# Public Workshop on
# Fiscal Year 2017-18 Funding Plan
# for Clean Transportation Incentives

**<u>Covering the Following Funding Sources</u>:**

- **$560 Million for Low Carbon Transportation Investments (Cap-and-Trade Auction Proceeds)**
- **$28.64 Million for Air Quality Improvement Program**
- **$25 Million Volkswagen Settlement Funds for Zero-Emission Vehicle Aspects of Vehicle Replacement Programs**
- **$50 Million for Zero- and Near Zero-Emission Warehouse Program**

## DISCUSSION DRAFT FUNDING PLAN

Public Workshop Date and Location:

Wednesday October 4, 2017
9:30 am to 4:30 pm
Cal/EPA Headquarters Building
Sierra Hearing Room, 2nd Floor
1001 I Street
Sacramento, California 95814

Link to Workshop Notice:
https://www.arb.ca.gov/msprog/mailouts/msc1717/msc1717.pdf

Link to Webcast Information: https://video.calepa.ca.gov/

Workshop presentation will be posted on the morning of the workshop at:
http://www.arb.ca.gov/aqip/

Released: September 26, 2017

## Workshop Agenda

| | |
|---|---|
| 9:30 am – 10 am | Introduction and Overview of Project Category Funding Allocations |
| 10 am – Noon | Light-Duty Vehicle and Transportation Equity Investments<br>• Low Carbon Transportation<br>  o CVRP<br>  o Transportation Equity Projects<br>• $25 Million Volkswagen Settlement Funds for ZEV Aspects of Vehicle Replacement |
| Noon – 1 pm | Lunch Break |
| 1:00 pm – 4:00 pm | Heavy-Duty Vehicle and Off-Road Equipment Investments<br>• Low Carbon Transportation<br>• AQIP<br>• Zero- and Near Zero-Emission Warehouse Program<br>• Three-Year Investment Strategy for Heavy-Duty Vehicles and Off-Road Equipment from Low Carbon Transportation Investments and the Air Quality Improvement Program |
| 4:00 pm – 4:30 pm | Additional Discussion (if necessary) |

*Times above are approximate and subject to change. Those attending the afternoon session only should note that the session may start as early as 12:30 pm if the morning session concludes early.*

Workshop will be webcast at: https://video.calepa.ca.gov/

**Discussion Draft Funding Plan**
**Table of Contents**

**Preface** ..... **iii**

**PART I: PROPOSED INVESTMENTS** ..... **I-1**
**CHAPTER 1: INTRODUCTION AND BACKGROUND** ..... **I-1**
**CHAPTER 2: PROPOSED FUNDING ALLOCATIONS FOR FY 2017-18** ..... **I-17**
**CHAPTER 3: LIGHT-DUTY VEHICLE AND TRANSPORTATION EQUITY INVESTMENTS** ..... **I-23**
CVRP ..... I-28
Transportation Equity Investment Overview ..... I-36
EFMP Plus-up ..... I-40
Financing Assistance for Lower-Income Consumers ..... I-45
Clean Mobility Options for Disadvantaged Communities ..... I-50
Agricultural Worker Vanpools ..... I-54
Rural School Bus Pilot Project ..... I-56
One-Stop-Shop for CARB's Equity ZEV Replacement Incentives ..... I-59
**CHAPTER 4: HEAVY-DUTY VEHICLE AND OFF-ROAD EQUIPMENT INVESTMENTS** ..... **I-62**
Zero- and Near Zero-Emission Freight Facilities Project ..... I-67
Zero-Emission Off-Road Freight Voucher Incentive Project ..... I-72
Clean Truck and Bus Vouchers (HVIP and Low NOx Engine Incentives) ..... I-77
Truck Loan Assistance Program ..... I-94
**CHAPTER 5: MAXIMIZING AB 1550 BENEFITS** ..... **I-98**
**CHAPTER 6: CONTINGENCY PROVISIONS** ..... **I-105**
**CHAPTER 7: GRANT ADMINISTRATION** ..... **I-108**

**PART II: THREE-YEAR INVESTMENT STRATEGY FOR HEAVY-DUTY VEHICLES AND OFF-ROAD EQUIPMENT FROM LOW CARBON TRANSPORTATION INVESTMENTS AND AQIP**
Introduction ..... II-1
Background ..... II-2
Role of Incentives ..... II-3
Investment Strategies for Low Carbon Transportation & AQIP ..... II-11
Metrics of Success ..... II-14

Technology Pathways ..... II-16
Beachheads for Technology Pathways ..... II-33
Recommendations ..... II-42

**Acronym List**

**APPENDICES**

Appendix A: Emission Reductions Quantification Methodology

Appendix B: SB 1204 Requirements and Performance Criteria Evaluation for Heavy-Duty Projects

# Preface

The Fiscal Year (FY) 2017-18 Funding Plan for Clean Transportation Incentives will cover four funding sources:

- $560 million for Low Carbon Transportation Investments funded with Cap-and-Trade Auction Proceeds.
- $28.64 million for the Air Quality Improvement Program (AQIP).
- $25 million Volkswagen Settlement Funds for Zero-Emission Vehicle (ZEV) Aspects of Vehicle Replacement Programs.
- $50 million for a new Zero- and Near Zero-Emission Warehouse Program.

This draft FY 2017-18 Funding Plan summarizes staff's work to date reflecting input from a February 2017 public workshop,15 public work group meetings held between February and June 2017, and additional stakeholder comments. The draft Funding Plan is organized into two parts:

- Part I: Proposed Investments. Describes staff draft proposals for the project categories and funding allocations for the FY 2017-18 cycle consistent with budget appropriations for the four funding sources listed above. A table summarizing staff's draft project allocations is shown on the next page.

- Part II: Three-Year Investment Strategy for Heavy-Duty Vehicles and Off-Road Equipment. Summarizes staff's evaluation of the status of heavy-duty technology and the funding needs for advancing these technologies which will guide CARB's investments covered in this Funding Plan.

Staff will present and seek comment on these recommendations at a public workshop on October 4, 2017. Stakeholders are encouraged to provide comments at the workshop or after the workshop. Staff requests comments on the draft Funding Plan no later than October 9, 2017. Based on input provided at this workshop, along with previous public workshops, project-specific public work group meetings, written submissions, and individual meetings with stakeholders, staff will develop final proposed recommendations for Board consideration. Staff plans to release the proposed FY 2017-18 Funding Plan on October 13, 2017 for public comment prior to Board consideration at the November 16-17, 2017 Board meeting.

In addition to these programs, the Legislature appropriated CARB funding for two new incentive programs in the budget bills passed on September 15, 2017. One provides $135 million to reduce emissions from agricultural equipment, and the other provides $250 million to implement the community emission reduction programs developed pursuant to Assembly Bill (AB) 617 (Garcia, Chapter 136, Statutes of 2017). These new programs were not covered in previously in the public process and therefore are outside of the scope of this workshop and the FY 2017-18 Funding Plan <u>and will not be covered</u>

at the October 4 workshop. CARB will launch separate public processes shortly to develop these new programs. It is worth noting that many of the proposed investments in this Funding Plan will help make progress toward the community emission reduction goals of AB 617 because of their disadvantaged community focus.

**Draft Project Allocations for FY 2017-18 Funding Plan**

| Project Category | Draft Allocation by Funding Source (millions) | | | | |
|---|---|---|---|---|---|
| | Low Carbon Transportation[1] | AQIP[2] | VW Settlement[2] | Warehouse Program[3] | **Total** |
| **LIGHT-DUTY VEHICLE AND TRANSPORTATION EQUITY INVESTMENTS** | | | | | |
| CVRP (standard rebates) | $140 | | | | $140 |
| Transportation Equity Projects | $100 | | $25 | | $125 |
| EFMP Plus-Up | $10 | | $10 | | $20 |
| Financing Assistance for Lower-Income Consumers | $10 | | $10 | | $20 |
| Clean Mobility Options in Disadvantaged Communities | $17 | | | | $17 |
| Agricultural Worker Vanpools | $3 | | | | $3 |
| Rural School Bus Pilot | $10 | | | | $10 |
| CVRP Rebates for Low-Income Applicants | $40 | | | | $40 |
| To Be Allocated in Spring 2018 Based on Demand | $10 | | | | $10 |
| One-Stop-Shop for CARB's Equity ZEV Replacement Incentives *(new)* | | | $5 | | $5 |
| **Light-Duty Vehicle Transportation and Equity Investment Total** | **$240** | | **$25** | | **$265** |
| **HEAVY-DUTY VEHICLE AND OFF-ROAD EQUIPMENT INVESTMENTS** | | | | | |
| Advanced Freight Equipment Demonstration and Deployment | $140 | | | $50 | $190 |
| Zero- and Near Zero-Emission Freight Facilities[3] *(new)* | $100 | | | $50[3] | $150 |
| Zero-Emission Off-Road Freight Voucher Incentive Project *(new)* | $40 | | | | $40 |
| Clean Truck and Bus Vouchers (HVIP + Low NOx Engine Incentives) | $180 | $8 | | | $188 |
| Truck Loan Assistance Program | | $20 | | | $20 |
| **Heavy-Duty Vehicle and Off-Road Equipment Investment Total** | **$320** | **$28** | | **$50** | **$398** |
| **TOTAL** | **$560** | **$28** | **$25** | **$50** | **$663** |

[1]CARB was appropriated $560 million for Carbon Transportation projects including CVRP, transportation equity projects, freight hubs/ports, and clean truck and bus vouchers in AB 134 (Committee on Budget, Chapter 254, Statutes of 2017).

[2]CARB was appropriated $28.64 million for AQIP and $25 million of Volkswagen settlement funds for the ZEV aspects of vehicle replacement in AB 97 (Ting, Chapter 14, Statutes of 2017). Staff proposes allocating $28 million of AQIP funds to projects and holding $0.64 million as a reserve.

[3]CARB was appropriated $50 million for a new Zero- and Near Zero-Emission Warehouse Program in SB 132 (Committee on Budget and Fiscal Review, Chapter 7, Statutes of 2017). This funding is limited to warehouses only per provision of SB 132. Low Carbon Transportation funding for the freight facilities project category is open to any freight facility located in a disadvantaged community as discussed further in Chapter 4.

# PART I: PROPOSED INVESTMENTS

## CHAPTER 1: INTRODUCTION AND BACKGROUND

The draft FY 2017-18 Funding Plan for Clean Transportation Incentives (FY 2017-18 Funding Plan or Funding Plan) covers four related funding sources:

- $560 million for Low Carbon Transportation Investments funded with Cap-and-Trade Auction Proceeds appropriated to CARB in AB 134 (Committee on Budget, Chapter 254, Statutes of 2017).

- $28.64 million for AQIP appropriated to CARB in AB 97 (Ting, Chapter 14, Statutes of 2017), the Budget Act of 2017.

- $25 million Volkswagen Settlement Funds for ZEV Aspects of Vehicle Replacement Programs appropriated to CARB in the AB 97 Budget Act of 2017.

- $50 million for the new Zero- and Near Zero-Emission Warehouse Program established by Senate Bill (SB) 132 (Committee on Budget and Fiscal Review, Chapter 7, Statutes of 2017).

The draft Funding Plan describes CARB's policy drivers and vision for these advanced technology mobile source investments, eligible project categories and criteria, project funding allocations, program implementation details, and the justification for these investments. CARB staff has developed a joint plan for these funding sources to ensure synergistic investments among the four related programs while also ensuring that statutory requirements applicable to each are met.

California faces ambitious goals to reduce greenhouse gas (GHG) and short-lived climate pollutant emissions, improve air quality and reduce toxics risk, deploy ZEVs, and reduce petroleum dependency. CARB's 2014 and 2017 *Climate Change Scoping Plans* and 2016 *Mobile Source Strategy* conclude that many of the same actions are needed to meet GHG, smog forming, and toxic pollutant emission reduction goals – specifically, a transition to zero-emission and near zero-emission technologies and use of the cleanest, lowest carbon fuels and energy across all vehicle and equipment categories. The 2016 *California Sustainable Freight Action Plan* reiterates the need for this transition as it relates to the freight sector. In addition, AB 617 establishes new goals for reducing emissions of toxic air contaminants and criteria air pollutants in communities affected by a high cumulative exposure burden.

CARB is using these incentives to accelerate development and deployment of the cleanest feasible mobile source technologies and to improve access to clean transportation. In designing these investments, CARB strives to maximize the benefits for disadvantaged communities, low-income communities, and low-income households. Incorporating the findings and recommendations from CARB's draft SB 350 (De León,

Chapter 547, Statutes of 2015) study, Overcoming Barriers to Clean Transportation Access to Low-Income Residents, is one of the facets of this year's Funding Plan. The clean air goals driving the investments proposed in this Funding Plan include:

- Reducing GHG emissions to 1990 levels by 2020 as required by AB 32 (Núñez, Chapter 488, Statutes of 2006) and to 40 percent below 1990 levels by 2030 as required by SB 32 (Pavley, Chapter 249, Statutes of 2016).

- Reducing petroleum use in vehicles by 50 percent by 2030, one of the pillars of the State's climate change strategy for reducing GHG emissions, and reducing GHG emissions from the transportation sector to 80 percent below 1990 levels by 2050 as directed in the Governor's Executive Order B-16-2012.

- Meeting the federal health-based ambient air quality standards for ozone by 2023 and 2031 as well as the fine particulate matter (PM2.5) air quality standards.

- Reducing emissions of toxic air contaminants and criteria air pollutants in communities affected by a high cumulative exposure burden as required by AB 617.

- Ensuring that the State's overall auction proceeds investments meet the disadvantaged community, low-income community, and low-income household targets established in AB 1550 (Gomez, Chapter 369, Statutes of 2016) and maximizing the benefits to these communities and households as required by the 2017 *Cap-and-Trade Auction Proceeds Funding Guidelines for Agencies that Administer California Climate Investments.*

- Increasing access to clean transportation options for low-income residents, including those in disadvantaged communities, as called for in SB 350.

- Deploying 1 million ZEV and near zero-emission vehicles by 2023 as codified in Health and Safety Code Section 44258.4(b), 1.5 million ZEVs by 2025 as directed in Executive Order B-16-2012, and 4.2 million ZEVs by 2030 as identified in CARB's 2016 *Mobile Source Strategy*.

- Deploying over 100,000 freight vehicles and equipment capable of zero-emission operation and maximizing near zero-emission freight vehicles and equipment powered by renewable energy by 2030 as called for in the 2016 *California Sustainable Freight Action Plan*.

- Reducing emissions of methane and black carbon to 40 percent and 50 percent, respectively, below 2013 levels by 2030 as called for in the *Short-Lived Climate Pollutant Reduction Strategy*.

- Reducing the carbon intensity of California's transportation fuels as required by the Low Carbon Fuel Standard (LCFS).

CARB is developing this investment strategy in a coordinated manner. Where possible, CARB tries to identify investments that support several of these air quality and climate change goals while meeting the statutory requirements governing each program. The investments proposed in this Funding Plan build on previous years' Low Carbon Transportation and AQIP investments incorporating lessons learned.

As noted above, much of CARB's investments covered in this Funding Plan focus on deploying the cleanest available mobile source technologies. This is just one aspect of the State's climate change and air quality investment portfolio. The investment strategy is also coordinated with and complemented by other State agencies' clean transportation and sustainable community, clean energy, and natural resources programs funded with Cap-and-Trade auction proceeds and other funding sources. Figure I-1 shows the State agencies with California Climate Investments programs.

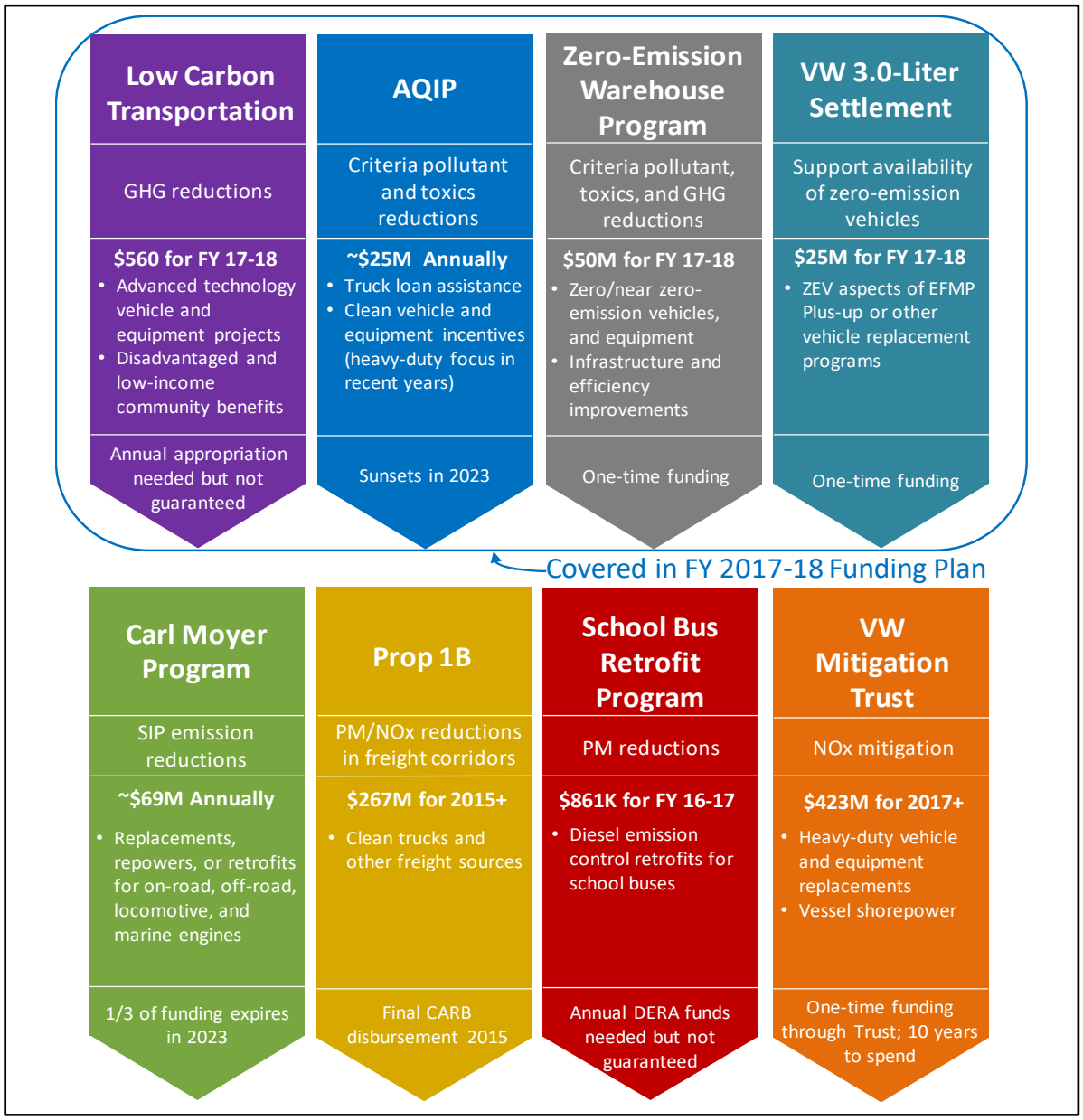
**Figure I-1: State Agencies Administering California Climate Investments**

These other agencies' programs use additional approaches to reduce emissions complementing CARB's mobile source technology focused projects. Affordable housing and sustainable communities programs reduce vehicle miles travelled and the associated emissions by bringing jobs and housing closer together. Active transportation programs reduce emissions by making it easier for people to use non-vehicular modes of transportation. Clean transit and rail programs improve public transportation and mobility options to reduce vehicle miles travelled. Clean energy programs reduce emissions from energy sources and reduce energy use through improved efficiency. Wood smoke programs reduce emissions through cleaner, more efficient home heating. Natural resources programs reduce emissions from wildfire and land conversion, reduce emissions through waste diversion, and store carbon in biomass and soils. These programs are described in the *2017 Annual Report to the Legislature on California Climate Investments using Cap-and-Trade Auction Proceeds*.

In addition to the four programs covered in this Funding Plan, CARB administers a number of other air quality incentive programs. Each has its own statutory requirements and drivers. Figure I-2 illustrates how each of these programs fit together. While the need for incentives to transform California's fleet is more than the funding available for

this Funding Plan, these other program will make additional progress. There will be considerable additional investment in heavy-duty vehicle emission reductions through the Volkswagen nitrogen oxides (NOx) mitigation trust, continued implementation of the Carl Moyer Program, and the final Proposition 1B Goods Movement Emission Reduction Program awards in process at the local level. Though the public process for the Volkswagen NOx mitigation trust is just starting, staff is designing the investments in this Funding Plan with an eye toward these forthcoming Volkswagen investments.

**Figure I-2: CARB Incentive Programs**




In addition to these programs, the Legislature appropriated CARB funding for two new incentive programs in the AB 134 budget bill passed on September 15, 2017. One provides $135 million to reduce emissions from agricultural equipment, and the other

provides $250 million to implement the community emission reduction programs developed pursuant to AB 617. These new programs are outside of the scope of this FY 2017-18 Funding Plan for Clean Transportation Incentives. However, it is worth noting that many of the proposed investments in this Funding Plan will help make progress toward the community emission reduction goals of AB 617 because of their disadvantaged community focus. CARB will launch separate public processes shortly to develop these two new programs with thorough public engagement and input. They provide significant new incentive funding to further progress toward the air quality and climate change goals highlighted earlier in this document.

Table I-1 provides an illustrative example of how the suite of proposed investments in this Funding Plan is part of CARB's coordinated strategy to make progress toward California's multiple air quality and climate change goals. Most of this funding comes from Cap-and-Trade auction proceeds, and as such, there is a primary focus on investments that reduce GHG and benefit disadvantaged and low-income communities. However, CARB has also designed these investments to provide co-benefits to support the Governor's climate pillars of reducing short-lived climate pollutants and petroleum use, provide emission reductions for the State Implementation Plan and 2016 *Sustainable Freight Action Plan*, and reduce diesel toxics emissions.

**Table I-1: Benefits of Funding Plan Investments**

| **Proposed Projects**<br>Low Carbon Transportation<br>AQIP<br>Zero- Near Zero-Emission Warehouse Program<br>Volkswagen Settlement: ZEV Aspects of Vehicle Replacement Programs | **Climate Change Scoping Plan** | **Short-Lived Climate Pollutants** | **Ozone and PM State Implementation Plan** | **Sustainable Freight** | **Air Toxics** | **Petroleum Reduction** | **Disadvantaged / Low Income Communities** |
|---|---|---|---|---|---|---|---|
| Clean Vehicle Rebate Project (CVRP) | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Transportation Equity Projects:<br>EFMP Plus-up, Financing Assistance, Clean Mobility Options, Agricultural Worker Vanpools, Rural School Bus Pilot, CVRP Rebates for Low-Income Applicants | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Advanced Freight Equipment Demonstration and Deployment<br>Zero-Emission Off-Road Freight Equipment Vouchers and Zero- and Near Zero-Emission Freight Facilities | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Clean Truck and Bus Vouchers:<br>Hybrid and Zero Emission Truck and Bus Voucher Incentive Project (HVIP) and Low NOx Engine Incentives | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Truck Loan Assistance | | ✓ | ✓ | ✓ | ✓ | | ✓ |

Though AQIP funded projects are not subject to the statutory requirements related to disadvantaged communities, CARB is still focusing these funds to provide benefits to underserved populations as shown in Table I-1. For example, AQIP funding in recent

years has been primarily directed to the Truck Loan Assistance Program serving small business truckers who are often lower-income and many of the trucks cleaned up operate in and near disadvantaged communities.

The remainder of this introductory chapter provides background on each of the four funding sources covered in this Funding Plan including a summary of Low Carbon Transportation and AQIP projects funded to date. This is followed by chapters covering proposed funding allocations, light-duty vehicle and transportation equity investments, heavy-duty vehicle and equipment investments, approaches to maximize disadvantaged community benefits for the Low Carbon Transportation Program, and contingency provisions. The second part of the Funding Plan covers the 3-Year Investment Strategy for Heavy-Duty Vehicles and Off-Road Equipment, which is guiding the heavy-duty investment decisions.

## CALIFORNIA CLIMATE INVESTMENTS LOW CARBON TRANSPORTATION FUNDING

The Low Carbon Transportation Program is part of California Climate Investments, a statewide program that puts billions of Cap-and-Trade dollars to work reducing GHG emissions, strengthening the economy, and improving public health and the environment—particularly in disadvantaged communities. California Climate Investments support CARB's advanced technology, clean transportation incentive programs, expanding the types of projects CARB has funded through AQIP.

These investments accelerate the transition to low carbon freight and passenger transportation with a priority on providing health and economic benefits to California's most disadvantaged communities. They support the Governor's climate change strategy pillars of a 50 percent reduction in petroleum use in vehicles by 2030 and reducing short-lived climate pollutants and the Governor's goal to deploy 1.5 million ZEVs by 2025. These investments also reduce ozone precursor emissions and toxic diesel particulate emissions, supporting the State's goals in these areas.

The statutes governing California Climate investments establish a two-step process for allocating funding to State agencies to invest in GHG-reducing projects. Department of Finance, in consultation with CARB, is required to submit to the Legislature a three-year investment plan identifying proposed investments of auction proceeds. To date, the administration has prepared two investment plans. Both identify low carbon transportation, including zero-emission passenger transportation and zero-emission and near zero-emission freight transport, as investment priorities. Funding is appropriated to State agencies from the Greenhouse Gas Reduction Fund (GGRF) by the Legislature through the annual Budget Act, consistent with the investment plan.

AB 398 (Garcia, Chapter 135, Statutes of 2017), the bill that extends the Cap-and-Trade program beyond 2020, provides additional direction from the Legislature on priorities for investing auction proceeds. These priorities are:

- Air toxic and criteria air pollutants from stationary and mobile sources.
- Low- and zero-carbon transportation alternatives.
- Sustainable agricultural practices that promote the transitions to clean technology, water efficiency, and improved air quality.
- Healthy forests and urban greening.
- Short-lived climate pollutants.
- Climate adaptation and resiliency.
- Climate and clean energy research.

CARB's Low Carbon Transportation investments align well with these priorities. Funding low- and zero-carbon transportation with air toxics and criteria co-benefits has been and will continue to be a main driver for CARB's investments. As shown in Table I-1, CARB's investments also reduce short-lived climate pollutants through black carbon reductions from the zero- and near zero-emission vehicle and equipment projects, another priority established by the Legislature.

AB 617, the companion bill to AB 398, establishes new requirements to reduce air pollution at the neighborhood level to complement the Cap-and-Trade program. AB 617 requires CARB to develop a statewide strategy to reduce emissions of toxic air contaminants and criteria pollutants in communities affected by a high cumulative exposure burden. It also requires air districts to develop community emissions reduction programs, consistent with the statewide strategy, for those communities identified by CARB as having the highest cumulative exposure burdens. While the new AB 617 effort is separate and distinct from this Funding Plan, many of the proposed investments in this Funding Plan will help make progress toward the community emission reduction goals of AB 617 because of their disadvantaged community focus.

*Disadvantaged Community, Low-Income Community, and Low-Income Household Investment Requirements*: SB 535 (de León, Chapter 830, Statutes of 2012) established the original requirements relating to the investment of auction proceeds in disadvantaged communities in order to provide economic and health benefits to these communities. In 2016, AB 1550 revised these requirements, increasing the percent of the State's auction proceeds that must be invested within disadvantaged communities and adding new requirements to direct additional investments to low-income communities and low-income households. AB 1550 requires at least 25 percent of auction proceeds be invested for projects within and benefiting disadvantaged communities; 5 percent for projects within and benefiting low-income communities or benefiting low-income households statewide; and 5 percent for projects within and benefiting low-income communities, or low-income households, that are within ½ mile of a disadvantaged community. Chapter 5 of this Funding Plan includes a discussion of the steps CARB is taking to maximize AB 1550 benefits for the FY 2017-18 Low Carbon Transportation appropriation.

In 2014, the California Environmental Protection Agency (Cal/EPA) identified disadvantaged communities for the purposes of SB 535 using the California Communities Environmental Health Screening Tool (CalEnviroScreen 2.0). In 2017,

Cal/EPA updated the list of disadvantaged communities based on the newer CalEnviroScreen 3.0 model and identified low-income communities for the purposes of implementing AB 1550. CARB will use the 2017 CalEnviroScreen 3.0 based list of disadvantaged communities and the new low-income communities to determine compliance with AB 1550 requirements. More information on the CalEnviroScreen model and disadvantaged communities is available on Cal/EPA's website.[1]

*California Climate Investments Program Guidance*: In 2015, CARB approved the *Cap-and-Trade Auction Proceeds Funding Guidelines for Agencies that Administer California Climate Investments* (California Climate Investments Guidelines) establishing the requirements that State agencies receiving Cap-and-Trade auction proceeds must follow as they implement their programs. These guidelines define the criteria for determining whether projects qualify as being located in and benefiting a disadvantaged community. The guidelines also identify approaches for implementing State agencies to maximize benefits to disadvantaged communities, while recognizing additional priorities identified by disadvantaged communities (in addition to reducing GHG emissions) that State agencies should strive to achieve with their investments. These include reducing health harms and exposure to toxic air contaminants among other needs.

CARB is in the process of updating the California Climate Investments Guidelines to address AB 1550, among other changes. The revised guidelines are not yet final, but the FY 2017-18 Low Carbon Transportation Program will be implemented in accordance with all requirements of the updated 2017 California Climate Investments Guidelines.

*Low Carbon Transportation Funding to Date*: The Legislature has appropriated nearly $700 million to CARB for Low Carbon Transportation projects over the past four budget cycles (FY 2013-14 through FY 2016-17). These appropriations are being used to fund: zero-emission and plug-in hybrid passenger vehicles through CVRP; light-duty vehicle equity projects to increase access to the cleanest vehicles in and near disadvantaged communities and for lower-income Californians; deployment incentives for clean trucks and buses utilizing zero-emission, hybrid, and low NOx technologies; and advanced technology demonstration projects for freight trucks and equipment.

60 percent of CARB's Low Carbon Transportation funding has been allocated to benefit disadvantaged communities, including low-income residents of these communities, and 30 percent of this funding will be spent directly in disadvantaged communities as shown in Table I-2. The 30 percent spent in disadvantaged communities greatly exceeds the commitments made in past Funding Plans. Much of the disadvantaged community focused funding is for light-duty equity projects, Zero-Emission Truck and Bus Pilot Projects, and Advanced Freight Technology Demonstration Projects. While not limited to disadvantaged communities, 40 percent of HVIP funding has been awarded for trucks and buses operating in disadvantaged communities.

[1] http://www.calepa.ca.gov/EnvJustice/GHGInvest/

**Table I-2: Low Carbon Transportation Project Allocations to Date**
(FY 2013-14, 2014-15, 2015-16, and 2016-17)

| Project | Funding (millions) | In DC | Benefiting DC | Project Outcomes[1] |
|---|---|---|---|---|
| **Light-Duty Vehicle Investments (SB 1275)** | | | | |
| CVRP | $337 | 7%[2] | 38%[2] | • ~140,000 ZEV rebates. |
| Light-Duty Equity Projects | | | | |
| EFMP Plus-up | $72 | >50%[2] | 100%[3] | • ~9,000 vehicles scrapped and replaced. |
| Car Sharing and Mobility Options | $11 | 100%[3] | 100%[3] | • Los Angeles and Sacramento car share projects launched.<br>• Will award $8 million for additional projects in 2017. |
| Public Fleet Incentives for CVRP Eligible Vehicles | $6 | 42%[2] | 100%[3] | • ~750 ZEV rebates for public fleets in or near disadvantaged communities. |
| Financing Assistance for Lower-Income Consumers | $7 | tbd[4] | tbd[4] | • Loan assistance project launched in Bay Area.<br>• Will award $6 million for additional projects in 2017. |
| Agricultural Worker Vanpools in San Joaquin Valley | $3 | 100%[3] | 100%[3] | • Under development. Will award funding in 2017. |
| **Heavy-Duty Vehicle and Off-Road Equipment Investments (SB 1204)** | | | | |
| Advanced Technology Freight Demonstrations | $83 | >30%[3] | 100%[3] | • ~40 zero emission drayage truck project at multiple ports/facilities.<br>• Multi-source projects: ~40 pieces of zero-emission freight equipment at Port of Los Angeles and 3 facilities in San Bernardo County.<br>• Will award additional $34 million in 2017. |
| Zero-Emission Freight Equipment | $5 | tbd[4] | tbd[4] | • Propose to reallocate to HVIP due to waitlist. |
| Zero-Emission Truck/Bus Pilot | $85 | 97%[3] | 97%[3] | • ~150 zero-emission buses and trucks + supporting infrastructure and training. |
| Rural School Bus Pilot | $10 | tbd[4] | tbd[4] | • ~30 zero-emission or renewable-fueled school buses. |
| Low NOx Engine Incentives with Renewable Fuel | $13 | tbd[4] | tbd[4] | • ~500 low NOx engine vouchers. |
| HVIP | $48 | 43%[2] | 62%[2] | • ~1,000 vouchers for hybrid and zero-emission trucks or buses. |
| **Total[5]** | **$680[5]** | **30%** | **60%** | |

[1]Projected outcomes are estimated based on full expenditure of funds.
[2]Estimate based on rebates/vouchers issued to date as reported in the March 2017 *Annual Report to the Legislature on California Climate Investments Using Cap-and-Trade Auction Proceeds* projected forward to full expenditure of funds. Will be updated after all funds expended. For EFMP Plus-up, used a conservative estimate because data not yet available for the new air districts launching EFMP programs.
[3]Based on terms of project solicitation and/or grant agreement.
[4]To Be Determined. Insufficient data yet to determine. Will be calculated based on project implementation and reported in future Annual Reports to the Legislature.
[5]Total does not include $13 million for State operations.

Not all of this funding has been spent yet; these disadvantaged community benefits are projected based on the funding spent to date. Staff will refine these estimates as the remaining funds are spent and report updated numbers in future Funding Plans and Annual Reports to the Legislature on California Climate Investments. Staff will also estimate the low-income community and household benefits for these past projects where data are available once the updated California Climate Investments Guidelines are released in order to show how CARB's past investments align with the priorities established in AB 1550.

Staff has done a preliminary analysis of the low-income community benefits for several of the larger projects with the most available data. For CVRP, staff found that about 11 percent of funds spent in 2016 were for rebates to vehicles registered in low-income communities not also identified as disadvantaged communities. (AB 1550 does not allow "double counting" of investments in disadvantaged and low-income census tracts, so staff identified only the non-overlapping low-income community investments.) For HVIP, staff found that just under 30 percent of funds spent were for vouchers in non-overlapping low-income communities in addition to the approximately 40 percent spent in disadvantaged communities shown in Table I-2.

*FY 2017-18 Low Carbon Transportation Appropriation*: In the AB 134 budget bill, the Legislature appropriated $560 million to CARB for the Low Carbon Transportation Program to continue and build upon investments from previous years. The budget appropriation further specifies that the funding be invested in the following categories:

- Up to $140 million for CVRP. The budget directs that the changes to CVRP mandated by the Legislature in SB 859 (Committee on Budget and Fiscal Review, Chapter 368, Statutes of 2016) be extended for one more year. These include increased rebates for low-income applicants and an income cap at specified levels, among others. It also directs CARB to work with the Labor and Workforce Development Agency to develop procedures for certifying manufacturers of CVRP eligible vehicles as being fair and responsible in the treatment of their workers.

- Up to $100 million for transportation equity projects including EFMP and EFMP Plus-up, replacement of school buses, CVRP rebates for low-income applicants, and light-duty equity projects authorized pursuant to SB 1275 (Statutes of 2014).

- Up to $140 million for advanced freight equipment demonstration and pilot commercial deployment, including for projects for ships at birth. The budget further directs that these funds shall not be used for the purchase of fully automated cargo handling equipment.

- Up to $180 million for clean truck and bus vouchers through HVIP. The budget further directs that CARB consider forthcoming technological innovations in heavy-duty vehicle engines along with market demand for those vehicles that are

expected to come to market during FY 2017–18 and that at least $35 million be used for the purchase of zero-emission buses.

In addition to these programs, the Legislature appropriated CARB funding for two new incentive programs in the budget bill passed on September 15, 2017. One provides $135 million to reduce emissions from agricultural equipment, and the other provides $250 million to be distributed to air districts to implement the community emission reduction programs developed pursuant to AB 617. These new programs are outside of the scope of this workshop and the FY 2017-18 Funding Plan for Clean Transportation Incentives. CARB will launch separate public processes shortly to develop these new programs. It is worth noting that many of the proposed investments in this Funding Plan will help make progress toward the community emission reduction goals of AB 617 because of their disadvantaged community focus.

**AQIP**

AQIP is a mobile source incentive program that focuses on reducing criteria pollutant and diesel particulate emissions with concurrent reductions in GHG emissions. CARB investments initiated under AQIP provide the foundation for the Low Carbon Transportation investments that now make up the vast majority of the proposed Funding Plan. AQIP was created in 2007 by AB 118 (Núñez, Chapter 750, Statutes of 2007). AB 8 (Perea, Chapter 401, Statutes of 2013) reauthorized the fees that support AQIP through 2023. AB 8 also requires CARB to provide preference to projects with higher benefit-cost scores when considering projects for AQIP funding. A detailed discussion of the benefit-cost analysis and selection process for AQIP projects is provided in Appendix A of this Funding Plan.

Funding for AQIP comes primarily from the smog abatement fee assessed annually by the Department of Motor Vehicles (DMV) during a vehicle's first six registration years in lieu of a biennial smog inspection. A small portion of AQIP funding comes from two additional sources: an initial registration fee for new watercraft and a special equipment identification plate fee for certain types of equipment. AQIP has an annual budget of about $25-30 million.

ARB adopted regulations in 2008 and 2009 that establish the administrative procedures for implementing AQIP in order to ensure that the program is run efficiently, with transparency and public input, and complements California's existing air quality and climate change programs. Central to these program guidelines is the requirement for a Board-approved annual funding plan developed with public input. AQIP guidelines also establish the rules and requirements for soliciting projects and awarding funds.

*AQIP Funding to Date*: AQIP has provided funding for CVRP, truck and bus vouchers (HVIP and Low NOx engine incentives), and advanced technology demonstrations since 2009. In recent years, these projects have been primarily funded with Low Carbon Transportation appropriations, and the majority of AQIP funds have been directed to the Truck Loan Assistance Program and other diesel emission reduction

projects. The Truck Loan Assistance Program helps small business truckers to secure financing for newer trucks and diesel exhaust retrofits to meet compliance deadlines for CARB's In-use Truck and Bus Regulation. Table I-3 provides a summary of AQIP investments to date including one-time funding provided in various years to help meet demand. In some years, CVRP and HVIP received funding from both AQIP and Low Carbon Transportation.

**Table I-3: AQIP Project Allocations by Year[1]**

| AQIP Project | Project Allocations by Fiscal Year (million) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2008 -09 | 2009 -10 | 2010 -11 | 2011 -12 | 2012 -13 | 2013 -14 | 2014 -15 | 2015 -16 | 2016 -17 | Total |
| Truck Loan Assistance | $30 | | | | $4 | $20 | $10 | $18 | $25 | **$106** |
| CVRP[2] | | $4 | $7 | $16 | $36 | $70 | $10 | $3 | | **$146**[2] |
| HVIP[2] | | $20 | $23 | $11 | | $5 | $5 | | | **$64**[2] |
| Low NOx Engine Incentives | | | | | | | | $2 | | **$2** |
| Agricultural Equipment Trade Up in San Joaquin Valley | | | | | | | | $0.5 | $3 | **$4** |
| Advanced Technology Demonstration/Vehicle Testing | | $1.9 | $1.7 | $1.6 | $1 | | | | | **$6** |
| Lawn and Garden Equipment Replacement | | $1.6 | $1 | | | | | | | **$3** |
| Off-Road Hybrid Equipment Pilot | | | $2 | | | | | | | **$2** |
| Zero-Emission Agricultural Utility Equipment | | $0.1 | | | | | | | | **$0.1** |
| **TOTAL** | **$30** | **$28** | **$35** | **$29** | **$42** | **$95** | **$25** | **$23** | **$28** | **$334** |
| Air Quality Improvement Fund | $30 | $28 | $29 | $29 | $29 | $25 | $20 | $23 | $28 | $241 |
| Other funding sources[1] | - | - | $6 | - | $13 | $70 | $5 | - | - | $93 |

All project allocations rounded to nearest $ million, except for projects allocated less than $2 million.
Rows and columns may not sum to totals due to rounding.

[1]Includes a total of $93 million from other funding sources: $53 million from the California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program or Fund to support CVRP and HVIP in various fiscal years, $10 million appropriated to Truck Loan Assistance Program in FY 2013-14 as a loan from the Vehicle Inspection and Repair Fund (VIRF) per SB 359 (Corbett, Chapter 415, Statutes of 2013), and $30 million transferred by the Legislature from VIRF to meet CVRP demand in 2014 per SB 852 (Leno, Chapter 25, Statutes of 2014) and SB 862 (Committee on Budget and Fiscal Review, Chapter 36, Statutes of 2014).

[2]CVRP and HVIP also received Low Carbon Transportation funds in FY 2013-14 through 2016-17 as shown in Table I-2.

The California Energy Commission (Energy Commission) has augmented the funds directly appropriated to CARB by previously providing $53 million from its Alternative and Renewable Fuel and Vehicle Technology Program or Fund for CVRP and HVIP to meet consumer demand as shown in Table I-3. In addition to these direct investments, the Energy Commission's investments in fueling infrastructure for both electric vehicle charging stations and hydrogen fueling stations, vehicle manufacturing, and advanced technology vehicle demonstrations as part of the Alternative and Renewable Fuel and

Vehicle Technology Program provide critical support to the deployment of these zero-emission vehicles. The Alternative and Renewable Fuel and Vehicle Technology Program also provides key investments in low carbon biofuel production and infrastructure, natural gas vehicle deployment, and workforce training and development, all of which further progress towards California's climate change, air quality, and petroleum reduction goals.

*FY 2017-18 AQIP Appropriation*: For FY 2017-18, the Legislature appropriated $28.64 million for AQIP projects. Staff proposes to allocate $28 million to projects and to hold back the remaining $0.64 million as a prudent reserve to address revenue uncertainty as it has done in past years.

## VOLKSWAGEN SETTLEMENT FUNDS FOR ZEV ASPECTS OF VEHICLE REPLACEMENT

CARB has entered into several consent decrees with Volkswagen to resolve claims against the company for equipping its diesel vehicles with illegal defeat devices. The second California partial consent decree for 3.0 liter Volkswagen engines includes the following requirement:

> "Volkswagen shall further contribute to the availability of Zero Emission Vehicles in California by making a payment of $25,000,000 to ARB no later than July 1, 2017. Such payment shall be used, in the discretion of ARB, to support the ZEV-related aspects of the EFMP Plus Up program, or the ZEV-related aspects of similar vehicle replacement programs, in California in FY 2017-2018 or later years."

In the AB 97 Budget Act of 2017, the Legislature appropriated $25 million to CARB to implement this part of the settlement. The Legislature provided additional direction to CARB on how these funds should be spent, specifying that a portion of these funds shall be used to support the expansion of EFMP Plus-up statewide including the development of a tool to improve program efficiency and verify participant eligibility. The Legislature also specified that a portion may be used to increase community outreach efforts.[2] Staff is including a proposal for how to spend the $25 million in the FY 2017-18 Funding Plan because it directly relates to EFMP Plus-up, a program funded with CARB's Low Carbon Transportation appropriations.

This $25 million is just a small part of California's overall settlement with Volkswagen. Two other elements of the settlement, representing the vast majority of settlement funding, are not covered in this Funding Plan. Each is going through, or will go through, a separate public process on how funds should be spent.

Volkswagen will invest $800 million in California for ZEV projects over a 10-year period. These investments will complement CARB's Low Carbon Transportation funded ZEV investments. CARB is required to review and approve Volkswagen investment plans before this money is spent. Volkswagen released its first investment plan in

[2] See Item 3900-102-0115 in AB 97 (Ting, Chapter 298, Statutes of 2017) http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB97.

March 2017 and released a supplement to the plan in June 2017 in response to a request for additional information from CARB. CARB held a public workshop and two public Board meetings on Volkswagen's first investment plan, and the Board approved the plan on July 27, 2017.

California will also receive over $400 million as a share of a national NOx mitigation trust to offset the environmental damage from these vehicles. This will primarily fund heavy-duty vehicle and off-road equipment replacements. The Governor's Office has recently indicated its intent to designate CARB as the Lead Agency to administer these funds. While the public process for the Volkswagen NOx mitigation trust is just beginning, staff is designing the investments in this Funding Plan with an eye toward these forthcoming Volkswagen investments. The considerable additional investment in heavy-duty vehicle emission reductions through the Volkswagen NOx mitigation trust will fulfill some of the unmet needs for heavy-duty incentives that cannot be met in this Funding Plan.

## ZERO- AND NEAR ZERO-EMISSION WAREHOUSE PROGRAM

In April 2017, the Legislature appropriated CARB $50 million in one-time funding to establish a new Zero- and Near Zero-Emission Warehouse Program via SB 132, which amended the Budget Act of 2016. These funds are to be used for a competitive funding program to advance implementation of zero- and near zero-emission warehouses and technology with a requirement for a one-to-one match resulting in $100 million for projects. Funding for this new program comes from the Trade Corridor Enhancement Account established by SB 1 (Beall, Chapter 5, Statutes of 2017).

The Zero- and Near Zero-Emission Warehouse Program builds on Low Carbon Transportation investments CARB has made in previous cycles such as Advanced Technology Freight Demonstration Projects. SB 108 (Committee on Budget and Fiscal Review, Chapter 54, Statutes of 2017) directs CARB to use the Funding Plan process to develop criteria for this new program with public input that will help ensure it is coordinated with CARB's continuing Low Carbon Transportation freight investments. In Chapter 4, staff proposes allocating Low Carbon Transportation funds for zero- and near zero-emission equipment at freight facilities/hubs/ports to complement and expand the scope of the new Zero- and Near Zero-Emission Warehouse Program, an indication of how this funding fits into CARB's Low Carbon Transportation freight investments.

## ADDITIONAL LEGISLATION GUIDING FUNDING PLAN DEVELOPMENT AND IMPLEMENTATION

Several laws passed by the Legislature in recent years provide further guidance to CARB on these programs and specify requirements for the Funding Plan.

*SB 1275* (De León, Chapter 530, Statutes of 2014) guides CARB's light-duty vehicle investments. SB 1275 establishes the Charge Ahead California Initiative to increase the number of zero-emission and near zero-emission vehicles on California's roads and to increase access to these vehicles for lower-income Californians and disadvantaged

communities. It also identifies the Cap-and-Trade auction proceeds as a funding source that could be utilized to meet the provisions established in the Charge Ahead California Initiative. SB 1275 establishes requirements for how CARB implements CVRP and also requires that CARB establish programs such as car sharing, financing assistance, and enhancements to the EFMP scrap and replace program to increase access to clean vehicles for lower-income consumers and disadvantaged communities. Finally, SB 1275 requires CARB to include a long-term plan for CVRP and related light-duty vehicle incentives. CARB included the long-term plan of the FY 2016-17 Funding Plan. A short update to that long-term plan is provided in Chapter 3 of this document.

*SB 1204* (Lara, Chapter 524, Statutes of 2014) guides CARB's heavy-duty vehicle investments funded with Cap-and-Trade auction proceeds. SB 1204 creates the California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology Program intended to help accelerate the introduction of the next generation of cleaner heavy-duty vehicles and engines with a priority on projects that benefit disadvantaged communities. Among other requirements, SB 1204 directs CARB to develop an annual framework and plan to guide these investments. The Three-Year Investment Strategy for Heavy-Duty Vehicles and Off-Road Equipment included in this Funding Plan is intended to help address this requirement.

*SB 350* (De León, Chapter 547, Statutes of 2015) directs CARB to conduct a study on the barriers for low-income Californians to access clean transportation options, including those in disadvantaged communities, as well as recommendations on how to increase access. CARB released its draft *SB 350 Clean Transportation Access Guidance Document* (draft SB 350 Guidance Document) in April 2017. The main barriers identified in the draft SB 350 Guidance Document include: upfront affordability of zero-emission and near zero-emission technologies and supporting charging and fueling infrastructure; the need for permanent, long-term funding sources; awareness of clean transportation and mobility options and supporting infrastructure; and the dynamic, localized nature of transportation and mobility option needs of low-income residents. The draft SB 350 Guidance Document recommendations establish a pathway to overcoming these barriers and include actions for CARB and other State and local agencies, building on existing activities to increase clean transportation access. CARB will hold additional public meetings on the draft SB 350 Guidance Document and finalize it later this year.

Many of the investments staff recommends for continued funding in the FY 2017-18 Funding Plan are already working to address the barriers to accessing clean transportation. For example, the recommendations include increasing investments in used and new vehicle ownership projects, such as EFMP Plus-up, point-of-sale incentives, and low-cost loans. Additional funds should also be available to increase access for other clean mobility options such as car sharing, ride sharing and bike sharing as well as clean transit and school buses. Finally, one new project, the One-Stop-Shop for CARB's Equity ZEV Replacement Incentives, would address recommendations to increase clean transportation awareness, education, and outreach. CARB is evaluating the best mechanisms to make further progress, incorporating

lessons learned from existing projects and evolving them over time to ensure the accessibility needs of low-income residents are being met.

The investments in this Funding Plan are just one part of the State's efforts to address the barriers to clean transportation for low-income Californians. The availability of new community focused incentives to implement AB 617 provides an additional funding that can help overcome these barriers. Other State and local air quality, transportation, energy, and planning agencies all have programs that can help address these barriers.

The draft SB 350 Guidance Document identifies actions these agencies can take to implement the recommendations for clean transportation access. CARB is prioritizing the recommendations that can be implemented in the next two years. The Governor's Office convened a multi-agency task force as the mechanism to collaboratively address the barriers to clean transportation and energy access, establish accountability to ensure recommendations are implemented, and prioritize the actions needed to maximize benefits for low-income residents.

# CHAPTER 2: PROPOSED FUNDING ALLOCATIONS FOR FY 2017-18

This chapter summarizes staff's proposed funding allocations for $663 million in clean transportation projects from the four funding sources covered in this Funding Plan:

- $560 million for Low Carbon Transportation investments funded with Cap-and-Trade Auction Proceeds, including specific budget appropriations for CVRP, transportation equity, clean truck and bus vouchers through HVIP, and freight equipment.
- $28.64 million for the AQIP.
- $25 million Volkswagen Settlement Funds for ZEV Aspects of Vehicle Replacement Programs.
- $50 million for a new Zero- and Near Zero-Emission Warehouse Program.

Staff's proposal would fund an array of clean car, mobility improvement, truck, bus, freight equipment, and freight facility projects. These key investments support clean technologies identified in the *Climate Change Scoping Plan*, *State Implementation Plan*, *Mobile Source Strategy*, and *California Sustainable Freight Action Plan*.

## INVESTMENT PRIORITIES FOR FY 2017-18

CARB is using these incentives to accelerate deployment of the cleanest feasible mobile source technologies and to improve access to clean transportation. Staff strives to maximize benefits for disadvantaged communities, low-income communities, and low-income households. Staff also prioritizes investments that support multiple clean air goals described in Chapter 1. These projects are designed to both achieve immediate emission reductions and, equally important, support the transformation of the fleet needed to meet long-term air quality and climate change goals.

This Funding Plan covers four separate funding sources. By prioritizing projects that achieve multiple benefits and support zero-emission and near zero-emission technologies, staff ensures synergistic investments among the four related programs while also ensuring that statutory requirements applicable to each are met. The Legislature provided specific direction on the use of these funds in the various budget bills. All proposed projects are designed to meet the Legislature's direction.

The proposed projects for the FY 2017-18 cycle in most cases continue and build on investments from previous budget cycles that were envisioned as multi-year investments. Staff determined project allocations by evaluating anticipated demand, reviewing the long-term planning elements of previous Funding Plans and the Three-Year Investment Strategy for Heavy-Duty Vehicles and Off-Road Equipment included in this Funding Plan, considering other available funding sources, and considering stakeholder input. Staff also evaluated the state of technology in order to evaluate what projects are ready to fund. Staff's proposed funding allocations are shown in Table I-4.

**Table I-4: Draft Project Allocations for FY 2017-18 Funding Plan**

| Project Category | Draft Allocation by Funding Source (millions) | | | | |
|---|---|---|---|---|---|
| | Low Carbon Transportation[1] | AQIP[2] | VW Settlement[2] | Warehouse Program[3] | **Total** |
| **LIGHT-DUTY VEHICLE AND TRANSPORTATION EQUITY INVESTMENTS** | | | | | |
| CVRP (standard rebates) | $140 | | | | $140 |
| Transportation Equity Projects | $100 | | $25 | | $125 |
| EFMP Plus-Up | $10 | | $10 | | $20 |
| Financing Assistance for Lower-Income Consumers | $10 | | $10 | | $20 |
| Clean Mobility Options in Disadvantaged Communities | $17 | | | | $17 |
| Agricultural Worker Vanpools | $3 | | | | $3 |
| Rural School Bus Pilot | $10 | | | | $10 |
| CVRP Rebates for Low-Income Applicants | $40 | | | | $40 |
| To Be Allocated in Spring 2018 Based on Demand | $10 | | | | $10 |
| One-Stop-Shop for CARB's Equity ZEV Replacement Incentives *(new)* | | | $5 | | $5 |
| **Light-Duty Vehicle Transportation and Equity Investment Total** | **$240** | | **$25** | | **$265** |
| **HEAVY-DUTY VEHICLE AND OFF-ROAD EQUIPMENT INVESTMENTS** | | | | | |
| Advanced Freight Equipment Demonstration and Deployment | $140 | | | $50 | $190 |
| Zero- and Near Zero-Emission Freight Facilities[3] *(new)* | $100 | | | $50[3] | $150 |
| Zero-Emission Off-Road Freight Voucher Incentive Project *(new)* | $40 | | | | $40 |
| Clean Truck and Bus Vouchers (HVIP + Low NOx Engine Incentives) | $180 | $8 | | | $188 |
| Truck Loan Assistance Program | | $20 | | | $20 |
| **Heavy-Duty Vehicle and Off-Road Equipment Investment Total** | **$320** | **$28** | | **$50** | **$398** |
| **TOTAL** | **$560** | **$28** | **$25** | **$50** | **$663** |

[1]CARB was appropriated $560 million for Carbon Transportation projects including CVRP, transportation equity projects, freight hubs/ports, and clean truck and bus vouchers in AB 134 (Committee on Budget, Chapter 254, Statutes of 2017).

[2]CARB was appropriated $28.64 million for AQIP and $25 million of Volkswagen settlement funds for the ZEV aspects of vehicle replacement in AB 97 (Ting, Chapter 14, Statutes of 2017). Staff proposes allocating $28 million of AQIP funds to projects and holding $0.64 million as a reserve.

[3]CARB was appropriated $50 million for a new Zero- and Near Zero-Emission Warehouse Program in SB 132 (Committee on Budget and Fiscal Review, Chapter 7, Statutes of 2017). This funding is limited to warehouses only per provision of SB 132. Low Carbon Transportation funding for the freight facilities project category is open to any freight facility located in a disadvantaged community as discussed further in Chapter 4..

*Light-Duty Vehicle and Transportation Equity Investments*: Staff proposes a total of $265 million for light-duty vehicle emissions funded from Low Carbon Transportation and the Volkswagen settlement. This includes $140 million for standard CVRP rebates plus an additional $40 million for low-income applicants, a new refinement to ensure the equity element of CVRP continues to grow and that rebates are prioritized for low-income applicants even if funding for standard rebates runs short.

Staff proposes a total of $125 million for transportation equity projects to increase access to clean transportation in disadvantaged communities and low-income households as directed by SB 1275, including the funding reserved for low-income consumer CVRP rebates. The transportation equity funding would expand ongoing projects as envisioned in the long-term plan for light-duty vehicle incentives included in the last year's Funding Plan. Staff also proposes a new project, a One-Stop-Shop for CARB's Equity ZEV Replacement Incentives, designed to implement a recommendation from the draft SB 350 Guidance Document. The One-Stop-Shop and associated community-based outreach are critical for increasing participation in all of CARB's equity-focused projects. This $125 million in new transportation equity funding adds to over $80 million in equity funding allocated in previous Funding Plans, but not yet spent.

As shown in Table I-4, the Volkswagen settlement funding would be used to expand EFMP Plus-up as directed by the Legislature and the terms of the court-approved consent decree, both through additional program funding directly for EFMP Plus-up and for supporting projects to help low-income consumers access the program.

*Heavy-Duty Vehicle and Off-Road Equipment Investments*: Staff proposes a total of $398 million for heavy-duty vehicle and off-road equipment projects in this Funding Plan. These allocations reflect the Legislature's direction in the Low Carbon Transportation budget that $180 million be used for clean truck and bus vouchers through HVIP and $140 million for advanced freight equipment demonstration and pilot commercial deployment.

The projects shown in Table I-4 include advanced technology demonstrations, early commercial pilots, and voucher incentives for commercially available technologies (including off-road freight equipment vouchers for the first time) consistent with the direction of SB 1204. These support the beachhead technologies identified in the Three-Year Investment Strategy for Heavy-Duty Vehicles and Off-Road Equipment included in Part II of this Funding Plan.

A main focus is freight equipment deployment and transformational freight facility projects, which supports the actions called for in the *California Sustainable Freight Action Plan*. This includes Low Carbon Transportation funding and the new, one-time Zero- and Near Zero-Emission Warehouse Program funding. Freight projects have been under funded in previous years due to budget limitations, and this year's budget appropriation addresses that need.

This year, there is also a significant increase in the clean truck and bus voucher funding, an area that is experiencing tremendous growth as new vehicles come to market.

AQIP funding is directed to continue the criteria pollutant and air toxics-focused Truck Loan Assistance Program that is not the best fit for the GHG-focused Low Carbon Transportation funds. The truck loan program is expected to the see an increase in demand as a result of a new law, SB 1, that will only allow clean trucks to be registered by the DMV. AQIP funding is also allocated to low NOx engine vouchers through HVIP.

Taken as a whole, these investments support a broad range of clean and efficient vehicle technologies, with funding opportunities for battery electric, fuel cell, hybrid, natural gas, and clean diesel engine technologies as well as engine and system efficiency improvements and low carbon renewable fuel use. The proposed projects are based on staff's assessment of the state of each technology and its role in the long-term transformation of the heavy-duty fleet to zero-emission where feasible and near zero-emission powered by clean, low-carbon renewable fuels everywhere else. The Three-Year Investment Strategy for Heavy-Duty Vehicles and Off-Road Equipment in Part II of this Funding Plan provides more details on these assessments.

*Tracking Project Performance and Reporting on Outcomes*: Through its grant agreements for each project, CARB will require grantees to collect all data necessary to document the emission reductions achieved, benefits to AB 1550 populations, project effectiveness, and any other data specified in the California Climate Investments Guidelines. This will include requirements for project administrators to maintain records and submit regular status reports for CARB. Staff will use this information to report to the public, the Board, and the Legislature on program implementation in future Funding Plans and each Annual Report to the Legislature on California Climate Investments Using Cap-and-Trade Auction Proceeds.

## DISADVANTAGED COMMUNITY, LOW-INCOME COMMUNITY, LOW-INCOME HOUSEHOLD INVESTMENT TARGETS

CARB implements these programs with a priority on providing health and economic benefits to California's most disadvantaged communities and low-income households. As noted earlier, AB 1550 modifies the SB 535 disadvantaged community investment minimums for California Climate Investments and requires new investments for low-income communities and low-income households. For the $560 million FY 2017-18 Low Carbon Transportation appropriation, staff proposes that at least 45 percent of CARB's Low Carbon Transportation appropriation be invested in projects meeting one of the AB 1550 criteria with the following targets:

- At least 35 percent of funds for projects located within and benefiting disadvantaged communities.

- At least 10 percent of funds for projects within and benefiting low-income communities or benefiting low-income households. The subset of these funds meeting the additional AB 1550 requirement for low-income community/ household investments that are within ½ mile of a disadvantaged community would be determined based on program implementation and reported in future Annual Reports to the Legislature on California Climate Investments.

Staff considers the investment targets to be a floor and strives to exceed them. In designing project solicitations and implementation requirements, staff will consider whether there are provisions that can be incorporated to help ensure that CARB exceeds the minimum targets. Chapter 5 of this Funding Plan describes efforts CARB is taking to maximize AB 1550 benefits.

Appendix A provides additional details on how CARB staff developed these minimum AB 1550 investment targets. There are a number of projects where staff took a very conservative approach of projecting no AB 1550 benefits up front due to a lack of historical data, leaving the benefits for those projects "to be determined." Even with this conservative approach, staff is able to demonstrate that at least 45 percent of the Low Carbon Transportation funds meet at least one of the AB 1550 criteria. Staff will design each project to prioritize disadvantaged community, low-income community, or low-income household benefits. Thus, staff expects an appreciable amount of the funding will meet one of the AB 1550 criteria, even in cases where no benefits are estimated up front.

The guidance for implementing AB 1550 is currently under development and will be finalized later in 2017. Staff will follow the requirements in the forthcoming guidance for determining AB 1550 benefits of Low Carbon Transportation investments.

While the AB 1550 requirements formally only apply to programs funded from the GGRF, CARB develops and implements all these incentives with an eye toward providing benefits to disadvantaged communities, low-income communities, and low-income households wherever possible. For example, staff is proposing to prioritize projects located in disadvantaged communities for the new Zero/Near Zero-Emission Warehouse Program even though that is not a statutory requirement for the program. In addition, the AQIP-funded Truck Loan Assistance Program helps underserved populations by providing financing for small business truckers who have trouble getting conventional truck loans, thereby supporting the goals of AB 1550. Many of these cleaner trucks operate in and near disadvantaged communities.

## AIR DISTRICT ROLE IN CARB'S CLEAN TRANSPORTATION INCENTIVES PROGRAMS

CARB has a long history of implementing its incentive programs in close coordination with its local air district partners and the California Air Pollution Control Officers Association (CAPCOA). This includes the Carl Moyer Program and Goods Movement Emission Reduction Program in addition to the programs covered by this Funding Plan.

The air districts play an important role implementing the Low Carbon Transportation and AQIP projects that require a close on-the-ground presence. An example of this is the EFMP and EFMP Plus-up, which are administered by the local air districts in recognition of the close involvement at the community level necessary to make these programs successful. Similarly, CARB relies on the North Coast Air Quality Management District (AQMD) to administer the Rural School Bus Pilot Project, a decision made with CAPCOA because this funding is aimed at upgrading school district fleets in smaller air districts. Air districts have also been awarded funding to administer advanced technology freight demonstration grants, zero-emission truck and bus commercial pilot deployment grants, and car sharing projects. These are further examples of projects that benefit from a locally based administrator who can provide on-the-ground project oversight. CARB plans to build on this approach as it considers new and expanded FY 2017-18 funding.

## FUNDING PLAN DEVELOPMENT PROCESS

Staff held 2 public workshops, 15 public work group meetings, and numerous individual meetings with interested stakeholders to develop the FY 2017-18 Funding Plan. Table I-5 summarizes these public meetings.

**Table I-5: Public Meetings on Development of FY 2017-18 Funding Plan**

| Date | Meeting |
|---|---|
| 2/10/2017 | Workshop on Development of the FY 2017-18 Funding Plan |
| 2/14/2017 | Work Group Meeting: Light-Duty Equity Projects |
| 2/14/2017 | Work Group Meeting: CVRP |
| 2/15/2017 | Work Group Meeting: Heavy-Duty Three Year Plan |
| 2/16/2017 | Work Group Meeting: HVIP and Low NOx Engine Incentives |
| 2/23/2017 | Work Group Meeting: Heavy-Duty Vehicle Investments |
| 2/24/2017 | Work Group Meeting: EFMP Plus-up |
| 2/28/2017 | Work Group Meeting: CVRP |
| 3/1/2017 | Work Group Meeting: Heavy-Duty Vehicle Investments |
| 3/2/2017 | Work Group Meeting: Light-Duty Equity Projects (Agricultural Worker Vanpools, Financing Assistance, and Clean Mobility Options) |
| 3/6/2017 | Work Group Meeting: HVIP and Low NOx Engine Incentives |
| 3/14/2017 | Work Group Meeting: In-State Low-Carbon Fuels Incentive Project |
| 3/16/2017 | Work Group Meeting: Heavy-Duty Three Year Plan |
| 3/17/2017 | Work Group Meeting: Light-Duty Equity Projects (Potential New Projects and Volkswagen 3.0 Liter Settlement) |
| 5/18/2017 | Work Group Meeting: Heavy-Duty Three Year Plan |
| 6/15/2017 | Work Group Meeting: Light-Duty Equity Projects (Green Mobility in Schools) |
| 10/4/2017 | Workshop on Development of the FY 2017-18 Funding Plan |

In addition to the public meetings on developing this Funding Plan, CARB does public outreach to inform stakeholders on incentive opportunities for funding appropriated in past budget years. There's been an increasing focus over the past year on tailoring outreach to disadvantaged communities. A summary of these outreach activities is provided later in the document, in Chapter 5: Maximizing AB 1550 Benefits.

# CHAPTER 3: LIGHT-DUTY VEHICLE AND TRANSPORTATION EQUITY INVESTMENTS

This chapter presents staff's proposal for light-duty vehicle investments. This includes continued funding for CVRP and transportation equity projects through CARB's Low Carbon Transportation Program appropriation and $25 million Volkswagen settlement funds for the ZEV-related aspects of the EFMP Plus-up or similar vehicle replacement programs.

## POLICY AND STATUTORY DRIVERS

The light-duty fleet will need to become largely zero-emission by 2050 (and fueled by low carbon, renewable energy sources) with a mix of battery electric and fuel cell vehicles in order to meet California's climate change and air quality emission reduction goals. The need for this transformation is highlighted in CARB's *Climate Change Scoping Plan* and 2016 *Mobile Source Strategy*. There are a number of regulatory, policy, and statutory drivers that set interim milestones and identify actions along the path to this transformation of the light-duty fleet.

- CARB's ZEV Regulation: The introduction and deployment of ZEVs in California was first driven by, and continues to be driven by, CARB's ZEV regulation that requires auto manufacturers to produce increasing numbers of ZEVs for sale in California.

- ZEV Deployment Goals: In Executive Order B-16-2012, Governor Brown set a goal of deploying 1.5 million ZEVs in California by 2025, complementing and building upon CARB's ZEV regulation.

  In SB 1275, the Legislature codified in statute the goals of: deploying 1 million ZEVs and near zero-emission vehicles by 2023; establishing a self-sustaining California market where these vehicles are a mainstream option; and increasing access for disadvantaged, low-income, and moderate-income communities and consumers to these vehicles. SB 1275 guides CARB's implementation of light-duty vehicle incentives.

  More recently, CARB identified a goal of 4.2 million ZEVs by 2030 in its 2016 *Mobile Source Strategy*.

- Cap-and-Trade Auction Proceeds Investment Plans: The Administration's first two Cap-and-Trade Auction Proceeds Investment Plans each identify light-duty ZEV deployment as a priority investment area.

- ZEV Action Plan: The 2016 update to the Governor's ZEV Action Plan identifies specific actions for State agencies to accelerate both the light-duty and

heavy-duty ZEV market in California. The investments recommended in this Funding Plan directly support actions identified in the ZEV Action Plan.

- SB 350 Barriers Study: SB 350 directs CARB to study the barriers for low-income Californians to access clean transportation and recommend actions for overcoming those barriers. The investments in this Funding Plan implement recommendations from the draft SB 350 Guidance Document.

CARB's light-duty vehicle and transportation equity investments are aimed at supporting the long-term transformation of the fleet and meeting each of these policy, statutory, and regulatory goals and requirements. There are two distinct, but complementary elements to CARB's advanced technology light-duty investments:

CVRP supports increasing the number of ZEVs on California's roadways to meet these deployment goals and achieve the large scale transformation of the fleet. These incentives are a critical part of the early ZEV deployment to help the market reach sustainability. In recent funding cycles, CARB has refined CVRP requirements in an effort to increase participation by low-income consumers thereby adding an equity component to the project. For FY 2017-18, staff proposes allocating $40 million for low-income applicant rebates only in addition to the standard CVRP allocation, a new refinement to ensure the equity component of CVRP continues to grow and that rebates are prioritized for low-income applicants even if funding for standard rebates runs short.

Transportation Equity Projects are designed to increase access to these clean vehicles for lower-income households, disadvantaged communities, and low-income communities. These projects provide opportunities for ownership through vehicle retirement and purchase incentives and financing assistance as well as consumer exposure to clean vehicles in disadvantaged communities through car sharing and other mobility improvement programs. SB 1275 directs CARB to fund these types of projects. For FY 2017-18, staff is proposing a new equity focused project: One-Stop-Shop for CARB's Equity ZEV Replacement Incentives. The new project would support the goals of SB 1275 and implement a recommendation from CARB's SB 350 study.

The various light-duty vehicle projects are interrelated and closely coordinated with one another. Financing assistance helps low-income consumers purchase advanced technology vehicles through CVRP and EFMP Plus-up. In addition, the new, proposed One-Stop-Shop is designed to help low-income consumers access all these projects.

## UPDATE TO LONG-TERM PLAN FOR CVRP AND LIGHT-DUTY VEHICLE INCENTIVES

CARB included a long-term plan for CVRP and light-duty vehicle incentives in the FY 2016-17 Funding Plan as required by SB 1275. Staff evaluated different aspects of the ZEV market to understand how the market is progressing and found positive ZEV market growth with technology costs decreasing quicker than originally expected in

most cases. The assessment also showed growth in vehicle diversity, number of manufacturers selling vehicles, and consumer demand with ZEVs and plug-in hybrid vehicles at 3 percent of annual passenger car sales in California by early 2016. These are all positive signs regarding the state of the ZEV market and technology development. However, the market is still in its infancy, and staff noted that it will take at least another 5 to 10 years before the market reaches sustainability.

Since last year's Funding Plan was released, CARB completed its Mid-Term Review of the Low-Emission Vehicle III and ZEV regulations, and staff has continued to track vehicle deployment trends and market growth. Updated findings are presented below.

Mid-Term Review Findings: The January 2017 Mid-Term Review report provides CARB's latest evaluation of technology advancement along with recommendations to the Board for next steps. The review focused on progress in technology since 2012 when the last comprehensive technology assessment had been conducted. Staff found advancements in vehicle and engine technologies that reduce GHG, criteria pollutant emissions, and particulate matter. ZEV technology development is beyond what was envisioned just four years ago as staff had noted in last year's Funding Plan. There are now over half a million ZEVs and plug-in hybrids in the U.S. Improvements in battery technology and reduction in battery costs have led to an increase in commercially available ZEV models. The Mid-Term Review found 25 different models available, and staff projects about 70 models may be released over the next 5 model years based on manufacturer announcements. ZEV infrastructure in California and the other states that have opted into CARB's ZEV regulation has grown with substantial investments in the past several years.

In the Mid-Term Review, staff recommended strengthening the ZEV program for 2026 and subsequent model years to continue on the path towards meeting California's 2030 and later climate change and air quality targets. Staff also recommended maintaining the current ZEV stringency through model year 2025 including the existing regulatory and credit structure and flexibility provisions, with some refinements to improve implementation of the regulation and maximize GHG and criteria pollutant reductions. In addition to regulatory efforts, CARB will continue efforts to accelerate and expand complementary policies to build market demand and remove remaining barriers to ZEV adoption.

Progress Toward Sustainable ZEV Market: As part of the long-term plan for CVRP and light-duty vehicle incentives, staff identified the "diffusion of innovation" theory as a basis for evaluating ZEV market growth. Staff also identified several indicators to use to evaluate the ZEV market. Results of staff's early assessment demonstrated that the market is still young. ZEV deployment is still in the early stages and has not yet overcome the toughest barriers to adoption despite the growth over the last few years. Below is an update to the ZEV market indicators that staff is monitoring:

- *New ZEV sales in the comparable California new car market*: Through 2016, nearly 260,000 new ZEVs and plug-in hybrids have been sold in California.[3] In 2016, sales of these vehicles accounted for 3.6 percent of the total light-duty vehicle sales, which is higher than 3.1 percent in 2015, and 3.2 percent in 2014. Their market share grew to 4.8 percent in the first quarter of 2017, compared to 2.7 percent in the same quarter of 2016 and 2.8 percent in 2015. Analysis of other indicators, which ultimately affect ZEV sales, suggests that the ZEV market is developing in the right direction and numbers are in line with projections.

- *Impact of the federal tax credit expiration:* Since 2010, purchasers of a new ZEV have been eligible for a federal tax credit of up to $7,500. This is the largest incentive available, and it makes up the majority of the initial incremental cost of these vehicles. This tax credit is scheduled to phase out once a manufacturer's cumulative ZEV sales reaches 200,000 vehicles. It is likely that one or more manufacturers may reach this limit and thus initiate the phase out of tax credits for their consumers as early as 2018. Once this incentive phases out, staff expects to see a decline in ZEV sales for affected manufacturers. This will, in turn, have a negative effect on the overall ZEV market. CARB will continue to monitor the market, especially as this threshold is overcome, and will continue to update the Board in future funding plans.

- *Technology advancement*: There has been a remarkable improvement in battery technology in terms of capacity and electric range in recent years. For instance, the range for a Nissan Leaf with a 30kWh battery pack increased from 84 miles in the 2014 model year to 107 miles in 2016. The 2016 Tesla Model S P100D package is certified by the U.S. Environmental Protection Agency (U.S. EPA) with an electric range of 315 miles, the longest range available for electric vehicles.[4]

- *Battery cost or vehicle price*: Battery costs have decreased mostly due to economies of scale, material cost reductions and production process improvements, and significant additional reductions are expected in the future. In spite of battery cost reductions, ZEV and plug-in hybrids are expected to remain more expensive than comparable internal combustion engine vehicles for the next decade. According to U.S. EPA's 2016 Technical Assessment Report, an incremental cost for battery electric vehicle or plug-in hybrid compared to an equivalent internal combustion engine vehicle is still expected to be $6,500 to $14,200 in the 2025 model year.[5]

- *Vehicle choice diversity and/or number of manufacturers that produce ZEVs*: As of August 2017, there are 30 eligible vehicle models in CVRP compared to a single model in 2010. Staff anticipates more than 70 models in the next 5 years.

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[3] https://autoalliance.org/energy-environment/zev-sales-dashboard /
[4] http://www.fueleconomy.gov/feg/Find.do?action=sbs&id=37235&id=37240&id=38172
[5] https://www.epa.gov/regulations-emissions-vehicles-and-engines/midterm-evaluation-light-duty-vehicle-greenhouse-gas-ghg

Manufacturers are also diversifying their offerings into more vehicle categories, so consumers should soon have multiple options in each vehicle class.

- *Analyzing the used ZEV market*: The used (or secondary) ZEV car market is an important element of an overall sustainable market. An increasing number of used ZEVs are expected to enter the market as a large number of vehicles come off their lease agreements. CARB has sponsored a study to explore the emergence of the used ZEV market, and the findings are expected to be available in early 2018.

- *Evaluating consumer awareness about ZEVs*: Multiple CARB-sponsored research as well as independent studies at state and national levels show that overall consumer awareness of ZEV technology is still very low. This lack of knowledge and awareness is one of the main barriers for consumer acceptance and ZEV adoption. CARB and its light-duty vehicle project grantees continue working to improve outreach and education efforts in order to address this issue. As part of this, CARB and the CVRP grantee, Center for Sustainable Energy (CSE), use surveys and other methods to evaluate how well outreach/education efforts are working.

## CVRP

Low Carbon Transportation Appropriation:
$140 million for Standard CVRP Rebates
$40 million Proposed for CVRP Rebates to Low-Income Applicants

### PROJECT OVERVIEW

CVRP offers vehicle rebates on a first-come, first-served basis for light-duty ZEVs, plug-in hybrid electric vehicles, and zero-emission motorcycles. CVRP helps get the cleanest vehicles on the road in California by providing consumer rebates to partially offset the higher initial cost of these advanced technologies. Per vehicle rebate amounts are based on consumers' income and vehicle technology as shown in Table I-6. Increased rebates for low-income applicants were introduced in 2016.

**Table I-6: CVRP Rebate Amounts and Income Limits**

| | Eligibility | | Vehicle Type | | | |
|---|---|---|---|---|---|---|
| | **Filing Status** | **Gross Annual Income** | **Fuel Cell** | **Battery Electric** | **Plug-in Hybrid[1]** | **Zero-Emission Motorcycle** |
| **Increased Rebate for Low-Income Applicants** | ≤ 300 percent of the federal poverty level (FPL) | | $7,000 | $4,500 | $3,500 | $900 |
| **Standard Rebate** | Individual | 300% FPL to $150,000 | $5,000 | $2,500 | $1,500 | |
| | Head of Household | 300% FPL to $204,000 | | | | |
| | Joint | 300% FPL to $300,000 | | | | |
| **Income Cap** | Individual | > $150,000 | $5,000 | Not Eligible | | |
| | Head of Household | > $204,000 | | | | |
| | Joint | > $300,000 | | | | |

[1]With electric range of at least 20 miles.

In 2016, the Legislature passed SB 859 which mandated a number of changes to CVRP, including:

- Increasing rebate amounts for low-income applicants with household incomes less than or equal to 300 percent of the federal poverty level to those shown in Table I-6.
- Reducing the income cap to the levels shown in Table I-6.
- Limiting plug-in hybrid electric vehicle eligibility to vehicles with at least 20 miles electric range.

- Requiring outreach to low-income consumers.

- Requiring prioritized rebate payments for low-income consumers.

CARB incorporate all these changed to CVRP in last year's Funding Plan. The AB 134 budget bill extends these provisions for one more year, so they will remain in place for FY 2017-18.

**CURRENT PROJECT STATUS**

Through April 2017, CVRP has provided rebates for nearly 200,000 vehicles at a cost of over $430 million since the project's launch in 2010. About 60 percent of rebates went to battery electric vehicles and 40 percent for plug-in hybrid electric vehicles, with only a small number of rebates issued for fuel cell electric vehicles and zero-emission motorcycles. More than 30 eligible vehicle models are now available and more vehicle introductions are planned for 2017 and 2018. As noted in the introduction to this chapter, ZEV sales in California have grown to over 3 percent of the total light-duty vehicle sales. Additional project statistics are available on the CVRP website: https://cleanvehiclerebate.org/eng/rebate-statistics.

Staff monitors CVRP participation rates by comparing rebate application data to California DMV registration data as part of its evaluation of program effectiveness. Historically, about 70 percent of ZEVs purchased or leased in California received a rebate. However, the current CVRP participation rate has dropped to about 50 percent of ZEVs purchased or leased in California. This decrease in the percent of the ZEV purchases receiving rebates is likely due to the introduction of an income cap, suggesting that the income cap is having its intended effect. Staff will continue to monitor CVRP participation rates as more data become available.

In the FY 2016-17 Funding Plan, CARB introduced prioritized rebate payments to low-income applicants as required by SB 859. Staff evaluated remaining funding in spring 2017 and determined that CVRP would run out of funding prior to the appropriation of FY 2017-18 funds. CARB set aside $8 million of the remaining funds to pay for rebates for low-income applicants after the rest of the CVRP funding ran out. Thus, CVRP remains up and running for low-income applicants with rebates being paid as soon as applications are reviewed and approved even though the project is in a waiting list mode for other applicants. Staff expects this set aside will be sufficient to keep paying low-income rebate applicants until the FY 2017-18 funding is available.

Staff is developing a pre-qualification mechanism to bring the CVRP rebate closer to the point of sale, a change included in the FY 2016-17 Funding Plan. Staff held public work group meetings to get stakeholder input on how to implement this change. Launch of pre-qualification is currently on hold because CVRP is in a waiting list mode for standard rebates. Staff intends to launch pre-qualification later in 2017, with an initial pilot in San Diego prior to launching statewide, once FY 2017-18 CVRP funding is available. Pre-qualification is expected to increase CVRP participation, and the initial

pilot will allow CARB and the CVRP administrator to test and refine implementation on a small scale, conduct one-on-one dealer training and support, and gauge effectiveness before launching statewide.

In addition to pre-qualification, outreach and public education was also expanded as directed by the Board in last year's Funding Plan and by the Legislature in SB 859. Expanded efforts include increased event participation in disadvantaged communities, conducting ride and drive events, expanding strategic partnerships with community-based organizations, increasing outreach towards dealerships in disadvantaged communities, and developing a new webpage targeted towards low-income consumers. The CVRP Community Incentive Assistance webpage offers tools such as a cost savings calculator to give low-income consumers a better understanding of available incentives. More information on cost savings and other tools are available on the CVRP website, https://cleanvehiclerebate.org/eng/community.

Staff is also exploring the development of a DMV mailer to provide consumers information on the benefits of ZEV ownership and available incentives. This concept directly supports one of the tasks outlined in the 2016 Governor's ZEV Action Plan. The increased outreach with low-income consumer and disadvantaged community focus is consistent with recommendations from the draft SB 350 Guidance Document.

## STAFF PROPOSAL FOR FY 2017-18

In the AB 134 budget bill, the Legislature appropriated $140 million for standard CVRP rebates with the additional direction that a portion of the transportation equity appropriation could be used for low-income applicant CVRP rebates. Staff proposes allocating $40 million of this equity funding for low-income CVRP rebates for applicants earning less than 300 percent of the federal poverty level in addition to the $140 million for standard rebates. This should meet low-income demand through at least fall 2018 based on the staff's projections presented below.

AB 134 also directs CARB to work with the Labor and Workforce Development Agency to develop procedures for certifying manufacturers of CVRP eligible vehicles as being fair and responsible in the treatment of their workers. In AB 134, the Legislature further expresses its intent that the Labor Secretary shall first certify manufacturers as fair and responsible in the treatment of their workers before their vehicles are included in any rebate program funded with state funds beginning with FY 2018-19. Staff will work with Labor and Workforce Development Agency to implement this direction and will propose any necessary changes in the FY 2018-19 Funding Plan.

Staff is proposing no major changes to CVRP eligibility requirements. One refinement for the FY 2017-18 funding cycle is incorporating into CVRP the Public Fleet Pilot Project, which provides an extra incentive for CVRP-eligible vehicles to public fleets operating in and near disadvantaged communities. This pilot had been funded separately as an equity project in previous budget cycles, but administered by the

CVRP grantee. It will now be fully integrated into CVRP, and staff's plans for this transition are discussed below.

*CVRP Demand Projections*: Staff estimated CVRP demand over the next three years as shown in Figure I-3. This updates the projections included in last year's Funding Plan using the same methodology but factoring in the most recent CVRP and registration data, the new income caps and low-income rebate levels, and anticipated new vehicle introductions.

**Figure I-3: Projected Three-Year CVRP Demand**

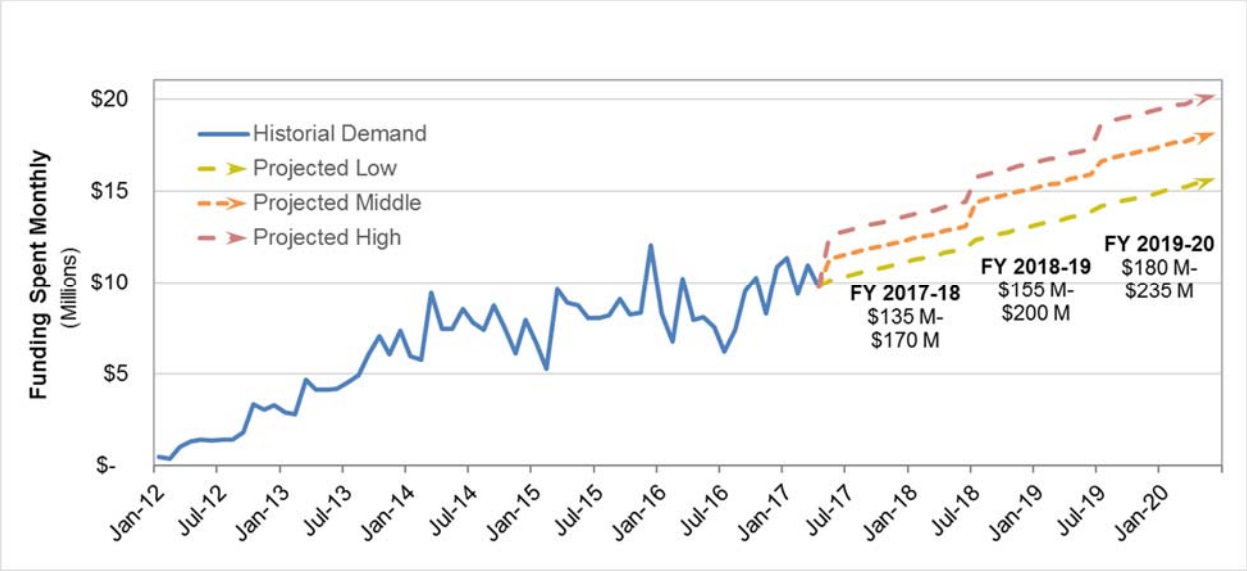



Table I-7 shows staff's estimated rebate demand for the FY 2017-18 funding cycle and the corresponding funding need, with projections for both standard rebates and low-income rebates.

**Table I-7: Projected Rebate Demand for FY 2017-18 Funding Cycle**

| Time Period | Projected CVRP Demand | | |
|---|---|---|---|
| | All Rebates | Standard Rebates Only | Low-Income Rebates Only |
| July 2017 – June 2018 (12 months) | $135 to $170 million 52,000-65,000 rebates | $115 to $145 million 47,000 – 59,000 rebates | $20 to $30 million 5,000 – 6,500 rebates |
| July 2017 – Sept 2018 (15 months) | $170 to $220 million 65,000-85,000 rebates | $145 to $180 million 59,000 – 70,000 rebates | $25 to $40 million 6,000 – 10,000 rebates |

*Standard rebate and low-income rebate columns don't exactly add to all rebates due to rounding.*

A 15 month projection is included in addition to the 12 month projection because staff would ideally like to allocate sufficient funding to meet demand through September 2018 to avoid the need for waiting lists to bridge funding shortfalls between budget cycles. Waiting lists are particularly problematic for low-income applicants, who need the

incentive as close to the time of purchase as possible. Furthermore, the prequalification element of CVRP only works if there is funding to fulfill prequalified rebates.

Based on these estimates, the Legislature's $140 million appropriation for standard CVRP rebates should meet 12 to 14 months of demand through June or July 2018. Staff's proposed $40 million low-income rebate allocation would meet at least 15 months of demand; this would keep the low-income applicant element of CVRP funded through at least fall 2018.

Staff's proposal would keep rebates for low-income applicants funded for at least 3 or 4 months longer than standard rebates. Staff believes this is consistent with the Legislature's direction to prioritize rebates for low-income applicants. Staff will reassess these projections at the start of the fourth quarter of the fiscal year. In the event that staff finds the low-income applicant demand is higher than projected, it would consider reallocating funding from standard rebates to low-income rebates. However, staff would not consider reallocating funding from low-income rebates to standard rebates. It would instead consider managing a standard rebate funding shortfall with a waiting list.

Because the budget aligns with projected demand, staff believes no major changes to CVRP rebate amounts or eligibility requirements are needed. This is consistent with staff's findings from the long-term plan for CVRP and light-duty vehicle incentives that the ZEV market has not progressed to the point where changes, such as reduced rebates, are warranted.

*CVRP Eligibility Requirements*: Staff is proposing no major changes to CVRP eligibility requirements. However, staff did evaluate several minor refinements including: out of state vehicle eligibility; fuel cell vehicle rebate amounts; and zero-emission motorcycle eligibility. After considering stakeholder input, staff determined that it is premature to reduce fuel cell vehicle rebate amounts because these vehicles are still in the earliest stage of commercialization. Staff also decided to make no changes to the zero-emission motorcycle category, which accounts for about 0.3 percent of rebates issued to date. However, staff is proposing one change described below:

- Elimination of CVRP Eligibility for Out of State Vehicles: CVRP currently allows vehicles purchased or leased out of state as long as the consumer is a California resident and the vehicle is registered as new in California. This provision was designed to enable consumers to obtain a specific vehicle model, trim, color, etc. that may not be available in California. These applications are often difficult and time consuming to evaluate because each state has different documentation for temporary operating permit requirements. For example, some states require vehicles to be registered prior to leaving the dealer lot, thus making the vehicle ineligible for CVRP. Other states allow dealers to issue temporary operating permits, and CVRP has allowed these on a case-by-case basis. Interstate dealership trades are available to consumers. These trades ensure the vehicle is purchased or leased in California, and the consumer acquires the vehicle of their choice. With dealership trades available, staff proposes eliminating CVRP

eligibility for out of state vehicle purchases or leases. This change would affect far less than one percent of the CVRP transactions.

*Public Fleet Incentives*: CARB currently offers incentives for public fleets both through CVRP and the Public Fleet Pilot, which provides an extra incentive for public fleets operating in and near disadvantaged communities. This pilot had been funded separately as an equity project in previous budget cycles, but administered by the CVRP grantee. As noted in last year's Funding Plan, CARB plans to fully incorporate the Public Fleet Pilot into CVRP once FY 2016-17 pilot funds are exhausted. Staff proposes a two-step process for this transition beginning on January 1, 2018:

- FY 2017-18 CVRP Public Fleet Incentives: Staff proposes incorporating several provisions unique to the Public Fleet Pilot into CVRP. These include: the option for public fleets to reserve funds by submitting a pre-acquisition plan; a streamlined application process (e.g. one application for all vehicles); required annual vehicle usage reports; flexibility for assigning rebates and retaining ownership; and tribal government participation. Staff also proposes allowing fleets up to 6 months to apply for pre-acquisition applications and up to 18 months to apply for regular applications (e.g. after the purchase is complete or vehicles are delivered). These would apply to public fleets anywhere in California, not just those operating in disadvantaged communities. These are intended to make participation easier for public fleets by accommodating their typical procurement process.

- Increased Incentives for Public Fleets in Disadvantaged Communities: When the FY 2016-17 Public Fleet Pilot funds are exhausted later this year, staff proposes maintaining an increased incentive for fleets operating in disadvantaged communities to complete the pilot's transition into CVRP. Staff proposes aligning the increased incentives for fleets to match the incentives for low-income consumers of up to $7,000 as shown in Table I-6. This would be a decrease of up to $8,000 from the current increased Public Fleet Pilot incentive. As the Public Fleet Pilot transitions, staff proposes to limit eligibility for the extra incentive to those vehicles domiciled in a disadvantaged community census tract consistent with the new direction in AB 1550, rather than allowing vehicles in ZIP Codes containing disadvantaged community census tracts to qualify.

- California Department of General Services (DGS) Procurement Process: Staff proposes setting aside up to $1 million of CVRP's allocation for fleets to acquire CVRP-eligible vehicles through DGS's procurement process. Staff envisions CARB entering into an interagency agreement with DGS to administer rebates during the procurement process, allowing fleets to utilize the incentive at the point of sale. Staff proposes allowing the normal CVRP process for fleets that do not use the DGS procurement process. CARB needs to work with DGS on implementation details, so staff envisions this would launch in early to mid 2018.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits*: CVRP will continue to be implemented on a first-come, first-served, statewide basis, so it is not possible to estimate in advance exactly how much funding will be spent in and benefit disadvantaged communities, low-income communities, and low-income households. About 7 percent of Low Carbon Transportation funding for CVRP to date has been spent in disadvantaged communities as reported in the March 2017 *Annual Report to the Legislature on California Climate Investments Using Cap-and-Trade Auction Proceeds*. Staff has also reviewed recent CVRP data and found that an additional 11 percent of funds were spent in low-income communities that don't overlap with disadvantaged communities.

Staff expects that the AB 1550 benefits for the FY 2017-18 funding should increase with the recent and proposed changes to increase the equity-focused components of CVRP. These include the higher rebates for low-income consumers, a dedicated funding allocation for low-income rebates, launch of prequalification, and increased outreach for disadvantaged communities and low-income households all of which should help low-income consumers make these purchases. As part of the Cap-and-Trade auction proceeds reporting requirements, CARB will track where funds are spent, so it can calculate and report the portion that meets AB 1550 investment criteria.

*Terms and Conditions*: When CVRP and the Public Fleet Pilot were established, CARB and the project administrator developed Terms and Conditions to highlight the policies set forth by the Board in more detail for consumers, and ensure a fair, equitable, and responsible project. More specifically, the Terms and Conditions are intended to notify consumers of the core requirements of the program prior to submitting an application. Additionally, CARB and the project administrator developed an Implementation Manual to further define these rules and define roles and responsibilities. The current Terms and Conditions and Implementation Manual are available at:

CVRP Terms and Conditions: https://cleanvehiclerebate.org/terms-and-conditions
CVRP Implementation Manual:
https://cleanvehiclerebate.org/sites/default/files/docs/nav/transportation/cvrp/documents/CVRP-Implementation-Manual.pdf
Public Fleet Pilot Terms and Conditions: https://cleanvehiclerebate.org/eng/pfp/requirements
Public Fleet Pilot Implementation Manual:
https://cleanvehiclerebate.org/sites/default/files/docs/nav/transportation/pfp/Public-Fleet-Pilot-Project-Implementation-Manual.pdf.pdf

These documents are incorporated into the proposed Funding Plan by reference and updated periodically throughout the year to reflect project changes after the Board adopts each funding plan and as other changes are necessary to provide further clarity.

*Solicitation Process*: CARB selected a grantee to administer FY 2016-17 CVRP funds via a three-year competitive solicitation with the option of adding the FY 2017-18 funds with an updated grant agreement. As the current grant comes to a close, staff will evaluate whether a new grant remains feasible under the three-year solicitation.

## OUTCOMES

Staff expects the $140 million CVRP allocation for standard rebates would fund approximately 58,000 rebates and provide 360,000 metric tons of carbon dioxide (CO2) equivalent GHG emission reductions. The allocation would also provide 48 tons of NOx, 19 tons of PM 2.5, and 10 tons of reactive organic gas (ROG) emission reductions. The additional $40 million allocation for low-income consumer rebates would fund approximately 10,000 rebates and provide 59,000 metric tons of CO2 equivalent GHG emission reductions, 7.8 tons of NOx, 3.4 tons of PM 2.5, and 1.6 tons of ROG emission reductions. After the funding is expended, CARB will report on the number of rebates issued, emission reductions achieved, and disadvantaged community benefits as part of future Annual Reports to the Legislature on California Climate Investments.

The ZEV market is continuing to grow dynamically. Although it is still early in the ZEV market's development, there is a clear need to evaluate the effectiveness of investments toward CVRP and other light-duty vehicle incentives. Staff provided an update to its long-term plan for CVRP and light-duty vehicle incentives in the introduction to this chapter, including an update on the metrics CARB is tracking to evaluate ZEV market growth. Staff will continue to monitor market and technology indicators and report on progress in each future Funding Plan. These indicators include, but are not limited to: ZEV sales as a fraction of the new car market; technology advancement such as vehicle range; battery cost and vehicle price; vehicle diversity and number of manufacturers producing ZEVs; growth of the used ZEV market; and consumer awareness about ZEVs.

## Transportation Equity Investment Overview

Since FY 2014-15, CARB has allocated Low Carbon Transportation funding to a suite of light-duty equity pilot projects designed to increase access to clean vehicles in disadvantaged communities and lower-income households. These projects reduce GHG, criteria pollutant, and toxics emissions, and they are support the goals of SB 1275. CARB initially funded four projects:

- EFMP Plus-up.
- Car Sharing and Mobility Options in Disadvantaged Communities (now known as Clean Mobility Options for Disadvantaged Communities).
- Financing Assistance for Lower-Income Consumers.
- Increased Public Fleet Incentives for CVRP.

A new pilot project, Agricultural Worker Vanpools in San Joaquin Valley, was added in the FY 2016-17 Funding Plan, but has not yet launched. The Increased Public Fleet Incentives for CVRP Eligible Vehicles project, in this category since FY 2014-15, is transitioning into CVRP and is covered in that section.

This section provides an update on each of these transportation equity projects as well as staff's funding proposals for the FY 2017-18 budget cycle to continue to grow these projects. The AB 134 budget bill appropriates $100 million to CARB in Low Carbon Transportation funding for equity-focused projects, including EFMP Plus-up, school bus replacement, CVRP rebates for low-income applicants, and other projects authorized by SB 1275. With the direction to include school bus replacement as a transportation equity project category, staff is proposing continuing funding for its Rural School Bus Pilot Project in addition the other projects listed above.

The Legislature also appropriated $25 million in Volkswagen settlement funding for the ZEV aspects of EFMP Plus-up and similar vehicle replacement programs. Staff's proposal for this Volkswagen settlement funding is covered in this section.

New priorities for the year include incorporating the findings from CARB's draft SB 350 Guidance Document on the barriers faced by low-income consumers to access clean transportation and addressing the new AB 1550 disadvantaged community and low income community/household investment requirements.

Consistent with the findings in the draft SB 350 Guidance Document, staff will continue to develop projects with input from community-based and statewide health, welfare, and environmental justice advocates. CARB will continue to require that grantees have strong community-based experience and commit to conduct extensive outreach and education tailored to the communities the projects will serve. During the SB 350 study, low-income residents and other stakeholders stated that all of these projects serve an important equity function for low-income and disadvantaged communities and have urged CARB to provide an increase in funding support as the projects move forward.

## EQUITY PROJECTS STATUS

To date, CARB has allocated $109 million to light-duty equity projects: $9 million in FY 2014-15; $10 million in FY 2015-16; and $90 million in FY 2016-17 (including the $10 million for the Rural School Bus Pilot). Table I-8 shows how these funds were allocated and provides a project status update.

**Table I-8: Cumulative Transportation Equity Pilot Project Status**
(FY 2014-15, 2015-16, and 2016-17)

| Projects | Funds Allocated (millions) | Funds Spent (millions) | Outcomes To Date | Description |
|---|---|---|---|---|
| EFMP Plus-up | $72 | $12 | 2,100 vehicles replaced | • San Joaquin Valley and South Coast programs launched in 2015, implementation ongoing.<br>• Working with Bay Area, Sacramento, and San Diego to launch new programs. |
| Clean Mobility Options for Disadvantaged Communities | $11.1 | $1.4 | 2 projects launched in 2017 | • Awarded $3.1 million for car sharing projects with to serve about 8,000 community residents in Los Angeles and Sacramento.<br>• $6 million FY 2016-17 solicitation released spring 2017, $2 million for expansion of existing projects pending, preliminary grant awardees anticipated fall 2017. |
| Financing Assistance for Lower-Income Consumers | $6.9 | $0.4 | 22 loans issued | • Awarded $0.9 million for Bay Area disadvantaged community project.<br>• $6 million FY 2016-17 solicitation released spring 2017, preliminary grant awardees anticipated fall 2017. |
| Increased Public Fleet Incentives for CVRP-Eligible Vehicles | $6 | $5 | 600 vehicles | • Launched February 2015. Initial $3 million exhausted in April 2016.<br>• Relaunched March 2017 with $3 million in FY 2016-17 funds, implementation ongoing with about $1 million remaining. |
| Agricultural Worker Vanpools in San Joaquin Valley | $3 | $0 | Solicitation pending | • New project for FY 2016-17, solicitation to be released fall 2017. |
| Rural School Bus Pilot | $10 | $6 | 30 buses | • Awarded funding for 30 zero-emission or renewable-fueled school buses operating in small air districts. |
| **Total** | **$109** | **$25** | | |

As shown in Table I-8, there is still over $80 million in equity project funds allocated in previous budget cycles, but not yet spent. Staff factored in this “in the pipeline” funding as it considered project allocations for the FY 2017-18 funding cycle.

Many of these projects are still in the early stages of implementation. CARB is gaining valuable lessons that will help refine and grow these projects. Staff has learned that launching these new pilots successfully is largely dependent on time and resource intensive efforts that tailor outreach for specific neighborhoods and provides personal interaction with participants. Despite these challenges, the projects are now entering a phase in which vehicles and charging infrastructure are being delivered and installed, lessons are being learned, increased funding is flowing, and momentum is ramping up.

## PROPOSED EQUITY PROJECT FUNDING ALLOCATIONS

Table I-9 shows staff's proposed FY 2017-18 transportation equity project funding allocations from Low Carbon Transportation and the Volkswagen settlement appropriations. To develop these proposed allocations, staff used 3-year funding need projection for the light-duty equity projects from last year's Funding Plan as a starting point. Staff then considered the implementation status and lessons learned from existing projects as well as stakeholder input from the Funding Plan public workshop and work group meetings and the SB 350 study. Funding these projects implements recommendations from the draft SB 350 Guidance Document and the ZEV Action Plan. For example, a specific recommendation from the SB 350 study that the State develop one-stop-shops to make it easier for low-income residents to access clean transportation incentives, and staff is proposing that as a new project.

**Table I-9: Proposed Transportation Equity Project Allocations for FY 2017-18**

| Project | Proposed Transportation Equity Allocations by Funding Source (millions) | | |
|---|---|---|---|
| | Low Carbon Transportation | Volkswagen Settlement | **Total** |
| EFMP Plus-up | $10 | $10 | **$20** |
| Financing Assistance for Lower-Income Consumers | $10 | $10 | **$20** |
| Clean Mobility Options for Disadvantaged Communities | $17 | - | **$17** |
| Agricultural Worker Vanpools | $3 | - | **$3** |
| Rural School Bus Pilot | $10 | - | **$10** |
| CVRP Rebates for Low-Income Households | $40 | - | **$40** |
| To Be Allocated Based on Demand | $10 | - | **$10** |
| One-Stop-Shop for CARB's Equity ZEV Replacement Incentives *(new)* | - | $5 | **$5** |
| **TOTAL** | **$100** | **$25** | **$125** |

As shown in Table I-9, staff proposes holding back $10 million of the $125 million transportation equity funding to award to any equity project that has higher demand than can be met with its initial allocations. Staff proposes flexibility to shift funding between equity projects in the event one project is oversubscribed while another is undersubscribed.

*Rationale for $25 Million Volkswagen Settlement Funding Proposal*: As shown in Table I-9, staff proposes the $25 million in Volkswagen settlement funds be used to augment EFMP Plus-up and Financing Assistance for Lower-Income Consumers and for a One-Stop-Shop for CARB's Equity ZEV Replacement Incentives. Staff's proposal would implement the Legislature's direction in the AB 97 Budget Act of 2017 that these funds be used to support expansion of EFMP Plus-up statewide including development of a tool to improve program efficiency and verify participant eligibility. The additional funding for EFMP Plus-up clearly supports that goal. Lack of financing has been noted as a reason some low-income consumers are unable to participate in EFMP Plus-up, and the additional financing assistance funding is intended to address that barrier. The Volkswagen funding would be in addition to the proposed Low Carbon Transportation allocations in order to further expand these projects, not displace GGRF funding.

The One-Stop-Shop funding would include development of a tool to improve program efficiency and verify participation as directed by the Legislature. It would also be used to increase community outreach efforts, another of the Legislature's goals for this funding. The One-Stop-Shop would directly support low-income consumers' ability to access EFMP Plus-up, Financing Assistance, and CVRP incentives; it is not intended for broad ZEV marketing, and as such, would not duplicate the Volkswagen funded outreach campaign required under another consent decree.

As with the other equity project funding, staff propose flexibility to reallocate the Volkswagen funds between EFMP Plus-up, Financing Assistance, and the One-Stop-Shop based on demand, so they can be used efficiently in the event one project is oversubscribed and another is undersubscribed.

The remainder of this section provides more details on each proposed transportation equity project.

# EFMP Plus-up

Proposed Allocation – $20 million
$10 million Low Carbon Transportation funds
$10 million Volkswagen settlement funds

## PROJECT OVERVIEW

EFMP Plus-up provides incentives for lower-income consumers living in and near disadvantaged communities who scrap their old vehicles and purchase new or used hybrid, plug-in hybrid, or ZEV replacement vehicles. Incentive amounts are based on a participant's income level, with up to $7,000 available for a hybrid replacement vehicle and up to $9,500 for a plug-in hybrid or ZEV replacement vehicle.

To participate in these programs, consumers must have a household income less than 400 percent of the federal poverty limit and live in a ZIP code containing disadvantaged community census tracts. To date, 90 percent of recipients have annual incomes that are 225 percent of the federal poverty level or below. Metrics for measuring progress include overall participation rates by lower-income consumers and in disadvantaged communities, number of vehicles of each technology type funded, GHG benefits and increased fuel economy vehicle replacements, and age and mileage of retired and replaced vehicles.

This project supports the statutory goals of SB 1275 and SB 350 recommendations by prioritizing funds to help low-income residents living in or near disadvantaged communities gain access to advanced technology vehicles or clean mobility options. Through education and outreach efforts, this project is also increasing awareness of advanced technology vehicles and the benefits of clean transportation to low-income residents. In addition, helping low-income residents purchase newer and more fuel-efficient vehicles provides social co-benefits by maximizing their economic opportunities, lowering their overall cost of driving, and minimizing work interruptions due to unreliable transportation.

## CURRENT PROJECT STATUS

CARB has allocated $72 million in Low Carbon Transportation funding for EFMP Plus-up over the past three budget cycles: $2 million in FY 2014-15; $10 million in FY 2015-16; and $60 million in FY 2016-17. Of this $72 million, CARB has awarded $42 million in grants to the San Joaquin Valley APCD and South Coast AQMD with $21 million awarded to each district. Both air districts launched their programs to the public in 2015. To date, $12 million has been expended and $60 million remains to be spent, as detailed below:

- San Joaquin Valley APCD Program ($21 million awarded: $1 million in FY 2014-15, $5 million in FY 2015-16, and $15 million in FY 2016-17): Through the second

quarter of 2017, about $5.4 million has been expended to replace 800 vehicles. About 16 percent are battery electric vehicles, 31 percent are plug-in hybrid electric vehicles, and 53 percent are hybrids. Public events are held bi-weekly throughout the San Joaquin Valley where participants can have their older vehicles assessed for retirement and begin shopping for a cleaner replacement. None of the $15 million awarded in FY 2016-17 has been expended yet.

- South Coast AQMD Program ($21 million awarded: $1 million in FY 2014-15, $5 million in FY 2015-16, and $15 million in FY 2016-17): Through the second quarter of 2017, about $6.1 million has been expended to replace 1,264 vehicles. About 20 percent are battery electric vehicles, 40 percent are plug-in hybrid electric vehicles, and 40 percent are hybrids. Interested participants can apply to the program online or through a multi-lingual dedicated call center. None of the $15 million awarded in FY 2016-17 has been expended yet.

CARB still has $30 million of its FY 2016-17 EFMP Plus-up allocation left to award. At the current pace of expenditure, neither of the existing air district programs will exhaust their awarded funds. Plans for this remaining funding are described below:

- New Air District Programs ($10 million reserved): CARB has reserved $10 million of its remaining FY 2016-17 EFMP Plus-up allocation for new pilot projects in three air districts. Staff is working with the Bay Area AQMD, the Sacramento Metropolitan AQMD, and the San Diego APCD. The districts are developing implementation plans, and grant agreements and project are expected to launch in the beginning of 2018.

- Carry Over to be Awarded in FY 2017-18 Based on Demand ($20 million): Even with the addition of new district programs, CARB is carrying forward $20 million from the FY 2016-17 allocation. This remaining funding will be awarded as part of the FY 2017-18 Funding Plan as described below.

## STAFF PROPOSAL FOR FY 2017-18

Staff proposes a $20 million allocation of FY 2017-18 funds, comprised of $10 million from Low Carbon Transportation and $10 million from the Volkswagen settlement fund. Combined with the $20 million carried over from FY 2016-17, a total of $40 million would be available to award, distributed as follows:

- $30 million would be allocated to the San Joaquin Valley APCD and South Coast AQMD ($15 million to each district) to support the anticipated growth of these two existing programs. Staff estimates this would fund about 3,400 vehicle replacements (1,700 in each air district).

- $6 million would be allocated to expand EFMP Plus-up to other air districts. This would fund about 660 additional vehicles This could include the three air districts currently developing programs or any other air district that develops a qualifying

program. This funding would supplement the $10 million reserved from last year's Funding Plan for new air districts, but not yet under grant agreement, meaning the total available for these new district programs is at least $16 million.

- Up to $4 million would be reserved to allocate in spring 2018 based on air districts' funding need projections. CARB staff would work with each interested air district and the CAPCOA to allocate this funding among the air districts. This would fund about 440 vehicles.

- Data reporting system: Staff recommends reserving a small portion of the allocation to develop a data reporting system that could be used by all the districts and CARB. This would streamline reporting obligations and increase transparency and accountability. This proposed data reporting system is specific to air district and CARB internal operations of the program and is not related to the One-Stop-Shop proposal that is detailed later in this document.

Staff proposes maintaining the same project parameters for EFMP Plus-up (incentive amounts, eligibility requirements, etc.) from past years with the exception that staff is proposing to allow the Volkswagen settlement funds to be used outside of ZIP codes containing a disadvantaged community census tract. This would help expand the potential geographic reach of the program consistent with the Legislature's direction in the AB 97 Budget Act of 2017 that the Volkswagen funds be used to assist the expansion of EFMP Plus-up statewide. The Low Carbon Transportation funding would continue to be limited to low-income consumers living in a ZIP code containing a disadvantaged community census tract; the rationale for this is discussed below.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits*: EFMP Plus-up requires that recipients must reside in ZIP codes containing a disadvantaged community census tract. For FY 2017-18, AB 1550 imposes new investment criteria and goals for projects funded by GGRF with minimums for being located in and benefiting a disadvantaged community; being located in and benefiting a low-income community or benefiting low-income households; or being located in and benefiting low-income communities within ½ mile of a disadvantaged community. Staff considered whether it should change the geographic eligibility requirements in response to AB 1550, such as limiting participation to disadvantaged community census tracts rather than ZIP codes containing disadvantaged community census tracts.

Through public work group meetings and communication with air districts, CARB received input that limiting participation to the census tract level could be an obstacle to new air districts adopting the program. The new air districts have significantly less disadvantaged community census tracts compared to South Coast and San Joaquin Valley air districts, but still have a great need to assist lower-income residents. Rather than downsizing the program to meet AB 1550 requirements, staff proposes continuing the existing ZIP code eligibility and low-income eligibility requirements for the Low Carbon Transportation funding. Because ZIP codes are larger geographic units than

census tracts, this approach would result in the program including some lower-income consumers who reside in areas outside of AB 1550 areas.

Staff believes that maintaining the current structure has advantages for both participants and implementing air districts and is key for overall project success. A primary benefit of this approach is that gathering ZIP codes from consumers instead of census tract numbers simplifies outreach efforts by eliminating a restriction that would need explanation for those unfamiliar with it. In addition, because all outreach to date has focused on ZIP codes, implementing air districts can continue to rely on word of mouth from past participants to help set expectations for future applicants. Thus, overall transparency of the program would be retained and there would be less confusion as to eligibility.

Retaining the current structure would still result in the vast majority of Low Carbon Transportation EFMP Plus-up investments meeting one of the three AB 1550 investment criteria. Overlaying historic project data with AB 1550 areas shows that about two thirds of EFMP Plus-up funding to date has been spent in disadvantaged community census tracts and an additional 20 percent of funds have been spent outside of but within ½ mile of disadvantaged community census tracts. Overall, about 90 percent of funds have gone to low-income households as defined by AB 1550. For the purposes of estimating the minimum AB 1550 benefits for FY 2017-18 Low Carbon Transportation funds in Appendix A, staff made more conservative estimates of the percent of funding meeting AB 1550 criteria than these historic percentages due to lack of data for new air districts planning to launch EFMP Plus-up programs. Staff estimated at least 75 percent of these FY 2017-18 funds would meet one of the AB 1550 criteria (see Table A-54 in Appendix A), but staff expects to exceed this minimum estimate.

*Volkswagen Settlement Funding*: As noted above, staff proposes that the $10 million of Volkswagen settlement funds could be used for low-income participants who live outside of the AB 1550 designated areas as discussed above. In addition, Volkswagen settlement funds would be limited to transactions where the replacement vehicle is a ZEV or plug-in hybrid consistent with the provisions of the consent decree. This additional funding would support program expansion beyond that which CARB could support with GGRF funding only.

*Grant Award Process*: Consistent with previous years' allocations, CARB would award EFMP Plus-up funding non-competitively through grant agreements with the San Joaquin Valley APCD, South Coast AQMD, and other air districts that choose to start an EFMP Plus-up program. This project will continue to require outreach, education, and consumer protections for lower-income consumer recipients living in or near disadvantaged communities. The small set aside to cover the cost of developing a data reporting system would be awarded via a competitive grant solicitation.

## OUTCOMES

CARB's air quality and climate change plans show that the vast majority of the on-road fleet must be zero- and near zero-emission vehicles by 2050 to meet the State's GHG targets. CARB's *Mobile Source Strategy* indicates that incentive programs such as EFMP and EFMP Plus-up will be essential in facilitating the light-duty fleet transition to zero-emission and near zero-emission technologies. It also calls for further deployment of cleaner light-duty vehicle technology through the expansion and enhancement of retire-and-replace incentive projects to accelerate the turnover of the fleet to meet an overall LEV III or better emissions level. Further, the draft SB 350 Guidance Document identifies barriers that low-income consumers experience, such as affordability and lack of infrastructure, and recommends increased funding and outreach for clean transportation incentives projects. The increased funding proposed above will play an important part in meeting these demands.

Staff estimates the proposed $20 million in new FY 2017-18 funding would pay for 2,300 vehicle replacements and reduce 11,000 metric tons of CO2 equivalent GHG emissions, 23tons of NOx, 1 tons of PM2.5, and 5.5 tons of ROG emission reductions.

Participating air districts must report project information on a quarterly basis based on project administration and consumer surveys. With this information, and through continued interaction with stakeholders and analysis of the state of the light-duty vehicle market, CARB will be able to determine the participation rate and advancement of clean vehicles for disadvantaged communities and lower-income consumers, assess future funding needs, and evaluate other opportunities for making program enhancements.

CARB will report in Annual Reports and future Funding Plans the outcomes of this project including GHG reductions achieved or anticipated using the appropriate CARB quantification methodology; progress in meeting or exceeding SB 535 and AB 1550 targets for investment in and benefits to disadvantaged communities; updates on economic, environmental, and public health co-benefits achieved or anticipated; and transaction locations. Metrics to measure progress for this project includes information on the types of vehicles utilized, the number of participants, and clean mobility improvements experienced by participants.

# Financing Assistance for Lower-Income Consumers

| |
|---|
| Proposed Allocation – $20 million<br>$10 million Low Carbon Transportation funds<br>$10 million Volkswagen settlement funds |

## PROJECT OVERVIEW

The Financing Assistance for Lower-Income Consumers pilot project is designed to help lower-income Californians overcome the significant barrier of obtaining vehicle financing by improving access to affordable clean new and used vehicles through low cost loans and vehicle price buy-downs. This will result in GHG and criteria pollutant emission reductions as well as economic benefits to these consumers such as increasing credit scores, ability to qualify for housing loans, and more reliable transportation. Metrics to measure progress include the number of consumers that participate, costs and types of vehicles purchased, and loan repayment rates. SB 1275 directs CARB to establish financing assistance projects for lower-income consumers.

This project supports the statutory goals of SB 1275 and SB 350 recommendations by prioritizing funds for clean transportation and mobility options. This is accomplished by implementing programs that expand the new and used vehicle ownership programs with point-of sale incentives (price buy-downs) and low-cost loans; increasing awareness of clean transportation and mobility options by educating consumers of clean transportation options and infrastructure investments; and incentivizing charging infrastructure for lower-income residents.

## CURRENT PROJECT STATUS

For FY 2014-15, CARB awarded a $900,000 grant via competitive solicitation to the Richmond, California based Community Housing Development Corporation (CHDC). This Bay Area project is offered only to lower-income residents living in ZIP codes containing disadvantaged communities in the Bay Area. Participants are offered a low interest loan and a vehicle price buy-down to purchase used advanced technology vehicles, and lenders are offered a loan loss reserve to mitigate their risk. CHDC helps participants understand their vehicle technology choices and provides financial information to ensure that vehicles chosen meet participant needs and loan experiences are successful. Once prequalified, CHDC works with their dealer partners to assist participants in finding qualified vehicles.

This project has provided several lessons about providing financing for lower-income consumers in disadvantaged communities. For those consumers that complete the process and attain a vehicle loan, participants are mostly opting for hybrid over plug-in and battery electric vehicles because of lack of charging infrastructure. For those participants who do not complete the project, interested consumers have dropped out of the program due to limited advanced technology vehicle offerings, such as minivans, SUVs, and light-duty trucks. For others, life circumstances change and they cannot

afford a loan. For those interested in charging infrastructure to support a plug-in vehicle, often the challenge is installing a charging site while renting at a property, an issue for plug-in penetration that is broader than this financing program. In addition, the infrastructure cost must be paid up front by the consumer and participants may be uncertain of the quality of their existing electrical supply to support the charger. CHDC has enhanced their outreach and education efforts to address these issues to enroll appropriate participants and provide them the best chances of success.

An additional issue is that many interested consumers have been turned away because they do not live in ZIP codes containing a disadvantaged community, one of the FY 2014-15 eligibility requirements. Marketing the project is confusing to potential consumers because eligibility depends on where an individual lives. To address this issue in FY 2016-17, CARB added a statewide project solicitation that made that project open to lower-income consumers regardless of where they live, and staff now proposes to provide the CHDC project this additional flexibility.

In FY 2016-17, CARB allocated an additional $6 million for Financing Assistance of Lower-Income Consumers. This funding includes two elements: up to $5 million for one statewide project and up to $1 million for local projects. As discussed above, to increase the project reach CARB expanded the project to include lower-income consumers beyond disadvantaged communities. CARB released a $6 million competitive grant solicitation in May 2017, the solicitation closed in July 2017 with two applicants for a statewide project. CARB staff expect to select a statewide Financing Assistance Pilot Project administrator by the Fall of 2017. Because no applications were submitted for a local project, that $1 million local project set aside will be reprogrammed to other light-duty equity projects.

## STAFF PROPOSAL FOR FY 2017-18

Staff proposes a $20 million allocation for FY 2017-18, with $10 million coming from the proposed Low Carbon Transportation appropriation and $10 million from the Volkswagen settlement funds. Consistent with the provisions of the Volkswagen settlement consent decree, the settlement funds used in this project would be limited to ZEV or plug-in hybrid vehicle replacements. This combined $20 million allocation would consist of two complementary elements:

- $18 million statewide project that staff anticipates would build upon FY 2016-17 funding for lower-income consumers throughout California. To qualify, a project must demonstrate a plan that offers consumer financing statewide but may start at a regional or multi regional level. The statewide project targets lower-income consumers with an emphasis on outreach in disadvantaged communities.

  *Project Solicitation:* Staff proposes that this grant funding be awarded via a competitive three-year solicitation to select one grantee to develop and implement the statewide project. While the solicitation would encompass up to three fiscal years, the grant agreement would initially cover one fiscal year with

the option to renew with each of the following two fiscal years. The solicitation would be released mid-2018 to allow time for staff to incorporate lessons learned from the FY 2016-17 statewide project as it begins implementation.

- $2 million reserved for expansion of the existing local financing assistance project if it is meeting project goals and provides a plan that makes a compelling case for expansion. Grant awards would be subject to staff evaluation of the existing project and a required comprehensive application by the project grantee.

Acknowledging that current data is limited on financing mechanisms targeting lower-income consumers, CARB staff sees the need for flexibility in funding allocations going forward. This includes moving allocations between the statewide project and expansion of the local project, refining project designs as new information is obtained and financial models are developed and administered, and adjusting timeframes in recognition that project start up can take more time than anticipated. If either the statewide or expansion of the local project are undersubscribed, staff proposes a contingency provision to shift funding between them based on demand, augment the set aside for expansion of the existing project, or to increase funding for other light-duty equity projects. If expansion funding is not awarded, staff proposes a contingency provision to shift the funding to either the statewide project or increase funding for other light-duty equity projects if they are oversubscribed.

*Project Changes*: In public work group meetings, staff have proposed aligning vehicle price buy-down amounts available in the Financing Assistance program with the incentive amounts offered in EFMP Plus-up and CVRP. Stakeholders have expressed general agreement with this concept. Before modifying the buy-down amounts, however, staff proposes to begin implementation of the FY 2016-17 statewide project using current buy-down amounts to determine project uptake, learn more about the used clean vehicle market and the needs of low-income consumers, and analyze how the CARB clean transportation incentives programs work together. Once staff gains experience with the project, they will work with stakeholders to establish appropriate buy-down amounts. If new amounts are determined, staff will propose the changes for Executive Officer approval for the FY 2017-18 funding.

A similar issue regards aligning Financing Assistance with CVRP. Currently, a consumer may receive a Financing Assistance vehicle loan with both a vehicle price buy-down and a CVRP rebate. Staff is considering changing this to allow a loan to combine with either a vehicle price buy-down or a CVRP rebate, but not both. As noted above, staff seeks to learn from the FY 2016-17 statewide project as it begins implementation with the current structure before working with stakeholders and proposing changes for the Executive Officer to approve.

The proposed new One-Stop-Shop project, described later in this document, would help coordinate these and other issues among all complementary clean transportation projects. Finally, staff also proposes providing the FY 2014-15 CHDC local project with

additional flexibility of being open to low-income consumers regardless of where they live.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits*: This proposed funding would be available statewide, so it is not possible to estimate in advance exactly how much funding will be spent in and benefit disadvantaged communities, low-income communities, and low-income households. Based on program design, however, staff expects that much of this funding will be spent in and will benefit these communities and households because the project would be closely coordinated with EFMP Plus-up, which will continue to focus on benefiting consumers living in and near disadvantaged communities. As part of the Cap-and-Trade auction proceeds reporting requirements, CARB will track where funds are spent and report the portion that meets AB 1550 investment criteria.

**OUTCOMES**

CARB will continue to use data from the current CHDC project as it becomes available to better understand the costs, types, and issues associated with vehicle purchased or leased, how well participant needs are met, how well the financing mechanisms work, and opportunities to continue or expand this project. This pilot project will also help identify the success of this model and can be used by other local community organizations that have a focus on promoting vehicle ownership for lower-income consumers. Similarly, CARB will also begin to use data from the FY 2016-17 statewide project as that project comes on line.

For FY 2017-18, the goal is to provide $18 million to a statewide project and $2 million for expansion of the existing local project. For the statewide project, staff proposes a program that includes a loan loss reserve model that is designed to minimize the lender risk for loans made to lower-income consumers, in combination with a low cost loan and vehicle price buy-down to assist consumers by making a clean vehicle purchase more affordable. Together, these projects address barriers that disadvantaged communities' experience, such as the ability to finance a clean vehicle, affordability, and lack of infrastructure, and incorporates recommendations for increased funding and outreach, as identified in the draft SB 350 Guidance Document.

Because implementation of this project is in its early stages, staff has limited data upon which to estimate emission benefits. Based on the assumptions described in Appendix A, the proposed allocation of $20 million is estimated to provide 8,600 metric tons of CO2 equivalent GHG emission reductions, 1.4 tons of NOx, 0.55 tons of PM 2.5, and 0.28 tons of ROG reductions. Staff will refine these estimates as more data become available.

CARB will report in Annual Reports and future Funding Plans the outcomes of this project, including GHG reductions achieved or anticipated using the appropriate CARB quantification methodology; progress in meeting or exceeding SB 535 and AB 1550 targets for investment in and benefits to disadvantaged communities; updates on

economic, environmental, and public health co-benefits achieved or anticipated; and project locations. Metrics to measure progress for this project may include information on the loans made, types of vehicles utilized, the number of participants, and changes in access to mobility experienced by participants.

# Clean Mobility Options for Disadvantaged Communities

Proposed Low Carbon Transportation Allocation – $17 million

## PROJECT OVERVIEW

Clean Mobility Options for Disadvantaged Communities is designed to help individuals in disadvantaged communities benefit from the use of an automobile without the responsibility of car ownership costs and to offer alternate modes of transportation that encourage the use of zero-emission and plug-in hybrid vehicles, vanpools, and other mobility options. As the name change from Car Sharing to Clean Mobility Options implies, this project's previous focus on car sharing is evolving to include additional mobility enhancements, such as introducing electric bicycle sharing and, new this year, regular bicycle sharing. SB 1275 directs CARB to establish car sharing projects that serve disadvantaged communities.

Clean Mobility Options for Disadvantaged Communities projects will provide GHG and criteria pollutant emission reductions and can be used to gather data to help support larger scale light-duty vehicle advanced technology transportation programs in the future. Metrics to measure progress include the types of vehicles purchased, number of disadvantaged community residents signed up for services, vehicle miles traveled and number of trips taken, and changes in access to mobility experienced by participants.

Clean Mobility Options for Disadvantaged Communities supports the goals of SB 1275 and the SB 350 recommendations for overcoming clean transportation barriers for low-income consumers and disadvantaged communities. These include prioritizing funding for clean transportation and mobility options, increasing awareness, and educating consumers about clean transportation options and infrastructure investments.

## CURRENT PROJECT STATUS

In FY 2014-15, CARB awarded $3.1 million via competitive solicitation. This solicitation was greatly oversubscribed with nearly $16 million in applications. These Car Sharing and Mobility Options pilot projects feature strong support from local and regional government agencies, private sector operators, and community-based organizations that together will help to ensure that the health, economic, and social benefits of advanced technology car sharing reach disadvantaged neighborhoods. In addition, these projects include extensive targeted bilingual outreach and education, mechanisms to include residents who do not have bank accounts, and installation of charging infrastructure to serve multi-unit housing in disadvantaged communities.

- City of Los Angeles received $1.7 million to start a zero-emission car share in Los Angeles serving Westlake, Koreatown, Pico-Union, Downtown, Echo Park, Boyle Heights, and Chinatown. The project includes deploying 100 electric vehicles with 40 curbside multiple-outlet charging stations and a membership

goal of over 7,000 participants within three years of project launch. The City of L.A. process to select and contract with project implementer BlueLA was unexpectedly lengthy due to the need to optimize the project framework between a number of City departments and unforeseen infrastructure costs and planning requirements. A demonstration site launched in June 2017, and full commercial launch is expected by the end of 2017.

- Sacramento Metropolitan AQMD received $1.4 million to provide eight electric vehicles and charging stations for a car sharing system for three Sacramento area subsidized multi-unit housing communities: Alder Grove, Edgewater, and Mutual Housing at Lemon Hill. Service began in April 2017 and will eventually serve up to 2,000 residents.

Both projects have experienced unexpected delays and hurdles, mostly regarding the installation of vehicle charging infrastructure. Close coordination between grantees, subcontractors, site owners, and local governing agencies has been key in launching these projects. Even with cooperation, progress has proven slower than anticipated. The good news is that grantees are sharing lessons learned with stakeholders from other cities throughout California, nationally, and internationally because the needs and issues these projects address, and the solutions they can offer, are not unique to California. Knowledge gained through these first two pilots should make it easier to launch and sustain future projects.

In FY 2016-17, CARB allocated an additional $8 million for the Car Sharing and Clean Mobility Options Pilot Project. In April 2017, CARB released a $6 million competitive solicitation for project proposals that received 15 applications seeking almost $22 million of grant funding and pledging $18.5 million of matching funds. Preliminary grantee selections are anticipated in fall 2017. CARB is also conducting a simultaneous process to award up to $2 million of expansion funding for existing projects with grant awards anticipated in winter 2017.

## STAFF PROPOSAL FOR FY 2017-18

Staff proposes a $17 million for FY 2017-18 allocated as follows:

- $12 million for a statewide administrator to award funding on a first-come, first-served basis for small, simple car sharing projects serving disadvantaged communities. The funding would target small car sharing projects of new or used battery-electric, fuel cell electric, or plug-in hybrid vehicles, along with support for outreach, a reservation system, charging infrastructure, and ridesharing. These types of projects will bring clean transportation options to people and neighborhoods that need them the most. Goals would be set for minimum lower-income consumer participation, and the administrator would conduct targeted outreach in disadvantaged communities to present the opportunity and work with applicants to apply for funding.

Staff has received input from past applicants and community stakeholders that the CARB solicitation and application process can be complicated and expensive. The statewide administrator would address these issues by creating a streamlined application process to make it easier for community-based organizations, government agencies, and tribal governments to apply for and implement car sharing projects. This more streamlined approach for small projects also addresses recommendations from the draft SB 350 Guidance Document.

*Project Solicitation:* Staff proposes that this grant funding be awarded via a competitive three-year solicitation to select one grantee to develop and implement the statewide administrator. While the solicitation would encompass up to three fiscal years, the grant agreement would initially cover one fiscal year with the option to renew with each of the following two fiscal years.

- $5 million reserved for expansion of existing pilot projects that are successfully meeting project goals and can demonstrate a compelling case for expansion. Grant awards would be subject to staff evaluation of the existing project and a required comprehensive application by the project grantee.

If there is insufficient demand in either of these two categories, funds may be reallocated to the other category or another transportation equity project based on demand as set forth in the contingency provisions described in Chapter 6.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits*: Consistent with previous years' Low Carbon Transportation car sharing project requirements, staff proposes that Clean Mobility Options be limited to projects located in disadvantaged communities thereby providing a benefit to the residents of these communities. Because AB 1550 prohibits "double counting" investments for determining compliance with minimum disadvantaged community and low-income household/community targets, staff will not count any of the Clean Mobility Options funding as being within and benefiting low-income communities or benefiting low-income households even though staff expects some of the funds will meet those criteria as well.

## OUTCOMES

CARB will continue to use data from the current projects as it becomes available to better understand the costs, strategies, and issues associated with introducing car sharing and other mobility options into disadvantaged communities. As the projects are beginning to roll out to residents, grantees and CARB are evaluating how well the neighborhood's transportation needs are met, which project design elements work and those that do not, and the opportunities to continue or even expand the projects. These pilot projects provide lessons and strategies that may be used by other local agencies and community organizations interested in launching similar projects.

The knowledge already gained helps shape staff's FY 2017-18 proposals. The Statewide Administrator proposal is designed to meet the pressing need to assist low-income disadvantaged community residents. Expansion of the existing pilots will be based on lessons learned informing decisions on how best to move forward for each project.

Staff cannot estimate the exact emission benefits until projects are selected and implemented. However, staff provides an example of the magnitude of anticipated benefits by quantifying the emission reductions associated with a "sample" project based on assumptions described in Appendix A. The proposed allocation of $17 million is estimated to provide 2,100 metric tons of CO2 equivalent GHG emission reductions, 0.28 tons of NOx, 0.11 tons of PM 2.5, and 0.06 tons of ROG reductions.

CARB will report in Annual Reports and future Funding Plans the outcomes of this project including GHG reductions achieved or anticipated using the appropriate CARB quantification methodology; progress in meeting or exceeding SB 535 and AB 1550 targets for investment in and benefits to disadvantaged communities; updates on economic, environmental, and public health co-benefits achieved or anticipated; and project locations. Metrics to measure progress for this project may include information on the types of vehicles utilized, the number of participants, numbers of trips and vehicle miles traveled, and changes in access to mobility experienced by participants.

# Agricultural Worker Vanpools

Proposed Low Carbon Transportation Allocation – $3 million

## PROJECT OVERVIEW

The FY 2016-17 Funding Plan allocated $3 million for the Agricultural Worker Vanpools in the San Joaquin Valley pilot project that would provide expanded access to clean transportation vanpools for agricultural workers in the San Joaquin Valley's disadvantaged communities. For FY 2017-18, the primary focus of this project remains the San Joaquin Valley, but with increased available funding, staff seeks flexibility to expand to other agricultural disadvantaged community areas if appropriate. Eligible technologies include zero-emission, plug-in hybrid, or hybrid passenger and shuttle vans, and vehicles and vehicle conversions must be HVIP- or CVRP-eligible. Installation of electric vehicle supply equipment for appropriate multi-unit dwellings and other appropriate locations may also be considered for funding.

This project supports the statutory goals of SB 1275 and SB 350 recommendations by prioritizing funding for clean transportation, increasing access to vanpools in disadvantaged communities, and funding installation of charging infrastructure at multi-unit dwellings in disadvantaged communities.

## CURRENT PROJECT STATUS

Staff plans to release the FY 2016-17 competitive grant solicitation later in 2017.

## STAFF PROPOSAL FOR FY 2017-18

Staff proposes $3 million for FY 2017-18 for projects that are located within disadvantaged communities. CARB staff will use a public work group process to develop project parameters.

Stakeholder feedback is that this level of funding will meet the current level of demand in the San Joaquin Valley. However, similar needs for agricultural worker vanpools exist in other California agricultural communities. For this funding cycle, staff proposes to prioritize funding within the San Joaquin Valley, while allowing expansion to other disadvantaged agricultural regions if appropriate.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits:* Consistent with FY 2016-17 Agricultural Worker Vanpools in the San Joaquin Valley pilot project requirements, staff proposes that all funding be spent in and for the benefit of disadvantaged communities. AB 1550 prohibits "double counting" investments for determining compliance with minimum disadvantaged community and low-income household/community targets. Staff will not count any of the Agricultural Worker Vanpools pilot project funding as being within and benefiting low-income communities or

benefiting low-income households, even though staff expects some of these funds will meet those criteria as well.

*Project Solicitation*: Staff proposes that this grant funding be awarded via a competitive solicitation. Staff may include this funding as part of the forthcoming FY 2016-17 Agricultural Worker Vanpools pilot competitive solicitation and/or release a separate solicitation.

## OUTCOMES

Staff cannot estimate specific outcomes of a pilot project until a project is selected and implemented. However, in Appendix A, staff has provided an illustration of emission reductions that could result from an agricultural worker vanpool pilot project scenario. The proposed $3 million allocation is estimated to provide total potential GHG emission reductions of 1,900 metric tons of CO2 equivalent GHG emission reductions. The project could also provide 0.09 tons of NOx, 0.17 tons of PM 2.5, and 0.01 tons of ROG emission reductions.

CARB will report in Annual Reports and future Funding Plans the outcomes of this project, including GHG reductions achieved or anticipated using the appropriate CARB quantification methodology; progress in meeting or exceeding SB 535 and AB 1550 targets for investment in and benefits to disadvantaged communities; updates on economic, environmental, and public health co-benefits achieved or anticipated; and project locations. Metrics to measure progress for this project may include information on the types of vehicles purchased, the number of workers signed up for services, the vehicle miles traveled and number of trips taken, and changes in access to mobility experienced by participants.

# Rural School Bus Pilot Project

Proposed Low Carbon Transportation Allocation – $10 million

## PROJECT OVERVIEW

The objective of the Rural School Bus Pilot Project is to enhance the turnover of the California school bus fleets to lower-carbon transportation choices. This project was funded with $10 million in the FY 2016-17 Plan, and is currently administered by the North Coast Unified AQMD. This project implements the recommendation from the draft SB 350 Guidance Document to secure commitments from school bus fleet owners to purchase zero-emission and near-zero emission buses.

## CURRENT PROJECT STATUS

In February 2017, North Coast Unified AQMD released a solicitation for school districts to apply for grant funding. The solicitation closed on March 30, 2017, and 422 applications were received requesting $127 million in funding. North Coast Unified AQMD ranked the applications, and on May 1, 2017 published a list of the top 29 projects and requested documentation to confirm eligibility. More than one-third of the selected projects will be in school districts located in disadvantaged or low-income communities of the state.

## STAFF PROPOSAL FOR FY 2017-18

In December 2016, CARB staff presented an informational update to the Board regarding the population of school buses in California, with recommendations for priorities in cleaning up the school bus fleet. Staff estimates that over 5,000 school buses have immediate or imminent need for replacement to meet basic health-protective criteria, especially for the children riding the school buses. The Board asked staff to find ways to expedite this clean up. Many sources of incentive funds, such as Carl Moyer, VW mitigation funds, and SB 617 funds, can be spent on school bus clean-up, but no one source of funding can completely meet the on-going needs of the fleet.

The overwhelming response during the project's application period for the FY 2016-17 funding cycle demonstrates a strong interest by California school districts to participate in the project and utilize zero- and near zero-emission school buses. Therefore, staff proposes allocating $10 million to continue this project for FY 2017-18. Such an investment complements other sources of school bus funding for clean-up, while also supporting the transformation of the school bus fleet to zero-emission technologies.

No changes to project criteria are proposed. The project would continue to be implemented using the same criteria as for FY 2016-17. The possibility of adding conversions of conventional-fuel school buses to zero-emission school buses as part of

the FY 2017-18 project was discussed at work group meetings, based on stakeholder input. The project targets replacement of the oldest school buses first. Because these older school buses do not meet the same safety standards as new buses, and have less than half of their useful life remaining, staff determined that conversions will not be included as an eligible project for this funding cycle.

The intention is to continue prioritizing funding to school buses used in small and medium air districts because those air districts have less access to DMV fees and other funding sources. However, school buses located in large air districts will continue to be eligible to receive funding if projects if small and medium air districts do not utilize all of the funding. Project eligibility is described below:

- The old school bus being replaced or designated as a back-up bus must be at least 20 years old. This ensures that the program targets the oldest, dirtiest school buses for clean-up, consistent with staff's recommended priorities to the Board.

- Fuel cell and battery electric zero-emission school buses or plug-in hybrid school buses, including funding for associated vehicle charging/fueling equipment, are eligible replacement expenses. Applicants applying for zero-emission school buses may receive funding for up to three school buses.

- School buses with internal combustion engines or hybrid school buses operating on renewable fuels, including renewable diesel, renewable natural gas, and renewable propane, are also eligible replacement expenses. Funding will also be available for the additional costs associated with renewable fuels. Applicants applying for school buses with internal combustion engines operating on renewable fuel may receive funding for one school bus in the first round of funding.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits*: Rural school bus funding is prioritized first to applicants in small air districts, then medium air districts, and then large air districts. Staff is not proposing a minimum disadvantaged community investment target for these funds because rural areas in small air districts infrequently meet the definition of disadvantaged communities, despite their lack of access to school bus replacement funds. The priority air districts do contain a large number of low-income communities, so staff expects a significant portion of this funding may be spent in low-income communities. As part of the Cap-and-Trade auction proceeds reporting requirements, CARB will track where funds are spent, so it can calculate and report the portion that meet AB 1550 investment criteria.

*Project Solicitation*: Staff proposes to continue implementing this project for the FY 2017-18 allocation through a small local air district as the project administrator, in consultation with North Coast Unified AQMD and CAPCOA.

## OUTCOMES

This project encourages the turnover of the California school bus fleet to lower carbon transportation choices. The FY 2016-17 allocation is funding approximately 13 new zero-emission, battery-electric school buses with the remainder funding approximately 16 internal-combustion school buses committed to using only renewable fuels. Based on the success of the current program, the proposed $10 million allocation for FY 2017-18 would again fund approximately 30 to 60 new school buses. Depending on the technology and school bus size purchased, an estimated 8,200 metric tons of CO2 equivalent GHG emission reductions could be obtained. The allocation is also estimated to provide 100 tons of NOx, 1.1 tons of PM 2.5, and 1.4 tons of ROG emission reductions. Appendix A provides additional details on the emission estimates. Criteria pollutant and toxic air contaminant emission reductions are also expected as the advanced-technology school buses replace conventionally-fueled engines. Metrics such as data on zero-emission miles, technology type, and renewable fuel use will be used to assess the success of these incentives.

Based on the response to the FY 2016-17 solicitation, staff anticipates that participation of school districts in disadvantaged and low-income communities of the state will most likely be the same if not higher for the FY 2017-18 solicitation.

With approximately 21,000 diesel-fueled or gasoline-fueled school buses operating throughout California, this project provides opportunities to transform California's school bus fleet and meet zero-emission vehicle deployment goals along with near-term and long-term air quality goals. Additional funding will be needed to continue this work as staff expects demand for advanced technology school buses to continue for several years.

# One-Stop-Shop for CARB's Equity ZEV Replacement Incentives

| Proposed Allocation from Volkswagen Settlement – $5 million |
|---|

## PROJECT OVERVIEW

Staff proposes allocating $5 million to support a new project to develop a single application tool for consumers to access incentive projects such as EFMP Plus-up, CVRP, and Financing Assistance for Lower-Income Consumers. It would also coordinate outreach across all these projects to support ZEV adoption in disadvantaged communities, low-income communities, and low-income households.

During the public process for Funding Plan development public and through CARB's SB 350 study, staff received input that these equity projects would benefit from a single application process for determining eligibility with supporting outreach on equity-focused incentives to make it easier to access funding. Currently, the requirements for income eligibility are mostly aligned among these projects. However, the One-Stop-Shop is a necessary tool especially for the EFMP Plus-up program to increase ZEV and PEV adoption. It would reduce confusion about available incentives and allow consumers to pre-qualify or apply for these incentives without the need to seek out and complete multiple applications. This would directly implement a recommendation from CARB's SB 350 study to increase community outreach, simplify the process to apply for incentives, and offer a One-Stop-Shop for consumers.

In the AB 97 Budget Act of 2017, the Legislature specified that, to the extent allowed under the consent decree, CARB shall expend a portion of the $25 million Volkswagen settlement funding to assist the expansion of EFMP Plus-up, including, but not limited to:

> "Development of a tool to improve program administration efficiency, including verifying participant and vehicle eligibility for the EFMP Plus-up Pilot Project and potentially other incentive programs."

The Legislature further specified that:

> "The State Air Resources Board may expend a portion of these funds to increase community outreach efforts and program participation."

## STAFF PROPOSAL FOR FY 2017-18

The proposed One-Stop-Shop for CARB's Equity ZEV Replacement Incentive Projects would include two elements: development of a web-based application tool and a coordinated community-based outreach effort to increase program participation. These

two elements would collectively address the Legislature's direction on the how these Volkswagen settlement funds should be used.

Development of a web-based application/tool: Staff envisions a web-based application with support for phone and mail applications that pre-qualifies consumers based on income eligibility and other specific project requirements. The system would inform consumers about the technology and incentive options available and seamlessly connect them with all relevant incentives in a simple, clear manner. This is intended to increase program efficiency and make it easier for consumers to stack incentives consistent with the Legislature's direction in AB 97.

Coordinated community outreach to increase program participation: This would complement, but not duplicate, the efforts already underway through existing projects to ensure potential low-income participants are aware of the One-Stop-Shop and how to access these CARB incentives. Close coordination with the air districts and grantees implementing EFMP Plus-up, financing assistance programs, and CVRP will be key in designing the outreach component. This is intended to increase community outreach efforts and program participation including:

- A consumer awareness and education strategy to inform consumers about available CARB incentives and direct them to the One-Stop-Shop to pre-qualify, including supporting multilingual educational materials.

- On the ground support by the grantee or sub-grantees to help consumers through the application process. Staff believes that strategically collaborating with community-based organizations via sub-grants at the local level would be an efficient way to conduct this outreach. Multiple year funding for on-the-ground outreach is key for increasing participation in these programs, and CARB will place a high priority on applications with strong outreach plans and well-crafted strategies for on the ground outreach in disadvantaged communities.

This project would support ZEV vehicle replacements in California. Hence, staff proposes the Volkswagen Settlement funds as the funding source. Because the Volkswagen settlement is one-time funding, staff proposes $5 million to develop and support the One-Stop-Shop over multiple years. Staff envisions ongoing operations and associated low-income consumer outreach would come from a portion of each of the Low Carbon Transportation grants served by the One-Stop-Shop in future budget cycles.

CARB would focus this funding initially on developing and maintaining a One-Stop-Shop for EFMP Plus-up and CARB's other equity ZEV incentives, with a goal to eventually include other clean energy, transportation, and housing incentives. Staff notes that the Energy Commission, the Public Utilities Commission, and the Strategic Growth Council are embarking on similar one-stop-shop concepts for clean energy and transportation community incentives. CARB will work closely with these entities to ensure these efforts are coordinated, and CARB would require that the grantee selected to develop

and administer this project do so with an eye toward integrating with these efforts to the extent feasible.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits*: The AB 1550 minimum investment requirements apply to Cap-and-Trade auction proceeds funding only. Because this project would be funded with Volkswagen settlement funds, it cannot count toward meeting AB 1550 investment targets. However, this funding is intended to make it easier for low-income households and disadvantaged communities to access Low Carbon Transportation funding and thus supports AB 1550 goals of increasing investments in disadvantaged communities, low-income communities, and low-income households. In addition, development of one-stop-shops is one of the recommendations in CARB's SB 350 Guidance Document.

*Project Solicitation*: Staff proposes to award funding for this grant via a competitive three-year solicitation to select one grantee to develop and implement the One-Stop-Shop. While the solicitation would encompass up to three fiscal years, the grant agreement would initially cover one fiscal year with the option to renew with each of the following two fiscal years. Staff anticipates having a grant in place early 2018. As noted above, CARB will place a high priority on applications with strong outreach plans and a well-crafted strategy. This includes, but is not limited to, on the ground outreach with a focus in disadvantaged communities and close coordination with the grantees already administering EFMP Plus-up, financing assistance programs, and CVRP equity-focused clean transportation incentives and community-based groups.

## OUTCOMES

This project would be designed to enable more efficient implementation of CARB's EFMP Plus-up and equity ZEV incentives and expand participation in these projects by low-income households. Because this is an "enabling" project, CARB staff is not quantifying any direct emission reductions for this funding. Rather, this project would help achieve the emission reductions anticipated for EFMP Plus-up and CVRP, quantified in those sections of the Funding Plan. However, it is still important to measure the success of this project. CARB will report in Annual Reports and future Funding Plans the outcomes of this project. Staff proposes to use metrics such as number of consumers accessing the One-Stop-Shop and the number ultimately qualified through this process as a measure of its success. CARB would also encourage or perhaps require the grantee to develop surveys of participants as a way to determine how well the project is working and determine whether refinements are needed.

# CHAPTER 4: HEAVY-DUTY VEHICLE AND OFF-ROAD EQUIPMENT INVESTMENTS

Achieving California's climate and clean air goals will require an ongoing transformation of the transportation sector – in both the light-duty and heavy-duty vocations – to the use of zero-emission technologies wherever feasible and near zero-emission technologies with the cleanest, lowest carbon fuels everywhere else. This transformation will utilize advanced technologies and fuels, while supporting progress towards creating the jobs of the future and achieving and maintaining healthy and sustainable communities for all Californians.

Programs such as the Carl Moyer Program, the Proposition 1B Goods Movement Emission Reduction Program, and the AQIP-funded Truck Loan Assistance Program achieve near-term emission reductions through incentivizing fleet turnover. These programs complement Low Carbon Transportation and other AQIP projects that intend to support the transition to advanced technologies for long-term emission reductions. Low Carbon Transportation and AQIP investments have traditionally funded multiple technologies at different points on their commercialization arcs in order to support technologies that are providing emission reductions today, as well as the technologies that need to mature to meet future goals. These longer-term program benefits accrue primarily from overcoming deployment barriers, reducing production costs, promoting consumer acceptance, and accelerating technology transfer to other sectors.

The transition toward cleaner, more efficient heavy-duty vehicles and off-road equipment will also require a substantial financial commitment from the public sector. The relatively low price of diesel fuel, current lack of high volume advanced technology manufacturing, and resulting large price differential are all obstacles to making this happen. The financial commitments made thus far have had a positive impact, moving towards achieving lifecycle cost parity between conventional and advanced technology. For example, investments in the light-duty sector have led to cost reductions in battery technologies. This reduction in cost enabled the technology to move into the transit sector. We are now starting to see a reduction in the cost of these battery technologies on the heavy-duty side as well. However, short-term, inconsistent, or otherwise limited funding will not be sufficient to change technology availability, costs, and purchase decisions over the long-term.

In Part II of this document, titled "Three-Year Investment Strategy for Heavy-Duty Vehicles and Off-Road Equipment from Low Carbon Transportation and the Air Quality Improvement Program" (Three-Year Heavy-Duty Strategy), staff is providing a three-year strategy for heavy-duty vehicle and off-road equipment incentives. The Three-Year Heavy-Duty Strategy builds on CARB's Low Carbon Transportation and AQIP portfolio approach as described above. The plan also applies the concept of beachheads to prioritize funding around those technologies and applications that have strong potential to transfer and spread to broader applications. These are essentially

technology footholds that can be built upon much like a foundation, enabling further expansion into follow-on applications.

In developing the recommendations for areas to potentially focus Low Carbon Transportation and AQIP funding, staff considered the technology status assessments[6] developed by CARB, additional research when available, recent market trends, previous investments, and conversations with industry. Staff identified the required level of activity to move pathway technologies forward toward 2030 goals over the three-year funding period (FY 2018-19, 2019-20, and 2020-21). The assessment is based on the strategies identified, the segment opportunities identified in the beachhead assessments and the technology status snap shots. It should be noted that Three-Year Heavy-Duty Strategy and the funding it recommends is specific to continuing the technology transfer demonstrated through targeted Low Carbon Transportation and AQIP investments. There is enormous need for investment in the heavy-duty and off-road advanced technology arena and Low Carbon Transportation and AQIP investments is just a small part of the down payment needed to reach our long-term goals. The investments for Fiscal Year 2017-18 will have a positive impact on moving the State's heavy-duty and off-road fleets to advanced technologies, particularly when it comes to demonstrating and piloting critical components needed in the freight sector. However, it should be noted that to remain on this trajectory, investments from these programs need to include not just freight-focused projects, but also projects that support the transition to zero-emission equipment everywhere feasible, and near zero-emission equipment powered by clean, low-carbon renewable fuels everywhere else – as is highlighted in the Three-Year Heavy-Duty Strategy.

## POLICY AND STATUTORY DRIVERS

The State has adopted a number of climate change and air quality goals, which this plan supports. Key elements of these plans are described below.

- Governor Brown's climate change strategy pillars include a 50 percent reduction in petroleum use in vehicles by 2030 and reducing short-lived climate pollutants.

- The *State Implementation Plan* and *Mobile Source Strategy* highlight the need for early investments in incentives that accelerate deployment of zero- and near zero-emission technologies in the heavy-duty sector.

- The *California Sustainable Freight Action Plan* notes that freight will need to be moved more efficiently and with zero- or near zero–emission technologies wherever possible.

- Governor Brown's Executive Order B-16-2012 directs the deployment of 1.5 million zero-emission vehicles by 2025.

[6] California Air Resources Board, *Technology and Fuels Assessment Reports*, 2015-2016. https://www.arb.ca.gov/msprog/tech/report.htm

- The *Climate Change Scoping Plan* identifies a need to include an increasing focus on cleaner medium- and heavy-duty vehicles and equipment.

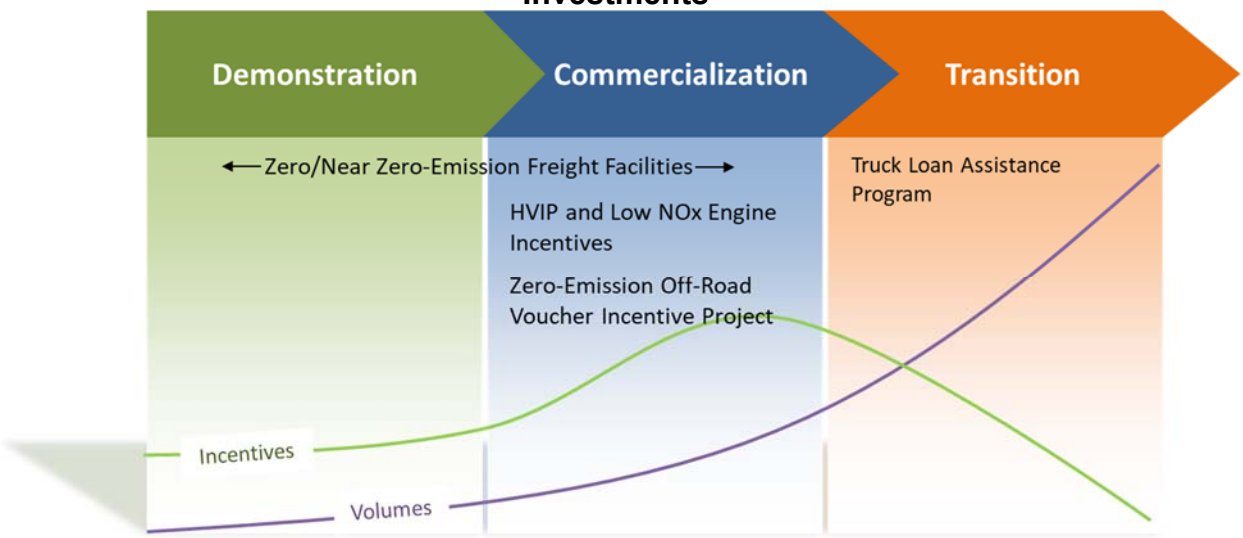
- The State's *Short-Lived Climate Pollutant Reduction Strategy* calls for the transformation to near zero- and zero-emission technologies and cleaner renewable fuels.

- Even though the new AB 617 effort is separate and distinct from this Funding Plan, many of the proposed investments in this Funding Plan will help make progress toward the community emission reduction goals of AB 617 because of their disadvantaged community focus.

- SB 350 directs CARB to study the barriers for low-income Californians to access clean transportation and recommend actions for overcoming those barriers. The investments in this proposed Funding Plan implement recommendations from the draft SB 350 Guidance Document.

In 2014, SB 1204 created the California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology Program, which utilizes California Climate Investment funds for the development, demonstration, pre-commercial pilot, and early commercial deployment of zero- and near zero-emission truck, bus, and off-road vehicle and equipment technologies. SB 1204 also prioritizes certain types of heavy-duty projects, including those that provide a benefit to disadvantaged communities. The proposed heavy-duty vehicle and off-road equipment projects for FY 2017-18 support SB 1204's overarching vision for the phases of technology development and deployment, with a focus on moving technologies through the commercialization process, as illustrated in Figure I-4.

**Figure I-4: Proposed FY 2017-18 Heavy-Duty Vehicle and Off-Road Equipment Investments**



- The new Zero- and Near Zero-Emission Freight Facilities Project is designed to support technologies moving all the way through the commercialization process, beginning with the demonstration and development of emission reducing technologies which provide greater confidence to fleets and investors that these pre-commercial technologies are ready to enter the pilot stage of commercialization. It will also include the collection of data and analysis of technology ability at each stage. Staff is proposing that 100 percent of the Freight Facilities Project investments be located in disadvantaged communities.

- For pilot projects, zero-emission technology is ready for deployment in some sectors, and considerable investments now will not only encourage the production and purchases necessary to achieve full commercialization, but will enable technology transfer into other vehicle weight classes and vocations. Significant investment at this stage allows larger volume purchases to drive down the price and move technology to a voucher program where fleets can begin to purchase at lower cost. The Freight Facilities Project will continue to support technologies as they move through the pilot stage, as will the Zero-Emission Off-Road Freight Voucher Incentive Project and the HVIP and Low NOx Engine Incentives.

- The additional funding proposed for CARB's ongoing HVIP and Low NOx Engine Incentives for FY 2017-18, as well as the new Zero-Emission Off-Road Freight Voucher Incentive Project will help increase production volumes, reducing technology costs further, and enhance the process toward full commercialization.

As a technology moves from commercialization into the transition phase, incentives can be targeted to focus specifically on moving the technology into expanded or new markets and on building upon earlier benefits in disadvantaged communities (as well as supporting other technology sectors). While funding for this later phase of a technology's evolution is not a focus of SB 1204, the AQIP-funded Truck Loan Assistance Program and the Carl Moyer Program are examples of this type of incentive, providing assistance to help small fleets access financing to upgrade their trucks in order to meet regulatory requirements.

As required by SB 1204, the proposed heavy-duty project allocations ensure that at least 20 percent of Low Carbon Transportation truck funding supports early commercial deployment of existing zero- and near zero-emission heavy-duty truck technology. The HVIP and Low NOx Engine Incentives discussed later in this chapter will fund both heavy-duty trucks and buses, but staff estimates at least 30 percent of the $180 million proposed Low Carbon Transportation allocation for both projects will fund trucks (based on 2016-17 voucher requests). Since all of the vehicles funded through these projects are early commercial technologies, 100 percent of the truck funding would meet the SB 1204 requirement.

The focus for this year's heavy-duty vehicle and off-road equipment investments will be on freight facilities and disadvantaged communities. Many disadvantaged communities

and low income communities are disproportionately impacted by the operations of heavy-duty freight vehicles and equipment, and the residents of these communities often rely on heavy-duty vehicles such as transit buses and school buses for their everyday transportation needs. The proposed Zero- and Near Zero-Emission Freight Facilities Project, the Zero-Emission Off-Road Freight Voucher Project, and the Clean Truck and Bus Vouchers will work together to demonstrate and deploy a wide variety of advanced technology heavy-duty vehicles and off-road equipment – many of which will be operating at freight facilities and/or in disadvantaged communities. The voucher programs will operate on a first-come, first served basis and support a wide variety of private and public fleets who are ready to include commercially available zero-emission and near zero-emission technologies. The freight facilities project will be administered through a competitive process and will provide support to freight facilities (including some funding specifically for warehouses or distribution centers) that are ready to begin a holistic and complete transition to near zero- or zero-emission technologies, thus bringing the cleanest available vehicles and equipment to some of the most impacted areas of the State. Further details of these three projects, and of the Truck Loan project are included in this chapter. A summary of these projects and their respective funding allocations from the Low Carbon Transportation, AQIP, and Zero- and Near Zero-Emission Warehouse Program funding sources is shown in Table I-10.

**Table I-10: Summary of Proposed Heavy-Duty Vehicle and Off-Road Equipment Project Allocations**

| **Project Category** | **Project Allocation by Funding Source** (millions) | | | |
|---|---|---|---|---|
| | Low Carbon Transportation | AQIP | Zero/ Near Zero Emission Warehouse Program | Total |
| Advanced Freight Equipment Demonstration and Deployment | $140 | | $50 | $190 |
| Zero- and Near Zero-Emission Freight Facilities[3] *(new)* | $100 | | $50[3] | $150 |
| Zero-Emission Off-Road Freight Voucher Incentive Project *(new)* | $40 | | | $40 |
| Clean Truck and Bus Vouchers (HVIP + Low NOx Engines) | $180 | $8 | | $188 |
| Truck Loan Assistance Program | | $20 | | $20 |
| **Heavy-Duty Vehicle and Off-Road Equipment Investment Total** | **$320** | **$28** | **$50** | **$398** |

# Zero- and Near Zero-Emission Freight Facilities Project

Proposed Low Carbon Transportation Allocation – $100 million for Zero- and Near Zero-Emission Freight Facilities

Trade Corridor Enhancement Account Allocation – $50 million for Zero- and Near Zero-Emission Warehouse Program

## PROJECT OVERVIEW

The Zero- and Near Zero-Emission Freight Facilities Project (Freight Facilities Project) is a new, multi-faceted project that is designed to holistically reduce GHG and criteria pollutant emissions in freight facilities and to help achieve additional benefits, such as providing economic, environmental, and public health benefits to disadvantaged communities and/or low-income communities. Built from and expanding upon concepts in CARB's previous multisource demonstration project and the statutory requirements outlined in SB 132, the goal of this new project is to support bold, transformative emission reduction strategies that can be emulated throughout freight facilities statewide. As identified in SB 132, staff will focus $50 million directly on zero- and near zero-emission warehouses.

The project will fund a variety of technologies and strategies designed to:

- Provide direct GHG, criteria, and toxic pollutant emission reductions from freight facilities.
- Synergistically demonstrate the practicality and economic viability of deploying system and energy efficiencies alongside multiple zero- and near zero-emission vehicles and equipment along with necessary infrastructure.
- Demonstrate the potential for widespread commercial acceptance of the various types of zero- and near zero-emission vehicles and equipment used in freight facilities and associated on-road freight applications.
- Accelerate commercialization of zero- and near zero-emission goods movement technologies.

Freight facilities are excellent places to demonstrate and deploy a variety of zero- and near zero-emission heavy-duty vehicles and off-road equipment, as well as system efficiencies. This is partially because freight facilities utilize a wide variety of on-road vehicles and off-road equipment that can take advantage of a universal fueling or charging infrastructure. These types of facilities typically have limited or no public access, making it easier to demonstrate new types of equipment. Also, by nature of the work that takes place at these facilities, they are fertile testing grounds for improved logistics techniques and system efficiency improvements. As noted in Part II of this

document, it is common for technologies to begin in applications where the fleet is captive (such as school or transit buses) or where there is limited or no public access (such as freight facilities, construction sites, and agricultural fields).

The AB 134 budget bill includes up to $140 million to be used for the "Freight Equipment Advanced Demonstration and Pilot Commercial Deployment Project" from the Greenhouse Gas Reduction Fund. Staff is proposing this allocation be used to support both the Zero-Emission Off-Road Freight Voucher Incentive Project and this Freight Facilities Project. In addition to the Cap and Trade appropriation, the 2016 Budget Act, as amended by SB 132, included a one-time $50 million appropriation for the development of a competitive funding program that advances implementation of zero-and near zero-emission warehouses and technologies. Statute requires a one-to-one match, and CARB will develop implementation criteria via the AQIP process. Funding for this project comes from the Trade Corridor Enhancement Account, which was established through the passage of the Road Repair and Accountability Act of 2017 (SB 1).

This project supports the continued implementation of the *California Sustainable Freight Action Plan's* Vision for a Sustainable Freight Transport System – one that is characterized by transporting freight reliably and efficiently by zero-emission equipment everywhere feasible, and near zero-emission equipment powered by clean, low-carbon renewable fuels everywhere else. It also supports the Plan's goal of deploying over 100,000 freight vehicles and equipment capable of zero emission operation and maximize near-zero emission freight vehicles and equipment powered by renewable energy by 2030.

## STAFF PROPOSAL FOR FY 2017-18

The intent of the overall project is to facilitate the transition of freight facilities to zero- or near zero-emission, which can then be emulated by other facilities. This provides a unique opportunity for freight facilities who are committed to a zero-emission future to take the steps necessary to achieve their goals. Staff anticipates that the projects funded under this category will be large and encompass a variety of advanced heavy-duty vehicles and off-road equipment, infrastructure, and system and energy efficiency improvements in potentially various stages of commercialization.

For purposes of this project, freight facilities include, but are not limited to: warehouses, distribution centers, ports, freight airports, and railyards. Defining facilities that are eligible to participate will be refined through the workgroup process prior to the release of a competitive solicitation. Because SB 132 directly allocated $50M towards near zero- and zero-emission warehouses and technologies, staff is proposing that at least $50M of this project allocation is spent supporting warehouses.

Elements of an eligible project application could include, but are not limited to:

- A wide variety of heavy-duty on-road vehicles and off-road equipment. These vehicles and equipment can be ready for demonstration, deployment at the pilot level, or commercially available. Types of vehicles and equipment that could be eligible include:

    - On-road vehicles and off-road equipment that enter and exit the facility, including, but not limited to: Zero-emission capable yard trucks, on-road delivery trucks, transport refrigeration units, drayage trucks, and locomotives. Technology options include battery electric, fuel cell electric, and hybrid technologies used in trucks that operate as zero-emission at all times, or are able to operate in zero-emission only mode. In areas where zero-emission technology is not available, hybridization and low NOx engines may be included.

    - Off-road equipment that works on-site, including, but not limited to: zero-emission capable switch locomotives, zero-emission cargo handling equipment, zero-emission rubber tired gantry cranes, zero-emission yard trucks, zero-emission ground support equipment, zero-emission capable tugboats, zero-emission forklifts, etc. (with the exception of fully automated cargo handling equipment as noted in statute). Technology options include battery electric, fuel cell electric, and hybrid technologies that are able to operate in zero-emission only mode. In areas where zero-emission technology is not available, hybridization and low NOx engines may be included.

- Technologies that support ships at berth, including shore power and bonnet systems.

- Fueling infrastructure to support project vehicles and equipment, including, but not limited to, hydrogen fueling infrastructure and charging infrastructure.

- Renewable power generation and energy storage systems to support vehicle and equipment fuel generation and warehouse operations, and manage energy demand.

- System efficiency upgrades, including process improvements such as preferential queuing and operational strategies.

- Education and outreach components that highlight measureable environmental and economic benefits of a zero-emission warehouse transformation.

In addition, the Zero- and Near Zero-Emission Facilities Project category would also fund other project elements that are compatible with the intent of this project. These may need to be funded with matching funds and could include, but are not limited to:

- Energy efficiency upgrades to heating, cooling and ventilation systems, lighting, cold storage facilities, etc.
- Grid improvements necessary to support the increased use of electricity.
- Facility improvements to support infrastructure, system efficiency, and energy efficiency upgrades.
- Workforce training and development.
- Employee mobility enhancements that reduce GHG and criteria pollutant emissions through ride sharing, bike sharing, vanpools or shuttle services, and charging stations for electric vehicles.

Details on eligible components for the projects and acceptable match will be further refined during the workgroup process, prior to the release of a competitive solicitation.

*Cost Sharing Requirements*: SB 132 requires a minimum cost share of 50 percent from the grantee, project partners, and/or other private or public (non-state) entities in recognition of the importance of establishing strong private investment to ensure successful projects. Because staff is recommending combining both allocations, they recommend for the entire project category to be subject to the one-to-one match requirement.

*Project Data Collection:* Staff will identify metrics to understand the effectiveness of the program and ensure the project proposals are structured to enable data collection. Information gathered will focus on factors such as technology cost, consumer acceptance, emission reductions, infrastructure investment, and any additional metrics stemming from discussions with stakeholders. In addition, staff hopes to collect activity and duty cycle data to better understand the capabilities and limitations of zero-emission technology in different applications.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits*: Staff proposes that all project funding be spent in disadvantaged communities. This would apply to both the $100 million Low Carbon Transportation funds for freight facilities as well as the $50 million in Trade Corridor Enhancement Account funds for warehouses. Meeting the AB 1550 disadvantaged community, low-income community, and low-income household investment targets is not a requirement for the $50 million in Trade Corridor Enhancement Account funding. However, because warehouse operations and freight corridors tend to be in disadvantaged communities or communities disproportionately impacted by poor air quality, staff recommend that the competitive process be structured to require that projects be located in these areas.

*Incentive Caps:* Staff is proposing the inclusion of incentive caps. This concept would likely include a regional cap and a facility type cap, but it could also include other types of caps. The purpose of the two suggested caps would be to ensure that there is both a diversity in the types of facilities and in the locations where this incentive funding is distributed. Staff will be developing the mechanism for implementing the incentive caps through a subsequent work group process.

*Project Solicitation*: CARB will develop a competitive process that clearly identifies eligible types of projects, vehicles and equipment, along with funding caps determined through the workgroup process. Eligible grantees are public agencies, such as air districts, cities and counties, and non-profit organizations with relevant experience. The competitive process will identify important required elements of any project application. In addition to CARB's traditional competitive solicitation method, other competitive models may be considered as well. Final determination of the project structure and mechanism will be developed during the public work group process for this project after Board approval of the Proposed FY 2017-18 Funding Plan.

**OUTCOMES**

The funding allocation for zero- and near-zero emission freight facilities could fund a large number of vehicles and materials handling equipment, supporting fueling infrastructure, and facility improvements. Therefore, staff cannot estimate the exact emission benefits until projects are selected and implemented. However, staff provides an example of the magnitude of anticipated benefits by quantifying the emission reductions based on one of many possible scenarios. Staff estimates the project could provide an estimated 180,000 tons of CO2e emission reductions and 310 tons of NOx, 9.7 tons of PM 2.5, and 180 tons of ROG emission reductions, based on the assumptions provided in Appendix A.

Staff envision the large flagship projects funded through this category to act as models for other freight facilities interested in reaching near-zero and zero-emission. This type of model – combining vehicles and equipment across the entire commercialization arc and pairing those with infrastructure, system, and energy efficiency upgrades – can be applied to a much wider array of facilities, including schools, passenger transportation hubs, industrial facilities, and others. With carefully crafted details, these projects can support the concepts discussed in Part II of this document, including: building on successful beachheads by supporting early commercial technologies; seeding promising next markets by including technologies in the pilot phase, and maintaining the innovation pipeline by including technologies that are in the demonstration phase. As staff develop this concept, lessons learned from this project category can be used to build similar project categories for other types of facilities.

# Zero-Emission Off-Road Freight Voucher Incentive Project

Proposed Low Carbon Transportation Allocation – $40 million

## PROJECT OVERVIEW

The Zero-Emission Off-Road Freight Voucher Incentive Project (Off-Road Freight Voucher Project) is a new project analogous to HVIP, but for off-road freight equipment. Like HVIP, it is targeted toward commercialized products and is designed to accelerate deployment of cleaner technologies by providing a streamlined way for fleets ready to purchase specific zero-emission equipment to receive funding to offset the higher cost of such technologies.

The AB 134 budget bill includes up to $140 million to be used for the "Freight Equipment Advanced Demonstration and Pilot Commercial Deployment Project" from the Greenhouse Gas Reduction Fund. Staff is proposing to use $40 million of this allocation to support the Off-Road Freight Voucher Project.

Some zero-emission off-road applications are already being deployed, and their main barrier to more widespread adoption is that production volumes are too low for the equipment to be cost competitive. Staff believes that serving these applications with an off-road freight voucher incentive project would help to bring about greater adoption of cleaner, commercially available off-road technologies throughout California, particularly in areas such as ports, railyards, airports, and warehouses, that are most impacted by emissions from off-road freight equipment.

This project complements the Clean Truck and Bus Vouchers and the Zero- and Near Zero-Emission Freight Facilities Project, which would demonstrate and deploy a wide variety of advanced technology heavy-duty vehicles and off-road equipment. This, as well as the Clean Truck and Bus voucher project, would operate on a first-come, first-served basis and support a wide variety of private and public fleets who are ready to purchase specific commercially available zero-emission and near zero-emission products.

## STAFF PROPOSAL FOR FY 2017-18

Staff proposes that $40 million be allocated to the Off-Road Freight Voucher Project. This proposed amount is based on discussions with stakeholders regarding the incremental cost and potential market uptake of zero-emission freight equipment. Because this project is new and predicting demand is difficult, staff proposes additional flexibility to make adjustments to funding amounts of eligible equipment categories by +/-25 percent of incremental cost and to other voucher criteria. These changes would be vetted through a public process and approved by the Executive Officer. Staff also proposes that as additional zero-emission off-road freight equipment becomes

available, the equipment could be added to the voucher project through the same process as mentioned above.

*Proposed Project Structure*: The structure for voucher disbursement would be similar to what is used for HVIP voucher transactions. The Off-Road Freight Voucher Project would provide a dealer of an eligible piece of zero-emission off-road freight equipment with a voucher for the incentive amount, redeemable at the time of the equipment delivery. The Off-Road Freight Voucher Project website would include a list of eligible equipment models, as well as the eligible voucher amount for each vehicle. The webpage would include a voucher request form for the dealer (in concert with the purchaser) to submit at the time a specific piece of equipment is ordered, with the voucher to be redeemable at the time the equipment is delivered.

*Proposed Equipment Incentive Amounts:* Table I-11 summarizes the preliminary eligible equipment types and funding amounts. In order to determine the voucher amounts for off-road terminal trucks with a GVWR less than 80,001 lbs., staff proposes to align the funding amounts with the amounts provided under HVIP for on-road terminal trucks of $95,000 outside of a disadvantaged community (DAC) and $110,000 in a DAC. This is because off-road and on-road terminal trucks have nearly identical build and performance requirements, with the exception that on-road terminal trucks need to be certified for on-road use.

For indoor worksites, battery-powered forklifts are already well-commercialized and are more prevalent than internal combustion technologies. However, certain innovative zero-emission technologies, such as fast-charge capable equipment and fuel cells, are available and while more expensive, may provide an advantage to fleets converting to them. Staff is considering providing funding for innovative forklift technologies. Funding amounts and eligible forklift technology types would be determined through public workgroup meetings.

For the other equipment types covered by the Off-Road Freight Voucher Project, variations in weight class, performance specifications, and commercialization status result in substantial differences in incremental cost. Because the types of equipment may have specialized performance requirements or are in the early stages of commercialization where development and production costs are rapidly changing, staff believes funding a specific dollar limit would not allow enough flexibility to allocate appropriate voucher amounts for the range of equipment types. Instead, staff recommends using the incremental cost of each equipment model as a starting point, then taking into account factors such as the technology status and demand for the equipment to determine appropriate incentives amounts. The incremental cost would be calculated by taking the difference in cost between the new piece of zero-emission equipment and the comparable new conventionally-fueled vehicle that could be purchased to perform the same function. This cost is determined on an equipment-specific basis based upon a manufacturer's voucher eligibility application submittal, voucher redemption data, discussions with fleets and other stakeholders, and other relevant data and information. Also, staff proposes to cap the voucher amount per

eligible piece of equipment at $500,000. Staff envisions that as the program evolves, more types of equipment will become eligible for the Off-Road Freight Voucher Project.

**Table I-11: Proposed Eligible Types of Equipment and Funding Caps**

| Equipment Type | Specifications | Preliminary Voucher Amounts[1,2,3,4] |
|---|---|---|
| Off-Road Terminal Trucks | GVWR ≤ 80,000 lbs. | Aligned with HVIP Funding for On-Road Terminal Trucks |
| | GVWR > 80,000 lbs. | Incremental Cost (Plus 10% in DAC) |
| Forklifts[5,6] | | |
| Side Handlers/Reach Stackers/Top Picks | | |
| Transport Refrigeration Units | | |
| Ground Support Equipment | | |
| Rubber-Tired Gantry Cranes | | |

[1] The proposed maximum voucher amount per piece of equipment is $500,000
[2] The voucher amounts in this table will be finalized via a public process
[3] DAC = disadvantaged community
[4] Additional voucher enhancements may be granted for eligible technology-support costs
[5] Forklifts vouchers would be for innovative technologies only (quick-charge, fuel cell, etc.)
[6] Class 3 trucks, as defined by the Industrial Truck Association, would not be eligible.

Based on discussions with stakeholders, many fleets are composed of leased equipment. Staff proposes incorporating provisions similar to HVIP to address rental or lease agreements (i.e., voucher applicability for rental or lease agencies and fleets that rent or lease equipment for at least a three-year term, voucher disclosure requirements, commitments to operate voucher-funded vehicles in California, and reporting requirements). Fleets applying for vouchers would be allowed to apply to multiple funding sources.

*Voucher Enhancements*: Voucher enhancements are designed to provide additional funding to help overcome barriers to adoption and may increase the voucher amounts beyond the incremental cost of the zero-emission equipment. The funding amounts for voucher enhancements have not yet been determined but will be discussed further through public workgroup meetings. Staff is considering voucher enhancements to be granted for bulk deployments and for technology-support costs.

- Voucher Enhancement for Bulk Deployments: In order to encourage a greater commitment to zero-emission technology from fleets utilizing this program, staff proposes to provide additional funding to fleets that purchase (through this program) five or more pieces of a single model of zero-emission equipment for use at a single worksite. Fleets investing heavily in one type of zero-emission equipment are assuming a greater risk and may need to make greater adjustments in workflow as they turn over large portions of their fleets.

- Voucher Enhancement for Technology-Support Costs: Because many of the eligible equipment types in the Off-Road Freight Voucher Project have only been deployed at very low volumes, fleets will likely require additional financial support in their transition to zero-emission technology to help cover costs beyond the equipment purchase, such as those for workforce training, infrastructure, etc. Actual voucher enhancement amounts will be determined through a public process and may be fixed enhancements added to a voucher amount dependent on factors such as equipment type. Furthermore, HVIP offers voucher enhancements for technology that is newer to the market, such as fuel cell vehicles and fast charging, and staff is proposing to offer the same enhancements in the Off-Road Freight Voucher Project.

*Project Data Collection:* Staff will identify metrics to understand the effectiveness of the program and ensure the project proposals are structured to enable data collection. Information gathered will focus on factors such as technology cost, consumer acceptance, emission reductions, infrastructure investment, and any additional metrics stemming from discussions with stakeholders. In addition, staff hopes to collect activity and duty cycle data to better understand the capabilities and limitations of zero-emission technology in different off-road equipment types.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits*: This proposed funding would be available statewide and implemented on a first-come, first-served basis, so it is not possible to determine exactly how much funding will be spent in and benefit disadvantaged communities, low-income communities, and low-income households. However, staff expects that much of this funding will be spent in and benefit these communities because many freight facilities are located in disadvantaged or low-income communities. Furthermore, staff is proposing higher voucher amounts for equipment used at facilities located in disadvantaged communities in order to encourage participation from fleets operating in those communities. For these reasons, staff expects a significant amount of this funding would meet one of these two AB 1550 criteria. As part of the Cap-and-Trade auction proceeds reporting requirements, CARB will track where funds are spent, so it can calculate and report the proportion of funding that meets the AB 1550 investment criteria.

*Project Solicitation*: A project administrator would be awarded this project via competitive grant solicitation. The Freight Voucher Project solicitation would be open to public agencies (including air districts, ports, cities, and counties) as well as non-profit organizations with relevant experience. The selected grantee would be responsible for implementing the Freight Voucher Project statewide, which could include processing applications for voucher requests, maintaining a project website, completing reporting requirements, and conducting project outreach, with outreach efforts focused on those air basins with the worst air quality. Staff proposes allowable costs for administration and outreach of this project be capped at five percent.

## OUTCOMES

Staff cannot accurately estimate the emission benefits of the Off-Road Freight Voucher Incentive Project until it is actually implemented. However, in order to provide a rough characterization of the potential benefits of this project, staff quantified the emission reductions associated with a “sample” project based on assumptions described in Appendix A. In this illustrative scenario, the Zero-Emission Off-Road Freight Voucher Incentive Project is expected to fund 300 pieces of equipment and would provide an estimated 120,000 metric tons of CO2e GHG emission reductions. Staff also estimates about 130 tons of NOx, 5.2 tons of PM 2.5, and 92 tons of ROG would be reduced as zero-emission technology equipment displaces conventionally fueled equipment. Appendix A provides additional details on the emission estimates.

Funding equipment through this category is expected to help drive wide-scale adoption of zero-emission off-road freight equipment and expansion of zero-emission infrastructure, which in turn will drive down costs and strengthen the supply chain to support a broader zero-emission market. This project supports building on successful beachhead technology applications, and staff anticipates that as the technology matures, it will begin to penetrate additional off-road applications.

# Clean Truck and Bus Vouchers (HVIP and Low NOx Engine Incentives)

Low Carbon Transportation Appropriation: $180 million
Proposed AQIP Allocation: $8 million

## PROJECT OVERVIEW

HVIP and Low NOx Engine Incentives are intended to encourage and accelerate the deployment of zero-emission trucks and buses, vehicles using engines that meet the optional low NOx standard, and hybrid trucks and buses in California. HVIP and Low NOx Engine Incentives use a streamlined process to provide vouchers to vehicle purchasers to reduce the upfront cost of these advanced technology vehicles. In many cases, HVIP funding can be combined with other funding sources to provide up to 100 percent of total vehicle cost. While Low NOx Engine Incentives and HVIP have their own specified allocation amounts, Low NOx Engine Incentives have been implemented through HVIP since the introduction of these incentives in FY 2015-16. In some instances, Low NOx Engine Incentive Funding may be combined with other funding sources as long as incremental cost of the low NOx technology is not funded by another source of funding.

HVIP provides vouchers of up to $95,000 for California purchasers and lessees of zero-emission trucks and buses, and up to $30,000 for eligible hybrid trucks and buses on a first-come, first-served basis. In addition, HVIP provides increased incentives for fleets located in disadvantaged communities. These fleets qualify for vouchers up to $110,000 for zero-emission trucks and buses. Trucks and buses that are outfitted with engines meeting the optional low NOx standard are eligible for up to a $25,000 voucher through Low NOx Engine Incentives on a first-come, first-served basis.

HVIP is part of a portfolio of funding opportunities to support the commercialization of clean trucks and buses. Each individual funding program has a unique goal and implementation process that reflects statutory direction, policy objectives, and public input. One of the key distinctions unique to HVIP is that fleets are not required to scrap an existing baseline vehicle. Scrappage is a cornerstone of other incentive programs such as the Carl Moyer Program and Proposition 1B, as well as upcoming funding available from the Volkswagen Environmental Mitigation Trust. Since scrapping is not required for HVIP or Low NOx Engine Incentives, voucher funding is usually less than funding from other incentive programs with scrap requirements. AB 617 provides a new opportunity to expand California's funding portfolio with an emphasis on improving air quality and reducing toxics exposure in communities. AB 134 includes an appropriation of $250 million for early actions to support AB 617, and achieve maximum public health and air quality benefits.

AB 134 provides up to $180 million for clean truck and bus vouchers and further directs that CARB consider forthcoming technological innovations in heavy-duty vehicles and

market demand for those vehicles that are expected to come to market during FY 2017-18. The increased budget, compared to past allocations, provides an opportunity for California to continue to invest in the deployment of clean heavy-duty technologies in new vehicle applications and fully meet market demand. For example, HVIP has been successful in bringing hybrid and zero-emission heavy-duty vehicle technologies to California. Building on the success of past HVIP investments, we are now seeing new manufacturers enter the market with technologies transferring to heavier weight classes, such as 60-foot transit buses and Class 8 trucks, that the project is now able to further support with additional funding. The increased allocation also provides an opportunity to help fund infrastructure, one of the greatest barriers for advanced technology vehicle deployment. For low NOx engines, the release of the 11.9-Liter Low NOx Cummins Westport Engine in FY 2017-18 will expand low NOx technology availability beyond transit buses and refuse trucks to Class 7 and Class 8 trucks. Recommended changes to funding amounts and other criteria are proposed later in this section.

As stated above, AB 134 provides up to $180 million for clean truck and bus vouchers. Of the $180 million allocation, $35 million must be set aside to fund zero-emission buses. The remaining balance is then $145 million, available on a first-come first-served basis for all eligible technologies, including low NOx engines, hybrid and zero-emission trucks and buses, and trucks with electric power take off systems (ePTO).

In FY 2016-17, the first low NOx engines entered the market. The 8.9-liter low NOx Cummins Westport natural gas engine is currently certified to the optional low NOx standard, and is eligible for Low NOx Engine Incentives. Staff anticipates that the demand for low NOx engines will continue to increase as the market matures and as new engines become available, such as the 11.9-liter low NOx Cummins Westport engine expected to be available in early 2018. Staff recommends an allocation of $8 million in AQIP funding for Low NOx Engine Incentives.

HVIP and Low NOx Engine Incentives support the statutory goals of SB 1204 and SB 350 recommendations by prioritizing funds for clean heavy-duty vehicles and engines. The proposed HVIP and Low NOx Engine Incentive funding will ensure that at least 20 percent of Low Carbon Transportation truck funding supports early commercial deployment of existing zero- and near zero-emission heavy-duty truck technology. These projects are intended to help accelerate the introduction of the next generation of cleaner heavy-duty vehicles and engines with priority given to projects that benefit disadvantaged communities.

To date, about two thirds of the HVIP funding awarded has benefited disadvantaged communities, as reported in the *Annual Report to the Legislature on California Climate Investments*, March 2017.[7] HVIP will continue to be implemented on a first-come, first-served, statewide basis. CARB staff uses historical data to estimate in advance how much of this funding might go to vehicles domiciled in disadvantaged communities.

[7] https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/cci_annual_report_2017.pdf

To ensure that HVIP continues to meet its goal of providing funding in disadvantaged communities, and to satisfy AB 1550 requirements, a set aside of HVIP funding might be needed. Throughout the project year, if data shows that HVIP is not meeting AB 1550 goals, funding will be earmarked for vehicles located in disadvantaged communities. As part of the reporting requirements associated with Low Carbon Transportation funding, CARB will track where these funds are spent so the portion that is spent in disadvantaged and low-income communities can be calculated and reported in future annual reports to the Legislature.

## CURRENT PROJECT STATUS

HVIP and Low NOx Engine Incentives have supported the purchase of 761 zero-emission trucks and buses, 2,360 hybrid trucks, 337 low NOx engines, and 107 ePTOs by California fleets through June 30, 2017. Currently, there are now 18 manufacturers and 3 upfitters producing 48 HVIP and Low NOx Engine Incentives eligible trucks and buses. Voucher requests for hybrid trucks remained steady, while vouchers for battery-electric transit buses and utility trucks with electric power take off represented much of the increased funding demand. Meanwhile, the first voucher requests for Low NOx Engine Incentives were received in early 2017.

Over the past year, HVIP experienced a significant increase in demand that exceeded available funding, resulting in a waiting list for new voucher requests during much of the fiscal year. In response to market demand, the Executive Officer reallocated $10 million from Low NOx Engine Incentives and made that funding available on a first-come first-served basis to any eligible technology. The reallocation helped to reduce the HVIP waiting list, but continuing demand resulted in a waiting list for the remainder of the fiscal year. As of June, 30, 2017, 176 vehicles were placed on the waiting list totaling $10 million. The FY 2016-17 waiting list will continue until FY 2017-18 funding is available, potentially growing to $27 million by the end of 2017, and that demand has been fairly modest.

In Part II of the Funding Plan, the Three-Year Heavy-Duty Strategy expands on factors contributing to increased demand and addresses barriers to successfully bring innovative technologies to commercialization. Over the next three years, existing commercial applications need to be bolstered and expanded to grow supply chains further adding to demand for HVIP. Recent pilot project solicitations have also helped to spur market growth. As expected, zero-emission voucher demand increased due to the oversubscribed Zero-Emission Bus Pilot Commercial Deployment Project approved in the FY 2015-2016 and FY 2016-2017 Funding Plans. Interest from many transit agencies continue to contribute to the strong demand for zero-emission transit buses. Additionally, commercially available zero-emission trucks in the heaviest weight classes, up to 80,000-pounds, are entering the market. Zero-emission options in this weight class have not been commercially available until recently, which represents a new growth area for heavy-duty incentives. Zero-emission terminal trucks, which are designed to move trailers in warehouse facilities, ports and cargo yards are in early commercialization. Presently, one manufacturer produces two zero-emission on-road

terminal truck models that are eligible for HVIP. Fleets are recognizing the benefits of zero-emission terminal trucks, resulting in increasing voucher demand for these trucks. Furthermore, there has been increased interest from public utilities regarding purchasing work trucks with ePTOs. Utilities are beginning to realize the benefits of operating in zero-emission mode, and virtually eliminating work-site idling.

As required by AB 134, staff considered forthcoming technological innovations in heavy-duty vehicle engines, along with market demand over the coming year. The voucher allocation in this Plan is expected to fully fund the waiting list and meet all voucher demand through the entire fiscal year, for all eligible technologies.

Tables I-12 and I-13 summarize the types of vehicle vocations and weight classes receiving HVIP funding thus far. Table I-14 summarizes vehicle vocations receiving Low NOx Engine Incentives.

## STAFF PROPOSAL FOR FY 2017-18

### Proposed HVIP Changes:

The advanced clean heavy-duty vehicle sector is growing but still in the early stages of commercialization. As a result, staff continues to refine HVIP and make adjustments to build on the momentum HVIP has generated in bringing these vehicles to market.

After receiving input from stakeholders during public work group meetings, and working with CARB's HVIP administrator, staff recommends the following changes to the project criteria:

*Establish a New Tier for New Zero-Emission Class 7 and Class 8 Trucks*: All voucher amounts were set several years ago before zero-emission Class 7 and 8 trucks were in the market. Currently, all zero-emission vehicles over 26,000 pounds GVWR receive the same voucher amount. Now that more Class 7 and 8 zero-emission trucks are entering the market, staff recommends adding specific tiers for Class 7 and 8 trucks with voucher amounts that better address these truck classes.

*Adjust Voucher Amounts for New Zero-Emission Vehicles*: Since zero-emission vehicles vary widely in incremental cost, staff recommends adjusting voucher amounts to more accurately fund incremental cost.

- Zero-emission trucks: Due to high incremental costs associated with zero-emission Class 8 trucks (>33,000 GVWR), staff recommends increasing voucher amounts for those trucks. With the increase in funding, up to 100 percent of incremental cost will be covered. Voucher amounts for all other weight classes will remain unchanged. Voucher amounts are listed in Table I-15.

- Zero-Emission School Buses: In order to advance the use of zero-emission school buses, substantial funding must be made available. The increased

voucher amounts, as stated in Table I-16, are intended to fund zero-emission school buses at close to full incremental cost. For zero-emission school buses with 29,000 GVWR and higher, full incremental cost will be covered. HVIP school bus funding can be combined with other funding sources, such as AB 923 through local air districts, to help fund up to the full bus purchase. For example, HVIP and SCAQMD will be funding 33 zero-emission school buses benefiting disadvantaged communities. HVIP funding and AB 923 funding provided by SCAQMD will offset 100 percent of the total bus cost for all 33 zero-emission buses.

- Hydrogen Fuel Cell Electric Buses: Fuel cell electric buses are in the early phase of commercialization, with approximately 20 in operation today. Soon, HVIP will have at least one fuel cell electric bus eligible for funding and available to fleets. Because fuel cell technologies are still in low production volumes, the cost of fuel cell electric buses is substantial. To accelerate commercialization, considerable incentive funding will be needed. Staff recommends an increase in funding for fuel cell electric buses, as identified in Table I-17. With the increase in HVIP funding along with other funding sources, such as the Federal Transit Administration (FTA), fuel cell electric buses will become more feasible for transit agencies.

- Hydrogen Fuel Cell Electric Trucks: Fuel cell electric trucks are in the early stages of development with 11 medium- and heavy-duty demonstration projects underway in the U.S. Staff expects fuel cell electric trucks will be ready for commercialization within a year or two. Staff recommends a funding category to provide funding for fuel cell electric trucks once they become commercially available and to send a strong signal to manufacturers that funding will be available beyond the demonstration phase of the technology. The proposed funding amount can be found in Table I-17.

- 60-Foot Articulating Transit Battery-Electric Buses: Even though transit agencies receive federal funding for purchasing transit buses, the significant incremental cost poses a barrier for fleets to purchase the 60-foot articulating transit battery-electric bus. Additional funding is needed to help offset the substantial incremental cost. Increased funding from HVIP will reduce incremental cost; thus, making the purchase of the 60-foot articulating transit battery-electric bus a more feasible option. Staff recommends increasing voucher funding for the 60-foot articulating transit battery-electric bus, as specified in Table I-17.

After receiving input from stakeholders during public work groups, the current level of funding for zero-emission battery-electric transit buses less than 60 feet is sufficient and will not be adjusted due to the availability of funding sources such as FTA funding.

Staff will continue to work with truck and bus manufacturers to obtain updated incremental cost information.

*Voucher Enhancements*: Voucher enhancements are designed to provide additional funding to help overcome barriers to adoption. Many voucher enhancements have been in place for several grant cycles, and have been successful in encouraging fleets to purchase cleaner technologies. After staff evaluation and input from stakeholders, staff recommends the addition of the Voucher Enhancement for Infrastructure for Hydrogen Fuel Cell Vehicles and modifications to existing voucher enhancements.

- *Voucher Enhancement for Infrastructure for Hydrogen Fuel Cell Vehicles*: Hydrogen fuel cell electric buses are in the early commercial phase with fuel cell electric trucks currently being developed. As a result, costs are still high with fueling infrastructure challenges being a significant barrier to commercialization. Funding for fuel cell electric buses is in high demand, as demonstrated through the Zero-Emission Truck & Bus Pilot Commercial Deployment Projects solicitation. To further support the commercialization of fuel cell electric buses, staff recommends an infrastructure capital cost voucher enhancement of $100,000 per fuel cell electric bus with the purchase of 5 or more buses. Additionally, once fuel cell electric trucks enter the market, they will be eligible for the same voucher enhancement as fuel cell electric buses. Eligibility criteria and infrastructure performance criteria will be developed through a public workgroup process. This infrastructure voucher enhancement can be combined with any other funding source, not to exceed 100 percent of total capital cost.

- Voucher Enhancement for New Hybrid Vehicles: Staff recommends removing the voucher enhancements for the first three hybrid vehicle vouchers received by a fleet. New hybrid vehicles have been commercially available for several years in HVIP, and are becoming more widely accepted. They also do not have many key fleet adoption barriers, such as range limitations and need for infrastructure. New hybrids account for 2,360 of the 3,565 vouchers funded through HVIP. Furthermore, manufacturers of new hybrid vehicles have not advanced current hybrid technology, such as by incorporating all-electric range into their vehicles.

- Voucher Enhancement for Hydrogen Fuel Cell Vehicles: Presently, there is a voucher enhancement for fuel cell electric buses. Since there will be a specific voucher for fuel cell electric buses, the current Hydrogen Fuel Cell Vehicle voucher enhancement will no longer be needed and staff recommends this voucher enhancement be removed.

- Voucher Enhancements for Hybrid Vehicles with CARB-Certified OBD: This voucher enhancement was designed to encourage hybrid manufacturers to reduce on-board diagnostic (OBD) deficiencies during the engine certification process. This enhancement was intended to encourage hybrid manufacturers to produce vertically intergraded hybrid systems. Only one hybrid manufacturer has taken advantage of this voucher enhancement. For this manufacturer, the voucher enhancement was discounted because full incremental cost would be exceeded. Other vertically integrated hybrid systems have not come to market,

and this voucher enhancement has not been effective in serving its intended purpose. Therefore, staff recommends the removal of this voucher enhancement.

- New Plug-in or Hydraulic Hybrid Enhancements: There are no vehicles in HVIP that use these enhancements. Staff recommends that these voucher enhancements be removed.

- Voucher Enhancement for Zero-Emission Fast-Charge: The zero-emission fast change voucher enhancement is used by two manufacturers that have buses in HVIP. Fast charge is no longer a new concept and no longer requires an extra incentive. Staff recommends removing this voucher enhancement.

The existing voucher enhancements for the first three zero-emission vehicles will remain in place. Zero-emission vehicles are still in early commercialization, and incremental and infrastructure costs remain high. The first three vehicle voucher enhancement for zero-emission vehicles provide fleets with additional funding to help alleviate some of the barriers early adopters face.

*Remove Fleet Limits*: Since the goal of HVIP and Low NOx Engine Incentives is to reduce vehicle cost and accelerate the placement of vehicles into the market, staff recommends removing the 200-voucher limit per fleet per calendar year. The provision of discounting the voucher after the first hundred vehicles will stay in place.

*Expand Eligibility for ePTO Systems*: Currently, only Class 6 through 8 utility trucks are eligible for voucher funding. Class 6 through 8 utility trucks tend to be domiciled at the fleet maintenance yard, and are more likely to be plugged in while the vehicle is not in use. However, Class 5 utility trucks tend to domicile at home with employees, who may be less willing to incur electric charging costs. During public work group meetings, stakeholders recommended that CARB offer ePTO eligibility in Class 5 utility trucks, and expand eligibility of Class 6 through 8 boom trucks to other ePTO uses such as digger derricks. Now that ePTO technology has become more reliable and technology refinements have been made, staff agrees with stakeholders that expanding ePTO eligible uses in Class 6 through 8 trucks will be beneficial.

In the past, staff did not recommend eligibility for Class 5 utility trucks equipped with ePTOs. This was due to uncertainty of meeting charging requirements. However, now with the advancement of telematics, combined with a fleet policy addressing employee residence charging, staff agrees that Class 5 trucks equipped with ePTOs should be eligible for HVIP funding. A fleet policy requirement will be developed with input from stakeholders at a future public work group meeting to ensure that vehicles not returning to the fleet maintenance yard are plugged in, and are properly charged. Additional telematics data will also be required to ensure vehicles are plugged in for an appropriate amount of time to achieve adequate charging.

Staff recommends expanding eligibility to include Class 5 utility trucks equipped with ePTOs with an approved fleet policy addressing offsite charging, and expand eligibility options for Class 6 through 8 trucks equipped with ePTOs. See Table I-18 for voucher amounts.

*Incentives for Hybrid Conversion Vehicles*: Manufacturers of hybrid conversion vehicles are in the process of producing hybrid conversion vehicles that achieve AER. Since HVIP inception, the voucher amount for new hybrid vehicles has been set to offset about half of the incremental cost. The current voucher amount for hybrid conversion vehicles covers approximately 20 percent of the incremental cost.

- *Increase Voucher Incentive for Hybrid Conversion Vehicles*: Presently, only one hybrid conversion vehicle manufacturer is participating in HVIP. Other hybrid conversion vehicle manufacturers are interested in participating in HVIP, but have indicated that voucher amounts are not adequate. CARB staff has met with several hybrid conversion vehicle manufacturers, and agree that voucher amounts need to be reevaluated. Current voucher amounts have not influenced fleets to purchase hybrid conversion vehicles. Staff recommends increasing hybrid conversion vehicle vouchers to cover approximately 50 percent of incremental cost.

- *Increase Voucher Incentive for Plug-In Hybrid Conversion Vehicles Achieving 35 Miles of All-Electric Range*: Currently, HVIP offers limited funding for the purchase of plug-in hybrid conversion vehicles that achieve at least 35 miles of all-electric range. However, the funding amount is not enough to encourage manufacturers to produce eligible plug-in hybrid conversion vehicles. Staff recommends replacing the existing funding with a new voucher enhancement that will provide substantial additional funding to support fleet purchases, and indirectly encourage manufacturing of eligible vehicles. The 35-mile all-electric range requirement is consistent with the Board approved Innovative Technology Regulation (ITR). The total voucher will not exceed 50 percent of incremental cost, including the 35-mile all-electric range voucher enhancement if applicable.

- *Improve Eligibility for Hybrid Conversion Vehicles*: Hybrid conversion base vehicles must be purchased and registered before the conversion can take place. HVIP allows vehicles to have no more than 3,500 miles prior to conversion to be eligible. This presents a barrier to participate in HVIP, since hybrid conversion vehicle manufacturers must wait for the original equipment manufacturer (OEM) to obtain an Executive Order from CARB before they can pursue CARB's aftermarket parts certification. By the time the hybrid conversion vehicle manufacturer completes the certification process, vehicles that have been purchased by a fleet are likely to already exceed 3,500 miles and are no longer HVIP eligible due to exceeding the mileage limit. To resolve this issue, staff recommends increasing the mileage limitation from 3,500 miles to a new maximum of 25,000 miles. Additionally, conversion systems may be installed on

the vehicle model year that is no more than one year later than the current vehicle model year at the time of voucher request.

*Combining GVWR for New Hybrids and Hybrid Conversion Vehicles:* There is a voucher amount category for vehicles of 33,001-38,000 pounds GVWR, and another category for vehicles greater than 38,000 pounds GVWR. Staff recommends one category of greater than 33,000 pounds GVWR for consistency with zero-emission vehicle weight categories.

*Future Potential Changes:* Over the next year, staff will seek stakeholder input, and consider adjusting in FY 2018-19 the voucher amount for ePTOs to cover approximately 50 percent of incremental cost, and eliminate the "first three" voucher enhancement. Additionally, staff will seek stakeholder input, and consider adjusting the voucher amount for new hybrid vehicles based on an updated assessment of incremental costs, and offer a voucher enhancement for 35 miles or more of AER.

**Proposed Low NOx Engine Incentives Changes:**

CARB's optional low NOx standard allows manufacturers the ability to certify heavy-duty vehicle engines to NOx emission levels that are up to 90 percent lower than today's mandatory diesel emission standards. Incentivizing deployment of these engines coupled with renewable fuels is an important strategy for achieving both near-term and long-term reductions of GHG and criteria pollutant emissions in the heavy-duty sector.

The Cummins 8.9-liter natural gas engine is the first engine certified to the lowest optional NOx standard (0.02 grams per brake horsepower-hour (g/bhp-hr)) of the optional low NOx standards. This engine became available in 2016.

Currently, Cummins is in the process of certifying an 11.9-liter natural gas engine to meet the 0.02 g/bhp-hr standard. Anticipated for early 2018, the engine will qualify for funding once it becomes commercially available.

The incentivized engine must be used in a bus or truck greater than 14,000 pounds GVWR. Engine repowers and new vehicle purchases are eligible. The project will continue to be implemented through HVIP on a first-come, first-served, statewide basis with fleets able to secure a voucher through their local participating dealership as part of their engine repower or vehicle purchase order. Low NOx Engine Incentives can be combined with other State incentives, such as the California Energy Commission's natural gas vehicle incentives, the Carl Moyer Memorial Air Quality Standards Attainment (Carl Moyer) Program, and Proposition 1B. However, when combining funding sources, Low NOx Engine Incentives may only cover the incremental cost of the low NOx option as long as the incremental cost is not covered by the other funding source.

CARB is currently meeting all low NOx engine demand, and ended FY 2016-17 with a surplus of about $10 million. Staff expects demand for the Cummins Westport 8.9-liter

engine to increase over the next year, along with potential demand for funding to support the new 11.9-liter engine if it is commercially available during FY 2017-18. Therefore, staff recommends carrying over the approximate $10 million surplus and allocating an additional $8 million from AQIP, for a total of about $18 million in funding to support Low NOx Engine Incentives. Furthermore, as stated in the Proposed HVIP Changes section, staff recommends an allocation of $180 million for FY 2017-18. After the $35 million set aside for zero-emission bus vouchers, $145 million will be available. Staff recommends the remaining balance of $145 million be allocated to HVIP and Low NOx Engine Incentives as one allocation. Both HVIP and Low NOx Engine Incentives will be funded by this single allocation on a first-come, first-served basis.

CARB staff recommends the following project criteria:

*Low NOx Engine Incremental Cost:*

*8.9-Liter Low NOx Cummins Westport Engine:* As described in the FY 2016-17 Funding Plan, the voucher amounts for the 8.9-liter low NOx natural gas engine and vehicles equipped with the engine is based on the incremental cost of a heavy-duty vehicle engine above the purchase and installation costs of a conventional heavy-duty vehicle engine with the same fuel type. The FY 2016-17 Funding Plan also sets a limit of $25,000 per voucher for the 8.9-liter low NOx engine and vehicles. However, the incremental cost of the 8.9-liter low NOx engine for different manufacturers varies from ~$8,500 to $15,000 and engine repowers at $15,000. Based on project data, the average 8.9-liter low NOx inventive amount of over 350 vouchers issued is currently slightly over $9,000 per voucher. To further simplify the voucher process for fleets, staff recommends setting the voucher amounts for the 8.9-liter low NOx engine at $10,000 for both new vehicle purchase and repowers.

*11.9-Liter Low NOx Cummins Westport Engine:* Staff recommends that funding for the new 11.9-liter engine be based on the incremental cost relative to the equivalent diesel baseline and proposes to set the voucher amount at $40,000. The 11.9-liter low NOx engine is a new engine and is expected to be used primarily in Class 7 and Class 8 vehicles and in long-haul applications, where existing use of diesel is more common. Staff's recommendation of utilizing an equivalent diesel engine/vehicle as the baseline is intended to encourage existing diesel truck fleets to switch to the low NOx option in a vehicle sector where natural gas or advanced zero-emission options are not widely available or used. As described above, AB 134 requires CARB to consider technological innovations in heavy-duty vehicles along with market demand for those vehicles. In addition to the AB 134 requirements, staff also recommends to reevaluate the voucher amount for the FY 2018-19 Funding Plan with additional information that will be made available after the engine comes to market.

*Other Low NOx Engines:* Other potential low NOx engines may become commercially available and eligible for Low NOx Engine Incentives in the near future. Staff proposes to continue to base the voucher amounts on the incremental costs associated with the low NOx engine and vehicle compared to an equivalent non-low NOx counterpart. As

other low NOx engines come to market, staff proposes to determine the appropriate incentive amount, with approval from the Executive Officer, based on the following factors.

1. Existing fuel use common among target market of the low NOx engine
2. Availability of zero-emission technologies in the target market
3. Vehicle and incremental costs

*Low NOx Engine Renewable Fuel Requirements:*

*8.9-Liter Low NOx Cummins Westport Engine:* In order to maximize GHG emission reductions, staff recommends continuing to require the use of 100 percent renewable fuel for vehicles equipped with the 8.9-liter engine as specified in the FY 2016-17 Funding Plan. GGRF will be the source of funding for all 8.9-liter low NOx Cummins Westport engines.

*11.9-Liter Low NOx Cummins Westport Engine:* With the proposed availability of AQIP funding, which is primarily directed at criteria emission reduction with GHG co-benefits, staff recommends fleets have the option of using 100 percent renewable fuel or the option of using conventional fuel, depending on fleet size. Unlike the 8.9-liter engine that powers mostly transit buses and refuse trucks that return to base for fueling, the 11.9-liter engine could be used in applications that travel greater distances. Small fleets operating trucks in these applications, such as long-haul delivery, may face greater challenges to accessing renewable fuel since refueling location and times are less predictable, and not all fueling stations offer renewable natural gas.

Staff proposes to provide small fleets, with three or fewer trucks as defined by the Statewide Truck and Bus Regulation, the option to utilize conventional, non-renewable fuel and receive Low NOx engine vouchers funded by AQIP. Additionally, staff proposes to require larger fleets to use 100 percent renewable fuel, as larger fleets are better equipped to contract for 100 percent renewable fuel. Funding for vouchers utilizing 100 percent renewable fuel will be provided by the GGRF allocation.

*Other Low NOx Engines:* As described above, other low NOx engines may be available in the near future. Staff proposes to evaluate the engine and primary applications to determine the renewable fuel requirements. Staff proposes to determine the appropriate renewable fuel requirement options, with approval from the Executive Officer based on the following.

1. Existing fuel use common among target market of the low NOx engine
2. Availability of renewable fuel available to the target market

Staff may hold public Work Group meetings to continue gathering stakeholder input regarding the implementation of some of the Board approved changes to Low NOx Engine Incentives.

**General Staff Proposals:**

The following items apply to both HVIP and Low NOx Engine Incentives:

*Flexibility to Meet Market Demand:* To balance uncertainty in the market for clean heavy-duty vehicle technologies with the growing demand to support the turnover of the older fleet, staff proposes that the Executive Officer have the ability to reallocate AQIP funding between Low NOx Engine Incentives and the Truck Loan Assistance Program. Staff will evaluate demand for these projects at the start of the fourth quarter of the fiscal year. If demand for the Truck Loan Assistance Program is higher than projected, it would consider reallocating funding from Low NOx Engine Incentives to the Truck Loan Assistance Program.

*Terms and Conditions for HVIP and Low NOx Engine Incentives*: When HVIP was established, CARB and the project administrator developed Terms and Conditions to highlight the policies set forth by the Board in more detail for HVIP participants, and ensure a fair, equitable, and responsible project. More specifically, the HVIP Terms and Conditions are intended to notify potential participants of the core requirements of the program prior to submitting an application. Additionally, CARB and the project administrator developed an Implementation Manual to further define these rules and explain roles and responsibilities. The Terms and Conditions and Implementation Manual were updated when Low NOx engine incentives were added to HVIP. The current Terms and Conditions and Implementation Manual for HVIP are available at https://www.arb.ca.gov/msprog/aqip/hvip/hvip_implementation_manual.pdf. These are incorporated into the proposed Funding Plan by reference. These documents are updated periodically throughout the year to reflect project changes after the Board adopts each funding plan and as other changes are necessary to provide further clarity.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits:* HVIP and Low NOx Engine Incentives will continue to be implemented on a first-come, first-served, statewide basis, so it is not possible to estimate in advance exactly how much funding will be spent in and benefit disadvantaged communities, low-income communities, and low-income households. About 43 percent of Low Carbon Transportation funding for HVIP to date has been spent in disadvantaged communities as reported in the March 2017 *Annual Report to the Legislature on California Climate Investments Using Cap-and-Trade Auction Proceeds*. Staff has also reviewed recent HVIP data and found that an additional 17 percent of funds were spent in low-income communities that don't overlap with disadvantaged communities. Staff expects that a similar percentage of future HVIP vouchers will be spent in disadvantaged or low-income communities. Staff proposes a change to offer higher HVIP incentives for zero-emission vehicles operating in disadvantaged and low income communities as a way to encourage HVIP participation from fleets operating in these communities.

Implementation of Low NOx Engine Incentives is still in its early stages with limited data upon which to estimate possible disadvantaged community and AB 1550 benefits. Through June 2017, 337 low NOx vouchers have been issued totaling approximately

$1.2 million. Based on project data collected, about 86 percent of funding was spent for vehicles benefitting disadvantaged communities with 62 percent of funding spent in disadvantaged community census tracts. Additionally, 7 percent of funds supported vehicles operating in low-income community census tracts that do not overlap with disadvantaged communities. It should be noted that the data above is preliminary based on the limited number of vouchers issued and funding spent. For example, a total of 17 fleets have requested vouchers with two fleets accounting for more than half of the vouchers. Staff will continue to monitor Low NOx Engine Incentive funding in disadvantaged and low-income communities.

As part of the Cap-and-Trade auction proceeds reporting requirements, CARB will track where HVIP and Low NOx Engine Incentive funds are spent, so it can calculate and report AB 1550 investment criteria.

*Project Solicitation for HVIP and Low NOx Engine Incentives*: CARB held a competitive solicitation for a HVIP and Low NOx Engine Incentives grantee in November 2016. The grantee to administer the project was selected in January 2017. The next competitive solicitation is planned for FY 2019-20.

*Project Solicitation for HVIP and Low NOx Engine Incentives*: CARB selected a grantee to administer FY 2016-17 HVIP and Low NOx Engine Incentives funding via a three-year competitive solicitation with the option of adding the FY 2017-18 funds with an updated grant agreement. Staff proposes to utilize this option, and therefore, CARB would not issue a new solicitation for the FY 2017-18 HVIP and Low NOx Engine Incentives funds.

**OUTCOMES**

The proposed allocation is expected to fund about 3,000 zero-emission, hybrid, and low NOx vehicle vouchers, meeting expected demand and providing an estimated 610,000 metric tons of CO2 equivalent GHG emission reductions. Staff also estimates about 1,300 tons of NOx, 45 tons of PM 2.5, and 10 tons of ROG emissions would be reduced as the advanced technology vehicles replace conventional diesel trucks and buses. Appendix A provides additional details on the emission estimates.

Over the next several years, increasing annual investments will be needed to continue encouraging early deployment of advanced clean heavy-duty technology vehicles, such as zero-emission delivery trucks and transit buses and low NOx engines, and encourage technology advances in heavier truck sectors. These investments will be structured to encourage increasing participation among smaller California fleets, and with benefits to disadvantaged communities. The hybrid, zero-emission, and low NOx heavy-duty truck and bus markets are still at the early stages of commercialization. Production capacity has substantial growth potential and CARB expects production costs to decline as production volumes increase. CARB staff continuously monitors vehicle production costs to correspond with voucher amounts and make adjustments.

There continues to be a need to evaluate the effectiveness of investments. Staff believes metrics can eventually help identify when specific heavy-duty vehicle technologies become self-sustaining. Potential metrics could include:

- Number of hybrid (or battery electric and low NOx) trucks sold per vehicle vocation.
- Number and types of battery electric buses (or low NOx) sold per vocation (e.g., transit, school bus, airport shuttle, etc.).
- Vehicles sold per manufacturer.
- Manufacturer diversity.
- Declining vehicle incremental cost.
- Number of offerings in different vocational applications.
- Number of vehicles sold in states without public incentives.

These metrics are unlikely to drive a decision to sunset funding in the near term. Instead, such a decision will be driven more by desire to promote purchase of a new, even cleaner available technology. This could take the form of phasing out eligible technologies in favor of new commercially available technologies. Possible metrics of market health will continue to be developed as more technologies enter the market and will be discussed in depth with stakeholders in future work group meetings.

## HVIP AND LOW NOX ENGINE INCENTIVES TABLES

**Table I-12: HVIP Vouchers Issued by Vocation Since Inspection**

| Vehicle Type | Vouchers Issued | Total Voucher Funds | Average Voucher | % of Total Vouchers |
|---|---|---|---|---|
| Parcel Delivery | 1,180 | $29,310,000 | $24,839 | 39% |
| Beverage Delivery | 454 | $15,002,000 | $33,044 | 15% |
| Other Truck | 476 | $12,736,000 | $26,756 | 16% |
| Food Distribution | 225 | $5,609,000 | $24,929 | 7% |
| Uniform/Linen Delivery | 112 | $2,800,000 | $25,000 | 4% |
| Tow Truck | 76 | $2,396,000 | $31,526 | 2.5% |
| LP Pick-up & Delivery | 47 | $942,000 | $20,043 | 2% |
| Refuse Hauler | 26 | $1,030,000 | $39,615 | <1% |
| School Bus | 15 | $477,350 | $31,823 | <1% |
| Shuttle Bus | 147 | $11,952,776 | $81,311 | 5% |
| Utility Truck | 118 | $2,781,000 | $23,568 | 4% |
| Urban Bus | 75 | $7,929,000 | $105,720 | 2.5% |
| Dump Truck | 4 | $103,000 | $25,750 | <1% |
| Not Yet Defined | 97 | $8,454,097 | $87,156 | 3.0% |
| **Total** | **3,052** | **$101,522,223** | **$33,264** | **100%** |

Through June 30, 2017.
[1]Examples include asphalt trucks, moving trucks, and other delivery trucks.
[2]Overall average for all HVIP vouchers issued to date.

**Table I-13: HVIP Vouchers Issued by Gross Vehicle Weight Range**

| Gross Vehicle Weight Range | Vouchers Issued | Total Voucher Funds | % of Total Vouchers |
|---|---|---|---|
| 5,001 – 6,000 | 51 | $653,000 | 2% |
| 10,001 – 14,000 | 83 | $3,610,000 | 3% |
| 14,001 – 19,500 | 1,705 | $46,669,350 | 56% |
| 19,501 – 26,000 | 380 | $10,050,000 | 12% |
| 26,001 – 33,000 | 247 | $9,202,776 | 8% |
| ≥33,001 | 586 | $31,337,097 | 19% |
| **Total** | **3,052** | **$101,522,223** | **100%** |

Through June 30, 2017.

**Table I-14: Low NOx Engine Incentives Vouchers Issued by Vocation**

| Vehicle Type | Vouchers Issued | Total Voucher Funds | Average Voucher | % of Total Vouchers |
|---|---|---|---|---|
| Refuse | 279 | $2,376,968 | $8,520 | 82.8% |
| Transit | 9 | $135,000 | $15,000 | 2.7% |
| Not Yet Defined | 49 | $534,275 | $10,904 | 14.5% |
| **Total** | **337** | **$3,046,243** | **$9,039** | **100%** |

Through June 30, 2017.

**Table I-15: Eligible New Zero-Emission Truck Voucher Amounts**

| GVWR (lbs) | Base Vehicle Incentive | | |
|---|---|---|---|
| | 1 to 100 vehicles[1] | | >100 vehicles |
| | Outside DAC | In a DAC or Low-Income Census Tract | |
| 5,001 – 8,500 | $20,000 | $25,000 | $12,000 |
| 8,501 – 10,000 | $25,000 | $30,000 | $18,000 |
| 10,001 – 14,000 | $50,000 | $55,000 | $30,000 |
| 14,001 – 19,500 | $80,000 | $90,000 | $35,000 |
| 19,501 – 26,000 | $90,000 | $100,000 | $40,000 |
| 26,001 – 33,000 | $95,000 | $110,000 | $45,000 |
| >33,000 | $150,000 | $165,000 | $70,000 |
| Hydrogen Fuel Cell Electric Truck | $300,000 | $315,000 | $142,000 |

[1] The first three vouchers received by a fleet, inclusive of previous funding years, are eligible for the following additional funding amount: $2,000/vehicle if below 8,501 lbs; $5,000/vehicle if 8,501 to 10,000 lbs; and $10,000/vehicle if over 10,000 lbs.

**Table I-16: Eligible New Zero-Emission School Bus Voucher Amounts**

| GVWR (lbs) | Base Vehicle Incentive | | |
|---|---|---|---|
| | 1 to 100 vehicles[1] | | >100 vehicles |
| | Outside DAC | In a DAC or Low-Income Census Tract | |
| 5,001 – 8,500 | $25,000 | $30,000 | $12,000 |
| 8,501 – 10,000 | $30,000 | $35,000 | $18,000 |
| 10,001 – 14,000 | $55,000 | $60,000 | $30,000 |
| 14,001 – 16,000 | $90,000 | $100,000 | $35,000 |
| 16,001 – 26,000 | $150,000 | $160,000 | $85,000 |
| 26,001 – 29,000 | $175,000 | $190,000 | $90,000 |
| ≥29,001 | $220,000 | $235,000 | $110,000 |

[1] The first three vouchers received by a fleet, inclusive of previous funding years, are eligible for the following additional funding amount: $2,000/vehicle if below 8,501 lbs; $5,000/vehicle if 8,501 to 10,000 lbs; and $10,000/vehicle if over 10,000 lbs.

**Table I-17: Zero-Emission Transit Bus Voucher Amounts**

| Bus Length and Bus Type | Base Vehicle Incentive | | |
|---|---|---|---|
| | 1 to 100 vehicles[1] | | >100 vehicles |
| | Outside DAC | In a DAC or Low-Income Census Tract | |
| 20 ft – 24 ft | $80,000 | $90,000 | $35,000 |
| 25 ft – 29 ft | $90,000 | $100,000 | $40,000 |
| 30 ft – 39 ft | $95,000 | $110,000 | $45,000 |
| 40 ft – 59 ft | $150,000 | $165,000 | $70,500 |
| ≥ 60 ft. Zero-Emission Battery- Electric Articulating Transit Bus | $175,000 | $190,000 | $82,250 |
| ≥ 40 ft. Hydrogen Fuel Cell Electric Bus | $300,000 | $315,000 | $142,500 |

[1] The first three vouchers received by a fleet for transit buses, inclusive of previous funding years, are eligible for the $10,000/vehicle in additional funding amounts.

**Table I-18: Eligible ePTO Voucher Amounts**

| GVWR (lbs)[1] | Base Vehicle Incentive | |
|---|---|---|
| | 1 to 100 vehicles[2] | >100 vehicles |
| 16,001 – 19,500 | $15,000 | $10,000 |
| 19,501 – 26,000 | $20,000 | $12,000 |
| 26,001-33,000 | $25,000 | $15,000 |
| > 33,000 | $30,000 | $20,000 |

[1] The first three vouchers received by a fleet, inclusive of previous funding years, are eligible for $10,000/vehicle.

**Table I-19: Eligible Hybrid Truck and Bus Vehicle Conversion Voucher Amounts**

| GVWR (lbs)[1] | Base Vehicle Incentive | |
|---|---|---|
| | 1 to 100 vehicles[2] | >100 vehicles |
| 6,001 – 8,500 | $2,000 | $1,000 |
| 8,501 – 10,000 | $6,000 | $3,000 |
| 10,001 – 19,500 | $9,000 | $4,500 |
| 19,501 – 26,000 | $12,000 | $6,000 |
| 26,001-33,000 | $15,000 | $7,500 |
| > 33,000 | $18,000 | $9,000 |

[1] A vehicle that achieves 35 miles or more of AER are eligible for the following additional funding amounts: $5,000/vehicle if below 8,501 lbs; $10,000/vehicle if 8,501 to 19,500 lbs; and $45,000/vehicle if over 19,500 lbs.

# Truck Loan Assistance Program

Proposed AQIP Allocation – $20 million

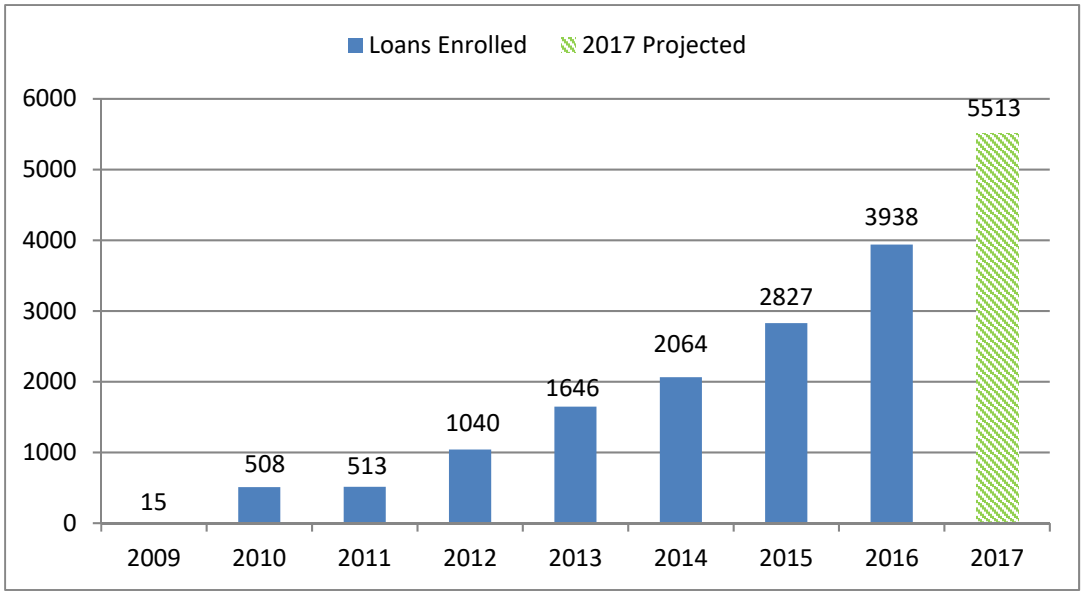
## PROJECT OVERVIEW

Launched in 2009, the Truck Loan Assistance Program utilizes AQIP funds to help small-business fleet owners affected by CARB's In-Use Truck and Bus Regulation to secure financing for upgrading their fleets with newer trucks or with diesel exhaust retrofits. The program is implemented in partnership with the State Treasurer's Office's California Pollution Control Financing Authority (CPCFA) through its California Capital Access Program (CalCAP) and leverages public funding with private funding from participating lending institutions. The program is available for small fleets with 10 or fewer trucks at the time of application. Lenders use traditional underwriting standards to establish loan terms; however, the program currently has a 20 percent interest rate cap. Because the program primarily reduces criteria and toxic air contaminant emissions, AQIP is the only source of CARB funding available for this program.

## CURRENT PROJECT STATUS

As of June 30, 2017, about $87 million in Truck Loan Assistance Program funding has been expended to provide about $912 million in financing to small-business truckers for the purchase of approximately 15,400 cleaner trucks, exhaust retrofits, and trailers. Demand by truck owners continues to increase each year as shown in Figure I-6. Program growth is driven by increased lender and borrower awareness and utilization of the program, increased cost of new diesel trucks, and increased enforcement of the Statewide In-Use Truck and Bus Regulation.

**Figure I-6: Loan Activity by Calendar Year**



To meet consumer demand and to ensure that the program would remain fully funded, CARB increased the original FY 2015-16 AQIP allocation of $15 million by $3 million during the fiscal year and increased the FY 2016-17 funding allocation to $22 million.

Based on the historic success of the program and low default rates, CARB contribution rates for loan loss reserve accounts were adjusted downwards in January 2016. This increased the leverage of the program and slowed the rate of expenditure of AQIP funding despite an increase in loan activity. The CARB contribution rate for lenders with loan loss reserve accounts exceeding $1.5 million was reduced from 10 to 4 percent. In addition, the rate for lenders with accounts between $500,000 and $1.5 million was reduced from 10 to 7 percent. This allowed program expenditures in calendar year 2016 to be reduced by 41 percent from the previous year, even though loan activity increased by 39 percent. The average current cost per loan (in the form of CARB contributions) is approximately $3,100.

Table I-20 provides a summary of financing provided to date. Nearly 55 percent of enrolled loans have been issued to owner operators with one truck, and nearly 95 percent of enrolled loans have been issued to fleet owners with 10 or fewer employees.

**Table I-20: Truck Loan Assistance Program Status –Vehicles/Equipment Financed**

| Number of Loans Issued[1] | Number of Projects Financed | Project Type | State Funding (million) | Total Amount Financed (million) |
|---|---|---|---|---|
| 14,213 | 14,562 | Truck Purchases | $87 | $912 |
| | 617 | Exhaust Retrofits | | |
| | 240 | Trailers | | |

Based on data through June 30, 2017.
[1] Total number of loans issued does not equal the number of projects financed because some loans included multiple projects.

## STAFF PROPOSAL FOR FY 2017-18

Staff proposes an allocation of $20 million for the Truck Loan Assistance Program to meet expected demand for the FY 2017-18 cycle. CARB remains committed to meeting the growing demand, as having loan assistance unavailable for even a short period erodes the confidence lenders have in providing the necessary financing to purchase trucks to meet the compliance requirements of the In-Use Truck and Bus Regulation. In 2016, CalCAP enrolled a record volume of loans to California small business owners. Program need and popularity is expected to grow even more in the coming years because of a new law that will only allow clean trucks to be registered by the DMV. SB 1 requires that, beginning in 2020, all vehicles subject to CARB's Truck and Bus Regulation must be in compliance to be registered with the DMV. For many small fleets, this loan program may offer the only viable option to achieve compliance. The

current allocation request takes into account the expected impact of SB 1 on this program.

To ensure the sustainability of the program and continuous availability of funding to participating lenders, staff is working with CPCFA on program modifications to address both short- and long-term cash flow and to meet ever-increasing demand. Strategies being pursued will improve leverage, make the program more self-sustaining, and slow the rate of expenditure of AQIP funding. These include:

- *Incremental recapture of funds in the lenders' loan loss reserve accounts:* Staff successfully worked with CPCFA to achieve the objective of incremental recapture. This mechanism will recycle older contributions to support future enrollments in the Truck Loan Assistance Program and make the program more self-sustaining by reinvesting funds from matured loans. Regulations to establish procedures to recapture contributions from a lender's loss reserve account were authorized by the CPCFA Board with input from lenders and stakeholders, and the Office of Administrative Law approved this regulation on August 7, 2017. All loan enrollments submitted on or after August 15, 2017 are subject to recapture. The approved regulations provide a full description of the recapture mechanism and the voluntary election process of the lenders to participate in this process.

- *Alignment of contribution rates consistent with the State CalCAP Program:* CPCFA may obtain input from lenders on the feasibility of introducing lender and borrower fees to realign the contribution rates to those currently offered under the regular small business program. This will improve program leverage.

- *Short-term cash flow:* Because the AQIP revenues accrue throughout the fiscal year, the demand for funding for the Truck Loan Assistance Program may from time-to-time precede the availability of funds to advance to CPCFA. Staff will assess whether there are any sources of funding that may be available to cover any temporary lack of funding. The current interagency agreement includes a provision of a $5 million bridge loan from CPCFA to cover temporary funding needs. The funding leftover from FY 2016-17 should be enough to cover the potential gap due to a temporary lack of AQIP funding that typically occurs at the start of each fiscal year for a duration of approximately three months.

Staff will continue to closely monitor program demand and work with CPCFA staff, participating lenders, and other stakeholders to evaluate whether to implement program changes to balance available funding with meeting the needs of the fleets. If changes are warranted, they would be developed and implemented through a public process resulting in an amended interagency agreement between CARB and CPCFA.

*Project Continuity Between Funding Cycles*: Staff proposes the following contingency provision to allow for uninterrupted implementation of the Truck Loan Assistance Program in the event that consideration of the FY 2018-19 Funding Plan is delayed beyond July 2018. If CARB is appropriated AQIP funding in the FY 2018-19 State

budget and the Executive Officer determines that the Truck Loan Assistance Program would run out of funding prior to Board consideration of the FY 2018-19 Funding Plan, the Executive Officer would have the authority to allocate up to 25 percent of FY 2018-19 AQIP funds to the Truck Loan Assistance Program.

*AB 1550 Disadvantaged Community and Low-Income Household/Community Benefits:* The AB 1550 disadvantaged community, low-income community, and low-income household investment targets apply only to projects funded with Cap-and-Trade auction proceeds. They are not a requirement of AQIP funding, the sole funding source for the Truck Loan Assistance Program. However, it is worth noting much of the Truck Loan Assistance Program funding has been spent within and benefiting individuals living in disadvantaged and low-income communities.

## OUTCOMES

The proposed FY 2017-18 allocation for the Truck Loan Assistance Program is expected to fund about 6,000 new truck purchases. This will help small business truckers comply with the In-Use Truck and Bus Regulation and result in an estimated 6,700 tons of NOx and 94 tons of ROG emission reductions. Appendix A provides additional details on the emission estimates.

This program has experienced steady growth for the past several years. Staff expects to fully support the additional demand for truck loans through monies remaining from FY 2016-17 and funds recaptured from lender's loan loss reserve accounts.

Staff anticipates that future funding plans will maintain funding for the program to continue to meet the strong demand and support for small-business fleets through the compliance deadlines approved by the Board and implementation requirements imposed by SB 1. Assessments of ongoing funding needs will take into account updated program activity trends, which reflect truck owners' demand for financing assistance, compliance schedules, and noncompliance rates. Because program activity fluctuates based on truckers' participation in the program, staff commits to perform periodic assessments to develop funding projections for annual program needs.

# CHAPTER 5: MAXIMIZING AB 1550 BENEFITS

CARB's August 2017 draft California Climate Investments Guidelines establish requirements and recommendations for maximizing AB 1550 benefits for California Climate Investments.[8] This chapter summarizes the steps staff is taking to meet these requirements. Although these guidelines only apply to programs funded with Cap-and-Trade Auction Proceeds, CARB is also striving to maximize disadvantaged community, low-income community, and low-income household benefits for the other investments covered in this Funding Plan. If there are any changes to the August 2017 draft California Climate Investments Guidelines when the Board considers them later in 2017, staff will revise the Funding Plan as necessary.

The specific California Climate Investments Guidelines requirements for State agencies related to evaluating investments for AB 1550 benefits and maximizing these benefits, particularly for disadvantaged communities, are summarized below, along with the actions CARB is taking to address them.

Guideline Requirement: Assess overall program structure for opportunities to target investments to benefit AB 1550 populations and evaluate projects for potential benefits to AB 1550 populations, using the criteria contained in Appendix 2.A of the California Climate Investments Guidelines.

> CARB Action: Staff expects that every project funded with the FY 2017-18 Low Carbon Transportation appropriation will provide some benefit for AB 1550 populations. The project category descriptions included in Chapters 3 and 4 of this Funding Plan describe the anticipated AB 1550 benefits for each project, and Appendix A shows how staff developed its minimum AB 1550 investment target that at least 45 percent of funds meet one of the AB 1550 criteria.
>
> For each project, staff will use the criteria in Appendix 2.A of the Climate Change Investment Guidelines to evaluate the AB 1550 benefits and to develop project solicitation and grant requirements. As project funds are expended, CARB will report the AB 1550 benefits in future *Annual Reports to the Legislature on California Climate Investments Using Cap-and-Trade Auction Proceeds*.

Guideline Requirement: Target funding, to the extent feasible, for projects that are located within and benefit residents of AB 1550 communities and low-income households. When selecting projects, give priority to those that maximize benefits to disadvantaged communities.

> CARB Action: The FY 2017-18 Funding Plan includes a mix of projects that are available statewide on a first-come, first-served basis and those that are limited to

[8]See Climate Changes Investments Guidelines, Volume II, Investments to Benefit AB 1550 Populations, Draft for Public Comments, August 4, 2017. https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/2017_draft_funding_guidelines.pdf

disadvantaged communities or to lower-income households. These are clearly specified in the Funding Plan. In cases where projects are not limited to disadvantaged communities, many grant agreements include a requirement to focus outreach on disadvantaged communities to increase participation in those communities.

For the statewide first-come, first-served projects (CVRP, HVIP, and the Zero-Emission Off-Road Freight Voucher Incentive Project), staff has incorporated project criteria intended to increase benefits to disadvantaged communities and low-income households. For HVIP, zero-emission truck and bus voucher amounts are higher for vehicles that operate in disadvantaged communities. Similarly, freight equipment deployed in disadvantaged communities would qualify for higher vouchers in the Zero-Emission Off-Road Freight Voucher Incentive Project. For CVRP, rebate amounts are higher for low-income vehicle purchasers with household incomes less than 300 percent of the federal poverty level and outreach is being increasingly focused on disadvantaged communities and low-income households.

New for FY 2017-18, staff is proposing to fund a One-Stop-Shop for CARB's ZEV equity incentives. This is intended to both make it easier of low-income households to access incentives and to increase awareness.

Guideline Requirement: Provide direct outreach to disadvantaged communities and identify an agency point or contact to provide the information on funding opportunities and to coordinate with other State agencies on California Climate Investments.

CARB Action: CARB has taken multiple actions to outreach to disadvantaged communities. CARB has hired dedicated staff to assist with disadvantaged community and low-income household outreach on Low Carbon Transportation investments and help ensure these communities are aware of funding opportunities. As part of this, CARB is working with liaisons from State agencies administering California Climate Investments to better share information at community events, so citizens can have access to all relevant California Climate Investments opportunities. This includes participating in the inter-agency California Climate Investments Outreach Work Group and the coordinating with the Strategic Growth Council on the California Climate Investments Outreach & Technical Assistance Program.

*Outreach events:* CARB has started an enhanced outreach/education program on the Low Carbon Transportation Program with a disadvantaged community focus. An important part of the effort is dedicated to assessing the needs of the communities. CARB is partnering with stakeholders, such as community based organizations, community advocates, and environmental justice groups to conduct community meetings aimed at explaining available incentives and increasing the community's awareness of these programs. A list of outreach events since July 2016 where CARB provided information on its Low Carbon Transportation Program is shown in Table I-21.

**Table I-21: Low Carbon Transportation Program Outreach Events**

| Outreach Event | Date | Location |
|---|---|---|
| Environmental Justice Advisory Committee (EJAC) Scoping Plan Local Community Meeting | 7/11/2016 | San Bernardino |
| EJAC Scoping Plan Local Community Meeting | 7/14/2016 | San Diego |
| EJAC Scoping Plan Local Community Meeting | 7/19/2016 | Oakland |
| EJAC Scoping Plan Local Community Meeting | 7/25/2016 | Wilmington |
| EJAC Scoping Plan Local Community Meeting | 7/26/2016 | Los Angeles |
| EJAC Scoping Plan Local Community Meeting | 7/28/2016 | Modesto |
| EJAC Scoping Plan Local Community Meeting | 7/29/2016 | Sacramento |
| Greenlining the hood in Partnership with Greenlining and Father and Families of Stockton | 8/2/2016 | Stockton |
| SB 350 Community Meeting | 8/11/2016 | Huron |
| Charge Ready Workshop in Partnership with Southern California Edison | 8/30/2016 | Irwindale |
| SB 350 Community Meeting | 8/31/2016 | Redwood Valley |
| SB 350 Community Meeting | 9/6/2016 | North Richmond |
| Radio Catolica Unidos Por Cristo Y Maria Radio Show | 9/9/2016 | Hughson |
| OneStop Diesel Truck Event | 9/23/2016 | Santa Ana |
| Malaga Elementary School | 9/27/2016 | Fresno |
| 1st Annual San Joaquin Valley Clean Transportation Summit | 10/19/2016 | Clovis |
| 7th Annual Imperial County Environmental Health Leadership Summit | 10/22/2016 | Brawley |
| Supplemental Environmental Project Policy Workshop | 10/24/2016 | Oakland |
| OneStop Diesel Truck Event | 10/28/2016 | Alameda |
| Supplemental Environmental Project Policy Workshop | 11/2/2016 | Fresno |
| EJAC Scoping Plan Local Community Meeting | 11/4/2016 | Orleans |
| Green Business Benefit Workshop | 11/10/2016 | Pacoima |
| South Coast AQMD Environmental Justice Summit | 11/16/2016 | Los Angeles |
| OneStop Diesel Truck Event | 10/28/2016 | Alameda |
| Supplemental Environmental Project Policy Workshop | 11/2/2016 | Fresno |
| EJAC Scoping Plan Local Community Meeting | 11/04/2016 | Orleans |
| Green Business Benefit Workshop | 11/10/2016 | Pacoima |
| South Coast AQMD Environmental Justice Summit | 11/16/2016 | Los Angeles |
| OneStop Diesel Truck Event | 10/14/2016 | Sacramento |
| Cap and Trade Funding Workshop: Bringing Resources to Los Angeles, Culver City, and South LA | 12/13/2016 | Los Angeles |
| OneStop Diesel Truck Event | 12/14/2016 | Sacramento |
| OneStop Diesel Truck Event | 01/18/2017 | Red Bluff |
| EJAC Scoping Plan Local Community Meeting | 03/01/2017 | Sacramento |
| San Bernardino County Transportation Authority Multi-Source Freight Facility Demonstration Project Press Event | 03/10/2017 | San Bernardino |
| EJAC Scoping Plan Local Community Meeting | 03/15/2017 | Los Angeles |
| EJAC Scoping Plan Local Community Meeting | 03/16/2017 | Bay Area |
| Outreach to California State University Sustainability Officers | 03/22/2017 | Sacramento |
| EJAC Scoping Plan Local Community Meeting | 03/27/2017 | Modesto |
| Environmental Justice Advisory Committee Meeting | 03/29/2017 | Los Angeles |

**Table I-21: Low Carbon Transportation Program Outreach Events** (continued)

| Outreach Event | Date | Location |
|---|---|---|
| Environmental Justice Advisory Committee Meeting | 03/30/2017 | Los Angeles |
| Goodwill Zero-Emission Delivery Van Project Press Event | 04/07/2017 | Bay Area |
| Sunline Transit Agency Award Ceremony | 04/21/2016 | Thousand Palms |
| Green California Summit | 4/26/2017 | Sacramento |
| Strategic Growth Council Technical Assistance for Affordable Housing and Sustainable Communities Program | 05/03/2017 | Fresno |
| State Climate Investment Workshop (Housing/Transportation) | 05/05/2017 | Gilroy |
| Demonstration Site Launch for City of LA Car Share Pilot Project Press Event | 05/09/2017 | Los Angeles |
| Sacramento Metropolitan Car Share Community Forum | 05/11/2017 | Sacramento |
| City of LA Car Share Community Forum | 05/11/2017 | Los Angeles |
| Sacramento Zero-Emission School Bus Pilot Project Event | 05/12/2017 | Sacramento |
| OneStop Diesel Truck Event | 05/23/2017 | Madera |
| 8th Annual Statewide Energy Efficiency Forum | 05/14/2017 | Fresno |
| 8th Annual Statewide Energy Efficiency Forum | 05/15/2017 | Fresno |
| City of Porterville Grant Award Ceremony/Site Launch | 06/02/2017 | Porterville |
| Leveraging Climate Investments in the Valley | 07/18/2017 | Merced |
| Kern Environmental Enforcement Task Force Meeting | 08/01/2017 | Bakersfield |
| California Climate Investments Guidelines Community Meeting | 08/22/2017 | Fresno |
| California Climate Investments Guidelines Community Meeting | 08/23/2017 | Los Angeles |
| California Climate Investments Guidelines Community Meeting | 08/28/2013 | Oakland |
| California Climate Investments Guidelines Community Meeting | 08/31/2017 | Sacramento |

*Website*: CARB has developed a new, user-friendly Moving California website to promote Low Carbon Transportation projects and increase awareness about funding opportunities: https://arb.ca.gov/msprog/lct/movingca.htm.

*Outreach by grantees*: As a part of project solicitations, CARB requires that applicants provide information on how they will outreach to disadvantaged communities, and their applications are scored in part on the quality of the outreach proposal.

*One-Stop-Shop*: Staff is proposing to fund a One-Stop-Shop for CARB's ZEV equity incentives to make it easier of low-income households to access incentives. This will also include an outreach/education component.

Guideline Requirement: Create or modify program guidelines or procedures to meet or exceed AB 1550 program targets.

CARB Action: This Funding Plan outlines the procedures CARB is taking to meet or exceed AB 1550 targets.

Guideline Requirement: Track and report on the AB 1550 of each investment.

CARB Action: All CARB grant agreements with funding recipients require grantees to collect and report to CARB all data necessary to AB 1550 benefits. This includes all information necessary to complete the evaluations specified in Appendix 2.A of the California Climate Investments Guidelines and the data required in Volume 3 of the California Climate Investments Guidelines (Reporting Requirements). CARB uses this information to provide input for the *Annual Report to the Legislature on California Climate Investments Using Cap-and-Trade Proceeds* including the AB 1550 benefits of Low Carbon Transportation investments.

Guideline Requirement: Assess how projects benefiting AB 1550 populations meet a community or household need. The California Climate Investments Guidelines provides a list of common needs identified by community advocates during the development of the guidelines. Letters of community support can also be used to document that investments address a community need.

CARB Action: Staff reviewed the commonly identified needs of AB 1550 populations in the California Climate Investments Guidelines. The needs being met by proposed FY 2017-18 Low Carbon Transportation investments are shown in Table I-23 below.

**Table I-23: Common Needs of AB 1550 Populations Addressed by Proposed FY 2017-18 Low Carbon Transportation Investments**

| | |
|---|---|
| Public Health and Safety, Need 1 | Reduce health harms suffered disproportionately by AB 1550 populations due to air pollutants.<br><br>*All Low Carbon Transportation projects meet this need. All projects reduce criteria air pollutants and/or toxic air contaminants as co-benefits thereby reducing health harms due to air pollutants, and a portion of funding from all projects is expected to benefit AB 1550 populations.* |
| Socio-economic, Need 5 | Reduce transportation costs and improve access to public transportation.<br><br>*The Low Carbon Transportation projects that provide consumer incentives for more fuel efficient vehicles meet this need. These include CVRP, EFMP Plus-Up, Financing Assistance for Lower-Income Consumers, and Clean Mobility Options projects.* |
| Socio-economic, Need 10 | Provide educational and community capacity building opportunities through community engagement and leadership.<br><br>*Public outreach in an element of many Low Carbon Transportation projects. For the light-duty equity projects in particular, CARB will continue to require that grant awardees have strong community-based experience and commit to conduct extensive outreach and education tailored to the communities' projects will serve.* |
| Environmental, Need 1 | Reduce exposure to local environmental contaminants, such as toxic air contaminants, criteria air pollutants, and drinking water contaminants.<br><br>*All Low Carbon Transportation projects meet this need because they reduce criteria air pollutants and/or toxic air contaminants as co-benefits*. |
| Environmental, Need 2 | Prioritize zero-emission vehicle projects for areas with high diesel air pollution, especially around schools or sensitive populations with near-roadway exposure.<br><br>*The Low Carbon Transportation projects that provide incentives for zero-emission vehicles to replace diesel vehicles meet this need. These include Rural School Bus Pilot, Zero-Emission Freight Equipment Voucher Incentives, Zero/Near Zero-Emission Freight Facilities, and HVIP.* |

Letters of community support can also be used to document that investments address a community need. During the development of previous Funding Plans, CARB has received comment letters from organizations representing several community groups voicing support for investments in light-duty pilot projects for disadvantaged communities and low-income households, financing assistance for lower-income consumers, prioritizing heavy-duty vehicle and freight funding to benefit disadvantaged communities, and changes CVRP to provide higher rebates to low-income consumers and increase equity-focused outreach. Each of these program elements is carried forward in the FY 2017-18 Funding Plan.

Guideline Recommendations: In addition to the requirements summarized above, the California Climate Investments Guidelines list a number of recommended strategies for targeting investments to benefit AB 1550 populations.

CARB Action: In developing the FY 2017-18 Funding Plan, staff utilized a number of these strategies, including:

*Set aside a portion of funding for projects benefiting AB 1550 populations*: Funding for the Clean Mobility Options, Agricultural Worker Vanpools, and Zero-Emission Freight Facilities projects are all limited to disadvantaged communities. In addition, the Low Carbon Transportation funding for EFMP Plus-up is limited to ZIP Codes benefiting disadvantaged communities. EFMP Plus-up and Financing Assistance funding is limited to lower-income consumers, and staff proposes an allocation of reserved CVRP rebates for low-income consumers earning less than 300 percent of the federal poverty level as a new refinement for FY 2017-18.

*Offer higher incentive amounts for projects benefiting AB 1550 populations*: HVIP provides higher voucher amounts for zero-emission trucks and buses that operate in disadvantaged communities. CVRP provides higher rebate amounts to lower-income consumers. EFMP Plus-up provides tiered incentive amount based on income, with the lowest-income participant receiving the highest incentive amounts.

*Prioritize projects that provide multiple benefits to AB 1550 populations*: Low Carbon Transportation co-benefits include reducing criteria pollutant and toxic air contaminant emissions, reducing fuel costs, and improving lower-income consumers' access to low carbon transportation. Many projects achieve more than one of these co-benefits.

*Provide outreach and assistance for AB 1550 community residents on funding opportunities and use a variety of approaches to reach a broader audience*: CARB's multi-faceted outreach effort to support its Low Carbon Transportation Program and help ensure AB 1550 populations are aware of funding opportunities is summarized earlier in this chapter.

# CHAPTER 6: CONTINGENCY PROVISIONS

The proposed FY 2017-18 Funding Plan is based on the latest available information. However, circumstances may change between the time the proposed Funding Plan is released for public comment and when the Board approves the Funding Plan, project solicitations are issued, project funds awarded, or as projects are implemented. This section describes staff's proposed contingency plans should mid-course corrections be needed to ensure that funds are spent expeditiously, efficiently, and where the need is the greatest. Under these provisions, the Board would grant the Executive Officer authority to make adjustments as necessary.

Low Carbon Transportation Appropriation: CARB was appropriated $560 million from GGRF for its Low Carbon Transportation Program. Section 15.14 of the Budget Act of 2017 specifies that the Director of Finance may proportionally reduce agencies' appropriations upon determination that available Cap-and-Trade auction proceeds are not sufficient. In the event this happens, CARB would proportionally scale down all unexpended project funding in each of the four Low Carbon Transportation funding categories specified in the State budget (CVRP, transportation equity projects, clean truck and bus vouchers through HVIP, and freight equipment projects). Staff would report on any changes in the FY 2018-19 Funding Plan.

AQIP Funding Levels: Over past funding cycles, AQIP revenues were sometimes lower than the levels included in the State Budget, and project solicitations had to be scaled back. AQIP appropriation levels have been adjusted in the State Budget in recent years to more closely track anticipated revenues, so staff does not expect needing to scale back AQIP funding in the FY 2017-18 funding cycle. However, staff is proposing to leave $0.64 million of the AQIP appropriation unallocated to function as a prudent reserve, as it has done in past years.

Staff proposes the following contingency provisions specifying how the $0.64 million in reserve funds would be allocated if revenues are sufficient. As a first priority, this additional $0.64 million would be allocated to either of the two AQIP-funded projects (Truck Loan Assistance Program or Low NOx Engine Incentives) if there is demonstrated demand. As a second priority, the $0.64 million could be allocated to research related to the mobile source emission categories covered in the Funding Plan if there are still remaining funds available. In the unlikely event that AQIP revenues are so low that project allocations need to be scaled back, staff proposes that funding for each AQIP project be reduced proportionally.

Additional Funding Sources: If funding from other sources is provided for any of the project categories authorized in the Funding Plan, these outside funds will be allocated as needed for projects or as specifically required by the authorizing entity. Additionally, projects receiving additional funding may be altered to accommodate any conditions placed upon the use of alternative sources of funding as long as these conditions are consistent with the statutory provisions for Low Carbon Transportation and AQIP. Staff will consult with project work groups prior to making any changes to projects.

Project Demand: Staff plans to issue initial solicitations and funding agreements based on the allocations listed in Table I-4 (Chapter 2). However, these solicitations and grant agreements will be written with provisions to allow an increase in awarded funding if there are sufficient revenues and project demand. Some solicitations may be written to allow for the potential use of funding from the FY 2018-19 budget year to meet excess demand subject to approval by the Board as part of the FY 2018-19 Funding Plan. Conversely, staff proposes that the Executive Officer have the ability to reallocate funding from any project in the event that demand does not materialize or if he determines that the project is not viable as envisioned in the Funding Plan (e.g. a technology considered for pilot deployment is not ready to be funded). In this case, funds would be reallocated within the same project category or sector prior. For example, if demand falls short for one of the transportation equity projects, CARB would shifting that funding to another transportation equity project. Any changes in funding for a particular project category would be publicly vetted through public project work groups.

When CARB is evaluating solicitations, there may be cases where funding has been awarded to the highest scoring applications and the remaining available funds are less than the amount requested in the next highest scoring application. In these cases, staff proposes that the Executive Officer have the authority to offer funding to the next highest scoring project(s) at a scaled down scope, carry the remaining funds forward to the next fiscal year, or shift the funds to another project category at his discretion.

Project Continuity Between Funding Cycles: To avoid disruptions to ongoing first-come, first-served projects, staff proposes the Executive Officer have the authority to establish applicant waiting lists for CVRP (including the public fleet element), HVIP, Low NOx Engine Incentives, or the Zero-Emission Off-Road Freight Voucher Incentive Project in the event funding is exhausted prior to the end of the funding cycle. If any of these projects end up with waiting lists, the Executive Officer would have the authority to amend the FY 2017-18 grant agreements to add FY 2018-19 funding upon the enactment of the 2018-19 State budget if funding is appropriated to these projects in the budget.

Staff also proposes a contingency provision to allow for uninterrupted implementation of the Truck Loan Assistance Program in the event that consideration of the FY 2018-19 Funding Plan is delayed beyond July 2018. If CARB is appropriated AQIP funding in the FY 2018-19 State budget and the Executive Officer determines that the Truck Loan Assistance Program would run out of funding prior to Board consideration of the FY 2018-19 Funding Plan, the Executive Officer would have the authority to allocate up to 25 percent of FY 2018-19 AQIP funds to the Truck Loan Assistance Program.

Minor Technical or Administrative Changes: The proposed Funding Plan specifies all policy-related details regarding the projects to be funded. However, technical or administrative changes in implementation procedures may be needed from time to time to ensure these projects are successful. Staff proposes a transparent process in which minor changes to a project category would be publicly vetted through the project work

groups that have been established to discuss the implementation details of each project. For several project categories, staff is already planning to use the public work group process to finalize technical details prior to issuing solicitations. These changes would be within the Funding Plan parameters approved by the Board.

# CHAPTER 7: GRANT ADMINISTRATION

The AB 109 (Ting, Chapter 249, Statutes or 2017) and AB 134 budget bills provide new direction on how CARB administers these incentive programs. These include limits on how much funding can be used for administrative costs for projects and provisions for advanced payments in grant agreements so projects may be implemented in a timely manner. This chapter describes staff proposed approach for addressing these new requirements.

Administrative Costs: AB 134 specifies that "Not more than five percent of the funds allocated to each program…shall be used for administrative costs." Typically, administrative costs are identified within each grant, and sometimes varies depending upon the needs of that particular project. However, a standard definition of what constitutes "administrative costs" for purposes of these grants doesn't exist. Staff is currently reviewing existing project grants to develop a common definition of administrative costs that is different from project implementation costs typically identified in a grant, such as outreach and education, research, and data support.

Advance Payments to Grantees: AB 109 directs CARB to "provide advance payments of the grant award to the recipient to initiate and implement the project in a timely manner." Further, CARB, in consultation with the Department of Finance, "shall adopt additional requirements in regulations regarding the provision of advance payments and the use of the advance payments by the recipient of the grant to ensure that the moneys are used properly." While each grant for these projects in the past has contained several safeguards to ensure public funding is protected, CARB will work with the Department of Finance regarding protocols for advance payment of grants.

Staff will include more detailed proposed requirements for addressing these issues in the proposed Funding Plan which staff intends to release on October 13, 2017.

# PART II:
# THREE-YEAR INVESTMENT STRATEGY FOR HEAVY-DUTY VEHICLES AND OFF-ROAD EQUIPMENT FROM LOW CARBON TRANSPORTATION INVESTMENTS AND AQIP

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## Introduction

Achieving California's climate and clean air goals will require an ongoing transformation of the transportation sector – in both the light-duty and heavy-duty vocations – to the use of zero-emission technologies wherever feasible and near zero-emission technologies with the cleanest, lowest carbon fuels everywhere else. This transformation will utilize advanced technologies and fuels, while supporting progress towards creating the jobs of the future and achieving and maintaining healthy and sustainable communities for all Californians.

**The need for incentives to support the transformation of the heavy-duty and off-road sectors is enormous.** There are local, state, and federal sources of funding to invest in this transformation, but more is needed to support both the next generation of technologies for cleaner vehicles and equipment, as well as for accelerating the turnover of the legacy vehicle fleet. For example, the South Coast AQMD, as part of their 2016 Air Quality Management Plan, estimated a need for financial incentives of $250 million to $1 billion per year through 2031.[9] In the San Joaquin Valley, the air district's preliminary incentive funding estimates, prepared as part of their PM2.5 attainment strategy, highlight a need for $22 billion in incentives by 2025.[10] CARB maintains a portfolio of investments that includes programs to support the acceleration of fleet turnover, which are necessary to meet near-term air quality goals, as well as programs that keep the momentum of advancing technology from demonstration to commercialization phase, in order to meet future State goals. The Low Carbon Transportation Investments are meant to jump-start the transformation process and provide a down payment on the overall funding needed to reach the State's long-term goals. However, CARB is not alone in this process. Many other agencies, federal, state, and local, are also contributing to this 'down payment' and a stronger coordinated effort is needed.

*The Low Carbon Transportation Investments are meant to jump-start the transformation process and provide a down payment on the overall funding needed to reach the State's long-term goals.*

This document outlines a three-year investment roadmap based on advanced technology market assessments to help identify what is needed to continue the advancement of low carbon, low emission heavy-duty vehicle and off-road equipment technologies using Low Carbon Transportation and AQIP funding. These technologies are at various stages of development, and this Three-Year Heavy-Duty Strategy builds on CARB's Low Carbon Transportation and AQIP previous investments and the

[9] South Coast Air Quality Management District: Draft Financial Incentives Funding Action Plan for the 2016 Air Quality Management Plan, December 2016; http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/draftfinancialincentivefunddec2016.pdf?sfvrsn=6

[10] San Joaquin Valley Air Pollution Control District: Preliminary Cost and Incentive Funding Estimates for Measures Aimed at Reducing Emissions for District's PM2.5 Attainment Strategy, March 16, 2017 Governing Board Meeting; http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2017/March/presentations/08.pdf

portfolio approach – a process of supporting continuous innovation by investing in identified technology applications where staff has identified the potential to move more quickly through the stages of commercialization.

This plan enhances CARB's current portfolio approach by applying the concept of beachheads, which prioritize funding around technologies and applications that have strong potential to transfer and spread to broader applications. This will allow State funds to be focused more strategically on driving actions needed over the next three years to support the transformation required in the long-term, while still being mindful of needed near-term benefits.

*This plan enhances CARB's current portfolio approach by applying the concept of beachheads, which prioritize funding around technologies and applications that have strong potential to transfer and spread to broader applications.*

**This document has been developed to send several important signals**:
(1) that it is critical for public investments to continue to support the demonstration and deployment of advanced technologies in the heavy-duty and off-road spaces;
(2) that the need for investment in the heavy-duty and off-road sectors far exceeds what is available; and
(3) to provide insight into how CARB will invest its Low Carbon Transportation and AQIP funding in a combination of transformational technologies for heavy-duty vehicles, off-road equipment, and fueling infrastructure with a focus on moving technologies through the commercialization process and meeting emerging market demand.

## Background

As discussed in the introduction to the Fiscal Year 2017-18 Funding Plan, there are many drivers that affect CARB investments. From climate change goals set in AB 32 and the subsequent SB 32, to air quality goals set in the Federal Clean Air Act – many documents and policies have been developed to support achieving these goals. SB 350 calls for improving access to clean transportation options (such as cleaner transit bus fleets, passenger trains, and ferries) for low-income residents, including those in disadvantaged communities. There are two other primary drivers with specific strategies relevant to the heavy-duty and off-road sectors: The Mobile Source Strategy and the California Sustainable Freight Action Plan.

- The Mobile Source Strategy notes that heavy-duty trucks over 8,500 pounds are currently the fastest growing transportation sector in the United States, responsible for about 33 percent of total statewide NOx emissions, approximately 25 percent of total statewide diesel PM emissions, and a significant source of GHG emissions. This also includes an expected growth in emissions from off-road diesel sources that are not subject to California regulation, such as

ocean-going vessels and locomotives.[11] Early investments of incentives that accelerate deployment of zero- and near zero-emission technologies in the heavy-duty and off-road sectors are essential and have already started to play a vital role in transitioning heavy-duty vehicles and off-road equipment to cleaner technology.

- The California Sustainable Freight Action Plan is designed to integrate investments, policies, and programs across several State agencies to help realize a singular vision for California's freight transport system. To meet the State's 80 percent GHG emission reduction target by 2050, freight will need to be moved more efficiently with zero-emission technologies wherever possible and near zero-emission technologies paired with renewable fuel use everywhere else.[12] The solution will require technology innovation including development and deployment of zero- and near zero-emission trucks, locomotives, cargo handling equipment, TRUs and ships; lower-emission aircraft; parallel development of the necessary supporting fueling infrastructure; and logistical/operational efficiency improvements.

## Role of Incentives

CARB's 2016 Mobile Source Strategy and the California Sustainable Freight Strategy include a combination of proposed regulations and incentives designed to help shift California from a reliance on petroleum-fueled heavy-duty vehicles and off-road equipment to zero- and near zero-emission vehicles and fuels.[13] CARB's ongoing success in reducing emissions from mobile sources has relied on a multi-pronged suite of policy and regulatory mechanisms that includes establishing emission and performance standards for new vehicles and fuels, setting mandates and sales requirements for advanced technologies, developing pilot programs, and implementing incentives to accelerate technology deployment. Together, these approaches are designed to achieve progressively cleaner in-use fleet emission levels.

*Analysis conducted as part of the Mobile Source Strategy demonstrated that, given the long lifetime of heavy-duty trucks and locomotives, additional incentive funding will be needed to help reach California's long-term goals.*

In the heavy-duty sector, for example, the current On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation is ensuring that the fleet consists of the cleanest engines currently available, requiring nearly all trucks and buses to have 2010 model year engines or the equivalent by 2023. Similarly, CARB's memorandum of understanding with the Class 1 Railroads operating in California has helped achieve cleaner fleet emission levels.

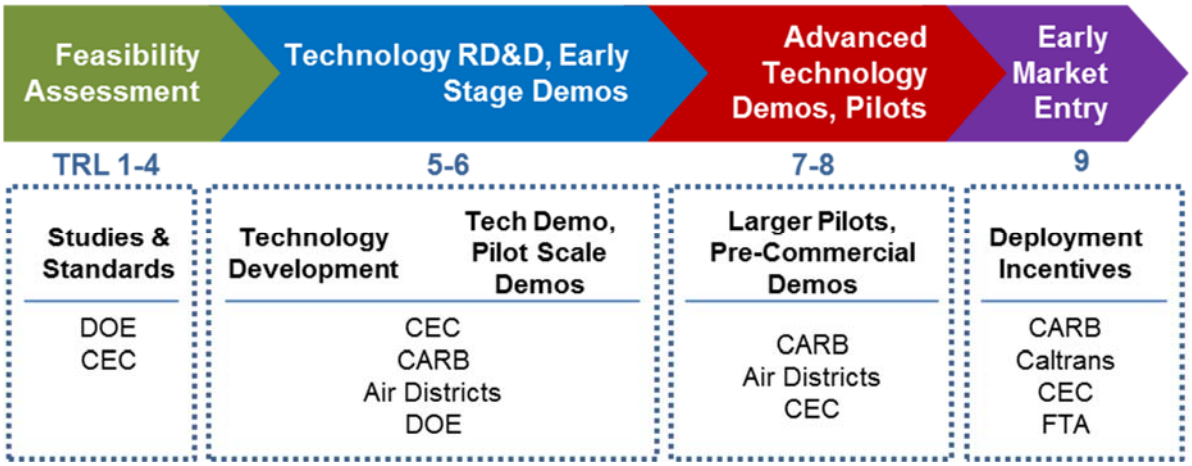
[11] CARB, Mobile Source Strategy, May 2016. https://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.pdf
[12] California Sustainable Freight Action Plan, July 2016. http://www.dot.ca.gov/casustainablefreight/theplan.html
[13] https://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.pdf

Activities like these are helping California meet its air quality, but analysis conducted as part of the Mobile Source Strategy demonstrated that, given the long lifetime of heavy-duty trucks and locomotives, additional incentive funding will be needed to help reach California's long-term goals.

While incentives are designed to help accelerate technology advancement and market penetration, they are also intended to award early adopters of these technologies. As the cleaner technologies become commercially available, costs continue to fall and market adoption increases. Incentives help bring more of the vehicle and equipment fleets into compliance ahead of a potential regulation. Planned regulations also help provide a higher level of certainty to fleet owners who may be hesitant about upgrading their equipment and help to increase acceptance of the new technologies.

Just as there is a range of regulations affecting heavy-duty vehicles and off-road equipment, there are incentives at the local, state, and federal levels that support technology advancement at the demonstration, pilot, and commercial deployment stages or across all technology readiness levels (TRL).[14] Figure II-1 below shows the evolution of technology and the public agencies that provide key incentives across this evolution.

**Figure II-1: Commercialization Arc: Stages and Sources of Public Investment**




As Figure II-1 shows, California invests public funds across the entire evolution of technology. This approach is critical because it provides the opportunity to invest not only in the commercial technologies that help meet important near-term goals, but also ensures continual development, demonstration, and deployment of technologies that are necessary to meet the State's long-term goals. It also signals the importance California places on the development and deployment of these advanced technologies, attracting innovators and green businesses to the state.

[14] https://www.nasa.gov/directorates/heo/scan/engineering/technology/txt_accordion1.html, October 28, 2012

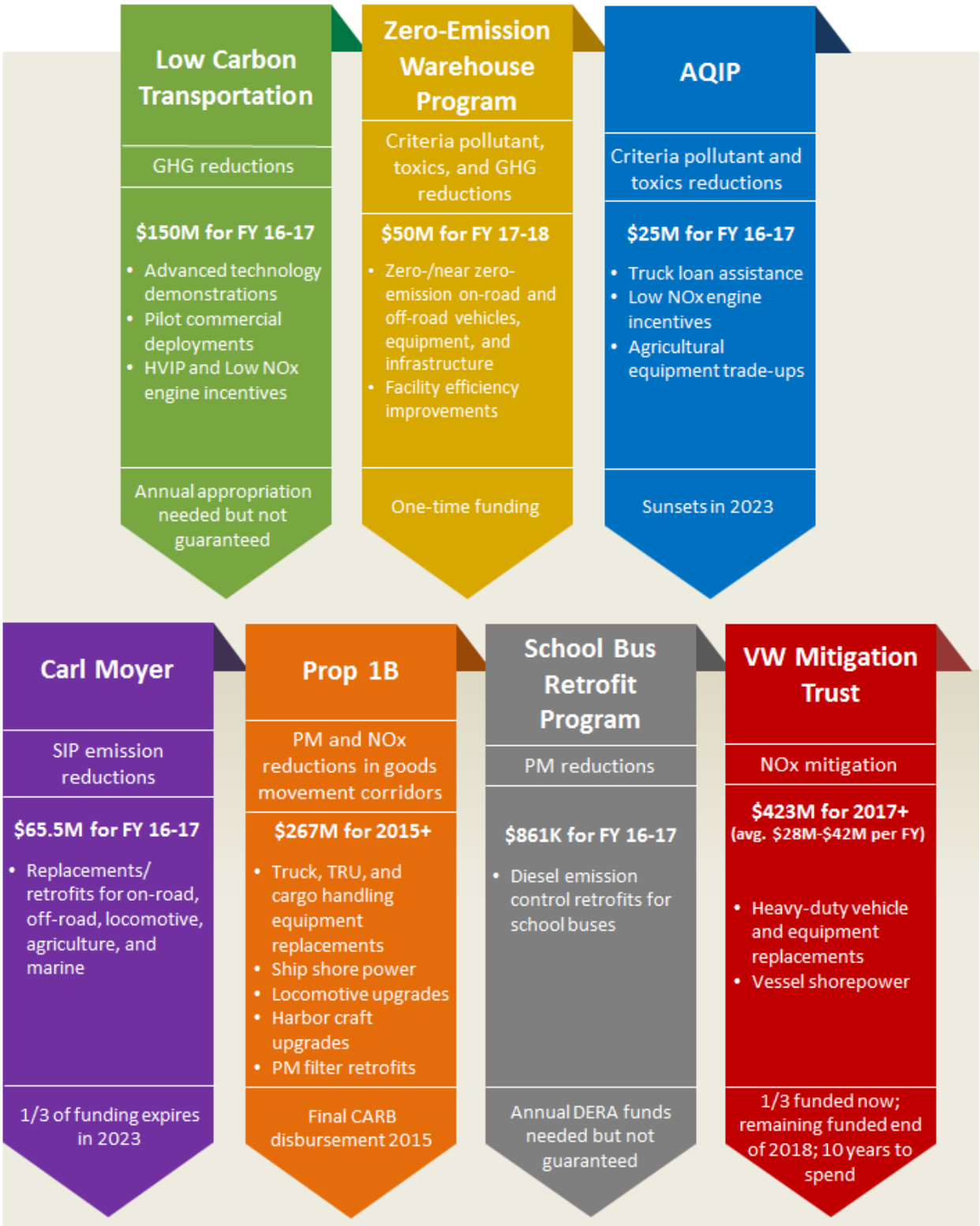
**Financial Sustainability**

Last year's Long-Term Plan for CVRP and Light-Duty Vehicle Incentives included an assessment of when a self-sustaining market is expected and how existing incentives may be modified to recognize expected changes in future market conditions. SB 1275 (Chapter 530, Statutes of 2014) calls for establishing a self-sustaining market for zero-and near zero-emission vehicles in California. This may be a reasonable near-term goal for the light-duty vehicle sector, and in the heavy-duty sector transit applications are coming close to this. However, in most cases, the heavy-duty sector is not yet at the same level of technological advancement, consumer acceptance, or market sustainability. Nevertheless, incentives are not expected to continue indefinitely, and at some point the market is expected to be self-sustaining – once technology providers reach the necessary levels of production and price points that allow them to be financially sustainable. As the market share of zero-emission and near zero-emission vehicles grows, CARB will continue to refine its strategy to most effectively deploy incentives to foster the growth of the clean vehicle market and work with other agencies to ensure incentive funding is coordinated for maximum effect.

## Sources of Funding for Heavy-Duty Investments

As mentioned previously, CARB has a portfolio of programs that funds both the transformation and the increased turnover of the legacy fleets. This year, the CARB funding plan will include funds from three different sources to support heavy-duty vehicle and off-road equipment investments (See Figure II-2, top row of graphic).

**Figure II-2: Current CARB Transportation Incentive Programs**



The Zero- and Near-Zero Emission Warehouse Program is new to the CARB investment portfolio. SB 132 (Chapter 7, Statutes of 2017) amended the 2016 Budget Act to include a one-time $50 million appropriation to CARB for a competitive funding program to advance implementation of zero- and near zero-emission warehouses and technology, with a one-to-one match requirement. This program, by virtue of SB 108 (Chapter 54, Statutes of 2017) which directs the money be invested using the existing AQIP funding plan process, will be included in the FY 2017-18 Funding Plan. It should be noted that when new sources of funding are allocated to CARB, if they are directed to flow through the AQIP process or if their inclusion makes programmatic sense, they will be included in CARB annual funding plans and will reflect the goals laid out in this plan.

Other CARB Funding Sources

The Carl Moyer Program began in 1998 as CARB's first incentive program. It is budgeted at $69 million annually, and provides a source of funding to all 35 air districts in the State. This program complements CARB's regulatory efforts and specifically targets ozone precursors and particulate matter emission reductions. To date the Moyer program has collectively replaced more than 50,000 engines and has reduced more than 178,000 tons of smog and 6,500 tons of toxic diesel PM. Popular funded projects include heavy-duty truck replacement, repower and replacement of off-road construction and agricultural equipment, as well as marine and locomotive projects.

California voters approved Proposition 1B, the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006. $1 billion in the Good Movement Emission Reduction Program has gone mostly to heavy-duty truck upgrades, but the program has also funded cleaner yard trucks, locomotives, cargo handling equipment, harbor craft, and shore power for ships at berth. In addition, Proposition 1B provided another $200 million just for school bus retrofit and replacement. Further rebates for school buses are available through the federal Diesel Emission Reduction Act funding.

Grant funding for lower emission school buses is available through the federal Diesel Emission Reduction Act (DERA). Although this funding is not guaranteed, it remains an important source of funding for replacing older diesel school buses. When these funds are available, they have been administered by the San Joaquin Valley APCD on behalf of CARB for the Lower-Emission School Bus Program.

The Volkswagen Environmental Mitigation Trust (also referred to as Appendix D of the first Partial Consent Decree in the Volkswagen settlement) provides California approximately $423 million to fund specified eligible actions that fully mitigate the lifecycle excess NOx emissions caused by Volkswagen's use of an illegal emissions test defeat device in certain diesel cars sold in California. There are ten eligible mitigation categories from which the State can choose to fund (as determined through a public process), most of which consist of scrap and replace projects for the heavy-duty sector. These include:

- Class 8 local freight and port drayage trucks.
- Class 4-8 transit, shuttle, and school buses.

- Class 4-7 local freight trucks.
- Freight switchers.
- Ferries and tugs.
- Forklifts and port cargo handling equipment.
- Airport ground support equipment.
- Light-duty electric vehicle charging/fueling supply equipment.
- Shorepower for ocean going vessels.
- DERA option.

Within 60 days of the Trust effective date, the Governor must identify a Lead Agency to act of the State's behalf as Beneficiary of the Trust to implement the requirements of the Consent Decree and Trust Agreement. The Trust is expected to become effective in September 2017.

In addition to these programs, the Legislature appropriated CARB funding for two new incentive programs in the budget bill passed on September 15, 2017. One provides $135 million to reduce emissions from agricultural equipment, and the other provides $250 million to implement the community emission reduction programs developed pursuant to AB 617 (Garcia, Chapter 136, Statutes of 2017). These new programs are outside of the scope of this FY 2017-18 Funding Plan for Clean Transportation Incentives. CARB will launch separate public processes shortly to develop these programs with thorough public engagement and input. They provide significant new incentive funding to further progress toward the air quality and climate change goals highlighted earlier in this document. AB 617 would require CARB to prepare a statewide strategy to reduce emissions of toxic air contaminants and criteria pollutants in communities affected by a high cumulative exposure burden. The bill also includes funding to provide grants to community-based organizations for technical assistance and to support community participation in the development of community emissions reduction programs.

<u>California Energy Commission</u>
CARB and the Energy Commission coordinate on their respective investment plans. The Energy Commission administers a key criteria pollutant and GHG reduction investment program for the transportation sector – the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP). Funds that are collected from vehicle and vessel registration fees, vehicle identification plates, and vehicle smog fees provide up to $100 million per year for projects that will transform California's fuel and vehicles to help attain the State's air quality and climate change policies. Investments in alternative fuel production and infrastructure, and vehicle projects can contribute to short-lived climate pollutant emission reductions through reduced diesel consumption, capture and use of biogas from waste management activities as a transportation fuel, demonstration and early commercialization of advanced technology trucks that utilize biogas, and avoided fugitive methane emissions from fossil fuel production and distribution operations.

Another Energy Commission-administered program, the Electric Program Investment Charge (EPIC) Program, supports investments in clean technologies and strategies to improve the State's electricity systems. The program provides opportunities to support short-lived climate pollutant emission reductions from reduced or avoided fugitive methane emissions stemming from fossil fuel production and distribution via investments such as improved energy efficiency technologies in building, industrial, agricultural and water sectors; demand response; distributed renewable generation; electric vehicle infrastructure; demonstration of biomass-to-energy conversion systems; advanced energy storage interconnection systems; and vehicle-to-grid power transfer for electric vehicles.

California State Transportation Agency / California Department of Transportation

The Transit and Intercity Rail Capital Program (TIRCP) was created by SB 862 (Chapter 36, Statutes of 2014) and modified by SB 9 (Chapter 710, Statutes of 2015) to provide grants from the Greenhouse Gas Reduction Fund to fund transformative capital improvements that will modernize California's intercity, commuter, and urban rail systems, and bus and ferry transit systems to reduce emissions of greenhouse gases by reducing congestion and vehicle miles traveled throughout California. The goal of the TIRCP is to achieve the following objectives:

- Reduce GHG emissions.
- Expand and improve rail service to increase ridership.
- Integrate the rail service of the State's various rail operations, including integration with the high-speed rail system.
- Improve safety.

California Electric Utilities

California's electric utilities, pursuant to SB 350, are required to invest in infrastructure for transportation electrification (TE). The large, investor-owned utilities have proposed over $1 billion in TE investments. Approximately three quarters ($779M) of this funding is specifically designated for implementation of medium- and heavy-duty transportation charging infrastructure. The utilities propose to implement most projects in response to requests on a first-come, first-served basis. These planned investments are subject to review and approval by the California Public Utilities Commission (CPUC). Publicly-owned utilities will design and submit their proposals to the Energy Commission by January 1, 2019.

Local Air Districts

Many of California's air districts provide grants to help fund cleaner vehicles. Some of these programs use state funds that are administered at the local level to eligible applicants such as the Carl Moyer Program, AB 923, and others. Some districts have local funds to support programs such as the San Joaquin Valley APCD's waste hauler, tractor replacement, and school bus replacement programs; the South Coast AQMD's Technology Advancement Program, the Mobile Source Air Pollution Reduction Review Committee (MSRC) funding, AB 3766 and Lawn Equipment programs; the Sacramento Metropolitan AQMD's SECAT truck replacement program; and the Bay Area AQMD's

Mobile Source Incentive Fund program. More information about these programs is available on the districts' websites.

U.S. Department of Energy

The U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) funds transportation solutions that put electric drive vehicles on the road and replace imported petroleum with clean domestic fuels. Through the Vehicle, Bioenergy, and Fuel Cell Technologies Offices, EERE advances the development of next-generation technologies to improve plug-in electric and other alternative-fuel vehicles, advanced combustion engine and vehicle efficiency, and produce low-carbon domestic transportation fuels.

The Vehicle Technologies Office (VTO) supports high impact projects that can significantly advance its mission to develop more energy efficient and environmentally friendly transportation technologies that use less petroleum. The VTO is strongly committed to partnerships to help ensure the eventual market acceptance of the technologies being developed. New funding opportunities are announced regularly.

Other examples of DOE grant funding opportunities in the heavy-duty space include the Zero Emission Cargo Transport Demonstration (designed to accelerate the introduction and penetration of electric transportation technologies into the cargo transport sector), Efficient Class 8 Trucks, or SuperTruck initiative (whose goal is developing Class 8 tractor trailers with 50 percent greater fuel efficiency), and the Clean Cities Program, which partners with cities across the country to reduce the use of petroleum in the transportation sector.

U.S. Department of Agriculture

The U.S. Department of Agriculture's National Air Quality Initiative Environmental Quality Incentives Program Fund Pool helps agricultural producers reduce NOx, VOC, and PM emissions from agricultural sources. This usually means funding the replacement of off-road mobile agricultural equipment with new equipment that meets Tier 4 emissions-certification, or meets 2016 or 2017 model-year California emission standards or equivalent.

Federal Transit Administration

The Federal Transit Administration provides funding to transit operators for the purchase of transit vehicles. In addition, the FTA offers specific programs to fund research and incentivize the purchase of zero- or near zero-emission transit vehicles.

FTA's Low or No Emission Vehicle Program is a competitive funding program available to states and transit agencies for the purchase or lease of zero- or near zero-emission transit buses and related equipment, or for leasing, constructing, or rehabilitating facilities in order to support zero- or near zero- emission transit buses. The program provides funding to support the wider deployment of advanced propulsion technologies within the nation's transit fleet.

The Low and No Emission Component Assessment Project is available to eligible institutions of higher education to fund testing, evaluation, and analysis of low or no emission (LoNo) components intended for use in LoNo transit buses used to provide public transportation.

The Zero Emission Research Opportunity (ZERO) is a program available to nonprofit organizations to fund research, demonstrations, testing, and evaluation of zero emission and related technology for public transportation applications.

All of these other funding programs can help to complement investments being made through CARB's Low Carbon Transportation and AQIP programs. These programs need to be considered as part of the process of developing the annual funding plan, as:

- New incentive dollars become available frequently from a variety of sources.
- Funding for heavy-duty incentives is a shifting landscape.
- When funding comes to CARB, if it makes sense, that funding will be incorporated into the AQIP funding plan process.

*CARB provides funding across multiple technologies at different points on their commercialization arcs to support technologies that are providing emission reductions today, as well as the technologies that need to mature to meet future goals.*

## Investment Strategies for Low Carbon Transportation & AQIP

CARB has traditionally considered taking a portfolio approach with the investment of Low Carbon Transportation and AQIP funds. This means that CARB provides funding across multiple technologies at different points on their commercialization arcs in order to support technologies that are providing emission reductions today, as well as the technologies that need to mature to meet future goals. Figure II-3 illustrates this strategy of investing in multiple technologies at varying stages of their development and commercial readiness. The goal is to move forward, in rapid sequence, increasing volumes of advanced technologies over time.

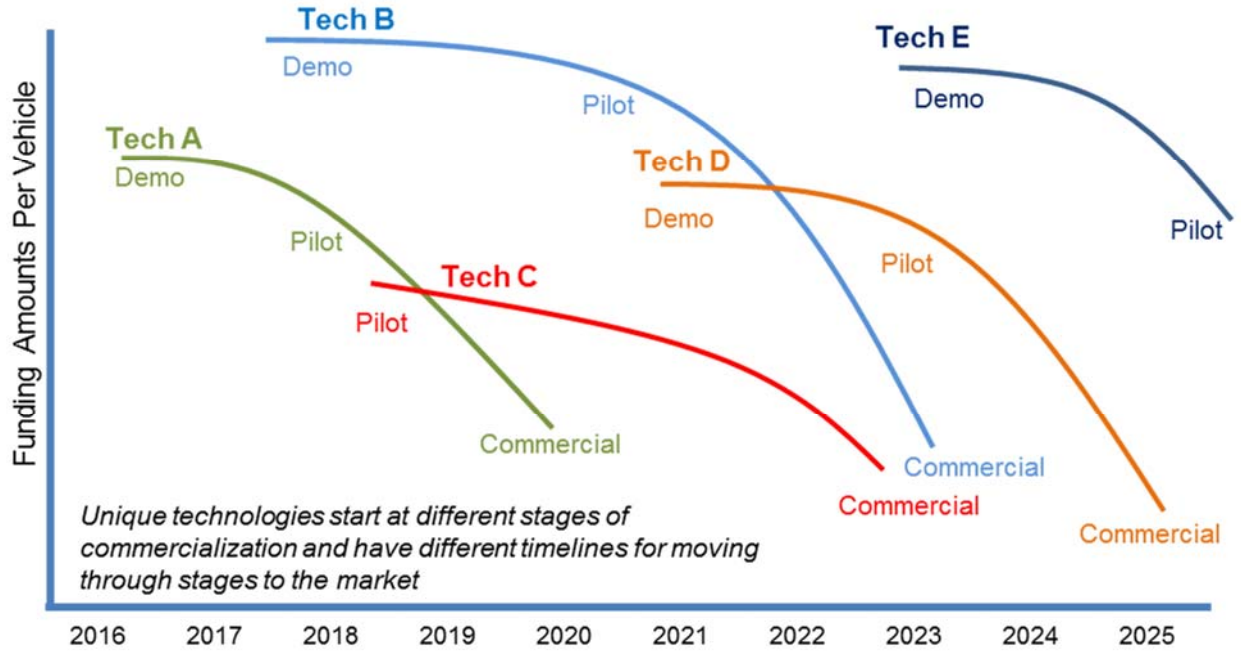
Incentives are provided to help fund the development of advanced technologies through demonstration and pilot projects.

In the demonstration phase, manufacturers are typically focused on producing single vehicle prototypes or small volume vehicle demonstration and testing projects. While per-vehicle incentives are larger for demonstration projects, these investments are crucial because they can accelerate the pace of commercializing advanced technology vehicles and equipment by spurring private investment.

In the pilot phase, projects are typically focused on larger scale deployments where issues around manufacturing design, user acceptance, and support can be assessed. During this phase, per-vehicle incentives are high because engineering designs are still evolving, manufacturing is not standardized and is focused on smaller batches of vehicles. Higher levels of incentives per-vehicle are needed to help entrepreneurs cover the costs of technology development.

In the commercialization phase, incentives are provided to encourage user adoption of advanced technologies. The commercialization phase can be broadly separated into lower-volume and higher-volume production phases. In the lower-volume commercialization phase, sales volumes generally start out low but grow over time as user acceptance increases and manufacturing costs decrease with engineering improvements, supply chain competition and economies of scale. In higher-volume production, incentives can help support the transition of the technology to wide-scale adoption.

**Figure II-3: Conceptual Evolution of the Role of Incentives**




As sales grow and economies of scale are achieved, incentive funding levels and vehicle eligibility requirements can be adjusted to reduce per vehicle funding. This ensures maximum incentive efficiency by better targeting incentive funding to motivate user decisions. In this higher-volume commercialization phase, while per vehicle incentives are decreasing, total sales are increasing and therefore total incentive funding commitments increase.

*For the heavy-duty and off-road sectors, incentives will need to keep increasing over the next three years, and well into the future, to ensure that market successes are solidified and continue to make progress towards reaching State goals.*

When higher volume production and increased market penetration for the technology are achieved, other sources of funding that only fund commercially available technologies, such as the Carl Moyer Program, begin to play a bigger role.

The continued deployment of incentives helps to accelerate the movement of the market in the direction of financial stability. For the heavy-duty on-road and off-road sectors, incentives will need to keep increasing over the next three years, and well into the future, to ensure that market successes are solidified and continue to make progress towards reaching State goals. However, the ultimate goal for each technology application is to reach a point of financial sustainability where incentives can be phased out entirely. As markets continue to grow, CARB staff will work with technology providers, researchers, and others to establish early markers of financial stability.

While this strategy has served CARB incentive funding decisions well for almost a decade, the field of technologies, applications for these technologies, and incentives has widened tremendously and as such, there is a need to refine this strategy to be more focused. This Three-Year Heavy-Duty Strategy or 'roadmap' will help signal CARB's focus for Low Carbon Transportation and AQIP investments and to spark dialogue with other agencies to stretch public funding further with equal or greater impact. Staff proposes doing this by identifying beachheads that can be built upon, much like a foundation, to enable further expansion of a given technology into follow-on applications later. The development of a sequenced roadmap, one that recognizes the different stages of the commercialization process for each technology, sector, and application, while leveraging private sector investments, is essential.

**EMERGING SUCCESS**: CALIFORNIA CLEAN HDV MANUFACTURING

California's clean air and climate policies have become growing magnets for medium- and heavy-duty clean transportation companies and manufacturing in the state. Proterra, originally based in South Carolina, is completing a manufacturing facility in the Los Angeles region and has moved its headquarters to the Silicon Valley. BYD established its first North American electric bus manufacturing and assembly facility in Lancaster, CA and is now doubling the size of that facility to accommodate more capacity for buses and for trucks and fork lifts. It employs 700 people which could double by 2020. Green Power Bus is opening a bus assembly facility in Porterville, CA starting with 60 employees as it enters its first phase. Motiv has recently expanded its design and production facilities in Hayward as has Efficient Drivetrains, Inc. in Milpitas. Both design and make advanced hybrid and electric powertrains and components. A new company has also recently emerged: Chanje. A partnership with a major Chinese vehicle maker, it has established LA headquarters and plans eventual California assembly for electric trucks and shuttles.

## Metrics of Success

As CARB refines its approach to investments, staff is also looking at ways to refine the approach used in measuring the success of these investments. In defining what makes a successful program, the metrics tend to fall into three broad categories, with some overlap between the three: Creating Healthy Communities; Growing the Green Economy; and Supporting Technology Evolution. While the metrics that staff currently quantitatively measure (i.e., Criteria and toxic pollutant and GHG emission reductions, investments in disadvantaged communities), using things like emission reductions or cost per emission reductions alone are not adequate. Qualitative observations (i.e., market trends, increases in suppliers and supply chain diversity, etc.) are also needed to help demonstrate that investments are resulting in measurable progress.

- Creating Healthy Communities – Today CARB quantifies the emission reductions from their projects. Staff also reports on how much of CARB investments are directly invested in disadvantaged and low income communities.

- Growing the Green Economy – Today staff has qualitative information on the expanding supply chain for advanced technology components, the number of manufacturers choosing California as a home for manufacturing, and how incentive dollars are being leveraged with private investment to support the commercial viability of advanced technology.

- Supporting Technology Evolution – Today staff can quantify how investments in commercially available technology are accelerating consumer acceptance. There is anecdotal evidence of reducing production costs for manufacturers. Staff is also collecting observations that investments are accelerating technology transfer from one application to another and improving technology performance.

**METRIC EXAMPLE**
HVIP BENEFITS

One of the projects making use of Low Carbon Transportation and AQIP incentive funding is the Hybrid and Zero Emission Truck and Bus Voucher Incentive (HVIP) Project. Operated as a point-of-purchase incentive to directly reduce the cost to fleets of the cleanest early production vehicles, the project has demonstrated strong success to date in driving fleet deployment:

- 3200+ clean vehicles funded
- 72% of hybrid and zero emission vehicles in disadvantaged communities
- Benefitted nearly 1,000 fleets taking part in all regions of state
- Driven more than $376-million in vehicle purchases

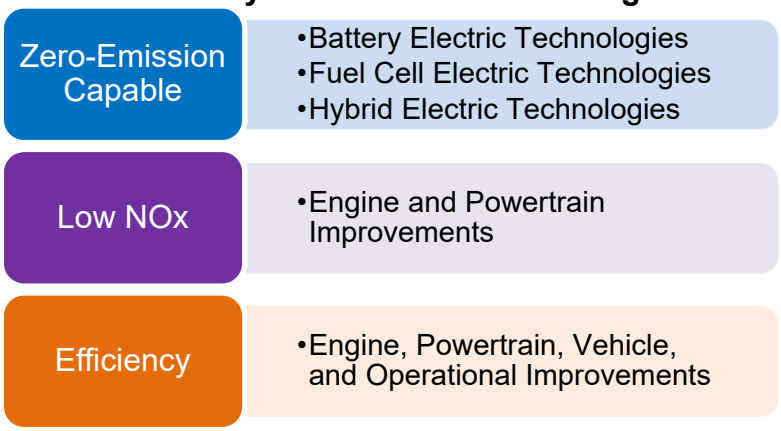
Metrics and Moving Forward

While current practices for monitoring success provide some feedback on the effectiveness of CARB investments in terms of emission reductions, there are additional benefits to these programs that aren't reflected above – and that staff can't as easily reflect quantitatively. For example, when demonstrating a new technology, if it is successful, what is the best approach to quantify the emission reductions that would occur with widespread adoption as opposed to immediate benefits? Will a specific project lead to an expansion in the number of education and training opportunities in advanced technology fields? And if so, is there an approach staff can use to quantify this or is it a qualitative observation? What is the structure, report or framework to more effectively convey these estimates and observations? Staff will work with industry stakeholders and funding partners to address these questions.

## Technology Pathways

These different pathways complement each other and accommodate different needs, while also providing the ability to adopt different technologies best suited to individual regions and applications (see Figure II-4).

**Figure II-4: Pathways to Near-Term and Long-Term Goals**




*It is important to fund pathway technologies and applications at all stages of development to meet immediate and long-term emission reduction goals.*

This will include achieving greater or even full electrification in some sectors, use of low NOx engines with low carbon fuels in others, and employing the kinds of supporting activities that lead to improvements in engine, vehicle, and operational energy efficiencies. Lastly, staff will be looking to identify funding needs and opportunities that support targeted applications across short-, mid-, and long-term time frames – deploying pathway-supporting technologies that are commercially available now, as well as demonstrating and piloting those that will be available on a more mid- to long-term timeframe. It is important to fund pathway technologies and applications at all stages of development to meet immediate and long-term emission reduction goals.

For each of these pathways and technology categories, staff has prepared a preliminary high-level overview of the market assessment of the technology as it pertains to heavy-duty vehicles and off-road equipment. Applications of the technology are characterized in terms of general stages on the path to commercialization and the potential market penetration of the application. These assessments started with the information available from the previously developed technology assessments conducted by CARB staff (in conjunction with staff from other agencies and industry) over the past

two years[15] and included additional or updated data and information from literature and technology providers where available. These status "snap-shots" are broadly guided by the framework of TRLs[16] but are not intended to be absolute. Rather, these status assessments are intended to provide directional information on where pathway technologies generally reside, and what supporting tools or funding could then benefit them. In the technology status charts that follow, the x-axis represents how far the technology has advanced, with those in the early demonstration stage on the left progressing to those that are closer to being commercially available on the right. The y-axis shows the potential market penetration for that technology, with those technologies having a very small market near the bottom, and those with a larger potential market near the top. For example, In Figure II-5, battery electric heavy-duty delivery trucks are near the top left quadrant on the graph because the technology is in the early stages of demonstration, but the potential fleet that can be converted is high. Conversely, transit buses are commercially available, so they are in the right quadrant, but the potential fleet size is smaller than that for trucks.
***Applications listed are meant as reasonable examples to illustrate these points, but do not specifically represent investment targets.***

***<u>Battery Electric Vehicles: Technology Status Snap-Shot</u>***

Battery-electric vehicles (BEV) in the heavy-duty size classes (for the purposes of this document GVWR>8,500 pounds, which include light-, medium-, and heavy-heavy duty vehicles) are in the early phases of commercial market deployment with a focus on several key applications, most notably full size transit buses. There are now nine manufacturers and upfitters – including all the major North American bus makers – producing BEV buses in nearly 20 different models. This expansion shows promise for building out a competitive product offering base as well as building a supply chain capable of supporting other vehicle types and applications.

Other BEV applications in the early market or late pilot stage include medium-duty delivery vehicles, work trucks and shuttle buses. On the off-road side, Class I and II electric forklifts are ubiquitous. BEV yard hostlers, which are designed to move trailers within a warehouse facility, intermodal facility, port terminal, or cargo yard, are on the cusp of moving beyond pilot to early market deployments, as are some select heavier equipment at ports. BEV ground support equipment at airports is available today as a commercially available option (See Figure II-5).

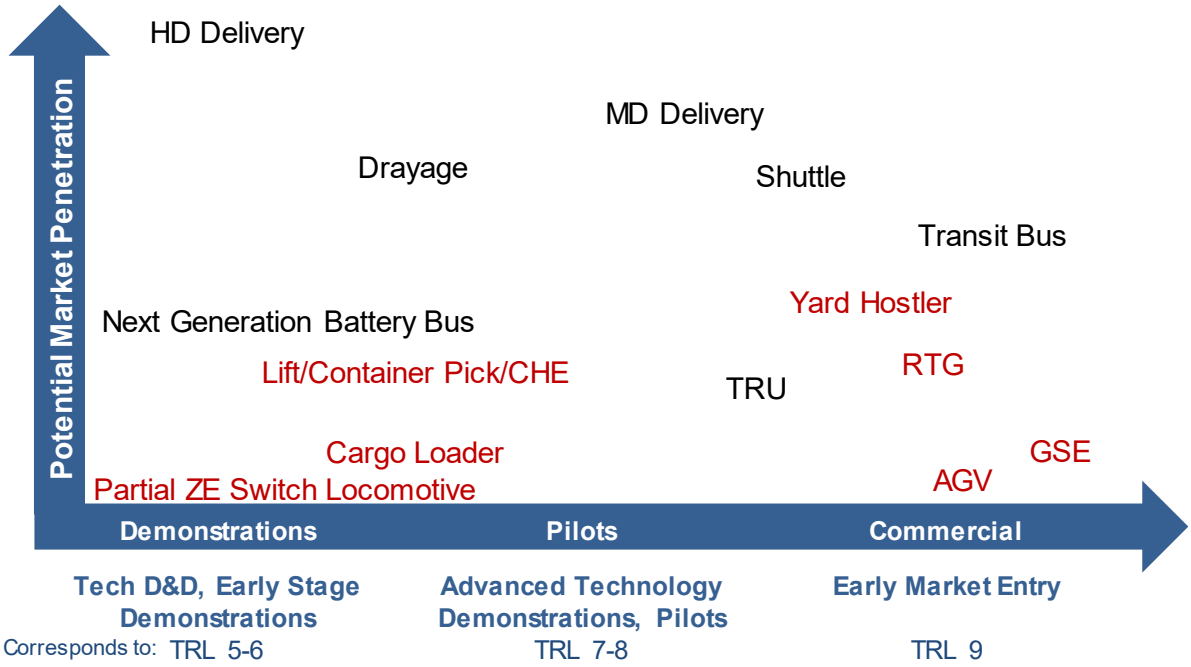
[15] CARB, Technology and Fuels Assessment Reports, June 2015 to December 2016. https://www.arb.ca.gov/msprog/tech/report.htm
[16] NASA, Technology Readiness Levels, October 28, 2012. https://www.nasa.gov/directorates/heo/scan/engineering/technology/txt_accordion1.html

**TECH EXAMPLE**
EMERGING MARKET: BEV DELIVERY TRUCKS

Mitsubishi Fuso, part of the international Daimler Truck Group, is entering the market with the first series production electric truck from a global original equipment manufacturer (OEM). While still very low volume, the Fuso eCantor, a Class 4 delivery truck, is expected to eventually be competitive with conventional vehicle costs for total cost of ownership partly due to its ability to tap automotive volume battery production from parent company Daimler's global battery facility in Europe, which already makes battery packs for Mercedes Benz and Smart electric cars.

There are also several promising demonstration stage projects underway or beginning in BEV drayage truck applications, as well as refuse and other heavier weight class applications, including BEV cargo handling equipment such as top picks, which are used to lift or pick up containers usually at port facilities. All-electric TRUs with solar panels on cargo van roof-tops and trailer axle generators that provide regenerative braking range extender strategies are now in the pilot stage. These projects can benefit from future year funding assistance to help them transition to upgraded system designs and early market stage deployments. There is also the opportunity to leverage on-board battery power to operate zero-emission all-electric TRUs via BEVs, as there is in hybrid systems, without the need for a secondary engine or power source. There are also some early stage dual-fuel switch locomotive designs with sufficient energy storage to allow some zero emission operations.

**Figure II-5: Technology Status – Battery Electric**




*Key: Off-road shown in Red*
*AGV = automated guided vehicle*
*GSE = ground support equipment*
*RTG = rubber tired gantry crane*
*CHE = cargo handling equipment*
*TRU = truck refrigeration unit*

*Source: Based on CARB technology assessments, interviews with manufacturers, and other studies and publications. These may be adjusted before being finalized based on further conversations and gathering additional information.*

<u>Key Barriers to BEV Adoption</u>

Low Carbon Transportation and AQIP funding can assist in overcoming key barriers to current adoption of battery electric heavy-duty vehicles and off-road equipment. These barriers include:

- High incremental cost of the vehicles due to low production volume, energy storage, and electric powertrain costs.
- Potential payload impacts from the size and weight of the battery electric components.
- Limited, though steadily improving, range or time of operations before refueling.
- Infrastructure costs for facility upgrades and fueling demand charges (which may be addressed by recent California Public Utility Commission rate filings from the state's major investor owned utilities).
- Lack of understanding of the business case and best deployment applications;

- Limited vendor and product selection and the accompanying service and support network.

BEV Opportunities over the Next Three Years

In on-road applications, BEV technology is in the development stage to move into heavier vehicle applications such as drayage and regional delivery trucks, where it can be combined with a power source to create an extended range electric vehicle to meet additional duty cycle needs. In the off-road sectors BEV technology is in the development stages for heavy cargo handling equipment such as top picks and heavy lifts. BEV power sources can also support TRUs in delivery applications without the need for a secondary engine or power source.

***Fuel Cell Electric Vehicles and Equipment: Technology Status Snap-Shot***

Fuel cell electric vehicle (FCEV) technology is commercially available now in forklifts and in the late pilot stage or early commercial stage for transit buses, with the development of fuel cell electric trucks and shuttle buses underway. Hydrogen fuel cell forklifts are commercially available in Class I, II, and III lift capacities and are commercially viable alternatives to battery-powered forklifts used for indoor applications. The capability to eliminate indoor emissions, as well as provide consistent power output and quick refueling capabilities compared to battery applications, help make this application of fuel cell technology cost-effective without incentives. Fuel cell-powered TRUs are in the early demonstration phase (See Figure II-6).

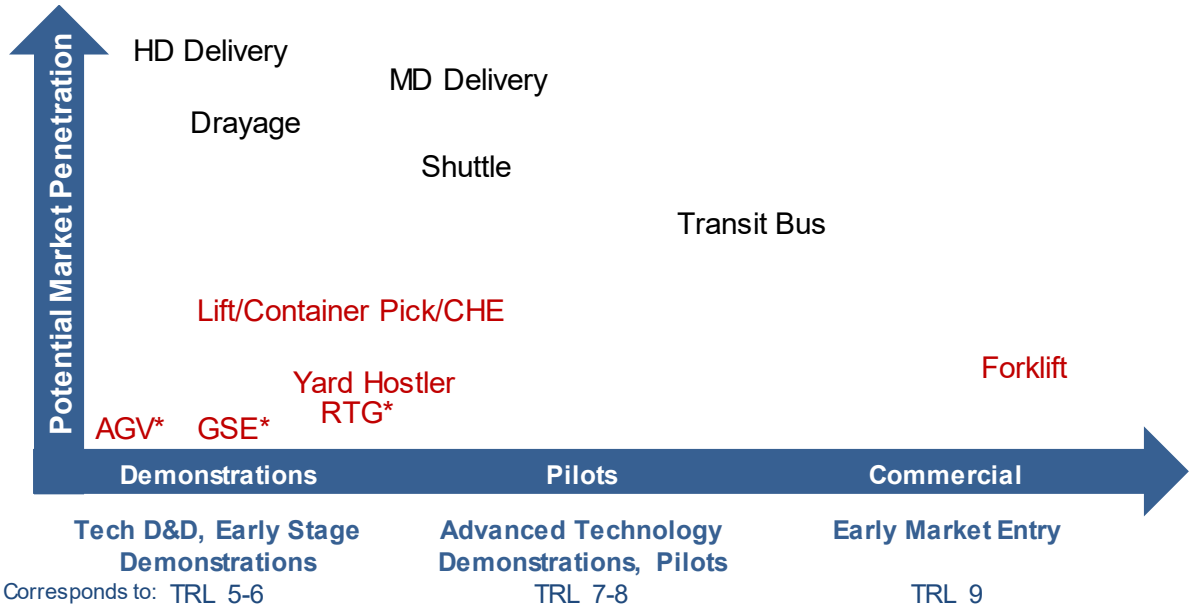
Fuel cell transit buses are in the early phase of commercialization, with approximately 20 operating today in regular transit service in California, including pilot projects underway at Sunline Transit and AC Transit. Fuel cell electric buses offer the same localized zero-emission benefits as battery electric buses, but with faster refueling and a longer range between refueling events. Manufacturers are subjecting their fuel cell electric buses to the same rigorous testing required for bus procurements using Federal Transit Administration funding, signaling that they are serious about increasing production volumes and competing in the zero-emission bus marketplace. Finally, fuel cell electric trucks are in the early stages of development with 11 medium- and heavy-duty demonstration projects underway in the

**TECH EXAMPLE**
FUEL CELL TRANSIT

New Flyer of America, the largest manufacturer of transit buses in the United States, has developed an electric powertrain architecture consisting of drive motors, power electronics and auxiliaries that is the "backbone" of all its electric drive buses. It launched this design in 2014 with battery electric buses. New Flyer has adapted that same framework architecture and integrated a fuel cell with it to power its 40 and 60-foot Xcelsior fuel cell electric buses. The fuel cell, using stored hydrogen, generates electricity to charge the batteries on-board for a range up to 300 miles of zero-emission operation.

United States. Due to many similarities, advancements in the commercialization of both battery electric trucks and fuel cell electric buses have the potential to expedite the commercialization of fuel cell electric trucks. There is promise for FCEV technology to transfer to range-extender functions in on- and off-road applications, including drayage trucks and cargo handling equipment.

**Figure II-6: Technology Status – Fuel Cell Electric**




*Key: Off-road shown in Red*
*AGV = automated guided vehicle*
*GSE = ground support equipment*
*RTG = rubber tired gantry crane*
*CHE = cargo handling equipment*
** Possible future applications*

*Source: Based on CARB technology assessments, interviews with manufacturers, and other studies and publications. These may be adjusted before being finalized based on further conversations and gathering additional information.*

## Key Barriers to FCEV Adoption

Low Carbon Transportation and AQIP funding can assist in overcoming key barriers to current adoption of fuel cell electric heavy-duty vehicles and off-road equipment. These barriers include:

- High incremental cost of the vehicles due to fuel cell stack, balance of plant and hydrogen tank costs.
- Unknowns about the life cycle of the fuel cell and time before replacement.
- Significant infrastructure costs and a lack of easily accessible infrastructure.
- Cost of hydrogen fuel is high relative to current diesel prices.

- Lack of understanding of the business case outside forklifts, and best deployment applications.
- Limited vendor and product selection and the accompanying service and support network.

FCEV Opportunities over the Next Three Years

In on-road applications, FCEV technology is straddling pilot and commercial stages for transit buses and could benefit from some additional pilot funding, particularly to assist with infrastructure. The ability to transfer and scale fuel cell electric systems from smaller applications, such as forklifts, to serve as range extenders for such applications as BEV delivery vehicles looks promising and deserves attention. Similarly, FCEV technology is ready to transfer to other range-extender functions in on and off-road applications, including cargo handling equipment demonstrations.

***Hybrid Electric Vehicles: Technology Status Snap-Shot***

Hybrid-electric vehicles (HEVs) – and more broadly, hybrid vehicles (HVs) – range from existing market entries and emerging market applications, to an array of pilot and demonstration stage vehicles in the heavy-duty and off-road sectors. This snapshot will focus on HEVs; non-electric hybrids are discussed in the Efficiency pathway. The beachhead market for this technology, as is true of many technologies, was established in the transit bus segment. There are early market offerings in the medium-duty delivery and work truck and shuttle bus categories, late pilot stage/early commercial offerings in the plug-in hybrid electric (PHEV) work truck category, and several demonstration stage projects in HEV drayage truck applications, specifically PHEV and extended range series-electric designs. An emergent property of hybrid electric and electric powertrains in general is the ability to provide power to operate zero-emission all-electric TRUs (See Figure II-7).

In the off-road segment, hybrid excavators are entering the early market, and hybrid wheel loaders are in the demo or advanced demo stage, both of which are commonly used for construction purposes. Hybrid cargo handling equipment has been developed, mostly in Europe, and some is entering the very early market. Self-contained hybrid-electric TRUs, using an internal engine to generate electricity for TRU operation, which can also be plugged

**TECH EXAMPLE**
HYBRID TECH TRANSFERABILITY

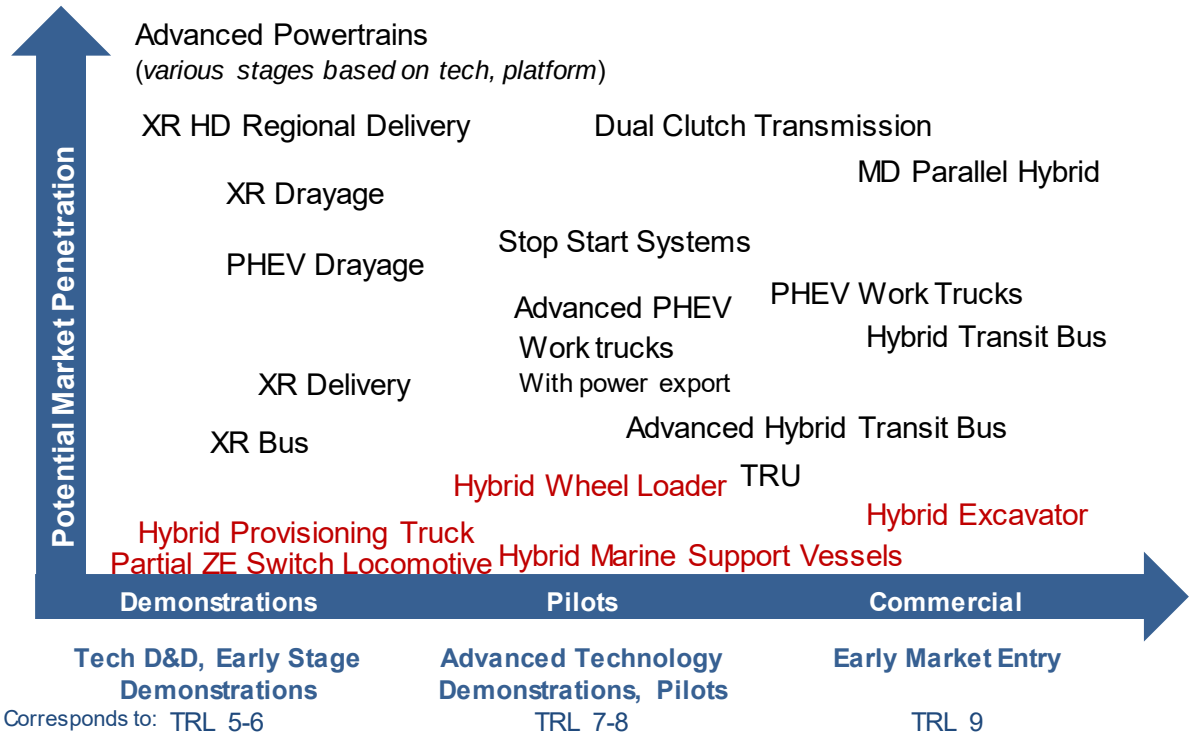
**BAE Systems** is a global leader as a manufacturer and supplier of both hybrid and electric series electric powertrains to the bus industry. It is now taking that bus system design and its main components and transferring them to other applications. With ARB demonstration funding, BAE Systems is working with Kenworth to adapt the bus powertrain for a range extended Class 8 drayage truck. BAE Systems has also already transferred the bus hybrid system components to marine vessels to create hybridized inland river workboats, passenger ferries and tenders.

in when stationary, have been commercially available for over 15 years, and thousands are now in use in the United States. In addition, some locomotive projects incorporating zero-emission mile capability using battery-electric power are entering demonstration and pilot stages. Even in the marine environment, hybrid electric systems for harbor and support vessels has been developed. These applications include tugs, tenders, ferries and other similar vessels. The functions range from full hybrid propulsion to power assistance to on board power for auxiliary systems.

Hybrid systems show promise to enable electrification of the driveline of heavier regional trucks and buses by augmenting their range with a secondary power system. This electrification has already enabled idle reduction at worksites (electric power take-off) and potentially could be used to power TRUs as well as provide ambulance and first responder power. There is increasing work to enable greater electrification of several HEV platforms, from transit buses to work trucks that can allow either additional efficiency and/or some zero-emission (engine-off) driving. For example, the Zero-Emission Drayage Truck Development and Demonstration project is funding the demonstration of heavy-duty (class-8) PHEVs for drayage applications to provide 35 miles of all-electric range. The proposed California Phase 2 GHG regulations contain a provision requiring PHEVs to achieve certain amount of all-electric range in order to generate advanced technology credits.

Hybrid technologies provide synergistic benefits for battery electric and fuel cell heavy-duty vehicle technologies because they share several core components with battery electric and fuel cell electric vehicles. While hybrids are not zero-emission, they provide a pathway for zero-emission technologies. Hybrid electric heavy-duty vehicles help increase the production volume for components like battery packs, electric motors, and control systems by bringing down manufacturing costs, and supporting the supply chain to benefit other zero-emission technologies.

**Figure II-7: Technology Status – Hybrid Electric**




*Key: Off-road shown in Red*
*Hybrid = electric hybrid*
*PHEV = Plug In Hybrid Electric Vehicle; can allow for some zero emission range*
*XR = Extended Range; series electric drive with power generator to allow longer range driving*
*Marine Support Vessels = tugs, tenders, ferries*
*TRU = truck refrigeration unit*

*Source: Based on CARB technology assessments, interviews with manufacturers, and other studies and publications. These may be adjusted before being finalized based on further conversations and gathering additional information.*

## Barriers to HEV Adoption

Low Carbon Transportation and AQIP funding can assist in overcoming key barriers to current adoption of hybrid electric heavy-duty vehicles and off-road equipment. These barriers include:

- The incremental cost of the vehicles, due to energy storage and control system integration, though this has dropped substantially for some platforms.
- Infrastructure is a barrier for plug-in hybrids but not conventional designs.
- Lengthy and expensive certification process for hybrid vehicles and equipment sometimes result in missing incentive funding opportunities.
- OBD integration, and the optimization of hybrid operations with emissions control systems; however, this barrier is being addressed by technology and CARB's Innovative Technology Regulation.

- Lack of understanding of the business case and best deployment applications.
- Limited vendor and product selection.

HEV Opportunities over the Next Three Years

Existing commercial applications need to be bolstered and expanded to grow supply chains, while extended range architectures for medium- and heavy-duty transit and delivery applications need both demonstration and pilot focus. The ability to power TRUs and provide worksite engine-off operation, as well as some drive cycle engine-off operations, need expansion as they bring NOx reduction benefits as well. In the off-road sector, hybrid heavy cargo handling equipment and construction equipment share some common architectures; demonstration projects can expand these capabilities to reduce GHG and criteria pollutant emissions in goods movement.

***Low NOx: Technology Status Snap-Shot***

Low NOx gaseous fuel engines (natural gas and propane) certified to the optional low NOx levels are continuing to make their way into the medium- and heavy-duty on-road sector. As of today, several engines are certified to one of the three optional low NOx standards: the Roush 6.8-liter V10 propane is certified at 0.05 g/bhp-hr NOx, the Cummins Westport 6.7-liter natural gas engine is certified to 0.10 g/bhp-hr NOx, and the Cummins Westport 8.9-liter natural gas engine is certified to 0.02 g/bhp-hr NOx, the cleanest of the optional standards (See Figure II-8).

**TECH EXAMPLE**
LOW NOX SCALABILITY

**Cummins Westport** has validated emission strategies to achieve low NOx emissions on its 8.9-liter engine, the primary natural gas engine for North American bus and refuse markets. These same strategies have been scaled to provide low NOx capability to the (upcoming) 11.9-liter engine for Class 8 trucks and the smaller 6.7-liter motor serving pickup and delivery fleets, shuttle and school buses and vocational applications such as street sweepers and yard tractors.

These engines employ emission controls, such as exhaust gas recirculation and advanced three-way catalysts. Typical applications for the 6.7-liter natural gas engine include shuttle and school buses and medium heavy-duty truck vocations. The 8.9-liter natural gas engine is most often used in transit buses as well as both medium and heavy heavy-duty refuse hauler applications, which shows promise for expansion. Additional low NOx engine certifications are expected over the next three years, which will expand the range of on-road heavy-duty vocations that can utilize these cleaner engines. Staff anticipates Cummins Westport bringing their 12-liter natural gas engines certified to the optional low NOx standards on the market in early 2018. The 15-liter low NOx natural gas engines are not yet available. Technology exists that could enable the first low NOx diesel engines to be certified within the next three years.

There continue to be technological challenges and costs associated with developing low NOx technologies for diesel engines, which have

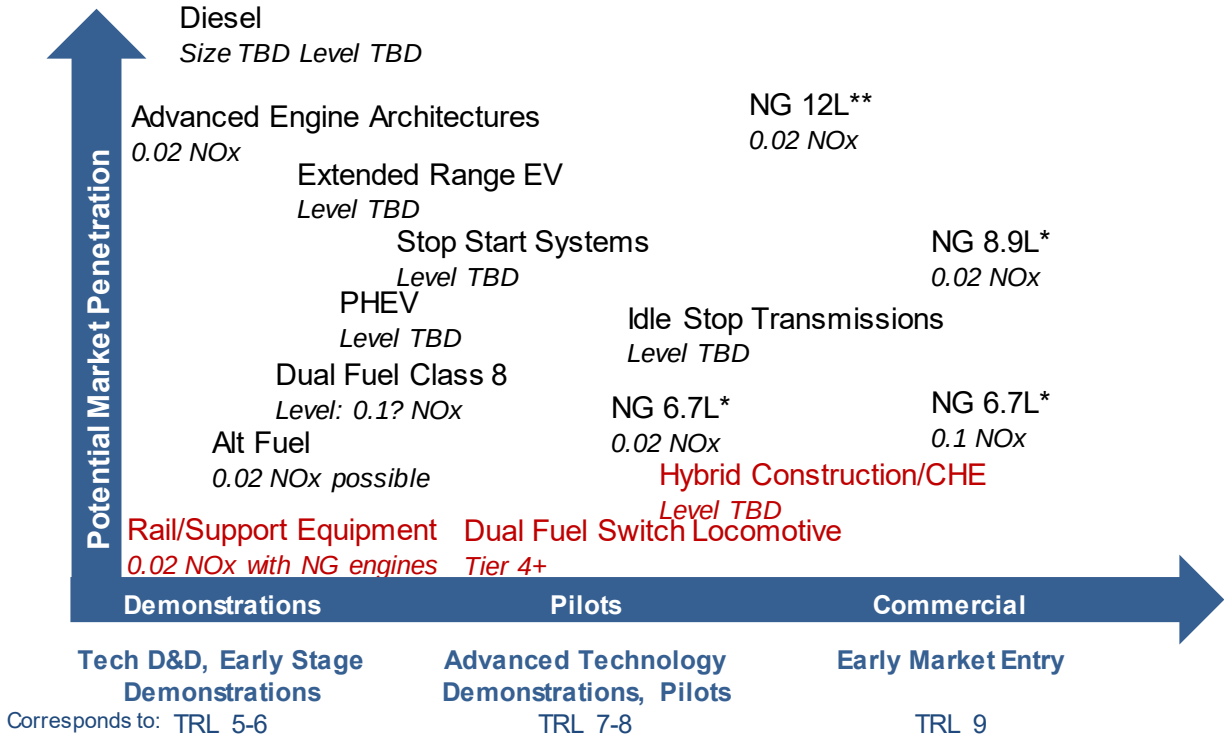
suffered control challenges in low speed and low load operation.[17] Expanding low NOx engine deployment into diesel-fueled vehicles and the heaviest on-road engine weight classes is important for technology transfer to off-road equipment. Additionally, to attain both the lowest NOx level and achieve significant GHG reductions, new low NOx engine technologies need to be paired with renewable fuel use.

While other development projects are underway to reach reduced NOx levels with alternative fuels, less discussed are retrofit and new vehicle options to use dual fuel engines (diesel-natural gas) to potentially achieve one of the low NOx optional standards. Such engines could help with the in-use vehicle installed base and its transition to reduced emissions. Larger displacement dual fuel engines in switch locomotives show the potential to exceed Tier 4 emissions.

Similarly, advanced engines such as opposed piston designs hold promise for significant fuel savings over conventional engines, and their development can include a low NOx pathway. There is also a potential overlap between the hybrid space and low NOx, assuming engines and after treatment systems are sufficiently integrated with the hybrid components and operation; demonstration planning is underway for locomotives with this configuration. With the advent of CARB's Innovative Technology Regulation, there is interest in assessing the potential for NOx reductions over a duty cycle from powertrain (efficiency) improvements.

[17] CARB, Draft Technology Assessment: Low Emission Natural Gas and Other Alternative Fuel Heavy Duty Engines, September 2015.

**Figure II-8: Technology Status – Low NOx**




**Applicable applications include: transit vehicles, refuse haulers, and school buses.*
***Drayage, Class 8 regional haul, some line haul*

*Key: Off-road shown in Red*
*NG = natural gas engine, either compressed or liquefied*
*Alt fuel = a recognized alternative, low carbon fuel other than NG*
*PHEV = plug-in hybrid electric vehicle*
*Dual fuel = engine capable of operating on diesel and NG/alt fuel*
*CHE = cargo handling equipment*

*Source: Based on CARB technology assessments, interviews with manufacturers, and other studies and publications. These may be adjusted before being finalized based on further conversations and gathering additional information.*

## Barriers to Low NOx Adoption

Low Carbon Transportation and AQIP funding can assist in overcoming key barriers to the adoption of low NOx heavy-duty vehicles and off-road equipment. These barriers include:

- The additional cost added to the vehicles.
- Reliability and maintenance concerns with the new systems (diesel).
- Lack of payback for emission reductions systems (unless there is an efficiency or reduced fuel cost benefit).

- Limited vendor and product selection.

Low NOx Opportunities over the Next Three Years

In addressing near-term air quality needs, it is important to accelerate the turnover of conventional natural gas engines to low NOx versions as fleets either repower or buy new vehicles, to expand the market as additional engines become available, and to transition to the use of renewable fuels. To further expand the market, more heavy-duty engine classes and renewable fuel types are needed and this requires expanded demonstration and pilot activities for low NOx diesel, alternative fuel and advanced engines, as well as validating other innovative NOx reduction strategies involving duty cycle improvements, powertrain efficiencies, and engine-off operations. This work should be focused on areas where zero-emission technologies are significantly further behind on the commercialization arc.

***Efficiencies: Technology Status Snap-Shot***

In the heavy-duty and off-road sectors, efficiency strategies can be grouped roughly into three categories: engine/powerplant and drivetrain optimization; vehicle efficiency improvements; and operational/worksite efficiency improvements.

Engine/powerplant and drivetrain optimization technologies (referred to collectively herein as drivetrain technologies) consist of heavy-duty engine and transmission technologies that are intended to result in improved fuel efficiency and therefore a reduction in GHG, criteria pollutant, and toxic emissions. Examples include waste heat recovery systems, stop-start systems, higher efficiency after treatment, air handling improvements, and combustion and fuel injection optimization.

A primary area of opportunity for efficiency gains stems from hybridization, particularly in vocational trucks. This includes all hybrid technologies, including hybrid electric, hybrid hydraulic and hybrid pneumatic systems. Both parallel (when both the

**TECH EXAMPLE**
IDLE REDUCTION FOR WORK AND DRIVE CYCLES

Trucks, buses and equipment are not always in motion. Often, half the time or more in some cases, they are idling. Idling can occur while driving, such as in traffic or at stops, or at a work site while operating equipment powered off the engine. Several companies have developed systems to eliminate this idling while maintaining operations, cutting fuel use and emissions. **Altec**, with a major facility in Dixon, CA, manufactures a system that uses a battery pack to power work tools and lifts without the engine operating on utility trucks. **Odyne Systems** provides a plug-in hybrid system that cuts driving fuel consumption and also powers work equipment like booms and compressors off battery power rather than the engine. **Effenco**'s system uses ultracapacitors to power auxiliaries when the truck engine shuts off at frequent stops, such as with terminal tractors or refuse trucks. **Allison** is validating stop-start systems for its transmissions to shut off the engine at stops. A first market will be their hybrid electric system for buses.

hybrid system and the engine system provide power to the wheels) and series (when the engine systems generate power but only the electric drive system transfers that power to the wheels) architectures will have their benefits, with series systems providing a bridge to range-extended zero emission operations. Hybridization can provide additional benefits, such as in operating vehicle tools without the engine operating, enabling significant idle reduction. They can also export power off the truck or power secondary systems requiring power more efficiently (See Figure II-9).

As noted earlier in the hybrid electric status assessment, hybrid technology also has applications for fuel reduction in construction equipment, cargo handling equipment, locomotive and marine applications. The technologies are at various stages of development, from demonstration phase to, in some cases, early market.

Additional vehicle efficiency improvement technologies consist of modifications to current heavy-duty trucks and off-road equipment (excluding the engine technologies discussed above) that would result in improved fuel efficiency and reduction in emissions. Examples include improved aerodynamics, using lightweight materials, improving axle efficiency, advanced transmissions (such as automated manual transmissions, or AMTs) and connected vehicle technologies (e.g., predictive cruise control, platooning, etc.).

Operation/worksite efficiency improvement technologies can leverage the power of data collected through intelligent transportation systems, telematics, and connected vehicles to make enhancements to industry practices and to improve the movement and delivery of goods and materials, while reducing fuel consumption and associated GHG and criteria pollutant emissions. Examples of locations that stand to potentially gain the most from operational efficiency are sea ports, airports, warehouse/distribution centers, quarries, agriculture, construction, and similar worksites where the same process-type businesses take place day in and day out. The refrigeration systems on TRUs have been optimized starting in 2013 to improve efficiency about 17 percent, allowing down-sized engines for many models, along with reduced GHG emissions.

**TECH EXAMPLE**
HIGH-EFFICIENCY ENGINES

San Diego-based **Achates Power** works with engine manufacturers to design and license advanced opposed piston (OP) engines that can significantly reduce fuel consumption as well as emissions. It has validated large stationary and military combat engine designs as well as smaller light duty engines. It is now scaling those core engines to serve as platforms for new medium and heavy-duty commercial vehicle engines. These engines can utilize many of the same components and after treatment systems of conventional engines with little or no change. But since OP engines eliminate many conventional parts – including the cylinder head, head gaskets, valves, and valve train – and can be built in the same production facilities using the same equipment and processes, OP engines can deliver significantly reduce fuel consumption at unit costs equal to or lower than conventional engines.

Advanced architecture engines, such as opposed piston designs, are only just moving to demonstration phase and show significant promise. Some additional capabilities such as idle-stop and dual-clutch transmissions are in active development. Several demonstration projects are underway in advanced powertrains which is a potentially powerful area for effort, including start-stop capability, hybridized powertrains (next generation designs of what was mentioned above), downsized engines optimized to series-electric or other hybrid powertrains and advanced engines operating on their own or in a hybrid configuration. Idle reduction technology in work trucks, which enable engines to shut-down at worksites, has started to show recent promise though penetration numbers remain low.

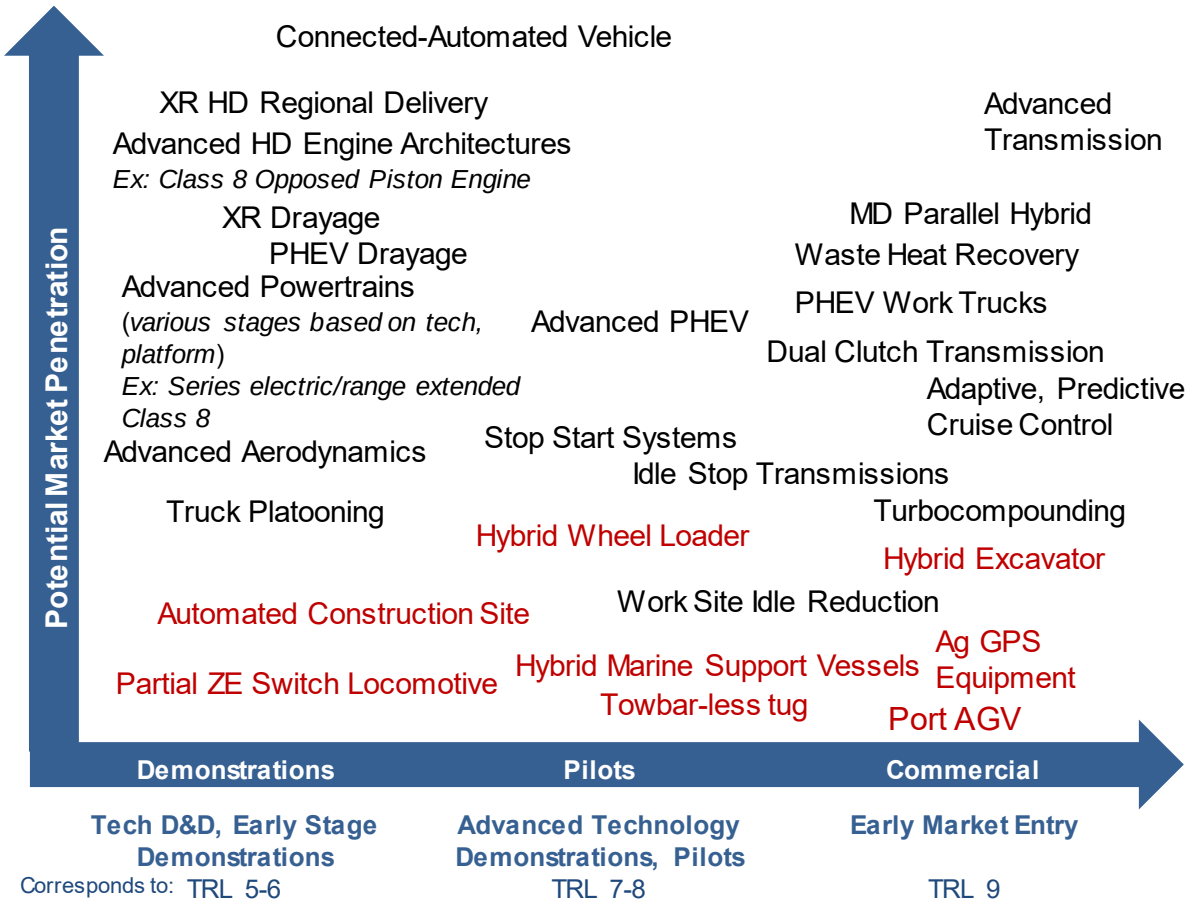
Use of geo-fencing technology to activate and deactivate zero-emission driving modes can benefit urban air quality and efficiency and are promising areas of focus. The off-road market has been using technologies such as automated guided vehicles and agricultural GPS-guided (and sometimes automated) equipment for field work, where introduction risks are low (controlled worksites and private property). However, truck "platooning" and fully automated worksites are still in the early--or mid-demonstration phase. Europe is testing automation and connected technologies at entire worksites with potential reductions in fuel use that should be considered for California.

**TECH EXAMPLE**
CONNECTED AND AUTOMATED TECHNOLOGY

Much of the first adoption of connected and automated technology in medium- and heavy-duty markets has occurred in mining, agriculture and construction, all of which are controlled access, non-highway settings. GPS-based systems to set blade height and track field path for plowing and grading have been long established. Some field equipment has already been adapted for driverless operation. In construction, similar GPS-based systems assist with greater efficiency of machine motion to reduce time needed to perform specific jobs. Such systems are only now starting to reach the on-road segment.

From the standpoint of CARB investments, connected vehicle technologies are viewed as having a "multiplier" effect. While they may not be a large investment category on their own, their inclusion in projects paired with advanced low NOx, near zero- and zero-emission powertrains can extend the effectiveness of these systems and can be encouraged.

**Figure II-9: Technology Status – Efficiencies**




*Connected and automated tech is emerging, but its impact on efficiency is unknown.*

*NOTE: Technology would include connected/automated worksites (ports, construction), and automated agriculture & mining sites.*

*Key: Off-road shown in Red*
*AGV = automated guided vehicle*
*Hybrid = hybrid electric, hybrid hydraulic, hybrid pneumatic*
*Marine Support Vessels = tugs, tenders, ferries*

*Source: Based on CARB technology assessments, interviews with manufacturers, and other studies and publications. These may be adjusted before being finalized based on further conversations and gathering additional information.*

## Barriers to Adoption of Efficiency Opportunities

Low Carbon Transportation and AQIP funding can assist in overcoming key barriers to the continuing adoption of more efficient heavy-duty vehicles and off-road equipment. These barriers include:

- The additional cost added to the vehicles, due to cost of components and relatively expensive integration - this varies greatly by technology.
- The low cost of diesel fuel makes for longer payback times for efficiency technology.
- Infrastructure may be a potential barrier for connected and automated technologies – the question is how much off-vehicle infrastructure is required.
- Lack of understanding of the business case and best deployment applications are a challenge with most new capabilities.
- There is not much familiarity yet with some of the advanced technologies.

Efficiency Opportunities over the Next Three Years

Advanced engine development is a technology gap California funding could fill because of its potential to leap-frog current designs in efficiency. Extended range electric drive architectures for regional vehicles and hybridized systems for off-road equipment are at key demonstration and pilot stages. Worksite and driveline engine off technologies can be accelerated to the market via focused pilots. Combining connected technology with the above strategies, such as geo-fenced power train management, provides a highly-leveraged strategy to move multiple technologies forward. Off-road connected and automated worksite demonstrations will be ready over the timeframe of this Three-Year Heavy-Duty Strategy and could provide users with reduced fuel use and costs while providing NOx reductions in extremely high fuel using classes of equipment.

Additional efficiency improvements are possible, resulting in further engine downsizing and emission reductions. Refrigeration system efficiency improvements are key to extending the range of all-electric battery-powered TRUs.

*Other Emerging Technologies*

There are additional applications of technologies that do not necessarily fit within the three-year timeframe of this plan or within these particular technology pathways, but nonetheless may represent opportunities for helping to achieve our goals in the long-term. These include, for instance, line-haul locomotives, and ocean-going vessels. Equipment in the rail sector is often slow to turnover and often has a long lifespan. Some early demonstration projects utilizing zero-emission or near zero-emission technologies are underway. For the marine sector, the lifespan of a vessel can be 25-30 years. As a result, changes in this sector are often expensive and slow to occur. There are some potential retrofit technologies as well as emission capture and control systems for reducing NOx, PM, and SOx emissions. In each of these areas, there is limited opportunity for technology transfer to other applications, but advances in these technologies do help in meeting our climate and air quality goals.

*Other Barriers*

There are a number of other barriers to adopting lower emission, more efficient heavy-duty vehicles and off-road equipment where CARB investments may not

necessarily be the only driver forging a path forward. These barriers will be important to overcome nonetheless, and include:

- Low diesel fuel costs make for longer payback times even with high utilization and slow the expansion of low NOx natural gas engine adoption.
- Concerns regarding the durability of and warranties for ZEV driveline and battery technologies.

These barriers will need to be addressed outside of CARB's annual Funding Plan development process. Staff anticipates working with other CARB divisions, other State agencies and stakeholders to begin to develop a process for addressing these issues.

Summary of Technology Status Snap-Shots:

These high-level technology status snap-shots provide a planning baseline for the key pathway technologies. Applications on these charts are meant as reasonable examples, but the focus can be further refined by looking at previous Low Carbon Transportation and AQIP investments, paired with the concept of beachheads.

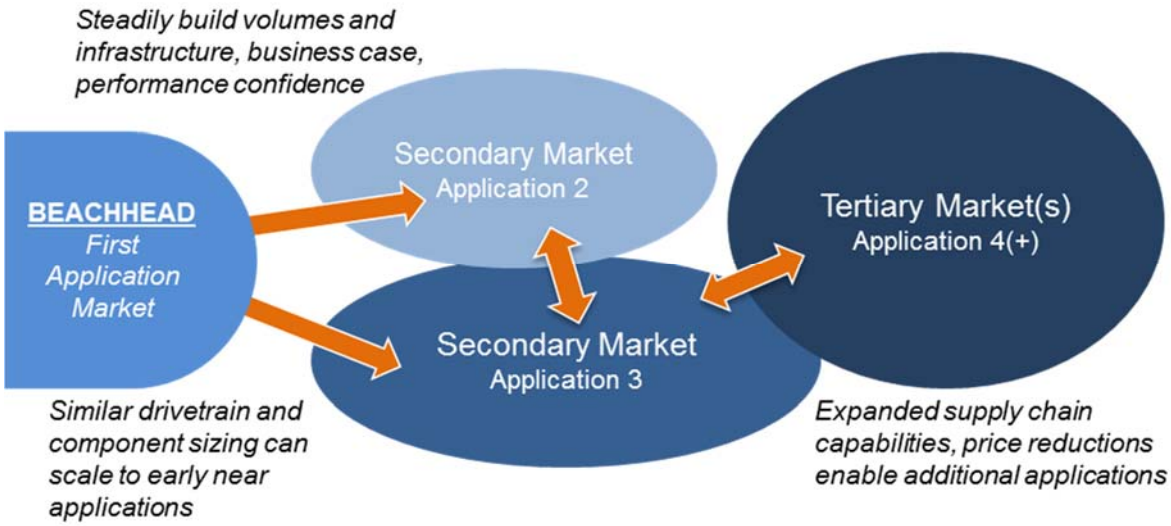
## Beachheads for Technology Pathways

One of the organizing concepts that will guide the Three-Year Heavy-Duty Strategy is using the concept of beachheads. These beachheads, or technology footholds, can be built upon much like a foundation and can enable further expansion into follow-on applications. The beachhead strategy is about focusing resources on a key area or areas, usually a smaller market segment or product, and successfully deploying in that market first, even dominating that market, to assist in moving into larger markets or other applications.[18]

Using this concept, staff is prioritizing most funding around applications that have strong potential to transfer and spread to broader applications. This involves identifying key places in the market where technology can be successful and then serve as a launch pad for additional market segment deployments. An important consideration will be the ability of the technology or its core components to transfer to other applications, or scale to other weight classes in an application. An additional consideration is the ability of the beachhead and its follow-on applications to build the expansion of a common supply chain that can provide similar components for powertrains and systems that can reduce cost over time. This in turn helps to build greater production volumes, leading to continued affordability (see Figure II-10).

[18] *http://timberry.bplans.com/the-power-of-beachhead-strategy.html*

**Figure II-10: Beachhead Process**




As a strategy to best use and leverage public funding, staff, together with consultants and stakeholders, have identified beachheads that align with the funding framework of Low Carbon Transportation and AQIP investments based on previous investments. It is believed that investing in beachheads and their pathways will lead to cost reductions and stable markets as well as provide technology links to the next viable vehicle or equipment platform for manufacturers and component suppliers.

**TECH EXAMPLE**
LEVERAGING MODULARITY

**Motiv Power Systems**, headquartered in Foster City with manufacturing in Hayward, CA, is an innovative electric powertrain maker whose modular and scalable components allow traditional vehicle builders to use existing facilities to build all-electric vehicles based on industry standard chassis and bodies already in use. Their scalable system can be used from Class 4 school buses to Class 8 refuse trucks. Motiv's components and software have proven to be flexible enough to control a range of off-the-shelf components such as electric motors, auxiliary systems, and battery packs, including utilizing packs with different chemistries in the same system. The system also allows for remote maintenance, diagnostics, and software upgrades.

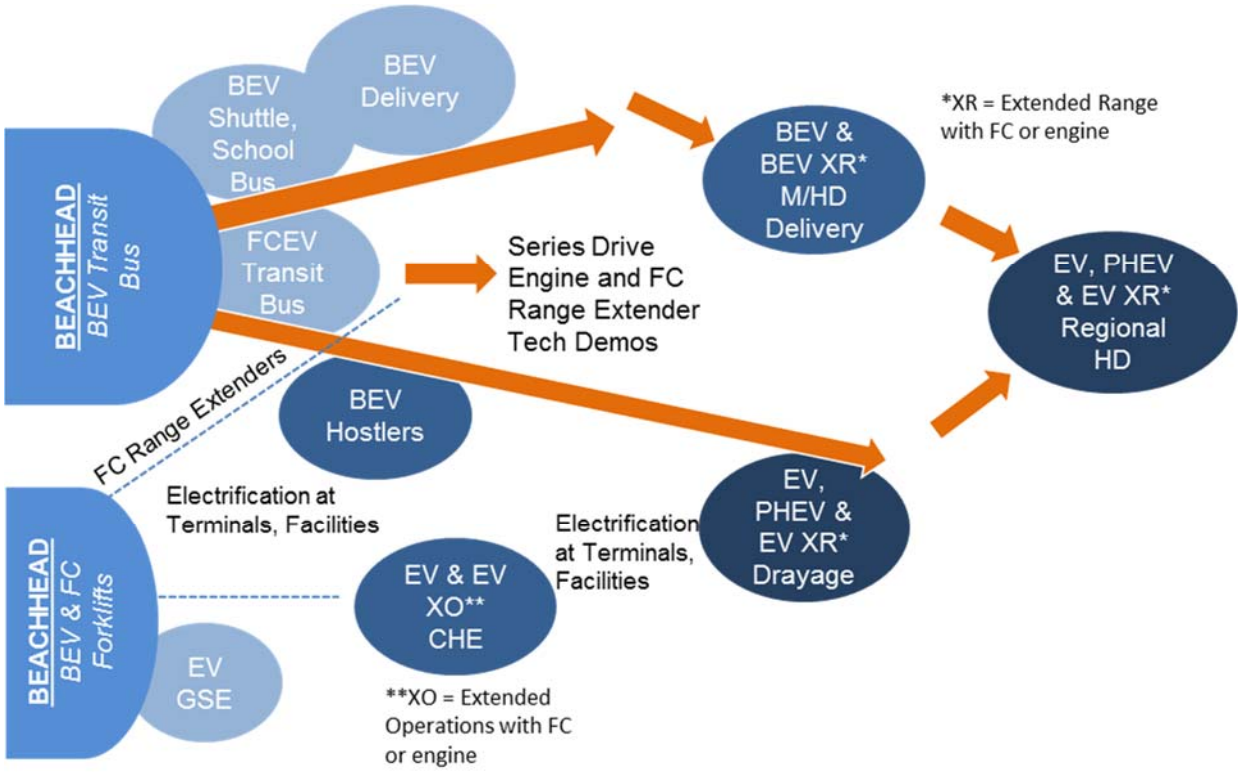
In the heavy-duty vehicle and off-road equipment sector, there are many possible beachheads. It is common for technologies to begin in applications where the fleet is captive – for example, where fleet vehicles return to a home base – like school buses and public transit buses, or where there is limited or no public access, such as a construction site, or agricultural field. Once introduced and successful, the technology would transfer to other applications. Each of the applications shown on the beachheads represents potential targeted funding categories within the 3-year timeframe. Some applications will be ready in the near-term for commercial purchase incentives during this time; some will be ready for pilot stage deployment incentives;

and others will be at the demonstration phase. This approach can be applied to many applications; however, this structure may not function as well for applications like ocean-going vessels and locomotives where there may be less potential for technology transfer.

For purposes of strategically focusing funding that falls into the Low Carbon Transportation and AQIP incentive funding framework, three main beachheads are proposed, along with their resulting progress stages, around the three technology pathways identified earlier: zero-emission capable; low NOx engines; and efficiencies. These beachheads and pathways are not mutually exclusive as some of the efficiency technologies can be overlaid on any one of these beachheads to maximize reductions (i.e. connected-automated vehicles, automated guided vehicles, stop-start systems, etc.).

The following graphics illustrate the vision for the potential sequenced expansion over time of these three technology pathways from early beachheads. Given a dynamic market, timing and stages can change and evolve differently. **Therefore, these sequences are not intended to be absolute or guaranteed, but to guide the investment focus. They represent a reasonable potential to progressively scale and transfer components and capabilities to additional applications and platforms.**

**Figure II-11: Zero Emissions Beachhead: BEV Transit Bus**



As Figure II-11 shows, the BEV transit bus serves as an important beachhead for further advanced medium- and heavy-duty zero-emission vehicle technology development. It was itself enabled by the early success of hybrid technology in this application, which began to expand the use of core electric drive components. In particular, it is serving currently as a launch point for the development of:

- Fuel cell electric transit buses.
- Battery electric shuttle and school buses.
- Battery electric delivery vehicles.

This is due to:

- Similar drivetrain and component sizing that can scale to other applications.
- Supply chain expansion assisted by hybrid, start-stop, and idle reduction technologies (from efficiency pathway).
- Steadily increasing volumes and infrastructure, business case, performance confidence.
- Expanded capabilities, including price reductions in energy storage/components enabling medium- and heavy-duty.

The BEV transit bus, and the expanded applications stemming from it, are also helping support expansions into BEV yard hostlers/terminal tractors, and providing capability for BEV and Extended Range (XR) battery electric heavy-duty delivery vehicles and battery electric and XR battery electric drayage and regional heavy duty delivery vehicles. The extended range capability can come from an engine paired with a generator (genset) or fuel cell power source.

**TECH EXAMPLE**
ELECTRIC TECHNOLOGY TRANSFERABILITY

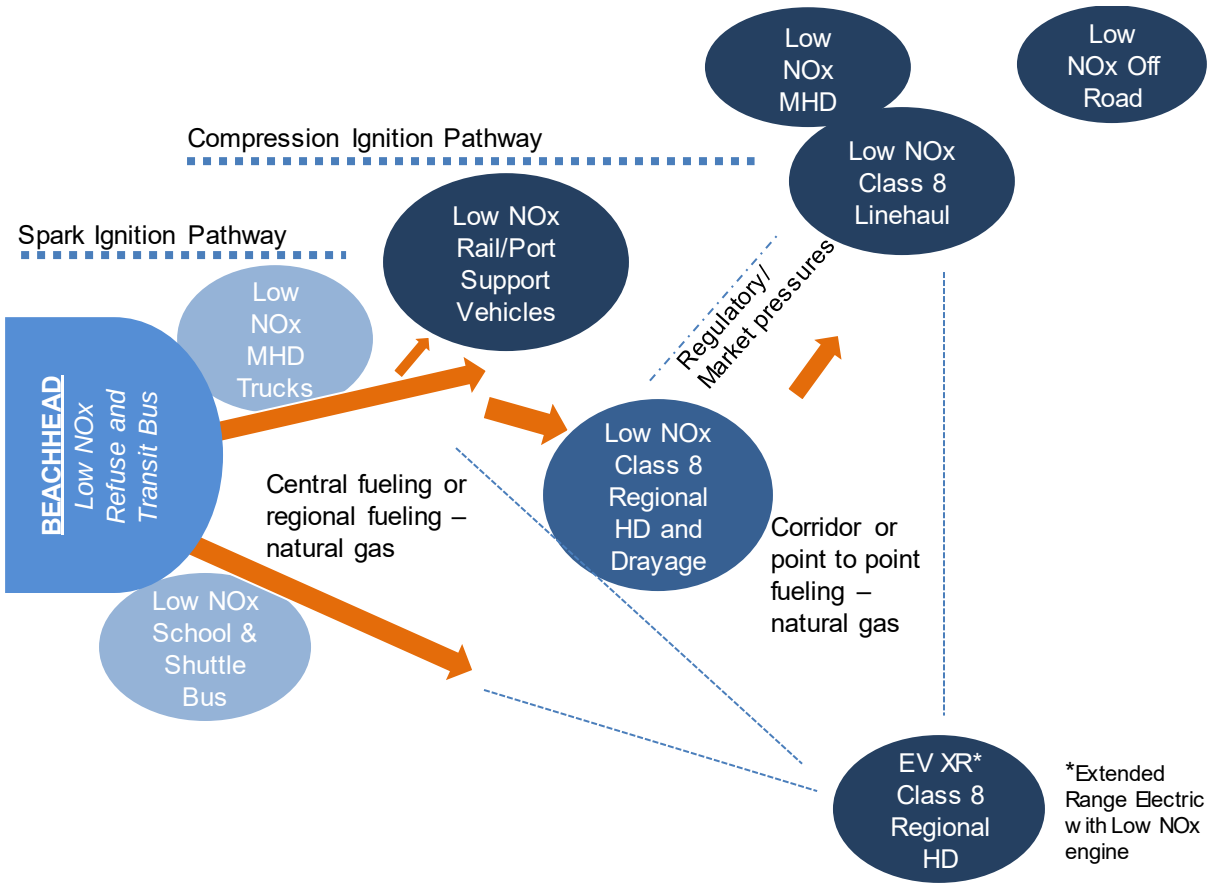
**BYD** is one of the world's leading lithium battery makers; it has taken this core expertise to become the world's largest producer of electric vehicles. It is now expanding its Lancaster, CA production facility to assemble both electric transit buses and electric trucks from Class 5 through 8 sizes. The energy storage batteries in BYD vehicles are highly modular and are universally transferable across medium- and heavy-duty products. While the electric bus motors are generally different from those used in their trucks, there are instances where BYD can use the same bus motors for truck applications. Also, the power electronics and control systems, such as inverters, controllers and voltage distribution units, have a high degree of transferability between bus and truck platforms, and scalability to different size ranges.

There is a parallel zero-emission beachhead that is cross-supporting this expansion: the Forklift/Industrial Lift Beachhead. Industrial lifts have been an important market for zero-emission technologies such as battery electric and fuel cell electric systems. Fuel cell systems from the industrial lift application are now becoming an asset for extended range and extended operation capabilities and are in the demonstration phase for these uses. The knowledge base and core technology is enabling, if not in all cases directly leading to, additional applications, such as:

- Battery GSE.
- Fuel Cell GSE.

- Battery Electric and Extended Operations (XO) Battery Electric Cargo Handling Equipment (CHE).
- Fuel Cell TRUs

**Figure II-12: Low NOx Engine Beachhead: Refuse and Transit Bus**




As Figure II-12 shows, there are two main pathways for low NOx engines: a spark ignition (natural gas) pathway and a compression ignition (diesel) pathway.

The spark ignition pathway around the natural gas and propane market segments, with its beachheads in refuse truck and transit bus applications is already well established. This is primarily driven by the first engine size commercialized, the 8.9 liter engine. With follow-on engine products in larger and smaller displacement sizes, it serves as a beachhead for further medium- and heavy-duty applications like low NOx class 8 regional tractors.

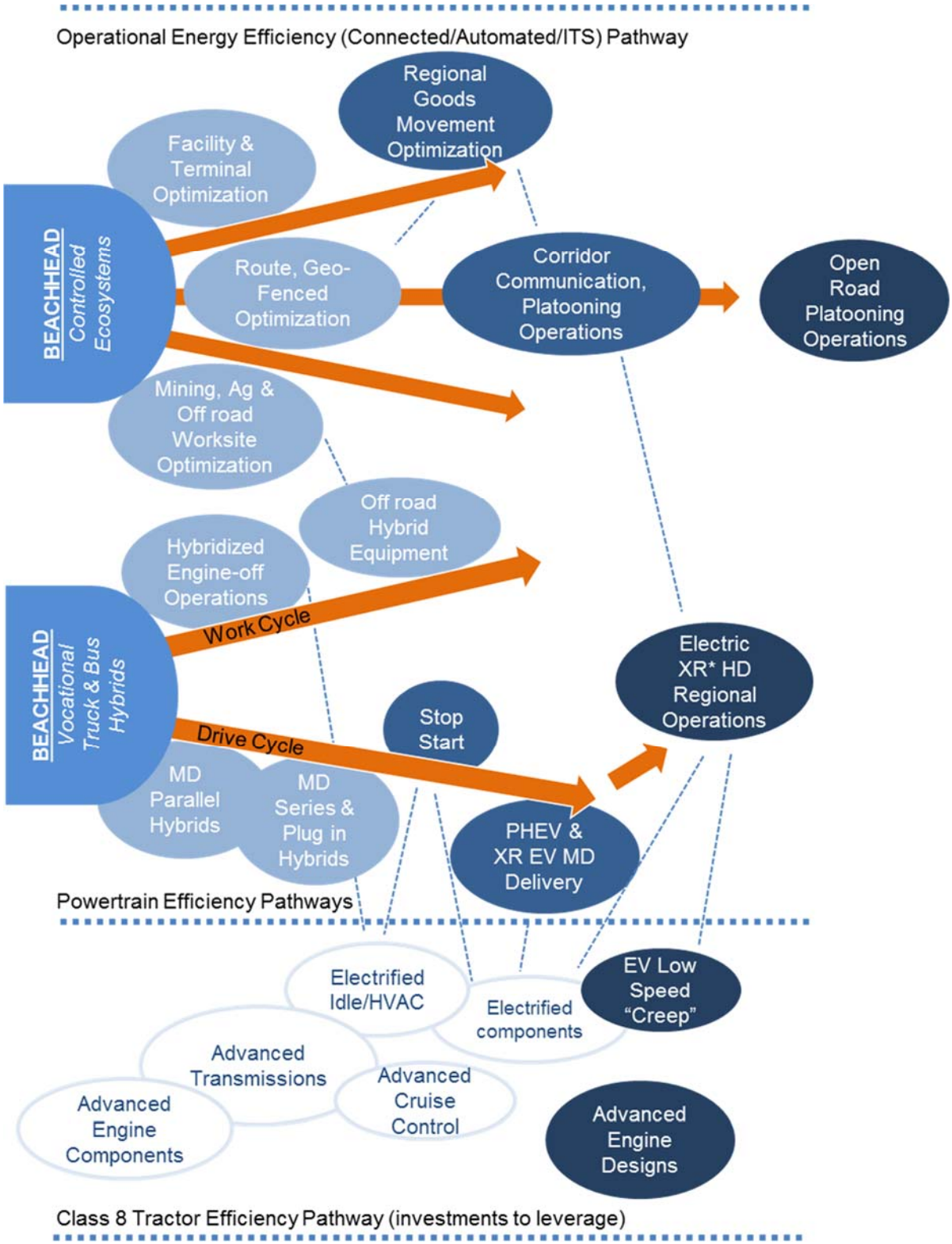
Additional engineering work could lead to other potential application markets, such as low NOx class 8 linehaul/corridor tractors or using low NOx engines as range extender powerplants for class 8 extended range electric regional tractors.

Spark ignited low NOx engines share core components and after-treatment strategies with each other and in general with the existing spark ignition engine marketplace. These engines are emerging in the commercial deployment stage.

The compression ignited (diesel) pathway involves very different engine and after-treatment strategies than the spark ignited pathway and is on a different timeline for potential introduction. Customer and market pressure are likely to drive development of a low NOx product from compression ignited technology. The most likely beachhead for this engine is the Class 8 linehaul application, as this represents highest volumes and the potential for less complicated control strategies than vocational engines. Once established, the control and engine strategies could then be augmented to support applications such as low NOx off-road engines (CHE, construction, agriculture).

Similarly, a low NOx compression ignited engine could also be used as a powerplant for an extended range electric regional class 8 tractor.

**Figure II-13: Efficiency Beachheads: Controlled Ecosystems and Vocational Hybridization**



Efficiencies represent a large arena for technology improvement and include many potential technologies. For purposes of strategic clarity and to best align with California's climate, emission and petroleum reduction goals, this strategy focused on two primary pathways, operational energy efficiency and powertrain efficiency, augmented by leveraging the investments already being made by others in class 8 tractor efficiencies. Figure II-13 shows this landscape and the technology growth from two generalized beachheads: controlled ecosystems and vocational truck and bus hybridization.

For the purposes of this document, a controlled ecosystem is characterized by limited access where advanced systems to control, increase, and optimize the energy efficiency of vehicle and equipment operations can first operate. Such locations reduce risk because of limited or no interaction with general purpose vehicles. Increased efficiency can be accomplished with connected vehicle, "smart" (ITS – intelligent transportation systems), and automated technology solutions.

The first applications of success have been in mining and agricultural markets. There is now an expansion of these applications to other controlled ecosystems, including:

- Off-road worksites (including construction).
- Ports, facilities, and terminals.
- Fleet routing and geofencing.

From these capabilities, additional extensions, deployment, and inter-vehicle connections of the technology can allow for the following:

- Regional goods movement optimization.
- Corridor communications and "platooning" (close following truck convoys with electronic control assistance).
- Full open road truck platooning.

On a parallel track is the powertrain efficiency pathway, and its beachhead, vocational truck and bus hybridization. Many of these hybrid systems have been early enablers of the zero-emission pathway by supporting electric drive components and energy storage development. However, they will also remain important drivers of urban and regional efficiency via several energy storage approaches: hybrid electric,

**TECH EXAMPLE**
ADVANCED HYBRID POWERTRAINS

Milpitas-based **Efficient Drivetrains, Inc (EDI)** is a plug-in hybrid and all-electric powertrain maker and system integrator with a powerful ability to scale its drive system architecture from small trucks to Class 8 vehicles. The underlying control scheme and system enables **OEMs, suppliers and integrators to rapidly and cost effectively bring electric and hybridized vehicles to market while reducing overall development costs. EDI's system of electric motors and clutches** replaces the stock transmission and performs as an All-In-One drivetrain that can function in Two Hybrid or Two Pure Electric Modes providing an optimized powertrain for any driving situation, automatically adapting to driving conditions. Some configurations can even generate excess electricity to use off the vehicle for work or emergency purposes. The design allows EDI to readily adapt to larger or smaller vehicles with the same control

hybrid hydraulic and hybrid pneumatic, as examples.

The initial applications of this beachhead have been in transit bus and delivery applications. The technology capabilities in the on-road markets have been advanced via:

- Parallel systems, which primarily boost or augment conventional engine power to the wheels.
- Plug in systems, which provide additional hybrid energy for greater efficiency or power needs.
- Series systems, which use the conventional engine as a power generator only.

Building on these capabilities, hybrid systems have extended to the worksite for:

- Engine-off operations of tools and equipment at on-road worksites.
- More efficient operation of off-road equipment in construction and CHE applications.

Additional control schemes and system cost reductions are already enabling additional capabilities to be demonstrated, including:

- Start-stop systems to shut off engines at every stop in a drive cycle.
- Plug-in hybrid and extended range electric medium-duty delivery.
- Plug-in hybrid and extended range electric heavy-duty regional operations.

Worth noting are the multiple cross connections between efficiency pathways, including connection to the Class 8 tractor pathway. Significant federal and engine manufacturer investments, including via Supertruck, in waste heat recovery (WHR), turbocompounding, automated manual transmissions, and other systems provides a rich platform to leverage increases in efficiency. It is likely that no additional state investment is necessary in these systems; advanced engine architectures and powertrains are exceptions. Targeted leverage points include technology sets used to deliver overnight idle reduction and augment engine efficiency and include electrically-driven heating ventilation and air conditioning (HVAC) and electrified pumps and compressors. These same systems and their volumes will emerge first in vocational systems, but then benefit from the increased component volumes as they are implemented in Class 8 applications. This can also help enable start-stop technologies.

Operational energy efficiency technology will reduce energy demands of electric and hybrid powertrains, extending their ranges; their electronic control systems will provide easier implementation for greater automation.

These beachheads only begin the discussion of efficiency's complex web of connections. CARB staff welcomes comments and feedback on this beachhead and its connections to additional beachhead concepts.

## Recommendations

What follows are high-level draft recommendations for areas to potentially focus Low Carbon Transportation and AQIP funding across the beachheads that were identified. These are based on 1) the technology status assessments previously summarized, 2) the additional research into each sector performed for this planning, 3) recent trends, and 4) industry conversations and feedback to date. As was discussed in the introduction to this plan, these recommended funding levels do not represent the total funding need, but represent a down payment for potential priority investment areas. Additional funding from other State programs and private investments will also continue to support these efforts. The recommended amounts are guided in part on assessments of OEM and supplier capabilities for producing a meaningful number of demonstration and pilot projects during this three-year timeframe. The funding strategy and amounts are designed to ensure State funds are going to the best projects. These priorities are intended to drive critical progress on near-term and long-term outcomes needed to achieve California's 2030 and 2050 goals. The investments focus on a targeted and vital portion of what needs to move forward over the next three years to impact 2030 and 2050 outcomes, while still also mindful of providing crucial near-term benefits. The strategy is focused on building successful beachheads, seeding the next promising market, and maintaining the innovation pipeline. If significant additional resources were to become available, the transformation of the heavy-duty and off-road sectors could be expedited and, if that funding were sufficient, it could also spur manufacturers to increase production capacity and provide additional fleet support, training and infrastructure.

**TECH EXAMPLE**
GROWING CONNECTION BETWEEN ON- AND OFF-ROAD SYSTEMS

AxleTech International is a global specialty drivetrain technology company. AxleTech has developed a unique electric-powered axle, connecting the electric motor directly to the drive axle of the vehicle and creating an easily installable, efficient electric drive system. While transit buses are a prime market for the product, one early launch has also been an electric terminal tractor from Hoist Lift Truck, a manufacturer of industrial lifts and off road equipment. The system is scalable to various size and weight needs, and transferable between on and off road applications.

**Build on Successful Beachheads.** The recommended strategy will focus, at its core, on building out and ensuring market success in the zero-emission bus and low NOx engine beachhead markets via adequate funding for HVIP vouchers, combined with supporting the secondary markets emerging for each pathway. This includes delivery and shuttle applications for the technologies enabling zero-emission, and drayage service, regional haul, and tractor applications for the low NOx pathway.

Several off-road zero-emission enabling technologies are ready for purchase incentives. BEV yard hostlers are available and can be an off-road beachhead market that will support expansion into drayage as well as other port and terminal equipment. Some port equipment

meets this market threshold, as does much ground support equipment at airports. Therefore, continuing support for an off-road voucher structure to build out these beachheads is recommended.

**Seed Promising Next Markets.** Coupled with this will be aggressive pilot stage investments, potentially including:

- School buses.
- FCEV transit buses.
- Zero- and plug-in hybrid drayage trucks.
- BEV or FCEV yard hostlers and other off-road equipment, in parallel with market incentives, will encourage those ready to purchase to move forward, while supporting additional higher volume assessments.
- Zero-emission and plug-in hybrid port and construction equipment, including wheel loaders, lifts, and cargo handling equipment.
- FCEV medium-duty delivery vehicles, particularly in the higher weight classes (Classes 6-8).

Making use of emerging connected and automated technologies in combination with these pilots will provide a critical test bed to prove out the efficiency benefits of these systems, particularly in off-road worksites and in on-road sequencing and separating of vehicles. Such pilots will ensure that continual progress is made to move this critical technology and application forward and reduce the starts-and-stops often faced with new technology.

**TECH EXAMPLE**
NEW TECHNOLOGY CROSSING OLD BOUNDARIES

While Toyota is mostly known in North America for its passenger cars, its advanced automotive components have demonstrated the ability to both scale and transfer to medium and heavy duty applications. The energy storage systems found in the Hino hybrid truck derived from the same packs in Toyota hybrid cars such as the Prius. Recently, Toyota engineers have also combined two passenger car fuel cell stacks from its Mirai hydrogen fuel cell car to provide the power for a Class 8 drayage truck powertrain.

**Maintain the Innovation Pipeline.** It is recommended that CARB staff work in partnership with other agencies that also provide demonstration stage funding to target demonstration projects around medium- and heavy-duty extended range electric drive technologies. This investment is being made now in the near zero- and zero-emission drayage sector. Similar projects show promise in transit and regional medium- and heavy-duty delivery vehicles. Funding additional advanced high-efficiency engine and low carbon alternative fuel engine demonstrations have longer-term benefits. The off-road sector is also poised for demonstrating breakthrough technologies in high fuel use applications. These technologies include near zero-, zero-emission, and efficiency technologies. The construction and agricultural sectors can be important

demonstration applications because of the ability to transfer and scale many of the technologies to goods movement applications.

**Funding Needed.** To assemble the recommended funding, staff identified the required level of activity to move pathway technologies forward toward 2030 goals over the three-year funding period. The assessment is based on the above listed strategies, the segment opportunities identified in the beachhead assessments and the technology status snap-shots. From this a portfolio of high value priority project funding was assembled. The representative projects were roughly sized based on expected funding needed from the Low Carbon Transportation and AQIP funds in each application category, considering historical investments, possible number, type, and size of vehicles or equipment, project duration, the need to encourage competition, and a desire for multi-regional participation. Past examples of comparable demonstration and pilot projects managed by CARB and other state and regional agencies were also a factor.

*To assemble the recommended funding, staff identified the required level of activity to move pathway technologies forward toward 2030 goals over the three-year funding period.*

Similarly, for the commercial project activities, market research, OEM and supplier interviews, and confidential sales projections from manufacturers were used to develop an aggregated expected market demand projection for HVIP and Low NOx engines. This has been presented to and discussed with industry at separate HVIP work group meetings.

The aggregated results of this planning activity are summarized in the chart below. It highlights the key focus areas to be targeted and frames the range of investments ideally needed each year over the three years of the funding plan to support their progress to near and long term outcomes needed, but is not intended to show all potential areas of funding.

It is important to note that this strategy and the funding it recommends is specific to continuing the technology transfer demonstrated through targeted Low Carbon Transportation and AQIP investments. However, it is just a subset of the larger work required, and does not represent the overall funding need for transforming the heavy-duty and off-road sectors as a whole. As has been highlighted in many public meetings, the need for incentives geared towards meeting California's near- and long-term GHG and air quality goals far exceeds the resources available from these two incentive programs.

*This strategy and the funding it recommends is specific to continuing the technology transfer demonstrated through targeted Low Carbon Transportation and AQIP investments. But is a subset of the larger work required, and does not represent the overall funding need for transforming the heavy-duty and off-road sectors as a whole.*

**Table II-1: Draft Recommendations for Investment Priorities to Advance Long-Term Pathways**

| THREE-YEAR HEAVY-DUTY STRATEGY INVESTMENT PLAN* | | | |
|---|---|---|---|
| | **FY 2018-19** | **FY 2019-20** | **FY 2020-21** |
| **Demos** | $70-135 Million Focus: ZE/PHEV On-Road Drayage, Advanced Powertrains, ZE/Hybrid Heavier Cargo Handling Equipment | $50-80 Million Focus: PHEV/ Extended Range M/HD Delivery, Advanced Powertrains, ZE/Hybrid Heavier Cargo Handling Equipment | $55-85 Million Focus: ZE/PHEV HD Regional Delivery, ZE/Hybrid Construction Equipment |
| **Pilots** | $110-225 Million Focus: ZE Delivery, Facilities, Fuel Cell Transit, ZE Freight Facilities | $150-250 Million Focus: ZE/PHEV On-Road Drayage and M/HD Trucks, ZE/Hybrid Heavier Cargo Handling Equipment, ZE Facilities | $160-275 Million Focus: ZE/PHEV Drayage and Regional Delivery, ZE/Hybrid Heavier Cargo Handling Equipment, ZE Facilities |
| **Commercial** | $175-280 Million Focus: Battery Electric Transit, Low NOx Regional Trucks; Yard Tractors, Cargo Handling Equipment | $240-425 Million Focus: ZE Transit and Delivery, Low NOx Regional Trucks; Yard Tractors, Ground Support Equipment, Cargo Handling Equipment | $335-595 Million Focus: ZE Delivery, Fuel Cell Transit, Low NOx Linehaul Trucks; Ground Support Equipment, Cargo Handling Equipment |
| **Total Funding** | **$355-640 Million*** | **$440-755 Million*** | **$550-955 Million*** |
| *Three-year funding plan investment priorities define yearly focus areas and propose funding that aligns with progress required for key pathways.* <br> ** The draft funding amounts listed here represent a critical down payment towards meeting the funding need outlined at the beginning of this section, but do not meet the entire need.* | | | |

These are preliminary recommendations for the Low Carbon Transportation and AQIP investments and CARB staff will be working with stakeholders and partners to hone the

analysis before final release of the document. This plan should also be considered a 'living document' that will be re-evaluated and updated each year as technology and market conditions evolve.

**Further Observations**

A number of other observations, some related to incentive funding and some not, have been made relative to opportunities and barriers regarding heavy-duty and off-road investments. Staff anticipates that these issues will be addressed outside of CARB's annual Funding Plan process. These observations include:

- Fueling infrastructure. CARB demonstration and pilot incentives reduce the purchase price of vehicles and often does allow for infrastructure costs, but fleets purchasing vehicles that use emerging alternative fuels (e.g. electricity, hydrogen) face potentially expensive fueling infrastructure costs. The impacts of charging increasing numbers of heavy-duty vehicles to the electrical grid need to be considered. In the early years of deployment assistance with infrastructure costs will be crucial.
- Service centers. Advanced technology vehicle suppliers may not yet have an adequate network of service centers in California. Access to local service and warranty support can allay operational concerns for prospective fleets. Building and supporting vocational training programs with California's community colleges will be important. A shared network of service centers around California could reduce the cost of support for each supplier.
- Policy signal. There is a need for a stable multi-year signal on policy and incentives that includes clear metrics of success.
- Vehicle-based approach. If technology investments are expanded beyond powertrains, it will provide a complete vehicle approach that would lead to the greatest and most cost-effective emission reductions.
- California as a first adopter. California's state fleets should be first adopters of these technologies.
- Certification process. Even with CARB's proposed Innovative Technology Regulation, the certification process can be very expensive, and it can be a barrier to the timely introduction of new technologies. This appears to be particularly true for hybrid technologies.
- Better align funding timeline with approval/certification process. The timeline for certification does not align well with the timeline for seeking incentive funding: available incentive funds have often already been spent by the time a technology makes it through the certification process.

## Summary

An ongoing transformation of the transportation sector to the use of zero-emission technologies wherever feasible and near zero-emission technologies with the cleanest, lowest carbon fuels everywhere else will continue to require incentives. CARB's Low Carbon Transportation and AQIP funding represent a key component of this. These

funds are designed to help jump-start the transformation process and provide a down payment on the overall funding need. The need for incentives is quite large; however, multiple agencies at the federal, state, and local level are also contributing funding to this ‘down payment’. Additional sources of funding for heavy-duty and off-road technologies will be included here as they become available. The three-year roadmap outlined in this document builds on CARB’s Low Carbon Transportation and AQIP Investments portfolio approach while applying the concept of beachheads to prioritize funding around those technologies and applications that have strong potential to transfer and spread to broader applications. Such an approach enables a more strategic focus on driving actions needed over the next three years to both support the transformation required for the long-term, as well as needed near-term benefits.

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# ACRONYM LIST

1. AB – Assembly Bill
2. AGV – automated guided vehicle
3. AMT – automated manual transmission
4. ARFVTP – Alternative and Renewable Fuel and Vehicle Technology Program
5. APCD – Air Pollution Control District
6. AQIP – Air Quality Improvement Program
7. AQMD – Air Quality Management District
8. BEV – battery-electric vehicle
9. CalCAP – California Capital Access Program
10. Cal/EPA – California Environmental Protection Agency
11. CAPCOA – California Air Pollution Control Officers Association
12. CARB – California Air Resources Board
13. CEC – California Energy Commission
14. CHDC – Community Housing Development Corporation
15. CHE – cargo handling equipment
16. CO2 – carbon dioxide
17. CPCFA – California Pollution Control Financing Authority
18. CPUC – California Public Utilities Commission
19. CSE – Center for Sustainable Energy
20. CVRP – Clean Vehicle Rebate Project
21. DGS – Department of General Services
22. DOE – Department of Energy
23. DMV – Department of Motor Vehicles
24. EERE – Office of Energy Efficiency and Renewable Energy
25. EFMP – Enhanced Fleet Modernization Program
26. ePTO – electric power take-off
27. EV – electric vehicle
28. FC – fuel cell
29. FCEV – fuel cell electric vehicle
30. FPL – federal poverty level
31. FTA – Federal Transit Administration
32. FY – fiscal year
33. g/bhp-hr – grams per brake horsepower-hour
34. GHG – greenhouse gas
35. GPS – global positioning system
36. GSE – ground support equipment
37. GVWR – gross vehicle weight rating
38. HD – heavy-duty
39. HEV – hybrid-electric vehicle
40. HV – hybrid vehicle
41. HVAC – heating, ventilation, and air conditioning
42. HVIP – Hybrid and Zero-Emission Voucher Incentive Program
43. ITR – Innovative Technology Regulation

44. ITS – intelligent transportation systems
45. LCFS – Low Carbon Fuel Standard
46. LoNo – Low or No Emission Vehicle Program
47. MD – medium-duty
48. MOU – memorandum of understanding
49. MSRC – Mobile Source Air Pollution Reduction Review Committee
50. NG – natural gas
51. NOx –nitrogen oxides
52. N/ZE – near zero- and zero-emission
53. OBD – on-board diagnostics
54. OEM – original engine manufacturer
55. PHEV – plug-in hybrid-electric vehicle
56. PM – particulate matter
57. ROG – reactive organic gas
58. RTG – rubber tired gantry crane
59. SB – Senate Bill
60. SECAT – Sacramento Emergency Clean Air and Transportation Program
61. SLCP – short lived climate pollutant
62. SOx – sulfur oxides
63. TIRCP – Transit and Intercity Rail Capital Program
64. TRL – technology readiness level
65. TRU – Transport Refrigeration Unit
66. VTO – Vehicle Technologies Office
67. WHR – waste heat recovery
68. XO – extended operations
69. XR – extended range
70. ZE – zero-emission
71. ZERO – Zero Emission Research Opportunity
72. ZEV – zero-emission vehicle

# Appendix A

# Emission Reductions: Quantification Methodology

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# Table of Contents


Overview ..... 3
Emission Factor Development ..... 5
GHG Emission Factors ..... 5
Criteria Pollutant and Toxics Emission Factors ..... 7
Quantification Methodology for Projects ..... 9
Annual Per-Vehicle Emission Reductions ..... 9
Project Costs ..... 10
Total Lifetime Emission Reductions ..... 10
Light-Duty Vehicle and Transportation Equity Investments ..... 11
CVRP ..... 11
EFMP Plus-Up ..... 14
Financing Assistance for Lower-Income Consumers ..... 16
Clean Mobility Options for Disadvantaged Communities ..... 18
Agricultural Worker Vanpools ..... 20
Rural School Bus Pilot Project ..... 21
One-Stop-Shop for CARB's Equity ZEV Replacement Incentives ..... 23
Heavy-Duty Vehicle and Off-Road Equipment Investments ..... 24
Zero- and Near Zero-Emission Freight Facilities ..... 24
Zero-Emission Off-Road Freight Voucher Incentive Project ..... 28
Clean Truck and Bus Vouchers ..... 31
HVIP ..... 31
Low NOx Engine Incentives ..... 34
Truck Loan Assistance Program ..... 37
AB 8 ..... 40
Overview ..... 40
Benefit-Cost Score Analysis ..... 41
Additional Preference Criteria ..... 42
Proposed or Potential Reduction of Criteria or Toxic Air Pollutants ..... 43
Contribution to Regional Air Quality Improvement ..... 44
Ability to Promote the Use of Clean Alternative Fuels and Vehicle Technologies ..... 45
Ability to Achieve GHG Reductions ..... 46
Ability to Support Market Transformation of California's Vehicle or Equipment Fleet to Utilize Low Carbon or Zero-Emission Technologies ..... 47

Ability to Leverage Private Capital Investments ..... 47
Total Benefit Index ..... 47
AB 1550: Disadvantaged Community, Low-Income Community, Low-Income Household Investment Targets ..... 49

## Overview

In the Governor's proposed budget for the 2017-18 fiscal year (FY), the California Air Resources Board (CARB) was appropriated $28 million for Air Quality Improvement Program (AQIP) projects, $522.5 million for Low Carbon Transportation Investments from Cap-and-Trade auction proceeds, $25 million for zero-emission vehicle aspects of vehicle replacement programs from the Volkswagen 3.0 liter (L) settlement funds, and $50 million for a new Zero/Near Zero Emission Warehouse Program funded through the Trade Corridor Enhancement Account. This appendix conservatively estimates the emission reductions of the project categories presented in the Funding Plan and provides additional details on the methodology developed and assumptions used. This analysis was guided by Assembly Bill (AB) 8 (Perea, Chapter 401, Statutes of 2013) and published Greenhouse Gas Reduction Fund (GGRF) quantification methodologies.[1]

CARB anticipates updating and revising the analysis in each subsequent Funding Plan as new data becomes available and methodologies are refined. It is important to note that these emission reduction estimates are illustrative examples of potential emission reductions that can be achieved with the funding allocated to these projects. Refined emission reduction estimates will be quantified as projects are implemented and data becomes available.

Table A-1 summarizes the funding allocations for the projects proposed in the Funding Plan and the potential emission reductions over the project life.

[1] Cap-and-Trade auction proceeds quantification materials are available at: https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/quantification.htm.

**Table A-1: Summary of Proposed Projects in the FY 2017-18 Funding Plan and Total Potential Emission Reductions**

| Category | Project | Proposed FY 2017-18 Allocation (millions) | # of Vehicles or Equipment Funded | Total Potential Lifetime Emission Reductions (tons) | | | |
|---|---|---|---|---|---|---|---|
| | | | | GHG | NOx | PM 2.5 | ROG |
| Light-Duty & Transportation Equity | CVRP | $140 | 58,000 | 360,000 | 48 | 19 | 10 |
| | EFMP Plus-Up | $20 | 2,300 | 11,000 | 23 | 1.0 | 5.5 |
| | Financing Assistance for Lower-Income Consumers | $20 | 1,700 | 8,600 | 1.4 | 0.55 | 0.28 |
| | Clean Mobility Options for Disadvantaged Communities | $17 | 430 | 2,100 | 0.28 | 0.11 | 0.06 |
| | Agricultural Worker Vanpools | $3 | 60 | 1,900 | 0.09 | 0.17 | 0.01 |
| | Rural School Bus Pilot | $10 | 30 | 8,200 | 100 | 1.1 | 1.4 |
| | CVRP Rebates for Low-Income Applicants | $40 | 10,000 | 59,000 | 7.8 | 3.4 | 1.6 |
| | One-Stop-Shop for CARB's Equity ZEV Replacement Incentives | $5 | -- | -- | -- | -- | -- |
| Heavy-Duty & Off-Road | Zero- and Near Zero-Emission Freight Facilities | $150 | 473 | 180,000 | 310 | 9.7 | 180 |
| | Zero-Emission Off-Road Freight Voucher Incentive Project | $40 | 300 | 120,000 | 130 | 5.2 | 92 |
| | Clean Truck and Bus Vouchers | $188 | 3,000 | 610,000 | 1,300 | 45 | 10 |
| | Truck Loan Assistance Program | $20 | 6,000 | -- | 6,700 | -- | 94 |

Note: the emissions reductions listed in this table do not include the $10 million to be allocated for transportation equity projects based on demand.

## Emission Factor Development

To support the analysis of emission reductions from the proposed projects, staff developed a set of emission factors for a variety of different vehicle classes. The emission factors and assumptions used in the analysis were derived from a number of sources such as CARB's California-modified Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (CA-GREET 2.0) model,[2] CARB's Emission Factor (EMFAC2014) Model,[3] information from CARB regulation staff reports and emissions inventories, publically available technical reports, and staff assumptions. Greenhouse gas (GHG) emission factors were developed on a well-to-wheel (WTW) basis since greenhouse gases are global pollutants. Criteria pollutant and toxic emission factors are calculated based solely on tailpipe emissions because of their localized impact.

Staff developed emission factors for the following vehicle classes:

- Light-duty vehicles (LDV);
- Light heavy-duty vehicles (LHD);
- Medium heavy-duty vehicles (MHD);
- Heavy heavy-duty vehicles (HHD);
- Urban buses;
- School buses;
- Cargo-handling equipment (CHE);
- Transport refrigeration units (TRU);
- Off-road mobile agricultural equipment (tractors); and
- Locomotives.

### *GHG Emission Factors*

Fuel economy is an important component of the emission reduction analysis, as the value determines the emissions generated based on the consumption of each unit of fuel for the miles traveled or for off-road applications, unit of fuel consumed per hour of use. Fuel economy values were derived from EMFAC 2014[4] and CARB's off-road mobile source emissions inventories[5], specifically the 2011 Cargo Handling Equipment Inventory and the 2011 Transport Refrigeration Unit (TRU) Emissions Inventory models. Table A-2 summarizes the gasoline or diesel baseline, on-road fuel economy values and Table A-3 summarizes the baseline diesel, off-road fuel economy values used in the analysis for conventional vehicles.

[2] http://www.arb.ca.gov/fuels/lcfs/ca-greet/ca-greet.htm
[3] http://www.arb.ca.gov/emfac/2014/
[4] https://www.arb.ca.gov/emfac/2014/
[5] https://www.arb.ca.gov/msei/msei.htm

**Table A-2: On-Road Fuel Economy Values of Baseline Conventional Vehicles**

| Vehicle Class | Fuel Type | Fuel Economy Values (mpg) | | | |
|---|---|---|---|---|---|
| | | 1995 | 1997 | 2013 | 2017 |
| LDV | Gasoline | 23.0 | - | 26.5 | 31.7 |
| LHD | Gasoline | - | - | - | 11.0 |
| MHD | Diesel | - | - | - | 8.9 |
| HHD | Diesel | - | - | - | 6.2 |
| Urban Bus | Diesel | - | - | - | 5.4 |
| School Bus | Diesel | - | 7.3 | - | 7.7 |

**Table A-3: Off-Road Fuel Economy Values of Baseline Diesel Vehicles**

| Vehicle Class | Horsepower Range | Fuel Economy Values (gal/hr) |
|---|---|---|
| | | Tier 4 Final |
| Forklift | 100-174 | 1.4 |
| Yard Truck | 175-299 | 3.5 |
| TRU | 23-25 | 0.7 |

The fuel economy was paired with carbon intensity (CI) values from the Low Carbon Fuel Standard (LCFS)[6] and the lower heating value (LHV) of applicable fuels to calculate the WTW GHG emission factor for each project type, as shown in Formula 1. This was done so that the upstream (well-to-tank) emissions of the fuel were representative of the fuel used, paired with an illustrative potential technology. For on-road vehicles, the GHG emission factor is in units of grams of carbon dioxide (CO2) equivalent per mile (gCO2e/mi), and for off-road vehicles, the GHG emission factor is in units of grams of CO2e per hour (gCO2e/hr).

**Formula 1: GHG Emission Factors**

$$GHG\ Emission\ Factor\ \left(\frac{gCO2e}{mi}\ or\ \frac{gCO2e}{hr}\right) = \frac{LCFS\ carbon\ intensity * LHV\ of\ fuel}{fuel\ economy\ of\ vehicle}$$

For alternative-fueled vehicles, the baseline fuel economy values were converted for a given alternative fuel, using LHVs of the baseline and alternative fuels and the energy economy ratio (EER) value, as shown in Formula 2. EER values were derived from the LCFS Regulation[7] or based on a study on the energy efficiency of battery-electric vehicles compared to conventional diesel vehicles operating on the same duty cycle.[8]

[6] https://www.arb.ca.gov/fuels/lcfs/lcfs.htm
[7] https://www.arb.ca.gov/regact/2015/lcfs2015/lcfsfinalregorder.pdf
[8] https://www.arb.ca.gov/msprog/actruck/mtg/170425eerdraftdocument.pdf

**Formula 2: Alternative Fuel Vehicle Economy**

$$Alt.Fuel\ Vehicle\ Economy\ \left(\frac{miles}{fuel\ unit}\ or \frac{hours}{fuel\ unit}\right)$$
$$= fuel\ economy_{baseline} * \frac{LHV_{alt.\ fuel}}{LHV_{baseline\ fuel}} * EER$$

Lifecycle emission factors were adopted from the LCFS Program's carbon intensities, representing average or typical production processes for each fuel used in California. Staff assumed the following pathways for the fuels analyzed:

- Gasoline: California reformulated gasoline (CaRFG) from the LCFS Lookup Table[9];
- Diesel: ultra low sulfur diesel (ULSD), also from the LCFS Lookup Table;
- Compressed Natural Gas (CNG): volume-weighted average CI of CNG from North American natural gas consumed in California in 2016 from LCFS Reporting Tool (LRT)[10] data;
- Electricity: California grid average mix, which meets the Renewable Portfolio Standard (RPS) requirements, from the LCFS Lookup Table;
- Hydrogen: SB 1505 compliant gaseous hydrogen reformed on-site at the refueling station from a mix of North American natural gas and 33 percent biomethane from landfill gas, from the LCFS Lookup Table;
- Renewable Diesel (RD): volume-weighted average CI of RD consumed in California in 2016 from LRT data; and
- Renewable Natural Gas (RNG): biomethane to CNG (off-site refueling), based on the average CI of RNG consumed in California in 2016 from LRT data.

It should be noted that as more renewables are introduced into the transportation fuel mix, thus lowering the average CI of the fuel, additional GHG benefits may be achieved, which may lower the emission factors. As the fuel mix changes, staff will reflect those changes in future analyses.

## *Criteria Pollutant and Toxics Emission Factors*

For the determination of tailpipe criteria pollutant emission factors for on-road vehicles, staff utilized CARB's EMFAC 2014 model to calculate the tailpipe emissions and emissions associated with the usage of the supported vehicles or equipment, such as idling emissions and PM 2.5 emissions from brake and tire wear, when applicable. For off-road equipment, staff utilized CARB's 2011 Cargo Handling Equipment Inventory and 2011 TRU Emissions Inventory to develop emission factors associated with the usage of the supported vehicles or equipment. In the off-road inventories, PM 2.5 emissions associated with brake wear and tire wear are not identified separately;

[9] https://www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm
[10] https://www.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm

therefore, for off-road equipment, emission factors are based solely on tailpipe emissions. Once information on PM 2.5 emissions associated with brake wear and tire wear become available for off-road equipment, staff will reflect this information in future analyses.

As discussed in previous funding plans, preliminary data show that attaching a hybrid driveline to a vehicle without careful integration with the engine and after-treatment system can have the unintended consequence of increasing criteria pollutant emissions. Subsequently, the emission factors for hybrids are based on a certified vertically integrated hybrid vehicle. Moreover, improved fuel economy from the use of a hybrid system[11] provides improvements in the emission factors as less fuel is used and the upstream (well-to-tank) GHG emissions are reduced.

Staff incorporated deterioration, when available, for both on-road and off-road vehicles. Staff also applied a 50 percent reduction in brake wear emissions for on-road vehicles that implement regenerative braking capability.[12] Emission factors were developed for advanced technology vehicles supported by the proposed projects when appropriate, along with emission factors for baseline conventional vehicles.

[11] Hybrid vehicle fuel economy improvement based on Climate Change Scoping Plan Appendices, Volume I: Supporting Documents and Measure Detail. http://www.arb.ca.gov/cc/scopingplan/document/appendices_volume1.pdf

[12] NREL, BAE/Orion Hybrid Electric Buses at New York City Transit, http://www.afdc.energy.gov/pdfs/42217.pdf, March 2008

## Quantification Methodology for Projects

To quantify the potential emission reductions for each project, staff must first determine the annual per-vehicle emission reductions for each technology weighted by the amount of each technology funded in the project. Once the annual per-vehicle emission reductions are determined, staff estimate the average project costs to determine the number of vehicles or equipment that may be funded by the allotted funding amounts. Finally, to determine the total potential emission reductions for each project, the average annual per-vehicle emission reductions is multiplied by the number of vehicles or equipment funded and the project life. As noted in the individual project write-ups, staff have quantified emission reductions based on an illustrative example due to the uncertainty in the vehicle and equipment types that will be funded.

### *Annual Per-Vehicle Emission Reductions*

Annual emission reductions are first calculated for each eligible or representative technology in the project using the emission factors that have been developed for each project. Annual emission reductions are in units of tons per year (tpy) for the emissions reduced and are calculated by taking the difference in emission rates between the baseline vehicle and advanced technology vehicle and then multiplying by usage. This value is then converted from grams per year to metric tons per year for GHG emissions and U.S. tons per year for criteria pollutants and toxic air contaminants.

For on-road projects, annual emission reductions are calculated using Formula 3, where emission factors are in terms of grams per mile (g/mi) and usage is based on annual vehicle miles traveled (VMT) or miles per year (mi/yr). For off-road projects, annual emission reductions are also calculated using Formula 3, however, emission factors are in terms of grams per hour (g/hr) and usage is in terms of hours per year. Additionally, the vehicle or equipment's load factor, which is an indicator of the nominal amount of work done by the engine for a particular application, and the horsepower rating of the engine are included when developing emission factors for off-road projects.

**Formula 3: Annual Per-Vehicle Emission Reductions**

$$Annual\ Per\ Vehicle\ Emission\ Reductions\ (tpy) = (EF_{baseline} - EF_{ATV}) * Usage$$

Once the annual per-vehicle emission reductions are calculated for the eligible technologies in each project, technology splits are factored in so that the emission reductions on a per-vehicle basis are representative of an average vehicle or equipment replaced under the project, as shown in Formula 4. The technology splits or mix for each project are determined based on historical project data or projected demand.

**Formula 4: Average Annual Per-Vehicle Emission Reductions**

$$Average\ Annual\ Per\ Vehicle\ Emission\ Reductions\ (tpy) = \sum (annual\ emission\ reductions\ per\ vehicle\ type * fraction\ of\ vehicles\ funded)$$

## *Project Costs*

Once staff have identified the incentive cost for each technology and potential technology split for a given project, staff can calculate the average incentive amount for each project, using Formula 5.

**Formula 5: Average Incentive Cost**

$$Average\ Incentive\ Cost\ (\$) = \sum (cost\ per\ vehicle\ type * fraction\ of\ vehicles\ funded)$$

Once the average incentive amount is determined, the allotted funding for the project minus the administrative cost can be divided by the average incentive amount to estimate the number of vehicles or equipment likely to be funded, as shown in Formula 6. Staff evaluated the appropriate administrative cost for each project, which vary depending on the amount of oversight necessary to implement the project.

**Formula 6: Number of Vehicles Funded**

$$Number\ of\ Vehicles\ Funded = \frac{(Proposed\ Funding\ Allocation - Administrative\ Cost)}{Average\ Incentive\ Cost}$$

## *Total Lifetime Emission Reductions*

Once the average per-vehicle emission reductions are determined, it is multiplied by the potential number of vehicles funded and the project life to determine the total potential lifetime emission reductions for a project, as shown in Formula 7.

**Formula 7: Lifetime Emission Reductions**

$$Lifetime\ Emission\ Reductions\ (tons) = average\ per\ vehicle\ emission\ reductions * number\ of\ vehicles * project\ life$$

## Light-Duty Vehicle and Transportation Equity Investments

CARB's light-duty vehicle and transportation equity investments are grouped into two broad project categories: the Clean Vehicle Rebate Project (CVRP) and transportation equity projects. CVRP supports increasing the number of zero-emission vehicles (ZEV) on California's roadways to meet the State's ZEV deployment goals and achieve the large scale transformation of the light-duty fleet. The transportation equity projects are designed to increase access to clean vehicles in disadvantaged communities and lower-income households. The transportation equity projects proposed in this year's Funding Plan include: the Enhanced Fleet Modernization Program (EFMP) Plus-Up Pilot Project, Financing Assistance for Lower-Income Consumers, Clean Mobility Options for Disadvantaged Communities, Agricultural Worker Vanpools, and the One-Stop-Shop for CARB's Equity ZEV Replacement Incentives.

All light-duty vehicle and transportation equity investment projects use the light-duty automobile classification in EMFAC 2014 for the development of emission factors, with the exception of the Agricultural Worker Vanpools Project, which uses the LHD vehicle classification.

In addition to the light-duty vehicle and transportation equity investment projects mentioned above, CARB set aside $10 million to be allocated to transportation equity projects based on demand. The additional $10 million in funding is not quantified in the project write-ups below, but the funds may be used to increase the number of vehicles deployed in the transportation equity projects, which would result in additional emission reduction benefits.

Quantification of the light-duty vehicle and transportation equity investment projects proposed in this year's Funding Plan is described in more detail below.

### *CVRP*

CVRP achieves emission benefits by providing incentives for plug-in hybrid, battery-electric, and fuel cell vehicles to help motivate consumer purchasing decisions and support widespread adoption. When estimating emission benefits for CVRP, staff assumed that the consumer was purchasing or leasing a new vehicle. As a result, emission reductions for CVRP are calculated as the difference between an average 2017 model year conventional light-duty passenger vehicle and an average 2017 model year advanced technology vehicle that was purchased or leased.

Project data from November 2016 through May 2017 shows that approximately 55 percent of standard CVRP rebates went to battery-electric vehicles and 45 percent went to plug-in hybrid vehicles. Project data for low-income applicants for the same period shows that 40 percent of rebates went to battery-electric vehicles and 60 percent went to plug-in hybrid vehicles. For this analysis, staff assumed that rebates for FY 2017-18 would continue to fund those same technologies at similar rates. While fuel cell vehicles are eligible for CVRP rebates, less than 4 percent of the rebates between

November 2016 and May 2017 were claimed for fuel cell vehicles, therefore, fuel cell vehicles are not included in the emission reduction estimates for FY 2017-18.

Table A-4 shows the emission factors for the selected baseline vehicle and PHEV and BEV replacements. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

**Table A-4: CVRP Emission Factors**

| Pollutant | 2017 Gasoline (g/mi) | 2017 PHEV (g/mi) | 2017 BEV (g/mi) |
|---|---|---|---|
| NOx | 0.0313 | 0.0150 | 0 |
| PM 2.5 | 0.0198 | 0.0109 | 0.0099 |
| ROG | 0.0063 | 0.0030 | 0 |
| GHG | 360 | 218 | 113 |

Staff generated vehicle usage assumptions for CVRP through literature review for each of the vehicle types evaluated. The annual usage assumptions for CVRP are shown in the table below.

**Table A-5: CVRP Annual Usage Assumptions**

| Technology | Usage (mi/yr) |
|---|---|
| PHEV | 14,855[13] |
| BEV | 11,059[14] |

Using the emission factors, technology mix, and the annual usage assumptions above, staff calculated the potential annual per-vehicle emission reductions for CVRP, as shown in Table A-6.

[13] Based on 40.7 miles per day. Smart, J., Powell, W., and Schey, S., "Extended Range Electric Vehicle Driving and Charging Behavior Observed Early in the EV Project," SAE Technical Paper 2013-01-1441, 2013, doi:10.4271/2013-01-1441. (http://papers.sae.org/2013-01-1441/)

[14] Based on 30.3 miles per day. Smart, J. and Schey, S., "Battery Electric Vehicle Driving and Charging Behavior Observed Early in The EV Project," *SAE Int. J. Alt. Power.* 1(1):27-33, 2012, doi:10.4271/2012-01-0199. (http://papers.sae.org/2012-01-0199/)

**Table A-6: CVRP Annual Emission Benefits on a Per-Vehicle Basis**

| Type of Rebates | Pollutant | Supported Technologies | Per Vehicle Annual Emission Reductions | |
|---|---|---|---|---|
| | | | Per Technology | Average |
| Standard Rebates | GHG | PHEV | 2.11 | 2.45 |
| | | BEV | 2.73 | |
| | NOx | PHEV | 0.00027 | 0.0003 |
| | | BEV | 0.00038 | |
| | PM 2.5 | PHEV | 0.00015 | 0.0001 |
| | | BEV | 0.00012 | |
| | ROG | PHEV | 0.00005 | 0.0001 |
| | | BEV | 0.00008 | |
| Rebates for Low-Income Applicants | GHG | PHEV | 2.11 | 2.36 |
| | | BEV | 2.73 | |
| | NOx | PHEV | 0.00027 | 0.0003 |
| | | BEV | 0.00038 | |
| | PM 2.5 | PHEV | 0.00015 | 0.0001 |
| | | BEV | 0.00012 | |
| | ROG | PHEV | 0.00005 | 0.0001 |
| | | BEV | 0.00008 | |

For FY 2017-18, staff propose allocating $40 million to CVRP rebates for low-income applicants. Based on project data, staff anticipate the average rebate cost to be $3,900 for low-income applicants and $2,250 for standard rebates.

With the proposed $140 million allocation for CVRP and the average cost discussed above, staff estimate that approximately 58,000 vehicles can be funded, in addition to the 10,000 vehicles that can be funded with the proposed $40 million allocation for CVRP rebates for low-income applicants. CVRP has a 30 month (2.5 years) ownership requirement, therefore, total potential emission reductions for the project are quantified over the course of 30 months and shown in Table A-7.

**Table A-7: Total Potential Emission Reductions for CVRP**

| Type of Rebates | Pollutant | Per Vehicle Average Annual Emission Reductions | Number of Vehicles | Average Annual Emissions | Project Life (years) | Lifetime Annual Emission Reductions |
|---|---|---|---|---|---|---|
| Standard Rebates | GHG | 2.45 | 58,000 | 142,000 | 2.5 | 360,000 |
| | NOx | 0.0003 | | 19.1 | | 48 |
| | PM 2.5 | 0.0001 | | 7.67 | | 19 |
| | ROG | 0.0001 | | 3.87 | | 10 |
| Rebates for Low-Income Applicants | GHG | 2.36 | 10,000 | 23,600 | 2.5 | 59,000 |
| | NOx | 0.0003 | | 3.13 | | 7.8 |
| | PM 2.5 | 0.0001 | | 1.36 | | 3.4 |
| | ROG | 0.0001 | | 0.63 | | 1.6 |

## *EFMP Plus-Up*

EFMP Plus-Up achieves emission reductions by incentivizing the scrap and replacement of old, high-emitting vehicles with cleaner advanced technology vehicles. To calculate the emission reductions for this project, staff used past project data to determine the model year of the baseline vehicle and the replacement vehicle. Based on project data from the 2016 calendar year, on average, a 1995 vehicle model year was being scrapped and was replaced by an average 2013 model year advanced technology vehicle.

Project data for the 2016 calendar year shows that 17 percent of the funding went to battery-electric vehicle purchases, 33 percent went to plug-in hybrid vehicle purchases, and the remaining 50 percent went to conventional hybrid vehicle purchases. For the purposes of this analysis, staff assumed that FY 2017-18 funding would continue to incentivize those technologies at similar rates. Table A-8 reflects the emission factors for the selected baseline, conventional hybrid, plug-in hybrid, and battery-electric vehicles. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

**Table A-8: EFMP Plus-Up Emission Factors**

| Pollutant | 1995 Gasoline (g/mi) | 2013 Conventional Hybrid (g/mi) | 2013 PHEV (g/mi) | 2013 BEV (g/mi) |
|---|---|---|---|---|
| NOx | 0.4353 | 0.0402 | 0.0241 | 0 |
| PM 2.5 | 0.0283 | 0.0106 | 0.0103 | 0.0099 |
| ROG | 0.1018 | 0.0081 | 0.0048 | 0 |
| GHG | 495 | 345 | 261 | 135 |

Staff generated conservative usage assumptions for EFMP Plus-Up based on data in EMFAC 2014 for the baseline vehicle. According to EMFAC 2014, a 1995 model year vehicle operates approximately 7,500 miles per year in 2018.

Using the emission factors and technology mix mentioned above and the annual usage of 7,500 miles per year, staff calculated the potential annual per-vehicle emission reductions for EFMP Plus-Up, as shown in Table A-9.

**Table A-9: EFMP Plus-Up Annual Emission Reductions on a Per-Vehicle Basis**

| Pollutant | Supported Technologies | Per-Vehicle Annual Emission Reductions (tpy) | |
|---|---|---|---|
| | | Per Technology | Average |
| GHG | Conventional Hybrid | 1.13 | 1.60 |
| | PHEV | 1.76 | |
| | BEV | 2.70 | |
| NOx | Conventional Hybrid | 0.0033 | 0.0034 |
| | PHEV | 0.0034 | |
| | BEV | 0.0036 | |
| PM 2.5 | Conventional Hybrid | 0.0001 | 0.0001 |
| | PHEV | 0.0001 | |
| | BEV | 0.0002 | |
| ROG | Conventional Hybrid | 0.0008 | 0.0008 |
| | PHEV | 0.0008 | |
| | BEV | 0.0008 | |

Based on proposed funding amounts and past project data, staff anticipate the average incentive amount to be $7,500 per vehicle. With proposed $20 million allocation for EFMP Plus-Up, staff estimate that approximately 2,300 vehicles can be funded. For the purpose of this analysis, staff estimate that the remaining useful life of the baseline, 1995 model year vehicle is 3 years, therefore, emission reductions are quantified over the course of 3 years. The total potential emission reductions for EFMP Plus-Up are shown in Table A-10 below.

**Table A-10: Total Potential Emission Reductions for EFMP Plus-Up**

| Pollutant | Per-Vehicle Average Annual Emission Reductions (tpy) | Number of Vehicles | Average Annual Emission Reductions (tpy) | Project Life (years) | Lifetime Annual Emission Reductions (tons) |
|---|---|---|---|---|---|
| GHG | 1.60 | 2,300 | 3,680 | 3 | 11,000 |
| NOx | 0.0034 | | 7.74 | | 23 |
| PM 2.5 | 0.0001 | | 0.34 | | 1.0 |
| ROG | 0.0008 | | 1.83 | | 5.5 |

## *Financing Assistance for Lower-Income Consumers*

The Financing Assistance for Lower-Income Consumers project (Financing Assistance) achieves emission reduction benefits by assisting lower-income consumers in purchasing clean vehicles by improving access to more affordable financing options. Because this project is designed to assist the same consumer base as EFMP Plus-Up, staff used EFMP Plus-Up project data to determine the average replacement vehicle. According to EFMP Plus-Up data, the average replacement vehicle is a 2013 model year, so staff used a 2013 model year, conventional gas vehicle as the baseline.

Because this project is designed to help facilitate the purchase of advanced technology vehicles, staff assumed the same vehicle technologies would be funded as in EFMP Plus-Up (17 percent BEVs, 33 percent PHEVs, and 50 percent conventional hybrids). Emission factors for Financing Assistance are shown in Table A-11. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

**Table A-11: Financing Assistance Emission Factors**

| Pollutant | 2013 Gasoline (g/mi) | 2013 Conventional Hybrid (g/mi) | 2013 PHEV (g/mi) | 2013 BEV (g/mi) |
|---|---|---|---|---|
| NOx | 0.0503 | 0.0402 | 0.0241 | 0 |
| PM 2.5 | 0.0187 | 0.0106 | 0.0103 | 0.0099 |
| ROG | 0.0101 | 0.0081 | 0.0048 | 0 |
| GHG | 431 | 345 | 261 | 135 |

Staff generated vehicle usage assumptions for Financing Assistance through literature review for each of the vehicle types evaluated, similar to CVRP. The annual usage assumptions for Financing Assistance are shown in Table A-12.

**Table A-12: Financing Assistance Annual Usage Assumptions**

| Technology | Usage (mi/yr) |
|---|---|
| Conventional Hybrid/PHEV | 14,855[15] |
| BEV | 11,059[16] |

Using the above assumptions and emission factors, staff calculated the potential annual per-vehicle emission reductions for Financing Assistance, as shown in Table A-13.

**Table A-13: Financing Assistance Annual Emission Reductions on a Per-Vehicle Basis**

| Pollutant | Supported Technologies | Per-Vehicle Annual Emission Reductions (tpy) | |
|---|---|---|---|
| | | Per Technology | Average |
| GHG | Conv. Hybrid | 1.28 | 2.03 |
| | PHEV | 2.53 | |
| | BEV | 3.27 | |
| NOx | Conv. Hybrid | 0.00016 | 0.0003 |
| | PHEV | 0.00043 | |
| | BEV | 0.00061 | |
| PM 2.5 | Conv. Hybrid | 0.00013 | 0.0001 |
| | PHEV | 0.00014 | |
| | BEV | 0.00011 | |
| ROG | Conv. Hybrid | 0.00003 | 0.0001 |
| | PHEV | 0.00009 | |
| | BEV | 0.00012 | |

Staff anticipate the average cost per loan, including the vehicle price buy down and loan loss reserve, will range from $9,000 to $12,000 and thus, estimated the average incentive cost per loan would be $10,500.

Based on the proposed $20 million allocation for Financing Assistance and the average cost shown above, staff estimate that approximately 1,700 vehicles can be funded. Financing Assistance has a 30-month ownership requirement; therefore, total potential emission reductions for the project are quantified over the course of two and a half years, as shown in Table A-14.

[15] Based on 40.7 miles per day. Smart, J., Powell, W., and Schey, S., "Extended Range Electric Vehicle Driving and Charging Behavior Observed Early in the EV Project," SAE Technical Paper 2013-01-1441, 2013, doi:10.4271/2013-01-1441. (http://papers.sae.org/2013-01-1441/)

[16] Based on 30.3 miles per day. Smart, J. and Schey, S., "Battery Electric Vehicle Driving and Charging Behavior Observed Early in The EV Project," *SAE Int. J. Alt. Power.* 1(1):27-33, 2012, doi:10.4271/2012-01-0199. (http://papers.sae.org/2012-01-0199/)

**Table A-14: Total Potential Emission Reductions for Financing Assistance**

| Pollutant | Per-Vehicle Average Annual Emission Reductions (tpy) | Number of Vehicles | Average Annual Emissions (tpy) | Project Life (years) | Lifetime Annual Emission Reductions (tons) |
|---|---|---|---|---|---|
| GHG | 2.03 | 1,700 | 3,450 | 2.5 | 8,600 |
| NOx | 0.0003 | | 0.557 | | 1.4 |
| PM 2.5 | 0.0001 | | 0.220 | | 0.55 |
| ROG | 0.0001 | | 0.112 | | 0.28 |

## *Clean Mobility Options for Disadvantaged Communities*

Clean Mobility Options for Disadvantaged Communities (Clean Mobility Options) projects achieve emission reduction benefits by implementing car share programs that use advanced technology vehicles instead of conventional light-duty vehicles in disadvantaged communities. Clean Mobility Options projects also offer alternate modes of transportation that encourage the use of zero-emission and plug-in hybrid vehicles, vanpools, and other mobility options. While a number of strategies can be employed, the use of advanced technology vehicles instead of conventional light-duty vehicles in a car sharing component provides the primary GHG reductions resulting from a project. For this analysis, staff estimates reductions from the emissions offset between a brand new, conventional light-duty vehicle and an advanced technology vehicle. As project data becomes available, staff anticipate updating this analysis to also reflect alternate modes of transportation.

The first Clean Mobility Options pilot project launched in May 2017, with another to launch later in 2017. Because future projects are unknown, for this analysis, staff assumes that vehicles funded are an equal split of battery-electric and plug-in hybrid vehicles. Table A-15 shows the emission factors for the selected baseline vehicle and PHEV and BEV replacements. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

**Table A-15: Clean Mobility Options Emission Factors**

| Pollutant | 2017 Gasoline (g/mi) | 2017 PHEV (g/mi) | 2017 BEV (g/mi) |
|---|---|---|---|
| NOx | 0.0313 | 0.0150 | 0 |
| PM 2.5 | 0.0198 | 0.0109 | 0.0099 |
| ROG | 0.0063 | 0.0030 | 0 |
| GHG | 360 | 218 | 113 |

Staff generated an annual usage assumption of 8,200 miles per year for Clean Mobility Options based on data from other car sharing programs in the United States.[17]

Using the above assumptions and emission factors, staff calculated the potential annual per-vehicle emission reductions for Clean Mobility Options, as shown in Table A-16.

**Table A-16: Clean Mobility Options Annual Emission Reductions on a Per-Vehicle Basis**

| Pollutant | Supported Technologies | Per-Vehicle Annual Emission Reductions (tpy) | |
|---|---|---|---|
| | | Per Technology | Average |
| GHG | PHEV | 1.16 | 1.59 |
| | BEV | 2.02 | |
| NOx | PHEV | 0.00015 | 0.00022 |
| | BEV | 0.00028 | |
| PM 2.5 | PHEV | 0.00008 | 0.00009 |
| | BEV | 0.00009 | |
| ROG | PHEV | 0.00003 | 0.00004 |
| | BEV | 0.00006 | |

Based on costs to lease or purchase new or used project eligible vehicles that range from below $10,000 to more than $100,000, staff believes that a reasonable estimate for the average incentive amount for is $35,000. Based on the proposed $17 million allocation for Clean Mobility Options and the average cost of $35,000, staff estimates that up to 430 vehicles can be funded.

The required project life for Clean Mobility Options vehicles is one to two and half years. However, light-duty vehicles can last about 15 years. For the purpose of this analysis, staff conservatively assumed that emission reductions will occur over the course of 3 years. The total potential emission reductions for Clean Mobility Options are shown in Table A-17.

[17] Martin, E., Shaheen, S., and Lidicker, J. "Impact of Carsharing on Household Vehicle Holdings," *Transportation Research Record: Journal of the Transportation Research Board,No. 2143,* Transportation Research Board of the National Academies, Washington, D.C., 2010, pp. 150–158. DOI: 10.3141/2143-19. http://sfpark.org/wp-content/uploads/carshare/Impact_of_Carsharing_on_Household_Vehicle_Holdings.pdf

**Table A-17: Total Potential Emission Reductions for Clean Mobility Options**

| Pollutant | Per-Vehicle Average Annual Emission Reductions (tpy) | Number of Vehicles | Average Annual Emission Reductions (tpy) | Project Life (years) | Lifetime Annual Emission Reductions (tons) |
|---|---|---|---|---|---|
| GHG | 1.59 | 430 | 685 | 3 | 2,100 |
| NOx | 0.00022 | | 0.093 | | 0.28 |
| PM 2.5 | 0.00009 | | 0.037 | | 0.11 |
| ROG | 0.00004 | | 0.019 | | 0.06 |

## *Agricultural Worker Vanpools*

The Agricultural Worker Vanpools pilot project (Agricultural Worker Vanpools) achieves emission reduction benefits by providing incentives for advanced technology vehicles instead of conventional vehicles to be used for agricultural worker vanpools in disadvantaged communities. While Agricultural Worker Vanpools may achieve more significant emission benefits through VMT reductions and the displacement of single owner vehicles, there is not enough project data yet to quantify the potential emission reductions from VMT reductions or vehicle displacements. For the purposes of this analysis, staff estimated reductions from the emissions offset between a new 2017 model year, conventional light heavy-duty (LHD) van and an advanced technology van.

The Agricultural Worker Vanpools solicitation has not yet been released. There is not yet enough data to determine the technology splits, so for this analysis, staff assumes that the funded vehicles will be conventional hybrid vehicles. Emission factors for Agricultural Worker Vanpools are shown in Table A-18. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

**Table A-18: Agricultural Worker Vanpools Emission Factors**

| Pollutant | 2017 Gasoline (g/mi) | 2017 Conventional Hybrid (g/mi) |
|---|---|---|
| NOx | 0.0457 | 0.0366 |
| PM 2.5 | 0.0362 | 0.0195 |
| ROG | 0.0071 | 0.0057 |
| GHG | 1,038 | 830 |

Staff also generated an annual usage assumption of 25,000 miles per year based on the average use of a 2017 model year, LHD van in EMFAC 2014.

Using the above assumptions and emission factors, staff calculated the potential annual per-vehicle emission reductions for Agricultural Worker Vanpools, as shown in Table A-19.

**Table A-19: Agricultural Worker Vanpools Annual Emission Reductions on a Per-Vehicle Basis**

| Pollutant | Per-Vehicle Annual Emission Reductions (tpy) |
|---|---|
| GHG | 5.19 |
| NOx | 0.00025 |
| PM 2.5 | 0.00046 |
| ROG | 0.00004 |

Estimating the cost for all components for a van conversion to a hybrid system van equipped to carry agricultural workers, staff anticipates the average incentive amount per van would be approximately $45,000. Based on the proposed $3 million allocation for Agricultural Worker Vanpools and the average cost of $45,000 per van, staff estimate that approximately 60 vans can be funded. Using data from a similar program through CalVans, staff anticipate the funded vans would have a project life of 6 years. Using the estimated number of vehicles and project life as stated previously, staff calculated the total potential emission reductions for Agricultural Worker Vanpools, as shown in Table A-20.

**Table A-20: Total Potential Emission Reductions for Agricultural Worker Vanpools**

| Pollutant | Per-Vehicle Average Annual Emission Reductions (tpy) | Number of Vehicles | Average Annual Emissions (tpy) | Project Life (years) | Lifetime Annual Emission Reductions (tons) |
|---|---|---|---|---|---|
| GHG | 5.19 | 60 | 311 | 6 | 1,900 |
| NOx | 0.00025 | | 0.015 | | 0.09 |
| PM 2.5 | 0.00046 | | 0.028 | | 0.17 |
| ROG | 0.00004 | | 0.002 | | 0.01 |

## *Rural School Bus Pilot Project*

The Rural School Bus Pilot Project provides emission reduction benefits by providing incentives for school districts to purchase advanced technology school buses, giving priority to districts in rural areas and small air districts in the state. The Rural School Bus Pilot Project provides funding for battery-electric school buses and school buses that operate on renewable fuels.

Based on applications received for the 2016-17 fiscal year project, staff anticipate the average school bus replaced will be a 1997 model year. Using data from the project applications, staff also expect that the 55 percent of the buses funded will be battery-electric and the remaining 45 percent will operate on renewable diesel. Because limited data is available on vehicles utilizing renewable fuels, staff assume that

the renewable diesel vehicles will have similar emission rates as conventional diesel-fueled vehicles. Emission factors for the Rural School Bus Pilot Project are shown in Table A-21. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

**Table A-21: Rural School Bus Pilot Project Emission Factors**

| Pollutant | 1997 Diesel (g/mi) | 2017 BEV (g/mi) | 2017 RD (g/mi) |
|---|---|---|---|
| NOx | 16.242 | 0 | 1.408 |
| PM 2.5 | 0.4105 | 0.1626 | 0.3249 |
| ROG | 0.2464 | 0 | 0.0549 |
| GHG | 1,869 | 335 | 622 |

Staff generated an annual usage assumption of 13,000 miles per year, based on the average use of 1997 model year school buses in EMFAC 2014. Applying the emission factors, technology mix, and annual usage assumptions mentioned above, staff calculated the potential per-vehicle emission reductions for the Rural School Bus Pilot Project, as shown in Table A-22.

**Table A-22: Rural School Bus Pilot Project Annual Emission Reduction Benefits on a Per-Vehicle Basis**

| Pollutant | Supported Technologies | Per-Vehicle Annual Emission Reductions (tpy) | |
|---|---|---|---|
| | | Per Technology | Average |
| GHG | Battery-Electric | 19.94 | 18.26 |
| | Renewable Diesel | 16.20 | |
| NOx | Battery-Electric | 0.2328 | 0.2237 |
| | Renewable Diesel | 0.2126 | |
| PM 2.5 | Battery-Electric | 0.0036 | 0.0025 |
| | Renewable Diesel | 0.0012 | |
| ROG | Battery-Electric | 0.0035 | 0.0032 |
| | Renewable Diesel | 0.0027 | |

Applying the assumed technology mix from FY 2016-17 project applications, staff calculated the average incentive cost for the Rural School Bus Pilot Project, as shown in Table A-23.

**Table A-23: Rural School Bus Pilot Project Average Incentive Cost**

| Supported Technologies | Cost Per Technology | Average |
|---|---|---|
| Battery-Electric | $400,000 | $294,250 |
| Renewable Diesel | $165,000 | |

Based on the proposed $10 million allocation for the Rural School Bus Pilot Project, staff anticipate that approximately 30 school buses can be funded. The average school bus has a useful life of 15 years.[18] Thus, for this analysis, staff assumed a conservative project life of 15 years and quantified the Rural School Bus Pilot Project's potential emission reduction benefits over the course of 15 years, as shown in Table A-24.

**Table A-24: Total Potential Emission Reductions for the Rural School Bus Pilot Project**

| Pollutant | Per-Vehicle Average Annual Emission Reductions (tpy) | Number of Vehicles | Average Annual Emission Reductions (tpy) | Project Life (years) | Lifetime Annual Emission Reductions (tons) |
|---|---|---|---|---|---|
| GHG | 18.26 | 30 | 548 | 15 | 8,200 |
| NOx | 0.2237 | | 6.710 | | 100 |
| PM 2.5 | 0.0025 | | 0.075 | | 1.1 |
| ROG | 0.0032 | | 0.095 | | 1.4 |

### *One-Stop-Shop for CARB's Equity ZEV Replacement Incentives*

In addition to the light-duty vehicle investment projects described previously, CARB is proposing to allocate $5 million to support a new project to develop a single application tool for accessing incentive project funding and to coordinate outreach across all these projects in order to support ZEV adoption in disadvantaged communities, low-income communities, and low-income households. The goal of this project is to enable more efficient implementation of CARB's equity ZEV incentives and to expand participation by low-income households. Because this project helps enables ZEV adoption through other incentive projects, such as CVRP and EFMP Plus-Up, staff is not quantifying any direct emission reductions for this project. Instead, this project is expected to help achieve the emission reductions projected for CVRP and EFMP Plus-Up.

[18] https://www.afdc.energy.gov/uploads/publication/case-study-propane-school-bus-fleets.pdf

## Heavy-Duty Vehicle and Off-Road Equipment Investments

The heavy-duty vehicle and off-road equipment investments proposed in this year's Funding Plan are grouped into the following categories: zero-emission freight equipment deployment projects, clean truck and bus vouchers, and the Truck Loan Assistance Program.

The purpose of the zero-emission freight equipment deployment projects and clean truck and bus vouchers is to advance the widespread use of advanced technologies and reduce costs by supporting increased production volumes. The proposed zero-emission freight equipment deployment projects include the Zero-Emission Off-Road Freight Voucher Incentive Project and Zero- and Near Zero-Emission Freight Facilities. The proposed clean truck and bus vouchers include the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) and Low NOx Engine Incentives.

The purpose of the Truck Loan Assistance Program is to provide financing assistance for the purchase of commercialized clean technologies by economically challenged consumers.

There is a total of $188 million available for clean truck and bus vouchers, so staff assumed that $163 million would be used in HVIP and $25 million in Low NOx Engine Incentives to illustrate the potential magnitude of emission reductions in this funding plan. However, clean truck and bus voucher funding is available for either HVIP or Low NOx Engine Incentives based on project demand.

Quantification of the emission reduction benefits for each of the heavy-duty vehicle and off-road equipment investment projects is described in more detail below.

### *Zero- and Near Zero-Emission Freight Facilities*

The Zero- and Near Zero-Emission Freight Facilities project achieves emission reduction benefits by deploying zero- and near zero-emission technology associated with freight facilities. Eligible types of vehicles, equipment, and technologies in this project include forklifts, yard trucks or tractors, delivery and drayage trucks, TRUs, and supporting fueling infrastructure. Because this project includes a variety of eligible types of vehicles, equipment, and technologies, it is important to note that this analysis is an illustrative example of the potential emission reductions that may be achieved through this project.

This project can support a wide variety of vehicles and equipment that are commercially available, near commercial, or in the demonstration phase. For this analysis, staff estimated the potential emission reductions for four vehicle and equipment types that are likely to be funded under this project: Class 1 and 2 forklifts, off-road yard trucks, drayage trucks, and TRUs. Unless project data supports an alternate baseline, staff typically quantify emission reductions using the cleanest available technology as the baseline. Battery-electric Class 1 and 2 forklifts are already commercially available,

therefore, staff assume that there are no additional emission reduction benefits for incentivizing forklifts under this project. Emission factors for the remaining three categories (off-road yard trucks, drayage trucks, and TRUs) are shown in Table A-25. For off-road vehicles, such as yard trucks and TRUs, emission factors are in units of grams per hour and for on-road vehicles, such as drayage trucks, emission factors are in units of grams per mile. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

**Table A-25: Zero- and Near Zero-Emission Freight Facilities Emission Factors**

| Vehicle Class | Pollutant | 2017/Tier 4 Final Baseline | 2017 BEV | 2017 FCV |
|---|---|---|---|---|
| Yard Truck (g/hr) | NOx | 8.238 | 0 | |
| | PM 2.5 | 0.484 | 0 | |
| | ROG | 4.271 | 0 | |
| | GHG | 47,885 | 8,974 | |
| Drayage Truck (g/mi) | NOx | 1.905 | 0 | 0 |
| | PM 2.5 | 0.040 | 0.022 | 0.022 |
| | ROG | 0.089 | 0 | 0 |
| | GHG | 2,096 | 393 | 955 |
| TRU (g/hr) | NOx | 47.261 | 0 | |
| | PM 2.5 | 1.699 | 0 | |
| | ROG | 36.849 | 0 | |
| | GHG | 9,001 | 1,687 | |

Note: As noted in the Emission Factor Development section, PM 2.5 emissions associated with brake and tire wear for off-road vehicles are not identified separately; therefore, PM 2.5 emissions associated with brake and tire wear are currently included for on-road vehicles only.

Staff generated annual usage assumptions using CARB's CHE inventory model for yard trucks, EMFAC 2014 for drayage trucks, and TRU inventory model for TRUs, as shown in Table A-26. For off-road vehicles, such as yard trucks and TRUs, annual usage is in terms of hours per year, and for on-road vehicles, such as drayage trucks, annual usage is in terms of miles per year.

**Table A-26: Zero- and Near Zero-Emission Freight Facilities Annual Usage Assumptions**

| Vehicle Class | Technology | Usage (mi/yr or hrs/yr) |
|---|---|---|
| Yard Truck | BEV | 2,400 |
| Drayage Truck | BEV & FCV | 60,000 |
| TRU | BEV | 1,300 |

Applying the emission factors and usage assumptions above, staff calculated the potential annual per-vehicle emission reductions for Zero- and Near Zero-Emission Freight Facilities, as shown in Table A-27.

**Table A-27: Zero- and Near Zero-Emission Freight Facilities Annual Emission Reduction Benefits on a Per-Vehicle Basis**

| Pollutant | Vehicle Class | Supported Technologies | Per-Vehicle Annual Emission Reductions (tpy) |
|---|---|---|---|
| GHG | Yard Truck | BEV | 93.4 |
| | Drayage Truck | BEV | 102 |
| | | FCV | 68.4 |
| | TRU | BEV | 9.51 |
| NOx | Yard Truck | BEV | 0.0218 |
| | Drayage Truck | BEV | 0.1260 |
| | | FCV | 0.1260 |
| | TRU | BEV | 0.0677 |
| PM 2.5 | Yard Truck | BEV | 0.0013 |
| | Drayage Truck | BEV | 0.0012 |
| | | FCV | 0.0012 |
| | TRU | BEV | 0.0024 |
| ROG | Yard Truck | BEV | 0.0113 |
| | Drayage Truck | BEV | 0.0059 |
| | | FCV | 0.0059 |
| | TRU | BEV | 0.0528 |

Because Zero- and Near Zero-Emission Freight Facilities is a new project that has not yet launched, for this analysis, staff assumed that $30 million of the project funding will be used to support infrastructure and the match requirement will cover energy efficiencies and infrastructure costs. The remaining $120 million of the project funding will be split among the four equipment types mentioned, specifically $30 million for Class 1 and Class 2 forklifts, $30 million for off-road yard trucks, $30 million for drayage trucks with $7.5 million for fuel cell drayage trucks and $22.5 million for battery electric drayage trucks, and $30 million for TRUs. Based on applications from past demonstration and pilot projects and discussions with manufacturers, staff generated estimated incentive costs as shown in Table A-28.

**Table A-28: Zero- and Near Zero-Emission Freight Facilities Average Incentive Cost**

| Vehicle Class | Supported Technologies | Cost Per Technology |
|---|---|---|
| Yard Truck | BEV | $300,000 |
| Drayage Truck | BEV | $440,000 |
| | FCV | $2,300,000 |
| TRU | BEV | $90,000 |

Based on the proposed $150 million allocation for Zero- and Near Zero-Emission Freight Facilities and the estimated costs shown above, staff anticipate that approximately 100 battery-electric yard trucks, 50 battery-electric drayage trucks, 3 fuel cell drayage truck, and 320 battery-electric TRUs may be funded. Considering the expected life of heavy-duty diesel trucks and equipment, staff conservatively quantified the emission reductions over the course of 10 years, as shown in Table A-29.

**Table A-29: Total Potential Emission Reductions for Zero- and Near Zero-Emission Freight Facilities**

| Pollutant | Vehicle Class & Technology | Per-Vehicle Annual Emission Reductions (tpy) | Number of Vehicles | Annual Emission Reductions (tpy) | Project Life (years) | Lifetime Emission Reductions Per Vehicle Class (tons) | Project Total Lifetime Emission Reductions (tons) |
|---|---|---|---|---|---|---|---|
| GHG | Yard Truck BEV | 93.4 | 100 | 9,340 | 10 | 93,400 | 180,000 |
| | Drayage Truck BEV | 102 | 50 | 5,110 | | 51,100 | |
| | Drayage Truck FCV | 68.4 | 3 | 205 | | 2,050 | |
| | TRU BEV | 9.51 | 320 | 3,040 | | 30,400 | |
| NOx | Yard Truck BEV | 0.0218 | 100 | 2.18 | | 21.8 | 310 |
| | Drayage Truck BEV | 0.1260 | 50 | 6.30 | | 63.0 | |
| | Drayage Truck FCV | 0.1260 | 3 | 0.378 | | 3.78 | |
| | TRU BEV | 0.0677 | 320 | 21.7 | | 217 | |
| PM 2.5 | Yard Truck BEV | 0.0013 | 100 | 0.128 | | 1.28 | 9.7 |
| | Drayage Truck BEV | 0.0012 | 50 | 0.060 | | 0.600 | |
| | Drayage Truck FCV | 0.0012 | 3 | 0.004 | | 0.040 | |
| | TRU BEV | 0.0024 | 320 | 0.779 | | 7.79 | |
| ROG | Yard Truck BEV | 0.0113 | 100 | 1.13 | | 11.3 | 180 |
| | Drayage Truck BEV | 0.0059 | 50 | 0.294 | | 2.94 | |
| | Drayage Truck FCV | 0.0059 | 3 | 0.018 | | 0.180 | |
| | TRU BEV | 0.0528 | 320 | 16.9 | | 169 | |

### *Zero-Emission Off-Road Freight Voucher Incentive Project*

The Zero-Emission Off-Road Freight Voucher Incentive Project achieves emission reduction benefits by incentivizing the purchase of zero-emission off-road freight equipment, resulting in larger deployments of zero-emission technologies that are just entering the market or have not yet achieved substantial market penetration for many other freight applications. Eligible equipment in this project include off-road yard trucks, small-lift capacity forklifts (less than 8,000 lbs. lift capacity), heavy-lift capacity forklifts (greater than 8,000 lbs. lift capacity), cargo handling equipment (such as reach stackers, top handlers, side handlers, and rubber tired gantry cranes), TRUs, railcar movers, locomotive switchers, and cargo loaders.

Because this project can fund a wide variety of equipment, staff estimated the potential emission reductions for four of the equipment types that are likely to be funded under this project: battery-electric small- and heavy-lift capacity forklifts, battery-electric off-road yard trucks, and battery-electric TRUs. As discussed in the Zero- and Near Zero-Emission Freight Facilities project, unless project data supports an alternate baseline, staff typically quantify emission reductions using the cleanest available technology as the baseline. Battery-electric forklifts are already commercially available for smaller lift capacity forklifts, therefore, staff assume that there are no additional emission reduction benefits for incentivizing smaller lift capacity forklifts under this project. Emission factors for the remaining three equipment types (heavy-lift capacity forklifts, off-road yard trucks, and TRUs) are shown in Table A-30. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

**Table A-30: Zero-Emission Off-Road Freight Voucher Incentive Project Emission Factors**

| Vehicle Class | Pollutant | Tier 4 Final Diesel (g/hr) | BEV (g/hr) |
|---|---|---|---|
| Heavy-Lift Capacity Forklift | NOx | 0.781 | 0 |
| | PM 2.5 | 0.281 | 0 |
| | ROG | 1.748 | 0 |
| | GHG | 19,604 | 5,318 |
| Yard Truck | NOx | 8.2376 | 0 |
| | PM 2.5 | 0.4842 | 0 |
| | ROG | 4.2710 | 0 |
| | GHG | 47,885 | 8,974 |
| TRU | NOx | 47.261 | 0 |
| | PM 2.5 | 1.699 | 0 |
| | ROG | 36.849 | 0 |
| | GHG | 9,001 | 1,687 |

Staff generated annual usage assumptions using CARB's CHE inventory model for heavy-lift capacity forklifts and yard trucks and TRU inventory model for TRUs, as shown in Table A-31.

**Table A-31: Zero-Emission Off-Road Freight Voucher Incentive Project Annual Usage Assumptions**

| Vehicle Class | Usage (hrs/yr) |
|---|---|
| Heavy-Lift Capacity Forklift | 800 |
| Yard Truck | 2,400 |
| TRU | 1,300 |

Applying the emission factors and usage assumptions above, staff calculated the potential annual per-vehicle emission reductions for the Zero-Emission Off-Road Freight Voucher Incentive Project, as shown in Table A-32.

**Table A-32: Zero-Emission Off-Road Freight Voucher Incentive Project Annual Emission Reduction Benefits on a Per-Vehicle Basis**

| Pollutant | Vehicle Class | Per-Vehicle Annual Emission Reductions (tpy) |
|---|---|---|
| GHG | Heavy-Lift Capacity Forklift | 11.43 |
| | Yard Truck | 93.39 |
| | TRU | 9.51 |
| NOx | Heavy-Lift Capacity Forklift | 0.0007 |
| | Yard Truck | 0.0218 |
| | TRU | 0.0677 |
| PM 2.5 | Heavy-Lift Capacity Forklift | 0.0002 |
| | Yard Truck | 0.0013 |
| | TRU | 0.0024 |
| ROG | Heavy-Lift Capacity Forklift | 0.0015 |
| | Yard Truck | 0.0113 |
| | TRU | 0.0528 |

Because the Zero-Emission Off-Road Freight Voucher Incentive Project is a new project that has not yet launched, for this analysis, staff assumed that approximately $4 million (or 10 percent) of the project funding will be used for infrastructure, $12 million (or 30 percent) would be used for small-lift capacity forklifts, and the remaining project funding would be split among yard trucks, heavy-lift capacity forklifts, and TRUs. Based on applications from past demonstration and pilot projects and discussions with manufacturers, staff generated estimated incentive costs as shown in Table A-33.

**Table A-33: Zero-Emission Off-Road Freight Voucher Incentive Project Average Incentive Cost**

| Vehicle Class | Supported Technologies | Cost Per Technology |
|---|---|---|
| Heavy-Lift Capacity Forklift | BEV | $50,000 |
| Yard Truck | BEV | $110,000 |
| TRU | BEV | $50,000 |

Based on the proposed $40 million allocation for the Zero-Emission Off-Road Freight Voucher Incentive Project and the costs shown above, staff estimate that approximately 300 pieces of equipment can be funded across the three equipment types (40 heavy-lift capacity forklifts, 110 yard trucks, and 150 TRUs). Considering the expected life of heavy-duty diesel equipment, staff conservatively quantified the emission reductions over the course of 10 years, as shown in Table A-34.

**Table A-34: Total Potential Emission Reductions for the Zero-Emission Off-Road Freight Voucher Incentive Project**

| Pollutant | Vehicle Class | Per Vehicle Annual Emission Reductions (tpy) | Number of Vehicles | Annual Emission Reductions (tpy) | Project Life (years) | Lifetime Emission Reductions Per Vehicle Class (tons) | Project Total Lifetime Emission Reductions (tons) |
|---|---|---|---|---|---|---|---|
| GHG | Forklift | 11.43 | 40 | 457 | 10 | 4,570 | 120,000 |
| | Yard Truck | 93.39 | 110 | 10,300 | | 103,000 | |
| | TRUs | 9.51 | 150 | 1,430 | | 14,300 | |
| NOx | Forklift | 0.0007 | 40 | 0.028 | | 0.280 | 130 |
| | Yard Truck | 0.0218 | 110 | 2.40 | | 24.0 | |
| | TRUs | 0.0677 | 150 | 10.2 | | 102 | |
| PM 2.5 | Forklift | 0.0002 | 40 | 0.010 | | 0.100 | 5.2 |
| | Yard Truck | 0.0013 | 110 | 0.141 | | 1.41 | |
| | TRUs | 0.0024 | 150 | 0.365 | | 3.65 | |
| ROG | Forklift | 0.0015 | 40 | 0.062 | | 0.62 | 92 |
| | Yard Truck | 0.0113 | 110 | 1.24 | | 12.4 | |
| | TRUs | 0.0528 | 150 | 7.92 | | 79.2 | |

## *Clean Truck and Bus Vouchers*

Clean Truck and Bus Vouchers are intended to encourage and accelerate the deployment of zero-emission trucks and buses, vehicles using engines that meet the optional low NOx standard, and hybrid trucks and buses in California. There is a total of $188 million available for Clean Truck and Bus Vouchers projects, which include HVIP and Low NOx Engine Incentives. To illustrate the potential magnitude of emission reductions in this funding plan, staff assumed $163 million would be used for HVIP and $25 million for Low NOx Engine Incentives, as described below. However, funding for HVIP and Low NOx Engine Incentives may change based on demand.

### HVIP

HVIP achieves emission reduction benefits by reducing the up-front cost of hybrid or zero-emission trucks and buses, allowing fleet owners to secure a voucher through their local dealer as part of their vehicle purchase. For the purposes of this analysis, staff estimated reductions from the emissions offset between a new 2017 model year, conventional truck or bus and an advanced technology vehicle.

According to the HVIP waitlist as of June 2017, approximately 50 percent of vouchers will go towards the purchase of MHD conventional hybrids, 5 percent for MHD battery-electric trucks, 5 percent for HHD battery-electric trucks, 20 percent battery-electric urban buses, and 20 percent for battery-electric school buses. Staff assume that the current waitlist represents the voucher demand expected for the 2017-18 fiscal year, therefore, for this analysis, staff used the vehicle class and technology splits mentioned above.

For baseline urban bus emission factors, staff used an average of diesel and CNG urban bus emission rates since the current California fleet utilizes a mix of the two fuel types. Only limited data is available for heavy-duty CNG-fueled vehicles, therefore, staff assume CNG vehicles have similar emission rates as diesel-fueled vehicles because they are certified to the same emission standard. Emission factors for HVIP are shown in Table A-35. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

**Table A-35: HVIP Emission Factors**

| Vehicle Class | Pollutant | 2017 Diesel (g/mi) | 2017 CNG (g/mi) | 2017 Conventional Hybrid (g/mi) | 2017 BEV (g/mi) |
|---|---|---|---|---|---|
| MHD | NOx | 0.8579 | | 0.6863 | 0 |
| | PM 2.5 | 0.0616 | | 0.0331 | 0.0309 |
| | ROG | 0.0371 | | 0.0297 | 0 |
| | GHG | 1,540 | | 1,232 | 289 |
| HHD | NOx | 1.4310 | | | 0 |
| | PM 2.5 | 0.0408 | | | 0.0222 |
| | ROG | 0.0789 | | | 0 |
| | GHG | 2,223 | | | 417 |
| Urban Bus | NOx | 0.8140 | 0.8140 | | 0 |
| | PM 2.5 | 0.3669 | 0.3669 | | 0.1834 |
| | ROG | 0.0228 | 0.0228 | | 0 |
| | GHG | 2,539 | 2,079 | | 476 |
| School Bus | NOx | 1.4076 | | | 0 |
| | PM 2.5 | 0.3249 | | | 0.1626 |
| | ROG | 0.0549 | | | 0 |
| | GHG | 1,786 | | | 335 |

Note: MHD and HHD emission factors are based on population-weighted averages of the T6 and T7 diesel vehicle classes in EMFAC 2014, respectively, excluding out-of-state vehicles.

Staff generated an annual usage assumption for MHD conventional hybrid vehicles, based on the average use of a conventional MHD diesel vehicle in EMFAC 2014. For urban buses, staff used data provided by previous HVIP voucher recipients to determine the average annual usage. For all other battery-electric vehicle classifications, the annual usage assumption was based on Measure T-7 of the Climate Change Scoping Plan, Measure Documentation Supplement.[19] The annual usage assumptions for HVIP are shown in Table A-36.

**Table A-36: HVIP Annual Usage Assumptions**

| Vehicle Class | Technology | Usage (mi/yr) |
|---|---|---|
| MHD | Conv. Hybrid | 20,000 |
| | BEV | 12,000 |
| HHD | BEV | 12,000 |
| Urban Bus | BEV | 30,000 |
| School Bus | BEV | 12,000 |

Using the emission factors, technology mix, and the annual usage assumptions above, staff calculated the potential annual per-vehicle emission reductions for HVIP, as shown in Table A-37.

[19] https://www.arb.ca.gov/cc/scopingplan/document/measure_documentation.pdf

**Table A-37: HVIP Annual Emission Benefits on a Per-Vehicle Basis**

| Pollutant | Vehicle Class | Supported Technologies | Per-Vehicle Annual Emission Reductions (tpy) | |
|---|---|---|---|---|
| | | | Per Technology | Average |
| GHG | MHD | Conv. Hybrid | 6.16 | 19.40 |
| | | BEV | 15.02 | |
| | HHD | BEV | 21.68 | |
| | Urban Bus | BEV | 54.99 | |
| | School Bus | BEV | 17.41 | |
| NOx | MHD | Conv. Hybrid | 0.0038 | 0.0125 |
| | | BEV | 0.0113 | |
| | HHD | BEV | 0.0189 | |
| | Urban Bus | BEV | 0.0269 | |
| | School Bus | BEV | 0.0186 | |
| PM 2.5 | MHD | Conv. Hybrid | 0.0006 | 0.0020 |
| | | BEV | 0.0004 | |
| | HHD | BEV | 0.0002 | |
| | Urban Bus | BEV | 0.0061 | |
| | School Bus | BEV | 0.0021 | |
| ROG | MHD | Conv. Hybrid | 0.0002 | 0.0005 |
| | | BEV | 0.0005 | |
| | HHD | BEV | 0.0010 | |
| | Urban Bus | BEV | 0.0008 | |
| | School Bus | BEV | 0.0007 | |

Applying the proposed voucher amounts for the 2017-18 fiscal year and the technology mix from the current HVIP waitlist data, staff calculated the average voucher cost for HVIP as shown in Table A-38.

**Table A-38: HVIP Average Incentive Cost**

| Vehicle Class | Supported Technologies | Cost Per Technology | Average Cost |
|---|---|---|---|
| MHD | Conv. Hybrid | $20,000 | $97,000 |
| | BEV | $90,000 | |
| HHD | BEV | $150,000 | |
| Urban Bus | BEV | $150,000 | |
| School Bus | BEV | $225,000 | |

The budget includes $188 million for Clean Truck and Bus Vouchers. To illustrate the potential magnitude of emission reductions in this funding plan, staff assumed that $163 million would be used for HVIP. Of the $163 million, staff assumed $2 million will be used for infrastructure. With the remaining $161 million for HVIP and the average cost shown above, staff estimate that approximately 1,500 vehicles can be funded. The

budget requires that at least $35 million is used for the purchase of zero-emission buses. Based on expected voucher demand for zero-emission urban buses and school buses, staff anticipate that the minimum allocation for zero-emission buses will be exceeded.

Heavy-duty trucks can have a useful life of over 20 years[20] and the average school bus has a useful life of 15 years.[21] Therefore, staff assumed a conservative project life of 15 years and quantified HVIP's total potential emission reductions over the course of 15 years, as shown in Table A-39 below.

**Table A-39: Total Potential Emission Reductions for HVIP**

| Pollutant | Per-Vehicle Average Annual Emission Reductions (tpy) | Number of Vehicles | Average Annual Emissions Reductions (tpy) | Project Life (years) | Lifetime Annual Emission Reductions (tons) |
|---|---|---|---|---|---|
| GHG | 19.40 | 1,500 | 29,100 | 15 | 440,000 |
| NOx | 0.0125 | | 18.8 | | 280 |
| PM 2.5 | 0.0020 | | 2.98 | | 45 |
| ROG | 0.0005 | | 0.682 | | 10 |

## Low NOx Engine Incentives

Low NOx Engine Incentives achieve emission reduction benefits by supporting the deployment of engines that meet optional low NOx standards. The optional low NOx standards provide manufacturers the ability to certify engines to NOx emission levels that are 50 percent, 75 percent, or 90 percent lower than today's mandatory heavy-duty engine emission standards. Currently, the only available low NOx engines are natural gas engines, so staff used 2017 model year, CNG-fueled vehicles and the associated fuel economy values as the primary baseline for this analysis.

Based on currently available technology, staff assumed that approximately 50 percent of the incentives would go to HHD vehicles, which includes most refuse haulers, 45 percent for urban buses, and 5 percent for MHD vehicles. With the 8.9 liter engine currently available, we anticipate the market share for HHD and urban bus classifications will be similar, but because the 11.9 liter engine could be commercially available toward the end of the next fiscal year, staff gave the HHD classification a slightly higher share. Staff anticipate that the 11.9 liter low NOx engine is likely to replace conventional HHD diesel engines, therefore, staff also developed emission factors for HHD diesel vehicles.

Because data available for heavy-duty CNG-fueled vehicles is limited, staff assume CNG-fueled vehicles have similar emission rates as diesel-fueled vehicles since they

[20] http://www.calstart.org/Libraries/CalHEAT_Documents/Baseline_and_Preliminary_Pathways_Whitepaper.sflb.ashx
[21] https://www.afdc.energy.gov/uploads/publication/case-study-propane-school-bus-fleets.pdf

are certified to the same emission standard. At this time, the only optionally certified low NOx engine meets the standard that is 90 percent lower than the diesel baseline, so staff assumed a 90 percent tailpipe NOx reduction for the low NOx engines.

In order to maximize the GHG emission reduction benefits for low NOx engines, staff proposes to require the use of 100 percent renewable fuels for the first 3 years for vehicles funded by GGRF. Currently, low NOx engines are only available for natural gas, therefore, staff developed emission factors for low NOx engines fueled with RNG. Emission factors for Low NOx Engine Incentives are shown in Table A-40. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

**Table A-40: Low NOx Engine Incentives Emission Factors**

| Vehicle Class | Pollutant | 2017 CNG (g/mi) | 2017 Diesel (g/mi) | 2017 Low NOx RNG (g/mi) | 2017 Low NOx Diesel (g/mi) |
|---|---|---|---|---|---|
| MHD | NOx | 0.8579 | | 0.0858 | |
| | PM 2.5 | 0.0616 | | 0.0616 | |
| | ROG | 0.0371 | | 0.0371 | |
| | GHG | 1,261 | | 557 | |
| HHD | NOx | 1.4310 | 1.4310 | 0.1431 | 0.1431 |
| | PM 2.5 | 0.0408 | 0.0408 | 0.0408 | 0.0408 |
| | ROG | 0.0789 | 0.0789 | 0.0789 | 0.0789 |
| | GHG | 1,821 | 2,223 | 804 | 2,223 |
| Urban Bus | NOx | 0.8140 | | 0.0814 | |
| | PM 2.5 | 0.3669 | | 0.3669 | |
| | ROG | 0.0228 | | 0.0228 | |
| | GHG | 2,079 | | 918 | |

Note: MHD and HHD emission factors are based on population-weighted averages of the T6 and T7 diesel vehicle classes in EMFAC 2014, respectively, excluding out-of-state vehicles.

Staff generated annual usage assumptions for Low NOx Engine Incentives, based on the average use of a conventional diesel vehicle in EMFAC 2014 for the corresponding vehicle class. The annual usage assumptions for Low NOx Engine Incentives are shown in Table A-41.

**Table A-41: Low NOx Engine Incentives Annual Usage Assumptions**

| Baseline Vehicle | Usage (mi/yr) |
|---|---|
| MHD CNG | 20,000 |
| HHD Diesel | 58,000 |
| HHD CNG | 25,000 |
| Urban Bus CNG | 47,000 |

Using the emission factors, technology mix, and the annual usage assumptions above, staff calculated the potential annual per-vehicle emission reductions for Low NOx Engine Incentives, as shown in Table A-42. Engines certified to the optional low NOx

standard are held to the same standards for PM 2.5 and ROG as currently certified heavy-duty engines, therefore, the only criteria pollutant emission benefit for Low NOx Engine Incentives is a reduction in NOx.

**Table A-42: Low NOx Engine Incentives Annual Emission Reduction Benefits on a Per-Vehicle Basis**

| Pollutant | Baseline Vehicle | Supported Technologies | Per-Vehicle Annual Emission Reductions (tpy) | |
|---|---|---|---|---|
| | | | Per Technology | Average |
| GHG | MHD CNG | Low NOx with RNG | 14.09 | 38.66 |
| | HHD CNG | Low NOx with RNG | 25.43 | |
| | HHD Diesel | Low NOx | 0 | |
| | HHD Diesel | Low NOx with RNG | 82.34 | |
| | Urban Bus CNG | Low NOx with RNG | 54.58 | |
| NOx | MHD CNG | Low NOx with RNG | 0.0170 | 0.0450 |
| | HHD CNG | Low NOx with RNG | 0.0355 | |
| | HHD Diesel | Low NOx | 0.0823 | |
| | HHD Diesel | Low NOx with RNG | 0.0823 | |
| | Urban Bus CNG | Low NOx with RNG | 0.0380 | |

For Low NOx Engine Incentives, staff are proposing to fund the incremental cost between a conventional vehicle and the low NOx engine. Using quotes from the engine manufacturer on the incremental cost, staff anticipate the incentive cost would be around $10,000 for low NOx engines in conventional CNG vehicles. Staff also anticipate the incremental cost may be more for HHD vehicles with a conventional diesel engine, therefore, staff used $40,000 for the incentive amount for HHD low NOx engines. Applying the technology split to the expected incentive amounts, staff calculated the average incentive cost for Low NOx Engine Incentives, as shown in Table A-43.

**Table A-43: Low NOx Engine Incentives Average Incentive Cost**

| Baseline Vehicle | Supported Technologies | Cost Per Technology | Average |
|---|---|---|---|
| MHD CNG | Low NOx with RNG | $10,000 | $16,000 |
| HHD CNG | Low NOx with RNG | $10,000 | |
| HHD Diesel | Low NOx | $40,000 | |
| HHD Diesel | Low NOx with RNG | $40,000 | |
| Urban Bus CNG | Low NOx with RNG | $10,000 | |

While the budget includes $188 million for Clean Truck and Bus Vouchers, to illustrate the potential magnitude of emission reductions in this funding plan, staff assumed that $25 million would be used for Low NOx Engine Incentives. Using the average cost of $16,000 per engine, staff estimate that approximately 1,500 engines can be funded, thus meeting the expected demand. For this analysis, staff used a project life of 3 years

when estimating the potential GHG emission reduction benefits because GHG emission reductions are tied to the use of renewable fuel, which is required for 3 years. However, heavy-duty trucks can have a useful life of over 20 years,[22] therefore, staff used a project life of 15 years to calculate the emission benefits for criteria pollutant and toxic air contaminants. The total potential emission reductions for Low NOx Engine Incentives are shown in Table A-44.

**Table A-44: Total Potential Emission Reductions for Low NOx Engine Incentives**

| Pollutant | Per-Vehicle Average Annual Emission Reductions (tpy) | Number of Vehicles | Average Annual Emission Reductions (tpy) | Project Life (years) | Lifetime Annual Emission Reductions (tons) |
|---|---|---|---|---|---|
| GHG | 38.66 | 1,500 | 58,000 | 3 | 170,000 |
| NOx | 0.0450 | | 67.6 | 15 | 1,000 |

## *Truck Loan Assistance Program*

The Truck Loan Assistance Program aids small business truckers affected by CARB's In-Use Truck and Bus Regulation[23] by providing financing assistance for fleet owners to upgrade their vehicles with newer models or with diesel exhaust retrofits. Program data from the 2016 calendar year through June 2017 shows that, on average, funds were directed toward the replacement of 2001 model year diesel trucks in both the MHD and HHD vehicle classifications.

While analyzing the annual loan trends, staff have seen an increasing number of trucks with 2010 model year or newer engines purchased through the Truck Loan Assistance Program. From the 2016 calendar year through June 2017, 10 percent of loans went towards the purchase of MHD vehicles with 2010 model year or newer engines, 15 percent towards the purchase of HHD vehicles with a 2007 to 2009 model year engine, and 75 percent towards the purchase of HHD vehicles with 2010 model year or newer engines. On average, fleet owners that purchased trucks with 2010 model year or newer engines purchased 2012 model year trucks.

Staff used this engine model year information to develop the emission factors as shown in Table A-45. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

[22] http://www.calstart.org/Libraries/CalHEAT_Documents/Baseline_and_Preliminary_Pathways_Whitepaper.sflb.ashx
[23] https://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm

**Table A-45: Truck Loan Assistance Program Emission Factors**

| Vehicle Class | Pollutant | 2001 Diesel (g/mi) | 2008 Diesel (g/mi) | 2012 Diesel (g/mi) |
|---|---|---|---|---|
| MHD | NOx | 14.4489 | | 1.4050 |
| | PM 2.5 | 0.4193 | | 0.0620 |
| | ROG | 0.9509 | | 0.0422 |
| HHD | NOx | 22.7371 | 10.6516 | 2.6184 |
| | PM 2.5 | 0.1307 | 0.0911 | 0.0418 |
| | ROG | 0.3468 | 0.3170 | 0.0872 |

Note: MHD and HHD emission factors are based on population-weighted averages of the T6 and T7 diesel vehicle classes in EMFAC 2014, respectively, excluding out-of-state vehicles.

Staff generated annual usage assumptions based on the average use of a 2001 model year, conventional MHD and HHD diesel truck in EMFAC 2014. The annual usage assumptions for the Truck Loan Assistance Program are shown in Table A-46.

**Table A-46: Truck Loan Assistance Program Annual Usage Assumptions**

| Vehicle Class | Usage (mi/yr) |
|---|---|
| MHD | 11,000 |
| HHD | 19,000 |

Using the emission factors, mix of vehicle model years, and annual usage assumptions above, staff calculated the potential annual per-vehicle emission reductions for the Truck Loan Assistance Program, as shown in Table A-47. PM 2.5 emission reductions for the Truck Loan Assistance Program are not quantified because PM emission reductions are required by the Truck and Bus Regulation through the use of diesel particulate filters. Additionally, GHG emission reductions are not quantified because this program is funded through AQIP, which focuses on criteria pollutant and toxics emission reductions, and the trucks do not achieve a significant fuel economy improvement.

**Table A-47: Truck Loan Assistance Program Annual Emission Reduction Benefits on a Per-Vehicle Basis**

| Pollutant | Vehicle Class | Supported Technologies | Per-Vehicle Annual Emission Reductions (tpy) | |
|---|---|---|---|---|
| | | | Per Technology | Average |
| NOx | MHD | 2012 MY | 0.1582 | 0.3698 |
| | HHD | 2008 MY | 0.2531 | |
| | | 2012 MY | 0.4214 | |
| ROG | MHD | 2012 MY | 0.0110 | 0.0052 |
| | HHD | 2008 MY | 0.0004 | |
| | | 2012 MY | 0.0054 | |

In the Truck Loan Assistance Program, the average loan contribution amount has gone down over time and based on program data from 2016 and 2017, staff found that the average cost per loan is approximately $3,100. With the proposed $20 million allocation for the Truck Loan Assistance Program, staff estimate that approximately 6,000 vehicles can be funded. To achieve NOx reductions, the Truck and Bus Regulation requires the replacement of 2001 engine model year trucks with 2010 or newer engines by January 1, 2021. Therefore, when calculating the emission reduction benefits for this program, staff used a project life of 3 years to estimate emission reductions that have occurred prior to what is required by the Truck and Bus Regulation.

The total potential emission reductions for the Truck Loan Assistance Program are shown in Table A-48.

**Table A-48: Total Potential Emission Reductions for the Truck Loan Assistance Program**

| Pollutant | Per-Vehicle Average Annual Emission Reductions (tpy) | Number of Vehicles | Average Annual Emission Reductions (tpy) | Project Life (years) | Lifetime Annual Emission Reductions (tons) |
|---|---|---|---|---|---|
| NOx | 0.3698 | 6,000 | 2,220 | 3 | 6,700 |
| ROG | 0.0052 | | 31.4 | | 94 |

# AB 8

AB 8 extended the funding for AQIP through 2023, refined the evaluation criteria for projects supported by AQIP, and introduced the following requirements that staff followed to develop the project scoring criteria:

- The state board shall provide preference in awarding funding to those projects with higher benefit-cost scores that maximize the purposes and goals of the Air Quality Improvement Program.[24]
- "Benefit-cost score" means the reasonably expected or potential criteria pollutant emission reductions achieved per dollar awarded by the Board for the project.[25]
- The state board also may give additional preference based on the following criteria, as applicable, in funding awards to projects:[26]

    1. Proposed or potential reduction of criteria or toxic air pollutants.
    2. Contribution to regional air quality improvement.
    3. Ability to promote the use of clean alternative fuels and vehicle technologies as determined by the state board, in coordination with the Energy Commission.
    4. Ability to achieve climate change benefits in addition to criteria pollutant or air toxic emission reductions.
    5. Ability to support market transformation of California's vehicle or equipment fleet to utilize low carbon or zero-emission technologies.
    6. Ability to leverage private capital investments.

Statute directs CARB to annually evaluate potential project categories to assign preference for AQIP funding, based upon the specific criteria identified above. The analysis and methodology in this section of the appendix describes the implementation of the provisions that require CARB to assign preference to projects with a higher benefit-cost score. The AB 8 analysis is fully executed for the three projects that will be funded through AQIP: the Trade-Up Pilot Project, the Truck Loan Assistance Program, and the Low NOx Engine Incentives Project.

## *Overview*

Conservative estimates for criteria pollutant, toxic air contaminants, and GHG emission reductions were developed using guidance provided in AB 8. Because criteria pollutant and toxic air contaminant emissions are geographically localized, criteria pollutant and toxic air contaminant emission reductions reported in this appendix are estimated at the tailpipe. Greenhouse gas emission reductions are tabulated on a WTW basis, as greenhouse gases are a statewide pollutant. Building upon the emission reductions and cost information from the Project Quantification section, this section of the appendix provides information on the following:

[24] Health & Safety Code Section 44274(b)
[25] Health & Safety Code Section 44270.3(e)(1)
[26] Health & Safety Code Section 44274(b)

- Benefit-Cost Score Analysis;
- Additional Preference Criteria Scores; and
- Total Benefit Index Scores.

## *Benefit-Cost Score Analysis*

Staff analyzed the expected costs and developed cost-effectiveness values for each AQIP-funded project using well-established cost-effectiveness calculation methodology for incentives, consistent with that used in the Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program). In addition, to calculate cost-effectiveness, staff also applied an appropriate discount rate and utilized a capital recovery factor (CRF) in the analysis based on 2017 Carl Moyer Program Guidelines.[27] The one percent discount rate was used and the corresponding CRF was determined based on the assumed usage life of the vehicles or equipment supported by a given project.

For each of the proposed projects funded by AQIP, a cost-effectiveness value was calculated. The cost-effectiveness of a project is determined using Formula 8 below.

**Formula 8: Cost-Effectiveness**

$$Cost\ Effectiveness\left(\frac{\$}{ton}\right) = \frac{Incentive\ Amount\ per\ Vehicle\ or\ Equipment * CRF}{Annual\ Per\ Vehicle\ Weighted\ Emission\ Reductions}$$

Weighted emission reductions are calculated using Formula 9, consistent with Carl Moyer Program Guidelines:

**Formula 9: Annual Weighted Emission Reductions**

$$Annual\ Weighted\ Emission\ Reductions\left(\frac{weighted\ tons}{year}\right) = NOx\ reductions + ROG\ reductions + (20 * PM\ reductions)$$

Table A-49 provides the inputs and the resulting weighted criteria pollutant and toxic air contaminant cost-effectiveness, in terms of dollars per ton of weighted emission reductions, for projects funded by AQIP. The longer project life of 15 years was used for Low NOx Engine Incentives because criteria pollutant and toxic air contaminant reductions occur regardless of whether renewable fuel is used. Additionally, for Low NOx Engines Incentives, staff are proposing to use AQIP funding for HHD diesel replacements only, therefore, staff utilized the NOx emission reduction benefits for a HHD diesel baseline in the AB 8 analysis.

[27] https://www.arb.ca.gov/msprog/moyer/guidelines/2017gl/2017_cmp_gl_volume_1.pdf

**Table A-49: AB 8 Analysis – Weighted Criteria Pollutant and Toxic Air Contaminant Cost-Effectiveness**

| Proposed Project | Project Life | CRF | Average Annual Per-Vehicle Weighted Emission Reductions (tpy) | Average Incentive Cost | Cost-Effectiveness ($/ton) |
|---|---|---|---|---|---|
| Truck Loan Assistance | 3 | 0.340 | 0.375 | $3,100 | $2,810 |
| Low NOx Engine Incentives | 15 | 0.072 | 0.082 | $40,000 | $34,977 |

The cost-effectiveness values for each project were given points based on a scale of one to five points. The bins were determined by taking the high and low resulting benefits and scaled to develop an equal distribution of scores. Those projects with a cost-effectiveness of less than $5,000 per ton of weighted emission reductions received a high of five points. The remaining bins were increased by $5,000 increments with the least cost-effective projects, those projects that cost over $20,000 per weighted ton of emissions reduced, receiving the lowest points possible. The cost-effectiveness of each proposed project was scored based on the following scale:

5: Less than $5,000 per ton
4: $5,000 to $9,999 per ton
3: $10,000 to $14,999 per ton
2: $15,000 to $19,999 per ton
1: $20,000 per ton or more

The resulting scores from the scale shown above were then used in the "Total Benefit Index" for AB 8 project selection. Finally, per AB 8, the cost-effectiveness values were converted to benefit-cost values based on pound of weighted emission reductions per dollar spent. The cost-effectiveness, benefit-cost value, and resulting score of each of the proposed projects are shown in Table A-50.

**Table A-50: AB 8 Analysis – Benefit-Cost Value and Score for Total Benefit Index**

| Proposed Project | Cost-Effectiveness ($/ton) | Benefit-Cost Value (lbs/$) | Benefit-Cost Score |
|---|---|---|---|
| Truck Loan Assistance | $2,810 | 0.712 | 5 |
| Low NOx Engine Incentives | $34,977 | 0.057 | 1 |

## *Additional Preference Criteria*

Per AB 8, additional preference criteria may be used to provide additional funding preference in conjunction with the benefit-cost scores summarized in Table A-50. The additional preference criteria includes:

- Proposed or potential reduction of criteria and toxic air pollutants;

- Contribution to regional air quality improvement;
- Ability to promote the use of clean alternative fuels and vehicle technologies;
- Ability to achieve GHG reductions;
- Ability to support market transformation of California's vehicle or equipment fleet to utilize low carbon or zero-emission technologies; and
- Ability to leverage private capital investments.

Recognizing the range of potential benefits and to ensure a robust mix of proposed projects to be funded, staff analyzed the associated data and equally divided the results into scores between 0 and 5 for quantitative preference criteria. The quantitative preference criteria for each project includes the proposed or potential reduction of criteria and toxic air pollutants, contribution to regional air quality, and the ability to achieve GHG reductions. Staff used the following steps to develop scoring scales and final scores for the quantitative preference criteria:

1. Quantify the results for each additional preference criteria for the proposed projects;
2. Establish scoring scale increments to generate an equal distribution in points for the proposed projects; and
3. Rank the proposed projects based on the established scoring scale, which is then used in the "Total Benefit Index".

Staff anticipate that the scales for the quantitative additional preference criteria may change each year depending on the mix of projects proposed, due to differences in the range of expected benefits or when additional information becomes available to refine the evaluation. The data and rationale used to establish each of the criteria weighting factors for the associated scores are described below.

## Proposed or Potential Reduction of Criteria or Toxic Air Pollutants

This analysis considered the magnitude of emission reductions by quantifying the direct criteria pollutant and toxic air contaminant emission reductions expected per average vehicle or equipment supported under each project. With the benefit-cost score analysis primarily driven by overall project incentive amounts, this additional criteria allowed staff to make direct comparisons of the emission reductions expected by the different proposed projects, independent of the associated incentive amounts.

For this additional preference criterion, staff analyzed the emission benefits on a per-vehicle basis to account for the differences in vehicle sales volumes and statewide populations of the various vehicles supported by AQIP. Resulting total lifetime emission reductions ranged from less than one ton to almost three tons of lifetime criteria pollutant and toxic air contaminant emission reductions per-vehicle. The scoring scale for this criterion was established by evaluating the range of lifetime tons of emission reductions between the highest and lowest value to try to have an equal distribution of scores. As a result, the bins were scaled in half ton increments. Projects with less than or equal to one ton of criteria pollutant and toxic air contaminant emission reductions receive one point, while those projects with greater than two and a half tons of criteria

pollutant and toxic air contaminant emission reductions received a score of five points. The resulting scale for criteria pollutant and toxic air contaminant emission reductions on a per-vehicle basis is shown below.

5: Greater than 2.5 tons of criteria and toxic emission reductions per vehicle
4: 2 to 2.49 tons of criteria and toxic emission reductions per vehicle
3: 1.5 to 1.99 tons of criteria and toxic emission reductions per vehicle
2: 1 to 1.49 tons of criteria and toxic emission reductions per vehicle
1: Less than 1 ton of criteria and toxic emission reductions per vehicle

Based on the information described above, Table A-51 summarizes the results and the corresponding score for this additional preference criterion.

**Table A-51: AB 8 Analysis – Potential Reduction of Criteria or Toxic Air Pollutants**

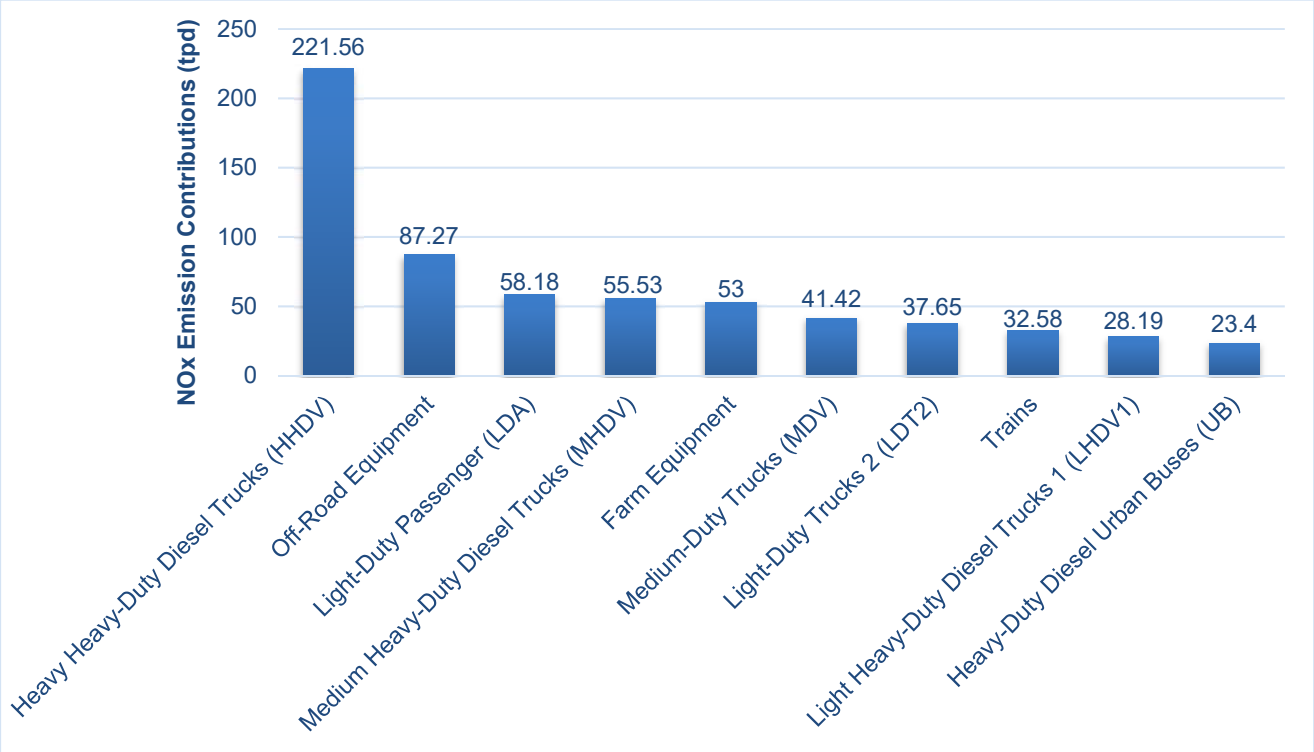
| Proposed Project | Annual Per-Vehicle Emission Reductions (tpy) | Project Life (years) | Per-Vehicle Lifetime Emission Reductions (tons) | Score |
|---|---|---|---|---|
| Truck Loan Assistance | 0.375 | 3 | 1.13 | 2 |
| Low NOx Engine Incentives | 0.082 | 15 | 1.24 | 2 |

## Contribution to Regional Air Quality Improvement

Staff developed a scoring scale based on CARB's emissions inventory for the South Coast and San Joaquin Valley air basins, two of the state's extreme nonattainment regions, and ranked projects based on their corresponding emissions contributions from highest to lowest. Specifically, staff used the NOx emissions inventory in tons per day from the 2016 State Implementation Plan (SIP) emission projection data for the South Coast and San Joaquin Valley air basins.[28] The ranking scale is based on the emissions inventory shown in Figure A-1.

[28] https://www.arb.ca.gov/ei/maps/2017statemap/abmap.htm

**Figure A-1: Largest NOx Emission Sources in the South Coast & San Joaquin Valley Air Basins**




The top ten NOx emission sources were ranked in tons per day for various vehicle and equipment types, ranging from heavy heavy-duty diesel trucks, at 222 tons per day, to heavy-duty diesel urban buses, at 23 tons per day. Because the HHD diesel truck category is the largest emission source by far, the scoring scale for this criterion was established for the range of NOx emissions between the second highest and lowest value. As a result, the bins were rounded and scaled in 25-ton per day increments. Projects corresponding to inventory sources with less than or equal to 25 tons of NOx per day receive one point, while those projects with greater than 100 tons of NOx per day receive five points. Each project's potential contribution to regional air quality improvement was ranked based on the scale below.

5: Category contributes more than 100 tons of NOx per day
4: Category contributes 75 to 99 tons of NOx per day
3: Category contributes 50 to 74 tons of NOx per day
2: Category contributes 25 to 49 tons of NOx per day
1: Category contributes less than 25 tons of NOx per day

## Ability to Promote the Use of Clean Alternative Fuels and Vehicle Technologies

Clean alternative fuels are fuels that have lower well-to-wheel emissions compared to conventional fuels, such as electricity, hydrogen, and renewable fuels. Clean vehicle technologies are technologies that emit zero tailpipe emissions, such as battery-electric

and fuel cell vehicles, or enabling technologies, such as vehicles that utilize conventional hybrid or plug-in hybrid systems. This qualitative analysis ranked projects by whether or not they used a clean low carbon alternative or renewable fuel or utilized clean vehicle technologies. Staff scored this additional preference criterion on the scale below.

5: Projects that use low carbon alternative fuels and clean vehicle technologies
3: Projects that use low carbon alternative fuels or clean vehicle technologies
1: Projects that do not use low carbon alternative fuels nor clean vehicle technologies

## Ability to Achieve GHG Reductions

Similar to the methodology established in the first preference criterion for criteria pollutant and toxic air contaminant emission reductions, staff conducted a full well-to-wheel GHG emissions analysis for the vehicles and equipment supported by the proposed projects. Staff determined expected lifetime GHG emission reductions achieved for each vehicle or equipment funded by the proposed projects and found that there were minimal or no GHG emission reductions. Because staff are proposing to use AQIP funding for HHD diesel replacements for Low NOx Engine Incentives without requiring the use of renewable fuels, staff found that there were no GHG emission reductions for Low NOx Engine Incentives funded by AQIP. The scoring scale for GHG emission reductions is shown below.

5: Greater than 200 metric tons of CO2e per vehicle
4: 150 to 199 metric tons of CO2e per vehicle
3: 100 to 149 metric tons of CO2e per vehicle
2: 50 to 99 metric tons of CO2e per vehicle
1: Less than 50 metric tons of CO2e per vehicle

Based on the information described above, Table A-52 summarizes the results and the corresponding score for this additional preference criterion.

**Table A-52: AB 8 Analysis – Ability to Achieve GHG Emission Reductions**

| Proposed Project | Annual Per-Vehicle GHG Emission Reductions (tpy) | Project Life (years) | Per-Vehicle Lifetime GHG Emission Reductions (tons) | Score |
|---|---|---|---|---|
| Truck Loan Assistance | N/A | 3 | N/A | 1 |
| Low NOx Engine Incentives | N/A | 3 | N/A | 1 |

## Ability to Support Market Transformation of California's Vehicle or Equipment Fleet to Utilize Low Carbon or Zero-Emission Technologies

This qualitative analysis ranked projects by whether or not technologies with the potential for market transformation are supported by the proposed projects. Staff used CARB's Three-Year Investment Strategy for Heavy-Duty Vehicles and Off-Road Equipment from Low Carbon Transportation and Air Quality Improvement Program Investments as a key reference in scoring technologies used for this evaluation. Low NOx engines, battery-electric, and fuel cell electric vehicle technologies, for example, are considered transformative technologies that will help the State meet its air quality goals. Staff scored this preference criterion based on the scale below.

5: Technologies that support market transformation
0: Technologies that do not support market transformation

## Ability to Leverage Private Capital Investments

Staff is proposing not to include this criterion for FY 2017-18 as staff works on developing methodologies to analyze the private capital investments leveraged by projects. Staff intends to identify information sources and may include this preference criterion in future years.

## *Total Benefit Index*

Staff utilized the benefit-cost/cost-effectiveness scores of the proposed projects and the additional preference criteria in the consideration of the projects to be given funding preference under AB 8. Staff developed the Total Benefit Index (TBI) score that preferentially weights the benefit-cost score (at 75 percent of the total score) with additional preference scores (at 25 percent of the total score). Staff weighted the benefit-cost/cost-effectiveness scores in this manner because AB 8 identified the benefit-cost score as the primary metric to assign funding preference for proposed projects.

Table A-53 summarizes the individual scores and the TBI scores for all of the AQIP projects currently proposed in the FY 2017-18 Funding Plan.

**Table A-53: AB 8 Analysis – Project Scores and Total Benefit Index Score of Proposed Projects**

| Proposed Project | Additional Preference Criteria | | | | | 25% of TBI | 75% of TBI | Total Benefit Index Score |
|---|---|---|---|---|---|---|---|---|
| | Potential Reduction of Criteria or Toxic Air Pollutants | Contribution to Regional Air Quality Improvement | Ability to Promote Use of Clean Fuels and Technologies | Ability to Achieve GHG Emission Reductions | Ability to Support Market Transformation | **Average of Additional Preference Criteria Score** | **Benefit-Cost Score** | |
| Truck Loan Assistance | 2 | 5 | 3 | 1 | 0 | 2.2 | 5 | 4.3 |
| Low NOx Engine Incentives | 2 | 5 | 5 | 1 | 5 | 3.6 | 1 | 1.65 |

## AB 1550: Disadvantaged Community, Low-Income Community, Low-Income Household Investment Targets

In the proposed Funding Plan, staff proposes that at least 45 percent of CARB's Low Carbon Transportation appropriation be invested in projects meeting one of the AB 1550 criteria with the following targets:

- At least 35 percent of funds for projects located within and benefiting disadvantaged communities.

- At least 10 percent of funds for projects within and benefiting low-income communities or benefiting low-income households. The subset of these funds meeting the additional AB 1550 requirement for low-income community/ household investments that are <u>within ½ mile of a disadvantaged community</u> would be determined based on program implementation and reported in future Annual Reports to the Legislature on California Climate Investments.

Staff considers the investment targets to be a floor and expects to exceed them. This section provides additional detail showing how CARB will meet, and very likely exceed these targets, based on a historical performance of Low Carbon Transportation funded projects and the project criteria established in this Funding Plan.

This minimum CARB commitment of at least 45 percent would exceed the overall target set in AB 1550 for the State's collective California Climate Investments in disadvantaged communities, low-income communities, and low-income households. AB 1550 does not set targets for individual agencies, but requires that the State overall invest at least 25 percent in project located in and benefiting disadvantaged communities, at least 5 percent in and benefiting low-income communities or benefiting low-income households, and at least 5 percent low-income communities located within ½ mile of a disadvantaged community for a total AB 1550 investment of at least 35 percent of California Climate investment funds.

Table A-54 shows staff estimates of the minimum percent of funds for each project expected to be spent within and benefiting disadvantaged community census tracts as well as the non-overlapping minimum percent of funds expected to be spent within and benefiting low-income communities. Staff only counted an investment as being in a low-income community if it had not already been counted as being spent in disadvantaged communities because AB 1550 does not allow funds to be counted twice for reporting purposes. Staff used several different methods for these estimates.

For ongoing projects with several years of implementation data such as CVRP, HVIP, and EFMP Plus-Up, staff used the historical percent of funds spent in disadvantaged communities as reported in the *2017 Annual Report on California Climate Investments* to project future performance. In the case of HVIP, staff updated these estimates based on vouchers issued through February 2017. In the case of EFMP Plus-Up, staff adjusted the future projection to be more conservative because of the lack of historical

data for the potential new air districts expected to start programs. Staff estimated the percent of funds within low-income communities by comparing the most recent project data with the low-income communities identified by CARB and Cal/EPA in April 2017 and the development of guidelines for implementing AB 1550. For EFMP Plus-Up, there are historical data on participants' incomes, so staff estimated the expected percent of funds that would be invested in low-income households.

As shown in Table A-54, several project categories are limited to disadvantaged communities, so staff can say with certainty 100 percent of these funds will be spent in these communities. These include Clean Mobility Options for Disadvantaged Communities, Agricultural Worker Vanpools, and Zero- and Near Zero-Emission Freight Facilities.

There are also a number of proposed projects that lack sufficient historical data upon which to make an informed estimate of the percent of funds that will be spent in disadvantaged and low-income communities. In these cases, staff took the most conservative approach and left the estimates as "to be determined" even though staff expects an appreciable amount of this funding will meet one of the AB 1550 criteria. For example, the Financing Assistance of Lower-Income Consumers pilot project will be limited to consumers with household incomes of less than 400 percent of the federal poverty limit and outreach will be targeted in disadvantaged communities. Thus, staff expects much of this funding will be spent in disadvantaged communities, in low-income communities, or for consumers meeting the AB 1550 low-income household definition.

Even with these conservative estimates, staff estimates that over 34 percent of the proposed Low Carbon Transportation funds would be spent in disadvantaged communities and over 10 percent in non-overlapping low-income communities for a total of over 45 percent meeting one of the AB 1550 criteria as shown in Table A-54. When data are included for all the projects based on actual performance including those for which no AB 1550 is estimated at this time, staff expects CARB will exceed its AB 1550 targets by a considerable margin. CARB will report on these projects' performance in future Annual Reports to the Legislature on California Climate Investments as funds are awarded and spent.

**Table A-54: Estimate of the Minimum Proposed FY 2017-18 Low Carbon Transportation Investments in Disadvantaged Communities, Low-Income Communities, and Low-Income Households**

| Project | Allocation (million) | % in DC | $ in DC (million) | % in LIC (non-overlapping) | $ in LIC (million) | %DC/LIC Combined | $DC/LIC Combined (million) | Data Source for Estimates |
|---|---|---|---|---|---|---|---|---|
| **Light-Duty Vehicle and Transportation Equity Projects** | | | | | | | | |
| CVRP | $140 | 7% | $10 | 11% | $15 | 18% | $25 | • 7% spent in DCs to date from *2017 Annual Report on California Climate Investments.*<br>• Staff estimates 11% in LICs not overlapping with DCs based on 2016 CVRP data. |
| EFMP Plus-up | $10 | 50% | $5 | 25% | $2.5 | 75% | $8 | • 64% spent in DCs to date from *2017 Annual Report on California Climate Investments*. Staff made a more conservative future estimate of 50% because potential new districts have less dense concentration of DC census tracts.<br>• 90% spent to date in low-income households (meeting AB 1550 definition). Staff made a more conservative future estimate of 75% due to lack of historical data for potential new air districts. |
| Financing Assistance for Lower-Income Consumers | $10 | tbd | $- | tbd | $- | tbd | $- | • No data upon which to base estimates, so left as "to be determined" to be most conservative.<br>• Statewide project, but limited to participants with household incomes less than 400% of federal poverty limit with outreach targeted in DCs, so appreciable amount of funds should be spent in DCs, LICs, or low-income households. |
| Clean Mobility Options | $17 | 100% | $17 | 0% | $- | 100% | $17 | • Project limited to DCs. |
| Ag Worker Vanpools | $3 | 100% | $3 | 0% | $- | 100% | $3 | • Project limited to DCs. |
| Rural School Bus Pilot Project | $10 | tbd | $- | tbd | $- | tbd | $- | • No data upon which to base estimates, so left as "to be determined" to be most conservative.<br>• Many of the school districts expected to receive funding located in LICs, so appreciable amount of funds should be spent in LICs. |
| Low-Income CVRP Rebates | $40 | 7% | $3 | 11% | $4 | 18% | $7 | • Used same data as CVRP standard rebates above.<br>• Low-income rebates limited to consumers earning less than 300% of federal poverty level; very likely a larger percentage of these funds will be spent in DCs, LICs, or AB 1550 low-income households. |

**Table A-54: Estimate of the Minimum Proposed FY 2017-18 Low Carbon Transportation Investments in Disadvantaged Communities, Low-Income Communities, and Low-Income Households (cont.)**

| Project | Allocation (million) | % in DC | $ in DC (million) | % in LIC (non-overlapping) | $ in LIC (million) | %DC/LIC Combined | $DC/LIC Combined (million) | Data Source for Estimates |
|---|---|---|---|---|---|---|---|---|
| Allocate Based on Demand | $10 | tbd | $- | tbd | $- | tbd | $- | • Will quantify and report based on project implementation. |
| **Heavy-Duty Vehicle and Off-Road Projects** | | | | | | | | |
| Zero-Emission Off-Road Freight Voucher Incentives | $40 | tbd | $- | tbd | $- | tbd | $- | • No data upon which to base estimates, so left as "to be determined" to be most conservative.<br>• Statewide project, but freight equipment used at facilities predominantly located in DCs. Project design provides extra incentives for equipment in DCs, so appreciable amount of funds should be spent in DCs. |
| Zero- and Near Zero-Emission Freight Facilities | $100 | 100% | $100 | 0% | $- | 100% | $100 | • Project limited to DCs. |
| Clean Truck and Bus Vouchers (HVIP + Low NOx Engine Incentives) | $180 | 30% | $54 | 25% | $45 | 55% | $99 | • 39% spent in DC and 29% in LICs not overlapping with DCs based on HVIP vouchers reserved or issued through February 2017. Limited data for low NOx engine vouchers upon which to base estimate.<br>• Staff made a more conservative future estimate of 30% spent in DC and 25% in LICs not overlapping with DCs because of limited data on low NOx voucher distribution and no historical data for new technology/vehicle classes that may enter market. |
| **Total** | **$560** | **34%** | **$192** | **12%** | **$67** | **46%** | **$259** | |

**DC** means disadvantaged community as described in Health and Safety Code Section 39711.
**LIC** means low-income community (or low-income household in the case of EFMP Plus-up) as defined in Health and Safety Code Section 39713.
"% in LIC" shown in this table means the percent of funds spent in low-income communities that have not already been counted as being spent in disadvantaged communities because AB 1550 does not allow funds to be counted twice for reporting purposes.
**tbd** means "to be determined" and reported in future *Annuals Report on California Climate Investments* based on project implementation.

# Appendix B

# SB 1204 REQUIREMENTS AND PERFORMANCE CRITERIA EVALUATION FOR HEAVY-DUTY PROJECTS

(Health & Safety Code Section 39719.2(c) and (d))

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## Overview

SB 1204 (Lara, Chapter 452, Statutes of 2014) created the California Clean Truck, Bus, and Off-road Vehicle and Equipment Technology Program funded with Low Carbon Transportation Investments, to support the development, demonstration, pre-commercial pilot, and early commercial deployment of zero- and near zero-emission technologies with priority given to projects that benefit disadvantaged communities. This appendix describes the ten requirements of SB 1204 and how CARB is addressing each of these requirements, followed by an evaluation of how each applicable heavy-duty or off-road project proposed in the FY 2017-18 Funding Plan satisfies the proposed performance criteria.

CARB's proposed heavy-duty vehicle and off-road equipment projects were evaluated based on a range of criteria that address emission reductions, technology viability and advancement, and market acceptance. Both SB 1204 and AB 8 (Perea, Chapter 401, Statutes of 2013) provide important policy drivers behind CARB's process of evaluating heavy-duty and off-road projects for funding consideration. Projects funded by AQIP must be evaluated based on the benefit-cost of criteria pollutant reductions and five additional preference criteria consistent with the requirements of AB 8, as detailed in Appendix A – Emission Reductions: Quantification Methodology. While some of the heavy-duty and off-road projects receive funding from AQIP, most are funded from CARB's Low Carbon Transportation appropriation and must satisfy the requirements of SB 1204, discussed in this appendix. Therefore, to ensure compliance with the requirements from both bills, CARB evaluated all proposed heavy-duty projects consistent with the benefit-cost and additional preference criteria requirements of AB 8 and the requirements of SB 1204, regardless of the project funding source. The complete AB 8 and GHG emission analysis is detailed in Appendix A.

## 1. Addressing SB 1204 Requirements

SB 1204 establishes specific program planning and project eligibility requirements and directs CARB to use the existing AQIP Funding Plan process to develop the guidance necessary to implement the program (Health and Safety Code section 39719.2(c)). The Funding Plan coordinates AQIP and Low Carbon Transportation investments in the heavy-duty sector, while implementing the specific statutory requirements that apply to each program.

SB 1204 establishes ten goals for California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology Program in Health and Safety Code section 39719.2(d) that should be addressed in CARB's guidance. The following describes how CARB will address each of these requirements, either by continuing procedures and processes that have been in place for previous AQIP or Low Carbon Transportation funding cycles or through new requirements proposed in this Funding Plan, followed by CARB's overarching vision for heavy-duty vehicle investments.

*SB 1204 Requirement 1: Outline performance criteria and metrics for deployment incentives. The goal shall be to design a simple and predictable structure that provides incentives for truck, bus, and off-road vehicle and equipment technologies that provide significant greenhouse gas reduction and air quality benefits.*

As Low Carbon Transportation and AQIP evolve, there is a clear need to evaluate the effectiveness of program investments. Staff has and will continue to work with stakeholders to identify appropriate metrics of success for each project funded under AQIP and the California Clean Truck, Bus, and Off-Road Vehicle and Equipment Program.

To achieve the pace of technology advancement needed to meet long-term air quality and climate goals, this funding should spur increasingly low-emission and low-carbon technologies as they are introduced and achieve market acceptance. The availability of significant Low Carbon Transportation funding will enable the progression of advanced heavy-duty technologies toward commercialization at a faster pace. Similar to how light-duty vehicles transitioned from basic hybrids to plug-in and fuel cell electric vehicles, basic hybrid trucks are a precedent to advanced hybrids, and finally to the ultimate goal of zero-emission trucks (or trucks that achieve zero-emission miles in specific duty cycles).

While CARB's heavy-duty vehicle incentives have historically funded hybrid and zero-emission urban package and delivery trucks, California Clean Truck, Bus, and Off-Road Vehicle and Equipment Program funding is expected to also expedite widespread deployment of zero-emission urban buses, freight and line-haul trucks, and off-road equipment, which are responsible for the bulk of emissions from the heavy-duty sector. Investments in Clean Truck and Bus Vouchers (HVIP and Low NOx Engine Incentives), the Zero-Emission Off-Road Freight Voucher Incentive Project, and Zero/Near Zero-Emission Freight Facilities Projects all play a critical role in transitioning the entire freight and passenger transportation sector to zero-emission technologies, while at the same time providing immediate benefits to disadvantaged communities.

*Proposed Performance Criteria for Evaluating Heavy-Duty Projects*: Staff proposes the following performance criteria for evaluating heavy-duty projects funded through AQIP, California Clean Truck, Bus, and Off-Road Vehicle and Equipment Program, or both. These performance criteria are also intended to fulfill SB 1204 requirements:

- Potential for statewide and local emission reductions and health benefits.
    - Near-term reductions in both GHG and criteria emissions.
    - Long-term reductions in GHG and criteria emissions.
    - Emission reductions in non-attainment areas.
    - Emission reductions in and benefiting disadvantaged communities.

- Potential for technology viability.
    - Cost parity compared to conventional technology.

- Reliability and durability in chosen application.
- Ability to transfer technology to other vehicle or equipment types.
- Fueling infrastructure support.
- Ability to integrate renewable fuels.

- Broad market acceptance.
  - Ability to leverage additional public and private funding.
  - Collaboration between multiple entities.
  - Ability to address market barriers.

*SB 1204 Requirement 2: Ensure that program investments are coordinated with funding programs developed pursuant to the California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007 (Chapter 8.9 (commencing with Section 44270) of Part 5).*

Developing a joint Funding Plan that covers both AQIP and Low Carbon Transportation funding sources ensures coordinated investments between these two programs. The California Clean Truck, Bus, and Off-Road Vehicle and Equipment Program complements and enhances the existing CARB/Energy Commission coordination in the AQIP planning process by directing additional funding for the development, demonstration, pre-commercial pilot, and early commercial deployment of zero- and near zero-emission truck, bus, and off-road vehicle and equipment technologies.

In developing the joint Funding Plan, CARB and the Energy Commission staff meet routinely during the development of each agency's funding/investment plans for these respective programs to ensure that investments are coordinated. CARB has a representative on the Advisory Committee that assists with the development of the Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program. Similarly, Energy Commission staff participate in the public workshops and work groups that are part of CARB's annual funding plan development.

*SB 1204 Requirement 3: Promote projects that assist the state in reaching its climate goals beyond 2020, consistent with Sections 38550 and 38551.*

In the FY 2014-15, FY 2015-16, and FY 2016-17 Funding Plans, heavy-duty projects focused on vehicles and industry sectors that, when transitioned to zero-emission, will have a significant impact on reducing climate change emissions. All of these Funding Plans included significant Low Carbon Transportation funding allocations for demonstrations, pilot commercial deployments, and ongoing deployments of commercially available vehicles that will achieve both near-term and long-term GHG emission reductions.

By continuing to develop promising near zero- and zero-emission technologies for use in industry sectors that: (1) are significant GHG emitters; and (2) hold promise for technology expansion and transfer to other sectors, these investments will help the State reach its long-term climate goals. Some of the key performance criteria listed

above are “potential for long-term GHG reductions” and “ability to transfer technology to other vehicle or equipment types.” These criteria help to promote projects that will contribute to meeting post-2020 climate goals.

> *SB 1204 Requirement 4: Promote investments in medium- and heavy-duty trucking, including, but not limited to, vocational trucks, short-haul and long-haul trucks, buses, and off-road vehicles and equipment, including, but not limited to, port equipment, agricultural equipment, marine equipment, and rail equipment.*

Since the launch of AQIP with the first annual Funding Plan in 2009, CARB has funded the types of projects identified by SB 1204, and staff proposes to continue and to expand these investments. As shown in Table I-4 in Chapter 2 of this Funding Plan, staff proposes $320 million for pilots and deployment projects in the truck, bus, and off-road vehicle and equipment sectors.

> *SB 1204 Requirement 5: Implement purchase incentives for eligible technologies to increase use of the cleanest vehicles in disadvantaged communities.*

To date, approximately 60 percent of CARB’s Low Carbon Transportation funding has been allocated to benefit disadvantaged communities, including low-income residents of these communities, and about 30 percent of this funding will be spent in disadvantaged communities. The 30 percent spent in disadvantaged communities greatly exceeds the commitments made in past Funding Plans. For FY 2017-18, staff anticipates exceeding the current requirement that at least 25 percent of auction proceeds be invested for projects within and benefiting disadvantaged communities; 5 percent for projects within and benefiting low-income communities or benefiting low-income households statewide; and 5 percent for projects within and benefiting low-income communities, or low-income households, that are within ½ mile of a disadvantaged community. This will ensure that CARB’s heavy-duty vehicle incentives increase the use of the cleanest vehicles in these communities.

Over past funding cycles, CARB has provided AQIP and Low Carbon Transportation funding for purchase incentives for clean technologies, reducing emissions from the heavy-duty sector and providing benefits to disadvantaged communities. To date, nearly 3,100 vouchers have helped fund hybrid and battery electric delivery trucks and buses through HVIP, with about two-thirds of HVIP funding providing benefits to disadvantaged communities, and about 50 percent spent in disadvantaged and low income communities.

> *SB 1204 Requirement 6: Allow for remanufactured and retrofitted vehicles to qualify for purchase incentives if those vehicles meet warranty and emissions requirements, as determined by the state board.*

The Hybrid and zero-emission conversions of original equipment manufacturer (OEM) vehicles were added to HVIP in FY 2015-16 and will continue for this project in

FY 2017-18. Conversions of existing in-use vehicles to zero-emission are also already an eligible vehicle category, as are repowers of existing heavy-duty vehicles with engines certified to an optional low NOx standard.

*SB 1204 Requirement 7: Establish a competitive process for the allocation of moneys for projects funded pursuant to this section.*

CARB has used an established process for awarding AQIP funding through competitive solicitations since 2009. This process is serving as the basis for allocating most Low Carbon Transportation funding in the FY 2014-15 funding cycle, and staff proposes using the same process moving forward to solicit and award California Clean Truck, Bus, and Off-Road Vehicle and Equipment Program funding. Staff also proposes to allow funding allocations to be directed to a local air district or other agency to administer first-come first-served funding projects that more effectively address local needs.

*SB 1204 Requirement 8: Leverage, to the maximum extent feasible, federal or private funding.*

Currently, most grant solicitations require a minimum level of match funding, and projects that offer more match funding have the potential to be scored higher than projects with less match funding. Proponents are encouraged to seek additional funding from federal, state, and local public sources, as well as private sources. Staff proposes continuing the solicitation scoring criteria to encourage leveraging and is working with other funding providers to maximize federal and private funding.

*SB 1204 Requirement 9: Ensure that the results of emissions reductions or benefits can be measured or quantified.*

Since the inception of AQIP, all grant solicitations require that the project proponent report various metrics associated with vehicle operation and fuel consumption. Emissions from vehicles certified to a cleaner standard (i.e., low NOx) will be compared to a diesel baseline to determine emission reductions. Fuel consumption and carbon intensity will be used to quantify GHG emission benefits from hybrids, battery electric and fuel cell electric vehicles, as well as from vehicles using renewable fuels, compared to their conventional counterparts. All program-level emission reduction benefits will be quantified by comparing to conventional technologies on a well-to-wheel basis. In addition, telematic devices will be used when possible to monitor in-use data and provide information on usage in disadvantaged communities and other designated areas. Staff proposes to contract with a third party to collect and analyze operation, maintenance, and performance data associated with demonstration and pilot projects.

> *SB 1204 Requirement 10: Ensure that activities undertaken pursuant to this section complement, and do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminants.*

The zero- and near zero-emission technologies funded in California Clean Truck, Bus, and Off-Road Vehicle and Equipment Program provide GHG reductions as well as criteria pollutant and toxic air contaminant reductions, consistent with the existing AQIP program. These technologies operating in and near disadvantaged communities will reduce NOx and diesel particulate matter, contribute to criteria pollutant emission reductions, and reduce GHG emissions in the heavy-duty sector.

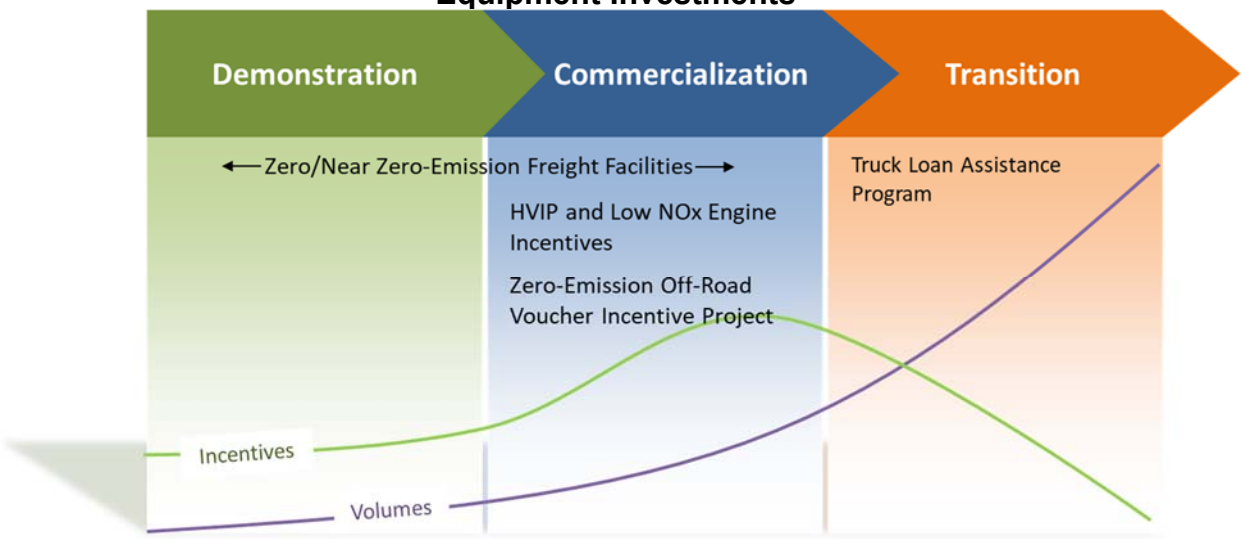
## OVERARCHING VISION FOR HEAVY-DUTY VEHICLE INVESTMENTS

SB 1204 directs that the annual framework and plan required under Health and Safety Code Section 39719.2(f):

> Articulate an overarching vision for technology development, demonstration, pre-commercial pilot, and early commercial deployments, with a focus on moving technologies through the commercialization process.

The recommended heavy-duty vehicle and off-road equipment projects support SB 1204's overarching vision for technology development, demonstration, pre-commercial pilot, and early commercial deployments, with a focus on moving technologies through the commercialization process. This evolutionary role of incentives – is illustrated in Figure B-1 and described below.

**Figure B-1: Recommended FY 2017-18 Heavy-Duty Vehicle and Off-Road Equipment Investments**




In the *demonstration phase*, manufacturers are placing pre-commercial vehicles and equipment in service under real-world operating conditions. In this phase, per-vehicle incentives are high because manufacturing is not standardized and is focused on smaller batches of vehicles.

Funding is also provided for *pilot projects* to help the technology evolve in the early commercialization phase by deploying a larger volume of vehicles and equipment. Pilot projects can include both pre-commercial pilots and commercial pilots depending on the stage of technology advancement. *Pre-commercial pilots* are focused on first-time demonstrations of advanced technologies in new applications. *Commercial pilots*, on the other hand, involve deployments of vehicles and equipment that have been demonstrated, are certified by CARB, come with a warranty, and are purchased or leased by the end user. Vehicles in commercial pilots are ready to be sold commercially, but in such small numbers that they would not be able to compete without incentive support.

**Table B-1: Pilot Project Categories**

| Milestone | Demonstration or Pre-commercial Pilot | Early Commercial Deployment or Commercial Pilot |
|---|---|---|
| CARB Certification/Approval | Experimental permit | Vehicle/engine certification or zero-emission approval letter |
| Vehicle Ownership | Retained by manufacturer | Purchase or lease transaction |
| Manufacturer Warranty | No | Yes |

In addition, many projects would not advance to commercialization without the appropriate fueling infrastructure. For this reason, CARB provides funding for fueling infrastructure that directly supports funded vehicles and equipment.

In the *commercialization phase*, incentives are provided to encourage consumer adoption of advanced technologies. The commercialization phase can be broadly separated into lower volume and higher volume production phases. In the lower volume commercialization phase, per vehicle incentives are high. As sales grow and economies of scale are achieved, incentive funding levels and vehicle eligibility requirements can be adjusted to reduce per vehicle funding to ensure maximum incentive efficiency. In this higher volume commercialization phase, while per vehicle incentives are decreasing, total sales are increasing and total incentive funding commitments increase as a result. As a technology moves from lower volume commercialization to a fuller more mature higher volume, the incentive funding goals shift from a focus on technology development to a more specific focus on moving the technology from early adopters to mainstream consumers, disadvantaged communities, and the secondary market.

As a technology moves from commercialization into the transition phase, incentives can be adjusted to focus specifically on moving the technology into new consumer demographic segments and on building upon earlier benefits in disadvantaged communities.

## 2. Project-Specific SB 1204 Performance Criteria Evaluation

The following sections include an evaluation of each proposed heavy-duty and off-road equipment project in terms of how they satisfy the proposed performance criteria detailed earlier in this appendix.

### ZERO-EMISSION OFF-ROAD FREIGHT VOUCHER INCENTIVE PROJECT

Following is an assessment of the proposed Zero-Emission Off-Road Freight Voucher Incentive Project in terms of how it meets the proposed SB 1204 evaluation and performance criteria.

*Potential for Statewide and Local Emission Reductions and Health Benefits*: The proposed project is expected to achieve near-term greenhouse gas reductions along with co-benefit reductions in toxic and criteria pollutant emissions. The zero-emission off-road freight voucher incentive project is being designed to encourage and accelerate the deployment of new zero-emission off-road freight equipment in California, ultimately leading to long-term reductions in criteria and greenhouse gas emissions, and aiding California in attaining federal ozone and particulate matter standards within non-attainment areas. This proposed funding would be available statewide and implemented on a first-come, first-served basis, so it is not possible to estimate in advance exactly how much funding will be spent in and benefit disadvantaged communities, low-income communities, and low-income households. However, staff expects that much of this funding will be spent in and benefit these communities because so many freight facilities are located in disadvantaged or low-income communities. Furthermore, staff is proposing higher voucher amounts for equipment

used at facilities located in disadvantaged communities in order to encourage participation from fleets operating in these communities.

*Potential for Technology Viability*: The incremental cost for zero-emission off-road freight equipment is substantial when compared to its conventional counterparts. Providing incentive funding towards the purchase of zero-emission equipment accelerates the penetration of these technologies into the heavy-duty market. Increased production volumes will lead to cost reductions in components and assembly, energy storage systems, and fueling infrastructure. Increasing the numbers of advanced technology equipment will also result in increased demand for electricity and hydrogen fuels, which will help the state to meet its goals for transitioning from petroleum to fuels produced from renewable resources.

*Broad Market Acceptance*: The proposed project is being structured to encourage the leveraging of local, State, federal, and private funding. Fleets would be allowed to apply to multiple funding sources; however, the maximum allowable voucher plus all other public incentives may not exceed the incremental cost of the equipment. The collaboration between public agencies and their commitment to invest resources toward improving local air quality motivates advanced technology providers to invest in developing near zero- and zero-emission technologies. Incentive funding, along with public and private partnerships, encourages the deployment of advanced technology, reduces production costs, and increases commercial viability within the off-road freight equipment market. Greater availability of zero-emission freight equipment that successfully performs the same functions as their conventional counterparts will send a strong signal to those considering adopting similar zero-emission technologies.

## ZERO- AND NEAR ZERO-EMISSION FREIGHT FACILITIES PROJECT

Following is an assessment of the proposed Zero/Near Zero-Emission Freight Facilities Project in terms of how it meets the proposed SB 1204 evaluation and performance criteria.

*Potential for Statewide and Local Emission Reductions and Health Benefits*: The proposed project is expected to achieve near-term greenhouse gas reductions along with co-benefit reductions in toxic and criteria pollutant emissions. Longer term reductions in GHG, criteria and toxic pollutant emissions will be realized as the zero/near zero-emission freight facilities projects increase in scale over time, and as more end-users take advantage of the incentive funding for these technologies. Staff expects 100% of the equipment funded will benefit disadvantaged communities, which will have the added benefit of improving air quality in areas non-attainment.

*Potential for Technology Viability*: Funding to incentivize the purchase of zero and near zero-emission advanced technology freight vehicles and equipment has significant potential for technology viability by helping to support their penetration into the broader market, which in turn will positively impact cost differentials and consumer acceptability. The availability of funds for current commercialized freight technology will also help

transition zero and near zero-emission technologies to similar freight related applications that require even higher horsepower and longer duty cycles.

*Broad Market Acceptance*: Collaboration and commitment on the part of early users and beneficiaries of clean technology is essential to market acceptance. Fortunately, the need for air quality improvements is the impetus behind federal, state, and local funding for technologies that will result in lower emissions and increased use freight technology. The project will increase public and industry acceptance of the technology through education, outreach, and positive exposure to new technologies. Zero and near zero-emission freight technologies that successfully perform the same functions as their conventional counterparts will send a strong signal to those considering adopting similar zero and near zero-emission technologies.

$50 million of the proposed allocation for this project is funded through the Transportation Corridor Enhancement Account program and is not required to meet SB 1204 requirements; however it is consistent with a number of SB 1204's performance criteria. This portion of the proposed project is intended to facilitate the implementation of zero- and near zero-emission technology in multiple types of on- and off-road vehicles and equipment in warehouse facilities, which would result in criteria pollutant, toxic air contaminant, and GHG emission reductions as older diesel-powered equipment and vehicles are replaced with advanced technology. Where the project can successfully demonstrate pre-commercial zero-emission on- and off-road vehicles and equipment, it will support broad market utilization of these technologies and future cost-reductions due to economy-of-scale production. Since many of these projects will also require the installation of fueling infrastructure, they provide the opportunity to demonstrate hydrogen and charging fueling infrastructure in heavy duty on-and off-road applications, as well as provide increased opportunities to integrate renewable fuels. Staff proposes that 100% of the funding in this category go to projects located in disadvantaged communities.

## CLEAN TRUCK AND BUS VOUCHERS (HVIP AND LOW NOX ENGINE INCENTIVES)

### HYBRID AND ZERO-EMISSION TRUCK AND BUS VOUCHER INCENTIVE PROJECT

Following is an assessment of the proposed Zero-Emission Truck and Bus Pilot Commercial Deployment Projects relative to the proposed SB 1204 evaluation and performance criteria.

*Potential for statewide and local emission reductions and health benefits*: Zero emission trucks and buses, along with hybrid trucks, are designed to achieve near-term and long-term emission reductions. Vouchers issued to date indicate that about two thirds of HVIP funding has provided benefits to disadvantaged communities. Staff expects that for FY 2017-18 allocations, about one-third of HVIP and Low NOx Engine Incentives would be located in disadvantaged communities and an additional 15 percent located in low-income communities, with a combined total of about 50 percent. HVIP is designed to encourage and accelerate the deployment of new hybrid and zero-emission

trucks and buses in California, ultimately leading to long-term reductions in criteria and greenhouse gas emissions, and aiding California in attaining federal ozone and particulate matter standard within non-attainment areas.

*Potential for technology viability*: The incremental cost for zero-emission trucks and buses is substantial when compared to their conventional counterpart. For hybrid trucks, the incremental cost is not as significant. Providing incentive funding towards the purchase of zero-emission trucks and buses, along with hybrid trucks accelerates the penetration of these technologies into the heavy-duty market. Increased production volumes will lead to cost reductions in vehicle components and assembly, energy storage systems, and fueling infrastructure. Making this funding available to medium heavy-duty vehicles (14,001 to 26,000 pounds GVWR) will help transition the technology to heavy heavy-duty vehicles (greater than 26,000 pounds GVWR), since advanced technologies are often implemented in lighter weight classes before evolving to heavier weight classes with longer duty cycles. Increasing the numbers of advanced technology vehicles and miles traveled will also result in increased demand for electricity and hydrogen fuels, which will help the state meet goals for transitioning from petroleum to fuels produced from renewable resources.

*Broad Market Acceptance*: HVIP is structured to encourage leveraging of local, State, federal funding and private funding. The collaboration between public agencies and their commitment to invest resources toward improving local air quality motivates advanced technology providers to invest in developing near zero-, and zero-emission technologies. Incentive funding, along with public and private partnerships, encourages the deployment of advanced technology, reduces production costs, and increases commercial viability within the truck and bus market.

### LOW NOX ENGINE INCENTIVES

Following is an assessment of the proposed low NOx engine incentives in terms of how they meet the proposed SB 1204 evaluation and performance criteria.

*Potential for Statewide and Local Emission Reductions and Health Benefits*: The Low NOx Engine Incentives project is expected to achieve near-term reductions of GHG and criteria pollutant emissions, particularly with the use of renewable fuels. These near-term reductions will complement the incentives provided for zero-emission pathway technologies that achieve long-term reductions. Staff expects that for FY 2017-18 allocations, about one-third of HVIP and Low NOx Engine Incentives would be located in disadvantaged communities and an additional 15 percent located in low-income communities, with a combined total of about 50 percent. Staff will rely on required reporting and monitoring information to quantify the emission reductions in disadvantaged communities and federal ozone standard non-attainment areas.

*Potential for Technology Viability*: Funding to incentivize the purchase of early low NOx heavy-duty vehicle engines has significant potential for technology viability. Incentivizing the production and purchase of vehicles with these engines will help

support their penetration into the heavy-duty market, which in turn will positively impact cost differentials and consumer acceptability. Making this funding available to medium heavy-duty vehicles (14,001 to 26,000 pounds GVWR) will help transition the technology to heavy heavy-duty vehicles (greater than 26,000 pounds GVWR), since advanced technologies are often implemented in lighter weight classes before evolving to heavier weight classes with longer duty cycles. Lastly, this project encourages the development of renewable fuels by requiring renewable fueling for vehicles funded by Low Carbon Transportation Investments.

*Broad Market Acceptance*: Incentivizing the production and purchase of vehicles with low NOx engines will help support consumer acceptance and drive down incremental costs. Staff will continue to coordinate with the Energy Commission to ensure a clear, systematic implementation approach for this project. This coordination will be essential in addressing market barriers, since the Energy Commission has significant experience developing and implementing funding projects for alternative fueled vehicles.

## TRUCK LOAN ASSISTANCE PROGRAM

The proposed allocation for this ongoing AQIP-funded program is not required to meet SB 1204 requirements, and much of SB 1204's performance criteria does not apply since no advanced technologies would be used. However, the project would continue to help small business truckers comply with the In-Use Truck and Bus Regulation, which would result in criteria pollutant and toxic air contaminant emission reductions as older diesel trucks are replaced with cleaner vehicles or retrofitted with diesel emission control devices. Because newer trucks are more fuel-efficient, fleet turnover resulting from the proposed allocation will also achieve GHG emission reductions. Additionally, much of the Truck Loan Assistance Program funding benefits disadvantaged communities. Over 80 percent of the loans to date have been issued for trucks registered in zip codes that are defined as benefiting disadvantaged communities.

## RURAL SCHOOL BUS PILOT PROJECT

Following is an assessment of the proposed Rural School Bus Pilot Project in terms of how it meets the proposed SB 1204 evaluation and performance criteria.

*Potential for statewide and local emission reductions and health benefits*: Incentivizing lower carbon options for California's rural school bus fleet is expected to achieve near-term and long-term emission reductions. Displacing older, conventional-fueled school buses with zero-emission or hybrid technologies will result in immediate reductions of criteria pollutant, toxic air contaminant, and GHG emissions, providing health benefits to children, California's largest population group sensitive to the effects of air pollution. Internal combustion engine school buses using renewable fuels will also provide immediate GHG reductions while increasing the demand for low carbon fuels. The pilot deployments are designed to help overcome technology and market barriers to widespread adoption, ultimately leading to long-term reductions in emissions associated with the production and combustion of conventional fuel. Finally, while it is unknown if

funding will occur in disadvantaged community census tracts, centering projects in rural areas will enhance fleet turnover to cleaner technologies in areas that would not otherwise benefit.

*Potential for technology viability*: As has been the case with the zero-emission bus pilot deployments, the Rural School Bus Pilot Project will increase the numbers of zero-emission school buses in use and increase zero-emission miles. These increases will contribute to economy-of-scale cost reductions and provide school bus fleets the potential to experience fuel and maintenance cost savings. The use of renewable fuels for internal combustion engine school buses will help support the goals of the Low Carbon Fuel Standard and provide an opportunity to reduce GHG emissions. All of the low carbon options available in this project will help the State meet goals for reducing petroleum use.

*Broad Market Acceptance*: Collaboration and commitment on the part of early users and beneficiaries of clean technology is essential to market acceptance. The need for air quality improvements is the impetus behind federal, state, and local funding for technologies that will result in lower emissions and increased use of school buses with these technologies. The project will increase public and industry acceptance of zero-emission school buses and clean fuels through education, outreach, and positive exposure to new technologies. Advanced technology school buses and school buses using renewable fuels that successfully perform the same functions as their conventional counterparts will send a strong signal to those school bus owners considering adopting similar advanced clean technologies.

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