies, ports, industry, labor, community-based organizations, academia, and a national lab. **In**frastructure, **V**ehicles, and **E**quipment **St**rategy for **Cl**imate, **E**quity, **A**ir Quality, and **N**ational Competitiveness's (INVEST CLEAN's) greenhouse gas emission (GHG) reduction measures target limiting factors and challenges to the zero-emission (ZE) transformation of the Southern California goods movement corridor, including:

- **Measure 1** - Charging Infrastructure Deployment Incentive Program
  This measure provides incentives to install electrical charging equipment to support the Southern California goods movement corridor for battery electric ZE vehicles. The current lack of infrastructure is a limiting factor to deploying battery electric ZE vehicles.
- **Measure 2** - Battery Electric Freight Vehicle Deployment Incentive Program
  This measure will incentivize the decarbonization of goods movement operations by increasing the deployment of ZE heavy-duty long-haul and last-mile freight vehicles.
- **Measure 3** - Battery Electric Cargo Handling Equipment (CHE) Deployment Incentive Program
  This measure will replace or convert CHE used at facilities such as warehouses, intermodal railyards, airports, ports, or freight facility centers. Infrastructure will be paired with each deployment.
- **Measure 4** - Battery Electric Locomotive Pilot Program
  This measure will replace diesel freight switcher locomotives domiciled in the MSAs region with ZE switchers. Infrastructure will be paired with each deployment.

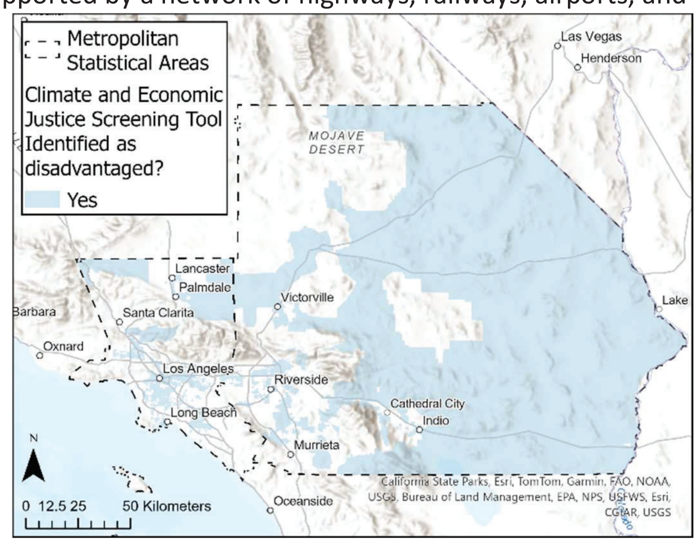
These measures incentivize ready to deploy and shovel-ready projects aligned with the National Zero-Emission Freight Corridor Strategy. The measures will create high-road jobs estimated at 470 in California and 4,700 across the nation. As the infrastructure becomes fully utilized, an additional 43,500 high-road jobs are expected to be created nationwide. A workforce training program in partnership with the National Electrical Contractors Association (NECA) and International Brotherhood of Electrical Workers (IBEW), academia, and CBOs directly will support the implementation and maintenance of ZE technologies through the development and training of skilled labor. Additionally, benefits for low-income disadvantaged communities (LIDAC) have been integrated into the GHG measures and through a community benefits program to facilitate authentic engagement and achieve CPRG and Justice40 goals. A total of seven (7) letters of commitment with 15 signatories and 73 letters of support with 101 signatories have been received in support of INVEST CLEAN from government, industry, chambers of commerce, academia and workforce training institutions, and community-based organizations.

In addition, charging infrastructure projects will support renewable energy and battery storage to help with resiliency and to create additional job benefits. These are critical components for charging infrastructure as seen from previous South Coast AQMD projects.

Sector: Transportation - Goods Movement

Expected Total Cumulative GHG Emission Reductions: 3.6 million metric tons CO_2e or $139/metric ton CO_2e for 2025-2030; 12 million metric tons CO_2e or $42/metric ton CO_2e for 2025-2050.

Location: The Los Angeles – Long Beach – Anaheim and Riverside–San Bernardino – Ontario MSAs span from the Pacific Coast eastward to the California border. This region is the western gateway to the U.S. supply chain and international commerce, hosting the two busiest ports in the nation which are ranked 9th in the world based on percentage of containerized waterborne import cargo in calendar year 2023.[1] The Ports of Long Beach and Los Angeles are supported by a network of highways, railways, airports, and intermodal facilities with corresponding warehouse and distribution facilities. The location of projects aligns with Phase 1 for hubs and corridors identified by the Joint Office of Energy & Transportation in the "National Zero-Emission Freight Corridor Strategy."[2] This region encompasses the South Coast, Coachella Valley, and Mojave Air Basins. The MSAs population is predominantly located in the South Coast Air Basin which is in extreme non-attainment for ozone and serious non-attainment for PM2.5 based on the National Ambient Air Quality Standards (NAAQS).[3]



The region also includes more than two-thirds of the State's LIDAC communities as shown in the map.

[1] Port of Los Angeles, Facts and Figures, https://www.portoflosangeles.org/business/statistics/facts-and-figures
[2] Joint Office of Energy and Transportation, "National Zero-Emission Freight Corridor Strategy," https://driveelectric.gov/files/zef-corridor-strategy.pdf
[3] U.S. Environmental Protection Agency, Green Book, Criteria Pollutant Non-attainment Summary Report, https://www3.epa.gov/airquality/greenbook/ancl3.html

The Los Angeles-Long Beach-Anaheim, CA MSA includes the following principal cities: Anaheim, Arcadia, Burbank, Carson, Costa Mesa, Cypress, Fountain Valley, Gardena, Glendale, Irvine, Long Beach, Los Angeles, Monterey Park, Newport Beach, Orange, Pasadena, Santa Ana, Santa Monica, Torrance, and Tustin.

The Riverside-San Bernardino-Ontario, CA MSA includes the following principal cities: Chino, Corona, Ontario, Palm Desert, Redlands, Riverside, San Bernardino, Temecula, and Victorville.

Applicable PCAP References(s):

Los Angeles – Long Beach – Anaheim, CA MSA	
PCAP Lead	County of Los Angeles
PCAP Title	Priority Climate Action Plan – The Los Angeles – Long Beach – Anaheim, CA Metropolitan Statistical Area
PCAP Website Link	**https://scag.ca.gov/sites/main/files/file-attachments/cprg_pcap_los_angeles-long_beach-anaheim_msa_mar2024_1.pdf**
List of GHG Reduction Measures	**Measure T1**: Decarbonize Goods Movement **Measure T3**: Transition Medium- and Heavy-Duty Vehicles to ZEVs
PCAP Page Numbers	Transportation Overview: Page 4-9 **Measure T1**: Page 4-10 **Measure T3**: Page 4-10

Riverside – San Bernardino – Ontario, CA MSA	
PCAP Lead	San Bernardino Council of Governments
PCAP Title	Priority Climate Action Plan – The Los Angeles – Long Beach – Anaheim, CA Metropolitan Statistical Area
PCAP Website Link	**https://www.gosbcta.com/wp-content/uploads/2024/03/Riverside_San-Bernardino_Ontario_PCAP.pdf**
List of GHG Reduction Measures	**Regional Goods Movement Decarbonization**
PCAP Page Numbers	**Regional Goods Movement Decarbonization**: page 4-35

State of California	
PCAP Lead	California Air Resources Board and California Environmental Protection Agency
PCAP Title	The State of California's Priority Climate Action Plan
PCAP Website Link	**https://ww2.arb.ca.gov/sites/default/files/2024-03/California%20CPRG%20Priority%20Climate%20Action%20Plan%202024%20March%201_0.pdf**
List of GHG Reduction Measures	**Transportation Measure 1**: Create a Holistic, Heavy-Duty ZE Vehicle Buydown Program **Transportation Measure 2**: Install Truck Charging to Support ZE Goods Movement at California Ports and Warehouse Districts **Transportation Measure 3**: Advance the Deployment of Clean Off-Road Equipment **Transportation Measure 4**: Bolster Investments in the State's Sustainable Port and Freight Infrastructure
PCAP Page Numbers	**Transportation Overview**: Page 21 **Transportation Measure 1**: Page 23 **Transportation Measure 2**: Page 26 **Transportation Measure 3**: Page 28 **Transportation Measure 4**: Page 30

INVEST CLEAN
Narrative

Section 1: Overall Project Summary and Approach

Introduction

The South Coast Air Quality Management District (South Coast AQMD) is leading **In**frastructure, **V**ehicles, and **E**quipment **S**trategy for **Cl**imate, **E**quity, **A**ir Quality, and **N**ational Competitiveness (INVEST CLEAN or Project) to implement zero-emission (ZE) transportation measures related to goods movement from the Priority Climate Action Plans (PCAPs) for the Los Angeles – Long Beach – Anaheim and Riverside – San Bernardino – Ontario Metropolitan Statistical Areas (MSA), and the state of California. The PCAPs prioritize goods movement due to the substantial greenhouse gas (GHG) reductions, co-benefits for criteria and hazardous air pollutants, impacts on low-income disadvantaged communities (LIDAC), and the opportunity to drive economic growth including job creation.

The two MSAs represent nearly 18 million residents who are impacted by drought, extreme heat, year-round wildfires, and floods and are home to over two-thirds of California's LIDAC communities who are disproportionately impacted by environmental and social inequalities. The Fifth National Climate Assessment highlights the fact that climate change exacerbates existing environmental, air quality, social, and economic inequities in LIDACs.[1] Further, the majority of the MSAs' population are living in areas classified under the Clean Air Act as extreme non-attainment for ozone and serious non-attainment for PM2.5.[2] Climate impacts and air pollution significantly degrade the quality of life for our residents, increasing risks of mortality, acute and chronic illnesses, lost wages and school days, and other long-term environmental and economic consequences. Additionally, unemployment in the two MSAs is at 5.5 percent, ranking the highest in the nation.[3]

On-road transportation and non-road equipment comprise over 50 percent of GHG emissions for both MSAs, with goods movement as a subset, including ports, airports, cargo-handling facilities, warehouses, railyards, and others. The State PCAP developed by the California Air Resources Board (CARB) indicates that the transportation sector is the largest source of GHG emissions when including fossil fuels processing. Goods movement-related mobile sources in the transportation sector accounted for 38 percent of the entire state's GHG emissions in 2021.[4] Mobile sources related to goods movement also contribute to more than 80 percent of the NOx and 30 percent of particulate matter in the South Coast Air Basin where the majority of the MSAs population are located.[5]

South Coast AQMD's primary regulatory authority is over stationary sources of air pollution with limited jurisdiction over mobile sources.[6] The Clean Air Act requires local air agencies, such as South Coast AQMD, to implement all feasible measures to reduce criteria pollution which includes conducting research, development, demonstration, and incentivizing the adoption of cleaner technologies which often has co-benefits for GHGs. During the last ten years, South Coast AQMD provided over $1.3 billion dollars and upgraded over 9,000 pieces of heavy duty on-road, non-road equipment, and locomotives through

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[1] Fifth National Climate Assessment, https://nca2014.globalchange.gov/report

[2] U.S. Environmental Protection Agency, Green Book, https://www3.epa.gov/airquality/greenbook/ancl3.html

[3] U.S. Bureau of Labor Statistics, Unemployment Rates for Large Metropolitan Areas, Not Seasonally Adjusted, https://www.bls.gov/web/metro/laulrgma.htm

[4] CARB - California Greenhouse Gas Emissions from 2000 to 2021: Trends of Emissions and Other Indicators. California Greenhouse Gas Emissions from 2000 to 2021: Trends of Emissions and Other Indicators

[5] 2022 Air Quality Management Plan, South Coast Air Quality Management District, https://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/final-2022-aqmp/final-2022-aqmp.pdf?sfvrsn=16

[6] California Health and Safety Code Sections 40400 et seq, https://law.justia.com/codes/california/2022/code-hsc/division-26/part-3/chapter-5-5/article-1/section-40400/

incentive programs.[7] South Coast AQMD has the capability, ability, experience, and systems to rapidly implement the proposed Project. South Coast AQMD has also worked closely with various original equipment manufacturers (OEMs) to develop ZE vehicles and equipment, and deployed numerous cutting-edge projects such as Volvo Low Impact Green Heavy-Transport Solutions (LIGHTS) and Joint Electric Truck Scaling Initiative (JETSI) projects which involved the first of its kind deployment of 150 battery electric ZE vehicles with requisite infrastructure.[8, 9] South Coast AQMD is also partnering with two major U.S. locomotive OEMs to develop ZE locomotive technologies.[10, 11] In addition, South Coast AQMD works with logistic real estate companies and charging network developers to establish ZE infrastructure. Overall, INVEST CLEAN's proposed investment in ZE infrastructure, vehicles, and equipment will create an estimated 470 high-road jobs in California while supporting and creating approximately 4,700 high-road jobs nationwide due to OEM manufacturing and the involvement of related suppliers. Figure 1 illustrates the extent of job creation throughout the nation. As the infrastructure is fully utilized over time, an estimated 43,500 additional high-quality jobs will be created and sustained through manufacturing, electrical installations, and maintenance. Coupled with the Project's proposed workforce training partnership with the National Electrical Contractors Association (NECA) and International Brotherhood of Electrical Workers (IBEW), there will be significant potential for job creation and development of the workforce needed to implement, maintain, and sustain the ZE transformation of the Southern California Goods Movement Corridor. The workforce training element will prepare workers to support the Southern California Goods Movement Corridor and also prepare the national workforce for the transition to ZE good movement.

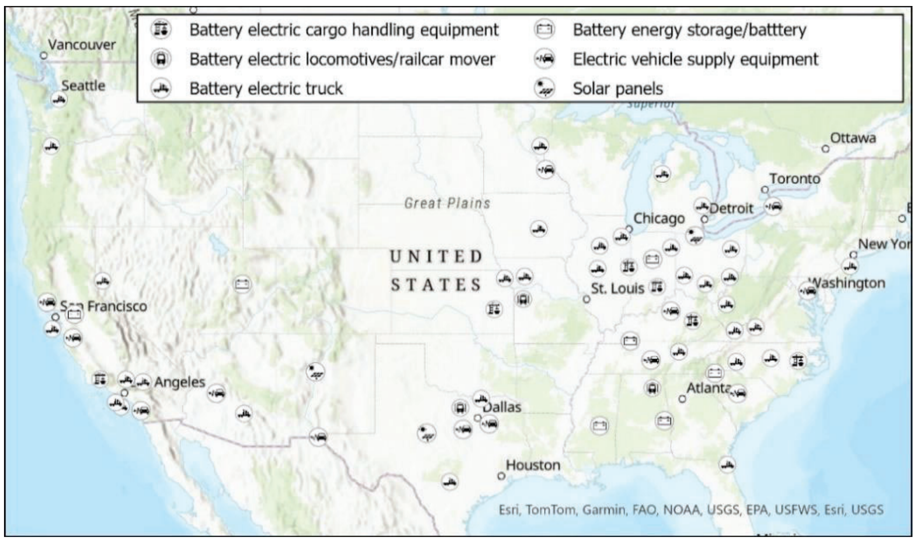

Figure 1: Manufacturing Locations for BE Trucks, CHE, Locomotives, and Charger

INVEST CLEAN is a transformational initiative aimed at overcoming barriers to transitioning the Southern California goods movement corridor to ZE technologies to reduce GHG emissions, criteria and hazardous air pollutants. Eliminating emissions from the goods movement sector requires the dedication of all levels of government and the commitment of industry to establish a comprehensive, long-term strategic plan for achieving carbon neutrality. INVEST CLEAN will accelerate the adoption of heavy-duty ZE technologies due to the concentration and scale of freight movement in combination with the cooperation of our local, State, and other government representation, as well as industry, labor, academia, community-based organizations, and others. (See files: Letters of Commitment and Support).

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[7] South Coast AQMD Incentives & Programs, https://www.aqmd.gov/home/programs

[8] Volvo LIGHTS: Low Impact Green Heavy Transport Solution, https://www.lightsproject.com/

[9] JETSI: The Joint Electric Truck Scaling Initiative, https://www.jetsiproject.com/

[10] South Coast AQMD Governing Board Letter, December 3, 2021, https://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2021/2021-dec3-004.pdf?sfvrsn=4

[11] South Coast AQMD Governing Board Letter, December 1, 2023, https://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2023/2023-dec1-006.pdf?sfvrsn=2

INVEST CLEAN will increase community benefits through a robust workforce training program in partnership with labor and educational institutions. Further, INVEST CLEAN will integrate community inputs and benefits into the proposed measures and create an innovative program to help mitigate the impacts of goods movement on our most vulnerable residents while significantly reducing GHG emissions.

1a. Description of GHG Reduction Measures

INVEST CLEAN implements and builds on the PCAP transportation measures to strategically address issues that are limiting factors for the successful ZE transformation of the Southern California goods movement corridor. These measures also have been developed to maximize GHG emission reductions as well as reductions in criteria and hazardous air pollutants. These co-benefits will further progress for Southern California to meet National Ambient Air Quality Standards and reduce public health impacts. The Project supports and reinforces the ZE transformation through a workforce development and training program that supports the proposed GHG reduction measures and is described below in "Section 5. Job Quality." Outreach is integrated into the Project by creating a Community Benefits Plan with community-based organizations to educate residents, focusing on LIDACs. Additional jobs will be created as a result of battery storage and solar panels installed to support charging infrastructure projects.

South Coast AQMD developed INVEST CLEAN by drawing from more than 25 years of experience in implementing incentive programs and managing technology development and demonstration projects, coupled with a comprehensive understanding of public-private partnerships and of challenges and urgent need to deploy ZE technologies to reduce GHGs and air pollutions. Over the past few decades, South Coast AQMD has successfully implemented truck, locomotive, and equipment upgrade incentive programs such as Proposition 1B-Goods Movement Emission Reductions, Carl Moyer, and Volkswagen (VW) Settlement Programs, as well as other incentive programs funded by State GHG reduction funds. These programs have resulted in the reduction of 61,040 tons of NOx and 1,230 tons of PM, as well as substantial amount of GHG emissions in the past 10 years. Notably, many of these commercially available clean technologies, including battery electric heavy-duty trucks and CHE, are the outcomes of the pilot and demonstration projects led by South Coast AQMD's Technology Advancement Office.

Below is a list of INVEST CLEAN's four (4) GHG reduction measures, outlining key features. The implementation plan for each measure will be developed. The implementation plan will specify procedures and criteria of project selection, explain the incentive funding amounts in detail, and define the responsibilities and requirements for the entities receiving the funding, including how the existing vehicles or equipment will be replaced. Development of the implementation plan will be done with EPA involvement, and plan changes will be consulted with the EPA grant administrator for confirmation before implementation. Input from the local communities regarding project priorities will be incorporated to the greatest extend feasible in the implementation plan.

<u>Measure 1 - Charging Infrastructure Deployment Incentive Program</u>

Incentives to install electrical charging equipment to support the Southern California goods movement corridor for battery electric vehicles. Electrical infrastructure is the limiting factor for the successful deployment of battery electric heavy-duty vehicles to support efficient and secure freight movement in the two MSAs. A scoring system will be developed to prioritize disadvantaged communities, community considerations, small fleets, shovel-ready sites, and public charging or shared charging projects.

<u>Measure 2 - Battery Electric Freight Vehicle Deployment Incentive Program</u>

Incentives to decarbonize freight operations by replacing or converting heavy-duty long haul diesel trucks (Class 8) , i.e., Measure 2.1, and last-mile delivery vehicles (primarily Classes 4 and 5) , i.e., Measure 2.2, with a CARB-certified battery electric technology. South Coast AQMD will partner with the Southern California Association of Governments (SCAG) and build on their existing Last Mile Freight Program.[12] The implementation of this measure will align with the State's Advanced Clean Fleet, Advanced Clean Trucks regulations and EPA's Green House Gas Standard for Heavy-Duty Vehicles-Phase 3, facilitating the gradual

[12] SCAG, Last Mile Freight Program, https://scag.ca.gov/last-mile-freight-program

adoption of ZE vehicles and mandating exclusive ZE manufacturing starting in 2036.[13, 14, 15] For fleet operators needing charging infrastructure for vehicles funded by Measure 2, they will be prioritized, if needed, for funding under Measure 1 or they can utilize the public or shared infrastructure funded by Measure 1. South Coast AQMD will provide charging facility information available to the fleet operators for them to plan and arrange charging based on their operational needs. SCAQMD will ensure the small fleet operators receive sufficient assistance so the funded trucks will have access to charging.

<u>Measure 3 - Battery Electric Cargo Handling Equipment (CHE) Deployment Incentive Program</u>
Incentivizes deployment of battery electric CHE to introduce advanced technologies to the market and drive adoption. This measure will help reduce emissions associated with goods movement by replacing or converting diesel-powered CHE used at facilities such as warehouses, intermodal railyards, airports, ports, or freight facility centers. CHE encompasses a wide variety of equipment including, but not limited to, rubber-tired gantry (RTG) cranes, yard trucks, forklifts, side handlers, top picks and reach stackers. Retiring existing CHE is pivotal to a strong emission reduction strategy because existing equipment is predominantly diesel and highly polluting. This measure is critical to help support the commercialization of more types of CHE to meet operational needs, especially duty cycles. Infrastructure will be paired with equipment to support successful deployment.

<u>Measure 4 - Battery Electric Locomotive Program</u>
Replace diesel switcher locomotives domiciled in the MSAs region with battery electric technology. Upgrading locomotives to ZE technology requires significant capital investment. Incentive funding will encourage the development and deployment of ZE switcher locomotive technologies and improve market penetration. Under normal conditions, locomotives have long service lives, so encouraging the transition of diesel locomotives to ZE technologies will provide substantial long-term reductions in GHG emissions. Additionally, thousands of gallons of diesel fuel can be saved annually when battery electric switcher locomotives are deployed. Infrastructure will be paired with equipment to support successful deployment.

The funding allocation for the four measures, including the incentive funding and associated cost for workforce training, community engagement, and data collection, and anticipated emission reductions for GHG and co-pollutants is summarized in Table 1 below. Additionally, the Ports of Los Angeles and Long Beach will provide $5,000,000 in leveraged funding to expand the deployment of charging stations beyond the scope of INVEST CLEAN. The respective implementation plan will be developed and provided.

Table 1: Overview of Proposed Measures Costs and Climate Benefits

CPRG Measures		Incentives		Budget**	Emission Reductions: GHG (MT CO2e) 2025-2030	GHG (MT CO2e) 2025-2050	NOx (ton/yr) 2030	PM2.5 (ton/yr) 2030	DPM (ton/yr) 2030
M1: Charging Infrastructure Deployment		700	$/kW	$191,267,885	3,427,178	11,153,463	1,289	18	19
M2: BE Freight Vehicle Deployment	M2.1	400,000	$/truck(class8)	$83,971,000	67,391	172,369	16.7	0.2	0.2
	M.2.2	67,000	$/truck(class4/5)*						
M3: BE CHE Deployment		300,000	$/yard tractor*	$25,528,435	61,230	143,567	24.1	1.2	1.1
		400,000	$/top handler*						
M4: BE Locomotive Program		10,600,000	$/locomotive*	$199,210,095	42,476	300,146	285	9	10
Total				**$499,997,415**	**3,598,274**	**11,769,545**	**1,615**	**28**	**30**

BE: battery electric

[13] CARB, Advanced Clean Fleets, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets
[14] CARB, Advanced Clean Trucks, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks
[15] U.S. EPA, Final Rule: Greenhouse Gas Emissions Standards for Heavy-Duty Vehicles – Phase 3, https://www.epa.gov/regulations-emissions-vehicles-and-engines/proposed-rule-greenhouse-gas-emissions-standards-heavy

* Incentive includes both vehicles/equipment and chargers.
** Budget includes incentive funding and associated cost for workforce training, community engagement, and data collection. Details are provided in the Budget Narrative.

Tasks, Milestones, and Risks

South Coast AQMD has many decades of experience implementing incentive programs similar to the proposed Project. South Coast AQMD has a division i dedicated to technology advancement, focusing on technology incentive and demonstration projects. The division includes highly skilled teams with extensive experience in handling high volumes of applications and projects and meeting grant deadlines, while achieving emission reduction goals.

If the proposed Project is awarded, a solicitation will be developed and brought through South Coast AQMD's standard procurement process to allow for public review and input which includes a policy committee and full Governing Board consideration. The solicitation will be developed to attract the most cost-effective, ready to deploy, and/or shovel-ready projects.

After public comment is addressed and the Governing Board approves the solicitation, it will be released in multiple languages for a specified amount of time to allow interested applicants to respond. During this time, South Coast AQMD will work with our local government partners, industry, Chambers of Commerce, community-based organizations, and others to conduct outreach on the open solicitation. Received projects will be evaluated based on a scoring criterion established for each measure. On a per equipment basis, the measures will prioritize projects with the largest GHG reduction potential. The measures were also designed to support equity, workforce training, and the transition to ZE with authentic community engagement and benefits.

The solicitation process will be managed through South Coast AQMD's state-of-the-art Grant Management System (GMS) for efficient application submittal, evaluation, and project approval, and a procedure established to implement projects of types and scale. South Coast AQMD also has an OnBase system to handle agreements/contracts and invoicing which provides several layers of review for accuracy and oversight, and communication, and ensures project information is securely stored with redundant backups in place. Additionally, South Coast AQMD closely monitors each project progression and takes necessary steps to ensure the project implementation meets the program requirements, including emission reductions.

Milestones will be used to assess the progress of the overall INVEST CLEAN project as well as the individual projects awarded under each GHG reduction measure. Based on our experience, South Coast AQMD will implement the program using a phased approach South Coast AQMD will work with The Alliance for Sustainable Energy, LLC (ASE) and the National Renewable Energy Laboratory (NREL) to assess and provide third party oversight to validate the program's emission reduction performance. ASE, a nonprofit organization, oversees all of the national laboratories, including NREL. This collaboration will improve the national labs' data tools and enhance their research work, which are integral to their mission of solving the nation's energy challenges. A standardized process will be created to collect data to evaluate the program's efficiency. Through ASE and its laboratory's scientific and consistent assessment of projects, we plan to improve and enhance the guidelines to expedite project solicitation. Additionally, we plan to modify the program as necessary to encourage participation, prioritize geographic diversity especially within disadvantaged communities, and mitigate any delays in achieving emission reductions. These program adjustments are also expected to lessen the possibility of projects dropping out of the program. Any funds becoming available due to a project falling through will quickly be awarded to projects in subsequent solicitations or from previous solicitation backup lists.

More details and the implementation timeline are further explained in Section 3c. Authorities, Implementation Timeline, and Milestones.

During the evaluation process of the GHG reduction measure projects, there will be criteria to demonstrate an applicant's ability to successfully implement a grant with strong results. If a grantee were to withdraw for any reason, South Coast AQMD will draw from a back-up list of eligible projects. South Coast AQMD incentive programs are often oversubscribed, and backup lists of eligible projects are maintained to allow for flexibility to reallocate funds to other projects which mitigates any delays and maintains the level of committed emission reductions. Further, South Coast AQMD's close partnership with major OEMs for infrastructure equipment, vehicles, CHE, and locomotives enables South Coast AQMD to keep up with the market forecast and lead time to assist with project deployments. South Coast AQMD also meets with utility companies regularly to discuss current and upcoming projects to prevent delays.

South Coast AQMD has observed that the OEM manufacturers can deliver battery electric trucks and equipment with minimal delay and anticipates that this trend will continue over the next few years. In fact, many OEM manufacturers have expressed readiness and capability to produce more ZE vehicles though the vehicles currently remain parked due to insufficient charging infrastructure. The lack of charging infrastructure to support medium- and heavy-duty vehicles and equipment has become the most important limiting factor that is delaying and preventing the deployment of these technologies. INVEST CLEAN was designed to address the limiting factors for ZE vehicle and equipment deployment at scale from issues such as lack of charging infrastructure, education on the new technologies, and developing the needed workforce.

For Class 8 heavy-duty trucks, program implementation efficiency will be evaluated on a regular basis and if the results show excessive delays on deployment, strategies will be explored to either address the impacting factors and/or funds could be shifted to last mile freight projects since there are a wide range of vehicles and more charging infrastructure to support these vehicle classes. Expediting the implementation of Measure 1 could mitigate the risk of lack of infrastructure.

ZE locomotive technology deployment is challenging due to the high-power demand, range, battery energy density, operation in the harsh environment, and cost. The production of battery electric locomotives will take 30-36 months; still a larger scale deployment could occur in late 2027 due to the pressing need for cleaner technologies. All levels of government are focused on advancing locomotive technology to achieve substantial emission reductions, health benefits, and public safety. Implementing Measure 4 for battery electric locomotives will enable the accumulation of significant experience in reliable operation, facilitating the resolution of technical challenges, cost reduction, and ensuring a longer operational life for the locomotives. Major locomotive manufacturers and operators in the MSA region are committed to supporting this Measure and explore the charging standard for switcher locomotives.

In summary, South Coast AQMD has the tools, partnerships, staff, ability, and experience needed to overcome any challenges we may encounter.

EPA Strategic Plan Alignment

All measures align with the EPA's FY 2022-2026 EPA strategic plan objective 1.1 by incentivizing the heavy-duty vehicles and equipment involved in the goods movement activities to transition to ZE technology to reduce GHG emissions. [1] These measures also support EPA Strategic Plan objectives 2.1, 2.2, and 4.1 by implementing programs through meaning feedback and comment that will provide capacity building resources to LIDACs and reducing disparities in environmental and public health conditions, responding to environmental justice concerns, working in ways that are community driven, coordinated and collaborative, supporting equitable and resilient community development, and addressing disproportionate impacts, as well as improving air quality and reducing fine particle pollution in counties not meeting the current National Ambient Air Quality Standards. Further, for 2.2 South Coast AQMD provides region-specific language assistance and disability access.

PCAP alignment

INVEST CLEAN implements GHG reduction measures from three PCAPs including the Los Angeles – Long Beach – Anaheim and Riverside – San Bernardino – Ontario MSAs, as well as the state of California. Table 2 shows the relevant GHG reduction measures from the PCAPs.

Table 2: Relevant GHG Reduction Measures from the PCAPs

MSA PCAP	INVEST CLEAN Measures	Measures
State of California	MI, M2 (M2.1 and M2.2), M3, M4	(1) Create a Holistic, Heavy-Duty ZE Vehicle Buydown Program (2) Install Truck Charging to Support ZE Goods Movement at California Ports and Warehouse Districts (3) Advance the Deployment of Clean Non-Road Equipment (4) Bolster Investments in the State's Sustainable Port and Freight Infrastructure (6) Allow for Local Deployment of ZEV Infrastructure and Low-Income ZEV Support.
Los Angeles-Long Beach-Anaheim	MI, M2 (M2.1 and M2.2), M3, M4	(T1) Decarbonize goods movement (T3) Transition Medium- and Heavy-Duty vehicles to ZEVs
Riverside-San Bernardino-Ontario	MI, M2 (M2.1 and M2.2), M3, M4	Goods Movement Decarbonization

Measure 1 will equip the region with charging infrastructure in alignment with the local and State PCAPs to support widespread adoption of ZE heavy-duty vehicles. Measures 2, 3, and 4 implement local and State PCAPs relating to creation of a buydown program, bolstering sustainable port and freight infrastructure, and decarbonizing goods movement. Specifically, Measure 2 will support long haul trucks and last-mile freight vehicles and strategies. Measure 3 will decarbonize CHE operated at the major goods movement hubs at the ports, railway yards, airports, and distribution warehouses which are often directly adjacent to or integrated in LIDACs. Measure 4 will help reduce emissions from rail by driving the adoption of ZE switcher locomotives which are difficult to abate due to long life cycles and cost.

The local and State PCAPs prioritize goods movement because the combined MSA region represents the busiest goods movement corridor in the nation with the San Pedro Bay Ports processing approximately 30 percent of U.S. containerized freight which is transported and processed by the Inland Empire Logistics corridor through a network of highways, railways, intermodal facilities, warehouses, and other facilities. The National Zero-Emission Freight Strategy prioritizes a significant portion of the hubs and corridors within the MSAs region for Phase 1 and 2. Further, the National Highway Freight Network includes several priority routes such as the I5, I10, I15, I110, I-215, I605, I710, Rt. 47, and SR 60. [16] According to the Vehicle Inventory and Use Survey (VIUS) data tables from 2021, medium- and heavy-trucks based in California account for roughly 10 percent of the national total, which is the highest percentage of trucks in the nation.[17] While no data readily available for the two MSA region, the 2021 EMission FACtor (EMFAC) database indicates that medium- and heavy- trucks based in the South Coast Air Basin account for roughly 38 percent of the total trucks in California.[18]. The State of California PCAP identified that medium- and heavy-duty trucks contribute disproportionately to GHG emissions. Though medium- and heavy-duty trucks account for roughly 3 percent of all vehicles, they contribute to one fourth of mobile source GHG emissions.[19]

1b. Demonstration of Funding Need

ZE Infrastructure Readiness

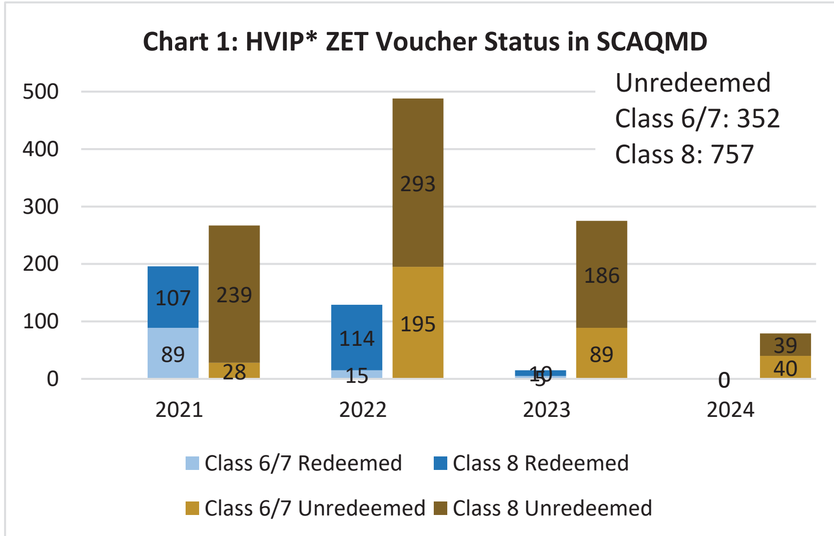
[16] National Highway Freight Network, National Highway Network Map and Tables for California, https://ops.fhwa.dot.gov/Freight/infrastructure/ismt/state_maps/states/california.htm

[17] United States Census Bureau. Vehicle Inventory and Use Survey (VIUS) Data Tables. https://www.census.gov/programs-surveys/vius/data/tables.html

[18] CARB, EMFAC 2021. https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

[19] CARB, Truck Loan Assistance. https://ww2.arb.ca.gov/resources/fact-sheets/truck-loan-assistance

California will need 109,000 lower-speed and 5,500 higher-speed chargers to support 155,000 medium- and heavy-duty plug-in electric vehicles by 2030.[20] Additionally, within the next five years, a minimum of 16,000 DC fast chargers supporting medium- and heavy duty will need to be installed. Currently, a few projects that have received Hybrid and ZE Truck and Bus Voucher Incentive Program (HVIP) vouchers will result in the deployment of approximately 3,000 chargers across all of California. The majority of these chargers only serve private fleets and are not accessible to the public. A charging facility located in Long Beach is the only known publicly accessible battery electric truck charger, allowing up to 26 trucks being charged simultaneously. Given the number of chargers needed by 2030 in the MSAs region, at least 23,000 chargers will need to be installed annually to meet the needed transition to battery electric technologies.



*HVIP: Hybrid and ZE Truck and Bus Voucher Incentive Project

As of March 2024, over 1,100 incentive vouchers (specifically, 352 medium-duty and 757 heavy-duty) for battery electric trucks in the South Coast AQMD area alone were not redeemed, mainly due to the lack of charging infrastructure (see Chart 1).[21]

The availability of heavy-duty vehicle charging infrastructure in the two MSA region is not sufficient to serve the vehicles and equipment anticipated to be delivered in the near future. To address this need, South Coast AQMD initiated an infrastructure-only solicitation in December 2023.[22] The solicitation received applications for 80 projects. Furthermore, after the solicitation's closure, additional infrastructure projects were proposed to South Coast AQMD creating a substantial funding gap of approximately $300 million. These potential projects are shown on Figure 2 below, as also provided in the attached file (Attachment: Potential projects_SCAQMD).

[20] CEC, California AB 2127 Report, https://www.energy.ca.gov/data-reports/reports/electric-vehicle-charging-infrastructure-assessment-ab-2127
[21] California Clean Truck & Bus Vouchers (HVIP), https://californiahvip.org/impact/
[22] South Coast AQMD Zero-Emission Infrastructure Program Announcement. https://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2023/2023-dec1-005.pdf

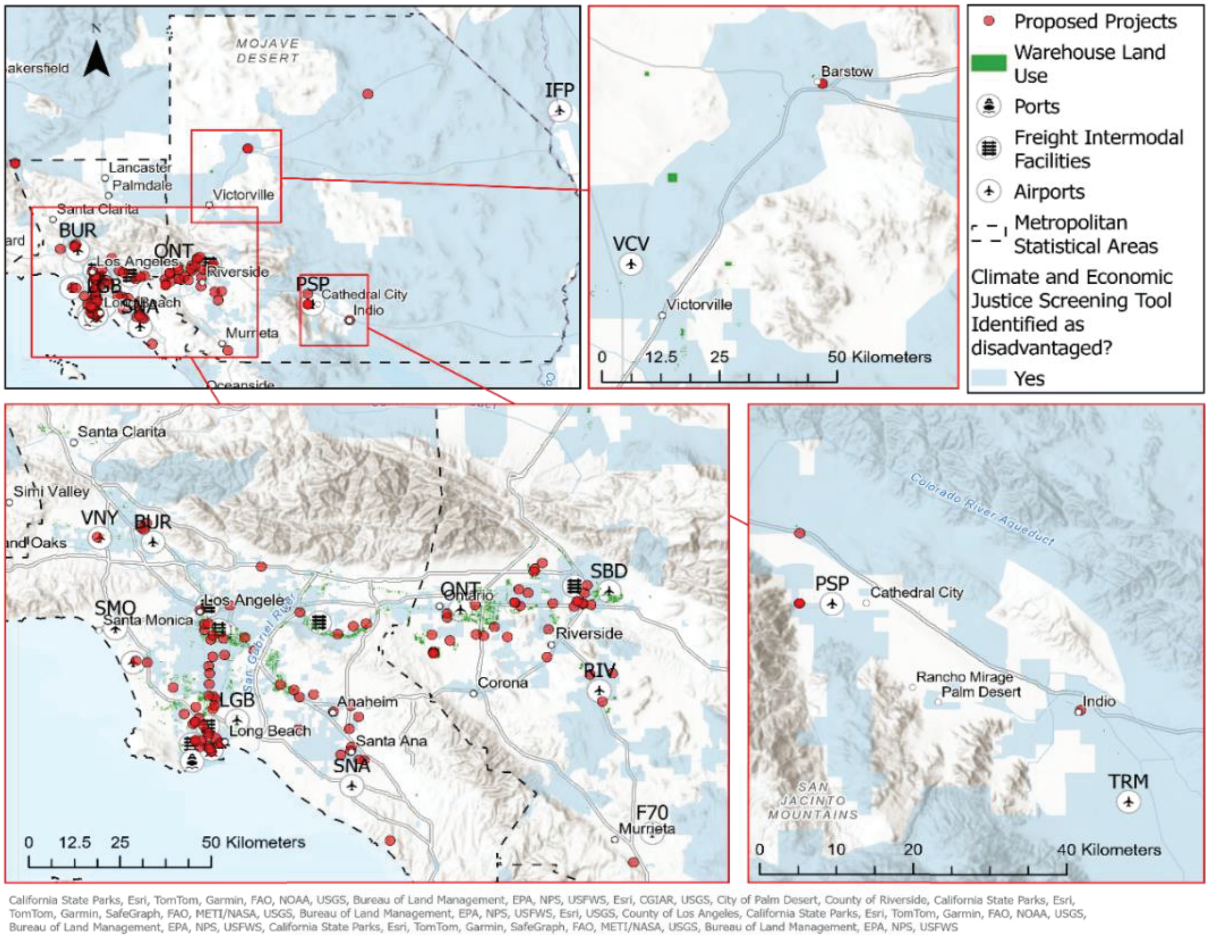


Figure 2: Illustration of Potential Projects in the Two MSA Region

Existing Incentive Program Limitations

Over the past decade, South Coast AQMD has successfully implemented several incentive programs representing hundreds of projects and pieces of equipment, including Proposition 1B, Carl Moyer, Voucher Incentive, and Volkswagen Environmental Mitigation Trust Programs. The equipment types include heavy-duty trucks, CHE, locomotives, and supporting infrastructure. Of these, Carl Moyer offers the highest awards. Table 3 below illustrates, on average, a fleet owner's out of pocket cost is more than $250,000 to purchase the ZE equipment, which is higher than the full purchase cost for an equivalent diesel truck ($150,000-180,000). For a small fleet, that amount is unaffordable and unless additional funds are available to leverage the purchase, many grant awardees cannot move forward with the replacement if the remaining balance cannot be secured.

There is a dire need for supporting infrastructure. Numerous equipment manufacturers expressed the ability to produce ZE equipment, but inadequate infrastructure prevents the deployment of the equipment.

Table 3: Examples of 2024 Battery Electric Class 8 Truck Cost

Vehicle Make	Vehicle Model	Technology	Vehicle Cost*	Carl Moyer Award	Grantee Cost
Peterbilt	579EV	Electric	$511,000	$222,280	$288,720
VOLVO	VNRE300	Electric	$545,076	$353,672	$191,404
Freightliner	PE116DC	Electric	$519,308	$210,207	$309,101
Volvo	VNRE62T300	Electric	$541,316	$204,194	$337,122
Nikola Motor	TRE BEV	Electric	$548,030	$247,402	$300,628
Freightliner	eCascadia	Electric	$615,538	$234,938	$380,600
		Average	**$546,711**		**$335,481**

*: vehicle total cost, including FET and sales tax. There is a $40k federal tax credit for ZE trucks.

Population of Goods Movement Equipment

The funding need for the two MSA regions was assessed by examining the population of existing Class 8 heavy-duty goods movement trucks using the available data for the South Coast AQMD. Only diesel-fueled trucks from Model Year (MY) 2011 to 2018, were included in the tally. This model year range was selected because these trucks, being 5 years or older, are compliant but are considered to have deteriorating emissions and limited useful remaining life.[23] Table 4 illustrates the scale of incentive funding needed based on 75 percent of the vehicle cost for 10 percent of the truck population:

Table 4: Funding Need Example for Battery Electric Goods Movement Trucks

Class 8 Diesel Freight Trucks (MY 2011-18) in South Coast AQMD	10 % of Population	Average Cost of Battery Electric Truck	Funding Need
29,245	2,924	$547,000	$1.19 billion

ZE Goods Movement Locomotives

Locomotive replacement projects offer the greatest GHG and criteria pollutant emission reduction benefits due to the amount of diesel fuel they consume and the abundance of high-emitting locomotives currently operating in the two MSA regions. ZE freight locomotives have only recently become available for switchers and rail car movers that do not travel long distances. Incentive programs for locomotive projects often require project life spans exceeding 10 years to make them eligible for appealing incentives, which has presented a challenge for operators in terms of commitment. It has been a concern for the first-generation products, and it could become obsolete or significantly decrease in value within a short period of time. In order to accelerate the technology advancement in the locomotive category, an estimate of $200 million in funding is recommended to encourage the production and deployment of 20 battery electric switchers in the MSAs. These switchers, averaging $10 million each, are 4 to 6 axle ZE models capable of serving as yard switchers and traveling between railyards on a single charge. Increasing the deployment of ZE switcher locomotives may provide even greater benefits, particularly if the technology can be scaled for line-haul locomotives or used as helper locomotives to reduce reliance on the larger, higher polluting line-haul locomotives.

Funding Sources

Over the last several years, the State and federal government have created large grant programs to address challenges related to climate change and goods movement, the need far exceeds the available resources. South Coast AQMD's Air Quality Management Plan identified that the South Coast Air Basin alone will require $1 billion annually to address air pollution to meet the National Ambient Air Quality

[23] Data was based on CARB's EMFAC database along with Port of Los Angeles and Port of Long Beach's registration databases.

Standards.[24] The MSAs funding needs would exceed what is estimated for the South Coast region alone. South Coast AQMD has applied for numerous grants, including:

- South Coast AQMD partnered with the local port terminal, Long Beach Container Terminal, to apply for the 2023 Port Infrastructure Development Program funded through Inflation Reduction Act (IRA) to complete the improvements for the terminal's charging infrastructure with a funding request of $68 million. The proposed project was expected to have an annual GHG emission reduction of approximately 3.6 thousand MT tons CO_2e.
- The Charging and Fueling Infrastructure program was created by the Bipartisan Infrastructure law in the amount of $2.5 billion. A portion of these funds are formula allocated to the States through the National EV Infrastructure program and the competitive portion is insufficient to meet national needs. South Coast AQMD was a partner in the California – Oregon – Washington's proposal and submitted on behalf of TESLA for corridor heavy-duty charging stations with a funding request of $97 million. An annual GHG emission reduction of 33 thousand MT tons CO_2e were expected in California alone.
- On the state level, primarily funded by Greenhouse Gas Reduction Fund, California Air Resource Board's California Advanced Technologies Demonstration and Pilot Projects grant was another opportunity that South Coast AQMD applied for. One proposal was to further expand the deployment of battery electric heavy-duty trucks with a funding request of $44m for an annual GHG emission reduction potential of 8.3 thousand MT tons CO_2e, and another was to deploy vehicles and equipment to facilitate the introduction of battery electric technologies to municipality operation with a funding request of $34M for an annual GHG emission reduction potential of 2.7 thousand MT tons CO_2e.

South Coast AQMD continues to seek for other funding opportunities, including:

- Clean Ports is a new funding opportunity created by the IRA. South Coast AQMD is partnering with the Ports of Los Angeles and Long Beach to strategically seek grants that do not overlap and/or focus on areas where need exceeds available funding sources to maximize coverage of the goods movement network. Therefore, South Coast AQMD is submitting this CPRG application which will provide at a minimum $200 million for the Riverside – San Bernardino – Ontario MSA and $300 million for the Los Angeles – Long Beach – Anaheim MSA. The Ports will submit applications under Clean Ports for the marine terminals.
- Clean Heavy-Duty Vehicles is another program created by IRA. Congress legislated this program to fund Class 6 and 7 vehicles. INVEST CLEAN does not include Class 8 and the Notice of Funding Opportunity is not yet available to know program details.
- Consolidated Rail Infrastructure and Safety Improvements (CRISI) does not include Class 1 railroads.
- Congressional Directed Spending Requests are limited to specific federal agency accounts and award sizes. In FY 2023, South Coast AQMD received a $500,000 award for a hydrogen fuel cell locomotive project, and in FY 2024, South Coast AQMD obtained another $500,000 award for a hybrid tugboat equipped with onboard ZE charging.
- Diesel Emissions Reduction Act (DERA) is a limited opportunity. For FY 2022 – 2023, U.S. EPA Region 9 was allocated $22,200,000 with a maximum request per application of $4.5 million. South Coast AQMD received $4.5 million for 20 Class 8 heavy-duty trucks. DERA provides limited funding and is nowhere near the scale needed to transition the Southern California Goods Movement Corridor to ZE technologies.
- Targeted Airshed Grants (TAG) funds projects for the five areas in the nation with the worst ozone and particulate matter 2.5 pollution. For the last grant cycle, FY2022, South Coast AQMD applied for four projects totaling $30 million and was awarded approximately $16 million. The Notice of Funding

[24] South Coast Air Quality Management District, 2016 Air Quality Management Plan, https://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/final2016aqmp.pdf?sfvrsn=15

Opportunity for the next grant cycle is not yet available. The funding is not sufficient to address climate and air pollution issues in the region.

1c. Transformative Impact

INVEST CLEAN will catalyze transformative change for the Southern California Goods Movement Corridor by addressing the most significant limitations and challenges to deploying ZE vehicles and equipment. This targeted strategy will result in more successful ZE technology deployments which will reduce GHGs, criteria and hazardous air pollutants to protect public health, especially in LIDACs. The Project will also support economic development and job creation locally, statewide, and across the nation.

This region is the western gateway to the U.S. supply chain and international commerce, hosting the two busiest ports in the nation. It is supported by a network of highways, railways, airports, and intermodal facilities with corresponding warehouse and distribution facilities that are located in and adjacent to environmental justice communities. The Project aligns with the Joint Office of Energy & Transportation in the "National Zero-Emission Freight Corridor Strategy" with 11 percent of Phase 1 and 2 Hubs located in this region.

This measure addresses the obstacles of limited availability of ZE vehicle/equipment charging infrastructure and affordability of new clean vehicle technologies by providing financial incentives. South Coast AQMD worked with ASE's laboratory to create an incentive structure that maximizes the building out of infrastructure and turnover of diesel-fueled medium- and heavy-duty trucks and CHE. ASE's laboratory will collect data and analyze the incentive structure on an annual basis to optimize the efficacy of the program and document best practices that can be utilized broadly. Further, implementing these measures will create market demand for commercially available battery electric ZE equipment and supporting infrastructure thus setting the pathway for the acceleration of ZE technology implementation. In addition, INVEST CLEAN will foster growth in sectors like renewable energy and batteries, and will facilitate ZE technology transfer to other sectors of the economy. The benefits of this measure and technology developed will apply to the MSAs and across the nation, setting a course for less reliance on fossil fuels. It also will spur economic growth through purchases of equipment, vehicles, and supplies across the nation and support job creation. The unemployment rate in the MSAs region is 5.5 percent, which is significantly higher than the national average of 3.9 percent. [25,26] (see File: Techappx_SCAQMD)

The ZE battery-electric locomotive deployment will be a pioneering step toward decarbonizing freight rail transportation which is one of the largest concerns by LIDAC communities in the MSAs region. This Project will overcome challenges to transitioning freight rail to ZE technologies by addressing the high capital investment for battery electric locomotives and by deploying 18 engines to generate the operational data required before wide-scale adoption can occur. By incentivizing the development and the deployment of the ZE locomotives and implementing a large-scale demonstration, the transition to clean technologies could be sped up significantly.

INVEST CLEAN will set a new standard for engaging in and implementing a Community Benefits Plan through a third-party facilitator. The Project will also implement a comprehensive workforce training program in partnership with the NECA and IBEW and supported by more than three (3) universities, seven (7) colleges, one (1) community college, and seven (7) educational-related institutions. Details on the Community Benefits Plan are in Section 4. Low Income and Disadvantaged Communities and the Workforce Training Program is described in Section 5. Job Quality.

The Project will put the Southern California Goods Movement Corridor on a transformational ZE pathway to reduce GHGs providing with co-benefits for from the reduction of criteria and hazardous air pollutants, and thereby protecting public health, especially in LIDACs. INVEST CLEAN will also support economic growth and create high-road jobs by supporting the goods movement sector which is vital to the U.S. supply chain and international commerce. Additionally, the Project will build resiliency in the freight sector

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[25] U.S. Bureau of Labor Statistics, Unemployment Rates for Large Metropolitan Areas, Not Seasonally Adjusted, https://www.bls.gov/web/metro/laulrgma.htm

[26] U.S. Department of Labor, Bureau of Labor Statistics, https://www.bls.gov/news.release/pdf/empsit.pdf

by modernizing vehicles and equipment and developing a skilled workforce to be better prepared for future events like the COVID-19 pandemic, foreign conflicts and geopolitical issues, inflation, or other impacts. The Project will also leverage community support to promote awareness about climate pollution and prevention.

Section 2: Impact of GHG Reduction Measures

INVEST CLEAN will strategically implement measures in the goods movement sector to achieve immediate, cost-effective GHG emission reductions with co-benefits from reductions of criteria and hazardous air pollutants, while building a foundation for a ZE future. The GHG reduction measures in the proposed Project will reduce fossil fuel usage by thousands of gallons in the goods movement sector by incentivizing ZE vehicles and equipment. Measure 1 is the highest priority due to the critical need to build charging infrastructure for ZE technologies. Providing ubiquitous and strategically placed charging stations to meet the operational needs of the goods movement industry along our freight corridors is the key to successful deployment and adoption of ZE battery electric trucks. Measures 2-4 will implement targeted incentive programs for ZE vehicles and last-mile freight, CHE, and switcher locomotives to support broad deployment in the MSAs region, while capturing experience and data to drive development and commercialization across the nation.

2a. Magnitude of GHG Reductions from 2025 through 2030

For the proposed Project, the emission reduction estimates are based on the vehicles or equipment miles traveled, hours of operation, fuel usage, and electricity consumption. Following the methodology in the AFLEET CFI Emissions tool[27], an emission calculator recommended by the Federal Highway Administration for Charging and Fueling Infrastructure Discretionary Grant Program, GHG emission reductions from the proposed Project was calculated in metric tons of CO_2 equivalent (CO_2e). Considered GHG pollutants are CO_2, CH_4 and N_2O. For battery electric trucks, truck chargers, and battery electric CHE, the project life is assumed to be 10 years. For battery electric switcher locomotives, a 20-year project life is assumed. The vehicles and equipment are assumed to be phased deployments starting in 2026 for trucks and chargers, and 2028 for locomotives. The emission reductions for Measures M1-4 from 2025 through 2030 are shown in Table 5. A total of 3.6 million MT tons of CO2e is expected to be avoided in that period from the upgrade of high-pollution vehicles and equipment with battery electric technologies funded under the Project. While the transition involves strong financial investment, comprehensive collaborations, and support from various sectors and agencies, the battery electric technologies are being well received by the fleets and other end users, as observed in the recent projects under South Coast AQMD's administration. It is expected that the vehicles and equipment will be utilized much longer after the end of this grant period, resulting in long-lasting emission reductions. The calculation for the emission reductions associated with Measure 1, deployment of charging infrastructure, conservatively assumed a 20 percent utilization rate for the first year of operation and 60 percent for the maximum, while as previously discussed, there is already a great demand for charging facilities. The mileage data and operation duration used in the estimation for Measures 2-4 are based on the real-world data that South Coast AQMD has collected through annual usage data from the equipment owners required by most of the incentive programs South Coast AQMD administers. Therefore, it is expected that the emission reductions will be permanent. The assumptions and calculation methods are explained in the attached technical appendix (Attachment: Techappx_SCAQMD).

[27] Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) for Charging and Fueling Infrastructure (CFI) Emissions, https://afleet.es.anl.gov/infrastructure-emissions/

Table 5: Cumulative GHG Emission Reduction for Measures 1-4 between 2025 and 2030

	2025-2030 Cumulative Emission Reductions (MT CO_2e)
M1: Charging Infrastructure Deployment	3,427,178
M2(M2.1 and M2.2): BE Freight Vehicle Deployment	67,391
M3: BE CHE Deployment	61,230
M4: BE Locomotive Program	42,476
Total	**3,598,274**

2b. Magnitude of GHG Reductions from 2025 through 2050

The equipment funded under the proposed measures will have a minimum project life of 10 years for heavy-duty trucks, chargers, and CHE and 20 years for the locomotives. The emission calculations are based on this minimum life span for a conservation estimation. It is expected that funded vehicles and equipment will be utilized at least for their minimum lifetime and beyond. It is estimated that a total $12 million MT tons of CO_2e will be eliminated between 2025 and 2050 from this Project. Furthermore, the funded infrastructure can continue providing charging service for battery electric trucks, CHE, and locomotive switchers throughout 2050 as the electricity power cable and other power components have much longer lifetime than the assumed 10 years for the chargers. A GHG emission reduction of 24 million MT CO2e is expected for Measure 1 for the scenario that the funded chargers last through 2050. The assumptions and calculation methods are explained in attached technical appendix (Attachment: Techappx_SCAQMD).

With the efforts of this Project, a large-scale truck charging network will be gradually established in the region, workforce training will ensure enough drivers and technicians will operate and maintain the battery electric equipment and chargers. Communities will receive education to obtain necessary knowledge and certifications to speed up the spread of battery electric technologies. The anticipated emission reductions are expected to be enduring.

For the longer term GHG reductions, the electricity generation emission factors estimate for 2030 and on reflect the implementation of California's Renewable Portfolio Standard (RPS) Program which requires 60 percent renewables by 2030 and 100 percent carbon fee by 2045. The 2030 GHG emission factors represent the weighted average of emission factors for utilities in Los Angeles and Orange counties and were used for the calculation in years 2030 to 2044. The 2045 (and later) GHG emission factors were set to zero because of RPS Program requirements. The EPA's GHG emission factors for the Western California subregion were used for the year 2025 to 2050. The cumulative emission reductions for each measure are listed in Table 6 below.

Table 6: Cumulative GHG reduction for Measures 1-4 between 2025 and 2050

	2025-2050 Cumulative Emission Reductions (MT CO_2e)
M1: Charging Infrastructure Deployment	11,153,463
M2 (M2.1 and M2.2): BE Freight Vehicle Deployment	172,369
M3: BE CHE Deployment	143,567
M4: BE Locomotive Program	300,146
Total	**11,769,545**

2c. Cost Effectiveness of GHG Reductions

The short-term (2025-2030) GHG cost-effectiveness is estimated to be $139/MT CO_2e, based on the projected GHG emissions in Table 5 and the proposed project budget. This ratio is substantially lower than EPA's estimate of $230/MT CO_2e for the 2030 GHG social cost.[28]

[28]Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances, https://www.epa.gov/system/files/documents/2022-11/epa_scghg_report_draft_0.pdf

The proposed Project implementation uses battery electric commercial technologies and chargers. Additionally, regionally and nationally, there is lack of skilled technicians and operators as well as a lack of public knowledge and acceptance of battery electric technologies. The proposed Project will invest in workforce training and community engagement. The immediate emission reductions from these efforts can't be conveniently qualified and reflected in the cost effectiveness rate. Furthermore, data from the operation of the deployed equipment and vehicles will be analyzed to optimize the performance and improve the energy consumption. Extra emission reductions can be achieved through this effort. It is also expected that there will be installation of solar panels and supporting stationary battery storage located with the charging infrastructure.

Being located in California, the proposed Project is also affected by relatively higher prevailing costs compared to other states. Among all the states, California has the highest Regional Price Parity, resulting in higher labor and material cost for deploying the equipment and vehicles proposed for the Project compared with equivalent projects in other states, indicating high levels of labor cost and purchase cost.[29] Some of the cities in the MSAs also have the highest sales tax in the nation, further impacting the cost of implementing the Project.[30]

2d. Documentation of GHG Reduction Assumptions

See Technical Appendix (Attachment: Techappx_SCAQMD).

Section 3: Environmental Results – Outputs, Outcomes, and Performance Measures

3a. Expected Outputs and Outcomes

The Project is expected to result in significant environmental benefits through the widespread large-scale transition to battery electric technologies and will eliminate a total of 3,598,274 MT CO_2e by 2030, which is sizable in comparison with the regional emissions. The PCAP for Los Angeles, Long Beach, and Anaheim indicates that under the business-as-usual scenario, GHG emissions in the MSA are projected to reach 83,457,200 MT CO_2e in 2030, with the transportation sector emitting 38,519,494 MT CO_2e. The PCAP for Riverside, San Bernardino, and Ontario indicates that under the business-as-usual scenario, GHG emissions in the MSA are projected to reach 4,474,988 MT CO_2e in 2030, with the transportation sector emitting 2,223,617 MT CO_2e. As previously mentioned, the two higher-dollar measures - M1 aimed at funding the charging infrastructure and M4 aimed at funding the battery electric switcher locomotives - have relatively long operation lifetimes. The emission reduction benefits are expected to last more than 20 years, with GHG emission reductions per year peaking in 2030 and continuing to accrue GHG reductions through 2050.

The Project will also result in significant co-benefits by reducing the emissions of criteria air and hazardous air pollutants. It is estimated that the project will eliminate an annual total of 1,615 tons of NOx and 28 tons of PM2.5. SCAB, the main portion of the two MSAs, is designated as being in extreme nonattainment for ozone and serious nonattainment for PM2.5. As shown in the 2022 South Coast Air Quality Management Plan, South Coast AQMD estimated 166 tons/day, or 69,719 tons/year are needed to reach attainment for ozone.[31] The Project will play a role in achieving that emission reduction goal. Since the emission sources to be eliminated by the Project are primarily diesel engines, it is estimated that there will be an annual emission reduction of 30 tons for diesel particulate matter (DPM) from the Project. DPM is the largest contributor to cancer risk in the SCAB, accounting for approximately 50 percent of the cancer

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[29] Regional Price Parities by State and Metro Area | U.S. Bureau of Economic Analysis (BEA): https://www.bea.gov/data/prices-inflation/regional-price-parities-state-and-metro-area

[30] California City & County Sales & Use Tax Rates: https://www.cdtfa.ca.gov/taxes-and-fees/rates.aspx

[31] South Coast AQMD Air Quality Management Plan, https://www.aqmd.gov/home/air-quality/air-quality-management-plans/air-quality-mgt-plan

risk.[32] Communities near freeways, ports, and intermodal facilities, most of which are in the LIDAC, will benefit from the Project and will be prioritized for investment under this Project.

3b. Performance Measures and Plan

South Coast AQMD will establish agreements with incentive fund awardees to determine the deployment timeline and reporting requirements. South Coast AQMD plans to reimburse the purchase of the vehicles and equipment after ZE equipment verifications. Inspection will be conducted to confirm the installation of the charging stations or purchase of vehicles prior to issuing the payment to the awarded entities. South Coast AQMD will closely track the deployment of charging stations, vehicles, and equipment. The deployment timeline of the charging stations will ensure that the vehicles and equipment can begin operations on schedule. Deployment status will be monitored and compared with the proposed timeline in the application. The updates will be included in the semi-annual and annual reports.

Incentive fund awardees will also be required to electronically collect and submit or make accessible the performance data of the charging stations and vehicles to the South Coast AQMD or a designated third party. For the charging stations, the designated third party will track the utilization of the individual chargers, including the charging sessions, charging time, electricity usage, vehicle types, etc. Such data will be used for the analysis of GHG emission reductions. For the battery electric trucks, CHEs, and locomotives, telemetry data will be collected for the mileages, operation hours, charging behaviors, vehicle types, etc. Individual awarded units under each measure will be tracked for their usage separately and then aggregated per measure on a quarterly basis. South Coast AQMD will establish emission reduction targets for each quarter based on the proposed timeline in the application. The following approaches will be taken to calculate the GHG and CAP/HAP emission reductions from the deployed equipment and track the progress. The data will be included in the semi-annual and annual reports, as well as the final report.

The qualification for GHG emissions from the operation of the funded charging stations will follow the qualification method outlined in the application, primarily based on energy consumption. It will consist of two components: (1) upstream GHG emission reductions, representing the difference in GHG emissions between diesel fuel production and electricity production; and (2) avoided GHG emissions from diesel truck operation as funded chargers create the charging availability for battery electric trucks. The qualification for CAP and HAP emission reductions will focus on the operations.

The qualification for GHG emissions from the operation of funded battery electric trucks, CHEs, and locomotives will also follow the qualification method in this application using the mileages or operation hours. As the Project will fund both the equipment and chargers, the GHG emissions will be comprised of two portions as well: (1) upstream GHG emission reductions, representing the difference in GHG emissions between diesel fuel production and electricity production and (2) avoided GHG emissions from diesel equipment operation. The qualification for CAP and HAP emission reductions will focus on the operations.

The locomotives will be connected to the manufacturers' Optimization Program which continuously monitors the locomotives around the clock, ensuring the data collection and analytics to drive advancements in locomotive technology. The locomotive monitoring program will provide real-time operational metrics throughout the entire lease period or project lifespan, which will be used by the manufacturers for product improvement and scale up plan. Both manufacturers and rail operators will utilize this data to further improve the performance of such locomotives.

3c. Authorities, Implementation Timeline, and Milestones

As shown in Table 7, the implementation of these measures will begin with administrative duties, which include the development of the Quality Management Plan (QMP), Quality Assurance Project Plan (QAPP), incentive program implementation plans, the release of program announcements, formulation of application evaluation guidelines, organization of workshops and outreach activities, project selection for

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[32] South Coast AQMD Multiple Air Toxics Exposure Study V: https://www.aqmd.gov/docs/default-source/planning/mates-v/mates-v-final-report-9-24-21.pdf

the most cost-effective projects that can be implemented in the near term. The project selection will prioritize projects located in overburdened communities. An increase in incentives will be reserved for small fleet operators to offset the risk of investing in advanced technology and provide funding to cover the incremental costs of diesel equipment. After the replacement vehicles or equipment is deployed, the vehicles/engines and equipment/engines will be scrapped and permanently removed from the service to ensure emission reductions are achieved. Under the Workplan worksheet in the “General Approach” column of the "Workplan and Reporting” tab, the basic scrappage approach is outlined for each measure. The scrappage procedures will be detailed in the Implementation Plans but will follow this principle: The existing vehicle and equipment will be surrendered to an authorized dismantler for proper destruction. The engine block shall be punctured with a 3-inch hole. The authorized dismantlers will provide South Coast AQMD with certificates of destruction, along with photographic documentation of the hole in the engine block. The project proposals for the infrastructure projects will be evaluated and selected based on a developed set of criteria, which may include utilization rate, public accessibility, and others. Feedback from community groups will be considered and the full selection criteria and ranking methodology will be detailed in the implementation plan. The installation of charging infrastructures will be conducted concurrently with the deployment of ZE vehicles and equipment. The equipment and vehicle solicitation and deployment timeline will occur as early as April 2025. It is anticipated that vehicle and equipment procurement and deployment can start in November 2025.

Table 7: Proposed Project Timeline for INVEST CLEAN

Tasks	Responsible Entities	Milestone Dates
Project Management for All 4 Measures		
SCAQMD Board Approval Recognizing the Award	SCAQMD	09/2024
EPA Grant Agreement/Project Start Date	EPA	10/01/2024
INVEST CLEAN webpage creation	SCAQMD	06/2025
INVEST CLEAN webpage providing project updates	SCAQMD	Ongoing
Regular meetings between SCAQMD and EPA	SCAQMD/EPA	Quarterly
Semi-annual reports to EPA for project-wide activities	SCAQMD	Semi-annually
One year performance report/Final performance report	SCAQMD	10/2025;04/2030
Community Outreach and Engagement for All 4 Incentive Measures		
Solicitation for the third-party facilitator	SCAQMD	12/2024
Third-party facilitator selection	SCAQMD	02/2025
Third-party facilitator contract execution	SCAQMD/Facilitator	03/2025
Formation of Community Steering Committee	SCAQMD/Facilitator	03/2025
Third party facilitator feedback on implementation plans	SCAQMD/Facilitator	03/2025
Development of Community Benefits Plan	SCAQMD/Facilitator	03/2025-01/2026
Development of outreach and educational metrics/materials	SCAQMD/Facilitator	03/2025-01/2026
Community Steering Committee Meetings	SCAQMD/Facilitator	Quarterly
Community outreach partners selection and subcontract	SCAQMD/Facilitator and Partners	05/2025
Outreach meetings and workshops	SCAQMD/Facilitator and Partners	Ongoing
Online social media activities	SCAQMD/Facilitator and Partners	Ongoing
Workforce Training for All 4 Incentive Measures		
Training entity subaward agreement execution	SCAQMD/IBEW & Other Entities	03/2025
Development and coordination for education components	SCAQMD/IBEW & Other Entities	06/2025
Updates to Community Steering Committee	IBEW/Other Entities	Quarterly
Compilation of existing education materials	IBEW/Other Entities	10/2025
Outreach for students enrollment	IBEW/Other Entities	Ongoing
Workforce training	IBEW/Other Entities	Ongoing
Data Reporting and Emission Validation for All 4 Incentive Measures		
Subaward agreement execution	ASE	01/2025
Development/update of QAPP	ASE/SCAQMD	06/2025
Development/update of QMP	ASE/SCAQMD	06/2025
Development of Data Collection and Emission Validation Plans	ASE	09/2025
Development of Data Reporting Standards	ASE	12/2025
Development of Database Management/Hosting/Access Plans	ASE	12/2025
Development of Scaling Plan/A report on optimization	ASE	10/2029
Emission reduction validation	ASE	10/2029
Incentive Measures		
M1: Charging Infrastructure Deployment		
Development of Implementation Plan	SCAQMD	03/2025
Development of Project Tracking Sheet	EPA/SCAQMD	03/2025
Release of the rebate program (2nd round, if needed)	SCAQMD	06/2025 (07/2026)
Project selection (2nd round, if needed)	SCAQMD	09/2025 (10/2026)

Rebate agreement execution	SCAQMD/Operators	10/2025-08/2027
Procurement and installation of charging equipment	Operators	01/2026-09/2028
Invoice review and rebate payment	SCAQMD	06/2026-03/2029
Performance and usage tracking	SCAQMD/ASE/Operators	06/2026-03/2029
Measure 2.1: Battery Electric Class 8 Deployment		
Development of Implementation Plan	SCAQMD	03/2025
Development of Project Tracking Sheet	EPA/SCAQMD	03/2025
Release of the rebate program (2nd round, if needed)	SCAQMD	06/2025 (07/2026)
Project selection (2nd round, if needed)	SCAQMD	09/2025 (10/2026)
Rebate agreement execution	SCAQMD/Operators	10/2025-08/2027
Procurement and deployment	Operators	01/2026-09/2027
Invoice review and rebate payment	SCAQMD	06/2026-03/2029
Performance and usage tracking	SCAQMD/ASE/Operators	06/2026-03/2029
Measure 2.2: Battery Electric Last Mile Freight Class 4/5 Vehicle Deployment		
Development of Implementation Plan	SCAQMD	03/2025
Development of Project Tracking Sheet	EPA/SCAQMD	03/2025
Release of the rebate program (2nd round, if needed)	SCAQMD	06/2025 (07/2026)
Project selection (2nd round, if needed)	SCAQMD	09/2025 (10/2026)
Rebate agreement execution	SCAQMD/Operators	10/2025-08/2027
Procurement and deployment	Operators	01/2026-09/2027
Invoice review and rebate payment	SCAQMD	06/2026-03/2029
Performance and usage tracking	SCAQMD/ASE/Operators	06/2026-03/2029
Measure 3: Battery Electric Cargo Handling Equipment Deployment		
Development of Implementation Plan	SCAQMD	03/2025
Development of Project Tracking Sheet	EPA/SCAQMD	03/2025
Release of the rebate program (2nd round, if needed)	SCAQMD	06/2025 (07/2026)
Project selection (2nd round, if needed)	SCAQMD	09/2025 (10/2026)
Rebate agreement execution	SCAQMD/Operators	10/2025-08/2027
Procurement and deployment	Operators	01/2026-09/2027
Invoice review and rebate payment	SCAQMD	06/2026-03/2029
Performance and usage tracking	SCAQMD/ASE/Operators	06/2026-03/2029
Measure 4: Battery Electric Locomotive Program		
Development of Implementation Plan	SCAQMD	03/2025
Development of Project Tracking Sheet	EPA/SCAQMD	03/2025
Release of the rebate program (2nd round, if needed)	SCAQMD	06/2025 (07/2026)
Project selection (2nd round, if needed)	SCAQMD	09/2025 (10/2026)
Subaward execution	SCAQMD/Operators or OEMs	10/2025-08/2027
Procurement and deployment	Operators or OEMs	01/2026-09/2028
Invoice review and payment	SCAQMD	06/2026-03/2029
Performance and usage tracking	SCAQMD/ASE/Operators or OEMs	06/2026-03/2029
Leveraged funding: Charging Infrastructure Deployment funded by POLA/POLB		
Funding MOU execution	POLA/POLB/SCAQMD	09/2025
Development of Implementation Plan	POLA/POLB/SCAQMD	09/2025
Release of the rebate program (2nd round, if needed)	SCAQMD	06/2025 (07/2026)

Project selection (2nd round, if needed)	SCAQMD	01/2026 (10/2026)
Rebate agreement execution	SCAQMD/Operators	02/2025-08/2027
Procurement and installation of charging equipment	Operators	05/2026-09/2028
Invoice review and rebate payment	SCAQMD	07/2026-03/2029
Performance and usage tracking	SCAQMD/ASE/Operators	07/2026-03/2029

The South Coast AQMD has over 25 years of incentive implementation experience and has a robust system established to implement the project as soon as it is awarded. South Coast AQMD is also aware of supply chain and infrastructure challenges and is working closely with OEMs to ensure that the vehicles and equipment can be procured and deployed within the proposed timeline to ensure the earliest GHG reduction possible. South Coast AQMD has been engaged with community-based organizations for outreach, community education and project selections and input. The South Coast AQMD meets with local utility companies regularly to discuss existing and upcoming infrastructure site development. All ZE equipment will be purchased and enter service by Q4 2026. South Coast AQMD will monitor and collect operational and performance data from participating fleets for the project duration. South Coast AQMD received a large list of projects from the solicitations released last year and earlier this year, exceeding the $300 million in funds we were able to secure. Further, this project list does not fulfill all the measures presented in this proposal; an additional $200 million in locomotive projects can be anticipated from the upcoming solicitation that will be released on April 9, 2024.

If the grant is awarded, a solicitation will immediately be released, and application outreach workshops will be held. South Coast AQMD has a user-friendly Grant Management System (GMS), which is a web-based platform designed for applicants to conveniently submit online applications, upload documentation, communicate with staff via messaging features, and the applicant can access the application dashboard to check their application status. Additionally, the GMS system facilitates internal application review and approval processes.

Table 8: Potential Project Partner Roles and Responsibilities

Organization	Financial Role	Responsibilities
South Coast AQMD	Recipient	Project administration and oversight, project planning, agreement/contract management, budget and payment tracking, data collection, reporting
Alliance for Sustainable Energy	Subawardee	Data analysis, report review, 3rd party validation,
Southern California Association of Governments (SCAG)	Subawardee	Implementation of Last-Mile Freight portion of Measure 2.2
Community outreach third-party facilitator	Contractor	Assist with implementation of Community Benefits Plan and Workforce Training
National Electrical Contractors Association (NECA) - International Brotherhood of Electrical Workers (IBEW)-Labor Union	Subawardee	Provide apprenticeship programs, education, and training
Port of Los Angeles Port of Long Beach	Leveraged funding provider	Provide project leverage funding and site selection collaboration for additional charging infrastructure projects

Section 4: Low-Income and Disadvantaged Communities

4a. Community Benefits

The Southern California Goods Movement Corridor impacts the quality of life for the MSAs for nearly 18 million residents. According to CalEnviroScreen over two-thirds of California's environmental Justice or

LIDACs are located within the MSAs region.[33] Due to the massive goods movement system in Southern California, many LIDACs are located near or adjacent to goods movement corridors, intermodal facilities and warehouses. The Climate and Economic Justice Screening Tool (CEJST) shows similar results for LIDACs and the census tracts are provided in a separate spreadsheet file (Attachment: Areas_SCAQMD).

LIDACs adjacent to the marine ports, intermodal facilities, highways, railways, warehouses, and related facilities are disproportionately impacted by degradations in the environment with far reaching social and economic impacts. These environmental impacts, including climate, criteria and hazardous pollution, noise, light, public safety, and overall quality of life are compounded by longstanding social and economic inequities. Community representatives have consistently expressed health concerns for exposure to emissions from sources associated with goods movement and have prioritized the need for emission reductions from intermodal facilities and warehouses.[34]

INVEST CLEAN is centered on equity to deliver direct and indirect benefits through the ZE transformation of the Southern California Goods Movement Corridor. First and foremost, this Project will reduce harmful GHG emissions with co-benefits for criteria and hazardous air pollutants. It will also uplift communities, especially LIDACS, through a comprehensive workforce training program in partnership with NECA – IBEW, universities/colleges, community colleges, and educational organizations and institutions. Moreover, INVEST CLEAN builds on South Coast AQMD's long history of environmental justice initiatives to create an authentic Community Benefits program that encourages infrastructure incentive grant awardees to incorporate community priorities and establishes a Community Steering Committee to conduct outreach, maintain open engagement, and implement community benefit projects.

The Project's GHG reduction measures focus on addressing the limitations and challenges to successfully transforming the Southern California Goods Movement Corridor to become a sustainable, ZE system while minimizing impacts on communities, in particular overburdened LIDACs.

INVEST CLEAN will deliver reductions of approximately 12 million MT CO_2e from 2025 to 2050 and over 1,615 tons per year of NOx, approximately 28 tons per year of PM2.5, and almost 30 tons per year of Diesel Particulate Matter to protect public health. The majority of the MSAs' populations reside in the South Coast Air Basin which is in extreme nonattainment for ozone and serious nonattainment for PM2.5. The project will result in reductions in criteria and toxic air pollution and will lay the groundwork to achieving ZE to assist the region meet National Ambient Air Quality Standards to protect public health and the associated costs. Table 9 below shows the Annual Benefits of Meeting National Ambient Air Quality Standards for NOx and PM2.5.

Table 9: Annual Benefits of Meeting National Ambient Air Quality Standards for NOx and PM2.5

Preventative Premature Deaths	Preventative Asthma Attacks	Preventative Work Loss Days	Potential Monetized Public Health Benefits[35]
1,600	27,000	96,000	$16.5 Billion

South Coast AQMD's Multiple Air Toxics Exposure Study (MATES) is a monitoring and evaluation study and characterizes health risk in the SCAB. The fifth MATES, as shown in Figure 3 below, illustrates areas with elevated air toxics cancer risks are predominantly located near ports and transportation corridors, amounting to approximately 88 percent of the carcinogenic risk attributed to mobile sources.[36] The

[33] California Office of Environmental Health Hazard Assessment, CalEnviroScreen, https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40

[34] South Coast AQMD,AB 617 Community Emission Reduction Plans, https://www.aqmd.gov/nav/about/initiatives/environmental-justice/ab617-134

[35] The Benefits of Meeting Federal Clean Air Standards in the South Coast and San Joaquin Valley Air Basins, http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/socioeconomic-analysis http://publichealth.lacounty.gov/mch/AsthmaCoalition/docs/BenefitsofMeetingCleanAirStandards_11_06_08.pdf

[36] South Coast AQMD Fifth Multiple Air Toxics Exposure Study, https://www.aqmd.gov/home/air-quality/air-quality-studies/health-studies/mates-v

Project will reduce DPM by 30 tons per year which will reduce air toxic cancer risk for the communities near freight hubs and corridors.

Additionally, ZE vehicles and equipment do not have internal combustion engines resulting in quieter operations without polluting communities with the strong smell of diesel. Odors affect quality of life and may cause headaches, irritation of the eyes, nose, and throat, cough, nausea, and other symptoms.[37]

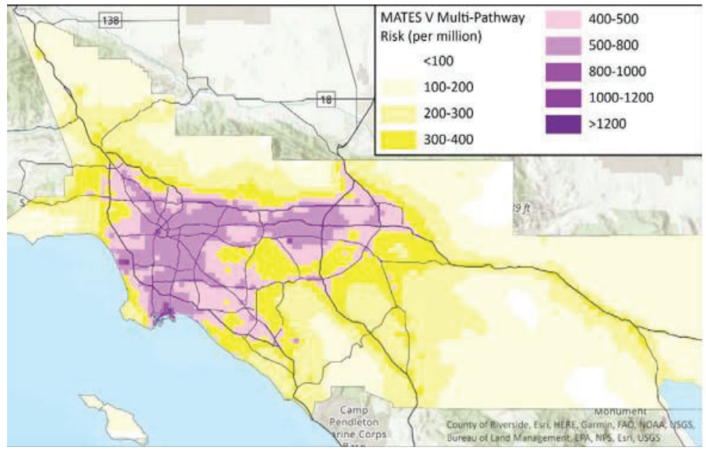

Figure 3: Air Pollution Health Impact in South Coast AQMD

INVEST CLEAN features a collaboration between South Coast AQMD and NECA-IBEW and its expansive network of community outreach organizations to ensure high-road and equitable job creation across all the projects. Through this collaborative effort, we aim to solidify a foundation of high-road labor standards, ensuring that every project under the CPRG umbrella is synonymous with quality construction and tangible, community-wide benefits Central to this commitment is our concerted effort to harness NECA-IBEW's comprehensive network to amplify the impact of our initiatives, particularly in providing equitable access to high-quality jobs and training opportunities. This alliance is crucial in extending our reach to LIDAC communities, ensuring they benefit directly from the unique opportunities presented by joint labor-management apprenticeship programs. Section 5. Job Quality provides greater details on the job and workforce training program.

Further enhancing the partnership with NECA-IBEW, INVEST CLEAN aims to mitigate adverse effects or disbenefits by encouraging infrastructure projects to integrate community benefits voluntarily. These may include initiatives such as engaging in outreach with educational resources to raise awareness about climate change and air pollution effect, programs to access resources for improved quality of life like building decarbonization and public transit, as well as creating open, green spaces, and vegetative barriers. This project approach will uplift community priorities in alignment with Justice40, CPRG, and informed by local environmental justice initiatives such as the Assembly Bill 617, Community Air Protection program.

INVEST CLEAN will set a new standard for authentic community engagement and deliver equitable access to ZE technologies by creating a Community Benefits Program led by a Steering Committee. The Steering Committee will include community-based organizations from geographically diverse areas throughout the MSAs and will be led by a third-party organization. The Steering Committee will serve an important role to provide South Coast AQMD with guidance and recommendations for the community engagement process and to conduct educational outreach on climate and air pollution including health impacts and zero-emission technologies. Engaging with the Community Steering Committee and the public will provide South Coast AQMD with the opportunity to assess, quantify and report community benefits accruing from INVEST CLEAN.

South Coast AQMD will provide funding through a combination of local, state, and other potential federal grants, and/or private sources to support community benefit projects. With administrative oversight by South Coast AQMD and under guidance by the third-party facilitator, the Steering Committee will select and work with appropriate organizations to implement selected community benefit projects. Prioritization of community benefit projects will be for freight-impacted areas and residential communities that are nearby a goods movement facility including warehouses, railyards/railways,

[37] Agency for Toxic Substances and Disease Registry, Environmental Odors, https://www.atsdr.cdc.gov/odors/faqs.html

seaports, airports, highway corridors, and Lithium extraction facilities. South Coast AQMD will also work with the Steering Committee to build capacity in seeking grants for emission reductions, climate, air pollution mitigation, and ZE projects.

Overall, INVEST CLEAN incorporates several pioneering Community Benefit components that have not traditionally been a part of an incentives type of Project. The Project will uplift community priorities to align with CPRG and Justice40 to ensure the most impacted LIDACs receive equitable environmental, social, and economic benefits to address longstanding issues from goods movement activity.

4b. Community Engagement

In early 2023, South Coast AQMD began meeting with the Southern California Association of Governments, Councils of Government throughout the MSA region, cities, counties, county transportation commissions, and other stakeholders to discuss and organize a regional effort for CPRG. Each MSA determined that they would form a Steering Committee including South Coast AQMD to participate in CPRG including the development of PCAPS, and the later CCAP and reports. The Los Angeles – Long Beach – Anaheim Steering met biweekly with a general and technical meeting and Riverside – San Bernardino – Ontario MSAs met on a weekly basis. Through the PCAP development process, South Coast AQMD actively participated in the development of the PCAP with meetings and briefings for Councils of Government, Chambers of Commerce, environmental justice organizations, cities, municipal agencies, and other stakeholders. Goods movement rose to the top as a priority GHG reduction measure for both MSAs. Both MSAs also met on a semi-regular basis with CARB to coordinate PCAP development and later on implementation grant proposals. South Coast AQMD volunteered to lead the Los Angeles – Long Beach – Anaheim MSA Working Group on goods movement which included members of the Steering Committee and expanded to include the Ports of Los Angeles and Long Beach and the Riverside – San Bernardino – Ontario MSA. South Coast AQMD elected to lead the regional CPRG goods movement proposal with the support of the Working Group and after extensive discussions with our sister agencies, industry, and community organizations. Throughout the development of the INVEST CLEAN proposal, South Coast AQMD held Working Group meetings as well as one-on-one meetings with all stakeholders to develop a collaborative workplan that effectively addressed ZE freight issues, balanced regional needs, and elevated community priorities.

CPRG also provided South Coast AQMD a unique opportunity to develop a Project with groundbreaking components to address the goods movement sectors longstanding impacts on the MSA communities, in particular LIDACs. In effect, South Coast AQMD worked with two community-based consulting firms to conduct engagement to inform the development of INVEST CLEAN, specifically focusing on a community benefits plan and workforce training component. The engagement process included three phases: initial outreach and education on the Climate Pollution Reduction Grant program and INVEST CLEAN, general organizational engagement meetings; and summation of community feedback. This process was augmented by additional collaborative meetings to discuss specific aspects of community benefits and small group meetings to ensure a diverse group of voices were uplifted during outreach and engagement.

As a result, INVEST CLEAN includes a Community Steering Committee to continue meaningful engagement with LIDACs throughout the implementation of the GHG reduction measures. The Community Steering Committee and third-party facilitator will create a structure and conduit to facilitate open dialogue between South Coast AQMD and residents in LIDACs and to uplift authentic community priorities and shared values for the equitable distribution of benefits from ZE technologies including workforce training and jobs. The Community Steering Committee will provide guidance, oversight, and recommendations for the community engagement process, community benefit project selection, implementation of the community benefits, and education and outreach on climate and air pollution, and zero-emission technologies.

INVEST CLEAN is the direct result of an extensive community engagement process as witnessed by the seven (7) Letters of Commitment with 15 signatories and 73 letters of support with 101 signatories, including both MSA Steering Committees, CARB, NECA-IBEW, public electric utilities, Councils of Government, cities, counties, industry, academia and educational institutions, and community-based organizations for environmental justice. (See attached Letters of Commitment and Support). This level of engagement will increase during implementation of the Project to ensure GHG emission reductions with co-benefits for criteria and hazardous air pollutants are realized while supporting the ZE transformation of the Southern California Goods Movement Corridor to realize environmental, social, economic benefits for the MSA region and the nation.

Section 5: Job Quality

South Coast AQMD is committed to advancing high-road and equitable economic development through INVEST CLEAN. In alignment with Executive Order 14082 and in support of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022, this Project is dedicated to the creation and support of high-road, family, and community sustaining jobs that provide workers a meaningful union career.[38] Recognizing the critical role that job quality plays in the success of our environmental initiatives, South Coast AQMD, in partnership with our organized labor and responsible partners, will implement high-road labor standards that emphasize not only the quantity, but the quality of jobs created through federal investments.

Through INVEST CLEAN, South Coast AQMD and our partners are committed to supporting a world-class apprenticeship pipeline that opens pathways into high-quality union careers performing CPRG related work. This approach is centered around joint-labor-management apprenticeship programs for electricians, along with trainings for vehicle and equipment operators and mechanics, where needed, to foster a diverse, highly skilled, and sustainable workforce equipped to meet the challenges of today and tomorrow. Our strategy includes the following key components:

- **Commitment to Apprenticeship Utilization**: Pledge to use apprentices from joint labor-management registered apprenticeship programs with a graduation rate of at least 60 percent in alignment with California's "Skilled and Trained" Public Contract Code for at least 15 percent of the total construction labor hours on all projects related to the implementation of GHG reduction measures.
- **Career Supporting Certifications:** Require the utilization of electricians certified by the Electric Vehicle Infrastructure Training Program (EVITP) in accordance with our existing procurement practices, as well as pertinent California legislation including LAB 841, California Public Utilities Commission Code 740.20, and the National Electric Vehicle Infrastructure (NEVI) Formula Program. EVITP certification ensures not only the responsible installation of our charging infrastructure but also positions the workforce for sustainable careers in the electrification industry. Additionally, certification programs for battery electric vehicle and equipment operators and mechanics will be made available.
- **Labor Rights**: Formalizing partnerships with labor organizations, we are ensuring that apprenticeship programs are aligned with industry standards and workers' rights. These partnerships also facilitate collective bargaining agreements, guaranteeing fair wages, family-sustaining benefits, and safe working conditions for all employees. This meets the Davis Bacon requirements under CPRG.
- **Supportive Services for Apprentices**: Provide and develop the necessary support services to address these critical workforce access gaps.
- **Benchmarks for Diversity and Inclusion**: Set clear benchmarks and goals to hire individuals from our disadvantaged and Justice40 communities. This approach not only enriches our workforce but also ensures that the benefits of our projects are shared widely across the communities we serve.

[38] Presidential Executive Order 14082 and the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022, https://www.federalregister.gov/documents/2022/09/16/2022-20210/implementation-of-the-energy-and-infrastructure-provisions-of-the-inflation-reduction-act-of-2022

In addition to the NECA – IBEW partnership, South Coast AQMD will collaborate with local community colleges and non-governmental workforce training organizations for operators and mechanics working on the battery electric vehicles or equipment. Operator and mechanic training will be provided to rebate recipients in M2 to M4 free of charge if needed. Furthermore, Furthermore, GHG Reduction Measure 4, each locomotive deployed will be supported by at least one dedicated expert from the manufacturer in locomotive and battery technology. This technician will be on the ground to support the safe and efficient operation of the locomotive and charging process, as well as provide "on the job" training to the operators and maintainers of the locomotive. This hands-on "train the trainer" methodology will provide the rail operators with best practices for locomotive operations and maintenance practices to prepare the operator on transitioning to ZE equipment.

South Coast AQMD will also follow CPRG guidance to ensure projects will be subject to the Build America, Buy America (BABA) provisions of the Infrastructure Investment and Jobs Act (IIJA) and will require a skilled workforce to design, install, and service the equipment, leading to job creation in these communities. Most infrastructure sites selected under Measure 4 will be in alignment with Justice40.

By integrating high-road labor standards, establishing a robust apprenticeship pipeline and following CPRG guidance, INVEST CLEAN will not only contribute to the reduction of greenhouse gas emissions and criteria and hazardous air pollutants but will also paving the way for a sustainable and equitable future for all.

Section 6: Programmatic Capability and Past Performance

6a. Past Performance

The South Coast AQMD has successfully managed several emission reduction projects, including the ones funded by EPA Targeted AirShed Grants, Diesel Emission Reduction Act Grants, as well as grants from the Department of Energy, California Air Resources Board, and California State Transportation Agency. The projects span a wide range, from air monitoring programs to the deployment of battery-electric and hydrogen fuel cell ZEVs, transport refrigeration units, marine vessels, CHE, locomotives, transit buses, and school buses. South Coast AQMD also has a long history of successfully collaborating with stakeholders in the Air Basin and surrounding areas to reduce emissions from a variety of mobile sources and stationary sources. Since 1998, South Coast AQMD has effectively implemented several state incentive programs, including the Carl Moyer, Community Air Protection, Proposition 1B Goods Movement, VW Mitigation Trust, Funding Agriculture Replacement Measures for Emission Reductions (FARMER), Lower-Emission School Bus, the On-Road Heavy-Duty Voucher Incentive programs. South Coast AQMD has also been partnering with OEMs and stakeholders on technology demonstration projects such as Volvo LIGHTS and JETSI to accelerate the deployment of ZE technologies. Over the past decade, South Coast AQMD has managed approximately $1.5 billion of incentive projects, executed more than 3,400 incentive projects, and replaced over 8,800 high polluting engines and equipment with cleaner technologies, resulting in emission reductions of 61,040 tons of NOx and 1,231 tons of PM. Additionally, South Coast AQMD has been actively soliciting and deploying infrastructure projects to support lower-emission and ZE equipment deployment since the late 1990s. With our extensive expertise, experience, resources, administrative support, and established business processes, South Coast AQMD is well-equipped to successfully implement the proposed Project and achieve the outlined emission reduction goals and milestones.

Since 1988, South Coast AQMD has collaborated in partnership with other governmental organizations, private industry, academia, and research institutes. South Coast AQMD has also continuously partnered with OEMs, marine engine designers, truck fleets, commercial harbor craft operators, and ocean-going vessel owners to develop engine emission control systems. South Coast AQMD has close partnership with ports, State, and federal agencies as well as regional collaboratives that work together in developing, demonstrating, and deploying near-zero and ZE technologies.

A list of recent federal funded projects administered by South Coast AQMD is shown below in Table 10.

Table 10: Recent Federal Funded Projects

Project Title	Federal Agency	CFDA#	Federal Agency Contact	Project Description	Grant Status
Switch-On: Deployment of Electric Freight Trucks & Charging Infrastructure	EPA	66.956	Vernese Gholson	Partnered with Volvo in the deployment of 70 Class 8 battery electric trucks (BETs) in the South Coast Air Basin	On-going, good standing with status reports and reporting
Freight Air Quality Solutions (FAQS)	DOT & DOE	N/A	Samir Barot	Deployment of a Liquid Hydrogen Fuel Cell Locomotive in San Pedro Bay Ports and Installation of 376 Chargers and Fuel Dispensers in the South Coast Air Basin	On-going, good standing with status reports and reporting
Plug-in Hybrid-Tugboat	EPA	66.956	Andrea Bennett	Partnered with Crowley Maritime Corporation to deploy a plug-in hybrid tugboat capable of ZE operation and develop an innovative charging infrastructure powered by ZE on-site power generation	On-going, good standing with status reports and reporting
Long Range Fuel Cell Trucks and ZE School Buses Deployment	EPA	66.956	Vernese Gholson	Partnered with School District to deploy 38 school buses and Hyundai to develop 5 fuel cell Class 8 trucks	On-going, good standing with status reports and reporting
ZE Freight Line-Haul Locomotive Replacement	EPA	66.956	Vernese Gholson	Partner with Progress Rail and BNSF to replace a line-haul locomotive with a ZE locomotive	On-going, good standing with status reports and reporting

6b. Reporting Requirements

South Coast AQMD has demonstrated proficiency in overseeing state and federal grants to agencies including US EPA, DOE, DOT, CARB, and CEC, effectively managing substantial grant-funded projects. In addition, the organization’s subject matter expertise and project management capabilities ensure that reporting is conducted on a complete and timely basis. As indicated in Table 10, the South Coast AQMD is in good standing on all past and ongoing projects and has submitted required reports for the awarded projects.

South Coast AQMD consistently submits satisfactory final technical reports for grant-funded projects and provides timely progress reports. When facing challenges, we promptly report obstacles with clear explanations. Overall, the performance in managing grant agreements reflects a commitment to meeting requirements and maintaining transparency.

6c. Staff Expertise

South Coast AQMD has the expertise and resources necessary to meet the goals of the proposed project. As stated previously, South Coast AQMD will administer project funds and provide comprehensive project management including managing EPA grants, preparing, and managing agreements with the fleets, and monitoring the progress of the proposed project. The proposed project will be implemented by a Planning & Rules Manager, a Program Supervisor, a Financial Analyst, an Air Quality Specialist, a Staff Assistant, and a Deputy District Counsel.

Overseeing the South Coast AQMD team is Dr. Aaron Katzenstein, Deputy Executive Officer for the Technology Advancement Office. Dr. Katzenstein's principal charge is to identify, evaluate and stimulate the development and commercialization of clean air technologies, develop and coordinate mobile source regulations, and implement incentive programs. Dr. Katzenstein received his doctorate in Atmospheric Chemistry and has over twenty years of experience at South Coast AQMD including multiple MATES studies, Air Quality Management Plans, policy development, research projects, air quality studies, and technology/infrastructure projects.

Ms. Mei Wang, Assistant Deputy Executive Officer for the Technology Advancement Office has over 20 years of experience in air pollution control technologies, emission source testing, advanced engine technologies, and incentive programs. She has overseen numerous incentive programs such as Carl Moyer, Proposition 1B, Enhanced Fleet Modernization, and various other state and federal grants. Additionally, she has managed technology demonstration projects ranging from retrofits for ocean-going vessels to the development of capture and control systems for oil tankers. Her responsibilities have also extended to overseeing projects focused on the advancement of ZE locomotive technology, the development and retrofitting of ZE commercial harbor craft, the deployment of vehicle-to-grid school buses, electric yard tractor deployment, and infrastructure projects. She has a BS degree in Textile/Fiber and Composite Material Engineering and an MS degree in Environmental Science.

Ms. Lisa Tanaka O'Malley, Assistant Deputy Executive Officer for Legislative and Public Affairs has over 30 years of experience in legislative and government and community relations in the public and private sectors. She oversees legislative affairs focusing on federal issues, government and community relations, small business assistance, communications and public information center, environmental justice, and other issues. She represents South Coast AQMD on both MSA Steering Committees and the regional CPRG Working Group on Goods Movement.

Mr. Tom Lee is the Technology Implementation Manager of the Technology Advancement Office. He has over 35 years of air quality experience and manages incentive programs including Carl Moyer, Proposition 1B and Enhanced Fleet Modernization He also manages the Capture and Control System for Oil Tankers Project demonstration and the development of Breathmobile mobile clinics. Mr. Lee received his Mechanical Engineering degree from the University of California, Irvine and is a California Board-certified Professional Engineer. Mr. Lee will monitor and manage the day-to-day activities of the proposed Project.

Dr. Fan Xu, Program Supervisor, will also manage the daily activities of the Project. She has 10 years of environmental consulting experience and project management. She has more than 3 years of incentive implementation experience with the Carl Moyer and Proposition 1B programs on HD vehicle and infrastructure projects. Dr. Xu has a BS degree in Environmental Science and doctorate in Health Science. Finance and Legal representatives will also participate in the project. A financial analyst will assist in providing financial administrative support for the proposed Project. The South Coast AQMD supporting staff will assist the Air Quality Specialist in managing agreements. The Deputy District Counsel will provide legal guidance throughout the planning and implementation of the Project.

Mr. Justin Joe, Air Quality Specialist, has over 5 years of experience managing heavy duty vehicle and infrastructure incentive programs and ZE technologies. In addition, he worked extensively on the Port of Los Angeles and Port of Long Beach Clean Truck program.

Technical Appendix

1. GHG and CAP/HAP Emission Calculation

This appendix describes the methodologies used for estimating greenhouse gases (GHG) and criteria air pollutants/hazardous air pollutants (CAP/HAP) emission reductions associated with implementation of South Coast AQMD's INVEST CLEAN Project. The Project includes four specific GHG reduction measures:

- Measure 1 - Charging Infrastructure Deployment Incentive Program
- Measure 2 - Battery Electric Truck Deployment Incentive Program
- Measure 3 - Battery Electric Cargo Handling Equipment Deployment Incentive Program
- Measure 4 - Battery Electric Locomotive Pilot Program

A. General Methodologies

The following general methodologies were used for estimating GHG and CAP/HAP emission reductions for all four measures:

1) GHG emissions reductions were calculated based on the estimated activity levels (e.g., vehicle miles traveled, operating hours, fuel consumption) of baseline vehicles and equipment, estimated electricity consumption for battery electric (BE) units, and the corresponding GHG emission factors for electricity generation. The overall methodology is consistent with the methodologies used in the available tools (e.g., AFLEET CFI[1,2]). The upstream GHG emission reductions for diesel fuel production and refining were also calculated based on the total gallons of diesel fuel and the corresponding GHG emission factor.

2) GHG emissions reductions were estimated for three GHG namely CO_2, CH_4, and N_2O and were reported in metric tons of CO_2-equivalent (CO_2e) emissions reductions based on the global warming potential values listed in Table 1.

Table 1. Global Warming Potential[3]

GHG	CO_2	CH_4	N_2O
GWP	1	28	265

3) The estimated electricity consumption for battery-electric units for all four measures were adjusted by: 1) overall charging efficiency representing the charger efficiency (grid to charger loss) and the battery charging efficiency (battery charging loss), and 2) transmission and distribution grid loss based on EPA's eGrid estimates for Western Power Grid (i.e., 5.1%).[4] The charging efficiency was based on the EPA's study which came up with an average combined charging efficiency of 85% for estimating electricity consumption for battery-powered electric vehicles and plug-in hybrid electric

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[1] Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) for Charging and Fueling Infrastructure (CFI) Emissions, https://afleet.es.anl.gov/infrastructure-emissions/

[2] Argonne National Laboratory, Well to Wheels Analysis of Energy Use and Greenhouse Gas Emissions of PHEV, 2010. Well-To-Wheels Energy and Greenhouse Gas Analysis of Plug-In Hybrid Electric Vehicleshttps://afdc.energy.gov/files/pdfs/argonne_phev_evaluation_report.pdf

[3] CPRG Program Implementation Grants - General Competition Notice of Funding Opportunity, Appendix B, https://www.epa.gov/system/files/documents/2024-01/cprg-general-competition-correction.pdf

[4] U.S. EPA's eGrid, Western Power Grid, https://www.epa.gov/egrid/frequent-questions-about-egrid#What%20is%20Grid%20Gross%20Loss

vehicles and is also reflected in AFLEET tools for on-road vehicles. However, with further developments in battery and charging technologies, the charging efficiency is expected to continue to improve resulting in lower overall GHG emissions from electricity consumption in future years.

4) The GHG electricity generation emission factors for 2030 and later years, used in these calculations, reflect the implementation of California's Renewable Portfolio Standard (RPS) Program which requires 60% renewables by 2030 and 100% carbon fee by 2045. The 2030 GHG emission factors represent the weighted average of emission factors for utilities in Los Angeles and Orange counties, which were used for years 2030 to 2044. The 2045 (and later) GHG emission factors were set to zero because of RPS Program requirements.[5] The EPA's GHG emission factors for the Western California electrical utility subregion were used for years 2025 to 2029.[6]

5) A project life was assumed for each measure to conservatively estimate the future GHG emissions reductions associated only with the CPRG incentive funding for these measures although emission reductions will continue as the new ZE units will be replaced with newer ZE units in the future. For heavy-duty trucks, heavy-duty truck chargers, and cargo handling equipment, the project life was assumed to be 10 years based on anticipated vehicle/equipment life. For switcher locomotives a 20-year project life was assumed.

6) The annual and cumulative GHG emissions reductions for each measure, and for all four measures combined, are calculated for two periods: 2025 to 2030 and from 2025 to 2050.

7) The methodology for estimating co-benefits of these measures in reducing CAP/HAP emissions is also based on estimated activity level (e.g., vehicle miles traveled, operating hours, fuel consumption) and the corresponding emission factors. The co-benefits emission reductions were estimated for NOx, PM2.5 and diesel particulate matter (DPM) for each measure in terms of short tons per year for year 2030.

8) Detailed GHG and CAP/HAP emission reductions calculations and calculation formulas for all four measures are provided in the GHG and CAP/HAP Emission Reductions Calculations Spreadsheet attached to this application.

B. Specific Methodologies

The following sections describe the specific methodologies for estimating GHG and CAP/HAP emissions reductions for each measure:

1. Measure M1: Charging Infrastructure Deployment Incentive Program

This measure is the construction or expansion of zero emission charging infrastructure in the two MSAs listed in the Workplan. Infrastructure projects are critical in supporting the deployment of zero emission equipment. A ranking system will be developed to prioritize disadvantaged communities, small fleets,

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[5] Priority Climate Action Plan - The Los Angeles-Long Beach-Anaheim, CA Metropolitan Statistical Area, March 2024 (Table B.18) https://www.epa.gov/inflation-reduction-act/priority-climate-action-plans-states-msas-tribes-and-territories

[6] EPA's 2024 GHG Emission Factor HUB, Table 6 for Electricity (CAMX WECC California Subregion) https://www.epa.gov/climateleadership/ghg-emission-factors-hub

charging site control, shared sites, and public charging projects. The number of charging units under this measure is assumed as shown in Table 2:

Table 2. Assumed Number of Chargers for Measure M1

Year	2025	2026	2027	2028	2029	2030
Number of Chargers		480	480	60		

The methodology for estimating GHG emission reductions for this measure is based on the assumed number of chargers deployed each year, charger power capacity, and percentage charger utilization rate. The projected annual electricity consumption, annual mileage, and number of battery-powered trucks were then calculated in conjunction with the corresponding GHG emission factors. Class 8 heavy duty trucks are the vehicles using the chargers under this measure. The projected annual truck miles and projected number of trucks are used in conjunction with the corresponding emission factors (i.e., g/mile, g/truck) to calculate GHG and CAP/HAP emission reductions using the methodology described in the next section for Measure G2: On-Road Heavy Duty Vehicles. The projected annual electricity consumption is used in conjunction with the electricity GHG emissions factors to calculate the electricity GHG emissions.

The charger power capacity and electricity consumption rate for trucks are assumed to be 250 KW and 2 KWh/mile (Class 8 truck data) based on information from ZE truck manufacturers. The utilization rate of chargers is assumed to be 20% for the first year of deployment, 2026 and increasing to a conservative maximum rate of 60% for 2028 and later years based on experience with existing chargers and the anticipated level of utilization.

The annual and cumulative GHG emissions reductions for this measure for 2025 to 2030 and 2025 to 2050 periods are provided in Tables 3 and 4 below.

Table 3. GHG Emission Reductions for Measure M1 for 2025 to 2030 (metric tons CO_2e)

Year	2025	2026	2027	2028	2029	2030
Annual	0	137,020	549,382	877,326	879,354	984,096
Cumulative	0	137,020	686,402	1,563,727	2,443,082	3,427,178

Table 4. GHG Emission Reductions for Measure M1 for 2025 to 2037 (metric tons CO_2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual	0	137,020	549,382	877,326	879,354	984,096	984,096	984,096	984,096	984,096	984,096	984,096	984,096
Cumulative	0	137,020	686,402	1,563,727	2,443,082	3,427,178	4,411,274	5,395,370	6,379,466	7,363,562	8,347,658	9,194,734	9,629,448

Table 4. GHG Emission Reductions for Measure M1 for 2038 to 2050 (metric tons CO_2e), continued

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual	984,096	984,096	984,096	984,096	984,096	984,096	984,096	1,202,846	1,202,846	1,202,846	1,202,846	1,202,846	1,202,846
Cumulative	9,736,219	9,840,960	9,840,960	9,840,960	9,840,960	9,840,960	9,840,960	10,059,711	10,278,461	10,497,212	10,715,962	10,934,712	11,153,463

The 2030 CAP/HAP emissions reductions for this measure are provided in Table 5.

Table 5. CAP/HAP Emission Reductions for Measure M1 (short tons/yr)

	2030
NOx	1,289
PM2.5	18
DPM	19

2. Measure M2: Battery Electric Freight Vehicles Deployment Incentive Program

This measure would incentivize the decarbonization of goods movement operations by increasing the use of ZE heavy duty long-haul trucks. This Measure would grant either the replacement or conversion of a heavy-duty diesel truck used to move goods with a CARB-certified zero emission technology. The number of ZE trucks for this measure is shown in Table 6:

Table 6. Number of Heavy-Duty Trucks for Measure M2

Truck Class	2025	2026	2027	2028	2029	2030
Class 8 Diesel Trucks		30	40			
Class 4 Diesel Trucks		179	194			
Class 5 Diesel Trucks		179	194			

The methodology for estimating the annual GHG emission reductions for this measure is based on the number of trucks, estimated activity level in terms of the annual vehicle miles traveled (VMT) and GHG emission factors (i.e., CO_2, CH_4, and N_2O) derived from CARB's EMFAC2021 Model[7] in terms of grams per mile for running exhaust and grams per truck for truck idling.

The estimated annual VMT for Class 8 heavy-duty trucks is based on the historical data for projects funded under the Prop 1B program. For Class 4 and Class 5 trucks, the average annual miles for the 2011 to 2017 model years from EMFAC2021 were used. The composite emission factors for running exhaust in grams per mile and for idling in grams per truck per day for CO_2, CH_4, and N_2O for the 2025 to 2030 calendar years were derived from CARB's EMFAC2021 Model assuming 2010 to 2017 model years trucks for Class 8 trucks and 2011 to 2017 model years for Class 4 and 5 trucks (no 2010 model year Class 4 and 5 trucks after 2025 in EMFAC model).[8] The assumption the truck model years is based on the selection of oldest model years that comply with the 2010 heavy-duty truck engine standards as of January 1, 2023[9] and will still be operating after 2025. The 2030 composite emission factors were used for GHG emissions reductions after 2030 since the GHG emission factors don't change much by year in EMFAC2021 Model. The number of operating days for trucks is assumed to be 312 days per year based on EMFAC2021 Model.

The methodology for estimating GHG emissions from the electricity consumption for battery-powered trucks is based on the annual MWh of electricity associated with these trucks, which is calculated based on the estimated annual VMT, estimated electricity consumption for battery-powered trucks (i.e., KWh/mile) and corresponding GHG emissions factors for electricity generation adjusted for the assumed charging efficiency and transmission and distribution grid loss.

The annual VMT for electric-powered trucks are assumed to be the same as those of the replaced diesel trucks. The electricity consumption for battery-powered trucks were assumed to be 2 KWh/mile for Class 8 trucks and 0.7 KWh/mile for Class 4 and 5 trucks based on information from ZE truck manufacturers.[10] With continued battery technology improvements, the electricity consumption rate of

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[7] EMFAC2021 Model, https://arb.ca.gov/emfac/emissions-inventory/e263cdd9de130c5e61759e36d202a9e6bbe4a24e

[8] To calculate the weighted-average composite emission factors in grams per mile, EMAFC 2021 Model was run in the Emissions Output mode for these model year trucks to determine the corresponding running exhaust emissions and VMT.

[9] California Truck and Bus Regulation https://ww2.arb.ca.gov/our-work/programs/truck-and-bus-regulation

[10] Volvo Electric Trucks https://www.volvotrucks.us/trucks/vnr-electric/

ZE trucks is expected to continue to decrease resulting in overall lower GHG emission from these trucks. The annual and cumulative GHG emissions reductions for this measure for 2025 to 2030 and 2025 to 2050 periods are provided in Tables 7 and 8 below.

Table 7. GHG Emission Reductions for Measure M2 for 2025 to 2030 (metric tons CO_2e)

	2025	2026	2027	2028	2029	2030
Annual	0	6,955	14,987	14,865	14,769	15,814
Cumulative	0	6,955	21,943	36,808	51,577	67,391

Table 8. GHG Emission Reductions for Measure M2 for 2025 to 2050 (metric tons CO_2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual	0	6,955	14,987	14,865	14,769	15,814	15,814	15,814	15,814	15,814	15,814	15,814	15,814
Cumulative	0	6,955	21,943	36,808	51,577	67,391	83,205	99,019	114,833	130,647	146,461	155,320	156,146

Table 8. GHG Emission Reductions for Measure M2 for 2025 to 2050 (metric tons CO_2e), continued

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual	15,814	15,814	15,814	15,814	15,814	15,814	15,814	18,186	18,186	18,186	18,186	18,186	18,186
Cumulative	157,096	158,140	158,140	158,140	158,140	158,140	158,140	160,512	162,883	165,255	167,626	169,998	172,369

The overall methodology for estimating CAP/HAP emission reductions for this measure is the same as the GHG emission reductions methodology described earlier. The composite emission factors for NOx, PM10 and PM2.5 for running exhaust in grams per mile and for idling in grams per truck per day were extracted from EMFAC2021 Model for the year 2030. The number of trucks in 2030 were based on the cumulative number of trucks from 2025 to 2030. The 2030 CAP/HAP emissions reductions for this measure are provided in Table 9.

Table 9. CAP/HAP Emission Reductions for Measure M2 (short tons/year)

	2030
NOx	17
PM2.5	0.2
DPM	0.2

3. <u>Measure M3: Battery Electric Cargo Handling Equipment Deployment Program</u>

This measure reduces emissions associated with goods movement by the replacement or conversion of cargo handling equipment (CHE) used at warehouses, inland/dry ports, railyards or freight facility center within the California trade corridors. Eligible types of equipment for conversion or replacement are diesel-powered rubber-tired gantry (RTG) cranes or existing diesel yard trucks and lifts, including forklifts, side handlers, top picks or reach stackers. For calculation purpose, yard trucks and top handlers are assumed as shown in Table 10.

Table 10. Number of CHE for Measure M3

	2025	2026	2027	2028	2029	2030
Yard Tractors		18	16			
Top Handlers		14	12			

The methodology for estimating the annual GHG emission reductions associated with the replaced cargo handling equipment is based on the estimated activity level in terms of the annual operating hours, average engine size, and load factor as well as the corresponding GHG emission factors in terms of grams per KWh of CO2, CH4, and N2O.

The annual operating hours and engine size (HP) for yard tractors and top handlers were based on the latest actual reported data for such equipment operating at the Ports of Los Angeles and Long Beach.[11] The load factors for these equipment are based on CARB's CHE documentation.[12] The GHG emission factors in grams per KWh were derived from EPA's GHG emission factors for diesel fuel and for the industrial/commercial off-road equipment (Kg or grams per gallon)[13], diesel off-road equipment fuel consumption rate and diesel fuel density. The diesel off-road equipment brake-specific fuel consumption rate used in these calculations was assumed to be 0.367 lbs/bhp-hr for diesel engines greater than 100 hp.[14] Diesel fuel density was assumed at 7 lbs per gallon.

The methodology for estimating GHG emissions from the electricity consumption associated with the operation of battery-powered CHE is based on the annual KWh of diesel equipment (calculated based on engine size, annual operating hours and load factor) converted to electricity consumption in MWh (calculated based on diesel fuel heat content and estimated KWh per gallon for offroad diesel equipment[15]) in conjunction with the corresponding GHG emissions factors for electricity generation adjusted for the assumed charging efficiency and estimated transmission and distribution grid loss.

The annual and cumulative GHG emissions reductions for this measure for 2025 to 2030 and 2025 to 2050 periods are provided in Tables 11 and 12 below.

Table 11. GHG Emission Reductions for Measure M3 for 2025 to 2030 (metric tons CO_2e)

	2025	2026	2027	2028	2029	2030
Annual	0	7,179	13,409	13,409	13,409	13,825
Cumulative	0	7,179	20,588	33,996	47,405	61,230

Table 12. GHG Emission Reductions for Measure M3 for 2025 to 2050 (metric tons CO_2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual	0	7,179	13,409	13,409	13,409	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825
Cumulative	0	7,179	20,588	33,996	47,405	61,230	75,056	88,881	102,706	116,531	130,357	137,003	137,420

Table 12. GHG Emission Reductions for Measure M3 for 2025 to 2050 (metric tons CO_2e), continued

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual	13,825	13,825	13,825	13,825	13,825	13,825	13,825	14,711	14,711	14,711	14,711	14,711	14,711
Cumulative	137,836	138,253	138,253	138,253	138,253	138,253	138,253	139,139	140,024	140,910	141,796	142,681	143,567

The methodology for estimating CAP/HAP emission reductions from battery-powered CHE is based on the estimated average emission rate for each CHE type (yard tractors and top handlers) in terms of tons per year of NOx, PM2.5, and PM10 which was calculated for the oldest model years of CHE operating in 2030 based on CARB's OFFROAD2021 Model[16] (i.e., 2017 and older model years).

[11] 2022 Air Emission Report for Port of Los Angeles (Table 5.1)
https://www.portoflosangeles.org/environment/air-quality/air-emissions-inventory
2022 Air Emissions Report for Port of Long Beach (Table 4.5)
https://polb.com/environment/air#emissions-inventory

[12] CARB 2022 Cargo Handling Equipment Documentation (Table 6)
https://ww2.arb.ca.gov/sites/default/files/2023-08/2022CHEInventory.pdf

[13] EPA's 2024 GHG Emission Factor HUB (Table 2 for diesel fuel; Table 5 for Industrial/Commercial non-road vehicles) https://www.epa.gov/climateleadership/ghg-emission-factors-hub

[14] EPA's Exhaust and Crankcase Emission Factors for Nonroad Compression-Ignition Engines in MOVES2014b; July 2018 Document Display | NEPIS | US EPA

[15] Based on diesel equipment fuel consumption rate of 0.367 lbs/hp-hr and diesel fuel density of 7 lbs/gal

[16] CARB's OFFROAD2021 Model https://arb.ca.gov/emfac/offroad/emissions-inventory/1c89220b7b52edd1aa5c253103ead65c6f617ab2

The number of CHE in 2030 were based on total number of CHE replaced from 2025 to 2030. The average emission factors for NOx, PM10 and PM2.5 in tons per year were calculated for each CHE type based on the average engine size, annual operating hours and load factors in conjunction with CARB's zero-hour emission factors and deterioration rates for the oldest model years (i.e., 2010 to 2017) of yard trucks and top handlers (container handling equipment) categories in CARB's OFFROAD2021 model for the year 2030. The selection of the oldest model years in the OFFROAD2021 Model was intended to provide a representative pool of replaced CHE covered in this measure. The 2030 CAP/HAP emissions reductions for this measure are provided in Table 13.

Table 13. CAP/HAP Emission Reductions for Measure M3 (short tons/year)

	2030
NOx	24.1
PM2.5	1.2
DPM	1.1

4. Measure M4: Battery Electric Locomotives Pilot Program

This measure is the replacement or repower of Class 1 to 3 diesel fueled freight locomotives domiciled in the South Coast Air Basin. Types of locomotives eligible are Switchers, Medium Horsepower (MHP), and Line Haul. Upgrading locomotives is capital intensive. Providing incentive funding would encourage the purchase of advanced technology as a replacement. Upgrade of locomotive provides the highest GHG emission reductions since many of them are still equipped with very large and uncontrol engines, and locomotives have a long service life. The number of ZE switcher locomotives for this measure is shown in Table 14.

Table 14. Number of Switcher Locomotives for Measure M4

	2025	2026	2027	2028	2029	2030
Switcher Locomotives			4	14		

The methodology for estimating the annual GHG emission reductions associated with the replaced switcher locomotives is based on the activity level in terms of the estimated annual diesel fuel consumption per locomotive and EPA's GHG emission factors for switcher locomotives.[17]

The average annual diesel fuel consumption for switcher locomotives operating at railyards was estimated to be 75,000 gallons per switcher based on the reported data for Class I switchers in 2017. [18]

The methodology for estimating GHG emissions from the electricity consumption associated with the operation of battery-electric switchers is based on the annual MWh of electricity that is calculated based on the estimated annual diesel fuel consumption, EPA's fuel conversion factor for switcher locomotives (15.2 hp-hr/gal)[19], and the corresponding GHG emissions factors for electricity generation adjusted for the assumed charging efficiency (i.e., charger efficiency and battery charging efficiency).

[17] EPA's 2024 GHG Emission Factor HUB (Table 2 for diesel fuel; Table 5 for locomotives), https://www.epa.gov/climateleadership/ghg-emission-factors-hub

[18] CARB's Methodology for Battery Electric Switcher Usage Pattern, https://ww2.arb.ca.gov/resources/fact-sheets/yes-california-grid-can-handle-electrification-all-switchers-all-railyards

[19] EPA's 2009 Technical Highlights Emission Factors for Locomotives (Table 3)

Since the annual diesel fuel consumption for switchers used in these calculations also includes idling operations, the estimated GHG emission reductions are conservative for battery-powered switcher locomotives as the electricity consumption for idling for these units is very small.

The annual and cumulative GHG emissions reductions for this measure for 2025 to 2030 and 2025 to 2050 periods are provided in Tables 15 and 16 below.

Table 15. GHG Emission Reductions for Measure M4 for 2025 to 2030 (metric tons CO_2e)

	2025	2026	2027	2028	2029	2030
Annual	0	0	2,835	12,755	12,755	14,130
Cumulative	0	0	2,835	15,590	28,345	42,476

Table 16. GHG Emission Reductions for Measure G4 for 2025 to 2050 (metric tons CO_2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual	0	0	2,835	12,755	12,755	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130
Cumulative	0	0	2,835	15,590	28,345	42,476	56,606	70,737	84,867	98,997	113,128	127,258	141,389

Table 16. GHG Emission Reductions for Measure G4 for 2025 to 2050 (metric tons CO_2e), continued

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual	14,130	14,130	14,130	14,130	14,130	14,130	14,130	17,053	17,053	17,053	17,053	17,053	17,053
Cumulative	155,519	169,650	183,780	197,911	212,041	226,172	240,302	257,355	274,409	288,627	292,925	297,223	300,146

The methodology for estimating CAP/HAP emission reductions from switcher locomotives is based on the estimated annual fuel consumption, EPA's fuel conversion factor for switchers in terms of hp-hr/gal, and EPA's emission factors for switcher locomotives at Tier level[20] in terms of grams per hp-hr for NOx, PM10 and PM2.5.

For the purpose of estimating CAP/HAP emissions benefits for this measure, it is assumed that all replaced switchers will be Tier 0 switchers locomotives since significant number of these units still operate at railyards in California, as documented in CARB's 2022 emissions inventory for switcher locomotives.[21] The 2030 CAP/HAP emissions reductions for this measure are provided in Table 17.

Table 17. CAP/HAP Emission Reductions for Measure M4 (short tons/year)

	2030
NOx	285.0
PM2.5	9.2
DPM	10.0

For detailed emissions calculations, please refer to the GHG and CAP/HAP Emission Reductions Calculations Spreadsheet attached to this application.

[20] EPA's 2009 Technical Highlights Emission Factors for Locomotives (Table 2)

[21] CARB's 2022 Class 1 Switcher Rail Yard Emissions Inventory (Figure 6) https://ww2.arb.ca.gov/our-work/programs/msei/road-categories/road-diesel-models-and-documentation

2. Jobs Estimation Calculator

Background

Estimating job creation from targeted investment is critical to understanding project impact. However, estimating this impact is challenging. Typically, economic models are used to describe relationships, test various scenarios, and understand optimal outcomes. However, existing models (including Argonne National Laboratory's JOBS EV and the Bureau of Economic Analysis RIMS II, among many) do not meet project specific needs, exist in an accessible format, and/or fit project constraints. Therefore, a custom jobs estimation calculator was created to better understand impacts from this project and inform decisions.

The developed Calculator combines existing research on the EV industry and supply chains with insider EV market knowledge. While this calculator is not an economic model, it uses insights from prior economic modeling to create a tool to understand, explore, and estimate the relationship between investment and job creation.

Methods

The Calculator requires users to input specific number of EV equipment into the model. The number of equipment is multiplied by market cost, job multipliers, and regional distribution of EV supply chain jobs to give users a comprehensive assessment of job creation based on investment.

$$\left(Number\ of\ Equipment * \ Cost\ per\ Unit * \frac{Median\ Direct\ Jobs}{\$1\ Invested}\right) +$$
$$\left(Number\ of\ Equipment * \ Cost\ per\ Unit * \frac{Median\ Indirect\ \&\ induced\ Jobs}{\$1\ Invested}\right)$$
$$= Total\ Jobs\ Created$$

Total jobs created are then broken down into eight (8) regions, to better describe the distribution of investment.

Equipment Costs

Equipment costs for medium-duty EVs (MDEV), heavy-duty EVs (HDEV), DC fast chargers (DCFC), level 2 chargers (L2), battery electric storage systems (BESS), solar microgrids, electric locomotives, and cargo-handling equipment are based on the average cost of specific equipment based on information from manufacturers, previous projects, and publicly available data.

Job Multipliers

The job creation estimates are based on job multipliers created from reports from EDF[22] and PERI.[23]

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[22] Environmental Defense Fund. (2024). U.S. Electric Vehicle Manufacturing Investments and Jobs: Characterizing the Impacts of the Inflation Reduction Act after 18 Months. https://www.edf.org/sites/default/files/2024-03/EDF_US_EV_Manufacturing_Investments_Spring2024.pdf

[23] Pollin, R., Chakraborty, S., & Wicks-Lim, J. (2021). Employment impacts of proposed us economic stimulus programs: Job creation, job quality, and demographic distribution measures. Political Economy Research Institute. https://peri.umass.edu/publication/item/1397-employment-impacts-of-proposed-u-s-economic-stimulus-programs

Based on the EDF's recent analysis, $185.6 billion in investments was associated with 194,500 created/retained jobs. This translates to 1.05 jobs created per $1 million invested. Additionally, the EDF estimated that indirect and induced jobs were +7 for each direct EV manufacturing job and +2.5 for each direct EV battery job.

Another report, from Pollin et al. (2021) from PERI, estimated job creation from public investment. Based on this report, for every $1 million invested in high-efficiency autos, one can expect 1.4 direct jobs and 7.2 indirect and induced jobs, for a total of 8.6 jobs. The report also found 3.8 direct jobs and 7.5 indirect/induced jobs for every million invested in solar energy.

The Calculator uses the median of these two reports to determine a jobs multiplier for every dollar invested in the specific type of equipment (EV general, EV batteries, or solar).

Regional Distribution

To determine regional distribution of jobs, the total jobs created are multiplied using a regional distribution multiplier, determined from the comprehensive assessment of EV supply chain from Turner (2024)[24].

$$Total\ Jobs\ Created * \frac{Regional\ Number\ of\ Supply\ Chain\ Sites}{All\ EV\ Supply\ Chain\ Activity} = Regional\ Distribution\ of\ Jobs$$

[24] Turner, J. M. (2024). US and Canada Electric Vehicle Supply Chain Map. Charged: A History of Batteries and Lessons for a Clean Energy Future. Retrieved from https://www.charged-the-book.com/na-ev-supply-chain-map[1]

Budget Narrative

a. Budget details

South Coast AQMD estimates the total budget for entire project will be $499,785,707 over the performance period of five years. The breakdown for the five years is shown in the summary table below (Table 1).

Table 1 Overview of the Project Budget

Cost-Type	Category	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Direct Costs	Total Personnel	$1,675,578	$1,675,578	$1,675,578	$1,675,578	$1,675,578	$8,377,890
	Total Fringe Benefits	$927,433	$927,433	$927,433	$927,433	$927,433	$4,637,165
	Total Travel	$0	$0	$0	$0	$0	$0
	Total Equipment	$0	$0	$0	$0	$0	$0
	Total Supplies	$0	$0	$0	$0	$0	$0
	Total Contractual	$590,000	$230,000	$80,000	$50,000	$50,000	$1,000,000
	Total Other	$1,890,000	$196,150,000	$200,615,000	$75,345,000	$700,000	$474,700,000
	Total Direct	$5,083,011	$198,983,011	$203,298,011	$77,998,011	$3,353,011	$488,715,055
Total Indirect		$2,256,472	$2,256,472	$2,256,472	$2,256,472	$2,256,472	$11,282,360
Total Funding		**$7,339,483**	**$201,239,483**	**$205,554,483**	**$80,254,483**	**$5,609,483**	**$499,997,415**

South Coast AQMD proposes to implement four measures under this Project as outlined in the previous section. A total of $467.9m (or 93.6% of the total project cost) is budgeted for the incentive funding, specifically,

- $178.5m for Measure 1 to fund the construction and installation of heavy duty charging infrastructure;
- $78m for Measure 2 to fund the deployment of battery electric heavy duty trucks and SCAG's Last Mile Freight Program (LMFP);
- $20.6m for Measure 3 to fund the deployment of battery electric cargo handling equipment; and
- $190.8m for Measure 4 to fund the pilot program of battery electric locomotives.

To effectively implement the incentive funding and deploy the vehicles, equipment, and charging stations, South Coast AQMD allocates budget for workforce training, community engagement, and data collection for each measure over the project period of five years. The respective activities will start in the first year of the project and be carried out throughout the five years. Experienced South Coast AQMD staff will administer the project and implement the incentive programs. Budget allocation for these project components is presented in Table 2 below. Budget allocation by measures is shown in Table 3. Details of the budget for each measure are presented in Tables 4 through 7.

Table 2 Budget Allocation by Project Components

	Cost	% of Total Cost
Incentive funding	$467,900,000	93.6%
Workforce training	$5,000,000	1.0%
Community engagement and outreach	$1,000,000	0.2%
Data collection, analysis and future planning	$1,800,000	0.4%
Project administration	$24,085,780	4.8%

Table 3 Budget Allocation by Measures

Project Name	Cost	% of Total Cost
M1: Charging Infrastructure Deployment	$191,267,885	38%
M2: BE Freight Vehicle Deployment	$83,971,000	17%
M3: BE CHE Deployment	$25,548,435	5%
M4: BE Locomotive Pilot	$199,210,095	40%

A total of $191.3m is budgeted to implement Measure 1, charging infrastructure deployment, as shown in Table 4. Main portion of the incentive fund for the infrastructure is expected to be distributed in Years 2 and 3 of the project period. A small amount of funding is allocated in Year 4 for projects that may take extended time. Workforce training and community engagement will be focused in the first three years of the project with funding is largely allocated in Years 1-3. The Project will develop the data reporting format and requirements in Year 1. Data collection and analysis activities will occur throughout the rest of project.

Table 4 Budget for Measure 1 – Charging Infrastructure Deployment Incentive Program

	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Incentive funding	$0	$84,000,000	$84,000,000	$10,500,000	$0	$178,500,000
Workforce training	$1,500,000	$1,200,000	$800,000	$400,000	$100,000	$4,000,000
Community engagement/outreach	$300,000	$100,000	$50,000	$20,000	$20,000	$490,000
Data collection, analysis and future planning	$50,000	$85,000	$200,000	$220,000	$150,000	$705,000
Project administration	$1,514,577	$1,514,577	$1,514,577	$1,514,577	$1,514,577	$7,572,885
Total						**$191,267,885**

A total of $84.0m is budgeted for Measure 2, battery electric truck deployment, as shown in Table 5. This measure includes deployment of Class 8 BETs and Last Mile Freight Program. The incentive funding for the truck deployment is expected to be distributed in Years 2 and 3 of the Project. This will allow South Coast AQMD to focus Year 1 to develop the incentive program and solicitate and select projects. Workforce training and community engagement will be focused in the first few years of the project with funding largely allocated in Years 1 through3. The Project will develop the data reporting format and requirements in Year 1. Data collection and analysis activities will occur throughout the rest of project.

Table 5 Budget for Measure 2 – Battery Electric Freight Vehicle Deployment Incentive Program

	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Incentive funding - Class 8 Trucks	$0	$12,000,000	$16,000,000	$0	$0	$28,000,000
Incentive funding - Last Mile Freight Program	$0	$24,000,000	$26,000,000	$0	$0	$50,000,000
Workforce training	$0	$0	$0	$0	$0	$0
Community engagement/outreach	$120,000	$50,000	$10,000	$10,000	$10,000	$200,000
Data collection, analysis and future planning	$50,000	$75,000	$100,000	$190,000	$110,000	$525,000
Project administration	$1,049,200	$1,049,200	$1,049,200	$1,049,200	$1,049,200	$5,246,000
Total						**$83,971,000**

A total of $25.5m is budgeted for Measure 3, battery electric cargo handling equipment deployment, as shown in Table 6. The incentive fund for the CHE deployment is expected to be distributed in Years 2 and 3 of the Project period. This will allow South Coast AQMD to focus Year 1 to develop the incentive program and solicit and select projects. Workforce training and community engagement will be focused in the first few years of the project with funding is largely allocated in Years 1 through 3. The Project will develop the data reporting format and requirements in Year 1. Data collection and analysis activities will occur throughout the rest of project.

Table 6 Budget for Measure 3 – Battery Electric CHE Deployment Incentive Program

	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Incentive funding	$0	$11,000,000	$9,600,000	$0	$0	$20,600,000
Workforce training	$200,000	$100,000	$100,000	$50,000	$50,000	$500,000
Community engagement/outreach	$70,000	$30,000	$10,000	$10,000	$10,000	$130,000
Data collection, analysis and future planning	$20,000	$20,000	$40,000	$50,000	$40,000	$170,000
Project administration	$829,687	$829,687	$829,687	$829,687	$829,687	$4,148,435
Total						**$25,548,435**

A total of $199.2m is budgeted for Measure 4, battery electric locomotive program, as shown in Table 7. The funding for the battery electric locomotive program is expected to be distributed in Year 3 and 4 of the Project period. South Coast AQMD will focus Year 1 to develop the incentive program and solicit and select projects. Community engagement will be focused in the first few years of the project with funding is largely allocated in Years 1 through 3. Workforce training will start in Year 2. The Project will develop the data reporting format and requirements in Year 1. Data collection and analysis activities will primarily take place in Years 3 through 5 of the Project period.

Table 7 Budget for Measure 4 – Battery Electric Locomotive Pilot Program

	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotal
Incentive funding	$0	$63,600,000	$63,600,000	$63,600,000	$0	$190,800,000
Workforce training	$0	$400,000	$200,000	$200,000	$100,000	$900,000
Community engagement/outreach	$100,000	$50,000	$10,000	$10,000	$10,000	$180,000
Data collection, analysis and future planning	$20,000	$20,000	$75,000	$135,000	$150,000	$400,000
Project administration	$1,466,019	$1,466,019	$1,466,019	$1,466,019	$1,466,019	$7,330,095
Total						**$199,210,095**

b. Expenditure of Awarded Funds

South Coast AQMD has extensive experience administering EPA and other federal grants and is familiar with the relevant guidelines and procedures. South Coast AQMD also has over 25 years of experience managing emission reduction incentive programs. South Coast AQMD will utilize the existing incentive program management tools and procedures to ensure efficient and timely deployment of the vehicles and equipment and distribution of the funding.

South Coast AQMD has an established procedure for incentive programs, which includes program announcement, project solicitation, project evaluation and selection, contract execution, funding disbursement, and reporting collection. This procedure is supported by:

- groups of dedicated staff who are specialized in community outreach, project evaluation, contract preparation, equipment/vehicle inspection, invoice processing, and others,
- an online grant management platform for easy proposal submission and project management,
- an internal digital contract and invoice processing system, and
- South Coast AQMD Governing board review and approval process.

South Coast AQMD proposes to take a similar approach as for the existing incentive programs to implement the funding of this Project. In such a way, the experiences and lessons learned from the previous practice will greatly minimize redundance, errors, and difficulties that might occur during the implementation. South Coast AQMD has recently started a leasing program for battery electric BET. The experience from that program can be easily transferred to this Project for reference.

South Coast AQMD will take the following steps to implement the incentive and leasing programs proposed in this application.

1. Program announcement
   The incentive and leasing programs will be announced to the public on South Coast AQMD's website, through newsletters and social media, and workshops. A proposal submission time window will be defined to allow enough entities interested in the program(s) to submit the application. Required information and documents for the application will be clearly explained in the announcement. Application related queries will be addressed timely to assist the applicants. The Project will utilize South Coast AQMD's existing online application submission platform.
2. Outreach
   While South Coast AQMD has a good understanding of funding needs by the local entities under the four measures, an extensive outreach will be conducted for a wide reach in the two MSAs to solicit proposals for projects which can be completed in a timely manner.
3. Evaluation and selection
   South Coast AQMD will evaluate the submitted proposals based on the criteria defined for this Project. Guidelines and criteria of other existing incentive and leasing programs will be referenced to develop the evaluation criteria. Lists of selected projects will be generated. Additionally, lists of backup projects will be developed as well so that when selected projects are withdrawn, projects can be quickly identified to utilize the returned fund.
4. Contract execution
   South Coast AQMD will reference the existing contract templates when developing the contracts to be funded under this Project. There are existing contract templates for projects to deploy charging infrastructure, battery electric trucks, and CHE, and to fund equipment leasing programs. South Coast AQMD expects minimum time for contract development. South Coast AQMD will require a contractual implementation schedule to ensure rapid progress and timely outcomes. South Coast AQMD will utilize an existing digital processing system for contract approval and execution. With electronic approvals and signatures, the process approves to be quick and efficient.
5. Payment processing
   Similar to contract execution, South Coast AQMD will utilize an existing digital processing system for invoice and payment for efficiency. At the same time, staff will conduct thorough and detailed review of the invoice documents to ensure proper expenditure evidence is provided. Where needed, South Coast AQMD will conduct inspection for the funded projects for verification purpose. Such an inspection process is a well-established practice.

South Coast AQMD has a strong leadership in overseeing the implementation. Fund expenditure and incentive project progress will be tracked and compared with the proposed timeline. Project officers will work closely with incentive fund awardees for status and updates. When delay or other obstacles are expected, the project officer will assist the awardees for remedies to ensure timely completion of the awarded incentive project.

Throughout many other grant projects, South Coast AQMD has worked closely with local workforce training institutions, community-based organizations, and data processing companies. The close partnership with these entities is beneficial for efficient communication and collaboration.

c. Reasonableness of Cost

i. Incentive programs

As shown in Table 2, $467.5m, or 93.6% of the total Project budget, is proposed for the deployment of charging infrastructure, and battery electric trucks and CHE, and battery electric locomotives. This high percentage of funding allocation on deployment is to maximize the GHG emission reductions with the funding.

Table 8 Proposed Incentives for the Measures

<table>
<tr><th></th><th>Incentive per unit</th><th>Incentive unit</th><th>Count</th><th>Unit</th><th>Total Incentive Funding</th></tr>
<tr><td>M1: Charging Infrastructure Deployment</td><td>700</td><td>$/kw</td><td>1020</td><td>chargers</td><td>$178,500,000</td></tr>
<tr><td>M2: BE Freight Vehicle Deployment - HD BET</td><td>400,000</td><td>$/truck</td><td>70</td><td>trucks</td><td rowspan="2">$78,000,000</td></tr>
<tr><td>M2: BE Freight Vehicle Deployment - LMFP</td><td>67,000</td><td>$/truck*</td><td>746</td><td>trucks</td></tr>
<tr><td>M3: BE CHE Deployment – Yard Tractor</td><td>300,000</td><td>$/CHE*</td><td>34</td><td>CHE</td><td rowspan="2">$20,600,000</td></tr>
<tr><td>M3: BE CHE Deployment – Top Handler</td><td>400,000</td><td>$/CHE*</td><td>26</td><td>CHE</td></tr>
<tr><td>M4: BE Locomotive Pilot</td><td>10,600,000</td><td>$/locomotive*</td><td>18</td><td>locomotive</td><td>$190,800,000</td></tr>
</table>

*: charger is included in the incentive

<u>Measure 1 - Charging Infrastructure Deployment Incentive Program:</u>

$178.5m is allocated to fund truck charging stations. The scope of actual infrastructure projects is different from one to the other. Due to the high power needs from the chargers, charging sites will often need utility upgrades or onsite power generation to expand the power capacity. After reviewing the cost information in the infrastructure proposals received, a unit cost of up to $1500/kw of the charging power is observed. Under the Project, $700/kw would be provided for the construction and installation of new charging facilities. To close the gap of current charging infrastructure needs and accelerate future deployment of BETs in the region, 1020 chargers over the project period are budgeted. Assuming 250kw charging power for the charger, $178.5m is needed. Furthermore, $10million will be provided by Port of Los Angeles and Port of Long Beach to support deployment of additional up to 60 chargers.

<u>Measure 2 - Battery Electric Freight Vehicle Deployment Incentive Program – HD BET:</u>

$28m is allocated to fund the deployment of Class 8 BET trucks. As shown in Table 9 below, Class 8 battery electric trucks cost in the range of $500,000 and higher. South Coast AQMD has observed that the incentive fund in the $200,000-250,000 can't still provide sufficient incentive for the fleets, especially the small fleets, to purchase battery electric trucks. Therefore, an incentive funding amount of $400,000 per truck is proposed to reduce the upfront cost so the fleets owners, especially for the small owner operators, can be incentivized for the technology selection decision while other obstacles, such as charging challenging, duty cycles, and operation cost for electric trucks are still being addressed. 70 trucks can be funded with the budgeted $28m for Class 8 BET truck incentive measure. This size of deployment under this Project will compensate the deployment by other incentive programs and voucher programs.

Table 9 Examples of 2024 Carl Moyer Battery Electric Goods Movement Truck Cost

Vehicle Make	Vehicle Model	Vehicle Cost*
Peterbilt	579EV	$511,000
VOLVO	VNRE300	$545,076
Freightliner	PE116DC	$519,308
Volvo	VNRE62T300	$541,316
Nikola Motor	TRE BEV	$548,030
Freightliner	eCascadia	$615,538
	Average	$546,711

*: vehicle total cost, including FET and sales tax.

<u>Measure 2 - Battery Electric Freight Vehicle Deployment Incentive Program – LMFP:</u>
Approximately $50m is allocated to augment commercial deployment of zero-emission technologies for the last-mile delivery market, including primarily Class 4 and 5 trucks, equipment, and supporting infrastructure. Approximately $67k incentive funding will be provided per vehicle and supporting charger to deploy up to 746 battery electric trucks. SCAG will provide additional $125m to further enhance the deployment and strategy development for last mile freight delivery.

<u>Measure 3 - Battery Electric Cargo Handling Equipment Deployment Incentive Program:</u>
$20.6m is allocated to fund the deployment of cargo handling equipment, including battery electric yard tractors and top handlers, and supporting chargers. An incentive funding of $300,000 per yard tractor and charger would cover at least 80% of the upfront purchase cost. An incentive funding of $400,000 per top handler and charger would cover up at least 80% of the upfront purchase cost. The scale of incentive is intended to accelerate the adoption of battery electric technologies for the cargo handling operation. Up to 60 units of cargo handing equipment can be funded.

<u>Measure 4 - Battery Electric Locomotive Pilot Program:</u>
$190.8m is allocated to fund the deployment of battery electric locomotives. An average of $10m will be provided to fund one locomotive. This funding amount is determined based on the quotes that South Coast AQMD received from multiple manufacturers in 2024. Additionally, $1.2m will be provided for each charging unit, which can be used by at least two locomotives. A total of up to 18 locomotives and 9 chargers are expected to be funded using the allocated budget.

ii. Workforce training

Workforce will be conducted throughout the project period by identified institutions. Specific tasks include:

- development of curriculum for the measures in the proposed Project,
- initial and ongoing training for operators, technicians, and other participating personnels on technologies, operation, safety, and maintenance, and
- tours of facilities.

The training will be primarily conducted in the partner institutions and fleet facilities. The cost will cover the facility usage, lecturers' time, training materials, demonstration units, etc. The budgeted amount for workforce training is expected to yield substantial returns in terms of safety, efficiency, compliance, innovation, and overall project success in the adoption of battery electric technology. The budget for each measure is allocated based on the scale of the respective measures.

iii. Community engagement and outreach

Community engagement and outreach plays an important role for the success of the GHG emission reduction projects, including the deployment of zero emission technologies.

South Coast AQMD will utilize the in-house staff and work with local community-based organizations to conduct the community engagement and outreach. A low budget of $1m is allocated for this activity. South Coast AQMD expects to seek for additional funding from other sources to enhance the community outreach.

iv. Data collection, analysis and future planning

There will be extensive data collection from the equipment and vehicles deployed by this Project. An identified partner will perform the following tasks:

- Development of data standards for reporting charging infrastructure performance, and operational data analysis;
- Data processing QA/QC;
- Database management and hosting;
- Charger utilization and performance analysis, 3rd party verification, and recommendations.
- Vehicle/equipment charging infrastructure performance, emission reduction monitoring, data collection, operational data analysis, and maintenance activities, etc.
- Preparation of a scaling plan and recommendations for the larger zero-emission equipment deployment and supporting infrastructure installation.
- Data reports

Charge-session data will be evaluated for time of day charging profiles. An optimization algorithm will be developed for charge management that factors utility rate structure and demand charges. Impacts of charge management will be evaluated using real-world charging data. Additionally, analyses will be conducted, using tools such as EVI-X, to help inform the optimal deployment of infrastructure based on data from vehicle types, locations, and usage patterns. A reasonable budget of $1.8 m is allocated for approximately 1020 chargers, 816 vehicles, 60 pieces of CHE, and 18 locomotives.

v. Project administration

South Coast AQMD will have dedicated staff to manage the incentive programs. The personnel projection is illustrated in Table 10 below. The responsibilities of staff, including Air Quality Specialists and Contract Assistants, will include:

- Assisting in incentive programs and program announcements;
- Working with the community-based organization to conduct community outreach and engagement;
- Working with workforce training institutions on curriculum design and training arrangement;
- Evaluating the proposals submitted by entities interesting in the incentive programs;
- Developing the contracts with the awarded entities; and
- Reviewing and processing invoices submitted by the awarded entities, etc.

The program supervisors and managers will be responsible for

- developing the incentive programs and program announcements;
- ensuring the awarded projects are properly selected and implemented;

- reviewing the data reports submitted by the data collection the partner;
- preparing and submitting semi-annual and final reports to EPA; and
- acting as liaisons with EPA, etc.

The budget is based on the personnel hours in implementing the existing incentive programs and 2023-2024 South Coast AQMD salary rates.

Table 10 Personnel Projection per Year

	Manager (FTE)	Program Supervisor (FTE)	Air Quality Specialist (FTE)	Contract Assistant (FTE)
M1: Charging Infrastructure Deployment	0.1	0.9	1.9	2.0
M2: BE Freight Vehicle Deployment	0.1	0.2	2.0	1.0
M3: BE CHE Deployment	0.1	0.2	1.6	0.7
M4: BE Locomotive Pilot	0.2	0.8	2.0	1.5
Total	0.5	2.1	7.5	5.2

*: FTE: full time employee

CensusTract2010ID	MSAID	MSAName
06037500500	31080	Los Angeles-Long Beach-Anaheim, CA
06037122410	31080	Los Angeles-Long Beach-Anaheim, CA
06037123103	31080	Los Angeles-Long Beach-Anaheim, CA
06037120020	31080	Los Angeles-Long Beach-Anaheim, CA
06037120300	31080	Los Angeles-Long Beach-Anaheim, CA
06037121210	31080	Los Angeles-Long Beach-Anaheim, CA
06037123410	31080	Los Angeles-Long Beach-Anaheim, CA
06037125320	31080	Los Angeles-Long Beach-Anaheim, CA
06037128210	31080	Los Angeles-Long Beach-Anaheim, CA
06037128220	31080	Los Angeles-Long Beach-Anaheim, CA
06037123601	31080	Los Angeles-Long Beach-Anaheim, CA
06037123510	31080	Los Angeles-Long Beach-Anaheim, CA
06037123520	31080	Los Angeles-Long Beach-Anaheim, CA
06037123700	31080	Los Angeles-Long Beach-Anaheim, CA
06037124102	31080	Los Angeles-Long Beach-Anaheim, CA
06037125310	31080	Los Angeles-Long Beach-Anaheim, CA
06037127210	31080	Los Angeles-Long Beach-Anaheim, CA
06037131020	31080	Los Angeles-Long Beach-Anaheim, CA
06037482301	31080	Los Angeles-Long Beach-Anaheim, CA
06037482401	31080	Los Angeles-Long Beach-Anaheim, CA
06037482600	31080	Los Angeles-Long Beach-Anaheim, CA
06059011601	31080	Los Angeles-Long Beach-Anaheim, CA
06059062625	31080	Los Angeles-Long Beach-Anaheim, CA
06037480011	31080	Los Angeles-Long Beach-Anaheim, CA
06037481712	31080	Los Angeles-Long Beach-Anaheim, CA
06037481713	31080	Los Angeles-Long Beach-Anaheim, CA
06037482303	31080	Los Angeles-Long Beach-Anaheim, CA
06037482304	31080	Los Angeles-Long Beach-Anaheim, CA
06037221401	31080	Los Angeles-Long Beach-Anaheim, CA
06037221602	31080	Los Angeles-Long Beach-Anaheim, CA
06037221402	31080	Los Angeles-Long Beach-Anaheim, CA
06037221601	31080	Los Angeles-Long Beach-Anaheim, CA
06037234502	31080	Los Angeles-Long Beach-Anaheim, CA
06037222002	31080	Los Angeles-Long Beach-Anaheim, CA
06037226001	31080	Los Angeles-Long Beach-Anaheim, CA
06037226002	31080	Los Angeles-Long Beach-Anaheim, CA
06037234901	31080	Los Angeles-Long Beach-Anaheim, CA
06037234902	31080	Los Angeles-Long Beach-Anaheim, CA
06037236203	31080	Los Angeles-Long Beach-Anaheim, CA
06037236204	31080	Los Angeles-Long Beach-Anaheim, CA
06037237101	31080	Los Angeles-Long Beach-Anaheim, CA
06037237102	31080	Los Angeles-Long Beach-Anaheim, CA
06037237201	31080	Los Angeles-Long Beach-Anaheim, CA
06037237202	31080	Los Angeles-Long Beach-Anaheim, CA
06037237401	31080	Los Angeles-Long Beach-Anaheim, CA
06037239201	31080	Los Angeles-Long Beach-Anaheim, CA

06037239202	31080	Los Angeles-Long Beach-Anaheim, CA
06037239501	31080	Los Angeles-Long Beach-Anaheim, CA
06037239502	31080	Los Angeles-Long Beach-Anaheim, CA
06037239601	31080	Los Angeles-Long Beach-Anaheim, CA
06037239602	31080	Los Angeles-Long Beach-Anaheim, CA
06037239701	31080	Los Angeles-Long Beach-Anaheim, CA
06037239801	31080	Los Angeles-Long Beach-Anaheim, CA
06037240401	31080	Los Angeles-Long Beach-Anaheim, CA
06037239702	31080	Los Angeles-Long Beach-Anaheim, CA
06037239802	31080	Los Angeles-Long Beach-Anaheim, CA
06037240402	31080	Los Angeles-Long Beach-Anaheim, CA
06037504101	31080	Los Angeles-Long Beach-Anaheim, CA
06037530005	31080	Los Angeles-Long Beach-Anaheim, CA
06037530204	31080	Los Angeles-Long Beach-Anaheim, CA
06037533402	31080	Los Angeles-Long Beach-Anaheim, CA
06037531603	31080	Los Angeles-Long Beach-Anaheim, CA
06037502802	31080	Los Angeles-Long Beach-Anaheim, CA
06037503104	31080	Los Angeles-Long Beach-Anaheim, CA
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06037242300	31080	Los Angeles-Long Beach-Anaheim, CA
06037407701	31080	Los Angeles-Long Beach-Anaheim, CA
06037406200	31080	Los Angeles-Long Beach-Anaheim, CA
06065043239	40140	Riverside-San Bernardino-Ontario, CA
06065043316	40140	Riverside-San Bernardino-Ontario, CA
06065043512	40140	Riverside-San Bernardino-Ontario, CA
06065043513	40140	Riverside-San Bernardino-Ontario, CA
06065043274	40140	Riverside-San Bernardino-Ontario, CA
06065043601	40140	Riverside-San Bernardino-Ontario, CA
06065043602	40140	Riverside-San Bernardino-Ontario, CA
06065043813	40140	Riverside-San Bernardino-Ontario, CA
06073018700	31080	Los Angeles-Long Beach-Anaheim, CA
06037408301	31080	Los Angeles-Long Beach-Anaheim, CA
06037408627	31080	Los Angeles-Long Beach-Anaheim, CA
06037432202	31080	Los Angeles-Long Beach-Anaheim, CA
06037432602	31080	Los Angeles-Long Beach-Anaheim, CA
06037432802	31080	Los Angeles-Long Beach-Anaheim, CA
06037433601	31080	Los Angeles-Long Beach-Anaheim, CA
06037572900	31080	Los Angeles-Long Beach-Anaheim, CA
06037533502	31080	Los Angeles-Long Beach-Anaheim, CA
06037533503	31080	Los Angeles-Long Beach-Anaheim, CA
06037533701	31080	Los Angeles-Long Beach-Anaheim, CA
06037534002	31080	Los Angeles-Long Beach-Anaheim, CA
06037534102	31080	Los Angeles-Long Beach-Anaheim, CA
06037535605	31080	Los Angeles-Long Beach-Anaheim, CA
06037540203	31080	Los Angeles-Long Beach-Anaheim, CA
06037541002	31080	Los Angeles-Long Beach-Anaheim, CA
06037541802	31080	Los Angeles-Long Beach-Anaheim, CA
06037113234	31080	Los Angeles-Long Beach-Anaheim, CA
06037482402	31080	Los Angeles-Long Beach-Anaheim, CA
06037533401	31080	Los Angeles-Long Beach-Anaheim, CA
06037534301	31080	Los Angeles-Long Beach-Anaheim, CA
06037542000	31080	Los Angeles-Long Beach-Anaheim, CA
06037502004	31080	Los Angeles-Long Beach-Anaheim, CA
06065046403	40140	Riverside-San Bernardino-Ontario, CA
06065042800	40140	Riverside-San Bernardino-Ontario, CA
06065043220	40140	Riverside-San Bernardino-Ontario, CA
06065043503	40140	Riverside-San Bernardino-Ontario, CA
06065044102	40140	Riverside-San Bernardino-Ontario, CA
06065044509	40140	Riverside-San Bernardino-Ontario, CA
06065042412	40140	Riverside-San Bernardino-Ontario, CA
06065031701	40140	Riverside-San Bernardino-Ontario, CA
06065042618	40140	Riverside-San Bernardino-Ontario, CA
06037553801	31080	Los Angeles-Long Beach-Anaheim, CA
06037570501	31080	Los Angeles-Long Beach-Anaheim, CA
06037570502	31080	Los Angeles-Long Beach-Anaheim, CA
06037572500	31080	Los Angeles-Long Beach-Anaheim, CA

06065042740	40140	Riverside-San Bernardino-Ontario, CA
06065042741	40140	Riverside-San Bernardino-Ontario, CA
06065043008	40140	Riverside-San Bernardino-Ontario, CA
06037123104	31080	Los Angeles-Long Beach-Anaheim, CA
06037127102	31080	Los Angeles-Long Beach-Anaheim, CA
06037128302	31080	Los Angeles-Long Beach-Anaheim, CA
06037503202	31080	Los Angeles-Long Beach-Anaheim, CA
06037267502	31080	Los Angeles-Long Beach-Anaheim, CA
06037272302	31080	Los Angeles-Long Beach-Anaheim, CA
06037291110	31080	Los Angeles-Long Beach-Anaheim, CA
06037291120	31080	Los Angeles-Long Beach-Anaheim, CA
06037294610	31080	Los Angeles-Long Beach-Anaheim, CA
06037294620	31080	Los Angeles-Long Beach-Anaheim, CA
06037294830	31080	Los Angeles-Long Beach-Anaheim, CA
06037296500	31080	Los Angeles-Long Beach-Anaheim, CA
06065031401	40140	Riverside-San Bernardino-Ontario, CA
06065041001	40140	Riverside-San Bernardino-Ontario, CA
06037291220	31080	Los Angeles-Long Beach-Anaheim, CA
06037294410	31080	Los Angeles-Long Beach-Anaheim, CA
06037296210	31080	Los Angeles-Long Beach-Anaheim, CA
06065043307	40140	Riverside-San Bernardino-Ontario, CA
06065043309	40140	Riverside-San Bernardino-Ontario, CA
06065043311	40140	Riverside-San Bernardino-Ontario, CA
06065043404	40140	Riverside-San Bernardino-Ontario, CA
06065031300	40140	Riverside-San Bernardino-Ontario, CA
06037432902	31080	Los Angeles-Long Beach-Anaheim, CA
06037433602	31080	Los Angeles-Long Beach-Anaheim, CA
06037104401	31080	Los Angeles-Long Beach-Anaheim, CA
06037104500	31080	Los Angeles-Long Beach-Anaheim, CA
06037107020	31080	Los Angeles-Long Beach-Anaheim, CA
06065041203	40140	Riverside-San Bernardino-Ontario, CA
06065042009	40140	Riverside-San Bernardino-Ontario, CA
06065042517	40140	Riverside-San Bernardino-Ontario, CA
06065042903	40140	Riverside-San Bernardino-Ontario, CA
06065043310	40140	Riverside-San Bernardino-Ontario, CA
06065043505	40140	Riverside-San Bernardino-Ontario, CA
06065043507	40140	Riverside-San Bernardino-Ontario, CA
06065044103	40140	Riverside-San Bernardino-Ontario, CA
06065044507	40140	Riverside-San Bernardino-Ontario, CA
06065044916	40140	Riverside-San Bernardino-Ontario, CA
06065042409	40140	Riverside-San Bernardino-Ontario, CA
06065042511	40140	Riverside-San Bernardino-Ontario, CA
06065042516	40140	Riverside-San Bernardino-Ontario, CA
06065042706	40140	Riverside-San Bernardino-Ontario, CA
06065042717	40140	Riverside-San Bernardino-Ontario, CA
06037291210	31080	Los Angeles-Long Beach-Anaheim, CA
06037293202	31080	Los Angeles-Long Beach-Anaheim, CA

06037576402	31080	Los Angeles-Long Beach-Anaheim, CA
06037430101	31080	Los Angeles-Long Beach-Anaheim, CA
06037431400	31080	Los Angeles-Long Beach-Anaheim, CA
06037533603	31080	Los Angeles-Long Beach-Anaheim, CA
06037533902	31080	Los Angeles-Long Beach-Anaheim, CA
06037534203	31080	Los Angeles-Long Beach-Anaheim, CA
06037534405	31080	Los Angeles-Long Beach-Anaheim, CA
06037534501	31080	Los Angeles-Long Beach-Anaheim, CA
06037534700	31080	Los Angeles-Long Beach-Anaheim, CA
06037535501	31080	Los Angeles-Long Beach-Anaheim, CA
06037535804	31080	Los Angeles-Long Beach-Anaheim, CA
06037540202	31080	Los Angeles-Long Beach-Anaheim, CA
06037540300	31080	Los Angeles-Long Beach-Anaheim, CA
06037540501	31080	Los Angeles-Long Beach-Anaheim, CA
06037104703	31080	Los Angeles-Long Beach-Anaheim, CA
06037104704	31080	Los Angeles-Long Beach-Anaheim, CA
06037104821	31080	Los Angeles-Long Beach-Anaheim, CA
06037104822	31080	Los Angeles-Long Beach-Anaheim, CA
06037106405	31080	Los Angeles-Long Beach-Anaheim, CA
06037900103	31080	Los Angeles-Long Beach-Anaheim, CA
06037900104	31080	Los Angeles-Long Beach-Anaheim, CA
06037900505	31080	Los Angeles-Long Beach-Anaheim, CA
06037900507	31080	Los Angeles-Long Beach-Anaheim, CA
06037900508	31080	Los Angeles-Long Beach-Anaheim, CA
06037900608	31080	Los Angeles-Long Beach-Anaheim, CA
06037900609	31080	Los Angeles-Long Beach-Anaheim, CA
06027000800	40140	Riverside-San Bernardino-Ontario, CA
06029003306	31080	Los Angeles-Long Beach-Anaheim, CA
06029003305	31080	Los Angeles-Long Beach-Anaheim, CA
06059099402	31080	Los Angeles-Long Beach-Anaheim, CA
06059099701	31080	Los Angeles-Long Beach-Anaheim, CA
06059099803	31080	Los Angeles-Long Beach-Anaheim, CA
06029006007	31080	Los Angeles-Long Beach-Anaheim, CA
06029006500	40140	Riverside-San Bernardino-Ontario, CA
06037102105	31080	Los Angeles-Long Beach-Anaheim, CA
06037104124	31080	Los Angeles-Long Beach-Anaheim, CA
06037104108	31080	Los Angeles-Long Beach-Anaheim, CA
06037104203	31080	Los Angeles-Long Beach-Anaheim, CA
06037104204	31080	Los Angeles-Long Beach-Anaheim, CA
06037104403	31080	Los Angeles-Long Beach-Anaheim, CA
06037104404	31080	Los Angeles-Long Beach-Anaheim, CA

Project Company Name	Project Type	Location City	Location State
Anonymized	ZE Infrastructure	Van Nuys	California
Anonymized	ZE Infrastructure	Rancho Cucamonga	California
Anonymized	ZE Infrastructure	Ontario	California
Anonymized	ZE Infrastructure	Rancho Dominguez	California
Anonymized	ZE Infrastructure	Fontana	California
Anonymized	ZE Infrastructure	El Monte	California
Anonymized	ZE Infrastructure	Colton	California
Anonymized	ZE Infrastructure	Los Angeles	California
Anonymized	ZE Infrastructure	Wilmington	California
Anonymized	ZE Infrastructure	Rancho Dominguez	California
Anonymized	ZE Infrastructure	Colton	California
Anonymized	ZE Infrastructure	Long Beach	California
Anonymized	ZE Infrastructure	Temecula	California
Anonymized	ZE Infrastructure	Riverside	California
Anonymized	ZE Infrastructure	Vernon	California
Anonymized	ZE Infrastructure	Stanton	California
Anonymized	ZE Infrastructure	Laguna Canyon	California
Anonymized	ZE Infrastructure	CARSON	California
Anonymized	ZE Infrastructure	Fontana	California
Anonymized	ZE Infrastructure	Long Beach	California
Anonymized	ZE Infrastructure	Moreno Valley	California
Anonymized	ZE Infrastructure	Fontana	California
Anonymized	ZE Infrastructure	San Bernardino	California
Anonymized	ZE Infrastructure	Riverside	California
Anonymized	ZE Infrastructure	Buena Park	California
Anonymized	ZE Infrastructure	Perris	California
Anonymized	ZE Infrastructure	La Mirada	California
Anonymized	ZE Infrastructure	Ontario	California
Anonymized	ZE Infrastructure	Santa Ana	California
Anonymized	ZE Infrastructure	City of Industry	California
Anonymized	ZE Infrastructure	Chino	California
Anonymized	ZE Infrastructure	Vernon	California
Anonymized	ZE Infrastructure	Ontario	California
Anonymized	ZE Infrastructure	Chino	California
Anonymized	ZE Infrastructure	Chino	California
Anonymized	ZE Infrastructure	Chino	California
Anonymized	ZE Infrastructure	Carson	California
Anonymized	ZE Infrastructure	Mira Loma	California
Anonymized	ZE Infrastructure	Carson	California
Anonymized	ZE Infrastructure	Palm Springs	California
Anonymized	ZE Infrastructure	San Bernadino	California

Anonymized	ZE Infrastructure	Moreno Valley	California
Anonymized	ZE Infrastructure	Sun Valley	California
Anonymized	ZE Infrastructure	Fontana	California
Anonymized	ZE Infrastructure	Anaheim	California
Anonymized	ZE Infrastructure	Cudahy	California
Anonymized	ZE Infrastructure	Rialto	California
Anonymized	ZE Infrastructure	Orange	California
Anonymized	ZE Infrastructure	Santa Ana	California
Anonymized	ZE Infrastructure	Long Beach	California
Anonymized	ZE Infrastructure	Los Angeles, CA	California
Anonymized	ZE Infrastructure	Ontario	California
Anonymized	ZE Infrastructure	Long Beach	California
Anonymized	ZE Infrastructure	Santa Ana	California
Anonymized	ZE Infrastructure	City of Industry	California
Anonymized	ZE Infrastructure	Los Angeles	California
Anonymized	ZE Infrastructure	Rialto	California
Anonymized	ZE Infrastructure	Wilmington	California
Anonymized	ZE Infrastructure	Lynwood	California
Anonymized	ZE Infrastructure	Santa Ana	California
Anonymized	ZE Infrastructure	Orange	California
Anonymized	ZE Infrastructure	Sun Valley	California
Anonymized	ZE Infrastructure	Long Beach	California
Anonymized	ZE Infrastructure	Santa Ana	California
Anonymized	ZE Infrastructure	San Bernardino	California
Anonymized	ZE Infrastructure	Mira Loma	California
Anonymized	ZE Infrastructure	Vernon	California
Anonymized	ZE Infrastructure	Long Beach	California
Anonymized	ZE Infrastructure	Commerce	California
Anonymized	ZE Infrastructure	Compton	California
Anonymized	ZE Infrastructure	Rialto	California
Anonymized	ZE Infrastructure	Los Angeles	California
Anonymized	ZE Infrastructure	Pasadena	California
Anonymized	ZE Infrastructure	Wilmington	California
Anonymized	ZE Infrastructure	Santa Fe Springs	California
Anonymized	ZE Infrastructure	City of Industry	California
Anonymized	ZE Infrastructure	Pico Rivera	California
Anonymized	ZE Infrastructure	Long Beach	California
Anonymized	ZE Infrastructure	Long Beach	California
Anonymized	ZE Infrastructure	San Bernardino	California
Anonymized	ZE Infrastructure	Sun Valley	California
Anonymized	ZE Class 8 Freight Trucks	Walnut, California	California
Anonymized	ZE Infrastructure	Wilmington	California

Anonymized	ZE Infrastructure	Carson	California
Anonymized	ZE Infrastructure	South Gate	California
Anonymized	ZE Infrastructure	Baker, San Bernardino	California
Anonymized	ZE Infrastructure	Barstow, San Bernardino	California
Anonymized	ZE Infrastructure	Los Angeles, Los Angeles (multiple)	California
Anonymized	ZE Infrastructure	Port of Long Beach, Los Angeles	California
Anonymized	ZE Infrastructure	Colton, San Bernardino	California
Anonymized	ZE Infrastructure	Gorman	California
Anonymized	ZE Infrastructure	Palm Springs, Riverside	California
Anonymized	ZE Infrastructure	Anaheim	California
Anonymized	ZE Infrastructure	Compton	California
Anonymized	ZE Infrastructure	Fontana	California
Anonymized	ZE Infrastructure	Gardena	California
Anonymized	ZE Infrastructure	Indio	California
Anonymized	ZE Infrastructure	Jurupa Valley	California
Anonymized	ZE Infrastructure	Long Beach	California
Anonymized	ZE Infrastructure	Palm Springs	California
Anonymized	ZE Infrastructure	Riverside	California
Anonymized	ZE Infrastructure	Vernon	California
Anonymized	ZE Infrastructure & Trucks	Los Angeles	California
Anonymized	ZE Infrastructure & Trucks	Ontario	California
Anonymized	ZE Infrastructure & Trucks	Rancho Dominguez	California
Anonymized	ZE Infrastructure & Trucks	Wilmington	California
Anonymized	ZE Infrastructure & Trucks	Carson	California
Anonymized	ZE Infrastructure & Trucks	Carson	California
Anonymized	ZE Infrastructure & Trucks	Carson	California
Anonymized	ZE Infrastructure & Trucks	Long Beach	California
Anonymized	ZE Infrastructure & Trucks	Carson, CA 90745	California
Anonymized	ZE Infrastructure & Trucks	Long Beach	California
Anonymized	ZE Infrastructure & Trucks		California
Anonymized	ZE Infrastructure	Compton	California
Anonymized	ZE Infrastructure & Trucks	Fullerton	California

Cumulative GHG Emission Reductions (metric tons CO2e)

CPRG Measure	2025-2030	2025-2050
Measure G1: Infrastructure	3,427,178	11,153,463
Measure G2: On-Road Heavy Duty Vehicles	67,391	172,369
Measure G3: Cargo Handling Equipment	61,230	143,567
Measure G4: Locomotives	42,476	300,146
Total	3,598,274	11,769,545

Cumulative GHG Emission Reductions (metric tons CO2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
M1: Charging Infrastructure Deployment	0	137,020	686,402	1,563,727	2,443,082	3,427,178	4,411,274	5,395,370	6,379,466	7,363,562	8,347,658	9,194,734	9,629,448
M2: BE Freight Vehicle Deployment	0	6,955	21,943	36,808	51,577	67,391	83,205	99,019	114,833	130,647	146,461	155,320	156,146
M3: BE CHE Deployment	0	7,179	20,588	33,996	47,405	61,230	75,056	88,881	102,706	116,531	130,357	137,003	137,420
M4: BE Locomotive Pilot	0	0	2,835	15,590	28,345	42,476	56,606	70,737	84,867	98,997	113,128	127,258	141,389
Total	0	151,154	731,766	1,650,121	2,570,408	3,598,274	4,626,140	5,654,006	6,681,872	7,709,738	8,737,603	9,614,315	10,064,403

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
M1: Charging Infrastructure Deployment	9,736,219	9,840,960	9,840,960	9,840,960	9,840,960	9,840,960	9,840,960	10,059,711	10,278,461	10,497,212	10,715,962	10,934,712	11,153,463
M2: BE Freight Vehicle Deployment	157,096	158,140	158,140	158,140	158,140	158,140	158,140	160,512	162,883	165,255	167,626	169,998	172,369
M3: BE CHE Deployment	137,836	138,253	138,253	138,253	138,253	138,253	138,253	139,139	140,024	140,910	141,796	142,681	143,567
M4: BE Locomotive Pilot	155,519	169,650	183,780	197,911	212,041	226,172	240,302	257,355	274,409	288,627	292,925	297,223	300,146
Total	10,186,670	10,307,004	10,321,134	10,335,265	10,349,395	10,363,525	10,377,656	10,616,717	10,855,778	11,092,004	11,318,309	11,544,615	11,769,545

Annual GHG Emission Reductions (metric tons CO2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
M1: Charging Infrastructure Deployment	0	137,020	549,382	877,326	879,354	984,096	984,096	984,096	984,096	984,096	984,096	984,096	984,096
M2: BE Freight Vehicle Deployment	0	6,955	14,987	14,865	14,769	15,814	15,814	15,814	15,814	15,814	15,814	15,814	15,814
M3: BE CHE Deployment	0	7,179	13,409	13,409	13,409	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825
M4: BE Locomotive Pilot	0	0	2,835	12,755	12,755	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130
Total	0	151,154	580,612	918,355	920,287	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
M1: Charging Infrastructure Deployment	984,096	984,096	984,096	984,096	984,096	984,096	984,096	1,202,846	1,202,846	1,202,846	1,202,846	1,202,846	1,202,846
M2: BE Freight Vehicle Deployment	15,814	15,814	15,814	15,814	15,814	15,814	15,814	18,186	18,186	18,186	18,186	18,186	18,186
M3: BE CHE Deployment	13,825	13,825	13,825	13,825	13,825	13,825	13,825	14,711	14,711	14,711	14,711	14,711	14,711
M4: BE Locomotive Pilot	14,130	14,130	14,130	14,130	14,130	14,130	14,130	17,053	17,053	17,053	17,053	17,053	17,053
Total	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,252,796	1,252,796	1,252,796	1,252,796	1,252,796	1,252,796

CAP/HAP Emission Reductions (tons per year)

	2030		
	NOx	PM2.5	DPM
M1: Charging Infrastructure Deployment	1289.4	17.8	18.6
M2: BE Freight Vehicle Deployment	16.7	0.2	0.2
M3: BE CHE Deployment	24.1	1.2	1.1
M4: BE Locomotive Pilot	285.0	9.2	10.0
Total	1,615.2	28.3	29.8

Cumulative GHG Emission Reductions (metric tons CO2e)

CPRG Measure	2025-2030	2025-2050
Measure G1: Infrastructure	3,427,178	11,153,463
Measure G2: On-Road Heavy Duty Vehicles	67,391	172,369
Measure G3: Cargo Handling Equipment	61,230	143,567
Measure G4: Locomotives	42,476	300,146
Total	3,598,274	11,769,545

Cumulative GHG Emission Reductions (metric tons CO2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
M1: Charging Infrastructure Deployment	0	137,020	686,402	1,563,727	2,443,082	3,427,178	4,411,274	5,395,370	6,379,466	7,363,562	8,347,658	9,194,734	9,629,448
M2: BE Freight Vehicle Deployment	0	6,955	21,943	36,808	51,577	67,391	83,205	99,019	114,833	130,647	146,461	155,320	156,146
M2.1: Class 8	0	2,506	8,368	14,242	20,130	26,718	33,307	39,895	46,484	53,073	59,661	63,743	64,470
M2.1: Class 4/5	0	4,449	13,574	22,565	31,447	40,673	49,898	59,123	68,349	77,574	86,800	91,576	91,676
M3: BE CHE Deployment	0	7,179	20,588	33,996	47,405	61,230	75,056	88,881	102,706	116,531	130,357	137,003	137,420
M4: BE Locomotive Pilot	0	0	2,835	15,590	28,345	42,476	56,606	70,737	84,867	98,997	113,128	127,258	141,389
Total	0	151,154	731,766	1,650,121	2,570,408	3,598,274	4,626,140	5,654,006	6,681,872	7,709,738	8,737,603	9,614,315	10,064,403

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
M1: Charging Infrastructure Deployment	9,736,219	9,840,960	9,840,960	9,840,960	9,840,960	9,840,960	9,840,960	10,059,711	10,278,461	10,497,212	10,715,962	10,934,712	11,153,463
M2: BE Freight Vehicle Deployment	157,096	158,140	158,140	158,140	158,140	158,140	158,140	160,512	162,883	165,255	167,626	169,998	172,369
M2.1: Class 8	65,185	65,886	65,886	65,886	65,886	65,886	65,886	67,351	68,815	70,280	71,744	73,209	74,673
M2.1: Class 4/5	91,911	92,254	92,254	92,254	92,254	92,254	92,254	93,161	94,068	94,975	95,882	96,789	97,696
M3: BE CHE Deployment	137,836	138,253	138,253	138,253	138,253	138,253	138,253	139,139	140,024	140,910	141,796	142,681	143,567
M4: BE Locomotive Pilot	155,519	169,650	183,780	197,911	212,041	226,172	240,302	257,355	274,409	288,627	292,925	297,223	300,146
Total	10,186,670	10,307,004	10,321,134	10,335,265	10,349,395	10,363,525	10,377,656	10,616,717	10,855,778	11,092,004	11,318,309	11,544,615	11,769,545

Annual GHG Emission Reductions (metric tons CO2e)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
M1: Charging Infrastructure Deployment	0	137,020	549,382	877,326	879,354	984,096	984,096	984,096	984,096	984,096	984,096	984,096	984,096
M2: BE Freight Vehicle Deployment	0	6,955	14,987	14,865	14,769	15,814	15,814	15,814	15,814	15,814	15,814	15,814	15,814
M2.1: Class 8	0	2,506	5,862	5,874	5,887	6,589	6,589	6,589	6,589	6,589	6,589	6,589	6,589
M2.1: Class 4/5	0	4,449	9,125	8,991	8,882	9,225	9,225	9,225	9,225	9,225	9,225	9,225	9,225
M3: BE CHE Deployment	0	7,179	13,409	13,409	13,409	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825
M4: BE Locomotive Pilot	0	0	2,835	12,755	12,755	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130
Total	0	151,154	580,612	918,355	920,287	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
M1: Charging Infrastructure Deployment	984,096	984,096	984,096	984,096	984,096	984,096	984,096	1,202,846	1,202,846	1,202,846	1,202,846	1,202,846	1,202,846
M2: BE Freight Vehicle Deployment	15,814	15,814	15,814	15,814	15,814	15,814	15,814	18,186	18,186	18,186	18,186	18,186	18,186
M2.1: Class 8	6,589	6,589	6,589	6,589	6,589	6,589	6,589	8,053	8,053	8,053	8,053	8,053	8,053
M2.1: Class 4/5	9,225	9,225	9,225	9,225	9,225	9,225	9,225	10,132	10,132	10,132	10,132	10,132	10,132
M3: BE CHE Deployment	13,825	13,825	13,825	13,825	13,825	13,825	13,825	14,711	14,711	14,711	14,711	14,711	14,711
M4: BE Locomotive Pilot	14,130	14,130	14,130	14,130	14,130	14,130	14,130	17,053	17,053	17,053	17,053	17,053	17,053
Total	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,027,866	1,252,796	1,252,796	1,252,796	1,252,796	1,252,796	1,252,796

CAP/HAP Emission Reductions (tons per year)

	2030		
	NOx	PM2.5	DPM
M1: Charging Infrastructure Deployment	1289.4	17.8	18.6
M2: BE Freight Vehicle Deployment	16.7	0.2	0.2
M2.1: Class 8	9.5	0.1	0.1
M2.1: Class 4/5	7.2	0.0	0.0
M3: BE CHE Deployment	24.1	1.2	1.1
M4: BE Locomotive Pilot	285.0	9.2	10.0
Total	1,632.0	28.5	30.0

Number of ZE Units

Measure M1: Charging Infrastructure	2025	2026	2027	2028	2029	2030
Number of Chargers per Year	0	480	480	60	0	0
Cumulative Number of Chargers	0	480	960	1,020	1,020	1,020

Measure M2: BE Freight Vehicle Deployment	2025	2026	2027	2028	2029	2030
Number of Class 8 Diesel Trucks per Year	0	30	40	0	0	0
Cumulative Number of Class 8 Diesel Trucks	0	30	70	70	70	70
Number of Class 4 Diesel Trucks per Year	0	179	194	0	0	0
Cumulative Number of Class 8 Diesel Trucks	0	179	373	373	373	373
Number of Class 5 Diesel Trucks per Year	0	179	194	0	0	0
Cumulative Number of Class 8 Diesel Trucks	0	179	373	373	373	373

Measure M3: BE Cargo Handling Equipment Deployment	2025	2026	2027	2028	2029	2030
Number of Yard Tractors per Year	0	18	16	0	0	0
Cumulative Number of Yard Tractors	0	18	34	34	34	34
Number of Top Handlers per Year	0	14	12	0	0	0
Number of Top Handlers per Year	0	14	26	26	26	26

Measure M4: BE Locomotives Pilot	2025	2026	2027	2028	2029	2030
Number of Switcher Locomotives Per Year	0	0	4	14	0	0
Cumulative Number of Switcher Locomotives	0	0	4	18	18	18

Measure M1: Infrastructure (Assuming chargers for Class 8 HD Trucks)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
New Charger Counts (1)	0	480	480	60	0	0							
Cumulative Charger Counts	0	480	960	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020
Projected max charging power (KW)		120,000	240,000	255,000	255,000	255,000	255,000	255,000	255,000	255,000	255,000	255,000	255,000
Charging utilization rate (2)		20%	40%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
Projected annual energy consumption (KWh/year) (3)		179,712,000	718,848,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000
Projected ZET mileages (miles/year) (4)		89,856,000	359,424,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000
Projected electricity generation (MWh/year) (5)		222,788	891,152	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274
Projected number of trucks (6)		1,640	6,560	10,455	10,455	10,455	10,455	10,455	10,455	10,455	10,455	10,455	10,455

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
New Charger Counts (1)													
Cumulative Charger Counts	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020
Projected max charging power (KW)	255,000	255,000	255,000	255,000	255,000	255,000	255,000	255,000	255,000	255,000	255,000	255,000	255,000
Charging utilization rate (2)	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
Projected annual energy consumption (KWh/year) (3)	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000	1,145,664,000
Projected ZET mileages (miles/year) (4)	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000	572,832,000
Projected electricity generation (MWh/year) (5)	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274	1,420,274
Projected number of trucks (6)	10,455	10,455	10,455	10,455	10,455	10,455	10,455	10,455	10,455	10,455	10,455	10,455	10,455

(1) Assuming 250 KW Chargers
(2) Conservative assumptions for charger utilization per year
(3) 24 hours per day, 312 days per year truck operation (EMFAC2021 assumption)
(4) Based on 2 KWh/mile for ZET
(5) Includes charging efficiency and grid loss
(6) Based on average 54,788 miles per year

GHG Emissions from Electricity Generation

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
CO2 (metric tons)		50,266	201,062	320,443	320,443	217,526	217,526	217,526	217,526	217,526	217,526	217,526	217,526
CH4 (metric tons)		3.03	12.13	19.33	19.33	19.33	19.33	19.33	19.33	19.33	19.33	19.33	19.33
N20 (metric tons)		0.40	1.62	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
CO2e (metric tons		50,458	201,830	321,667	321,667	218,750	218,750	218,750	218,750	218,750	218,750	218,750	218,750
Cumulative CO2e (metric tons)		50,458	252,288	573,955	895,622	1,114,373	1,333,123	1,551,874	1,770,624	1,989,374	2,208,125	2,426,875	2,645,626
Cumulative CO2e with project life (metric tons)	0	50,458	252,288	573,955	895,622	1,114,373	1,333,123	1,551,874	1,770,624	1,989,374	2,208,125	2,376,418	2,393,338

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2 (metric tons)	217,526	217,526	217,526	217,526	217,526	217,526	217,526	-	-	-	-	-	-
CH4 (metric tons)	19.33	19.33	19.33	19.33	19.33	19.33	19.33	-	-	-	-	-	-
N20 (metric tons)	2.58	2.58	2.58	2.58	2.58	2.58	2.58	-	-	-	-	-	-
CO2e (metric tons	218,750	218,750	218,750	218,750	218,750	218,750	218,750	-	-	-	-	-	-
Cumulative CO2e (metric tons)	2,864,376	3,083,127	3,301,877	3,520,627	3,739,378	3,958,128	4,176,879	4,176,879	4,176,879	4,176,879	4,176,879	4,176,879	4,176,879
Cumulative CO2e with project life (metric tons)	2,290,421	2,187,504	2,187,504	2,187,504	2,187,504	2,187,504	2,187,504	1,968,754	1,750,003	1,531,253	1,312,503	1,093,752	875,002

GHG Emission Reductions from Diesel Trucks

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
CO2 (metric tons)		146,018	584,653	932,494	933,446	934,284	934,284	934,284	934,284	934,284	934,284	934,284	934,284
CH4 (metric tons)		0.16	0.64	1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
N20 (metric tons)		23.01	92.11	146.91	147.06	147.20	147.20	147.20	147.20	147.20	147.20	147.20	147.20
CO2e (metric tons		152,119	609,081	971,455	972,447	973,319	973,319	973,319	973,319	973,319	973,319	973,319	973,319
Cumulative CO2e (metric tons)		152,119	761,200	1,732,655	2,705,102	3,678,421	4,651,740	5,625,059	6,598,378	7,571,697	8,545,016	9,518,336	10,491,655
Cumulative CO2e with project life (metric tons)	0	152,119	761,200	1,732,655	2,705,102	3,678,421	4,651,740	5,625,059	6,598,378	7,571,697	8,545,016	9,366,216	9,730,454

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2 (metric tons)	934,284	934,284	934,284	934,284	934,284	934,284	934,284	934,284	934,284	934,284	934,284	934,284	934,284
CH4 (metric tons)	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
N20 (metric tons)	147.20	147.20	147.20	147.20	147.20	147.20	147.20	147.20	147.20	147.20	147.20	147.20	147.20
CO2e (metric tons	973,319	973,319	973,319	973,319	973,319	973,319	973,319	973,319	973,319	973,319	973,319	973,319	973,319
Cumulative CO2e (metric tons)	11,464,974	12,438,293	13,411,612	14,384,931	15,358,250	16,331,569	17,304,888	18,278,207	19,251,527	20,224,846	21,198,165	22,171,484	23,144,803
Cumulative CO2e with project life (metric tons)	9,732,319	9,733,191	9,733,191	9,733,191	9,733,191	9,733,191	9,733,191	9,733,191	9,733,191	9,733,191	9,733,191	9,733,191	9,733,191

Upstream GHG Emission Reductions from Diesel Fuel Production and Refining

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
CO2e (metric tons)	0	35,358	142,131	227,538	228,575	229,527	229,527	229,527	229,527	229,527	229,527	229,527	229,527
Cumulative CO2e (metric tons)	0	35,358	177,489	405,027	633,602	863,129	1,092,657	1,322,184	1,551,711	1,781,239	2,010,766	2,240,294	2,469,821
Cumulative CO2e with Project Life (metric tons)	0	35,358	177,489	405,027	633,602	863,129	1,092,657	1,322,184	1,551,711	1,781,239	2,010,766	2,204,935	2,292,332

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2e (metric tons)	229,527	229,527	229,527	229,527	229,527	229,527	229,527	229,527	229,527	229,527	229,527	229,527	229,527
Cumulative CO2e (metric tons)	2,699,348	2,928,876	3,158,403	3,387,930	3,617,458	3,846,985	4,076,512	4,306,040	4,535,567	4,765,095	4,994,622	5,224,149	5,453,677
Cumulative CO2e with Project Life (metric tons)	2,294,321	2,295,274	2,295,274	2,295,274	2,295,274	2,295,274	2,295,274	2,295,274	2,295,274	2,295,274	2,295,274	2,295,274	2,295,274

Net GHG Emission Reductions from Chargers

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual CO2e Reductions (metric tons)	0	137,020	549,382	877,326	879,354	984,096	984,096	984,096	984,096	984,096	984,096	984,096	984,096
Cumulative CO2e Reductions (metric tons) (with project life)	0	137,020	686,402	1,563,727	2,443,082	3,427,178	4,411,274	5,395,370	6,379,466	7,363,562	8,347,658	9,194,734	9,629,448
Cumulative CO2e Reductions (metric tons) (without project life)	0	137,020	686,402	1,563,727	2,443,082	3,427,178	4,411,274	5,395,370	6,379,466	7,363,562	8,347,658	9,331,754	10,315,850

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual CO2e Reductions (metric tons)	984,096	984,096	984,096	984,096	984,096	984,096	984,096	1,202,846	1,202,846	1,202,846	1,202,846	1,202,846	1,202,846
Cumulative CO2e Reductions (metric tons) (with project life)	9,736,219	9,840,960	9,840,960	9,840,960	9,840,960	9,840,960	9,840,960	10,059,711	10,278,461	10,497,212	10,715,962	10,934,712	11,153,463
Cumulative CO2e Reductions (metric tons) (without project life)	11,299,946	12,284,042	13,268,138	14,252,234	15,236,330	16,220,426	17,204,522	18,407,369	19,610,215	20,813,062	22,015,908	23,218,754	24,421,601

CAP/HAP Emission Reductions from Diesel Trucks

	2030
NOx (tons/year)	1,289.4
PM2.5 (tons/year)	17.8
DPM (tons/year)	18.6

Input Parameters

Charger Power (KW)	**250**

Class 8 Heavy Heavy Duty Trucks Emission Factors	2025	2026	2027	2028	2029	2030+
Annual Miles per Truck (1)	54,788	54,788	54,788	54,788	54,788	54,788
Average Miles per Gallon of Diesel (2)	5.95	5.92	5.89	5.87	5.84	5.82
Running Exhaust CO2 (g/mile) (2)	1,573.1	1,574.4	1,576.1	1,577.4	1,579.1	1,580.7
Running Exhaust CH4 (g/mile) (2)	0.0009	0.0009	0.0009	0.0009	0.0009	0.0008
Running Exhaust N2O (g/mile) (2)	0.2478	0.2480	0.2483	0.2485	0.2488	0.2490
Idling CO2 (g/truck/day) (2)	8,905.5	8,895.6	8,882.6	8,865.4	8,846.8	8,832.4
Idling CH4 (g/truck/day) (2)	0.1605	0.1605	0.1605	0.1605	0.1605	0.1605
Idling N2O (g/truck/day) (2)	1.4031	1.4015	1.3995	1.3967	1.3938	1.3915

(1) Average Annual Miles from Prop 1B Projects
(2) EMFAC2021, T7 Tractor Class 8 Category, 2010 to 2017 Model Year
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

ZE Truck Energy Consumption (5)	2
(kWh/mile)	

(5) Volvo Electric Trucks, https://www.volvotrucks.us/trucks/vnr-electric/

Charging Efficiency (6)	85%
Transmission and Distribution Grid Loss (7)	5.1%

(6) Argonne National Laboratory, Well to Wheels Analysis of
Energy Use and Greenhouse Gas Emissions of PHEV, 2010
Well-To-Wheels Energy and Greenhouse Gas Analysis of Plug-In Hybrid Electric Vehicles
(7) U.S. EPA's eGrid, Western Power Grid
https://www.epa.gov/egrid/frequent-questions-about-egrid#What%20is%20Grid%20Gross%20Loss

Electricity Generation Emission Factors (lbs/MWh)

GHG	CO2	CH4	N2O
GHG Emission Factors for Years 2025-2029 (8)	497.4	0.03	0.004
GHG Emission Factors for Years 2030-2044 (9)	337.7	0.03	0.004
GHG Emission Factors for Years 2045+ (9)	0	0	0

(8) EPA's 2024 GHG Emission Factor HUB
(Table 6 for Electricity, CAMX WECC California Subregion)
https://www.epa.gov/climateleadership/ghg-emission-factors-hub
(9) Average of emission factors for utilities in Los Angeles and Orange Counties reflecting CA's Renewable Portfolio Standard Program
Priority Climate Action Plan - The Los Angeles-Long Beach-Anaheim, CA Metropolitan Statistical Area, March 2024 (Table B.18)

GHG	CO2	CH4	N2O
GHG Global Warming Potential (10)	1	28	265

(10) CPRG Program Implementation Grants - General Competition Notice of Funding Opportunity, Appendix E
https://www.epa.gov/system/files/documents/2024-01/cprg-general-competition-correction.pdf

Criteria Air Pollutants (CAP)/Hazardous Air Pollutants	2030		
(HAP) Emission Factors	NOx	PM2.5	DPM
Class 8 Trucks Running Exhaust (g/mile) (11)	2.02	0.031	0.032
Class 8 Trucks Idling (g/truck/day) (11)	41.21	0.014	0.015

(11) EMFAC2021, T7 Tractor Class 8 Category, 2010 to 2017 Model Year Diesel Truck
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

Diesel Fuel Production and Refining Emission Factor (15)	18
(Kg/MMBtu)	

(15) https://www.epa.gov/fuels-registration-reporting-and-compliance-help/lifecycle-greenhouse-gas-results
https://www.epa.gov/sites/default/files/2016-07/documents/select-ghg-results-table-v1.pdf

Diesel Fuel Heat Content LHV (Btu/gal) (16)	129,488

(16) AFLEET Tool 2023

Project Life (years) (12)	10

(12) Assumed charger life

Measure M2: On-Road Heavy Duty Vehicles (ZE Class 4, 5, and 8 Trucks)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Number of Class 8 Diesel Trucks per Year	0	30	40	0	0	0							
Cumulative Number of Class 8 Diesel Trucks		30	70	70	70	70	70	70	70	70	70	70	70
Number of Class 4 Diesel Trucks per Year	0	179	194	0	0	0							
Cumulative Number of Class 8 Diesel Trucks		179	373	373	373	373	373	373	373	373	373	373	373
Number of Class 5 Diesel Trucks per Year	0	179	194	0	0	0							
Cumulative Number of Class 8 Diesel Trucks		179	373	373	373	373	373	373	373	373	373	373	373

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Number of Class 8 Diesel Trucks per Year													
Cumulative Number of Class 8 Diesel Trucks	70	70	70	70	70	70	70	70	70	70	70	70	70
Number of Class 4 Diesel Trucks per Year													
Cumulative Number of Class 8 Diesel Trucks	373	373	373	373	373	373	373	373	373	373	373	373	373
Number of Class 5 Diesel Trucks per Year													
Cumulative Number of Class 8 Diesel Trucks	373	373	373	373	373	373	373	373	373	373	373	373	373

Input Parameters

Class 8 Heavy Heavy Duty Trucks Emission Factors	2025	2026	2027	2028	2029	2030+
Annual Miles per Truck (1)	54,788	54,788	54,788	54,788	54,788	54,788
Average Miles per Gallon of Diesel (2)	5.95	5.92	5.89	5.87	5.84	5.82
Running Exhaust CO2 (g/mile) (2)	1,573.1	1,574.4	1,576.1	1,577.4	1,579.1	1,580.7
Running Exhaust CH4 (g/mile) (2)	0.0009	0.0009	0.0009	0.0009	0.0009	0.0008
Running Exhaust N2O (g/mile) (2)	0.2478	0.2480	0.2483	0.2485	0.2488	0.2490
Idling CO2 (g/truck/day) (2)	8,905.5	8,895.6	8,882.6	8,865.4	8,846.8	8,832.4
Idling CH4 (g/truck/day) (2)	0.1605	0.1605	0.1605	0.1605	0.1605	0.1605
Idling N2O (g/truck/day) (2)	1.4031	1.4015	1.3995	1.3967	1.3938	1.3915

(1) Average Annual Miles from Prop 1B Projects
(2) EMFAC2021, T7 Tractor Class 8 Category, 2010 to 2017 Model Years
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

Class 4 Medium Heavy Duty Trucks Emission Factors	2025	2026	2027	2028	2029	2030+
Annual Miles per Truck (3)	9,860	9,649	9,465	9,310	9,183	9,085
Average Miles per Gallon of Diesel (3)	8.77	8.75	8.72	8.71	8.69	8.68
Running Exhaust CO2 (g/mile) (3)	1,090.9	1,092.3	1,094.7	1,095.8	1,096.7	1,097.7
Running Exhaust CH4 (g/mile) (3)	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Running Exhaust N2O (g/mile) (3)	0.1719	0.1721	0.1725	0.1726	0.1728	0.1729
Idling CO2 (g/truck/day) (3)	2,110.0	2,109.0	2,107.9	2,106.8	2,105.6	2,104.4
Idling CH4 (g/truck/day) (3)	0.0077	0.0077	0.0077	0.0077	0.0077	0.0077
Idling N2O (g/truck/day) (3)	0.3324	0.3323	0.3321	0.3319	0.3317	0.3315

(3) EMFAC2021, T6 Instate Delivery Class 4 Category, 2010 to 2017 Model Years
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

Class 5 Medium Heavy Duty Trucks Emission Factors	2025	2026	2027	2028	2029	2030+
Annual Miles per Truck (4)	9,913	9,696	9,507	9,345	9,212	9,106
Average Miles per Gallon of Diesel (4)	8.70	8.68	8.65	8.64	8.63	8.61
Running Exhaust CO2 (g/mile) (4)	1,101.3	1,102.5	1,104.8	1,105.7	1,106.5	1,107.5
Running Exhaust CH4 (g/mile) (4)	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Running Exhaust N2O (g/mile) (4)	0.1735	0.1737	0.1741	0.1742	0.1743	0.1745
Idling CO2 (g/truck/day) (4)	2,099.4	2,098.2	2,097.2	2,096.0	2,094.8	2,093.4
Idling CH4 (g/truck/day) (4)	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078
Idling N2O (g/truck/day) (4)	0.3308	0.3306	0.3304	0.3302	0.3300	0.3298

(4) EMFAC2021, T6 Instate Delivery Class 5 Category, 2010 to 2017 Model Years
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

	Class 8	Class 4 & 5
ZE Truck Energy Consumption (5)	2	0.7
(kWh/mile)		

(5) Volvo Electric Trucks, https://www.volvotrucks.us/trucks/vnr-electric/
180124hdbevefficiency.pdf (ca.gov)

Charging Efficiency (6)	85%
Transmission and Distribution Grid Loss (7)	5.1%

(6) Argonne National Laboratory, Well to Wheels Analysis of
Energy Use and Greenhouse Gas Emissions of PHEV, 2010
Well-To-Wheels Energy and Greenhouse Gas Analysis of Plug-In Hybrid Electric Vehicles
(7) U.S. EPA's eGrid, Western Power Grid
https://www.epa.gov/egrid/frequent-questions-about-egrid#What%20is%20Grid%20Gross%20Loss

Electricity Generation Emission Factors (lbs/MWh)

GHG	CO2	CH4	N2O
GHG Emission Factors for Years 2025-2029 (8)	497.4	0.03	0.004
GHG Emission Factors for Years 2030-2044 (9)	337.7	0.03	0.004
GHG Emission Factors for Years 2045+ (9)	0	0	0

(8) EPA's 2024 GHG Emission Factor HUB
(Table 6 for Electricity, CAMX WECC California Subregion)
https://www.epa.gov/climateleadership/ghg-emission-factors-hub
(9) Average of emission factors for utilities in Los Angeles and Orange Counties reflecting CA's Renewable Portfolio Standard Program
Priority Climate Action Plan - The Los Angeles-Long Beach-Anaheim, CA Metropolitan Statistical Area, March 2024 (Table B.18)

GHG	CO2	CH4	N2O
GHG Global Warming Potential (10)	1	28	265

(10) CPRG Program Implementation Grants - General Competition Notice of Funding Opportunity, Appendix B
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Criteria Air Pollutants (CAP)/Hazardous Air Pollutants (HAP)	2030		
Emission Factors	NOx	PM2.5	DPM
Class 8 Trucks Running Exhaust (g/mile) (11)	2.02	0.031	0.032
Class 8 Trucks Idling (g/truck/day) (11)	41.21	0.014	0.015
Class 4 Trucks Running Exhaust (g/mile) (12)	0.67	0.005	0.006
Class 4 Trucks Idling (g/truck/day) (12)	9.67	0.002	0.002
Class 5 Trucks Running Exhaust (g/mile) (13)	0.60	0.005	0.005
Class 5 Trucks Idling (g/truck/day) (13)	9.68	0.002	0.002

(11) EMFAC2021, T7 Tractor Class 8 Category, 2010 to 2017 Model Year Diesel Trucks
(12) EMFAC2021, T6 Public Class 4 Category, 2010 to 2017 Model Year Diesel Trucks
(13) EMFAC2021, T6 Public Class 5 Category, 2010 to 2017 Model Year Diesel Trucks
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

Diesel Fuel Production and Refining Emission Factor (15)	18
(Kg/MMBtu)	

(15) https://www.epa.gov/fuels-registration-reporting-and-compliance-help/lifecycle-greenhouse-gas-results
https://www.epa.gov/sites/default/files/2016-07/documents/select-ghg-results-table-v1.pdf

Diesel Fuel Heat Content LHV (Btu/gal) (16)	129,488

(16) AFLEET Tool 2023

Project Life (years) (17)	10

(17) Assumed vehicle life

GHG Emission Reductions from Diesel Class 4, 5 and 8 Trucks

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
CO2 (metric tons)	0	6,706	14,510	14,392	14,297	14,225	14,225	14,225	14,225	14,225	14,225	14,225	14,225
CH4 (metric tons)	0	0.0049	0.0109	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108
N2O (metric tons)	0	1.057	2.286	2.267	2.252	2.241	2.241	2.241	2.241	2.241	2.241	2.241	2.241
CO2e (metric tons)	0	6,986	15,117	14,993	14,894	14,820	14,820	14,820	14,820	14,820	14,820	14,820	14,820
Cumulative CO2e (metric tons)	0	6,986	22,103	37,095	51,989	66,809	81,628	96,448	111,268	126,087	140,907	155,726	170,546
Cumulative CO2e with Project Life (metric tons)	0	6,986	22,103	37,095	51,989	66,809	81,628	96,448	111,268	126,087	140,907	148,740	148,443

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2 (metric tons)	14,225	14,225	14,225	14,225	14,225	14,225	14,225	14,225	14,225	14,225	14,225	14,225	14,225
CH4 (metric tons)	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108	0.0108
N2O (metric tons)	2.241	2.241	2.241	2.241	2.241	2.241	2.241	2.241	2.241	2.241	2.241	2.241	2.241
CO2e (metric tons)	14,820	14,820	14,820	14,820	14,820	14,820	14,820	14,820	14,820	14,820	14,820	14,820	14,820
Cumulative CO2e (metric tons)	185,366	200,185	215,005	229,824	244,644	259,464	274,283	289,103	303,922	318,742	333,562	348,381	363,201
Cumulative CO2e with Project Life (metric tons)	148,270	148,196	148,196	148,196	148,196	148,196	148,196	148,196	148,196	148,196	148,196	148,196	148,196

Upstream GHG Emission Reductions from Diesel Fuel Production and Refining

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
CO2e (metric tons)	0	1,573	3,415	3,393	3,377	3,366	3,366	3,366	3,366	3,366	3,366	3,366	3,366
Cumulative CO2e (metric tons)	0	1,573	4,988	8,381	11,759	15,125	18,490	21,856	25,222	28,588	31,954	35,320	38,686
Cumulative CO2e with Project Life (metric tons)	0	1,573	4,988	8,381	11,759	15,125	18,490	21,856	25,222	28,588	31,954	33,747	33,698

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2e (metric tons)	3,366	3,366	3,366	3,366	3,366	3,366	3,366	3,366	3,366	3,366	3,366	3,366	3,366
Cumulative CO2e (metric tons)	42,052	45,418	48,784	52,150	55,516	58,882	62,248	65,613	68,979	72,345	75,711	79,077	82,443
Cumulative CO2e with Project Life (metric tons)	33,671	33,659	33,659	33,659	33,659	33,659	33,659	33,659	33,659	33,659	33,659	33,659	33,659

GHG Emissions from ZE Class 4, 5 and 8 Trucks

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual MWh	0	7,080	15,650	15,547	15,463	15,397	15,397	15,397	15,397	15,397	15,397	15,397	15,397
CO2 (metric tons)	0	1,597	3,531	3,508	3,489	2,358	2,358	2,358	2,358	2,358	2,358	2,358	2,358
CH4 (metric tons)	0	0.096	0.213	0.212	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
N2O (metric tons)	0	0.013	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
CO2e (metric tons)	0	1,604	3,544	3,521	3,502	2,371	2,371	2,371	2,371	2,371	2,371	2,371	2,371
Cumulative CO2e (metric tons)	0	1,604	5,148	8,669	12,171	14,543	16,914	19,286	21,657	24,029	26,400	28,772	31,143
Cumulative CO2e with Project Life (metric tons)	0	1,604	5,148	8,669	12,171	14,543	16,914	19,286	21,657	24,029	26,400	27,168	25,995

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual MWh	15,397	15,397	15,397	15,397	15,397	15,397	15,397	15,397	15,397	15,397	15,397	15,397	15,397
CO2 (metric tons)	2,358	2,358	2,358	2,358	2,358	2,358	2,358	0	0	0	0	0	0
CH4 (metric tons)	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.000	0.000	0.000	0.000	0.000	0.000
N2O (metric tons)	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.000	0.000	0.000	0.000	0.000	0.000
CO2e (metric tons)	2,371	2,371	2,371	2,371	2,371	2,371	2,371	0	0	0	0	0	0
Cumulative CO2e (metric tons)	33,515	35,886	38,258	40,629	43,001	45,372	47,743	47,743	47,743	47,743	47,743	47,743	47,743
Cumulative CO2e with Project Life (metric tons)	24,845	23,715	23,715	23,715	23,715	23,715	23,715	21,343	18,972	16,600	14,229	11,857	9,486

Net GHG Emission Reductions for ZE Class 4,5, and 8 Trucks

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual CO2e Reductions (metric tons)	0	6,955	14,987	14,865	14,769	15,814	15,814	15,814	15,814	15,814	15,814	15,814	15,814
Cumulative CO2e Reductions (metric Tons)	0	6,955	21,943	36,808	51,577	67,391	83,205	99,019	114,833	130,647	146,461	155,320	156,146

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual CO2e Reductions (metric tons)	15,814	15,814	15,814	15,814	15,814	15,814	15,814	18,186	18,186	18,186	18,186	18,186	18,186
Cumulative CO2e Reductions (metric Tons)	157,096	158,140	158,140	158,140	158,140	158,140	158,140	160,512	162,883	165,255	167,626	169,998	172,369

CAP/HAP Emission Reductions from Diesel Class 4, 5, 8 Trucks

	2030
NOx (tons/year)	16.7
PM2.5 (tons/year)	0.17
DPM (tons/year)	0.18

Measure M2: On-Road Heavy Duty Vehicles (ZE Class 8 Trucks)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Number of Class 8 Diesel Trucks per Year	0	30	40	0	0	0							
Cumulative Number of Class 8 Diesel Trucks		30	70	70	70	70	70	70	70	70	70	70	70
Number of Class 4 Diesel Trucks per Year	0	0	0	0	0	0							
Cumulative Number of Class 8 Diesel Trucks		0	0	0	0	0	0	0	0	0	0	0	0
Number of Class 5 Diesel Trucks per Year	0	0	0	0	0	0							
Cumulative Number of Class 8 Diesel Trucks		0	0	0	0	0	0	0	0	0	0	0	0

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Number of Class 8 Diesel Trucks per Year													
Cumulative Number of Class 8 Diesel Trucks	70	70	70	70	70	70	70	70	70	70	70	70	70
Number of Class 4 Diesel Trucks per Year													
Cumulative Number of Class 8 Diesel Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Class 5 Diesel Trucks per Year													
Cumulative Number of Class 8 Diesel Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0

Input Parameters

Class 8 Heavy Heavy Duty Trucks Emission Factors	2025	2026	2027	2028	2029	2030+
Annual Miles per Truck (1)	54,788	54,788	54,788	54,788	54,788	54,788
Average Miles per Gallon of Diesel (2)	5.95	5.92	5.89	5.87	5.84	5.82
Running Exhaust CO2 (g/mile) (2)	1,573.1	1,574.4	1,576.1	1,577.4	1,579.1	1,580.7
Running Exhaust CH4 (g/mile) (2)	0.0009	0.0009	0.0009	0.0009	0.0009	0.0008
Running Exhaust N2O (g/mile) (2)	0.2478	0.2480	0.2483	0.2485	0.2488	0.2490
Idling CO2 (g/truck/day) (2)	8,905.5	8,895.6	8,882.6	8,865.4	8,846.8	8,832.4
Idling CH4 (g/truck/day) (2)	0.1605	0.1605	0.1605	0.1605	0.1605	0.1605
Idling N2O (g/truck/day) (2)	1.4031	1.4015	1.3995	1.3967	1.3938	1.3915

(1) Average Annual Miles from Prop 1B Projects
(2) EMFAC2021, T7 Tractor Class 8 Category, 2010 to 2017 Model Years
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

Class 4 Medium Heavy Duty Trucks Emission Factors	2025	2026	2027	2028	2029	2030+
Annual Miles per Truck (3)	9,860	9,649	9,465	9,310	9,183	9,085
Average Miles per Gallon of Diesel (3)	8.77	8.75	8.72	8.71	8.69	8.68
Running Exhaust CO2 (g/mile) (3)	1,090.9	1,092.3	1,094.7	1,095.8	1,096.7	1,097.7
Running Exhaust CH4 (g/mile) (3)	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Running Exhaust N2O (g/mile) (3)	0.1719	0.1721	0.1725	0.1726	0.1728	0.1729
Idling CO2 (g/truck/day) (3)	2,110.0	2,109.0	2,107.9	2,106.8	2,105.6	2,104.4
Idling CH4 (g/truck/day) (3)	0.0077	0.0077	0.0077	0.0077	0.0077	0.0077
Idling N2O (g/truck/day) (3)	0.3324	0.3323	0.3321	0.3319	0.3317	0.3315

(3) EMFAC2021, T6 Instate Delivery Class 4 Category, 2010 to 2017 Model Years
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Class 5 Medium Heavy Duty Trucks Emission Factors	2025	2026	2027	2028	2029	2030+
Annual Miles per Truck (4)	9,913	9,696	9,507	9,345	9,212	9,106
Average Miles per Gallon of Diesel (4)	8.70	8.68	8.65	8.64	8.63	8.61
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(kWh/mile)		

(5) Volvo Electric Trucks, https://www.volvotrucks.us/trucks/vnr-electric/
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Charging Efficiency (6)	85%
Transmission and Distribution Grid Loss (7)	5.1%

(6) Argonne National Laboratory, Well to Wheels Analysis of
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GHG Emission Factors for Years 2045+ (9)	0	0	0

(8) EPA's 2024 GHG Emission Factor HUB
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(11) EMFAC2021, T7 Tractor Class 8 Category, 2010 to 2017 Model Year Diesel Trucks
(12) EMFAC2021, T6 Public Class 4 Category, 2010 to 2017 Model Year Diesel Trucks
(13) EMFAC2021, T6 Public Class 5 Category, 2010 to 2017 Model Year Diesel Trucks
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Diesel Fuel Production and Refining Emission Factor (15)	18
(Kg/MMBtu)	

(15) https://www.epa.gov/fuels-registration-reporting-and-compliance-help/lifecycle-greenhouse-gas-results
https://www.epa.gov/sites/default/files/2016-07/documents/select-ghg-results-table-v1.pdf

Diesel Fuel Heat Content LHV (Btu/gal) (16)	129,488

(16) AFLEET Tool 2023

Project Life (years) (17)	10

(17) Assumed vehicle life

GHG Emission Reductions from Diesel Class 4, 5 and 8 Trucks

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
CO2 (metric tons)	0	2,671	6,238	6,243	6,250	6,255	6,255	6,255	6,255	6,255	6,255	6,255	6,255
CH4 (metric tons)	0	0.0030	0.0069	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068
N2O (metric tons)	0	0.421	0.983	0.984	0.985	0.985	0.985	0.985	0.985	0.985	0.985	0.985	0.985
CO2e (metric tons)	0	2,783	6,499	6,504	6,511	6,516	6,516	6,516	6,516	6,516	6,516	6,516	6,516
Cumulative CO2e (metric tons)	0	2,783	9,282	15,786	22,296	28,813	35,329	41,846	48,362	54,878	61,395	67,911	74,428
Cumulative CO2e with Project Life (metric tons)	0	2,783	9,282	15,786	22,296	28,813	35,329	41,846	48,362	54,878	61,395	65,129	65,146

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2 (metric tons)	6,255	6,255	6,255	6,255	6,255	6,255	6,255	6,255	6,255	6,255	6,255	6,255	6,255
CH4 (metric tons)	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068	0.0068
N2O (metric tons)	0.985	0.985	0.985	0.985	0.985	0.985	0.985	0.985	0.985	0.985	0.985	0.985	0.985
CO2e (metric tons)	6,516	6,516	6,516	6,516	6,516	6,516	6,516	6,516	6,516	6,516	6,516	6,516	6,516
Cumulative CO2e (metric tons)	80,944	87,461	93,977	100,494	107,010	113,527	120,043	126,560	133,076	139,592	146,109	152,625	159,142
Cumulative CO2e with Project Life (metric tons)	65,159	65,165	65,165	65,165	65,165	65,165	65,165	65,165	65,165	65,165	65,165	65,165	65,165

Upstream GHG Emission Reductions from Diesel Fuel Production and Refining

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
CO2e (metric tons)	0	647	1,517	1,523	1,530	1,537	1,537	1,537	1,537	1,537	1,537	1,537	1,537
Cumulative CO2e (metric tons)	0	647	2,163	3,687	5,217	6,754	8,290	9,827	11,364	12,901	14,437	15,974	17,511
Cumulative CO2e with Project Life (metric tons)	0	647	2,163	3,687	5,217	6,754	8,290	9,827	11,364	12,901	14,437	15,327	15,347

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2e (metric tons)	1,537	1,537	1,537	1,537	1,537	1,537	1,537	1,537	1,537	1,537	1,537	1,537	1,537
Cumulative CO2e (metric tons)	19,047	20,584	22,121	23,658	25,194	26,731	28,268	29,804	31,341	32,878	34,414	35,951	37,488
Cumulative CO2e with Project Life (metric tons)	15,361	15,367	15,367	15,367	15,367	15,367	15,367	15,367	15,367	15,367	15,367	15,367	15,367

GHG Emissions from ZE Class 4, 5 and 8 Trucks

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual MWh	0	4,075	9,509	9,509	9,509	9,509	9,509	9,509	9,509	9,509	9,509	9,509	9,509
CO2 (metric tons)	0	919	2,145	2,145	2,145	1,456	1,456	1,456	1,456	1,456	1,456	1,456	1,456
CH4 (metric tons)	0	0.055	0.129	0.129	0.129	0.129	0.129	0.129	0.129	0.129	0.129	0.129	0.129
N2O (metric tons)	0	0.007	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
CO2e (metric tons)	0	923	2,154	2,154	2,154	1,465	1,465	1,465	1,465	1,465	1,465	1,465	1,465
Cumulative CO2e (metric tons)	0	923	3,077	5,230	7,384	8,848	10,313	11,777	13,242	14,707	16,171	17,636	19,100
Cumulative CO2e with Project Life (metric tons)	0	923	3,077	5,230	7,384	8,848	10,313	11,777	13,242	14,707	16,171	16,713	16,024

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual MWh	9,509	9,509	9,509	9,509	9,509	9,509	9,509	9,509	9,509	9,509	9,509	9,509	9,509
CO2 (metric tons)	1,456	1,456	1,456	1,456	1,456	1,456	1,456	0	0	0	0	0	0
CH4 (metric tons)	0.129	0.129	0.129	0.129	0.129	0.129	0.129	0.000	0.000	0.000	0.000	0.000	0.000
N2O (metric tons)	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.000	0.000	0.000	0.000	0.000	0.000
CO2e (metric tons)	1,465	1,465	1,465	1,465	1,465	1,465	1,465	0	0	0	0	0	0
Cumulative CO2e (metric tons)	20,565	22,029	23,494	24,958	26,423	27,887	29,352	29,352	29,352	29,352	29,352	29,352	29,352
Cumulative CO2e with Project Life (metric tons)	15,335	14,646	14,646	14,646	14,646	14,646	14,646	13,181	11,716	10,252	8,787	7,323	5,858

Net GHG Emission Reductions for ZE Class 4,5, and 8 Trucks

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual CO2e Reductions (metric tons)	0	2,506	5,862	5,874	5,887	6,589	6,589	6,589	6,589	6,589	6,589	6,589	6,589
Cumulative CO2e Reductions (metric Tons)	0	2,506	8,368	14,242	20,130	26,718	33,307	39,895	46,484	53,073	59,661	63,743	64,470

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual CO2e Reductions (metric tons)	6,589	6,589	6,589	6,589	6,589	6,589	6,589	8,053	8,053	8,053	8,053	8,053	8,053
Cumulative CO2e Reductions (metric Tons)	65,185	65,886	65,886	65,886	65,886	65,886	65,886	67,351	68,815	70,280	71,744	73,209	74,673

CAP/HAP Emission Reductions from Diesel Class 4, 5, 8 Trucks

	2030
NOx (tons/year)	9.5
PM2.5 (tons/year)	0.13
DPM (tons/year)	0.14

Measure M2: On-Road Heavy Duty Vehicles (ZE Class 4, 5, and 8 Trucks)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Number of Class 8 Diesel Trucks per Year	0	0	0	0	0	0							
Cumulative Number of Class 8 Diesel Trucks		0	0	0	0	0	0	0	0	0	0	0	0
Number of Class 4 Diesel Trucks per Year	0	179	194	0	0	0							
Cumulative Number of Class 8 Diesel Trucks		179	373	373	373	373	373	373	373	373	373	373	373
Number of Class 5 Diesel Trucks per Year	0	179	194	0	0	0							
Cumulative Number of Class 8 Diesel Trucks		179	373	373	373	373	373	373	373	373	373	373	373

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Number of Class 8 Diesel Trucks per Year													
Cumulative Number of Class 8 Diesel Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Class 4 Diesel Trucks per Year													
Cumulative Number of Class 8 Diesel Trucks	373	373	373	373	373	373	373	373	373	373	373	373	373
Number of Class 5 Diesel Trucks per Year													
Cumulative Number of Class 8 Diesel Trucks	373	373	373	373	373	373	373	373	373	373	373	373	373

Input Parameters

Class 8 Heavy Heavy Duty Trucks Emission Factors	2025	2026	2027	2028	2029	2030+
Annual Miles per Truck (1)	54,788	54,788	54,788	54,788	54,788	54,788
Average Miles per Gallon of Diesel (2)	5.95	5.92	5.89	5.87	5.84	5.82
Running Exhaust CO2 (g/mile) (2)	1,573.1	1,574.4	1,576.1	1,577.4	1,579.1	1,580.7
Running Exhaust CH4 (g/mile) (2)	0.0009	0.0009	0.0009	0.0009	0.0009	0.0008
Running Exhaust N2O (g/mile) (2)	0.2478	0.2480	0.2483	0.2485	0.2488	0.2490
Idling CO2 (g/truck/day) (2)	8,905.5	8,895.6	8,882.6	8,865.4	8,846.8	8,832.4
Idling CH4 (g/truck/day) (2)	0.1605	0.1605	0.1605	0.1605	0.1605	0.1605
Idling N2O (g/truck/day) (2)	1.4031	1.4015	1.3995	1.3967	1.3938	1.3915

(1) Average Annual Miles from Prop 1B Projects
(2) EMFAC2021, T7 Tractor Class 8 Category, 2010 to 2017 Model Years
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

Class 4 Medium Heavy Duty Trucks Emission Factors	2025	2026	2027	2028	2029	2030+
Annual Miles per Truck (3)	9,860	9,649	9,465	9,310	9,183	9,085
Average Miles per Gallon of Diesel (3)	8.77	8.75	8.72	8.71	8.69	8.68
Running Exhaust CO2 (g/mile) (3)	1,090.9	1,092.3	1,094.7	1,095.8	1,096.7	1,097.7
Running Exhaust CH4 (g/mile) (3)	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Running Exhaust N2O (g/mile) (3)	0.1719	0.1721	0.1725	0.1726	0.1728	0.1729
Idling CO2 (g/truck/day) (3)	2,110.0	2,109.0	2,107.9	2,106.8	2,105.6	2,104.4
Idling CH4 (g/truck/day) (3)	0.0077	0.0077	0.0077	0.0077	0.0077	0.0077
Idling N2O (g/truck/day) (3)	0.3324	0.3323	0.3321	0.3319	0.3317	0.3315

(3) EMFAC2021, T6 Instate Delivery Class 4 Category, 2010 to 2017 Model Years
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

Class 5 Medium Heavy Duty Trucks Emission Factors	2025	2026	2027	2028	2029	2030+
Annual Miles per Truck (4)	9,913	9,696	9,507	9,345	9,212	9,106
Average Miles per Gallon of Diesel (4)	8.70	8.68	8.65	8.64	8.63	8.61
Running Exhaust CO2 (g/mile) (4)	1,101.3	1,102.5	1,104.8	1,105.7	1,106.5	1,107.5
Running Exhaust CH4 (g/mile) (4)	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Running Exhaust N2O (g/mile) (4)	0.1735	0.1737	0.1741	0.1742	0.1743	0.1745
Idling CO2 (g/truck/day) (4)	2,099.4	2,098.2	2,097.2	2,096.0	2,094.8	2,093.4
Idling CH4 (g/truck/day) (4)	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078
Idling N2O (g/truck/day) (4)	0.3308	0.3306	0.3304	0.3302	0.3300	0.3298

(4) EMFAC2021, T6 Instate Delivery Class 5 Category, 2010 to 2017 Model Years
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

	Class 8	Class 4 & 5
ZE Truck Energy Consumption (5)	2	0.7
(kWh/mile)		

(5) Volvo Electric Trucks, https://www.volvotrucks.us/trucks/vnr-electric/
180124hdbevefficiency.pdf (ca.gov)

Charging Efficiency (6)	85%
Transmission and Distribution Grid Loss (7)	5.1%

(6) Argonne National Laboratory, Well to Wheels Analysis of
Energy Use and Greenhouse Gas Emissions of PHEV, 2010
Well-To-Wheels Energy and Greenhouse Gas Analysis of Plug-In Hybrid Electric Vehicles
(7) U.S. EPA's eGrid, Western Power Grid
https://www.epa.gov/egrid/frequent-questions-about-egrid#What%20is%20Grid%20Gross%20Loss

Electricity Generation Emission Factors (lbs/MWh)

GHG	CO2	CH4	N2O
GHG Emission Factors for Years 2025-2029 (8)	497.4	0.03	0.004
GHG Emission Factors for Years 2030-2044 (9)	337.7	0.03	0.004
GHG Emission Factors for Years 2045+ (9)	0	0	0

(8) EPA's 2024 GHG Emission Factor HUB
(Table 6 for Electricity, CAMX WECC California Subregion)
https://www.epa.gov/climateleadership/ghg-emission-factors-hub
(9) Average of emission factors for utilities in Los Angeles and Orange Counties reflecting CA's Renewable Portfolio Standard Program
Priority Climate Action Plan - The Los Angeles-Long Beach-Anaheim, CA Metropolitan Statistical Area, March 2024 (Table B.18)

GHG	CO2	CH4	N2O
GHG Global Warming Potential (10)	1	28	265

(10) CPRG Program Implementation Grants - General Competition Notice of Funding Opportunity, Appendix B
https://www.epa.gov/system/files/documents/2024-01/cprg-general-competition-correction.pdf

Criteria Air Pollutants (CAP)/Hazardous Air Pollutants (HAP)	2030		
Emission Factors	NOx	PM2.5	DPM
Class 8 Trucks Running Exhaust (g/mile) (11)	2.02	0.031	0.032
Class 8 Trucks Idling (g/truck/day) (11)	41.21	0.014	0.015
Class 4 Trucks Running Exhaust (g/mile) (12)	0.67	0.005	0.006
Class 4 Trucks Idling (g/truck/day) (12)	9.67	0.002	0.002
Class 5 Trucks Running Exhaust (g/mile) (13)	0.60	0.005	0.005
Class 5 Trucks Idling (g/truck/day) (13)	9.68	0.002	0.002

(11) EMFAC2021, T7 Tractor Class 8 Category, 2010 to 2017 Model Year Diesel Trucks
(12) EMFAC2021, T6 Public Class 4 Category, 2010 to 2017 Model Year Diesel Trucks
(13) EMFAC2021, T6 Public Class 5 Category, 2010 to 2017 Model Year Diesel Trucks
https://ww2.arb.ca.gov/our-work/programs/msei/on-road-emfac

Diesel Fuel Production and Refining Emission Factor (15)	18
(Kg/MMBtu)	

(15) https://www.epa.gov/fuels-registration-reporting-and-compliance-help/lifecycle-greenhouse-gas-results
https://www.epa.gov/sites/default/files/2016-07/documents/select-ghg-results-table-v1.pdf

Diesel Fuel Heat Content LHV (Btu/gal) (16)	129,488

(16) AFLEET Tool 2023

Project Life (years) (17)	10

(17) Assumed vehicle life

GHG Emission Reductions from Diesel Class 4, 5 and 8 Trucks

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
CO2 (metric tons)	0	4,035	8,272	8,148	8,047	7,970	7,970	7,970	7,970	7,970	7,970	7,970	7,970
CH4 (metric tons)	0	0.0020	0.0041	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040
N2O (metric tons)	0	0.636	1.303	1.284	1.268	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256
CO2e (metric tons)	0	4,203	8,617	8,489	8,383	8,303	8,303	8,303	8,303	8,303	8,303	8,303	8,303
Cumulative CO2e (metric tons)	0	4,203	12,821	21,310	29,693	37,996	46,299	54,602	62,906	71,209	79,512	87,815	96,118
Cumulative CO2e with Project Life (metric tons)	0	4,203	12,821	21,310	29,693	37,996	46,299	54,602	62,906	71,209	79,512	83,612	83,297

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2 (metric tons)	7,970	7,970	7,970	7,970	7,970	7,970	7,970	7,970	7,970	7,970	7,970	7,970	7,970
CH4 (metric tons)	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040	0.0040
N2O (metric tons)	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256
CO2e (metric tons)	8,303	8,303	8,303	8,303	8,303	8,303	8,303	8,303	8,303	8,303	8,303	8,303	8,303
Cumulative CO2e (metric tons)	104,421	112,724	121,028	129,331	137,634	145,937	154,240	162,543	170,846	179,150	187,453	195,756	204,059
Cumulative CO2e with Project Life (metric tons)	83,112	83,031	83,031	83,031	83,031	83,031	83,031	83,031	83,031	83,031	83,031	83,031	83,031

Upstream GHG Emission Reductions from Diesel Fuel Production and Refining

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
CO2e (metric tons)	0	926	1,898	1,870	1,847	1,829	1,829	1,829	1,829	1,829	1,829	1,829	1,829
Cumulative CO2e (metric tons)	0	926	2,825	4,695	6,542	8,371	10,200	12,029	13,858	15,688	17,517	19,346	21,175
Cumulative CO2e with Project Life (metric tons)	0	926	2,825	4,695	6,542	8,371	10,200	12,029	13,858	15,688	17,517	18,420	18,351

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2e (metric tons)	1,829	1,829	1,829	1,829	1,829	1,829	1,829	1,829	1,829	1,829	1,829	1,829	1,829
Cumulative CO2e (metric tons)	23,005	24,834	26,663	28,492	30,321	32,151	33,980	35,809	37,638	39,468	41,297	43,126	44,955
Cumulative CO2e with Project Life (metric tons)	18,310	18,292	18,292	18,292	18,292	18,292	18,292	18,292	18,292	18,292	18,292	18,292	18,292

GHG Emissions from ZE Class 4, 5 and 8 Trucks

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual MWh	0	3,005	6,141	6,038	5,954	5,888	5,888	5,888	5,888	5,888	5,888	5,888	5,888
CO2 (metric tons)	0	678	1,386	1,362	1,343	902	902	902	902	902	902	902	902
CH4 (metric tons)	0	0.041	0.084	0.082	0.081	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080
N2O (metric tons)	0	0.005	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
CO2e (metric tons)	0	681	1,391	1,368	1,348	907	907	907	907	907	907	907	907
Cumulative CO2e (metric tons)	0	681	2,071	3,439	4,787	5,694	6,601	7,508	8,415	9,322	10,229	11,136	12,043
Cumulative CO2e with Project Life (metric tons)	0	681	2,071	3,439	4,787	5,694	6,601	7,508	8,415	9,322	10,229	10,455	9,972

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual MWh	5,888	5,888	5,888	5,888	5,888	5,888	5,888	5,888	5,888	5,888	5,888	5,888	5,888
CO2 (metric tons)	902	902	902	902	902	902	902	0	0	0	0	0	0
CH4 (metric tons)	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.000	0.000	0.000	0.000	0.000	0.000
N2O (metric tons)	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.000	0.000	0.000	0.000	0.000	0.000
CO2e (metric tons)	907	907	907	907	907	907	907	0	0	0	0	0	0
Cumulative CO2e (metric tons)	12,950	13,857	14,764	15,671	16,578	17,485	18,391	18,391	18,391	18,391	18,391	18,391	18,391
Cumulative CO2e with Project Life (metric tons)	9,511	9,069	9,069	9,069	9,069	9,069	9,069	8,162	7,255	6,349	5,442	4,535	3,628

Net GHG Emission Reductions for ZE Class 4,5, and 8 Trucks

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Annual CO2e Reductions (metric tons)	0	4,449	9,125	8,991	8,882	9,225	9,225	9,225	9,225	9,225	9,225	9,225	9,225
Cumulative CO2e Reductions (metric Tons)	0	4,449	13,574	22,565	31,447	40,673	49,898	59,123	68,349	77,574	86,800	91,576	91,676

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual CO2e Reductions (metric tons)	9,225	9,225	9,225	9,225	9,225	9,225	9,225	10,132	10,132	10,132	10,132	10,132	10,132
Cumulative CO2e Reductions (metric Tons)	91,911	92,254	92,254	92,254	92,254	92,254	92,254	93,161	94,068	94,975	95,882	96,789	97,696

CAP/HAP Emission Reductions from Diesel Class 4, 5, 8 Trucks

	2030
NOx (tons/year)	7.2
PM2.5 (tons/year)	0.04
DPM (tons/year)	0.04

Measure M3: Cargo Handling Equipment (ZE Cargo Handling Equipment)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Number of Yard Tractors per Year	0	18	16	0	0	0																				
Cumulative Number of Yard Tractors		18	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
Number of Top Handlers per Year	0	14	12	0	0	0																				
Number of Top Handlers per Year		14	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26

Input Parameters

	Yard Tractor	Top Handler
Engine Size (hp) (1)	221	344
Annual Operating Hours (1)	1,908	2,089
Load Factor (2)	0.39	0.59
CO2 (g/kWh) (3)	717.84	717.84
CH4 (g/kWh) (3)	0.0295	0.0295
N2O (g/kWh) (3)	0.0422	0.0422

(1) Average value for Ports of Los Angeles and Long Beach (2022 Emissions Inventory Reports)
https://www.portoflosangeles.org/environment/air-quality/air-emissions-inventory
https://polb.com/environment/air#emissions-inventory
(2) CARB 2022 Cargo Handling Equipment Documentation
https://ww2.arb.ca.gov/sites/default/files/2023-08/2022CHEInventory.pdf
(3) Derived emission factors (Kg/gal or g/gal converted to g/kWh); See CHE EF Tab

Diesel Fuel Heat Content LHV (Btu/gal) (4)	129,488
Off-Road Equipment Diesel Fuel Consumption Rate (kWh/gal)(5)	14.22
Btu to hp-hr conversion (Btu/hp-hr)	2,544
HP to kW conversion	0.746

(4) AFLEET Tool 2023
https://greet.anl.gov/afleet
(5) Calculated from estimated BSFC and fuel density; CHE EF Tab

Charging Efficiency (6)	85%
Transmission and Distribution Grid Loss (7)	5.1%

(6) Argonne National Laboratory, Well to Wheels Analysis of
Energy Use and Greenhouse Gas Emissions of PHEV, 2010
Well-To-Wheels Energy and Greenhouse Gas Analysis of Plug-In Hybrid Electric Vehicles
(7) U.S. EPA's eGrid, Western Power Grid
https://www.epa.gov/egrid/frequent-questions-about-egrid#What%20is%20Grid%20Gross%20Loss

Electricity Generation Emission Factors (lbs/MWh)

GHG	CO2	CH4	N2O
GHG Emission Factors for Years 2025-2029 (8)	497.4	0.03	0.004
GHG Emission Factors for Years 2030-2044 (9)	337.7	0.03	0.004
GHG Emission Factors for Years 2045+ (9)	0	0	0

(8) EPA's 2024 GHG Emission Factor HUB
(Table 6 for Electricity, CAMX WECC California Subregion)
https://www.epa.gov/climateleadership/ghg-emission-factors-hub
(9) Average of emission factors for utilities in Los Angeles and Orange Counties reflecting CA's Renewable Portfolio Standard Program;
Priority Climate Action Plan - The Los Angeles-Long Beach-Anaheim, CA Metropolitan Statistical Area, March 2024 (Table B.18)

GHG	CO2	CH4	N2O
GHG Global Warming Potential (10)	1	28	265

(10) CPRG Program Implementation Grants - General Competition Notice of Funding Opportunity, Appendix B
https://www.epa.gov/system/files/documents/2024-01/cprg-general-competition-correction.pdf

CAP/HAP Emission Factors	2030		
	NOx	PM2.5	DPM
Yard Tractors (tons/unit/year) (11)	0.221	0.010	0.009
Top Handlers (tons/unit/year) (11)	0.638	0.034	0.031

(11) Calculated average emission factors for 2017 and older model years; See CHE EF Tab

Diesel Fuel Production and Refining Emission Factor (12)	18
(Kg/MMBtu)	

(12) https://www.epa.gov/fuels-registration-reporting-and-compliance-help/lifecycle-greenhouse-gas-results
https://www.epa.gov/sites/default/files/2016-07/documents/select-ghg-results-table-v1.pdf

Project Life (years) (13)	10

(13) Assumed equipment life

GHG Emission Reductions from Diesel Yard Tractors and Top Handlers

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2 (metric tons)	0	6,379	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915	11,915
CH4 (metric tons)	0	0.262	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490
N2O (metric tons)	0	0.125	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235	0.235
CO2e (metric tons)	0	6,420	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991	11,991
Cumulative CO2e (metric tons)	0	6,420	18,411	30,402	42,393	54,384	66,374	78,365	90,356	102,347	114,338	126,329	138,320	150,311	162,302	174,293	186,284	198,275	210,266	222,257	234,248	246,238	258,229	270,220	282,211	294,202
Cumulative CO2e with Project Life (metric tons)	0	6,420	18,411	30,402	42,393	54,384	66,374	78,365	90,356	102,347	114,338	119,909	119,909	119,909	119,909	119,909	119,909	119,909	119,909	119,909	119,909	119,909	119,909	119,909	119,909	119,909

Upstream GHG Emission Reductions from Diesel Fuel Production and Refining

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2e (metric tons)	0	1,456	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720	2,720
Cumulative CO2e (metric tons)	0	1,456	4,176	6,896	9,616	12,336	15,056	17,776	20,496	23,216	25,936	28,656	31,376	34,096	36,816	39,536	42,256	44,976	47,696	50,416	53,136	55,856	58,576	61,296	64,016	66,736
Cumulative CO2e with Project Life (metric tons)	0	1,456	4,176	6,896	9,616	12,336	15,056	17,776	20,496	23,216	25,936	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200

GHG Emissions from ZE Yard Tractors and Top Handlers

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual MWh	0	3,079	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750	5,750
CO2 (metric tons)	0	695	1,297	1,297	1,297	881	881	881	881	881	881	881	881	881	881	881	881	881	881	881	0	0	0	0	0	0
CH4 (metric tons)	0	0.042	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.000	0.000	0.000	0.000	0.000	0.000
N2O (metric tons)	0	0.006	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.000	0.000	0.000	0.000	0.000	0.000
CO2e (metric tons)	0	697	1,302	1,302	1,302	886	886	886	886	886	886	886	886	886	886	886	886	886	886	886	0	0	0	0	0	0
Cumulative CO2e (metric tons)	0	697	1,999	3,302	4,604	5,490	6,375	7,261	8,146	9,032	9,918	10,803	11,689	12,574	13,460	14,346	15,231	16,117	17,002	17,888	17,888	17,888	17,888	17,888	17,888	17,888
Cumulative CO2e with Project Life (metric tons)	0	697	1,999	3,302	4,604	5,490	6,375	7,261	8,146	9,032	9,918	10,106	9,689	9,273	8,856	8,856	8,856	8,856	8,856	8,856	7,970	7,085	6,199	5,314	4,428	3,542

Net GHG Emission Reductions for ZE Cargo Handling Equipment

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual CO2e Reductions (metric tons)	0	7,179	13,409	13,409	13,409	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825	13,825	14,711	14,711	14,711	14,711	14,711	14,711
Cumulative CO2e Reductions (metric Tons)	0	7,179	20,588	33,996	47,405	61,230	75,056	88,881	102,706	116,531	130,357	137,003	137,420	137,836	138,253	138,253	138,253	138,253	138,253	138,253	139,139	140,024	140,910	141,796	142,681	143,567

CAP/HAP Emission Reductions from Yard Tractors and Top Handlers

	2030
NOx (tons/year)	24.1
PM2.5 (tons/year)	1.2
DPM (tons/year)	1.1

Measure M4: Locomotives (ZE Switcher Locomotives)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Number of Switcher Locomotives Per Year	0	0	4	14	0	0																				
Cumulative Number of Switcher Locomotives	0	0	4	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18

Input Parameters

	CO2 (Kg/gal)	CH4 (g/gal)	N2O (g/gal)
GHG Diesel Switcher Emission Factors (1)	10.21	0.8	0.26

(1) EPA's EF GHG HUB (Table 2 for CO2 and Table 5 for CH4 and N2O for Locomotives)
GHG Emission Factors Hub | US EPA

Fuel Consumption per Locomotive (gal/yr)(2)	75,000
Fuel Conversion (hp-hr/gallon) (3)	15.2

(2) CARB's Methodology for Battery Electric Switcher Usage Pattern
https://ww2.arb.ca.gov/resources/fact-sheets/yes-california-grid-can-handle-electrification-all-switchers-all-railyards
(3) EPA's 2009 Technical Highlights Emission Factors for Locomotives (Table 3)
https://nepis.epa.gov/Exe/ZyNET.exe/P100500B.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000010%5CP100500B.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=2

Charging Efficiency (4)	85%
Transmission and Distribution Grid Loss (5)	5.1%
Hp to kW conversion	0.746

(4) Argonne National Laboratory, Well to Wheels Analysis of
Energy Use and Greenhouse Gas Emissions of PHEV, 2010
Well-To-Wheels Energy and Greenhouse Gas Analysis of Plug-In Hybrid Electric Vehicles
(5) U.S. EPA's eGrid, Western Power Grid
https://www.epa.gov/egrid/frequent-questions-about-egrid#What%20is%20Grid%20Gross%20Loss

Electricity Generation Emission Factors (lbs/MWh)

GHG	CO2	CH4	N2O
GHG Emission Factors for Years 2025-2029 (6)	497.4	0.03	0.004
GHG Emission Factors for Years 2030-2044 (7)	337.7	0.03	0.004
GHG Emission Factors for Years 2045+ (7)	0	0	0

(6) EPA's 2024 GHG Emission Factor HUB
(Table 6 for Electricity, CAMX WECC California Subregion)
https://www.epa.gov/climateleadership/ghg-emission-factors-hub
(7) Average of emission factors for utilities in Los Angeles and Orange Counties reflecting CA's Renewable Portfolio Standard Program
Priority Climate Action Plan - The Los Angeles-Long Beach-Anaheim, CA Metropolitan Statistical Area, March 2024 (Table B.18)

GHG	CO2	CH4	N2O
GHG Global Warming Potential (8)	1	28	265

(8) CPRG Program Implementation Grants - General Competition Notice of Funding Opportunity, Appendix B
https://www.epa.gov/system/files/documents/2024-01/cprg-general-competition-correction.pdf

CAP/HAP Emission Factors (g/hp-hr) (9)	NOx	PM2.5	DPM
Tier 0+ Switcher Locomotive	12.6	0.405	0.44

(9) EPA's 2009 Technical Highlights Emission Factors for Locomotives (Table 2);
Assuming Tier 0 switcher locomotives; PM2.5 estimated at 92% of PM10(DPM).

Diesel Fuel Production and Refining Emission Factor (10)	18
(Kg/MMBtu)	

(10) https://www.epa.gov/fuels-registration-reporting-and-compliance-help/lifecycle-greenhouse-gas-results
https://www.epa.gov/sites/default/files/2016-07/documents/select-ghg-results-table-v1.pdf

Diesel Fuel Heat Content LHV (Btu/gal) (11	129,488

(11) AFLEET Tool 2023

Project Life (years) (12)	20

(12) Assumed equipment life

GHG Emission Reductions from Diesel Switcher Locomotives

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual Fuel Consumption (gal)	0	0	300,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000
CO2 (metric tons)	0	0	3,063	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784	13,784
CH4 (metric tons)	0	0	0.240	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080	1.080
N2O (metric tons)	0	0	0.078	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351
CO2e (metric tons)	0	0	3,090	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907	13,907
Cumulative CO2e (metric tons)	0	0	3,090	16,997	30,904	44,811	58,717	72,624	86,531	100,438	114,344	128,251	142,158	156,065	169,971	183,878	197,785	211,692	225,598	239,505	253,412	267,319	281,225	295,132	309,039	322,946
Cumulative CO2e with Project Life (metric tons)	0	0	3,090	16,997	30,904	44,811	58,717	72,624	86,531	100,438	114,344	128,251	142,158	156,065	169,971	183,878	197,785	211,692	225,598	239,505	253,412	267,319	278,135	278,135	278,135	278,135

Upstream GHG Emission Reductions from Diesel Fuel Production and Refining

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2e (metric tons)	0	0	699	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147
Cumulative CO2e (metric tons)	0	0	699	3,846	6,992	10,139	13,285	16,432	19,579	22,725	25,872	29,018	32,165	35,311	38,458	41,604	44,751	47,898	51,044	54,191	57,337	60,484	63,630	66,777	69,924	73,070
Cumulative CO2e with Project Life (metric tons)	0	0	699	3,846	6,992	10,139	13,285	16,432	19,579	22,725	25,872	29,018	32,165	35,311	38,458	41,604	44,751	47,898	51,044	54,191	57,337	60,484	62,931	62,931	62,931	62,931

GHG Emissions from ZE Switcher Locomotives

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual MWh	0	0	4,217	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977	18,977
CO2 (metric tons)	0	0	951	4,282	4,282	2,907	2,907	2,907	2,907	2,907	2,907	2,907	2,907	2,907	2,907	2,907	2,907	2,907	2,907	2,907	0	0	0	0	0	0
CH4 (metric tons)	0	0	0.057	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.000	0.000	0.000	0.000	0.000	0.000
N2O (metric tons)	0	0	0.008	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.000	0.000	0.000	0.000	0.000	0.000
CO2e (metric tons)	0	0	955	4,298	4,298	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	0	0	0	0	0	0
Cumulative CO2e (metric tons)	0	0	955	5,253	9,551	12,474	15,397	18,320	21,243	24,165	27,088	30,011	32,934	35,857	38,780	41,703	44,625	47,548	50,471	53,394	53,394	53,394	53,394	53,394	53,394	53,394
Cumulative CO2e with Project Life (metric tons)	0	0	955	5,253	9,551	12,474	15,397	18,320	21,243	24,165	27,088	30,011	32,934	35,857	38,780	41,703	44,625	47,548	50,471	53,394	53,394	53,394	52,439	48,141	43,843	40,920

Net GHG Emission Reductions for ZE Switcher Locomotives

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Annual CO2e Reductions (metric tons)	0	0	2,835	12,755	12,755	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130	14,130	17,053	17,053	17,053	17,053	17,053	17,053
Cumulative CO2e Reductions (metric Tons)	0	0	2,835	15,590	28,345	42,476	56,606	70,737	84,867	98,997	113,128	127,258	141,389	155,519	169,650	183,780	197,911	212,041	226,172	240,302	257,355	274,409	288,627	292,925	297,223	300,146

CAP/HAP Emission Reductions from Diesel Switcher Locomotives

	2030
NOx (tons/year)	285.0
PM2.5 (tons/year)	9.2
DPM (tons/year)	10.0

GHG Emission Factors for Cargo Handling Equipment

GHG Emission Factors for Diesel Fuel for CHE (1)

CO2 (Kg/gal)	10.21
CH4 (g/gal)	0.42
N2O (g/gal)	0.6

(1) EPA's EF GHG HUB (Table 2 for CO2 and Table 5 for CH4 and N2O for Industrial/Commercial Equipment)
GHG Emission Factors Hub | US EPA

Input Values

Off-Road Diesel Equipment Fuel Consumption Rate (lbs/hp-hr) (2)	0.367
Diesel Fuel Density (lbs/gal)	7
Off-Road Diesel Equipment Fuel Consumption Rate (kWh/gal)	14.22
HP to KW Conversion	0.7457

(2) EPA's Exhaust and Crankcase Emission Factors for Nonroad Compression-Ignition Engines in MOVES2014b; July 2018.
Document Display | NEPIS | US EPA

GHG Emission Factors for CHE (g/kWh) (3)

CO2 (g/kW-hr)	717.8
CH4 (g/kW-hr)	0.0295
N2O (g/kW-hr)	0.0422

(3) Derived from fuel-based emission factors based on fuel consumption rate and and fuel density

NOx/PM Emission Factors for Cargo Handling Equipment

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							2030			2030	2030
	Model Year	HP	Annual Hours	Load Factor	NOx ZH (1)	NOx DR (1)	NOx Emissions	PM ZH (1)	PM DR (1)	PM10 Emissions	PM2.5 Emissions (2)
					(g/hp-hr)		(tons/year)			(tons/year)	(tone/year)
Yard Tractors	2011	221	1908	0.39	1.5154	1.97E-05	0.318	0.0563	2.08E-06	0.014723516	0.013545635
	2012	221	1908	0.39	1.5154	1.97E-05	0.318	0.0563	2.08E-06	0.014723516	0.013545635
	2013	221	1908	0.39	1.6310	2.12E-05	0.342	0.0386	1.43E-06	0.010104474	0.009296116
	2014	221	1908	0.39	0.8367	1.1E-05	0.176	0.0336	1.24E-06	0.00878021	0.008077793
	2015	221	1908	0.39	0.6454	8.51E-06	0.136	0.0302	1.12E-06	0.00791089	0.007278019
	2016	221	1908	0.39	0.8862	1.17E-05	0.186	0.0298	1.1E-06	0.007799797	0.007175814
	2017	221	1908	0.39	0.3320	4.38E-06	0.070	0.0150	5.6E-07	0.003926763	0.003612622
						Average	**0.221**			**0.010**	**0.009**

Accumulated Hours Cap (3)
12,000

							2030			2030	2030
	Model Year	HP	Annual Hours	Load Factor	NOx ZH (1)	NOx DR (1)	NOx Emissions	PM ZH (1)	PM DR (1)	PM10 Emissions	PM2.5 Emissions (2)
					(g/hp-hr)		(tons/year)			(tons/year)	(tone/year)
Top Handlers	2010	344	2089	0.59	2.5505	3.31E-05	1.378	0.1106	5.58E-06	0.082993566	0.07635408
	2011	344	2089	0.59	1.2343	1.61E-05	0.667	0.0526	1.95E-06	0.035534138	0.032691407
	2012	344	2089	0.59	1.2343	1.61E-05	0.667	0.0526	1.95E-06	0.035534138	0.032691407
	2013	344	2089	0.59	1.4972	1.95E-05	0.809	0.0452	1.67E-06	0.030493932	0.028054417
	2014	344	2089	0.59	0.9727	1.28E-05	0.526	0.0365	1.35E-06	0.024609191	0.022640456
	2015	344	2089	0.59	0.8126	1.07E-05	0.440	0.0354	1.31E-06	0.02387272	0.021962902
	2016	344	2089	0.59	0.9041	1.19E-05	0.489	0.0385	1.42E-06	0.025943438	0.023867963
	2017	344	2089	0.59	0.2310	3.05E-06	0.125	0.0220	8.1E-07	0.014846898	0.013659146
						Average	**0.638**			**0.034**	**0.031**

(1) Zero-hour (ZH) emission factors and deterioration rates
2017 Off-Road Emissions Factor Documentation
https://ww2.arb.ca.gov/our-work/programs/msei/road-categories/road-diesel-models-and-documentation
(2) PM2.5/PM10 ratios: 0.92 for yard tractors and other cargo handling equipment (See OFFROAD Model Tab)
https://arb.ca.gov/emfac/offroad/emissions-inventory/e263cdd9de130c5e61759e36d202a9e6bbe4a24e
(3) Accumulated hours capped at 12,000 hours
https://arb.ca.gov/emfac/offroad/emissions-inventory/e263cdd9de130c5e61759e36d202a9e6bbe4a24e

Source: EMFAC2021 (v1.0.2) Emissions Inventory
Region Type: Air Basin
Region: South Coast
Calendar Year: 2025, 2026, 2027, 2028, 2029, 2030
Season: Annual
Vehicle Classification: EMFAC202x Categories
Units: miles/year for CVMT and EVMT, trips/year for Trips, kWh/year for Energy Consumption, tons/year for Emissions, 1000 gallons/year for Fuel Consumption

Region	Calendar Year	Vehicle Category	Model Year	Speed	Fuel	Population	Total VMT	CVMT	Trips	Energy Cor	NOx_RUNEX	NOx_IDLEX	PM2.5_RUNEX	PM2.5_IDLEX	PM10_RUNEX	PM10_IDLEX	CO2_RUNEX	CO2_IDLEX	CH4_RUNEX	CH4_IDLEX	N2O_RUNEX	N2O_IDLEX	Fuel Consumption
South Coast	2025	T7 Tractor Class 8	2010	Aggregate	Diesel	1.8401584	1151.978	1151.978	8342.1	0	0.00894732	0.03867223	5.61103E-05	8.90653E-06	5.86474E-05	9.30924E-06	2.044534566	6.921659062	1.10016E-05	0.000100041	0.000322117	0.00109051	0.800946525
South Coast	2025	T7 Tractor Class 8	2011	Aggregate	Diesel	1074.7384	20138917	20138917	4872176	0	93.4943831	17.0998347	1.066163123	0.005201829	1.114370288	0.005437033	33583.85464	3692.970439	0.102161921	0.059140736	5.291149975	0.581828997	3329.924018
South Coast	2025	T7 Tractor Class 8	2012	Aggregate	Diesel	1764.9685	34135542	34135542	8001237	0	131.813717	24.792333	0.998424493	0.008542604	1.043569341	0.008928863	57102.16162	5904.92735	0.035725089	0.097448236	8.996468818	0.930323709	5628.398299
South Coast	2025	T7 Tractor Class 8	2013	Aggregate	Diesel	1720.3579	34340611	34340611	7799002	0	122.998144	24.165693	0.959326189	0.008326685	1.002702663	0.008703181	53920.29696	5755.677015	0.035333564	0.094985178	8.495164745	0.906809258	5330.831116
South Coast	2025	T7 Tractor Class 8	2014	Aggregate	Diesel	1925.3546	39686102	39686102	8728326	0	57.2004681	27.0452608	1.303799753	0.009318887	1.362751793	0.009740246	70197.41535	5606.467184	0.019962841	0.106303548	11.05963138	0.883301188	6771.530798
South Coast	2025	T7 Tractor Class 8	2015	Aggregate	Diesel	2076.5636	44244680	44244680	9413811	0	62.8720708	29.1692787	1.419139522	0.010050753	1.483306714	0.010505203	78251.52493	6046.774899	0.021930669	0.11465217	12.32855962	0.952671848	7530.333731
South Coast	2025	T7 Tractor Class 8	2016	Aggregate	Diesel	2629.2888	57899727	57899727	11919513	0	80.9756709	36.9333535	1.798299494	0.012725992	1.879610617	0.013301404	102411.2764	7656.263185	0.028248248	0.145169483	16.13493831	1.206247383	9832.289712
South Coast	2025	T7 Tractor Class 8	2017	Aggregate	Diesel	1655.2898	37696319	37696319	7504024	0	51.6944561	23.2516871	0.925758377	0.008011749	0.967617063	0.008374005	69496.03186	4681.393996	0.018865344	0.091392605	10.94912812	0.73755553	6626.240068
Average Grams per Mile											2.03		0.0287		0.0300		1573.1		0.0009		0.2478		
Average Idling Grams per Truck per Day												41.30		0.0141		0.0147		8905.5		0.1605		1.4031	
Average miles per gallon																							5.9521
South Coast	2026	T7 Tractor Class 8	2010	Aggregate	Diesel	1.6558177	1036.5769	1036.5769	7506.418	0	0.008072	0.03479818	5.07463E-05	8.0143E-06	5.30408E-05	8.37668E-06	1.840258669	6.228271296	9.96777E-06	9.00192E-05	0.000289934	0.000981267	0.720758586
South Coast	2026	T7 Tractor Class 8	2011	Aggregate	Diesel	981.73597	17469208	17469208	4450563	0	81.7633122	15.6201021	0.933517443	0.004751689	0.97572696	0.00496654	29141.11317	3373.39958	0.089408063	0.054022998	4.591194247	0.531480478	2904.508544
South Coast	2026	T7 Tractor Class 8	2012	Aggregate	Diesel	1638.3672	30066997	30066997	7427308	0	117.67802	23.0139783	0.893184004	0.007929843	0.933569822	0.008288395	50313.05631	5481.366747	0.033798759	0.090458272	7.926842511	0.863591563	4984.09371
South Coast	2026	T7 Tractor Class 8	2013	Aggregate	Diesel	1631.4533	30879879	30879879	7395965	0	112.499122	22.9168585	0.880002916	0.007896379	0.919792743	0.008253418	48502.07893	5458.23519	0.032188407	0.090076535	7.641522287	0.859947177	4820.253485
South Coast	2026	T7 Tractor Class 8	2014	Aggregate	Diesel	1811.0563	35375759	35375759	8210170	0	51.6190386	25.4397237	1.187237798	0.008765673	1.240919423	0.009162018	62585.47799	5273.640259	0.018016764	0.099992857	9.860367545	0.830864171	6061.828152
South Coast	2026	T7 Tractor Class 8	2015	Aggregate	Diesel	1967.1286	39699540	39699540	8917702	0	57.2545657	27.6320561	1.306437069	0.009521077	1.365508356	0.009951578	70227.09203	5728.109524	0.019968763	0.108609994	11.06430695	0.902465988	6785.048067
South Coast	2026	T7 Tractor Class 8	2016	Aggregate	Diesel	2514.3799	52422087	52422087	11398589	0	74.6118367	35.3192387	1.678455784	0.012169822	1.754348106	0.012720087	92740.59884	7321.658111	0.026013898	0.138825076	14.61131911	1.153530217	8938.521775
South Coast	2026	T7 Tractor Class 8	2017	Aggregate	Diesel	1641.0005	35369110	35369110	7439246	0	49.519816	23.0509668	0.900079987	0.007942588	0.94077761	0.008301717	65215.63512	4640.981835	0.018045733	0.090603658	10.27474987	0.731188578	6240.263921
Average Grams per Mile											2.05		0.0292		0.0306		1574.4		0.0009		0.2480		
Average Idling Grams per Truck per Day												41.28		0.0141		0.0147		8895.6		0.1605		1.4015	
Average miles per gallon																							5.9232
South Coast	2027	T7 Tractor Class 8	2010	Aggregate	Diesel	1.4741674	922.85992	922.85992	6682.931	0	0.00718888	0.03098067	4.54452E-05	7.1351E-06	4.75E-05	7.45772E-06	1.636353649	5.54500306	8.83276E-06	8.01437E-05	0.000257808	0.000873617	0.64150775
South Coast	2027	T7 Tractor Class 8	2011	Aggregate	Diesel	867.63793	14725899	14725899	3933315	0	69.447121	13.8047229	0.79865682	0.004199445	0.834768537	0.004389325	24576.48938	2981.340723	0.075911212	0.047744407	3.87203591	0.469711445	2461.730047
South Coast	2027	T7 Tractor Class 8	2012	Aggregate	Diesel	1501.8688	26265988	26265988	6808512	0	104.178381	21.0965989	0.79647342	0.007269179	0.832486413	0.007597859	43995.49524	5024.693867	0.028065074	0.082921859	6.931508192	0.791642565	4378.954075
South Coast	2027	T7 Tractor Class 8	2013	Aggregate	Diesel	1519.7862	27392163	27392163	6889738	0	101.445513	21.3482832	0.800210081	0.0073559	0.83639203	0.007688502	43065.81852	5084.63891	0.028920546	0.083911125	6.785037246	0.801086931	4301.261288
South Coast	2027	T7 Tractor Class 8	2014	Aggregate	Diesel	1723.5085	32034996	32034996	7813285	0	47.2202365	24.2099493	1.10357859	0.008341934	1.153477516	0.008719152	56684.00259	5018.708729	0.016450453	0.095159131	8.930587692	0.790699604	5511.87876
South Coast	2027	T7 Tractor Class 8	2015	Aggregate	Diesel	1856.9367	35640126	35640126	8418163	0	52.0426752	26.0842017	1.208691449	0.008987739	1.263343113	0.009394124	63056.67028	5407.240194	0.018115509	0.102526029	9.934604082	0.851912895	6115.854002
South Coast	2027	T7 Tractor Class 8	2016	Aggregate	Diesel	2390.2543	47368600	47368600	10835883	0	68.4265022	33.5756601	1.570081525	0.011569043	1.641073644	0.012092144	83813.49943	6960.215263	0.023805775	0.131971802	13.20485097	1.096584749	8108.779975
South Coast	2027	T7 Tractor Class 8	2017	Aggregate	Diesel	1574.8229	32249492	32249492	7139239	0	45.9544446	22.1213775	0.854980702	0.007622283	0.893639135	0.007966929	59498.8893	4453.822343	0.01678909	0.086949833	9.37407424	0.701701524	5712.870398
Average Grams per Mile											2.06		0.0300		0.0314		1576.1		0.0009		0.2483		
Average Idling Grams per Truck per Day												41.26		0.0141		0.0147		8882.6		0.1605		1.3995	
Average miles per gallon																							5.8941
South Coast	2028	T7 Tractor Class 8	2010	Aggregate	Diesel	1.3327955	834.35817	834.35817	6042.042	0	0.00649947	0.02800964	4.1087E-05	6.4508E-06	4.29448E-05	6.74253E-06	1.479428247	5.01324036	7.98571E-06	7.24579E-05	0.000233085	0.000789838	0.579987515
South Coast	2028	T7 Tractor Class 8	2011	Aggregate	Diesel	760.97148	12368586	12368586	3449758	0	58.4452058	12.1075855	0.672537096	0.00368317	0.70294624	0.003849706	20642.08887	2614.817987	0.063894188	0.041874762	3.252169507	0.411965639	2077.530277
South Coast	2028	T7 Tractor Class 8	2012	Aggregate	Diesel	1331.3208	22275281	22275281	6035356	0	88.8657408	18.7009282	0.680348772	0.006443711	0.711111124	0.006735067	37310.9032	4454.103712	0.023908844	0.073505485	5.878347994	0.701745854	3730.851523
South Coast	2028	T7 Tractor Class 8	2013	Aggregate	Diesel	1397.3793	24074198	24074198	6334823	0	89.9794025	19.6288448	0.711312669	0.00676344	0.743475072	0.007069253	37849.16449	4675.110739	0.025597603	0.077152735	5.96315128	0.736565601	3798.676661
South Coast	2028	T7 Tractor Class 8	2014	Aggregate	Diesel	1610.3683	28587925	28587925	7300379	0	42.4269006	22.6206796	0.998344478	0.007794326	1.043485186	0.00814675	50584.21502	4689.254029	0.014790169	0.08891238	7.969563677	0.738793882	4937.557095
South Coast	2028	T7 Tractor Class 8	2015	Aggregate	Diesel	1772.5483	32471077	32471077	8035599	0	47.8375071	24.8988058	1.120710183	0.008579291	1.171383724	0.008967209	57449.33933	5161.508297	0.016663293	0.097866736	9.051166807	0.813197734	5593.002216
South Coast	2028	T7 Tractor Class 8	2016	Aggregate	Diesel	2263.1457	42781128	42781128	10259654	0	62.4896491	31.7901781	1.449089807	0.010953826	1.514612217	0.01144911	75695.86401	6590.085856	0.021753981	0.124953823	11.9259142	1.03827071	7350.571305
South Coast	2028	T7 Tractor Class 8	2017	Aggregate	Diesel	1501.5963	29316702	29316702	6807276	0	42.3460935	21.0927704	0.797762832	0.007267859	0.833834127	0.00759648	54088.0111	4246.727047	0.015478213	0.082906811	8.521588175	0.669073576	5211.01905
Average Grams per Mile											2.04		0.0304		0.0318		1577.4		0.0009		0.2485		
Average Idling Grams per Truck per Day												41.23		0.0141		0.0147		8865.4		0.1605		1.3967	
Average miles per gallon																							5.8678
South Coast	2029	T7 Tractor Class 8	2010	Aggregate	Diesel	1.1949081	748.03769	748.03769	5416.948	0	0.00582706	0.02511184	3.68363E-05	5.78346E-06	3.85018E-05	6.04496E-06	1.326370523	4.494583803	7.15953E-06	6.49616E-05	0.00020897	0.000708124	0.519983544
South Coast	2029	T7 Tractor Class 8	2011	Aggregate	Diesel	679.54945	10617058	10617058	3080642	0	50.1692736	10.8121044	0.57736171	0.00328908	0.603467445	0.003437797	17718.78094	2335.039055	0.054845849	0.037394268	2.791601153	0.367886354	1791.399797
South Coast	2029	T7 Tractor Class 8	2012	Aggregate	Diesel	1170.7148	18808058	18808058	5307271	0	75.2137192	16.4449113	0.57618634	0.005666363	0.602238929	0.005922571	31503.21167	3916.775668	0.020225	0.064638032	4.963343828	0.617089602	3164.053438
South Coast	2029	T7 Tractor Class 8	2013	Aggregate	Diesel	1241.959	20524148	20524148	5630247	0	77.1523592	17.445672	0.610753816	0.006011192	0.638369435	0.006282991	32267.69136	4155.132392	0.021919735	0.068571601	5.08378714	0.6546428	3253.636417
South Coast	2029	T7 Tractor Class 8	2014	Aggregate	Diesel	1484.5427	25256818	25256818	6729967	0	37.6662256	20.8532208	0.890749369	0.007185319	0.931025102	0.007510207	44689.74857	4322.860825	0.01313751	0.081965243	7.040888087	0.681068483	4378.276982
South Coast	2029	T7 Tractor Class 8	2015	Aggregate	Diesel	1660.5796	29130880	29130880	7528005	0	43.209821	23.3259927	1.019210606	0.008037153	1.065294787	0.008400766	51539.33919	4835.465038	0.01506111	0.091684669	8.120043879	0.761829486	5035.93893
South Coast	2029	T7 Tractor Class 8	2016	Aggregate	Diesel	2165.9562	39181541	39181541	9819059	0	57.7418122	30.4249669	1.35064151	0.01048342	1.411715126	0.010957434	69326.34281	6307.078343	0.020115127	0.119587752	10.92239354	0.993682761	6756.303551
South Coast	2029	T7 Tractor Class 8	2017	Aggregate	Diesel	1425.4798	26616745	26616745	6462213	0	38.8756073	20.0235707	0.740162018	0.006899449	0.77362886	0.007211412	49106.70292	4031.459007	0.014219543	0.078704237	7.736781043	0.635158008	4746.810955
Average Grams per Mile											2.03		0.030740706		0.032130655		1579.1		0.0009		0.2488		
Average Idling Grams per Truck per Day												41.2211632		0.014073489		0.01470983		8846.8		0.1605		1.3938	
Average miles per gallon																							5.8412
South Coast	2030	T7 Tractor Class 8	2010	Aggregate	Diesel	1.0422221	652.45308	652.45308	4724.768	0	0.00508247	0.02190303	3.21293E-05	5.04445E-06	3.35821E-05	5.27254E-06	1.156886286	3.920263812	6.24468E-06	5.66608E-05	0.000182268	0.000617639	0.453539807
South Coast	2030	T7 Tractor Class 8	2011	Aggregate	Diesel	603.0647	9326716.1	9326716.1	2733909	0	44.072392	9.59517879	0.507241536	0.002918887	0.530176748	0.003050866	15565.20599	2072.225385	0.048179993	0.033185463	2.452304543	0.326479953	1575.544758
South Coast	2030	T7 Tractor Class 8	2012	Aggregate	Diesel	1047.7023	16214390	16214390	4749612	0	64.8427711	14.7169681	0.49677951	0.005070972	0.519241675	0.005300259	27158.76376	3505.221857	0.017436123	0.05784624	4.278874291	0.552249131	2739.201689
South Coast	2030	T7 Tractor Class 8	2013	Aggregate	Diesel	1094.4939	17404459	17404459	4961735	0	65.5799082	15.3742447	0.519461735	0.005297448	0.542949489	0.005536975	27362.8765	3661.769053	0.01862189	0.060429691	4.311032335	0.576913206	2771.419297
South Coast	2030	T7 Tractor Class 8	2014	Aggregate	Diesel	1322.2619	21624921	21624921	5994289	0	32.347401	18.5736789	0.767392234	0.006399865	0.802090305	0.006689239	38263.17761	3850.313072	0.011269352	0.073005322	6.028379215	0.606618392	3761.98144
South Coast	2030	T7 Tractor Class 8	2015	Aggregate	Diesel	1534.163	25848617	25848617	6954913	0	38.5285555	21.5502317	0.913316863	0.007425485	0.954612999	0.007761233	45731.95845	4467.350785	0.013436509	0.084704899	7.205088678	0.703832935	4484.284409
South Coast	2030	T7 Tractor Class 8	2016	Aggregate	Diesel	2033.4966	35302221	35302221	9218572	0	52.380479	28.564321	1.233586298	0.009842304	1.289363597	0.01028733	62462.0179	5921.367512	0.01825931	0.112274335	9.840916358	0.932913863	6108.660731
South Coast	2030	T7 Tractor Class 8	2017	Aggregate	Diesel	1367.2041	24482370	24482370	6198028	0	36.0770123	19.2049768	0.692854293	0.006617389	0.72418009	0.006916598	45168.86811	3866.646867	0.013205836	0.075486689	7.116373565	0.609191788	4380.323128
Average Grams per Mile											2.02		0.0310		0.0324		1580.7		0.0008		0.2490		
Average Idling Grams per Truck per Day												41.21		0.0141		0.0147		8832.4		0.1605		1.3915	
Average miles per gallon																							5.8169
Region	Calendar Year	Vehicle Category	Model Year	Speed	Fuel	Population	Total VMT	CVMT	Trips	Energy Cor	NOx_RUNEX	NOx_IDLEX	PM2.5_RUNEX	PM2.5_IDLEX	PM10_RUNEX	PM10_IDLEX	CO2_RUNEX	CO2_IDLEX	CH4_RUNEX	CH4_IDLEX	N2O_RUNEX	N2O_IDLEX	Fuel Consumption
South Coast	2025	T6 Instate Delivery Class 4	2011	Aggregate	Diesel	114.05553	1047417	1047417	507802.6	0	2.38909948	0.43848687	0.019163827	9.02266E-05	0.02003033	9.43063E-05	1128.411808	89.73543008	0.0021752	0.000329361	0.17778174	0.014137854	108.8166103
South Coast	2025	T6 Instate Delivery Class 4	2012	Aggregate	Diesel	651.23497	6071237.6	6071237.6	2899454	0	10.8548051	2.1572711	0.053003192	0.000515177	0.055399761	0.000538471	6465.355658	492.7880224	0.002551797	0.00173106	1.018619417	0.077638954	621.5682186
South Coast	2025	T6 Instate Delivery Class 4	2013	Aggregate	Diesel	597.98108	5675228.3	5675228.3	2662355	0	9.61313855	1.98086307	0.047645818	0.000473049	0.04980015	0.000494438	5482.744195	452.4909246	0.002329174	0.001589507	0.863808581	0.071290129	530.1922021
South Coast	2025	T6 Instate Delivery Class 4	2014	Aggregate	Diesel	508.29993	4924171.9	4924171.9	2263073	0	1.45533191	1.68378665	0.019742961	0.000402104	0.02063565	0.000420285	6345.548901	364.1974298	0.0012669	0.001351124	0.999743814	0.057379453	599.3789818
South Coast	2025	T6 Instate Delivery Class 4	2015	Aggregate	Diesel	909.37504	9012671.8	9012671.8	4047865	0	2.61401285	3.01171949	0.035716285	0.000719327	0.037331217	0.000751747	11609.94805	651.4248689	0.002270901	0.002416699	1.829152043	0.102632253	1095.303585
South Coast	2025	T6 Instate Delivery Class 4	2016	Aggregate	Diesel	974.20293	9904507.1	9904507.1	4337385	0	2.8390765	3.2271299	0.03851822	0.000770669	0.040259843	0.000805515	12765.96113	698.0174203	0.002442441	0.002589552	2.011282375	0.109972929	1202.73187
South Coast	2025	T6 Instate Delivery Class 4	2017	Aggregate	Diesel	657.9411	6875253.5	6875253.5	2929312	0	1.92890002	2.17948574	0.026227962	0.000520482	0.027413874	0.000544016	8523.93516	453.5925933	0.001650936	0.001748889	1.342949456	0.071463698	801.9589979
Average Grams per Mile																	1090.9		0.0003		0.1719		
Average Idling Grams per Truck per Day																		2110.0		0.0077		0.3324	
Average miles per year							9859.8609																8.7724
South Coast	2025	T6 Instate Delivery Class 5	2011	Aggregate	Diesel	160.70002	1473962.1	1473962.1	715475.1	0	3.37781563	0.61781175	0.026488432	0.000127126	0.027686121	0.000132874	1593.574701	126.433896	0.003082003	0.000464057	0.251068343	0.019919712	153.6476866
South Coast	2025	T6 Instate Delivery Class 5	2012	Aggregate	Diesel	428.60665	3990826.7	3990826.7	1908260	0	7.14475406	1.41979592	0.034633745	0.000339061	0.03619973	0.000354391	4253.804709	324.3256816	0.001679362	0.001139289	0.670188664	0.051097643	408.9625742
South Coast	2025	T6 Instate Delivery Class 5	2013	Aggregate	Diesel	476.49833	4516791.5	4516791.5	2121485	0	7.66354207	1.57844116	0.03767007	0.000376947	0.039373343	0.00039399	4367.871651	360.5652058	0.00185594	0.001266591	0.688159957	0.056807195	422.3893914
South Coast	2025	T6 Instate Delivery Class 5	2014	Aggregate	Diesel	541.83831	5242796.7	5242796.7	2412394	0	1.55703057	1.79488538	0.020972948	0.000428636	0.021921251	0.000448017	6759.602933	388.1277137	0.00134042	0.001440273	1.064978195	0.061165434	638.5128802
South Coast	2025	T6 Instate Delivery Class 5	2015	Aggregate	Diesel	651.82593	6453799.4	6453799.4	2902085	0	1.88449586	2.1592287	0.025535947	0.000515644	0.026690569	0.000538959	8320.521501	467.0339574	0.001629407	0.001732634	1.310901551	0.07358139	784.9888481
South Coast	2025	T6 Instate Delivery Class 5	2016	Aggregate	Diesel	997.43378	10128408	10128408	4440815	0	2.90983177	3.30408405	0.039473389	0.000789046	0.0412582	0.000824724	13060.70223	714.6623452	0.002500959	0.002651302	2.057718955	0.112595344	1230.547861
South Coast	2025	T6 Instate Delivery Class 5	2017	Aggregate	Diesel	911.27614	9510952.1	9510952.1	4057220	0	2.68732706	3.01867955	0.036146824	0.000720889	0.037781223	0.000753484	11800.08983	628.2448467	0.002287427	0.002422284	1.859108958	0.098980231	1110.218213
Average Grams per Mile																	1101.3		0.0003		0.1735		
Average Idling Grams per Truck per Day																		2099.4		0.0078		0.3308	
Average miles per year							9912.6104																8.6998
South Coast	2026	T6 Instate Delivery Class 4	2011	Aggregate	Diesel	104.37045	946663.92	946663.92	464682.3	0	2.18312341	0.40125251	0.017550167	8.2565E-05	0.018343707	8.62982E-05	1020.641975	82.11549669	0.001989965	0.000301393	0.160802559	0.01293733	98.50888809
South Coast	2026	T6 Instate Delivery Class 4	2012	Aggregate	Diesel	602.90504	5535032.7	5535032.7	2684278	0	10.0565377	1.99717413	0.049261882	0.000476944	0.051489286	0.000498509	5898.791683	456.2168785	0.002354755	0.001602596	0.929357032	0.071877155	567.6903974
South Coast	2026	T6 Instate Delivery Class 4	2013	Aggregate	Diesel	561.81224	5236059.8	5236059.8	2501323	0	9.0363988	1.86105071	0.044949685	0.000444436	0.04698211	0.000464532	5062.362033	425.1220457	0.002178497	0.001493366	0.7975772	0.066978151	490.1947788
South Coast	2026	T6 Instate Delivery Class 4	2014	Aggregate	Diesel	481.08209	4564652.3	4564652.3	2141893	0	1.36900293	1.59582527	0.018582244	0.000380573	0.019422451	0.000397781	5885.389284	344.6958234	0.001198099	0.001278779	0.927245478	0.054306967	556.5310347
South Coast	2026	T6 Instate Delivery Class 4	2015	Aggregate	Diesel	863.41368	8362326.4	8362326.4	3844125	0	2.46672807	2.86031109	0.033721197	0.000683026	0.03524592	0.00071391	10778.49508	618.636804	0.002155655	0.00229506	1.69815629	0.09746648	1018.101277
South Coast	2026	T6 Instate Delivery Class 4	2016	Aggregate	Diesel	932.64781	9242585.7	9242585.7	4152372	0	2.69976506	3.08947504	0.036630801	0.000737796	0.038287083	0.000771156	11918.59516	668.2431335	0.002336897	0.002479093	1.877779522	0.105281978	1124.377279
South Coast	2026	T6 Instate Delivery Class 4	2017	Aggregate	Diesel	639.35419	6498586.1	6498586.1	2846558	0	1.86328478	2.11791502	0.025324561	0.000505778	0.026469626	0.000528647	8061.282228	440.7785499	0.001605028	0.001699482	1.270058298	0.06944484	759.4857213
Average Grams per Mile																	1092.3		0.0003		0.1721		
Average Idling Grams per Truck per Day																		2109.0		0.0077		0.3323	
Average miles per year							9648.807																8.7512
South Coast	2026	T6 Instate Delivery Class 5	2011	Aggregate	Diesel	147.0776	1332604.9	1332604.9	654824.8	0	3.08710252	0.56544032	0.024266769	0.00011635	0.025364004	0.00012161	1441.718262	115.7161908	0.002819771	0.00042472	0.227143299	0.018231133	139.1250028
South Coast	2026	T6 Instate Delivery Class 5	2012	Aggregate	Diesel	396.87131	3639695.3	3639695.3	1766966	0	6.62159986	1.31466991	0.032201391	0.000313956	0.033657395	0.000328151	3882.415316	300.311622	0.001550197	0.001054933	0.611676114	0.047314218	373.6413405
South Coast	2026	T6 Instate Delivery Class 5	2013	Aggregate	Diesel	447.75753	4168759.4	4168759.4	1993524	0	7.20613355	1.48323483	0.035554616	0.00035421	0.037162238	0.000370226	4034.347615	338.8171091	0.001736439	0.001190195	0.63561311	0.053380774	390.6530725
South Coast	2026	T6 Instate Delivery Class 5	2014	Aggregate	Diesel	512.90823	4861599.1	4861599.1	2283591	0	1.4647457	1.69905205	0.019736633	0.00040575	0.020629036	0.000424096	6270.928422	367.4992849	0.001276916	0.001363373	0.987987327	0.057899662	593.0081174
South Coast	2026	T6 Instate Delivery Class 5	2015	Aggregate	Diesel	619.11195	5989923.6	5989923.6	2756435	0	1.7780604	2.05086087	0.024096028	0.000489765	0.025185543	0.00051191	7725.87837	443.5943572	0.001545995	0.001645676	1.217215284	0.069888472	729.7757626
South Coast	2026	T6 Instate Delivery Class 5	2016	Aggregate	Diesel	955.05198	9454774.5	9454774.5	4252121	0	2.7674577	3.16369074	0.037525991	0.000755519	0.039222749	0.00078968	12196.84517	684.2957426	0.002392516	0.002538646	1.921617924	0.107811073	1150.667215
South Coast	2026	T6 Instate Delivery Class 5	2017	Aggregate	Diesel	885.67288	8992736	8992736	3943228	0	2.59567576	2.93386657	0.034891043	0.000700635	0.036468661	0.000732315	11161.84843	610.5936449	0.002223137	0.002354228	1.758553765	0.096199277	1051.627587
Average Grams per Mile																	1102.5		0.0003		0.1737		
Average Idling Grams per Truck per Day																		2098.2		0.0078		0.3306	
Average miles per year							9696.1945																8.6802
South Coast	2027	T6 Instate Delivery Class 4	2011	Aggregate	Diesel	95.213064	855607.14	855607.14	423911.4	0	1.99386189	0.36604693	0.016269273	7.53208E-05	0.017004897	7.87265E-05	922.8561577	74.91074682	0.001816024	0.000274949	0.145396363	0.011802219	89.13012233
South Coast	2027	T6 Instate Delivery Class 4	2012	Aggregate	Diesel	551.72607	5002916.4	5002916.4	2456417	0	9.23839612	1.82763943	0.045950752	0.000436457	0.048028441	0.000456192	5337.060083	417.4898647	0.002153568	0.001466556	0.84085599	0.065775698	514.0516673
South Coast	2027	T6 Instate Delivery Class 4	2013	Aggregate	Diesel	520.14823	4774160.6	4774160.6	2315825	0	8.39132237	1.72303516	0.042405444	0.000411477	0.04432283	0.000430082	4620.658349	393.5949855	0.002013102	0.001382618	0.727986605	0.06201105	447.9212641
South Coast	2027	T6 Instate Delivery Class 4	2014	Aggregate	Diesel	452.01601	4212022.8	4212022.8	2012484	0	1.27648255	1.49734139	0.017656241	0.000357579	0.018454578	0.000373747	5438.629666	323.8699423	0.00112927	0.001201514	0.856858319	0.051025841	514.7618073
South Coast	2027	T6 Instate Delivery Class 4	2015	Aggregate	Diesel	817.23241	7752765.3	7752765.3	3638515	0	2.31500514	2.70715172	0.03226064	0.000646493	0.033719323	0.000675725	10007.49509	585.5478766	0.002046269	0.002172305	1.576684927	0.092253306	946.2723321
South Coast	2027	T6 Instate Delivery Class 4	2016	Aggregate	Diesel	885.73391	8576209.8	8576209.8	3943500	0	2.54130393	2.93406874	0.035120562	0.000700683	0.036708558	0.000732365	11075.21563	634.6292709	0.002226002	0.00235439	1.744904733	0.0999861	1046.035806
South Coast	2027	T6 Instate Delivery Class 4	2017	Aggregate	Diesel	612.12058	6065043.9	6065043.9	2725308	0	1.76835664	2.02770138	0.024473387	0.000484234	0.025579965	0.000506129	7534.465734	422.0033685	0.001541834	0.001627092	1.187058145	0.066486803	710.7482332
Average Grams per Mile																	1094.7		0.0003		0.1725		
Average Idling Grams per Truck per Day																		2107.9		0.0077		0.3321	
Average miles per year							9465.4105																8.7232
South Coast	2027	T6 Instate Delivery Class 5	2011	Aggregate	Diesel	134.19465	1204811.9	1204811.9	597466.8	0	2.81984511	0.51591174	0.022514901	0.000106158	0.023532925	0.000110958	1303.887718	105.5802711	0.002573822	0.000387517	0.205428041	0.016634215	125.9072171
South Coast	2027	T6 Instate Delivery Class 5	2012	Aggregate	Diesel	363.24842	3290992.9	3290992.9	1617269	0	6.08492774	1.20329122	0.030050762	0.000287357	0.031409524	0.00030035	3513.952395	274.8692553	0.00141827	0.000965559	0.553624631	0.043305763	338.4539371
South Coast	2027	T6 Instate Delivery Class 5	2013	Aggregate	Diesel	414.62577	3802368.1	3802368.1	1846013	0	6.69349854	1.37348305	0.03356656	0.000328001	0.035084291	0.000342835	3683.494204	313.7463778	0.001605098	0.001102126	0.580336012	0.04943087	357.0719177
South Coast	2027	T6 Instate Delivery Class 5	2014	Aggregate	Diesel	481.9971	4487478.9	4487478.9	2145967	0	1.36647847	1.59665632	0.018746066	0.000381297	0.01959368	0.000398537	5796.648254	345.3514296	0.001204003	0.001281208	0.913264293	0.054410258	548.6623987
South Coast	2027	T6 Instate Delivery Class 5	2015	Aggregate	Diesel	586.08572	5554965.9	5554965.9	2609394	0	1.66986381	1.9414587	0.023029666	0.000463639	0.024070965	0.000484602	7175.132236	419.931033	0.001468079	0.001557888	1.130445006	0.066160305	678.4639932
South Coast	2027	T6 Instate Delivery Class 5	2016	Aggregate	Diesel	907.16473	8776072.1	8776072.1	4038915	0	2.60739174	3.00506016	0.035942803	0.000717637	0.037567977	0.000750085	11337.42343	649.9844781	0.002279763	0.002411356	1.786215679	0.102405319	1070.8304
South Coast	2027	T6 Instate Delivery Class 5	2017	Aggregate	Diesel	848.0801	8395431.6	8395431.6	3775856	0	2.46461974	2.80933731	0.033702785	0.000670896	0.035226676	0.000701231	10435.33824	584.6767286	0.002136432	0.002254301	1.64409179	0.092116057	984.4135719
Average Grams per Mile																	1104.8		0.0003		0.1741		
Average Idling Grams per Truck per Day																		2097.2		0.0078		0.3304	
Average miles per year							9506.9216																8.6535
South Coast	2028	T6 Instate Delivery Class 4	2011	Aggregate	Diesel	85.186056	760825.47	760825.47	379268.8	0	1.78303964	0.32749807	0.014573632	6.73887E-05	0.015232587	7.04357E-05	820.6231136	67.02180167	0.001624866	0.000245994	0.129289506	0.010559312	79.29296865
South Coast	2028	T6 Instate Delivery Class 4	2012	Aggregate	Diesel	503.33188	4521949.3	4521949.3	2240954	0	8.42940351	1.66732959	0.042043431	0.000398174	0.043944449	0.000416178	4823.960332	380.8700943	0.001960227	0.001337918	0.760016915	0.060006238	464.9454402
South Coast	2028	T6 Instate Delivery Class 4	2013	Aggregate	Diesel	476.01929	4315645.5	4315645.5	2119352	0	7.67536076	1.57685431	0.038917669	0.000376568	0.040677363	0.000393594	4176.877876	360.202718	0.001835396	0.001265318	0.65806881	0.056750085	405.2956122
South Coast	2028	T6 Instate Delivery Class 4	2014	Aggregate	Diesel	418.52174	3840959.2	3840959.2	1863359	0	1.17383353	1.38638878	0.016267693	0.000331083	0.017003246	0.000346053	4959.504211	299.871263	0.001043216	0.001112482	0.781371908	0.04724484	469.8179277
South Coast	2028	T6 Instate Delivery Class 4	2015	Aggregate	Diesel	767.9002	7154656.9	7154656.9	3418876	0	2.15798497	2.54373458	0.030134846	0.000607468	0.03149741	0.000634935	9235.434799	550.2012942	0.001917472	0.002041173	1.455046514	0.086684438	874.1469959
South Coast	2028	T6 Instate Delivery Class 4	2016	Aggregate	Diesel	838.38204	7951499	7951499	3732678	0	2.3843315	2.77721168	0.033021166	0.000663224	0.034514237	0.000693212	10268.46691	600.701611	0.002100709	0.002228523	1.617801143	0.094640783	970.9385183
South Coast	2028	T6 Instate Delivery Class 4	2017	Aggregate	Diesel	581.36252	5628397.7	5628397.7	2588365	0	1.66402388	1.92581269	0.023076479	0.000459902	0.024119895	0.000480697	6992.026807	400.7983867	0.0014601	0.001545333	1.101596671	0.063145949	660.398146
Average Grams per Mile																	1095.8		0.0003		0.1726		
Average Idling Grams per Truck per Day																		2106.8		0.0077		0.3319	
Average miles per year							9309.9131																8.7071
South Coast	2028	T6 Instate Delivery Class 5	2011	Aggregate	Diesel	120.07721	1071610	1071610	534612.6	0	2.5223139	0.46163722	0.020173131	9.49903E-05	0.021085271	9.92853E-05	1159.73172	94.4731023	0.002303472	0.00034675	0.182716205	0.014884276	112.0376199
South Coast	2028	T6 Instate Delivery Class 5	2012	Aggregate	Diesel	331.43374	2975455.5	2975455.5	1475623	0	5.5536797	1.09790238	0.027503106	0.000262189	0.028746675	0.000274044	3177.036708	250.7951566	0.001291314	0.000880992	0.500543427	0.039512879	306.2068626
South Coast	2028	T6 Instate Delivery Class 5	2013	Aggregate	Diesel	379.50199	3438140	3438140	1689634	0	6.12411694	1.25713254	0.030814087	0.000300215	0.032207363	0.000313789	3330.651775	287.1682913	0.001463818	0.001008763	0.524745543	0.045243481	323.1784334
South Coast	2028	T6 Instate Delivery Class 5	2014	Aggregate	Diesel	446.33631	4093158.4	4093158.4	1987196	0	1.25691102	1.47852692	0.017275947	0.000353086	0.018057089	0.000369051	5287.28904	319.8004344	0.001112528	0.001186417	0.833014541	0.050384689	500.8790816
South Coast	2028	T6 Instate Delivery Class 5	2015	Aggregate	Diesel	550.76897	5127572.5	5127572.5	2452156	0	1.55696445	1.82446897	0.02151686	0.0004357	0.022489756	0.000455401	6623.084393	394.6265455	0.001375986	0.001464012	1.043469643	0.062173573	626.8893382
South Coast	2028	T6 Instate Delivery Class 5	2016	Aggregate	Diesel	858.77868	8138916.1	8138916.1	3823489	0	2.44698813	2.84477726	0.033802807	0.00067936	0.03533122	0.000710077	10514.30886	615.3158206	0.002152003	0.00228274	1.656533643	0.096943258	994.204964
South Coast	2028	T6 Instate Delivery Class 5	2017	Aggregate	Diesel	805.56126	7792864.9	7792864.9	3586552	0	2.31977485	2.66849005	0.031786412	0.000637261	0.033223652	0.000666075	9686.360263	555.3637253	0.00202366	0.002141281	1.526090004	0.087497781	914.8891468
Average Grams per Mile																	1105.7		0.0003		0.1742		
Average Idling Grams per Truck per Day																		2096.0		0.0078		0.3302	
Average miles per year							9345.1992																8.6382
South Coast	2029	T6 Instate Delivery Class 4	2011	Aggregate	Diesel	75.859978	677440.6	677440.6	337746.8	0	1.59373788	0.29164393	0.013041279	6.0011E-05	0.013630948	6.27245E-05	730.6833436	59.68432645	0.001452878	0.000219063	0.115119458	0.00940329	70.60323088
South Coast	2029	T6 Instate Delivery Class 4	2012	Aggregate	Diesel	450.33549	4021201.6	4021201.6	2005002	0	7.54942063	1.49177454	0.037732303	0.00035625	0.039438391	0.000372358	4289.762591	340.7678441	0.001752409	0.001197047	0.675853843	0.053688113	413.6434495
South Coast	2029	T6 Instate Delivery Class 4	2013	Aggregate	Diesel	434.28513	3901100.5	3901100.5	1933542	0	7.00363947	1.43860634	0.035605579	0.000343553	0.037215505	0.000359087	3775.656803	328.6225701	0.001670488	0.001154383	0.594856267	0.05177462	366.6336506
South Coast	2029	T6 Instate Delivery Class 4	2014	Aggregate	Diesel	383.03559	3472448.3	3472448.3	1705366	0	1.06851098	1.26883789	0.01483331	0.00030301	0.015504007	0.000316711	4483.675713	274.4453978	0.000953297	0.001018156	0.706404935	0.043238984	425.041074
South Coast	2029	T6 Instate Delivery Class 4	2015	Aggregate	Diesel	711.03141	6524953.1	6524953.1	3165682	0	1.98463405	2.3553519	0.027767403	0.00056248	0.029022922	0.000587913	8422.592027	509.4547492	0.001771516	0.001890009	1.326982804	0.080264803	797.8962002
South Coast	2029	T6 Instate Delivery Class 4	2016	Aggregate	Diesel	787.78967	7338366.7	7338366.7	3507429	0	2.22270718	2.60962014	0.030846486	0.000623202	0.032241228	0.00065138	9476.67209	564.4521211	0.001968569	0.002094042	1.493053547	0.088929662	896.9696482
South Coast	2029	T6 Instate Delivery Class 4	2017	Aggregate	Diesel	550.3078	5218891.5	5218891.5	2450102	0	1.56138544	1.82294129	0.021698992	0.000435336	0.022680124	0.000455019	6483.304485	379.3888859	0.001378043	0.001462786	1.021447262	0.059772873	613.0416803
Average Grams per Mile																	1096.7		0.0003		0.1728		
Average Idling Grams per Truck per Day																		2105.6		0.0077		0.3317	
Average miles per year							9182.9242																8.6930
South Coast	2029	T6 Instate Delivery Class 5	2011	Aggregate	Diesel	106.94023	954323.38	954323.38	476123.6	0	2.25490699	0.41113207	0.018054925	8.45979E-05	0.018871288	8.8423E-05	1032.800153	84.13732686	0.002060005	0.000308814	0.162718085	0.01325587	99.77558259
South Coast	2029	T6 Instate Delivery Class 5	2012	Aggregate	Diesel	296.5666	2646495.6	2646495.6	1320386	0	4.97491986	0.98240202	0.024687768	0.000234607	0.02580404	0.000245215	2825.789862	224.4112706	0.001154646	0.000788311	0.445204344	0.035356087	272.4732589
South Coast	2029	T6 Instate Delivery Class 5	2013	Aggregate	Diesel	346.26361	3108491.6	3108491.6	1541649	0	5.58925985	1.14702758	0.028196983	0.000273921	0.029471926	0.000286306	3011.308719	262.0168846	0.001332558	0.000920411	0.474432915	0.041280867	292.4048795
South Coast	2029	T6 Instate Delivery Class 5	2014	Aggregate	Diesel	408.5265	3701079.7	3701079.7	1818858	0	1.14433513	1.35327871	0.015755253	0.000323176	0.016467635	0.000337788	4780.825988	292.7096656	0.001016809	0.001085914	0.753221081	0.046116527	453.2169302
South Coast	2029	T6 Instate Delivery Class 5	2015	Aggregate	Diesel	510.01957	4676997.1	4676997.1	2270730	0	1.4321214	1.68948311	0.019829402	0.000403464	0.020726	0.000421707	6041.093732	365.4295544	0.001271443	0.001355695	0.951776778	0.057573575	572.2921873
South Coast	2029	T6 Instate Delivery Class 5	2016	Aggregate	Diesel	807.02927	7512706	7512706	3593088	0	2.28154533	2.67335295	0.031582274	0.000638422	0.033010284	0.000667288	9705.335284	578.237316	0.002017006	0.002145183	1.529079526	0.091101525	918.6274668
South Coast	2029	T6 Instate Delivery Class 5	2017	Aggregate	Diesel	762.59304	7227063.4	7227063.4	3395247	0	2.177058	2.52615416	0.029893754	0.000603269	0.031245417	0.000630547	8983.081246	525.7409083	0.001910246	0.002027066	1.415288109	0.082830694	849.4193163
Average Grams per Mile																	1106.5		0.0003		0.1743		
Average Idling Grams per Truck per Day																		2094.8		0.0078		0.3300	
Average miles per year							9211.7728																8.6250
South Coast	2030	T6 Instate Delivery Class 4	2011	Aggregate	Diesel	66.56253	594341.75	594341.75	296352.4	0	1.40111943	0.25589986	0.01147212	5.2656E-05	0.011990839	5.50369E-05	641.0527179	52.36937712	0.001277528	0.000192214	0.100998117	0.008250817	61.94312106
South Coast	2030	T6 Instate Delivery Class 4	2012	Aggregate	Diesel	401.03506	3580518.7	3580518.7	1785504	0	6.7546125	1.32846266	0.033806934	0.000317249	0.035335533	0.000331594	3819.644397	303.4623173	0.001565992	0.001066001	0.60178653	0.047810612	368.3154895
South Coast	2030	T6 Instate Delivery Class 4	2013	Aggregate	Diesel	388.56733	3469257.1	3469257.1	1729995	0	6.27262466	1.28716227	0.031951975	0.000307386	0.033396702	0.000321285	3357.696456	294.028019	0.001493264	0.00103286	0.529006444	0.046324234	326.2071008
South Coast	2030	T6 Instate Delivery Class 4	2014	Aggregate	Diesel	349.4631	3139068.1	3139068.1	1555894	0	0.97117215	1.15762616	0.013501293	0.000276452	0.014111761	0.000288952	4053.209511	250.3906736	0.000869185	0.000928916	0.638584809	0.039449153	384.4388997
South Coast	2030	T6 Instate Delivery Class 4	2015	Aggregate	Diesel	650.75542	5899147.9	5899147.9	2897319	0	1.80663195	2.15568255	0.025319909	0.000514797	0.026464763	0.000538074	7614.783363	466.2669374	0.001618882	0.001729788	1.19971222	0.073460546	721.8770222
South Coast	2030	T6 Instate Delivery Class 4	2016	Aggregate	Diesel	729.44891	6692512.1	6692512.1	3247682	0	2.04416748	2.41636143	0.028423154	0.00057705	0.029708323	0.000603141	8642.622002	522.6509079	0.001818728	0.001938965	1.361648616	0.082343863	818.7301984
South Coast	2030	T6 Instate Delivery Class 4	2017	Aggregate	Diesel	517.10961	4816659.2	4816659.2	2302296	0	1.45560597	1.71296948	0.020270725	0.000409073	0.021187277	0.00042757	5983.619516	356.5016514	0.001291412	0.001374541	0.942721692	0.05616698	566.3605124
Average Grams per Mile											0.67		0.0053		0.0055		1097.7		0.0003		0.1729		
Average Idling Grams per Truck per Day												9.67		0.0023		0.0024		2104.4		0.0077		0.3315	
Average miles per year							9085.4117																8.6800
South Coast	2030	T6 Instate Delivery Class 5	2011	Aggregate	Diesel	93.840765	837388.83	837388.83	417801.6	0	1.98268685	0.36077112	0.015884877	7.42352E-05	0.016603121	7.75918E-05	906.2496773	73.83106336	0.001811661	0.000270986	0.142780006	0.011632114	87.55022432
South Coast	2030	T6 Instate Delivery Class 5	2012	Aggregate	Diesel	264.12306	2356878	2356878	1175939	0	4.45194061	0.87493005	0.022123214	0.000208942	0.023123527	0.000218389	2516.551044	199.8613186	0.001031999	0.000702072	0.396483642	0.031488232	242.6560403
South Coast	2030	T6 Instate Delivery Class 5	2013	Aggregate	Diesel	309.8383	2764858.3	2764858.3	1379474	0	5.00673259	1.02636567	0.02530779	0.000245106	0.026452096	0.000256188	2678.418449	234.4539402	0.001191389	0.000823588	0.421985917	0.036938314	260.2057366
South Coast	2030	T6 Instate Delivery Class 5	2014	Aggregate	Diesel	372.74859	3346266.5	3346266.5	1659566	0	1.04025365	1.23476132	0.014342606	0.000294873	0.014991115	0.000308205	4322.500225	267.074751	0.000927236	0.000990812	0.681011671	0.042077736	409.9849145
South Coast	2030	T6 Instate Delivery Class 5	2015	Aggregate	Diesel	466.81768	4229040.7	4229040.7	2078384	0	1.30386789	1.54637318	0.018084137	0.000369288	0.018901821	0.000385986	5462.48609	334.4753542	0.001162064	0.001240859	0.860616908	0.052696728	517.8402695
South Coast	2030	T6 Instate Delivery Class 5	2016	Aggregate	Diesel	747.32452	6852622.7	6852622.7	3327268	0	2.09862827	2.47557589	0.029105771	0.000591191	0.030421805	0.000617922	8852.60273	535.4587973	0.001863782	0.001986481	1.394731165	0.084361752	838.6318174
South Coast	2030	T6 Instate Delivery Class 5	2017	Aggregate	Diesel	716.64252	6671063.6	6671063.6	3190664	0	2.02988245	2.37393916	0.027930204	0.000566919	0.029193084	0.000592553	8291.985762	494.0620609	0.001790428	0.001904924	1.306405734	0.077839679	784.8541716
Average Grams per Mile											0.60		0.0051		0.0054		1107.5		0.0003		0.1745		
Average Idling Grams per Truck per Day												9.68		0.0023		0.0024		2093.4		0.0078		0.3298	
Average miles per year							9106.3831																8.6125

Measure G1: Infrastructure

$$GHGCHRGi = NCHRGi \times CP \times UTi \times HPD \times DPY \div CE \div (1 - GL) \times CF \times EF \times U \quad \text{(Equation 1)}$$

Where,

GHGCHRGi = GHG emissions for electricity generation metric tons in year i
NCHRGi = Number of chargers in year i
CP = Charger power (KW)
UTi = Utilization rate in year i
HPD = Hours per day
DPY = Days per year
CE = Charging Efficiency (%)
GL = Transmission and Distribution Grid Loss (%)
CF = Conversion factor from KWh to MWh (1000 kWh per MWh)
EF = Electricity generation GHG emission factors in pounds per MWh
U = Unit conversion from grams to metric tons (1000,000 grams per metric ton)

$$GHGTRKEXi = NCHRGi \times CP \times UTi \times HPD \times DPY \div ETi \times EF \times U \quad \text{(Equation 2)}$$

Where,

GHGTRKEXi = GHG emission reductions from running exhaust for trucks in metric tons in year i
CP = Charger power (KW)
UTi = Utilization rate in year i
HPD = Hours per day
DPY = Days per year
ETi = Estimated Electricity Consumption for battery-powered trucks (KWh/mile)
EF = Composite emission factor for running exhaust for diesel trucks in grams per mile derived from CARB's EMFAC2021 Model in year i
U = unit conversion from grams to metric tons (1000,000 grams per metric ton)

$$GHGTRKIDi = NCHRGi \times CP \times UTi \times HPD \times DPY \div ETi \div VMTi \times EF \times U \quad \text{(Equation 3)}$$

Where,

GHGTRKIDi = GHG emission reductions from idling for trucks in metric tons in year i
CP = Charger power (KW)
UTi = Utilization rate in year i
HPD = Hours per day
DPY = Days per year
ETi = Estimated Electricity Consumption for battery-powered trucks (KWh/mile)
VMTi = Annual vehicle miles traveled per truck in year i
EF = Composite emission factor for idling for diesel trucks in grams per truck per day derived from CARB's EMFAC2021 Model in year i
U = unit conversion from grams to metric tons (1000,000 grams per metric ton)

Note: For calculating CAP/HAP emission reductions, equations 2 and 3 are also used with the corresponding emission factors.

Measure G2: On-Road Heavy Duty Vehicles

$$GHGTRKEXi = NTi \times VMTi \times EF \times U \quad \text{(Equation 4)}$$

Where,

GHGTRKEXi = GHG emission reductions from running exhaust for trucks in metric tons in year i
NTi = Number of trucks in year i
VMTi = Annual vehicle miles traveled in year i
EF = Composite emission factor for running exhaust for diesel trucks in grams per mile derived from CARB's EMFAC2021 Model in year i
U = unit conversion from grams to metric tons (1000,000 grams per metric ton)

$$GHGTRKIDi = NTi \times EF \times U \quad \text{(Equation 5)}$$

Where,

$GHGTRKIDi$ = GHG emission reductions from idling for trucks in metric tons in year i
NTi = Number of trucks in year i
EF = Composite emission factor for idling for diesel trucks in grams per truck per day derived from CARB's EMFAC2021 Model in year i
U = unit conversion from grams to metric tons (1000,000 grams per metric ton)

Note: Equations 3 and 4 also used for calculating CPA/HAP emissions reductions based on total number of trucks in 2030 and corresponding emission factors.

$$GHGETRKi = NTi \times VMTi \times ETi \times CF \div CE \div (1 - GL) \times EF \times U \qquad \textit{(Equation 6)}$$

Where,

$GHGETRKi$ = GHG emissions for electricity generation in metric tons in year i
NTi = Number of battery-powered trucks per year in year i
$VMTi$ = Annual vehicle miles traveled per truck in year i
ETi = Estimated Electricity Consumption for battery-powered trucks (KWh/mile)
CF = Conversion factor from KWh to MWh (1000 kWh per MWh)
CE = Charging Efficiency (%)
GL = Transmission and Distribution Grid Loss (%)
EF = Electricity generation GHG emission factors in pounds per MWh
U = Unit conversion from grams to metric tons (1000,000 grams per metric ton)

In addition to the above equations, the annual upstream GHG emission reductions for this measure associated with diesel fuel production and refining are calculated based on the annual diesel fuel consumption and EPA's emission factor of 18 Kg/MMBtu.

Measure G3: Cargo Handling Equipment

$$GHGCHEi = NCHEi \times ENG \times HR \times LF \times CF \times EF \times U \qquad \textit{(Equation 7)}$$

Where,

$GHGCHEi$ = GHG emission reductions for CHE in metric tons in year i
$NCHEi$ = Number of replaced CHE in year i
ENG = Engine size (HP)
HR = Estimated annual operating hours
LF = Load Factor for each CHE type
CF = Conversion factor from HP to KW (0.7456 KW per HP)
EF = GHG emission factors in grams per KWh for each CHE type
U = unit conversion from grams to metric tons (1000,000 grams per metric ton)

$$GHGECHEi = NCHEi \times ENG \times HR \times LF \times CF1 \div BTU \times CF2 \times CF3 \times \div CE \div (1 - GL) \times EF \times U \qquad \textit{(Equation 8)}$$

Where,

$GHGECHEi$ = GHG emissions for electricity generation in metric tons in year i
$NCHEi$ = Number of replaced CHE in year i
ENG = Engine size (HP)
HR = Estimated annual operating hours
LF = Load Factor for each CHE type
$CF1$ = Btu to hp-hr conversion (2,544 Btu per hp-hr))
BTU = Diesel fuel heat content (lower heating value) (129,488 Btu/gal)
$CF2$ = Gallons of diesel fuel to KWh electricity conversion for diesel equipment (14.22 KWh/gal)
$CF3$ = Conversion factor from KWh to MWh (1000 kWh per MWh)
CE = Charging Efficiency (%)
GL = Transmission and Distribution Grid Loss (%)
EF = Electricity generation GHG emission factors in pounds per MWh
U = Unit conversion from grams to metric tons (1000,000 grams per metric ton)

$$CAPCHEi = NTi \times EF \times U \qquad \textit{(Equation 9)}$$

Where,

CAPCHEi = CAP/HAP emission reductions for CHE in short tons in 2030
NTi = Cumulative number of replaced CHE from 2025 to 2030
EF = Average emission factors in tons per year per unit in 2030
U = unit conversion from grams to short tons (907,200 grams per short ton)

Measure G4: Locomotives

$$GHGSWTi = NTi \times FC \times EF \times U \quad \textit{(Equation 10)}$$

Where,

GHGSWTi = GHG emission reductions for switchers in metric tons in year i
NTi = Number of replaced switchers in year i
FC = Estimated annual fuel consumption per switcher in gallons
EF = EPA's GHG emission factors for diesel switcher locomotives in Kg/gal or g/gal
U = unit conversion from grams to metric tons (1000,000 grams per metric ton)

$$GHGESWTi = NTi \times FC \times CF1 \times CF2 \times CF3 \times \div CE \div (1 - GL) \times EF \times U \quad \textit{(Equation 11)}$$

Where,

GHGESWTi = GHG emissions for electricity generation in year i
NTi = Number of battery-electric switchers in year i
FC = Estimated annual fuel consumption per switcher in gallons
CF1 = Switcher locomotives fuel consumption rate in hp-hr/gal
CF2 = Conversion factor from HP to KW (0.7456 KW per HP)
CF3 = Conversion factor from KWh to MWh (1000 kWh per MWh)
CE = Charging Efficiency (%)
GL = Transmission and Distribution Grid Loss (%)
EF = Electricity generation GHG emission factors in pounds per MWh
U = Unit conversion from grams to metric tons (1000,000 grams per metric ton)

$$CAPSWTi = NTi \times FC \times CF \times EF \times U \quad \textit{(Equation 12)}$$

Where,

CAPCHEi = CAP/HAP emission reductions for switchers in short tons in 2030
NTi = Cumulative number of replaced diesel switchers from 2025 to 2030
FC = Estimated annual fuel consumption per switcher in gallons
CF = Switcher locomotives fuel consumption rate in hp-hr/gal
EF = EPA's emission factors for switcher locomotives for each pollutant in grams per hp-hr
U = unit conversion from grams to short tons (907,200 grams per short ton)

In addition to the above equations, the annual upstream GHG emission reductions for this measure associated with diesel fuel production and refining are calculated based on the annual diesel fuel consumption and EPA's emission factor of 18 Kg/MMBtu.

Model Output: OFFROAD2021 (v1.0.5) Emissions Inventory
Region Type: Air Basin
Region: South Coast
Calendar Year: 2030
Scenario: All Adopted Rules - Exhaust
Vehicle Classification: OFFROAD2021 Equipment Types
Units: tons/day for Emissions, gallons/year for Fuel, hours/year for Activity, Horsepower-hours/year for Horsepower-hours

Region	Calendar Year	Vehicle Category	Model Year	Horsepower Bin	Fuel	NOx_tpd	CO2_tpd	PM10_tpd	PM2.5_tpd	PM2.5/PM10	SOx_tpd	NH3_tpd	Total_Popu	Horsepower_Hours_hhpy
South Coast	2030	Cargo Handling Equipment - Port Container Handling Equipment	Aggregate	Aggregate	Diesel	0.688880109	437.5766916	0.034091351	0.031364235	0.920005636	0.004149323	9.80927E-06	642.612	0
South Coast	2030	Cargo Handling Equipment - Port Yard Truck	Aggregate	Aggregate	Diesel	0.244992102	182.0131068	0.007848286	0.007225022	0.920586056	0.001333665	0.02464191	1881.546	0
South Coast	2030	Cargo Handling Equipment - Rail Truck	Aggregate	Aggregate	Diesel	0.021713086	3.584221654	0.0005567	0.0005123	0.920244297	0.00003396	8.032E-08	0	0
South Coast	2030	Cargo Handling Equipment - Rail Yard Truck	Aggregate	Aggregate	Diesel	0.055116534	30.60300912	0.002096942	0.001928636	0.919737584	0.000096324	0.010325423	0	0