

Public Workshop
on the Development of the Fiscal Year (FY) 2016-17 Funding Plan for
Low Carbon Transportation and Fuels Investments and
the Air Quality Improvement Program (AQIP)

DISCUSSION DOCUMENT

Public Workshop Date and Location:

Monday, April 4, 2016
9:30 a.m. to 4:00 p.m.
Cal/EPA Headquarters Building
Coastal Hearing Room, 2nd Floor
1001 I Street
Sacramento, California 95814

Link to Workshop Notice:

<http://www.arb.ca.gov/msprog/mailouts/msc1602/msc1602.pdf>

Link to Webcast Information:

<http://www.calepa.ca.gov/broadcast/>

Workshop presentation will be posted on the morning of the workshop at:

<http://www.arb.ca.gov/aqip/>

Released: March 25, 2016

Workshop Agenda

9:30 am – 10 am	Introduction and Overview of Project Category Funding Allocations
10 am – Noon	Light-Duty Vehicle Investments (SB 1275) <ul style="list-style-type: none">• Long-Term Plan for CVRP and Light-Duty Incentives• CVRP: Recommendations for 2016-17• Projects to Benefit Disadvantaged Communities and Low-Income Consumers: Recommendations for 2016-17
Noon – 1 pm	Lunch Break
1 pm – 2:30 pm	Heavy-Duty and Off-Road Investments (SB 1204/AQIP)
2:30 pm – 4 pm	Very Low Carbon Fuels Incentives

Times above are approximate and subject to change.

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DISCUSSION DOCUMENT INTRODUCTION

The Governor's proposed 2016-17 budget would appropriate to the Air Resources Board (ARB or Board) \$500 million in Cap-and-Trade auction proceeds for Low Carbon Transportation and Fuels investments and \$28.6 million for Air Quality Improvement Program (AQIP) projects. ARB staff is developing the proposed *Fiscal Year (FY) 2016-17 Funding Plan for Low-Carbon Transportation and Fuels Investments and AQIP* (FY 2016-17 Funding Plan) to describe how these funds would be spent. The plan will describe ARB's policy drivers and vision for advanced technology mobile source and fuels investments, eligible project categories and criteria, project funding allocations, program implementation details, and the justification for these investments.

This discussion document summarizes staff's work to date and draft recommendations for the FY 2016-17 Funding Plan. It is organized into two parts:

- Part 1: Draft Funding Plan Recommendations, presents staff recommendations on the project categories and funding allocations for the FY 2016-17 cycle.
- Part 2: Long-Term Plan for the Clean Vehicle Rebate Project (CVRP) and Light-Duty Incentives, summarizes staff's work to date on the long-term plan required by Senate Bill (SB) 1275 (De León, Chapter 530, Statutes of 2014).

ARB staff will present and seek comment on these recommendations at a public workshop on April 4, 2016. 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 2016-17 Funding Plan on May 20, 2016 for public comment prior to Board consideration at the June 23-24, 2016 Board meeting.

**PART I:
DRAFT FUNDING PLAN RECOMMENDATIONS**

BACKGROUND

Low Carbon Transportation and Fuels: Cap-and-Trade auction proceeds provide funding for ARB's advanced technology, clean transportation incentive programs that reduce greenhouse gas (GHG) emissions, expanding the types of projects ARB has funded through AQIP. Low Carbon Transportation is identified as a priority investment area in the first two Cap-and-Trade Auction Proceeds Investment Plans. These investments accelerate the transition to low carbon freight and passenger transportation, supporting the Governor's climate change strategy pillar of a 50 percent reduction in petroleum use in vehicles by 2030 and the Administration's goal to deploy 1.5 million zero-emission vehicles in California by 2025.

The Legislature has appropriated \$325 million to ARB for Low Carbon Transportation investments over the last 3 budget cycles. Projects include: rebates and vouchers for low carbon cars, trucks, and buses; pilots designed to increase access to the cleanest vehicles in disadvantaged communities and lower income households; and advanced technology demonstrations of freight equipment. More than 50 percent of the funds are providing benefits in disadvantaged communities, and more than 10 percent of the funds are being invested in disadvantaged communities.

The Low Carbon Transportation and Fuels investments account for about 95 percent of the funds that will be covered in the FY 2016-17 Funding Plan.

AQIP: AQIP is a mobile source incentive program that focuses on reducing criteria pollutant and diesel particulate emissions with concurrent reductions in GHG emissions. AQIP has an annual budget of about \$25 million. AQIP has provided funding for CVRP, the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), and demonstrations for advanced emission reduction vehicle technologies since 2009. In recent years, these projects have been primarily funded from the Low Carbon Transportation appropriations because demand has exceeded AQIP's budget, and the majority of AQIP funds have been directed to the Truck Loan Assistance Program which helps small business truckers to secure financing for newer trucks and diesel exhaust retrofits to meet compliance deadlines for ARB's in-use truck and bus regulation. AQIP accounts for about 5 percent of the funds that will be covered in the FY 2016-17 Funding Plan.

Legislation Guiding Funding Plan: Two bills signed into law in 2014 provide additional guidance in ARB's implementation of these programs and specify requirements for the funding plan.

- SB 1275 (De León, Chapter 530, Statutes of 2014) establishes the Charge Ahead California Initiative to increase the number of zero-emission and near zero-emission vehicles on California's roads and increase access to these vehicles for lower-income Californians and disadvantaged communities. SB 1275 requires ARB to include a long-term plan for CVRP and related programs in the FY 2016-17 Funding Plan.

- SB 1204 (Lara, Chapter 524, Statutes of 2014) 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 ARB to develop an annual framework and plan to guide these investments.

RECOMMENDED FUNDING ALLOCATIONS FOR FY 2016-17

The Governor's Proposed Budget for FY 2016-17, released on January 7, 2016, contains proposed appropriations to ARB for Low Carbon Transportation and Fuels investments and for AQIP.¹ The Governor's proposals are summarized below.

Governor's Budget Proposal for Low Carbon Transportation and Fuels and AQIP

Low Carbon Transportation and Fuels: The Governor's proposed 2016-17 budget would appropriate \$500 million in Cap-and-Trade auction proceeds to ARB for Low Carbon Transportation and Fuels investments. This proposal includes \$40 million for very low carbon fuel production incentives, a new element to ARB's Low Carbon Transportation incentive program.

- As described in the Governor's Budget Summary, these funds are to: "provide incentives for low carbon freight and passenger transportation, including rebates for zero-emission cars, vouchers for hybrid trucks."
- At least 50 percent of these Low Carbon Transportation funds would be invested to benefit disadvantaged communities and at least 10 percent would be invested directly in disadvantaged communities.
- State operations funding accounts for \$5 million of the \$500 million proposed appropriation, so \$495 million would be available to allocate to projects.

AQIP: The Governor's proposed 2016-17 budget would appropriate \$28.6 million to ARB for AQIP projects. This funding level is based on motor vehicle fee revenues.

- ARB staff recommends allocating \$25 million to AQIP projects, and setting aside \$3.6 million as a prudent reserve for revenue uncertainty consistent with previous budget cycles. The proposed Funding Plan will include contingency provisions specifying how these reserve funds would be allocated if revenues are sufficient.

Staff Draft Project Allocations

Low Carbon Transportation and Fuels: For the proposed \$500 million Low Carbon Transportation and Fuels appropriation, ARB staff recommends the project level allocations and disadvantaged community investment targets shown in Tables 1 and 2. The details of each of these projects and rationale for these recommendations are described more fully in the remaining sections of this discussion document. These investments would:

¹2016-17 Governor's Budget: <http://www.ebudget.ca.gov/2016-17/BudgetSummary/BSS/BSS.html>

- Meet expected consumer demand for existing first-come, first served projects such as CVRP and HVIP and provide incentives for new, low NOx trucks and buses just coming to market.
- Expand funding for Light-Duty Pilot Projects to Benefit Disadvantaged Communities and Financing Assistance for Low-Income Consumers.
- Carry forward and expand the project categories from the FY 2015-16 Funding Plan that were unfunded due to the smaller than anticipated program appropriation for the 2015-16 cycle, including advanced technology demonstration projects, zero-emission truck and bus commercial pilots, and a new school bus pilot project for rural and smaller school districts.
- Start a new project to incentivize production of very low carbon fuels.

Table 1: Draft Staff Recommended Project Allocations for \$500 Million Low Carbon Transportation and Fuels Appropriation

Project Category	Project Allocation (millions)	Minimum Disadvantaged Community Benefit
Light-Duty Vehicles Investments (SB 1275)		
CVRP Remaining 2015-16 Demand (Through Sept 2016) - \$55M 2016-17 Demand (Oct 2016-Sept 2017) - \$175M	\$230	≥33%
Light-Duty Pilot Projects to Benefit Disadvantaged Communities Enhanced Fleet Modernization Program (EFMP) Plus-Up - \$30M Car Sharing and Mobility Options - \$8M Agricultural Worker Vanpools in San Joaquin Valley - \$3M Increased Public Fleet Incentives for CVRP-Eligible Vehicles - \$3M	\$44	100%
Financing Assistance for Low-Income Consumers	\$6	≥50%
Heavy-Duty Vehicles and Off-Road Equipment Investments (SB 1204)		
Advanced Technology Demonstration Projects	\$59	100%
Zero-Emission Freight Equipment Pilot Commercial Deployment Project	\$5	≥50%
Zero-Emission Truck Pilot Commercial Deployment Project	\$18	≥75%
Zero-Emission Bus Pilot Commercial Deployment Project	\$42	≥75%
Rural School Bus Pilot Project	\$10	to be determined
Low NOx Engine Incentives with Low Carbon Fuel	\$23	≥50%
HVIP Remaining 2015-16 Demand (Through Sept 2016) - \$5M 2016-17 Demand (Oct 2016-Sept 2017) - \$13M	\$18	≥60%
Fuels		
Very Low Carbon Fuels Production Incentive Project	\$40	to be determined
State Operations	\$5	50%*
TOTAL	\$500	≥50%

*Reflects portion of State operations associated with projects that benefit disadvantaged communities.

Disadvantaged Community Investment Targets: As shown in Table 1, these draft recommended allocations would direct at least 50 percent of the \$500 million appropriation to projects that benefit disadvantaged communities. Staff considers the 50 percent target a floor and expects that some of these projects may deliver more benefits to disadvantaged communities.

Table 2 shows how the Funding Plan would ensure that at least 10 percent of the \$500 million appropriation is invested in disadvantaged communities. Staff recommends placing conditions in the solicitations and/or grant agreements for the projects listed in Table 2 to ensure that at least 10 percent of the total funds are invested directly in disadvantaged communities.

Staff considers the 10 percent target a floor and expects to exceed it. Staff expects that at least a portion of the funding for every project shown in Table 1 will be invested in disadvantaged communities. These will be calculated and reported in annual reports to the Legislature after fund awarded and spent. When those investments are added to the commitments shown in Table 2, ARB staff expects to exceed the 10 percent target.

Table 2: Draft Targets for Low Carbon Transportation and Fuels Investments in Disadvantaged Communities

Project Category	Minimum Investment in Disadvantaged Communities (millions)
Light-Duty Pilot Projects to Benefit Disadvantaged Communities	≥\$25
Advanced Technology Demonstration Projects	≥\$5
Zero-Emission Bus Commercial Pilot Projects	≥\$20
TOTAL	≥\$50

AQIP: As noted in the January 27, 2016 public workshop, ARB staff recommends directing AQIP funding to projects that primarily provide criteria pollutant and toxics benefits and, thus, are not be the best fit for auction proceeds funding. Table 3 shows draft AQIP project allocations.

Table 3: Draft Staff Recommended Project Allocations for \$28.6 Million AQIP Appropriation

Project Category	Project Allocation (millions)
Truck Loan Assistance Program	\$22
Agricultural Equipment Trade-Up Pilot for San Joaquin Valley	\$3
Reserve for Revenue Uncertainty	\$3.6
TOTAL	\$28.6

- Most AQIP funds would be directed to the Truck Loan Assistance Program as has been the case in recent budget cycles to meet expected increased consumer demand. Staff also recommends funding to scale up the Agricultural Equipment Trade-Up Pilot for the San Joaquin Valley started in FY 2015-16.

- The proposed FY 2016-17 Funding Plan will include contingency provisions specifying how the \$3.6 million in reserve funds would be allocated if revenues are sufficient. This may include increasing the allocations for the two projects shown in Table 3 or funding research related to the mobile source emission categories covered in the Funding Plan.

Addressing Possible Changes to Proposed Budget

Staff recognizes the appropriations for these programs will not be finalized until later this year when the State Legislature approves and the Governor signs the State budget. If necessary, ARB will update the allocations in the FY 2016-17 Funding Plan to reflect any changes to these proposed appropriations in the final State budget.

During previous public workshops and work group meetings, some stakeholders have asked that ARB staff share its approach for how it would modify its proposal in the event that appropriations for these programs differ from the Governor's January proposal. ARB's process for modifying project funding allocations to address budget changes is described below.

- **May Revise:** The Governor's revised Budget for FY 2016-17 will be released on or before May 14, 2016. If there are changes to the proposed Low Carbon Transportation and Fuels or AQIP appropriations for ARB in the May revised Budget, staff will reflect those changes in the proposed FY 2016-17 Funding Plan scheduled to be released on May 20, 2016.
- **Final Budget:** The State budget will be finalized close to the time of the Board's June 23-24, 2016 consideration of the proposed Funding Plan.
 - If the Budget is finalized before ARB's June Board meeting and there are changes to ARB's appropriation in the final Budget, staff would propose modifications to the Funding Plan to reflect the revised Budget appropriation at the Board meeting. The Board would consider those modifications as part of its consideration of the Funding Plan.
 - If the Budget is not final by the time of the June Board meeting, staff would propose contingency provisions at the Board meeting intended to address potential further changes to budget levels for these programs.

LIGHT-DUTY VEHICLE INVESTMENTS

This section of the discussion documents covers staff's draft recommendations for light-duty vehicles investments, including continued funding for CVRP and Light-Duty Pilot Projects to Benefit Disadvantaged Communities.

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 ARB's *First Update to the Climate Change Scoping Plan*² and *Mobile Source Strategy Discussion Draft*.³

There are a number of regulatory, policy, and statutory drivers that set interim milestones along the path to this transformation of the light-duty fleet.

- **ARB's Zero-Emission Vehicle (ZEV) Regulation:** The introduction and deployment of ZEVs in California was first driven by, and continues to be driven by, ARB's ZEV regulation which requires auto manufacturers to produce increasing numbers of ZEVs for sale in California. Under this regulation, one out of seven new cars sold in California in 2025 will be zero-emission or plug-in hybrid.
- **Governor's Executive Order for ZEV Deployment:** 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 ARB's ZEV regulation.
- **SB 1275 (De León, Chapter 530, Statutes of 2014):** In this law, the Legislature created the Charge Ahead California Initiative and codified in statute the goals of:
 - Deploying 1 million ZEVs and near zero-emission vehicles by the start of 2023.
 - Establishing a self-sustaining California market where these vehicles are a mainstream option.
 - Increasing access for disadvantaged, low-income, and moderate-income communities and consumers to these vehicles.

² *First Update to the Climate Change Scoping Plan, Building on the Framework*, May 2014.

http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf

³ *Mobile Source Strategy, Discussion Draft*, October 2015.

http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc_dd.pdf

- Cap-and-Trade Auction Proceeds Investment Plans: The Administration's first two Cap-and-Trade Auction Proceeds Investment Plans, developed pursuant to the Greenhouse Gas Reduction Fund Investment Plan and Communities Revitalization Act, identify light-duty ZEV deployment as a priority investment area.⁴

ARB's light-duty vehicle 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 ARB'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. SB 1275 directs ARB to include in the FY 2016-17 Funding Plan a long-term plan for CVRP and related light-duty incentives.
- Light-Duty Pilot Projects are designed to increase access to these clean vehicles in disadvantaged communities and lower-income households. These pilot 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 ARB to fund these types of projects.

The remainder of this chapter describes the light-duty vehicle projects recommended for funding in FY 2016-17. The long-term plan for CVRP and light-duty and related light-duty incentives required pursuant to SB 1275 is covered in Part II of this discussion document.

⁴*Cap-and-Trade Auction Proceeds Second Investment Plan: Fiscal Years 2016-17 through 2018-19.*
<http://www.arb.ca.gov/cc/capandtrade/auctionproceeds/16-17-final-second-investment-planii.pdf>
Cap-and-Trade Auction Proceeds Investment Plan: Fiscal Years 2013-14 through 2015-16.
http://www.arb.ca.gov/cc/capandtrade/auctionproceeds/final_investment_plan.pdf

CVRP

Recommended Low Carbon Transportation Allocation – \$230 million

Remaining FY 2015-16 Demand (through Sept 2016) – \$55 million

FY 2016-17 (Oct 2016-Sept 2017) – \$175 million

CVRP offers vehicle rebates on a first-come, first-served basis for light-duty ZEVs, plug-in hybrid electric vehicles (PHEVs), zero-emission motorcycles, and neighborhood electric vehicles. 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.

Rebate amounts are \$2,500 for battery electric vehicles (BEVs), \$1,500 for PHEVs, \$5,000 for fuel cell electric vehicles, and \$900 for zero-emission motorcycles and neighborhood electric vehicles. At the end of March 2016, rebate amounts will increase for lower-income consumers (with household incomes of less than or equal to 300 percent of the federal poverty level) to \$4,000 for BEVs, \$3,000 for PHEVs, and \$6,500 for fuel cell electric vehicles. An income cap will be instituted to exclude higher income consumers at the same time. The cap will exclude from CVRP individuals with gross annual incomes greater than \$250,000, head-of-household filers with gross incomes greater than \$340,000, and joint filers with gross incomes greater than \$500,000.

Project Status

- As of February 1, 2016, CVRP has provided rebates for about 137,000 vehicles at a cost of over \$291 million since the project's launch in 2010.
 - Nearly, 60 percent of these rebates have been issued for BEVs and 40 percent for PHEVs. Only a small number of rebates have been issued for fuel cell electric vehicle, neighborhood electric vehicles, and zero-emission motorcycles. Up to date project statistics are available on the CVRP website: <https://cleanvehiclerebate.org/>.
 - More than 35 models of eligible vehicles are now available to consumers, and more vehicle introductions are planned for 2016.
 - In December 2015, CVRP reached a new record of 5,400 rebates issued/reserved totaling approximately \$12 million in one month.
- Staff expects that the clean vehicle market will continue to grow as consumer choices in vehicle price and range options expand.
- For FY 2015-16, ARB allocated \$75 million in Low Carbon Transportation funds to CVRP. The Budget Act of 2015 includes a restriction that agencies cannot

spend more than 75 percent of their auction proceeds appropriations prior to the 4th Cap-and-Trade auction of the fiscal year. Consequently, only \$56.25 million is currently available to spend. This funding is projected to run out in early April 2016, close to the time that higher rebates for lower-income consumers launch which complicates the roll out of this new element of CVRP.

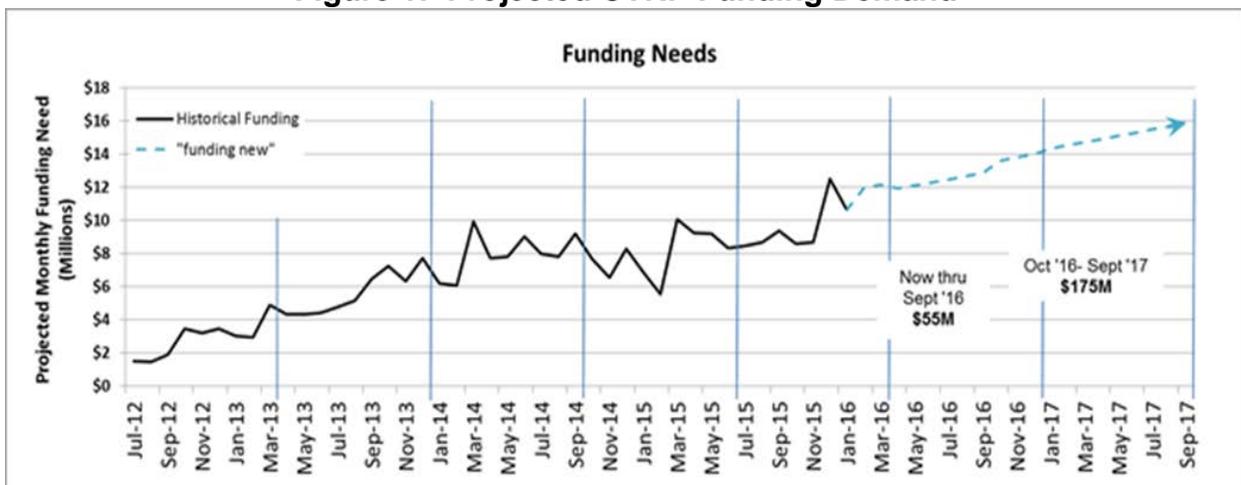
- CVRP will continue accepting applications after funding runs out in early April 2016. However, there may be delays in issuing rebates. The remaining \$18.75 million will be available in late May or June 2016. Rebate demand in excess of this amount will be fulfilled from the FY 2016-17 appropriation. ARB staff expects all consumers will receive rebates within 90 calendar days.

Projected Demand and Draft Funding Allocation

ARB staff has estimated the three year funding need for CVRP as part of the SB 1275 required long-term plan for CVRP and light-duty incentives. In that forecast, ARB staff has estimated CVRP demand for the remainder of the FY 2015-16 cycle (through September 2016) and the demand for the FY 2016-17 cycle (October 2016 through September 2017). These projections are shown in Figure 1, and a full discussion of the forecasting methodology is presented in Part II of this document.

ARB staff designs CVRP allocations so that each fiscal year’s appropriation meets consumer demand from October of the fiscal year to September of the following year in order to ensure a seamless transition from one budget cycle to the next and avoid funding disruptions. This allows time to incorporate project changes directed by the Board in the annual Funding Plan and solicit for a project administrator as necessary between funding cycles. With the smaller than anticipated FY 2015-16 appropriation, ARB was not able to allocate sufficient funding to meet CVRP demand through September 2016. However, staff has identified the funding needed to meet anticipated demand through September 2016 as shown in Figure 1.

Figure 1: Projected CVRP Funding Demand



- Figure 1 shows that \$55 million is needed to meet demand through September 2016 (which staff characterizes as remaining FY2015-16 demand), and additional \$175 million is needed for the 12 month period starting in October 2016 (FY 2016-17 demand) for a total funding need of \$230 million.
- Staff recommends that \$55 million to meet demand through September 2016 be incorporated into FY 2015-16 CVRP grant agreement via a grant amendment. This would ensure more timely payment of rebates while ARB conducts a competitive solicitation for a grantee to administer CVRP for FY 2016-17.
- The remaining \$175 million would be awarded via competitive solicitation. Staff expects a grant would be in place and this new funding would launch by October 1, 2016.
- Staff also recommends continuing the pilot project that provides increased incentives for public fleets operating in and near disadvantaged communities (Public Fleet Pilot). This pilot has operated as a set-aside within CVRP since February 2015, with a \$3 million allocation for FY 2016-17. This pilot is discussed further in the Light-Duty Pilot Projects to Benefit Disadvantaged Communities section of this discussion document.

Changes to CVRP Project Criteria Considered

Staff is recommending the following changes to CVRP for FY 2016-17.

- Disadvantaged community outreach: Staff recommends increasing outreach to promote consumer awareness, specifically in disadvantaged communities. As part of the solicitation for a CVRP administrator for FY 2016-17, staff will require applicants to submit outreach plans and how they would focus outreach in disadvantaged communities to help increase participation.
- Prioritize rebate payment for lower-income consumers: ARB staff has recommended a CVRP allocation that it believes will meet demand through September 2017. However, there are inherent uncertainties in forecasting demand, so staff wants to incorporate prioritization provisions in the event funding runs out prior to the end of the fiscal year. Staff recommends setting aside funding to prioritize payment of rebates for lower income consumers in the event funding runs low.
- Remove Neighborhood Electric Vehicles from CVRP: Neighborhood electric vehicles have been a part of CVRP since inception. However, no current models are available in the California market that meet the CVRP eligibility requirements, so staff recommends removing these vehicles from the CVRP list of eligible vehicles to avoid consumer confusion.

- Fuel Cell Electric Vehicle Rebate Levels: The rebate amount for fuel cell vehicles is currently \$5,000 (and \$6,500 for qualifying low- and moderate-income consumers starting at the end of March), and these vehicles are temporarily exempt from the income cap because these vehicles are in a much earlier stage of commercialization than BEVs or PHEVs. Staff has committed to re-evaluate these provisions annually. As of February 2016, CVRP has only issued rebates for about 150 fuel cell vehicles. Accordingly, staff believes the higher rebate level and temporary delay of the income cap for these vehicles should remain in place and recommends no changes to these provisions for FY 2016-17.

In addition to these changes, staff is also considering including point of sale/pre-qualification mechanisms into CVRP. ARB staff expects to recommend this in the proposed Funding Plan, but is still working through the issues associated with this potential modification. A discussion of this potential change is presented below.

Point of Sale and Pre-Qualification Consideration

SB 1275 requires ARB to consider converting CVRP to a point of sale incentive or include a pre-qualification mechanism. ARB staff has previously considered transitioning the rebate to a point of sale incentive, but did not recommend the change in prior fiscal years in part due to the need for stable and continuous funding to ensure such a mechanism will work effectively. Additionally, direct point of sale purchase incentives may provide incentives to consumers who would have purchased or leased an eligible advanced technology vehicle without the incentive, making the program less cost-effective and increasing the funding demand. Currently, only about 70 percent of BEV and PHEV purchasers are taking advantage of the rebate. However, staff has continued to evaluate the merits of such changes.

ARB staff held public work group meetings on February 23, 2016 and March 18, 2016 to discuss several long-term program considerations for CVRP, including transitioning the incentive to the point of sale and offering a pre-qualification mechanism. During the workgroups, staff posed several key considerations that may impact the ability to offer a purchase incentive directly at the time of purchase or may influence the effectiveness of this type of incentive:

- Historically, CVRP's funding source is an annual appropriation that varies from fiscal year to fiscal year. A point of sale incentive may be challenging to implement without a continuous appropriation. While staff recognizes that funding uncertainty currently exists, staff believes this factor is compounded when the incentive is moved closer to the point of purchase because of the amount of time it takes to notify dealers and the public when funding is running low. Stakeholders agree that using a prequalification approach, in conjunction with the current rebate, would be feasible with continued annual appropriations.
- Verification and enforcement of key CVRP program requirements (e.g. income eligibility, ownership requirements, etc.) will be challenging. Staff believes there

needs to be a prequalification element to any point of sale redesign of CVRP in order to allow for verification of income-based participation requirements (both higher rebates for low- and moderate-income consumers and the income cap) prior to issuing rebates. Lack of such safeguards would encourage fraud. Stakeholders agreed that maintaining the key program requirements is important and that a prequalification approach would enable the project to operate in such a fashion.

- The introduction of income eligibility requirements required by SB 1275 already adds a significant change to the program. Modifying the project further could add complexities, confuse consumers, and ultimately add to dealer responsibilities. Staff believes, however, that the addition of a prequalification process in addition to maintaining the option to apply for a rebate will help to minimize consumer confusion about when and how they may be eligible.

During the workgroup meetings, stakeholders advocated for including these mechanisms in FY 2016-17, noting that the incentive would be more powerful if available at the time of purchase, especially for low- and moderate-income consumers. Staff believes, however, that such an incentive should be consistent for all participants and committed to continue to work through some of the implementation challenges over the course of the next several months. Staff believes it will take about 4-6 months to implement a pre-qualification mechanism for CVRP, once an administrator for the FY 2016-17 project administrator is selected.

Solicitation Process

ARB will conduct a competitive solicitation to select one grantee to administer both CVRP and the Public Fleet Pilot. Currently, ARB solicits for a grantee every two years. ARB staff recommends extending this time frame to allow ARB to conduct a three-year solicitation.

- While the solicitation would encompass up to three fiscal years, the grant agreement would initially cover one fiscal year with the option to renew for each of the following two years.
- The solicitation would be released after the Board approves the FY 2016-17 Funding Plan and the State Budget is signed. It would be open for at least 30 days. Staff anticipates having a grant in place for the FY 2016-17 by the end of September 2016.

Light-Duty Pilot Projects to Benefit Disadvantaged Communities

Recommended Low Carbon Transportation Allocation – \$44 million

Since the FY 2014-15 funding cycle, ARB has allocated Low Carbon Transportation funding to a suite of light-duty pilot projects designed to increase access to zero-emission and near zero-emission vehicles in disadvantaged communities and lower-income households and to reduce GHG, criteria pollutant, and toxics emissions. ARB staff refers to these as “pilot projects” because they are designed to employ new strategies on an exploratory basis in order to learn which strategies have the best opportunities for expansion throughout California. ARB staff seeks to both encourage new project opportunities and build on successful pilot projects to scale them up in future years for broader implementation. SB 1275 directs ARB to fund these types of disadvantaged community and lower-income consumer focused projects.⁵

Table 4 shows the four pilot projects funded with Low Carbon Transportation appropriations to date. ARB allocated \$9 million to these projects in FY 2014-15. ARB intended to increase funding fourfold to \$37 million in the FY 2015-16 Fund Plan. However, with the smaller than anticipated budget appropriation, ARB only allocated \$10 million.

Table 4: Light-Duty Pilot Projects to Benefit Disadvantaged Communities

Pilot Projects	FY 2014-15 Allocation (millions)	FY 2015-16 Allocation (millions)	Recommended FY 2016-17 Allocation (millions)
EFMP Plus-up	\$2	\$10	\$30
Car Sharing and Mobility Options ¹	\$3.1	-	\$8
Increased Public Fleet Incentives for CVRP-Eligible Vehicles	\$2.9	-	\$3
Agricultural Worker Vanpools in San Joaquin Valley (<i>new for FY 2016-17</i>)			\$3
Financing Assistance for Low-Income Consumers ^{1,2} (<i>expand statewide for FY 2016-17</i>)	\$0.9	-	\$6 (not included in total) ²
Total	\$9	\$10	\$44

¹The FY 2014-15 Funding Plan allocated \$2.5 million for car sharing and \$1.5 million for financing assistance. Because the car sharing solicitation was over-subscribed and the financing assistance was under-subscribed, ARB reallocated funding between the two consistent with the contingency provisions.

² Financing Assistance is not included in the total for this table because ARB staff recommends expanding the project statewide for FY 2016-17 as discussed later in this document.

For FY 2016-17, ARB staff recommends allocating \$44 million to Light-Duty Pilot Projects to Benefit Disadvantaged Communities to build upon and increase prior years’

⁵SB 1275 (De León, Chapter 530, Statutes of 2014). See Health and Safety Code Section 44258.4(c)(4) for direction to establish these types of projects: http://www.leginfo.ca.gov/pub/13-14/bill/sen/sb_1251-1300/sb_1275_bill_20140921_chaptered.pdf

investments as shown in Table 4. In addition, staff recommends that Financing Assistance, one of the previously established pilot projects, be allocated \$6 million and be expanded to include low-income consumers on a statewide basis in addition to those in disadvantaged communities. To reflect this recommended expansion, staff has moved this project into a separate category, Financing Assistance for Low-Income Consumers, which is covered later in the discussion document.

Many of these projects have either just launched or are in the developmental stages making it a challenge to estimate funding needs. ARB staff has based its recommendations on experience with project solicitations through these beginning stages, as well as initial stakeholder feedback.

Stakeholders have consistently maintained that all of these projects serve an important equity function for disadvantaged communities, and ARB should provide increased funding support. Stakeholders also suggest that ARB increase coordination with similar projects by other State agencies, such as the California Energy Commission, Strategic Growth Council, and the California Department of Transportation (Caltrans). ARB staff meets routinely with these agencies and will continue to explore ways to coordinate investments.

The remainder of this section provides an overview of each of the project categories ARB staff recommends for funding in the FY 2016-17 funding cycle.

EFMP Plus-up

This EFMP Plus-up pilot project focuses on supporting advanced technology vehicle replacements for lower-income consumers living in and near disadvantaged communities by augmenting EFMP incentives.

EFMP is a vehicle retirement and replacement program authorized by Assembly Bill 118 (Nunez, Chapter 750, Statutes of 2007), funded by a surcharge on motor vehicle registrations. EFMP, has two components: retirement-only and retirement-and-replacement. The retirement-only component is run by the Bureau of Automotive Repair following guidelines set by ARB. It provides compensation to lower-income vehicle owners to retire their older, high polluting vehicle. The retirement-and-replacement component of EFMP is administered by the South Coast Air Quality Management District (AQMD) and the San Joaquin Valley Air Pollution Control District (APCD) in partnership with ARB. This component provides higher incentives to a person who retires a vehicle and purchases a replacement vehicle that meets certain fuel economy requirements. It has a tiered incentive structure, with the highest amounts allotted to the lowest income participants and the cleanest replacement vehicles.

ARB is using Low Carbon Transportation funding for EFMP Plus-up to focus the retirement-and-replacement component on benefiting disadvantaged communities. Under this project, lower-income vehicle owners living in or near disadvantaged communities in the South Coast or San Joaquin Valley regions get increased funding if

they purchase a new or used hybrid, plug-in hybrid, or pure zero-emission vehicle. For example, a qualifying participant who wants to purchase a PHEV or BEV replacement would receive \$4,500 from EFMP and an additional \$5,000 from EFMP Plus-up, for a total incentive of \$9,500. When coupled with a CVRP rebate, an eligible consumer could receive as much as \$12,000 towards the purchase of a new electric car.

Current Status:

- Over the last two budget cycles, ARB awarded \$12 million in EFMP Plus-up grants (\$6 million each to the South Coast AQMD and San Joaquin Valley APCD). As a requirement of these grants, participants must have incomes less than 400 percent of the federal poverty limit and live in ZIP Codes containing disadvantaged community census tracts. To date, nearly 95 percent of recipients have annual incomes below 225 percent of the federal poverty level.
 - *San Joaquin Valley APCD Program:* About \$1.3 million has been expended to replace 217 vehicles through the end of 2015. About 17 percent are BEVs, 23 percent are PHEVs, and 60 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. More information is available at: www.valleycan.org/tune_in_tune_up.php.html.
 - *South Coast AQMD Program:* About \$1.3 million has been expended to replace 222 vehicles through the end of 2015. About 23 percent are BEVs, 25 percent are PHEVs, and 52 percent are hybrids. Interested participants can apply to the program online or through a bilingual dedicated call center. More information is available at: www.replaceyourride.com.

Staff Recommendation for FY 2016-17:

- ARB staff recommends a \$30 million allocation for FY 2016-17, distributed as follows:
 - \$20 million would be allocated to the South Coast AQMD and San Joaquin Valley APCD (\$10 million to each district) to support the anticipated growth of these two existing programs. ARB staff estimates this funding level would contribute to replacing about 1,500 vehicles in each air district.
 - \$10 million would be allocated to expand EFMP Plus-Up to other air districts that implement a vehicle retirement and replacement program meeting the minimum requirements established in the EFMP Guidelines. The Bay Area and Sacramento air districts have both expressed interest. As with the South Coast and San Joaquin Valley EFMP Plus-up programs, Low Carbon Transportation funding would be limited to vehicle replacements that benefit disadvantaged communities.

- ARB staff recommends maintaining the FY 2015-16 project parameters with no significant changes. ARB 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.

Car Sharing

Car Sharing 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. Car sharing provides GHG emission reductions and can be used to gather data to help support larger scale advanced technology car share programs in the future.

Current Status:

- In FY 2014-15, a competitive solicitation process with \$2.5 million of available funding resulted in 13 applications requesting more than \$16 million. A transfer of \$567,543 from the Financing Assistance Pilot Project resulted in total available funding of nearly \$3.1 million which ARB awarded to:
 - San Diego Association of Governments (\$300,000) to expand an existing zero-emission car share to serve the Barrio Logan and Logan Heights neighborhoods.
 - City of Los Angeles (\$1.7 million) to start a new car share in Los Angeles. It will cover Westlake, Pico-Union, neighborhoods north of the University of Southern California, and portions of Downtown, Hollywood, and Koreatown currently unserved by car sharing.
 - Sacramento Metropolitan AQMD (\$1.1 million) to start a new car share to serve disadvantaged communities in the Sacramento region.
- These pilot projects intend to serve over 8,000 disadvantaged community residents starting in 2016 by providing charging infrastructure and access to more than 100 advanced technology vehicles.

Staff Recommendation for FY 2016-17:

- ARB staff recommends an \$8 million allocation for FY 2016-17, to be awarded through a competitive solicitation process.

- ARB staff recommends the following changes:
 - Add electric bike sharing as an eligible mobility options component.
 - Allow existing projects that are successfully meeting project goals to apply for additional funding to continue, enhance, or expand the project, if funds are available after awards are made to the highest ranked new projects.
 - Introduce a goal for regional balance of awarded projects, subject to availability within the group of the highest ranked proposed projects received.
 - Include in the project solicitation an increased focus on outreach and public education as an element of the car share projects to be funded.
- ARB staff recommends using a public work group process to develop the detailed solicitation parameters as it did with FY 2014-15 funding.

Agricultural Worker Vanpools in the San Joaquin Valley

The Agricultural Worker Vanpools in the San Joaquin Valley Pilot Project would provide expanded access to zero-emission, plug-in hybrid, or hybrid passenger vans, with preferences for HVIP-eligible vehicles and new vehicles, and much needed emission reductions for agricultural workers in the San Joaquin Valley's most disadvantaged communities. Vehicle conversions and installation of electric vehicle supply equipment for appropriate multi-unit dwellings and other appropriate locations may also be considered for funding.

The Board-approved FY 2015-16 Funding Plan included \$3 million for this pilot project based on an anticipated Low Carbon Transportation appropriation of \$350 million. However, with only \$95 million appropriated for 2015-16 State budget, this project was not implemented.

Staff Recommendation for FY 2016-17:

- ARB staff recommends \$3 million for FY 2016-17, the same funding amount ARB planned to direct to this project in FY 2015-16.
- ARB staff will use a public work group process to develop project parameters including vehicle eligibility criteria. Funding may be awarded either non-competitively through a grant agreement with a public entity or through a competitive process.

Increased Public Fleet Incentives for CVRP-Eligible Vehicles

The Public Fleet Pilot Project offers higher rebates for public fleets operating in and near disadvantaged communities for the purchase of CVRP eligible vehicles. Incentive

amounts are \$5,250 for a PHEV, \$10,000 a BEV, and \$15,000 for a fuel cell electric vehicle. These higher incentives are intended to help government fleets overcome barriers to advanced technology vehicle purchases. This pilot is operated as a set aside within CVRP.

Current Status:

- ARB awarded a grant of \$2.9 million to Center for Sustainable Energy to administer the Public Fleet Pilot Project within CVRP. The pilot launched in February 2015. To date, about three quarters of the available funding has been reserved by public fleets to purchase 270 vehicles. More information is available on the project web site at : <https://cleanvehiclerebate.org/eng/pfp>.

Staff Recommendation for FY 2016-17:

- ARB staff recommends a \$3 million allocation for FY 2016-17. This project will continue to be administered as a set aside within CVRP. ARB will conduct a competitive solicitation to select one grantee to administer both CVRP and Public Fleet Pilot.
- As public fleets achieve higher adoption rates of advanced technology vehicles, rebate amounts will be reduced in future funding cycles, and the project will transition from pilot project status to becoming a standard part of CVRP.

Other Project Categories Considered

- **Electric Bicycles:** Electric bicycles may offer potential GHG reductions and increased mobility, although more study is needed to substantiate a direct connection to reduced vehicle miles traveled and how public funding of the incremental cost between conventional and electric bicycles can be supported. For this round of funding, staff intends to use the public work group process to explore consideration of electric bicycle sharing as eligible components for the existing suite of light-duty pilot projects, especially as first mile/last mile complements to car sharing projects.
- **Low Rolling Resistance Tires:** Low Rolling Resistance Tires were identified in the FY 2015-16 Funding Plan as holding promise for achieving increased fuel efficiency and emission reductions in the light-duty fleet. Staff is open to future consideration of this technology in pilot projects but continues to not recommend incentives at this time. Until low rolling resistance tires are certified nationally, there is no uniform standard in place to identify tires as low rolling resistance tires or to verify emission reductions. More study is needed to verify potential fuel savings, emission reductions, and which vehicles are appropriate for low rolling resistance tires. ARB will continue to monitor the National Highway Safety Traffic Administration's tire rating program and, if appropriate, reconsider this type of project in future funding cycles.

Financing Assistance for Low-Income Consumers

Recommended Low Carbon Transportation Allocation – \$6 million

Vehicle financing can be a significant barrier to ownership for some lower-income consumers. The Financing Assistance for Low-Income Consumers pilot project is designed to help lower-income residents purchase clean vehicles by improving access to more affordable financing through mechanisms such as loan loss guarantees, interest rate buy-downs, and vehicle cost buy-downs. This will result in reduced GHG and criteria pollutants as well as an economic benefit to these consumers. These financing assistance approaches can be combined with CVRP, EFMP, and EMFP Plus-up to help make these other programs more accessible to lower-income Californians.

As noted in the previous section, the FY 2014-15 financing assistance funding was limited to projects in disadvantaged communities. To increase its reach and open up financing assistance opportunities to additional lower-income Californians, ARB staff is recommending that funding be extended to lower-income residents statewide and not be limited strictly to disadvantaged communities. ARB would include project design elements to ensure that a majority of this funding still benefits disadvantaged communities as described below.

Current Status:

- ARB awarded a FY 2014-15 grant for about \$900,000 in November, 2015 to the Community Housing Development Corporation to administer a Financing Assistance Pilot Project for lower-income residents living in disadvantaged communities in the Bay Area. The pilot combines a loan loss reserve program with vehicle price buy-down assistance. It launched to the public in early 2016.

Staff Recommendation for FY 2016-17:

- ARB staff recommends a \$6 million allocation for FY 2016-17, distributed as follows:
 - \$5 million for a statewide project open to lower-income consumers throughout California. This element would be designed to coordinate with EFMP, EFMP Plus-up, and CVRP to ensure that lower-income consumers throughout the State have increased access to advanced technology vehicles. By coordinating closely with EFMP Plus-up, which will still be limited to consumers living in and near disadvantaged communities, ARB will ensure much of this funding still benefits these communities. ARB staff will also explore changes in a public work group process that are designed to enhance the effectiveness of assistance to low-income consumers, such as increased

vehicle buy-down amounts, lowered interest rates, and changes to vehicle age and mileage requirements to offer stronger consumer protections.

This statewide project could be awarded through a competitive solicitation process or via an interagency agreement with the State Treasurer's Office California Pollution Control Financing Authority (CPCFA). Based on ARB's experience with CPCFA as administrator of the Truck Loan Assistance Program since 2009, ARB staff believes CPCFA is the best qualified entity to administer the statewide element of the Financing Assistance for Low-Income Consumers. A bill currently pending before the Legislature would give CPCFA the statutory authority it needs to implement this project. ARB staff will include in the proposed Funding Plan contingency provisions to reprogram this funding if this bill is not ultimately signed into law.

- Staff recommends that \$1 million for local projects to be awarded via a competitive solicitation as did the FY 2014-15 Financing Assistance Pilot Project, with the exception that this \$1 million element would also be expanded to include lower-income communities. These funds could be used for the expansion of existing projects as well as for new projects.

HEAVY-DUTY VEHICLE AND OFF-ROAD EQUIPMENT INVESTMENTS

Achieving California's critical air quality and climate change goals requires a transformation of the on-road and off-road fleet to one that utilizes zero- and near zero-emission technologies. ARB staff's recommended investments for heavy-duty vehicles and off-road equipment are intended to support this transformation by demonstrating emerging technologies, advancing commercial viability through pilot and deployment projects, and catalyzing further technological development by the private sector.

Because of the smaller than anticipated FY 2015-16 Low Carbon Transportation budget appropriation, only \$5 million of the \$148 million for heavy-duty vehicle and off-road equipment Low Carbon Transportation investments identified in the FY 2015-16 Funding Plan was allocated to projects. ARB staff recommends that unfunded projects from FY 2015-16 be carried forward to FY 2016-17, with adjustments made based on what staff has learned over the last year, as explained in the project descriptions in this chapter.

Policy and Statutory Drivers

ARB's 2015 *Mobile Source Strategy Discussion Draft*, 2014 *Climate Change Scoping Plan Update*, 2012 *Vision for Clean Air*,⁶ and 2015 *Sustainable Freight: Pathways to Zero and Near-Zero Emissions Discussion Draft*⁷ all emphasize the need for zero- and near zero-emission strategies to meet long-term GHG emission targets, federal health-based ozone standards, and petroleum use reduction goals. These plans identify near-term measures and actions to promote cleaner combustion in trucks, marine vessels, and off-road equipment as well as accelerated penetration of zero-emission trucks, buses, and equipment where the technologies are ready for the commercial market.

Development of advanced heavy-duty technologies requires a portfolio of incentives that provide funding for the range of technologies needed to achieve both near-term and long-term emission reductions. Where zero-emission technologies are not yet commercialized or have not yet reached the market penetration needed for deep near-term emission reductions, near zero-emission technologies can help meet critical emission reduction goals. For example, incentives for low NOx engines using renewable fuels, a project included in this chapter, can reduce criteria pollutant and GHG emissions while also supporting the goals of the Low Carbon Fuel Standard (LCFS) and complementing the Energy Commission's biofuel production incentives and the Very Low Carbon Fuels Incentive Project described in the next chapter.

⁶*Vision for Clean Air: A Framework for Air Quality and Climate Planning*, June 2012.

<http://www.arb.ca.gov/planning/vision/vision.htm>

⁷*Sustainable Freight: Pathways to Zero and Near-Zero Emission*, Discussion Draft, April 2015.

http://www.arb.ca.gov/gmp/sfti/Sustainable_Freight_Draft_4-3-2015.pdf

Guiding the investments recommended in this chapter are the requirements and goals of SB 1204 (Lara, Chapter 524, Statutes of 2014). SB 1204 created the California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology Program in Health and Safety Code Section 39719.2 to fund 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 program, funded with auction proceeds appropriated to ARB, builds on AQIP and Low Carbon Transportation investments from prior funding cycles.

The FY 2015-16 Funding Plan described both the requirements of SB 1204 and how ARB would meet these requirements for the projects to be funded. While most of the projects in the FY 2015-16 Funding Plan did not receive funding, the established framework will continue to guide heavy-duty vehicle and off-road equipment investments for FY 2016-17.

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.

- The on-road and off-road advanced technology demonstration projects will encourage advancement of emission reducing technologies and give confidence to fleets and investors of the pathway for these advanced technologies to enter the pilot stage of commercialization. All demonstration projects will be located within, or will benefit, disadvantaged communities.
- For the recommended bus and truck pilot projects, zero-emission technology is ready for deployment, and heavy investments now will not only encourage the production and purchase necessary to achieve full commercialization, but will enable technology transfer into other vehicle weight classes and vocations.
- The additional funding recommended for ARB's ongoing heavy-duty voucher incentive project (HVIP) for FY 2016-17 will help increase production volumes and enhance the process toward full commercialization. Over 50 percent of pilot and HVIP funding will benefit disadvantaged communities.

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 (as well as supporting other technology sectors). In the transition phase, incentives are targeted to foster technology adoption in these communities. While SB 1204 does not focus on funding for this later phase of a technology's evolution, the AQIP funded Truck Loan Assistance Program is an example of this type of incentive, providing loan assistance to help small fleets access financing to upgrade their trucks.

As required by SB 1204, the recommended 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. As shown in Table 5, about \$90 million is recommended for heavy-duty truck projects, and about \$60 million of that total, about two-thirds, is recommended for early commercial truck deployments:

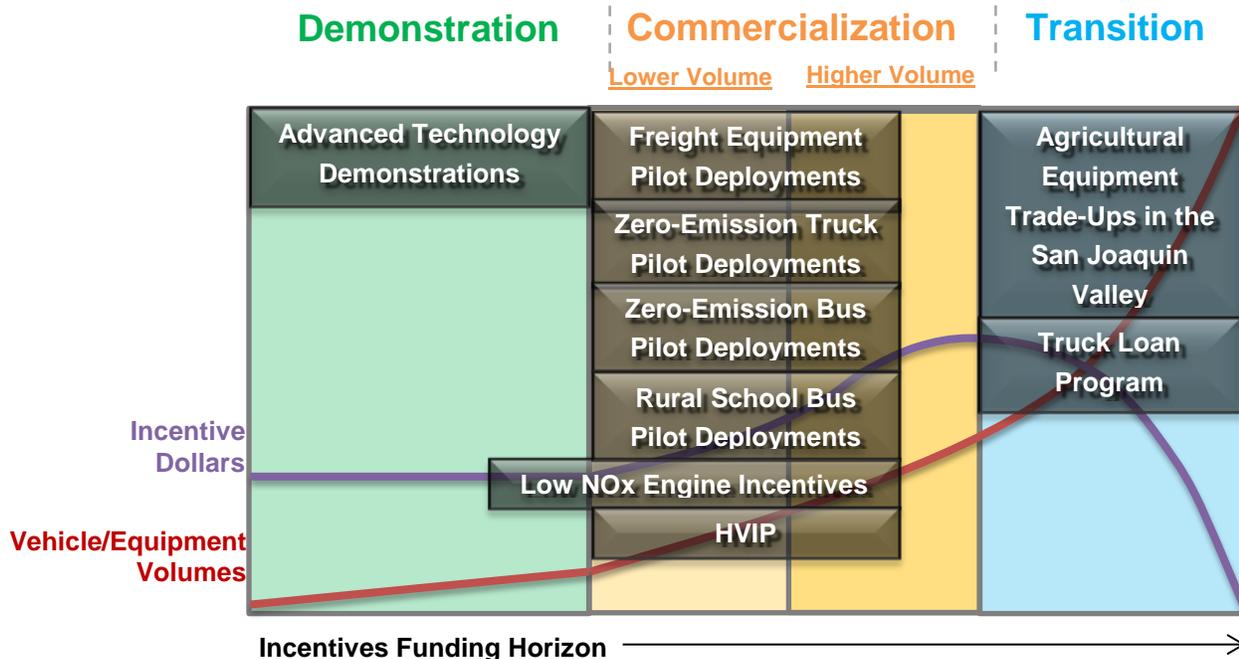
Table 5: Recommended FY 2016-17 Heavy-Duty Truck Investments

Project	Recommended Low Carbon Transportation Funding (million)	Early Commercial?
HVIP	\$18	Yes
Low NOx Engines ¹	\$23	Yes
Truck Pilot Commercial Deployment	\$18	Yes
Advanced Technology Demonstrations: On-Road Trucks	\$30	No

¹Low NOx engine incentives will be available for both trucks and buses, and the proportions are not yet known. In the hypothetical event that no funding goes to trucks, the percentage of truck funding for early commercial truck deployments would be 55 percent.

The remainder of this chapter describes the recommended heavy-duty vehicle and off-road equipment projects shown in Figure 2.

Figure 2: Recommended FY 2016-17 Heavy-Duty Vehicle and Off-Road Equipment Investments



Advanced Technology Demonstration Projects

Recommended Low Carbon Transportation Allocation – \$59 million

Advanced Technology Demonstration Projects are intended to accelerate into the California marketplace the introduction of advanced emission reducing technologies on the cusp of commercialization. A public investment in these technologies helps to achieve GHG reductions, as well as criteria pollutant and toxic air contaminant reductions, sooner than would be possible otherwise. This commitment from the State encourages industry to expeditiously invent, develop, test, and introduce cutting edge emission reducing technologies.

ARB staff recommends the projects shown in Table 6 to continue support for demonstrations of advanced technologies, with a priority for projects that benefit disadvantaged communities, consistent with the goals of the *Cap-and-Trade Auction Proceeds Second Investment Plan* and SB 1204. The projects build on previous demonstrations in on-road and off-road sectors, and most recently, the FY 2014-15 advanced technology demonstration projects for multi-source facilities and zero-emission drayage trucks, which were heavily over-subscribed. Those projects are currently in the grant agreement phase. The recommended project categories were included in the FY 2015-16 Funding Plan, but did not ultimately receive funding.

Table 6: Recommended Advanced Technology Demonstration Projects

Project Category	Recommended Projects	Recommended Allocation (million)
On-Road Trucks	Intelligent Truck Systems and Connected Vehicles	\$30
	Advanced Engines and Powertrains	
	Zero- or Near Zero-Emission Short and Regional Haul Trucks	
Off-Road Freight Equipment	Zero-Emission Cargo Handling Equipment	\$18
	Zero-Emission Ground Support Equipment	
	Advanced Port Equipment	
	Zero-Emission Locomotive Tenders and Switchers	
Non-Freight Off-Road Equipment	Advanced Technologies and Efficiencies for Agricultural Equipment	\$11
	Advanced Technologies and Efficiencies for Construction Equipment	
	Advanced Technologies for Passenger Transportation	

Funding will be awarded for these project categories via competitive grant solicitations. Each of these project categories is described further below.

In the event that additional Low Carbon Transportation funding becomes available for heavy-duty projects, ARB staff will consider an additional allocation for funding the

remaining highest-scoring applications received in response to the FY 2014-15 Multi-Source Facility Demonstration Project.

On-Road Trucks – Up to \$30 Million

- Intelligent Truck Systems and Connected Vehicles: Technologies to increase efficiencies by allowing communications between trucks and their environment.
 - Demonstration of real-time communications between individual trucks while on the road to allow for more efficient logistics scheduling.
 - Demonstration of increased efficiency with multiple groups of trucks working in tandem to allow for efficient braking, acceleration, accident avoidance, and other strategies.
 - Demonstration of technologies that can autonomously adjust to hills and grades and traffic anticipation strategies.
 - Demonstration of other advanced strategies that increase trucking efficiency.
- Advanced Engines and Powertrains: Advanced technologies employed in the generation of motive power with potential to increase efficiency and reduce emissions.
 - Demonstration of advanced engines such as microturbine, opposed-piston engines, or other advanced engine or powertrain technologies, as well as auxiliary electrification, and other strategies to reduce engine load and emissions for use in long range Class 7 and 8 trucks.
 - Engine Waste Heat technology in revenue service with Class 7 and 8 trucking fleets.
- Zero-Emission or Near Zero-Emission Short and Regional Haul Trucks: Advanced technologies for Class 7 and 8 trucks operating shorter daily driving distances than line-haul trucking, but more than drayage trucks, such as for food distribution, warehouse to retail store transport, solid waste collection, and recycling transfer trucks.
 - Demonstration of battery electric, fuel cell electric, electric drive with range extenders, or other advanced technologies that result in significant zero-emission miles.

Off-Road Freight Equipment – Up to \$18 Million

- Zero-Emission Cargo Handling Equipment
 - Demonstration of zero- and near zero-emission technologies for forklifts, reach stackers, yard trucks, and other cargo handling equipment operating at ports or intermodal rail yards.
- Zero-Emission Ground Support Equipment
 - Demonstration of advanced technologies and strategies that go beyond the current state of technology for airport ground support equipment and aircraft. Examples of technologies include battery electric, fuel cell electric, flow batteries, and strategies that can reduce emissions from aircraft while being loaded or unloaded, taxiing, and queuing.
- Advanced Port Equipment
 - Demonstrations of advanced technologies and strategies, such as zero-emission cargo handling equipment, zero- and near zero-emission vessel automated container movement technologies, advanced logistic strategies, or other equipment or strategies that enable more efficient port operations.
- Zero- or Near Zero-Emission Locomotive Switchers
 - Demonstration of on-board energy storage systems to provide motive power to switcher locomotives for most or all of their duty cycle.
- Zero-Emission Locomotive Tender Technologies
 - Demonstration of locomotive tenders used for energy storage technologies, such as batteries, and zero-emission energy generation systems, such as fuel cells, to facilitate zero-emission operation for part of the locomotive duty cycle.

Non-Freight Off-Road Equipment – Up to \$11 Million

- Advanced Technologies and Efficiencies for Agricultural Equipment
 - Demonstration and deployment of advanced technologies that reduce GHG and criteria pollutant emissions for off-road mobile agricultural equipment. Projects could include low NOx engines, electric drive powertrains, hybridization, automation strategies leading to efficiency gains, and new applications for zero- or near zero-emission technologies.

- Advanced Technologies and Efficiencies for Construction Equipment
 - Demonstration and deployment of advanced technologies that reduce GHG and criteria pollutant emissions for off-road mobile construction equipment. Projects could include hybrid bull dozers or front loaders, new applications for zero- and near zero-emission technologies, and engine, powertrain, and automation strategies leading to efficiency gains.
- Advanced Technologies for Off-Road Passenger Transportation
 - Demonstration of advanced, emission-reducing technologies for in-state passenger rail and ferry service. Ferry projects could include use of fixed wing sail technology that builds on successful past demonstrations or use of fuel cells or other technologies to reduce emissions. Passenger locomotive demonstrations could include fuel cells, hybrid technologies, advanced energy storage strategies, and other emission reduction technologies.

Zero-Emission Freight Equipment Pilot Commercial Deployment Project

Recommended Low Carbon Transportation Allocation – \$5 million

Zero-emission technologies are commercially available and in use in certain freight applications, including battery electric and fuel cell electric forklifts, certain types of cargo handling equipment, and airport ground support equipment. However, these technologies are just entering the market or have not yet achieved substantial market penetration for many applications. For example, zero-emission conversions for yard trucks have recently become commercially available, and cryogenic transport refrigeration units (TRUs) are transitioning from the demonstration to early commercial deployment phase.

The intent of this project is to accelerate deployment and drive consumer acceptance in the early stages of commercialization. At the same time, project applications will give ARB staff the opportunity to assess multiple equipment types at various stages of commercialization and better plan for future freight project funding opportunities. The eligible types of equipment and technologies are listed below.

- Zero-emission technologies in the early or low volume stages of commercial deployment for forklifts, cargo handling equipment, and airport ground support equipment. Examples can include, but are not limited to, battery electric or fuel cell conversions for yard trucks and zero-emission technologies for forklifts above 12,000-pound lift capacity.
- Zero-emission technologies in the early or low volume stages of commercial deployment for TRUs during all of the duty cycle.
- Fueling infrastructure to support project vehicles or equipment.

All vehicles and equipment would need to be operated at a freight related facility, such as a port, intermodal rail yard, distribution center, warehouse, or freight hub. The project would be designed to require that at least 50 percent of the project funding benefit disadvantaged communities. However, ARB staff hopes to exceed this minimum requirement because so many freight facilities are located in or near disadvantaged communities. Project funding would be awarded via competitive solicitation.

Zero-Emission Truck Pilot Commercial Deployment Project

Recommended Low Carbon Transportation Allocation – \$18 million

Zero-emission truck and bus pilot commercial deployment projects are designed to complement HVIP to support larger-scale deployments of zero-emission vehicles, thereby accelerating their introduction and market penetration. In the FY 2014-15 Funding Plan, ARB allocated \$25 million in Low Carbon Transportation funding to this category. ARB intended to augment this allocation with an additional \$60 million (\$20 million for trucks and \$40 million for transit/shuttle/school buses) in the FY 2015-16 Funding Plan. However, this additional funding was deferred because of the smaller than anticipated FY 2015-16 Low Carbon Transportation budget appropriation.

In October 2015, ARB released a \$25 million competitive solicitation for this project category.⁸ The solicitation was greatly oversubscribed, with funding requests totaling nearly \$300 million. The solicitation included provisions for adding the \$60 million from the FY 2015-16 Funding Plan if funding is appropriated by the Legislature.

For FY 2016-17, ARB staff recommends allocating \$18 million toward the highest-scoring remaining truck applications from the October 2015 solicitation for commercially available zero- and near zero-emission freight and delivery trucks. Staff recommends that project selections be made using the solicitation's established criteria and process, which follows the framework approved in the FY 2015-16 Funding Plan, including the requirement that at least half the funding benefit disadvantaged communities. The project is intended to fund large scale deployments of heavy-duty trucks (>14,000 pounds gross vehicle weight rating (GVWR)) used in delivery or freight vocations, as well as accompanying fueling infrastructure and supporting vehicle service and repair facility upgrades. Eligible trucks include:

- Commercially available zero-emission battery electric and fuel cell electric delivery or freight trucks.
- Commercially available near zero-emission delivery or freight trucks with the capability to operate in zero-emission only mode.
- Commercially available conversion of any type of delivery or freight truck to zero-emission technology.

Additional project eligibility requirements are described in the solicitation. Grant agreements for the FY 2014-15 funds should be in place by June 2016. Staff would work to expeditiously execute grant agreements and grant amendments for FY 2016-17 funds upon Board approval and appropriation of funds in the State budget.

⁸ The solicitation for the Truck and Bus Pilot Commercial Deployment Project is available at <http://www.arb.ca.gov/msprog/aqip/solicitations.htm>.

Zero-Emission Bus Pilot Commercial Deployment Project

Recommended Low Carbon Transportation Allocation – \$42 million

As noted in the previous section, ARB designed zero-emission truck and bus pilot commercial deployment projects to support larger-scale deployments of zero-emission vehicles, thereby accelerating their introduction and market penetration. \$25 million for zero-emission trucks and buses from the FY 2014-15 Funding Plan is being awarded via a competitive solicitation which was released in October 2015 and closed in January 2016. However, ARB was not able to fund this category in FY 2015-16.

For FY 2016-17, ARB staff recommends allocating \$42 million toward the highest-scoring remaining bus applications from the October 2015 solicitation for commercially available zero- and near zero-emission bus projects. As described in the previous section, the solicitation was significantly oversubscribed.

ARB staff recommends that project selections be made using the solicitation's established criteria and process, which follows the framework approved in the FY 2015-16 Funding Plan, including the requirement that at least half the funding be awarded to projects located in disadvantaged communities. The project is intended to fund large scale deployments of medium- and heavy-duty (>8,500 pounds GVWR) urban transit buses, shuttle buses, and school buses as well as accompanying fueling infrastructure and supporting vehicle service and repair facility upgrades. Eligible buses include:

- Commercially available zero-emission battery electric and fuel cell electric urban transit buses, shuttle buses, and school buses.
- Commercially available near zero-emission urban transit buses, shuttle buses, and school buses with the capability to operate in zero-emission only mode.
- Commercially available conversion of any type of urban transit buses, shuttle buses, and school buses to zero-emission technology.

Additional project eligibility requirements are stated in the solicitation. Grant agreements for the FY 2014-15 funds should be in place by June 2016. Staff would work to expeditiously execute grant agreements and grant amendments for FY 2016-17 funds upon Board approval and appropriation of funds in the State budget.

A separate project category for school buses in rural districts is included in the next section.

Rural School Bus Pilot Project

Recommended Low Carbon Transportation Allocation – \$10 million

The objective of the Rural School Bus Pilot Project is to enhance the turnover of the California school bus fleet to lower carbon transportation choices. This project was included in the FY 2015-16 Funding Plan with a \$5 million allocation. However, ARB was not able to fund the project because of the smaller than anticipated FY 2015-16 Low Carbon Transportation budget appropriation.

ARB staff held a public work group meeting on November 16, 2015 to shape project specifications and identify a potential project administrator. ARB staff worked with the California Air Pollution Control Officers Association to identify the North Coast Unified APCD to administer the pilot project should funding be made available.

For FY 2016-17, ARB staff recommends allocating \$10 million for this project, with the expectation for continued growth for several years. ARB staff intends to give funding priority to school buses used in small and medium air districts because those school bus owners have less access to Department of Motor Vehicle fees and other funding sources than school bus owners located in large air districts where populations are higher, resulting in more fees collected. However, school buses located in large air districts may be eligible to receive funding if projects in small and medium air districts do not utilize all of the funding. Project eligibility is described below:

- Fuel cell and battery electric zero-emission school buses or plug-in hybrid school buses including funding for associated vehicle charging/fueling equipment. Applicants applying for zero-emission school buses may receive funding for up to three buses.
- School buses with internal combustion engines or hybrid school buses operating on renewable fuels, including renewable diesel, renewable natural gas, and renewable propane. 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 only receive funding for one bus in the first round of funding.

ARB staff recommends entering into a grant agreement with the North Coast Unified APCD upon Board approval and appropriation of funds in the State budget.

Low NOx Engine Incentives

Recommended Low Carbon Transportation Allocation – \$23 million

Since the introduction of this project in the FY 2015-16 Funding Plan, ARB has certified the first low NOx heavy-duty engine. The Cummins 8.9 liter natural gas engine for both bus and truck duty cycles was certified in September 2015 to the lowest NOx level (0.02 grams per brake horsepower-hour (g/bhp-hr)) of the three optional low NOx standards. The FY 2015-16 Funding Plan allocated \$2 million in AQIP funding for low NOx engine incentives, and ARB intends to implement that portion of the project through HVIP beginning in spring 2016 when the first engines enter the market, as described in the HVIP section of this chapter.

For FY 2016-17, ARB staff recommends allocating \$23 million in Low Carbon Transportation funding for low NOx engine incentives in order to meet the expected demand for the funding cycle. ARB would continue implementing these incentives through HVIP. Additional recommendations include:

- In order to maximize GHG emission reductions, ARB staff recommends carrying forward the renewable fuel requirement as introduced for this project in the FY 2015-16 Funding Plan. This would also support the goals of the LCFS by increasing demand for renewable fuels and will complement the Very Low Carbon Fuels Incentive Project described in the next chapter. Implementation for this element would be determined during the public work group process following Board approval of the Funding Plan. ARB staff is expecting monitoring and reporting for the renewable fuel use requirement to occur at the fleet level.
- ARB staff recommends continuing implementation on a first-come, first-served, statewide basis for both buses and trucks (>14,000 pounds GVWR). Based on data from related projects such as HVIP, staff expects that at least 50 percent of these incentives would provide benefits to disadvantaged communities.
- ARB staff recommends a maximum \$15,000 per engine incentive for the certified 8.9 liter natural gas engine to cover the incremental costs above the purchase and installation costs of a conventional natural gas engine. Funding would be available for both new vehicle purchases and engine repowers. These incentives could be combined with other State incentives such as the Energy Commission's natural gas vehicle incentives. Staff intends to include an additional modest incentive, to be determined during a public work group process, to support the required use of renewable fuels. As other low NOx engines come to market, staff will recommend appropriate incentive amounts for those engines.

Incentive funding for low NOx engines is expected to continue for multiple years to support larger-scale deployment of these vehicles in the California fleet. As more engines are certified and introduced into the market in future funding cycles, ARB staff expects the incentive funding allocated to this category to increase. Allocations would be based on engine availability, demand, and incremental costs.

HVIP

Recommended Low Carbon Transportation Allocation – \$18 million

Remaining FY 2015-16 Demand (through Sept 2016) – \$5 million
FY 2016-17 (Oct 2016-Sept 2017) – \$13 million

HVIP is intended to encourage and accelerate the deployment of zero-emission trucks and buses, heavy-duty vehicles using engines that meet the optional low NOx standard, and hybrid trucks and buses in California. HVIP provides vouchers to vehicle purchasers to reduce the upfront cost of these advanced technology vehicles.

Program Status

Since its launch in 2010, HVIP has provided \$70 million to help California fleets purchase about 450 zero-emission trucks and buses and 2,000 hybrid trucks through January 2016. HVIP provides vouchers of up to \$95,000 per vehicle for California purchasers and lessees of zero-emission trucks and buses, and up to \$30,000 per vehicle for eligible hybrid trucks and buses, on a first-come, first-served basis. In addition, HVIP provides increased incentives for vehicles that provide benefits to disadvantaged communities. These fleets qualify for vouchers up to \$110,000 for zero-emission trucks and buses. New to HVIP for the 2015-16 fiscal year, engines certified to an optional low NOx standard will be eligible for a \$15,000 voucher. Low NOx engines are expected to enter the market in spring 2016.

Zero-emission and hybrid vehicle conversions were recently included in HVIP as a new eligible vehicle technology. Vehicle conversions are offered less funding than new original equipment manufacturer vehicles. ARB staff recommends voucher amounts for vehicle conversions remain unchanged for FY 2016-17 but will revisit funding amounts in the FY 2017-18 Funding Plan, once more conversions are successfully completed in HVIP. Currently, ARB has received one application for a Class 8 terminal truck diesel to zero-emission conversion. ARB staff expects to receive more vehicle conversion applications from manufacturers in the near future.

Starting in spring 2016, \$2 million in FY 2015-16 AQIP funding will be available to offset the incremental cost of engines certified to an optional low NOx standard. ARB staff is in the process of designing interim implementation guidelines in HVIP to include this new technology. Renewable fuel use will be optional for vouchers funded by AQIP. Low NOx vouchers may be provided for engine repowers and new vehicles.

Projected Demand and Funding Allocation

Staff expects demand to increase over the next year; therefore, staff recommends an \$18 million allocation for FY 2016-17. Staff expects that FY 2015-16 funding will be expended prior to September 2016 (when staff expects to have a project administrator in place for the FY 2016-17 cycle after a competitive solicitation process). In order to

provide uninterrupted funding until a grantee is selected to administer FY 2016-17 funding, ARB staff recommends that \$5 million of the \$18 million be incorporated into the FY 2015-16 HVIP currently administered by CALSTART via a grant amendment. The remaining \$13 million for FY 2016-17 would be awarded to a project administrator via competitive solicitation.

About two thirds of the HVIP funding awarded to date has benefited disadvantaged communities as reported in the *Annual Report to the Legislature on California Climate Investments*, March 2016.⁹ HVIP will continue to be implemented on a first-come, first-served, statewide basis, so ARB staff uses historical data to estimate in advance how much of this funding would benefit disadvantaged communities. As part of the reporting requirements associated with the Low Carbon Transportation funding, ARB will track where these funds are spent so the portion that benefits disadvantaged communities can be calculated and reported in future annual reports to the Legislature.

Changes to Project Criteria

ARB staff recommends the following changes to project criteria:

- *Certification of Conversions:* New hybrid and hybrid vehicle conversions will continue to be held to the current eligibility requirements specified in HVIP until the Innovative Technology Regulation¹⁰ is adopted by the Board. Once the regulation is adopted, hybrid vehicle conversion manufacturers would follow emission testing requirements specified in the regulation for a pathway to HVIP funding eligibility. This new regulation would provide certification and aftermarket parts approval flexibility for innovative heavy-duty engine and vehicle technologies.
- *Transit Bus Vouchers:* Currently, vouchers for transit buses and vans are based on GVWR. Based on input from stakeholders during public work group meetings, ARB staff recommends basing transit voucher amounts on bus and van length. Additionally, vouchers for buses and vans will be organized by vehicle type (e.g., fuel cell and battery electric transit buses and motor coaches).
- *Inductive Charging Technology:* HVIP offers voucher enhancements for innovative technologies that further promote ARB clean air policy goals. ARB staff recommends building on existing voucher enhancements for fast charge capable vehicles by adding a voucher enhancement for vehicles that are equipped with inductive charging technology.

⁹http://arb.ca.gov/cc/capandtrade/auctionproceeds/ccj_annual_report_2016_final.pdf

¹⁰For more information on the Innovative Technology Regulation, see <http://www.arb.ca.gov/msprog/itr/itr.htm>

Solicitation Process

ARB will conduct a competitive solicitation to select a grantee to administer HVIP. Currently, ARB solicits for a grantee every two years. ARB staff recommends extending this time frame to allow ARB to conduct a three-year solicitation.

- While the solicitation would encompass up to three fiscal years, the grant agreement would initially cover one fiscal year with the option to renew for each of the following two years.
- The solicitation would be released after the Board approves the FY 2016-17 Funding Plan and the State Budget is signed. It would be open for at least 30 days. Staff anticipates having a grant in place for the FY 2016-17 by the end of September 2016.

Agricultural Equipment Trade-Up Pilot Project in the San Joaquin Valley

Recommended AQIP Allocation – \$3 million

Emissions from mobile off-road agricultural equipment are among a number of significant sources of air pollution in the San Joaquin Valley. Incentive programs and regulations are already reducing emissions from a wide variety of diesel engines in the region; however, a continuing transition to the cleanest technologies is needed to meet federal ozone standards in 2023 and 2032. ARB staff recommends a continuing commitment to the Agricultural Equipment Trade-Up Pilot Project in the San Joaquin Valley (Trade-Up Pilot Project), first introduced in the FY 2015-16 funding cycle.

The Trade-Up Pilot Project provides ARB an opportunity to evaluate the feasibility of a new incentive model for mobile agricultural equipment, intended for owners of high-emitting equipment that are not well served by existing incentive programs which only provide funding for new equipment purchases. The trade-up concept is a two-step transaction in which the owner of equipment with a Tier 0 (uncertified) or Tier 1 certified diesel engine agrees to scrap that equipment in exchange for a previously used and reconditioned piece of equipment with a certified Tier 2 or Tier 3 engine at little or no out-of-pocket cost. This used equipment comes from another owner that relinquishes it for an incentive to purchase brand new equipment that employs the cleanest engine technology commercially available (Tier 4 Interim or Tier 4 Final certification).

Current Status

In FY 2015-16, ARB allocated \$500,000 in AQIP funds to launch the Trade-Up Pilot Project. ARB released a competitive solicitation in December 2015 to select a public entity to administer the project. The solicitation closed in January 2016, and a preliminary selection has been made. Project goals include determining the project's cost-effectiveness; developing implementation guidelines that would enable emission reductions resulting from trade-up transactions to be creditable under the State Implementation Plan (SIP); and assessing the owner/user experience and acceptance of incentivized equipment. Project launch is targeted for the spring of 2016.

Staff Recommendation for FY 2016-17

ARB staff recommends allocating \$3 million for the Trade-Up Pilot Project, building upon the FY 2015-16 project. This would include:

- Expanding the test of feasibility to a larger scale. An incrementally larger project is a logical and crucial step in evaluating the feasibility of implementing this concept as a potentially new incentive type San Joaquin Valley wide.

- Funding 40 to 60 equipment transactions. One equipment transaction includes scrapping the high-emitting equipment, reconditioning the used equipment, and incentivizing the new equipment.
- Potentially increasing local dealership involvement.
- Streamlining methods for making equipment matches.
- A stronger focus on evaluating the suitability of a trade-up incentive as a new, eligible Carl Moyer Program incentive type.

Truck Loan Assistance Program

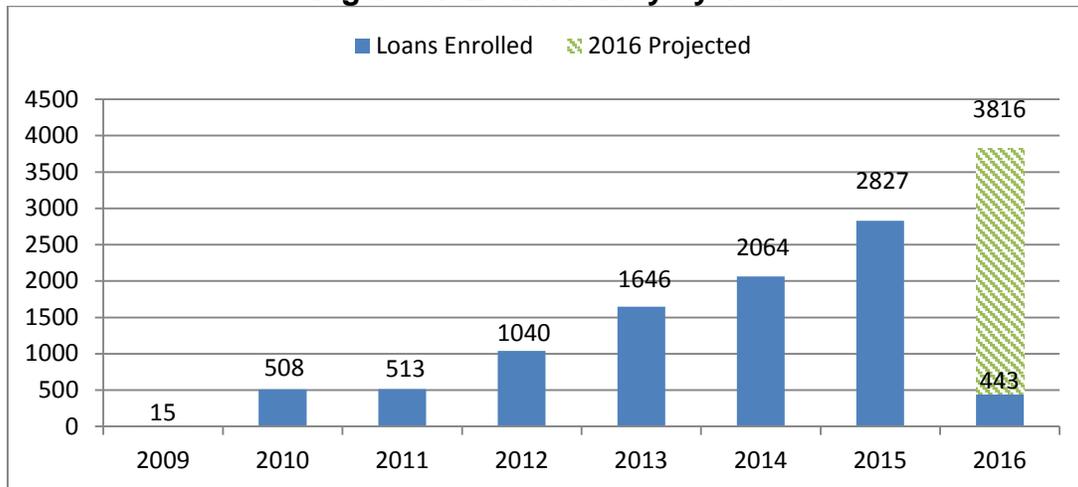
Recommended AQIP Allocation – \$22 million

Launched in 2009, the Truck Loan Assistance Program utilizes AQIP funds to help small-business fleet owners affected by ARB'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 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 their traditional underwriting standards to establish loan terms; however, the program currently includes an interest rate cap of 20 percent. Because the program primarily reduces criteria and toxic air contaminant emissions, AQIP is the only source of ARB funding available for this program.

Current Status

As of February 2016, about \$73 million in Truck Loan Assistance Program funding has been expended to provide about \$594 million in financing to small-business truckers for the purchase of approximately 9,800 cleaner trucks, exhaust retrofits, and trailers. Demand by truck owners continues to increase each year as shown in Figure 3. Program expenditures in 2015 were \$20.8 million, a 35 percent increase over 2014. 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 3: Loan Activity by Year



To meet consumer demand, ARB increased the original FY 2015-16 AQIP allocation of \$15 million by \$3 million to ensure that the program would remain fully funded through the rest of the FY 2015-16.

Table 7 provides a summary of financing provided to date. Nearly 70 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 7: 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)
8,914	9,142	Truck Purchases	\$73	\$594
	568	Exhaust Retrofits		
	122	Trailers		

Based on data through February 10, 2016.

¹Total number of loans issued does not equal the number of projects financed because some loans included multiple projects.

Because the Truck Loan Assistance Program is funded through AQIP, it is not subject to the disadvantaged community investment requirements that accompany the Low Carbon Transportation appropriation. However, it is worth noting much of this 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.

Recommendations for FY 2016-17

ARB staff recommends an allocation of \$22 million for the Truck Loan Assistance Program to meet expected demand for the FY 2016-17 cycle. ARB 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. To ensure the sustainability of the program and continuous availability of funding to participating lenders, ARB staff is working with CPCFA to examine potential program modifications to address both short- and long-term cash flow and to meet ever-increasing demand. Options under consideration include:

- *Alignment of contribution rates consistent with the State CalCAP Program:* In the coming months, CPCFA will 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. ARB contribution rates for loan loss reserve accounts have been adjusted as of January 1, 2016. The top tier rate has been reduced from 10 percent to 4 percent. This will improve the leverage of the program and slow the rate of the expenditure of AQIP funding.

- *Incremental recapture of funds in the lenders' loan loss reserve accounts:* CPCFA's analysis has indicated that an annual recapture mechanism is possible for each lender's loan loss reserve account for loans which have matured, or after five years from the date of loan enrollment, whichever comes first. Recapture would not be applicable to the contributions for loans which have defaulted or were charged-off. Any recapture mechanism would have to be adopted through a CPCFA public rulemaking, so the proposed structure or implementation details are subject to input from lenders and stakeholders, and approval from the CPCFA Board.
- *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. ARB staff will assess whether there are any sources of funding that may be available to cover the 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 recommended allocation along with recaptured premiums should be enough to cover the potential gap due to temporary lack of AQIP funding which typically occurs at the start of each fiscal year for about three months.

ARB 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 ARB and CPCFA.

VERY LOW CARBON FUELS INVESTMENTS

ARB's current mobile source control programs are expected to reduce NOx emissions in 2030 by over 50 percent from today's levels, position California to meet our 2020 GHG target, and provide approximately half the petroleum reductions needed by 2030. However, meeting all of our air quality and climate goals will require additional reductions beyond those occurring under existing programs. For GHGs, California's 2050 climate goal provides an ambitious long-term target. Many strategies developed to meet the shorter-term air quality standards — notably use of cleaner energy sources — will have benefits toward the longer-term climate goal. Pursuing cleaner energy sources is also the focus of the State's energy policies, providing the opportunity for economic, as well as environmental benefits.

A continued emphasis on development of cleaner renewable fuels and energy sources will be critical for decarbonizing the transportation system and reducing our reliance on fossil fuels. Both the LCFS and California's Cap-and-Trade program provide strong market incentives for fuel suppliers to develop cleaner fuels and sell them in California. Because the mobile sector (transportation) will continue to operate on internal combustion engines for some time, particularly in the heavy-duty sector, it's critical that the fuels consumed in these vehicles contribute to the emission reductions needed to meet our 2031 air quality and 2030 climate and petroleum reduction goals.

While there are a suite of regulatory drivers to encourage the production of very low carbon transportation fuels, the economics of advanced biofuels projects have become marginal due to a variety of market and policy drivers. These drivers include reducing the Renewable Fuel Standard volume obligations at the national level, unresponsive investors in the face of temporary production tax credits, higher-than-anticipated costs of agricultural residues and waste feedstocks, and rock-bottom oil prices.

California already devotes incentive funding to cover "up-front" capital costs of advanced biofuel facilities through the California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program, but industry and economic experts have commented that a long-term "per gallon" subsidy may be more critical and cost effective at both maintaining existing levels of production and stimulating new investment.

Policy and Statutory Drivers

- ARB's 2014 *Scoping Plan Update* notes that achieving California's long-term air quality and climate change goals will require a multi-pronged approach, including reducing the carbon content of fuels and providing market support to get these lower-carbon fuels into the marketplace.
- The 2015 *Mobile Source Strategy Discussion Draft* points out that renewable fuels can provide deep GHG and petroleum use reductions. Concurrent

investments by other agencies will also be essential to help fund fueling infrastructure, as well as low carbon and renewable fuels.

- ARB's *Technology and Fuels Assessment Overview* shows that one of the most viable approaches to meeting the 2031 and 2030 goals is low-NOx trucks. Lower NOx natural gas engines, when paired with the use of renewable natural gas, could provide near-zero emissions of both criteria and greenhouse gases.
- ARB's 2012 Vision for Clean Air Document presents a number of scenarios designed to show the actions required to meet our State's air quality and climate goals. It notes that as California plans for the future, transformational technologies, cleaner energy, and greater efficiency are expected to provide the foundation for meeting air quality standards and climate goals.
- The *Sustainable Freight Pathways to Zero and Near-Zero Emission Discussion Document* highlights the fact that the heavy-duty sector is diverse and there are many different technologies and approaches that can achieve substantial emissions reductions. Development and use of these technologies and fuels can provide nearer term emission reductions in applications where zero emissions are not yet feasible.
- ARB's draft *Short Lived Climate Pollutant Strategy*, developed pursuant to Senate Bill 605 (Lara, Chapter 523, Statutes of 2014), notes that a combination of incentives, State and private sector investment, and regulations will be necessary to capture the value in organic waste streams and ensure lasting emission reductions. These waste streams could provide valuable new sources of renewable electricity or biogas, clean transportation fuels, compost, and other beneficial soil amendments.
- The LCFS is designed to reduce GHG emissions in the transportation sector and foster innovation in fuels markets to develop the next generation of low carbon fuels used in California. ARB first approved the LCFS regulation in 2009 and adopted a new version of the LCFS in 2015 to achieve a ten percent reduction in the carbon intensity of transportation fuels used in California by 2020.
- The *Bioenergy Action Plan for California*, approved and publicly released by the Governor in July 2006, includes specific biofuels use targets in California.
- In 2015, Governor Brown signed Executive Order B-30-15, establishing a 2030 target of 40 percent GHG reduction below 1990 levels. He further identified five key climate change strategy pillars for California in his January 2015 inaugural address to help achieve the 2030 target and establish a model for other states and nations to follow. Of these five pillars, two are directly relevant to this effort:
 - Up to a 50 percent reduction in petroleum use.
 - Reducing emissions of short lived climate pollutants.

- In 2015, Governor Brown released an Executive Order, B-32-15, directing State agencies to develop an integrated sustainable freight action plan, which will outline the immediate and near-term steps that the State will take to support the use of zero-emission and near zero-emission technology in the freight system.

Investment Goals

The Governor's 2016-17 Budget proposal includes \$40 million for the production of very low carbon, renewable transportation fuels as part of the \$500 million Low Carbon Transportation and Fuels proposal. Goals of this funding include:

- Increasing the volume of very low carbon fuels produced and used in California.
- Reducing GHG emissions and, to the greatest extent possible, also reduce the criteria pollutants and air toxics emissions associated with fuels.
- Helping accelerate the transition to the use of very low carbon fuels needed to meet our long-term climate goals.
- Fulfill related goals, such as the collection and diversion of waste, and the capture and use of biomethane from landfills, sewage treatment plants and dairy digesters.
- Supporting vehicles and equipment that do not yet have zero-emission technology options.

Very Low Carbon Fuels Incentives Project

Recommended Low Carbon Transportation allocation – \$40 million

The \$40 million for the production of very low carbon fuels in California identified in the Governor’s proposed 2016-17 Budget is intended to encourage increased production of these fuels. These incentives would be designed to complement incentives administered by other agencies, such as the California Energy Commission, the California Department of Food and Agriculture, and CalRecycle.

Under ARB staff’s recommended approach, in-state biofuel producers would be eligible for a base “per gallon” subsidy if the carbon intensity of the fuel meets a defined carbon intensity threshold. These fuels would be eligible for an additional “per gallon” subsidy if they are sourced from feedstock produced in-state, and they would also be eligible for a further “per gallon” subsidy if they include a disadvantaged communities component. The rate of the base subsidy for a given fuel will be tied to the carbon intensity of the fuel pathway, with lower carbon intensity fuels earning a higher per gallon subsidy. This promotes diversity in the fuel pool in California and complements other agency funding efforts, such as the California Energy Commission’s role in funding infrastructure and production facilities.

ARB staff recommends the following eligibility requirements and incentive amounts:

Recommended Eligibility Requirements

Eligibility would be limited to:

- In-State production.
 - Supports the goals outlined in the Bioenergy Action Plan for California, approved and publicly released by the Governor in July 2006.
 - Supports the requirement that expenditures from the Greenhouse Gas Reduction Fund must reduce GHG emission in California (Health and Safety Code section 39712(b)) and to the extent feasible support development of the green economy (Health and Safety Code section 39712(b)(2)).
- Fuels with a certified fuel pathway under the LCFS regulation.
 - Ensures that reductions in fuel production chain are real.
 - Includes emission from well-to-wheels for complete picture.
- Fuels with a carbon intensity no greater than 40 percent of the closest comparable petroleum based fuel as shown in Table 8.

- Matches the definition of very low carbon fuels as stated in AB 692 (Quirk, Chapter 588, Statutes of 2015). AB 692 requires that State fleets procure at least 3 percent of their bulk transportation fuels from very low carbon sources starting in 2017, increasing by 1 percent each year until 2024.
- While AB 692 is not tied to this incentive project, it is currently the only definition of very low carbon fuels in statute.
- Adhering to this definition will ensure that fuels used by the State fleet to meet AB 692 requirements will receive additional support to help expand their production.
- Use of the carbon intensity threshold will encourage production of the lowest carbon fuels.

Table 8: Carbon Intensity Standards and Targets (as of 2016)

Fossil Fuel	Carbon Intensity (gCO₂e/MJ)	40% Carbon Intensity Target
Gasoline	99.78	39.91
Diesel	102.01	40.80

Recommended Incentive Amounts

- The base production incentive will be determined by the carbon intensity of the fuel pathway. Draft per gallon incentive amounts are shown in Table 9.
- Additional incentive available for fuels sourced with in-state feedstocks.
 - Based on preliminary data, few fuel providers will be able to claim this credit initially, however, increased use of in-state feedstocks would be incentivized through this program.
- Additional incentive available for fuels benefitting disadvantaged communities.
 - There is considerable interest in having a disadvantaged communities component to this project. Ideally this would be done at a consumer level. This would help get reductions from the consumption of the fuel in disadvantaged communities. For this first year, staff would look at offering an additional incentive factor to producers who can demonstrate their fuel is being used or distributed in disadvantaged communities.

Table 9: Draft Base and Additional Incentive Proposal

Range of proposed incentives for production of very low carbon transportation fuels (\$/gallon)	Amount per GGE*
Base incentive to vary depending on carbon intensity of fuel pathway**	\$0.10 - \$1.00
Additional incentive for use of in-state feedstock	\$0.20 - \$1.00
Additional incentive for use of fuels in disadvantaged communities	\$0.20 - \$0.50
Total Range of Possible Incentives	\$0.10 - \$2.50

* Gasoline Gallon Equivalent

** Eligibility for base incentive is dependent on meeting the following requirements:

- Fuel is produced in California
- The fuel pathway has been certified
- The carbon intensity of the fuel pathway is no more than 40% of the carbon intensity of the comparable petroleum based fuel.

Summary and Next Steps

For the first year of this new project, ARB staff is aiming to develop and implement a relatively simple approach to provide incentives for the production of very low carbon fuels in California. Staff will continue to have an open dialogue through the public work group process and individual meetings with stakeholders to determine the approach for this year. Staff will also continue to closely monitor the program and make recommendations for potential changes in subsequent years for as long as the project continues. Staff will also gather input on an ongoing basis through public workshop and work group meetings to finalize the development of the project and determine the appropriate process for implementation.

- **Project Implementation:** Staff will hold additional public work group meetings over the spring and summer of 2016 to develop the project implementation procedures.
- **Future Updates:** Staff intends to update this proposal in subsequent years for as long as the project continues to receive funding.
- **Timeline for Incentives:** Determining incentive amounts will be based on total in-state production volumes, as delivered, on a defined timeline.
- **Long-term Investments:** While this funding program is intended to be distributed over a single year, ARB will continue to explore options for supporting multi-year commitments to the funding in order to maximize the potential for longer term investments.
- **Incentive Cap:** Although staff does not believe that there is a need to cap the amount of incentives going to any one individual fuel type and/or producer in this first year of the program, we may consider including some sort of a cap in subsequent years.

**PART II:
LONG-TERM PLAN FOR CVRP AND LIGHT-DUTY
VEHICLE INCENTIVES**

Overview

The California clean car market has grown rapidly over the past few years, along with the need for continued and expanded incentives to ensure long-term market success. Over the past two funding cycles, significant allocations of funding have been directed toward light-duty vehicle incentives, primarily through CVRP. Because of this, policy makers continue to inquire about the cost-effectiveness, equity, financial sustainability, and structure of these incentive programs. More specifically, the Legislature and the Board have expressed interest in understanding when a self-sustaining ZEV market is expected and what steps we can take to ensure incentives are phased out appropriately. In response to these requests, ARB staff has spent the past two years reviewing relevant literature and evaluating available vehicle and market data. ARB has also sponsored external research projects in these areas to address. Throughout the development of the FY 2016-17 Funding Plan, ARB staff also engaged stakeholders in public workshops and a series of public work groups to better define the task and refine the work undertaken. The resulting Long-Term Plan for CVRP and Light Duty Vehicle Incentives is intended to serve as a foundational framework for future decision-making related to light-duty incentives policy.

The advanced technology clean vehicle market is still in its infancy. Only about five years of vehicle sales data for ZEVs and PHEVs is available, and while the market is growing, these vehicles collectively only made up about 3.1 percent of new car sales in 2015.¹¹ Predicting how this market will grow over the next several years is challenging. However, ARB staff has identified several possible market indicators and a plan for continued evaluation and annual updates to inform the Board moving forward.

Specifically, ARB staff recommends evaluating the market based on ZEV sales in comparison to the comparable California new car market. Using this approach, staff believes that the ZEV market won't be sustainable without broad purchase incentives for at least the next five to ten years. Focused financial incentives, or other types of incentives may still be necessary beyond that point. Staff recommends an approach for ramping down the current purchase incentive over-time based both on expected market sustainability and budgetary constraints, and suggests maintaining the primary current incentive structure at least for the next several years.

Statutory Goals and Requirements

SB 1275, signed into law in 2014, establishes the Charge Ahead California Initiative with the goals of placing one million zero-emission and near zero-emission vehicles in California by 2023 to establish a self-sustaining market and increasing access to these vehicles for low-income consumers and consumers in disadvantaged communities. Among other requirements, SB 1275 requires ARB to include a long-term plan for CVRP and related programs in the FY 2016-17 Funding Plan. The plan must include:

¹¹<http://www.cncda.org/CMS/Pubs/Cal%20Covering%20Q%202015.pdf>

- A three-year forecast of funding needs to support the goals of technology advancement, market readiness, and consumer acceptance of advanced vehicle technologies. Acknowledging the uncertainty in forecasting a dynamic market over an extended period, SB 1275 states that this forecast may be described as a range with high and low funding levels. The three-year forecast will cover the period between July 1, 2016 and June 30, 2019.
- A market and technology assessment for each funded vehicle technology (battery electric, plug-in hybrid, and fuel cell) to inform the appropriate funding level, incentive type, and incentive amount.
- 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.

Three-Year Forecast of Funding Needs

As required by SB 1275, ARB staff developed three-year funding projections for light-duty investments including both CVRP and light-duty pilot projects. ARB staff held several public work group meetings to discuss projections developed by ARB staff and external stakeholders.

Based on the projections developed for CVRP and the light-duty pilot projects, the estimated funding need is shown in Table 10. Projection approaches are described in further detail.

Table 10: Light-Duty Project Projections

Fiscal Year	Estimated Funding Need (millions)				
	All LD Projects	Low		High	
		CVRP	LD Pilots	CVRP	LD Pilots
FY 2016-17	\$200 - \$225	\$150	\$50	\$175	\$50
FY 2017-18	\$245 - \$290	\$175	\$70	\$200	\$90
FY 2018-19	\$305 - \$365	\$205	\$100	\$235	\$130

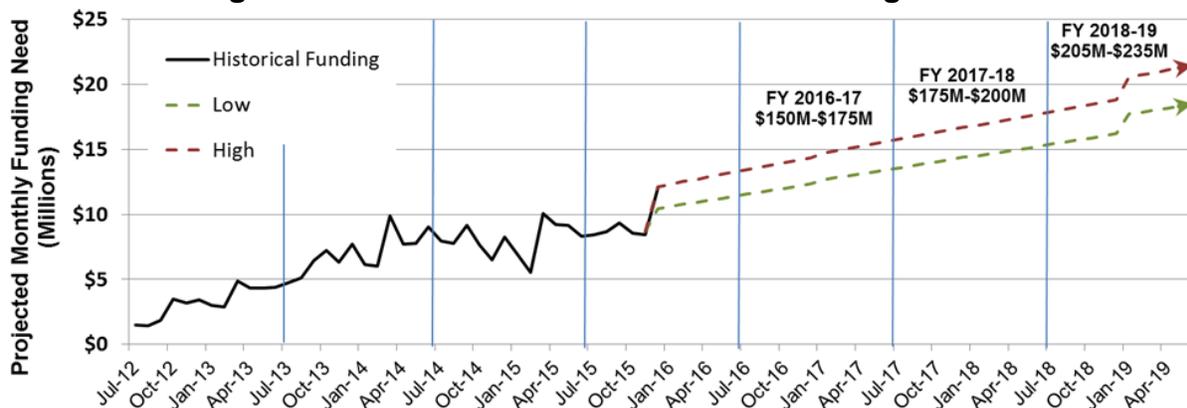
The CVRP funding estimates shown in Table 10 correspond to a projected rebate demand of: 65,000-77,000 rebates in FY 2016-17; 76,000-90,000 rebates in FY 2017-18; and 88,000-103,000 rebates in FY 2018-19.

CVRP Three-Year Funding Estimates

CVRP funding estimates are based on linear extrapolations of vehicle registration and historical rebate data, as explained in the following section. Both ARB staff and CVRP stakeholders are aware that these funding projections are not meant to predict the future of the clean vehicle market, but rather provide a reasonable basis to inform a more accurate funding estimate. Furthermore, projections farther into the future contain

greater uncertainties that are not included in this analysis. These include new vehicle model introductions; fluctuation of gasoline prices; vehicle and batteries prices; and other external factors.

Figure 4: Historical and Future CVRP Funding Needs



Projection Approach

ARB staff considered various approaches to projecting funding needs, and after comparing results from these approaches, staff determined that linear extrapolations of historical data serve as a reliable method for short-term funding estimations. Other approaches, such as forecasting for each vehicle or expected vehicle in the market, rely heavily on assumptions that have limited supporting empirical data. Additionally, most other approaches considered produced similar results. Therefore, staff determined that linear extrapolations of historical data, at this point in the market, are reliable and appropriate.

The following illustrates specific assumptions staff used while developing the three-year funding projections:

- Estimating Market Growth by Technology Type
 - PHEV and BEV forecasts were created individually by linear extrapolation of data representing vehicle sales for each technology type.
 - Vehicle registration data is used where available (March 2010 through May 2015).
 - To characterize the last few months for which registration data is forthcoming but not yet available, CVRP rebate data is used by adjusting it for historical rates of program participation to represent overall sales (June 2015 through November 2015).
 - Due to the small number of FCEV data points, a ZEV regulation compliance scenario (2011) was used instead of an extrapolation.

- The zero-emission motorcycle forecast was extrapolated from adjusted rebate data (assuming participation similar to the BEV category).
- Estimating Funding Needs
 - Rebate funding demand was calculated by multiplying forecasted volumes for each technology type by:
 - Historical percentage of participating vehicles relative to the overall market for each technology type.
 - Current rebate amount for the technology type (\$5,000 for fuel cell electric vehicle, \$2,500 for BEVs, \$1,500 for PHEVs, and \$900 for zero-emission motorcycles).
 - A high estimate was based on assuming increased participation rates (a 10 percent increase of the rebated market) for each technology type (this could be caused by the additional participation of low and moderate income consumers eligible for increased incentives, though no factual data is available).
 - A low estimate is the baseline that assumes CVRP trends remain the same with no project changes.
- Additional assumptions and conditions:
 - Incentive amounts and administrative costs remain at current levels.
 - Income cap and increased rebates for low-moderate income consumers were not incorporated in the baseline projection due to insufficient data. However, the high estimate includes some increase in participation which could be in part result from the increased rebate amounts as noted above.
 - External factors not included due to lack of quantitative data:
 - Upfront cost of ZEVs relative to conventional equivalents.
 - Fuel costs and total cost of ownership.
 - Other incentives such as federal incentives, high occupancy vehicle (HOV) lane access, subsidized electricity, free parking, etc.
 - Product diversity and new ZEV model introductions.
 - ZEV awareness increased through education & outreach.

ARB staff continues to assess the clean vehicle market and continues to seek input on other assumptions or potential methods to enhance future projections. However, due to the high variability of this market, it is very possible funding estimates may be above or below the narrow range provided. Staff will continue to examine clean vehicle market trends, keep open communication with stakeholders and update projections at least once a year.

Light-Duty Pilot Project Estimates

In addition to three-year funding projections for CVRP, staff also developed projections for light-duty pilot projects to benefit low income consumers and disadvantaged communities. The projections for light-duty pilot projects are based on current funding needs and were developed through a series of public work groups with external stakeholders. These projections, shown on Table 11, also account for future growth over the next three years.

Table 11: Light-Duty Pilot Projects Draft 3-Year Funding Projections

Pilot Projects	Funding To Date	3-Year Projections		
	FYs 2014-15 & 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
EFMP Plus-up	\$12	\$30	\$30 to \$40	\$40 to \$50
Car Sharing	\$3.1	\$8	\$20 to \$25	\$25 to \$30
Agricultural Worker Vanpools in San Joaquin Valley <i>(New for FY 16-17)</i>	-	\$3	\$3	\$3
Increased Public Fleet Incentives for CVRP-Eligible Vehicles	\$3	\$3	*	*
Financing Assistance for Low-Income Consumers	\$0.9	\$6	\$20 to \$25	\$35 to \$50
Potential New Projects	-	-	To be considered	To be considered
Total	\$19	\$50	\$70 - \$90+	\$100 - \$130+

* Project and funding transitioned to on-going set-aside within CVRP

+ Funding need may increase above range shown in table based on new project categories.

Projected funding needs for these pilot projects are based on a mix of staff experience in developing and administering these pilot projects and stakeholder input received since 2014. Stakeholders have consistently maintained that all of these projects serve an important equity function for low-income and disadvantaged communities and urge ARB to provide increasing funding support as the pilot projects move forward. Below are more detailed discussions of how the three-year funding projections for the current pilot projects were developed.

In addition to these projections for current pilot projects, ARB staff is open to consideration of and encourages input regarding potential new pilot projects for clean light-duty transportation options. For FY 2016-17, staff will engage the work group processes of the existing pilot projects to consider new eligible components instead of proposing any new stand-alone pilot projects. For the next funding cycles, staff will continue to seek input on possible new light-duty pilot projects. Projections of funding needs for FY 2017-18 and FY 2018-19 are subject to staff's continuing evaluation of performance of the existing pilot projects. Projections of data for all the projects will become more robust and informed as these projects are carried out. ARB will continue to seek stakeholder input regarding the effectiveness of the existing pilot projects and

their opportunities for growth, as well as ideas for future funding needs to assist the State's low-income and disadvantaged communities, meet GHG and other emission reductions needs, and help meet State goals for transforming the light-duty vehicle fleet to advanced clean technologies.

EFMP Plus-up

- High demand has resulted in the existing EFMP Plus-up programs being over-subscribed with first year funding being exhausted after providing incentives for over 400 vehicles in less than six months of implementation. South Coast AQMD, which accepts applications in part through its website, has a backlog of roughly 2,000 applicants while the San Joaquin Valley APCD, which holds biweekly events, continues to see large volumes of interested and eligible applicants. Both districts have worked to increase program efficiency and are now processing program participants at an even higher rate.
- The projected funding needs reflect both this upward trajectory of the existing programs as well as the expected expansion of EFMP Plus-up to additional districts eager to implement their own EFMP Plus-up programs. Both the Bay Area and Sacramento districts are expected to implement programs during the FY 2016-17 funding cycle and have demonstrated the ability to scale up incentive programs quickly. Additional districts may be added, and possible changes to the Carl Moyer Program Guidelines scheduled for spring 2017 may allow Moyer funds to be used toward vehicle retire and replace programs and provide additional support of EFMP Plus-up programs.
- Currently, the supply of used hybrid- and battery-electric vehicles remains a hurdle in expanding the programs to levels higher than those being considered. As such, the funding need identified attempt to balance the improvements to the existing programs and expansion into additional areas of the State with the projected availability of advanced vehicles in the used vehicle market.

Car Sharing

- The FY 2014-15 \$2.5 million Car Sharing solicitation generated substantial interest, with 13 applications requesting more than \$16 million in funds. Staff experience with grantees as they build their projects suggests that these projects could be expanded, and that other disadvantaged communities could benefit from similar projects.
- In addition to the recommended \$8 million in FY 2016-17, ARB staff projects a funding need of up to \$25 million in FY 2017-18, and up to \$30 million for FY 2018-19. This reflects staff's understanding of a potential uptake for these types of projects, interest expressed by disadvantaged communities, stakeholder input of demand in the next three years, and staff's intent to encourage the willingness of car sharing companies to invest in disadvantaged communities.

Public Fleets Increased Incentives

- ARB staff recommends \$3 million for Public Fleets Increased Incentives in FY 2016-17.
- Beginning in FY 2017-18, staff is recommending Public Fleets Increased Incentives and its funding be transitioned from the light-duty pilot project to an ongoing set-aside within CVRP.

Agricultural Worker Vanpools in San Joaquin Valley

- ARB staff recommends \$3 million for Agricultural Worker Vanpools in San Joaquin Valley for FY 2016-17, with and projects a similar need in the FY 2017-18 and FY 2018-19 funding cycles. Staff is open to expanded funding for this type of project, but projecting future needs for a new pilot project is difficult, especially prior to engaging in a public process to develop project parameters and to determine the availability of appropriate technologies.

Financing Assistance

- ARB has award \$0.9 million in FY 2014-15 funds for a financing assistance pilot project.
- For FY 2016-17, ARB staff recommends in increased allocation of \$6 million for financing assistance for low-income consumers, including a \$1 million set aside for local programs to encourage innovative financial strategies for introduction of advanced technology vehicles in disadvantaged communities. ARB staff will work with the State Treasurer's Office CPCFA to create a \$5 million financing assistance pilot project to reach low-income consumers throughout California. Stakeholders have maintained that financing assistance is needed throughout the State as a complement to EFMP and EFMP Plus-up in areas they are available as well as in other areas that those programs do not touch.
- Reflecting the demand experienced by EFMP Plus-up and the potential demand among low-income consumers statewide for advanced technology vehicles in their communities, staff projects a funding need of up to \$25 million in FY 2017-18 and up to \$50 million in FY 2018-19, with a continuing set aside in both cycles of at least \$1 million for local programs for disadvantaged communities.

Market and Technology Assessment

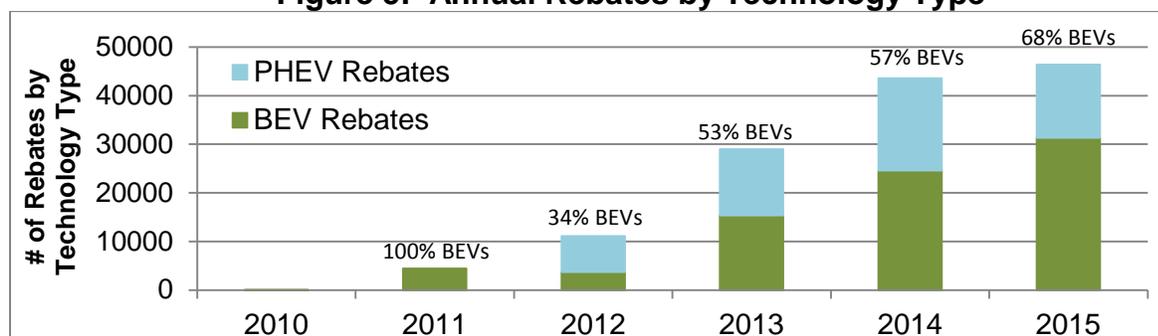
This section provides an overview of ARB staff's market and technology assessment, a second element of the long-term plan required by SB 1275.

Market Assessment

In developing the three-year funding forecast for CVRP, staff evaluated vehicle data from various sources, including CVRP data and Department of Motor Vehicles (DMV) registration data, in order to assess where the clean vehicle market is today. Although approximately 1.3 million plug-in electric vehicles (PEV) have now been sold worldwide and 2015 showed strong growth with over 158,000 PEVs registered in California alone, PEVs still represent less than 1 percent of the nationwide light-duty vehicle sales last year.^{12,13} In California in particular, the total PHEV and BEV sales account for 3.1 percent of total new car sales in 2015.¹⁴ This number was 2.5 percent and 3.2 percent in 2013 and 2014 respectively. Further, fuel cell electric vehicles are just being introduced into the California market; there were only 229 fuel cell vehicles registered in October 2015.¹⁵

Over the life of CVRP, the technology split between BEVs and PHEVs has grown in favor of BEVs, in part due to technology advancements and model availability. Table 5 shows the number of rebates of BEVs and PHEVs and the percent of BEVs over the last 5 years.

Figure 5: Annual Rebates by Technology Type



Fuel cell vehicles, zero-emission motorcycles, and neighborhood electric vehicles not shown.

New model releases and product availability are important factors in the growth of CVRP. Since 2010, CVRP has provided rebates for 39 different vehicle models: 25 BEVs; 10 PHEVs; and 4 fuel cell electric vehicles. Today, 35 of these models remain available. Table 12 shows the progression of the new model eligibility over the last 5 years. Note that the table does not incorporate the release of new model years of a particular model.

¹²<http://about.bnef.com/press-releases/electric-vehicles-to-be-35-of-global-new-car-sales-by-2040/>

¹³Vehicle Identification Number Analysis (VINA) Vehicle Registration (VR) Bi-Annual (OCT15) Extract.

¹⁴<http://www.cncda.org/CMS/Pubs/Cal%20Covering%204Q%2015.pdf>

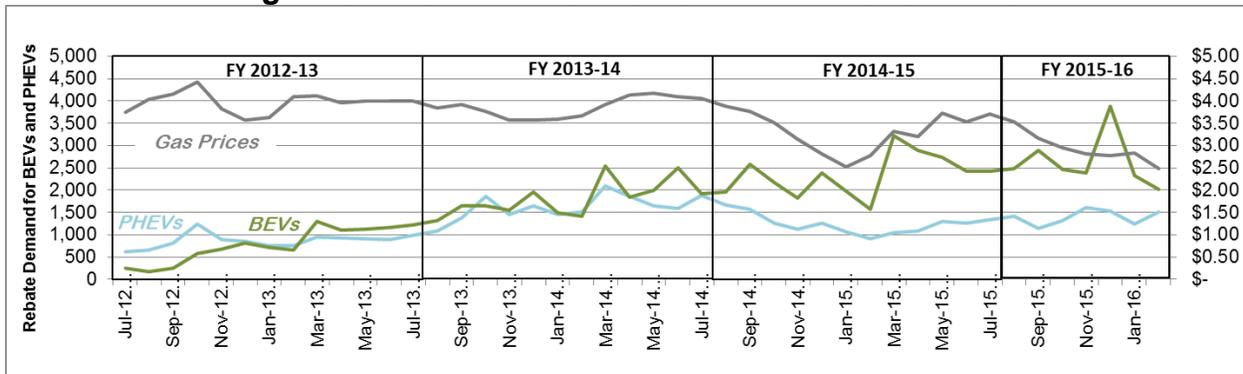
¹⁵Vehicle Identification Number Analysis (VINA) Vehicle Registration (VR) Bi-Annual (OCT15) Extract.

Table 12: New Vehicle Models Released Since 2010

Year	Model Eligible	Year	Model Eligible
2010	Tesla Roadster	2013	Ford Fusion Energi
	Honda FCX Clarity		Honda Accord Plug-in
	smart fortwo		Tesla Model S 60
	Nissan LEAF		FIAT 500e
2011	Th!nk City		Chevrolet Spark EV
	Wheego LiFe		Cadillac ELR
	Mitsubishi i-MiEV	BMW i3	
2012	Toyota Prius Plug-in Hybrid	2014	Hyundai Tucson Fuel Cell
	Chevrolet Volt		BMW i3 REx
	Ford Focus Electric		Mercedes-Benz B250e
	CODA		Kia Soul EV
	Tesla Model S 85		Volkswagen e-Golf
	BMW 1 Series Active E		2015
	Mercedes-Benz F-CELL	Mercedes-Benz S-Class 550e	
	Honda Fit EV	Toyota Mirai	
	Toyota RAV4 EV	Tesla Model S 90	
	Ford C-MAX Energi	Tesla Model X	
BYD e6	Hyundai Sonata Plug-in Hybrid		
Legend (by color) :		2016	Audi A3 e-tron
BEV	PHEV		FCEV
			Bolloré Bluecar

ARB staff also evaluated historical rebate demand in relationship to monthly average California gasoline prices to determine if any relationship between the two exists. The results of that analysis are included in Figure 6.

Figure 6: Historical Rebate Demand and Gas Prices



This component of the assessment is important because ZEV sales in 2015 didn't grow as rapidly as prior years, and many stakeholders suspect this is because gas prices in 2015 were considerably lower than in previous years. Although gas prices have been lower, ZEV sales have continued to grow as shown in Figure 6. There may be a relationship, but there isn't enough data to support the finding that a direct relationship exists. Further, in 2015, PHEV sales were lower because manufacturers limited

offerings of older models in preparation of the release of newer models at the end of 2015. PHEV sales are already showing growth again in the first quarter of 2016.

As discussed previously in the three-year forecast of funding needs section, staff continues to assess the clean vehicle market and continues to seek input on available data sources, assumptions, and other potential methods for enhancing future projections and evaluations. Further, staff inquired at the public work group meetings on this topic if additional analysis for the market assessment was necessary and whether or not the assessment conducted as part of the three-year funding forecast met the stakeholders expectations for what SB 1275 requires. Stakeholders indicated that this approach is sufficient, given the early state of the market.

Stakeholders did suggest, however, a variety of other studies that could be evaluated for future market assessments and projections. Additionally, some topics for ARB to include in future evaluations are: technology advancements and costs; oil prices; vehicle transaction prices; production costs of batteries and fuel cells; purchase vs lease rates; the secondary vehicle market; and the second life of batteries. Stakeholders also urged that it is important to ensure data collected from various studies use comparable assumptions and align with ARB's evaluation and to acknowledge the interdependencies of all the factors.

As noted, staff will continue to examine clean vehicle market trends, keep up with the published scientific studies, keep open communication with stakeholders, and update projections at least once a year.

Technology Assessment

ARB has relied upon its own and outside light duty vehicle technology assessments to help inform assumed vehicle costs, the overall status of technology, and long-term trends. Typically, these assessments cover a wide range of topics, including emission reduction strategies, electrification trends, safety considerations, and costs. Findings indicate positive trends such as significant battery cost reductions, and extended battery electric range.

Since adopting Advanced Clean Cars in 2012, ARB has been participating in a joint-agency review (commonly referred to as "the midterm review") of the nationwide GHG fleet average standards with the United States Environmental Protection Agency (U.S. EPA) and National Highway Traffic and Safety Administration (NHTSA). Now in its fourth and final year, a joint-agency draft technical assessment report (TAR) is being finalized, and will include a full review of light duty vehicle technologies, including component and vehicle costs as well as projected GHG compliance costs.

Due to the nature of the review, it is important that the technical analysis being conducted in the midterm review be released in line with the full fleet analysis, which is expected to be released in June 2016 (after the planned release of the proposed FY 2016-17 Funding Plan). The vehicle costs and technology assumptions that will be

released in the draft TAR are a result of years of study, analysis, stakeholder feedback, and review. It is important that those numbers are considered in any ARB technical assessment of advanced vehicles.

In addition to the joint-agency review, ARB is conducting its own midterm review on the ZEV regulation and particulate matter standards. ARB will hold a technical symposium in September 2016 on advanced conventional and ZEV technologies to gather more input on its review. ARB will release a final report in the Fall, which will build upon information released in the TAR, further exploring improvements made since the 2012 rulemaking and the 2016 summer TAR release. Staff plans to present its findings to the Board in December 2016.

These on-going efforts have limited the scope of this years' technology assessment required by SB 1275. Staff has chosen to conduct an evaluation of zero- and near zero-emission technologies by examining the following items:

- Most recent ARB regulatory vehicle incremental cost projections from December 2011 for the January 2012 Board hearing on the Advanced Clean Cars regulation proposal.
- National Academies of Sciences (NAS) study that directly compares vehicle cost projections of varying electric vehicle types (2013).
 - Results included here show up to 2023 for vehicles, longer term for system input values.
- More recent battery system cost reference review.
- More recent fuel cell system cost reference review.

ARB staff outlined the resources and subsequent findings for advanced technology vehicles cost projections to the year 2023 and presented them at a work group meeting with external stakeholders. These references are summarized below.

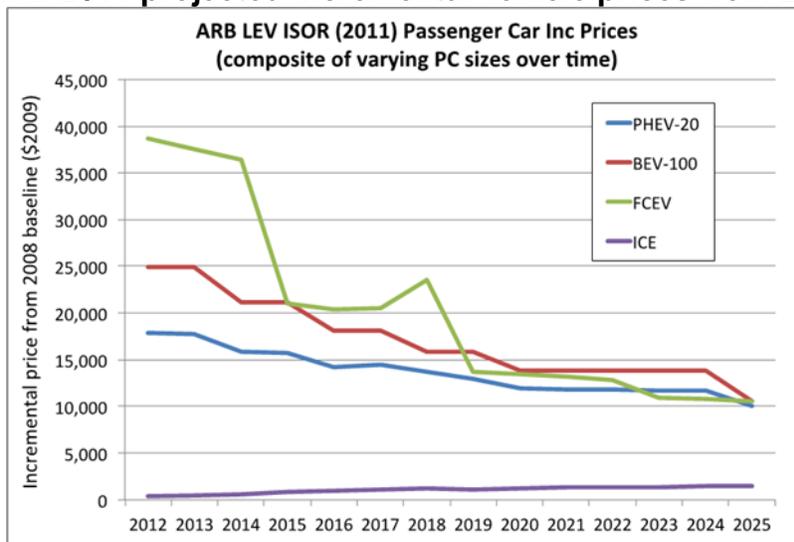
ARB 2011 Advanced Clean Cars Staff Report (ISOR)¹⁶

In the Advanced Clean Cars staff report supporting data released in December 2011, ARB projected incremental vehicle prices from 2012 to 2025 are shown in Figure 7. This analysis was based on the joint agency technology assessment from 2010 and 2011 (ARB, U.S. EPA and NHTSA). The values shown represent the increased price for the given technology above a 2008 baseline internal combustion engine (ICE) vehicle. The ICE curve near the horizontal axis of the plot shows that the incremental cost of producing an ICE vehicle increases slowly from zero (from a 2008 baseline

¹⁶Advanced Clean Cars - AB1085 Background Materials for Emissions Data, Economic Data and Public Health Impacts. "ACC Compliance Scenario Summary" (Refer to tab 2 in the spreadsheet, rows 30-42). http://www.arb.ca.gov/msprog/clean_cars/clean_cars_ab1085/clean_cars_ab1085.htm

vehicle in 2009 dollars) to a few thousand dollars in 2025. The slow increase represents the increased costs required to comply with increasing federal vehicle emission standards. Thus, it will cost from \$1,000 to \$2,000 more (in 2009 dollars) to produce an ICE vehicle in 2025 that is compliant with vehicle emission standards, than in 2008. The figure also indicates (for example) that in order to produce a fuel cell vehicle in 2016, it will cost almost \$20,000 more dollars (in 2009 dollars) than a similar 2008 ICE baseline vehicle. In 2023, all alternative drive trains will each cost between \$11,000 and \$14,000 more.

Figure 7: ARB 2011 projected incremental vehicle prices from 2012 to 2025*



*BEV-100 refers to a battery electric vehicle (BEV) capable of 100 miles of range on a single charge, while a PHEV-20 refers to a plug-in hybrid electric vehicle (PHEV) capable of 20 all electric miles before the ICE engages to extend the range of the vehicle.

NAS 2013 Model

The National Academy of Sciences Vehicle Cost Summary model (2013)¹⁷ is from the “Transitions to Alternative Vehicles and Fuels 2013” report. This is a well-known and publically available model that features both a “mid-range” and “optimistic” technology market.¹⁸ The incremental advanced technology vehicle costs for the years 2015 to 2023 are shown in Figure 8. The first figure (8a) is for vehicles in the federal vehicle type classifications of “passenger cars” and the second (8b) for “light trucks”. These incremental costs are relative to a 2010 baseline ICE vehicle (in 2009 dollars). Interpretation of these figures is similar to the ARB figure above except that this time there is a 2010 baseline vehicle and BEV110 refers to a BEV with a 110 mile range, and

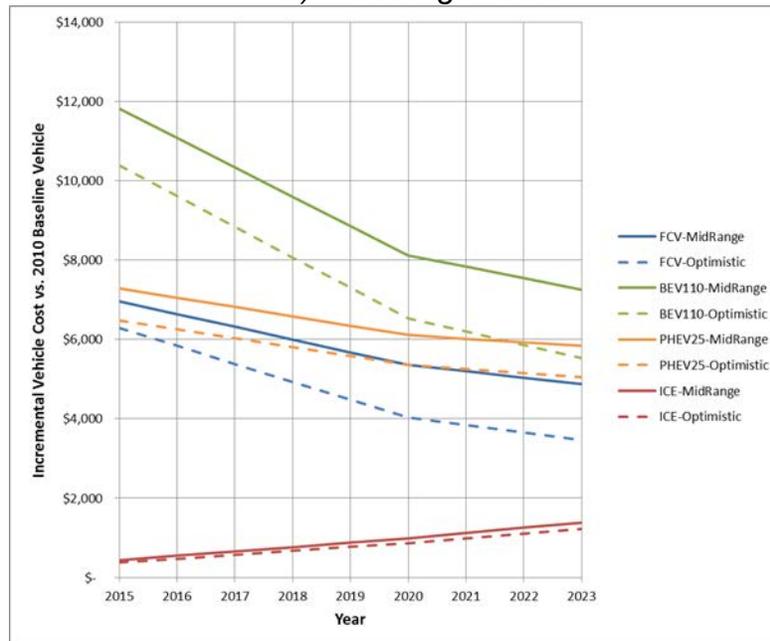
¹⁷ National Academies “Transitions to Alternative Vehicles and Fuels 2013”, Appendix F: The Vehicle Cost Summary (http://cart.nap.edu/cart/deliverxls.cgi?p=tavf&f=appF_vehiclecostsumm).

¹⁸ “Midrange” goals for cost and performance are ambitious but plausible in the committee’s opinion. Meeting this level will require successful research and development and no insurmountable barriers, such as reliance on critical materials that may not be available in sufficient quantities. The more optimistic goals are stretch goals: possible without fundamental technology breakthroughs, but requiring greater R&D and vehicle design success”. NRC 2013 Transitions to Alternative Vehicles and Fuels, National Academies Press, Washington DC.

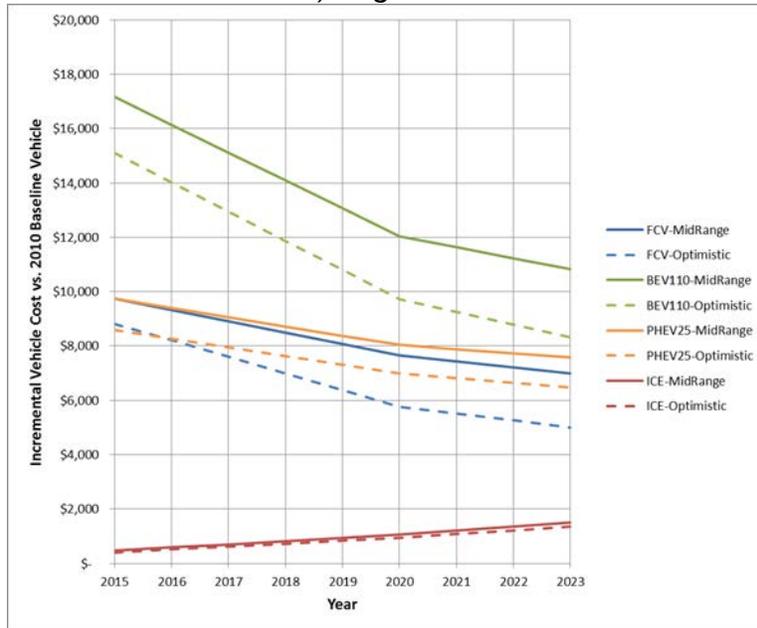
PHEV25 refers to a PHEV with a 25 mile all electric range. For example, the passenger car projections indicate that in 2023, it will cost more than \$7,000 (in 2009 dollars) to produce a BEV110 over a similar baseline 2010 ICE vehicle in the “mid-range” market scenario. Although the ARB 2011 cost projections are compared to a 2008 baseline vehicle and the NAS 2013 model is with respect to a 2010 baseline vehicle, evidence indicates that the newer cost projection is lower than the original for the entire date range.

Figure 8: NAS 2013 Vehicle Incremental Cost Projections: EVs vs. Conventional ICE Vehicle**

a) Passenger Cars



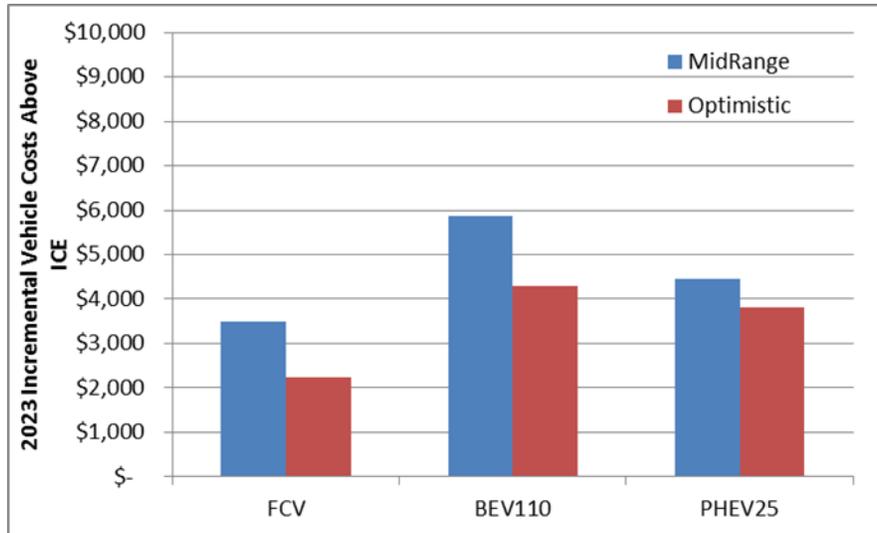
b) Light Trucks



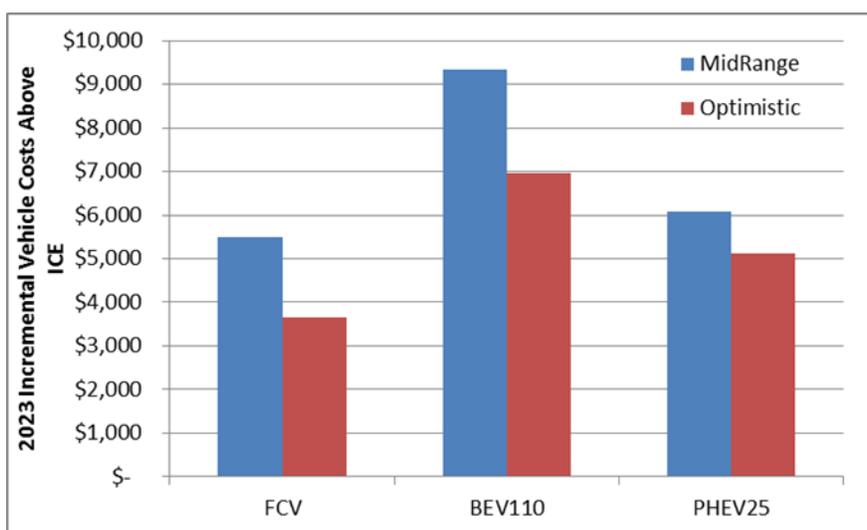
Of particular interest to the SB 1275 requirements, is the 2023 difference in the incremental cost for a given advanced vehicle technology and its ICE vehicle counterpart. Thus, the 2023 differences are shown for both passenger cars and light trucks in Figures 9a and 9b. The passenger car figure (9a) indicates that under a mid-range market assumption, a 2023 BEV with 110 mile range, will cost almost \$6,000 more than a similar 2023 ICE vehicle.

Figure 9: NAS 2013 Incremental Vehicle Costs Above ICE in Model Year 2023**

a) Passenger Cars



b) Light Trucks



*** Vehicle cost projections reference a 2010 ICE baseline vehicle. Fuel cell costs are based on an assumed annual production rate of at least 200,000 per year from 2015-2023. BEV and PHEV costs are based on an undefined high volume production for all time periods.*

System Cost Parameters from NAS 2013 Model

The key cost input parameters for the NAS 2013 for battery pack fuel cell systems and hydrogen storage systems are shown in Figures 10 through 12. The costs are generally assumed to reduce over time as the technology improves and more vehicles produced per year allow for economies of scale. The values are shown for mid-range and optimal market assumptions for the years 2015 through 2025 (minimum to span 2023). The plots indicate a projected cost for PHEV battery packs in the mid-range market to be approximately \$350 per kWh of the battery pack in the year 2025, fuel cell system costs will be approximately \$33 per kW of the fuel cell stack, and a hydrogen storage system to cost approximately \$2,500, both in the year 2030.

Figure 10: NAS 2013 BEV110 and PHEV25 Battery Cost Inputs

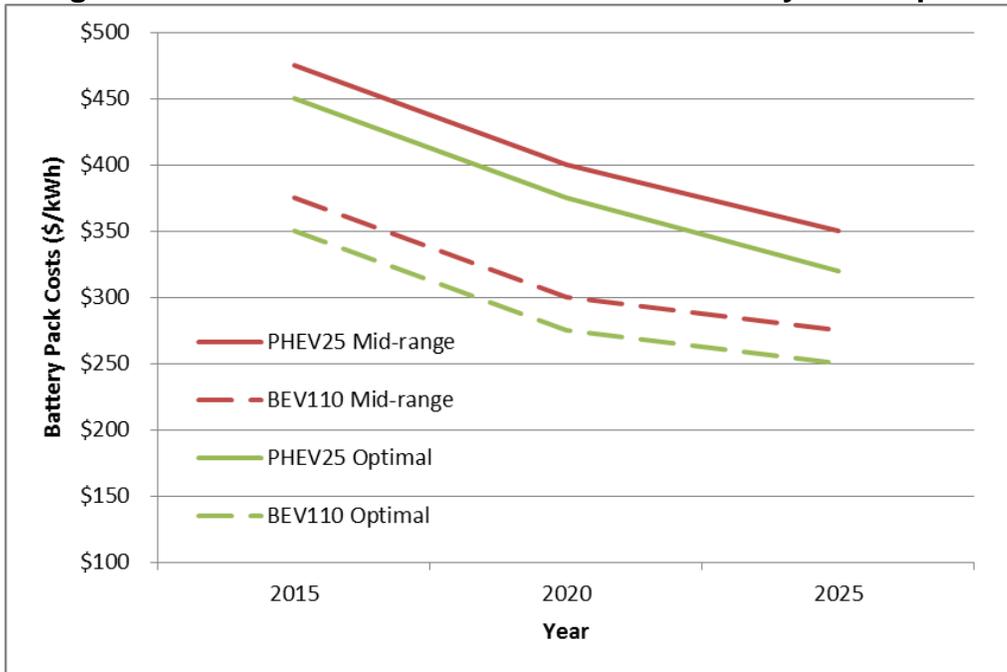


Figure 11: NAS 2013 Fuel Cell System Cost Inputs

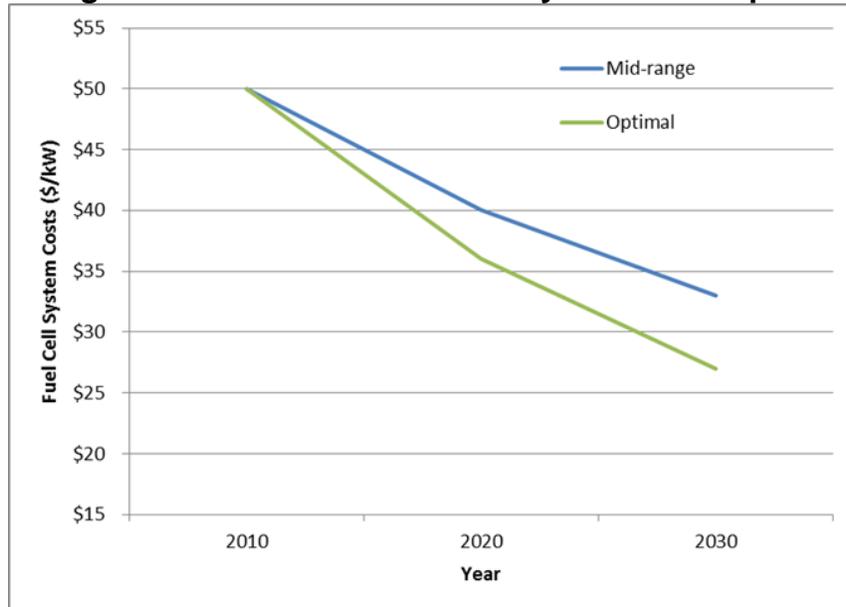
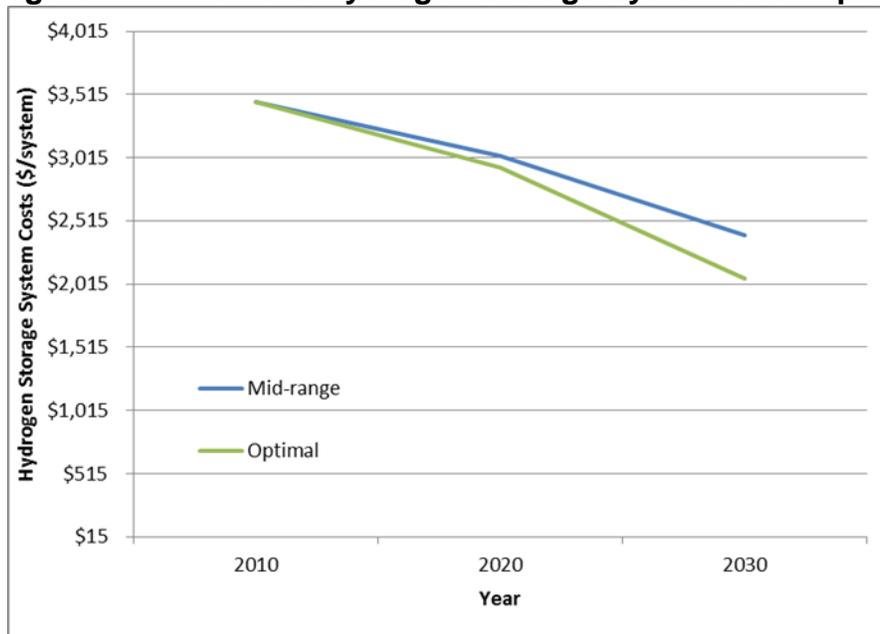


Figure 12: NAS 2013 Hydrogen Storage System Cost Inputs



Staff has reviewed several more current sources spanning the areas of battery system costs, fuel cell system costs, and hydrogen storage system costs.

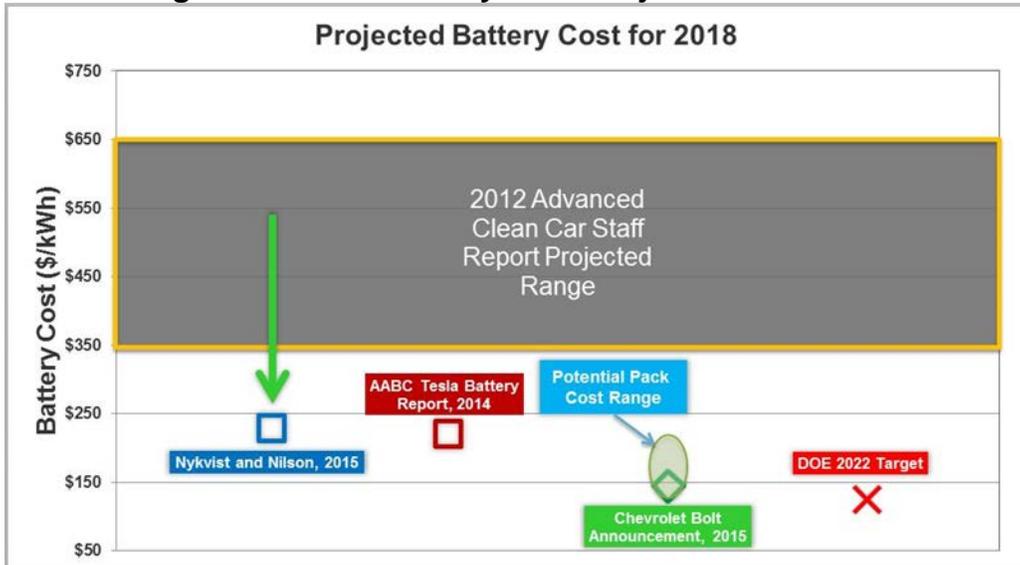
BEV and PHEV Battery System Costs

Review of the EPA NHTSA 2011 Joint Technical Support Document: Final Rulemaking for 2017 – 2025 Light-duty Vehicle GHG Emission Standards and CAFÉ Standards shows BEV battery costs that are lower than the NAS 2013 Model. However, PHEV battery costs are approximately the same as those used in the NAS 2013 Model.

The BEV battery cost projections for 2018 from newer cost analyses and announcements (as presented to the ARB Board in October 2015) are shown in Figure 13.¹⁹ The grey band along the top of the figure represents the range of battery costs in dollars per kWh of the battery pack assumed for 2018 from the ARB 2012 Advanced Clean Car Staff Report. The four points below the grey band each represent individual data points from individual sources that represent newer or updated information. The plot indicates that projections in 2012 regarding 2018 are already too high for 2014 and 2015. The last of the four points is a target set by the DOE for 2022.

¹⁹The grey band across the top represents the range of battery costs assumed for 2018 from the ARB 2012 Advanced Clean Car Staff Report. The four points below that are from: Nykvist and Nilson, Rapidly falling costs of battery packs for electric vehicles, March 23, 2015, <http://www.nature.com/nclimate/journal/v5/n4/full/nclimate2564.html>; Anderman, The Tesla Battery Report, November 12, 2014, <https://www.advancedautobat.com/industry-reports/2014-Tesla-report/Extract-from-the-Tesla-battery-report.pdf>; Chevrolet Bolt Announcement, October 2, 2015, <http://www.hybridcars.com/gm-ev-battery-cells-down-to-145kwh-and-still-falling/>; and the U.S. DOE 2022 Target, January 31, 2013, http://energy.gov/sites/prod/files/2014/02/f8/everywhere_blueprint.pdf respectively.

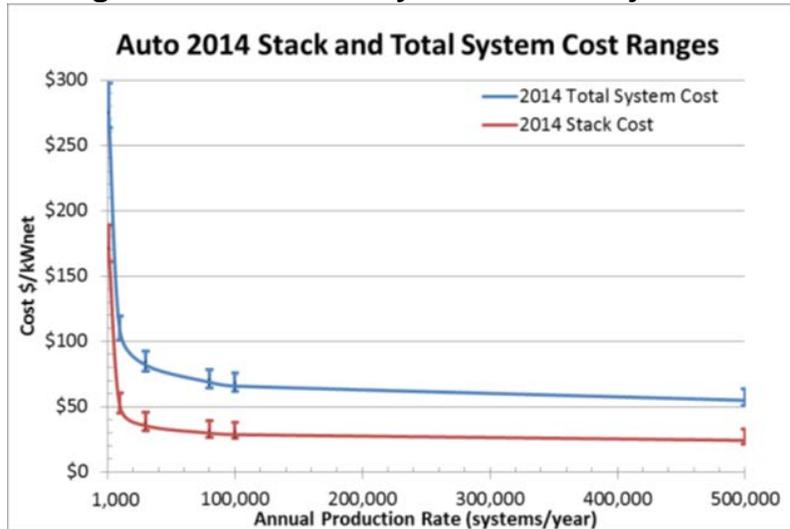
Figure 13: BEV Battery Cost Projections for 2018



Fuel Cell System and Hydrogen Storage System Costs

The fuel cell system cost projections in dollars per kW of the fuel cell system as a function of annual production rates are shown in Figure 14.²⁰ The plot indicates that when only 1,000 units are produced per year, the cost of the total system is approximately \$300 per kW of the fuel cell system. But, when 500,000 units are produced per year, the cost is approximately \$50/kW.

Figure 14: Fuel Cell System Cost Projections

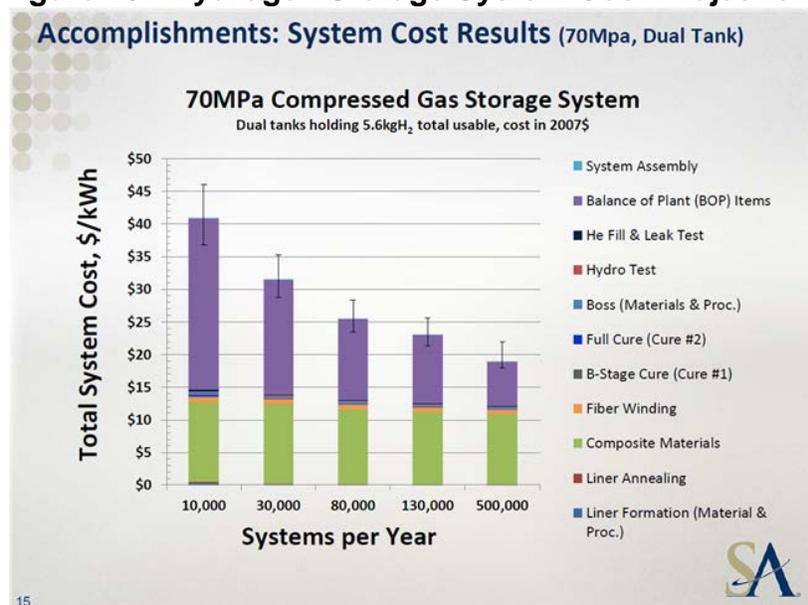


²⁰James, Brian. "Fuel cell vehicle and bus cost analysis." Annual Merit Review and Peer Evaluation Meeting. US Department of Energy. Arlington, VA. 10 June 2015. Presentation.

Hydrogen Storage System Costs

The hydrogen storage system cost projections as a function of annual production rates for a two tank (187kWh) system holding 5.6 kg of hydrogen are shown in Figure 15.²¹ The plot indicates that for 70MPa (about 10,000 psi of pressure), when 10,000 units are produced per year, a two-tank hydrogen storage system will cost approximately \$40 per kWh of storage. The colored legend on the right indicates what specific component of the storage system is assigned which color on the plot. It appears that most of the costs are due to the materials needed for the construction of the tanks, and for the balance of plant (BOP), which includes valves, safety releases, regulators, etc.

Figure 15: Hydrogen Storage System Cost Projections



Conclusions from Technology Assessment

ARB staff recognizes that this assessment does not directly inform the appropriate funding level, incentive type, or incentive amount. However, this assessment helps to show how vehicle technology costs are reducing, in most cases, quicker than originally expected. This assessment, combined with the market assessment, three-year funding forecast, and market sustainability assessment, aim to provide a framework for incentives policies going forward. Further, the efforts underway with the TAR and midterm review will further illustrate and verify the course of technology advancement, serving as important tools in future updates and evaluations.

A Sustainable ZEV Market

To address the requirements of SB 1275 related to the self-sustaining market assessment, ARB staff took the following approach:

²¹ibid

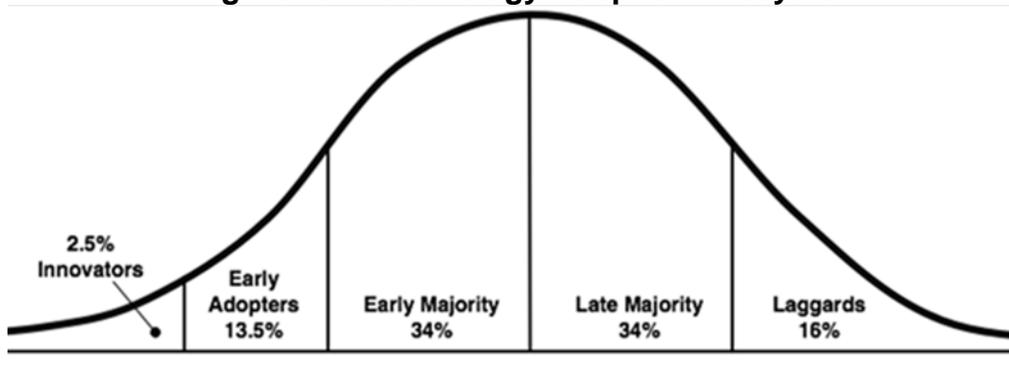
1. Considered definitions of what a self-sustaining ZEV market is and identified various indicators to determine how and when a self-sustaining ZEV market may be achieved.
2. Evaluated modifications to the current incentive structure and how to ramp it down over time.
3. Evaluated other incentive structures to determine the most effective incentive approaches for promoting the ZEV market

Defining a Self-Sustaining ZEV Market

Staff consulted a broad range of literature to help define a self-sustaining ZEV Market. The Diffusion of Innovation Theory, developed by Everett Rogers, is one of the oldest social theories related to ideas and technology adoption.²² Staff believes this behavioral change model serves as an appropriate framework to lay the foundation for this discussion.

The theory essentially seeks to explain how, why, and at what rate new ideas and technology spread. In other words, consumers adopt new technologies at varying rates. Their relative speed of adoption follows a bell curve, with the primary difference being individuals' psychological disposition to new ideas. Based on this definition, consumers are categorized into five different classifications on the basis of adopting innovations. As shown on Figure 16, the five categories include innovators, early adopters, early majority, late majority and laggards. These five broad categories of adopters each have a specific set of characteristics in relation to embracing innovative products.

Figure 16: Technology Adoption Lifecycle

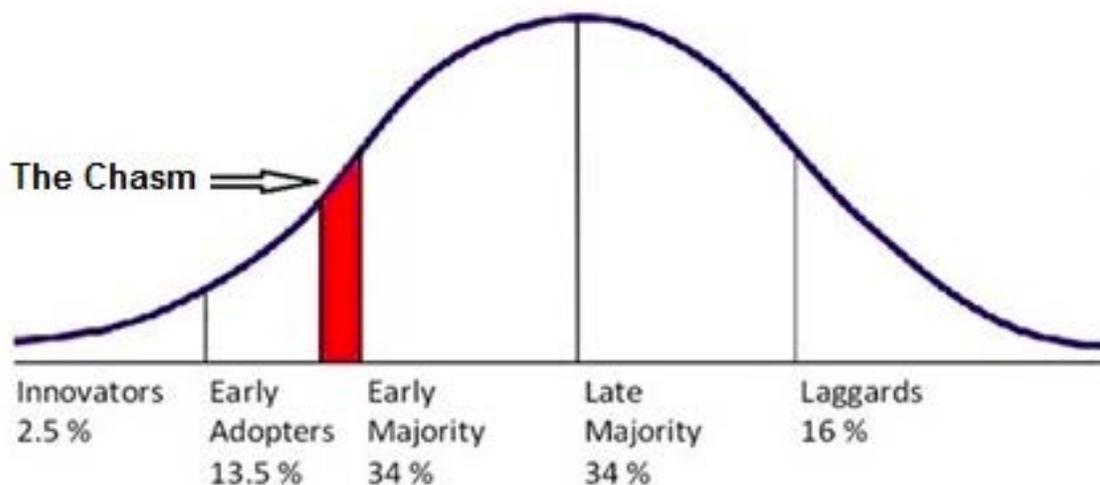


Innovators are the first 2.5 percent of a group to adopt a new idea. The next 13.5 are early adopters followed by 34 percent early majority, 34 percent late majority, and laggards as the last 16 percent of the group of consumers in a market.

²²Rogers, E.M., (2003) "Diffusion of Innovations".5th ed.

In 1999, Geoffrey A. Moore expanded the theory with the focus on high tech products and argued that there is a chasm between the early adopters of a high tech product (the technology enthusiasts) and the early majority (as shown on Figure 17).²³ He found that during the diffusion process, the focus should be on one group at a time, using each group as a base of transition to the next. He argues that the most difficult step is making the transition from early adopters to early majority, mostly because of their very different expectations, which creates a chasm between the two groups. Crossing this chasm would likely ensure successful diffusion of the technology into the next adopter categories.

Figure 17: Transitioning Early Adopters to Early Majority²⁴



Staff believes these theories help to provide a foundation for understanding technology adoption and may serve as a guide when using certain indicators to evaluate the market. These theories are well established among academia and empirically validated across many product categories. They can help in understanding consumer purchase decisions and market development processes for PEVs. For example, if the adopter categories outlined here were compared against current new car sales, California's market, at 3.1 percent of new car sales, is just starting to enter the early adopter phase.

Staff presented the concept of using this theory to help define a self-sustaining ZEV market at a public work group in February. The majority of the stakeholders argued that it is too early to provide an accurate definition or forecast on market sustainability as the ZEV market is still in its infancy and there is a lack of relevant data. Staff presented a list of indicators that could be evaluated to show where ZEV market and technology is on the path to broad consumer adoption and received mixed feedback about how these

²³Moore, G.A., (1991) "Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers"

²⁴ Adapted from Moore, G.A., (1991) "Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers"

indicators may be helpful. Below is the list of indicators and feedback associated with each approach:

- Evaluation of annual new ZEV sales in the comparable California new car market
 - Stakeholders noted that because a regulatory requirement for ZEVs exists, using annual sales or some other “market percentage” approach to evaluating market sustainability would be distorted. However, this approach presents the most available and reliable data compared to other indicators.
- Consideration of technology advancement (such as improved battery range)
 - This approach provides useful insight regarding the advancement and improvements in technology over time, but doesn’t necessarily provide a signal or guide related to sustainability. Additionally, since range options among BEVs are limited, there are not any significant data sources available to analyze from this approach.
- Evaluation of battery/fuel cost or vehicle price
 - Vehicle manufacturers argue that the market for ZEVs is sustainable only when the vehicle can be sold for the amount of money it takes to produce and market that vehicle. ARB staff agrees that this is a clear approach for evaluating sustainability on a per-vehicle basis, but noted that there is no current (2014 or more recent) available or reliable data on full vehicle manufacturing costs and transaction prices to analyze. As noted in the Technology Assessment section, technology costs (associated with batteries, fuels, fuel systems, etc) are being evaluated closely in the 2016 TAR and mid-term review. The results of those analyses may help provide some insight on how this type of indicator can be evaluated better over time.
- Consideration of vehicle choice diversity and/or number of manufacturers that produce ZEVs
 - Similar to technology advancement above, this approach is useful for showing how the technology is spreading over time, but is more difficult for use in measuring market penetration. From a consumer behavior standpoint, the more vehicle choice diversity exists, the more options consumers have for making a ZEV purchase decision, and the more likely consumers will adopt the technology broadly. An ARB-sponsored research project, to be finalized in mid-2016, is examining the impact of the number of PEV models on the market.

- Analyzing the secondary ZEV market
 - The used ZEV car market is an important element of the overall market, as some consumers may opt to test the newer technologies through used vehicle purchases instead of buying new. Staff agrees that understanding the used ZEV market is important, but as this market is especially new, available and reliable data is limited. Staff is continuing to seek reliable sources of data to better understand the secondary market. An ARB-sponsored research project focused on the secondary PEV market, expected to be finalized by mid-2017, will shed light in this area.

- Evaluating consumer awareness about ZEVs
 - Education and awareness is a critical component to the broad adoption of ZEVs. Consumers are generally unaware of ZEV technologies, including their availability, benefits, and available incentives, but as their knowledge increases so does their interest. A 2011 survey of adults with current driver's licenses in the 21 largest American cities assert that 2/3 of respondents provided incorrect answers to basic factual questions about PEVs.²⁵ They also found 94 percent of the respondents were unaware of these local and state PEV incentives, although 82 percent of them claimed purchase incentives would make them more likely to consider buying a PEV. Preliminary ARB-sponsored research suggests that financial incentives alone do not overcome the barriers of the people who do not already have a favorable valuation of ZEVs. Simply making the vehicles less expensive doesn't address the lack of knowledge and litany of concerns and barriers, perceptual and real, to ZEV acquisition and use.²⁶ Furthermore, studies show that when consumers are more familiar with PEVs, they express stronger interest in acquiring a PEV, while those that are unaware or have misconceptions about them are less likely to be interested in acquiring PEVs.^{27,28}

Additionally, stakeholders suggested the following indicators for ARB staff consideration:

- Cost of avoided health impacts for each ZEV brought into the market
 - Stakeholders asked ARB staff to look more broadly at avoided health impacts and the costs associated with them and correlate those costs with the costs of ZEV adoption. Essentially, some stakeholders argued that ZEV market sustainability depends upon the elimination of related

²⁵Krause, R. M., et al. (2013). "Perception and reality: Public knowledge of plug-in electric vehicles in 21 U.S. cities." *Energy Policy* 63(0): 433-440.

²⁶Kurani, K. S., et al. (2015). *New Car Buyers' Valuation Toward Zero-Emission Vehicles: California*.

²⁷Krause, R. M., et al. (2013). *ibid*

²⁸Kurani, K. S., et al. (2015). *ibid*

pollution and the existence of zero healthcare costs associated with that pollution. American Lung Association in its second report on Public Health and Societal Benefits of a Zero Emission Vehicle Fleet in California provides useful findings on annual and daily avoided health damages and costs as a result of a 100 percent ZEV fleet in California.²⁹ ARB staff agrees that this analysis is important and fits best within the larger planning efforts that take place, including the development of the SIP, AB 32 Scoping Plan, and other guiding efforts.

- Understanding consumer's willingness to pay for ZEV technology
 - See above regarding evaluating consumer awareness.

Considering the dynamic nature of the early ZEV market with various driving forces and multiple perspectives, staff believes that multiple indicators may be helpful for both defining a self-sustaining ZEV market and tracking progress toward achieving sustainability. Other indicators or topics staff is continuing to explore include infrastructure and the value of other non-monetary incentives. Given the availability of data, staff recommends using the available research on technology adoption to help guide the discussion for this first year. A new ARB-sponsored research project, to be finalized by late 2018, is tasked to identify self-sustaining indicators in the PEV market.

Staff recommends using Moore's theory, built upon Rogers' Diffusion of Innovation Theory, as a starting point for defining a self-sustaining ZEV market. As noted above, once a technology transitions from early adopters to early majority of consumers, the technology is most likely to be successful in diffusing across the remaining adopter categories. Staff recommends applying this theory to the new car market - specifically, sales of light-duty passenger vehicles by comparing annual new ZEV sales to California comparable light-duty new car sales.

The theory suggests that 16 percent of a population represents when the market has penetrated the most difficult group of adopters for ensuring success of a technology. Staff believes that if this is applied to the comparison between ZEVs and comparable new car sales in California that it would represent about 200,000 vehicles in a given year, in today's vehicle market. This assumes a California vehicle market of about 2 million new vehicle sales per year, with 60 percent of those vehicles being light-duty automobiles. Given that sales of ZEVs and PHEVs combined only reached around 60,000 in 2015, staff believes it will take at least another 5 to 10 years before this level of adoption is achieved.

²⁹ American Lung Association. (2012) THE ROAD TO CLEAN AIR II – A Zero Emission Future, Public Health and Societal Benefits of a Zero Emission Vehicle Fleet in California. <http://www.lung.org/assets/documents/research/estimated-prevalence.pdf>

Ramping Down Incentives Over Time

As stated above, staff believes that broad purchase incentives remain important for at least the next 5 to 10 years, until the ZEV market makes up 16 percent of California new light-duty passenger vehicle sales. The last few percent of those adopters are the most critical, making incentives critical in overcoming that chasm of technology adoption. Focused financial incentives, or other types of incentives may still be necessary beyond that point.

Hence, staff recommends continuing the current incentive structure for the next several years, with modifications for effectiveness as necessary. However, the funding needed to support such a commitment may exceed funding available. Staff is considering the following approaches for ramping down the current incentive program, CVRP, under both of the following conditions: once the market approaches the sustainability threshold, and to address possible budgetary constraints.

- Adjust income eligibility requirements
 - Staff recommends adjusting income eligibility requirements over time such that the project transitions to focusing investments on economically challenged populations, consistent with the Conceptual Evolution of the Role of Incentives, as presented in the 2015-16 Funding Plan.³⁰ Specifically, staff intends to monitor income distribution within the project and reduce the income cap to eliminate the top 5-10 percent of participants each year, slowly ramping down the cap over time. However, this modification may also be used as a lever to make short-term changes to the project in response to budgetary constraints. Under either approach, staff believes this form of adjustment is consistent with the intent of SB 1275.
- Lower the incentive amount over time
 - Staff recommends to ramp down incentive levels slowly as more is learned about technology costs. Changes in incentive amounts should be linked to the reduction of technology cost premiums. However, because of the difficulty in obtaining the most appropriate data for this type of analysis, this approach would also be appropriate to implement as the ZEV market reaches the sustainability threshold. For example, the incentive could be reduced by \$500 once 5 percent, 10 percent, and 15 percent of market share is achieved, thus slowly ramping down the incentive for PHEVs and ZEVs such that the cleanest vehicles continue to receive an incentive of about \$1000 as the market approaches the early adopter market.

³⁰Proposed Fiscal Year 2015-16 Funding Plan for Low Carbon Transportation Investments and the Air Quality Improvement Program (2015). Air Resources Board.

- Reducing rebates may be necessary in the future to address budgetary constraints. Staff cautions however, that significant reductions too quickly could have a negative effect on the market.
- Implement a manufacturer's suggested retail price (MSRP) cap
 - Similar to adjusting the project based on income eligibility, this approach is aimed at targeting ZEV sales toward more mainstream vehicle purchases. Staff recommends that this approach only be considered in future years to address budgetary constraints, as the above approaches listed are more appropriate for addressing technology costs and market advancement.
- Phase out rebates for lower electric range
 - This approach is aimed at maintaining incentives for only the cleanest vehicles in the long-term. Because fuel cell, BEV, and PHEV technologies are all critical to meeting long-term air quality and climate change goals, staff would only consider this approach in future years if necessary to meet budgetary constraints.

Alternative Incentive Structures

Staff conducted a literature review to better understand the suite of incentive options and their effectiveness in promoting the adoption of clean vehicles and meeting environmental goals. Preliminary research findings show that making PEVs more affordable through purchase incentives has the greatest impact on PEV adoption compared to other strategies studied.³¹ After considering the options and research below, and per the discussion above, staff recommends maintaining the current incentive structure for the next several years. Staff considered the following options as alternatives to CVRP:

- Purchase Rebates and Tax Incentives
 - Of these incentives, policies that offer upfront payments, such as point-of-sale sales tax waivers, appear to be more effective than deferred payments, such as tax credits.^{32,33,34} However, others argue that purchase tax credits are the least effective policy at reducing greenhouse gas emissions from the transportation sector because they require excessive government

³¹Adepetu, A., et al. (2016). "An agent-based electric vehicle ecosystem model: San Francisco case study." *Transport Policy* 46: 109-122.

³²Diamond, D. (2009). "The impact of government incentives for hybrid-electric vehicles: Evidence from US states." *Energy Policy* 37(3): 972-983.

³³Beresteanu, A. and S. Li (2011). "Gasoline prices, government support, and the demand for hybrid vehicles in the United States." *International Economic Review* 52(1): 161-182.

³⁴Gallagher, K. S. and E. Muehlegger (2011). "Giving green to get green? Incentives and consumer adoption of hybrid vehicle technology." *Journal of Environmental Economics and Management* 61(1): 1-15.

- expenditures to make a significant difference.³⁵ Furthermore, Green, Skerlos et al. (2014) assert that incentives in the form of income tax credits are not cost-effective because they mostly subsidize vehicle purchases that would have happened anyways since most consumers do not have a tax liability high enough to use the tax credit.³⁶
- To date, the majority of research in this area has focused on hybrid electric vehicles (HEV). Staff will include the full literature review on purchase rebates and tax incentives in the Funding Plan. In sum, several studies analyzed PEV incentives both in the US and in other countries and found that each incentive offered has had a different effect within each different market. Because the ZEV market in general is still in its infancy, each individual market reacts to incentives differently, thus making it difficult to draw clear conclusions about the best form of incentive for California.
 - Some research indicates that tax credits are considered more desirable because they directly offset a taxpayer's liability in the exact amount of the credit, whereas tax deductions reduce the amount of reported income that is subject to taxation rather than directly offsetting taxes owed. However, tax credits are available only to those who file a tax return, but tax deductions are available to those who file an itemized tax return. Studies show that less than 50 percent of federal tax returns claim itemized deductions.³⁷
- Sales Tax Exemption
 - Sales tax exemption benefits are realized immediately at the point of sale. Although, this type of incentive would not be able to contain constraints such as income limitations or ownership requirements. And, the incentive would essentially be available to anyone, including those who would have purchased advanced clean vehicles anyway. This approach has impacts on local sales tax, and cannot be applied toward leased vehicles in the same way it's applied to purchased vehicles. Further, this approach would take legislative action.
 - Feebates
 - There is much research considering feebates or upfront additional fees applied to the purchase or registration of vehicles that a government is trying to disincentivize, such as those with lowest gas mileage or the highest emitters while incentivizing the purchase of cleaner vehicles. Several

³⁵Morrow, R. W., et al. (2010). "Analysis of policies to reduce oil consumption and greenhouse-gas emissions from the US transportation sector." *Energy Policy* 38(3): 1305-1320.

³⁶Green, E. H., et al. (2014). "Increasing electric vehicle policy efficiency and effectiveness by reducing mainstream market bias." *Energy Policy* 65: 562-566.

³⁷Prante, G. 2007. "Most Americans Don't Itemize on Their Tax Returns." Tax Foundation, July. <http://taxfoundation.org/article/most-americans-dont-itemize-their-tax-returns> .

European countries have instituted various feebate programs. Brand, Anable et al. (2013) found that car purchase feebates were the most effective policy instrument (relative to excise taxes and scrappage schemes) at achieving GHG emissions reductions quickly in the U.K., and, if carefully implemented, can result in relatively little burden to the consumer.³⁸ In contrast, Higgins, Paevere et al. (2012) modeled various feebates in Australia and determined that they would have virtually no impact on the fraction of BEVs, PHEVs and ICE vehicles sold by 2030.³⁹ Using the Swiss fleet, de Haan, Mueller et al. (2009) studied different revenue-neutral feebate schemes which included both a cash incentives for very fuel efficient vehicles and additional fees for the most fuel inefficient vehicles⁴⁰. They concluded that these feebate systems nudged consumers to pay for the more efficient version of the vehicle they wanted anyway, rather than an entirely different vehicle.

- It appears feebate programs may be effective in some cases, but it's unclear how such an approach would work in California. Further, this approach would take legislative action.
- Emissions-Based Incentives
 - Emissions-based taxes may encompass both taxes on the vehicle, such as registration fees, and taxes on the fuel, such as gasoline taxes. Eppstein, Grover et al. (2011) simulated consumer uptake of PHEVs and concluded that gas prices and the ability of consumers to accurately account for lifetime fuel costs for PHEVs vs. ICEs or HEVs play an important role in determining PHEV uptake; they recommend setting a price floor or otherwise taxing gasoline in order to foster continued growth of PHEV market share.⁴¹ Morrow, Gallagher et al. (2010) concluded that increasing the cost of driving through gasoline taxes resulted in the largest GHG reductions compared to tax credits for new vehicles and increasing fuel economy.⁴² Brand, Anable et al. (2013) concluded that vehicle excise taxes can be effective at reducing GHG emissions, but acknowledged that they are more likely (relative to feebates and scrappage schemes) to face opposition from the driving public

³⁸Brand, C., et al. (2013). "Accelerating the transformation to a low carbon passenger transport system: The role of car purchase taxes, feebates, road taxes and scrappage incentives in the UK." *Transportation Research Part A: Policy and Practice* 49(0): 132-148.

³⁹Higgins, A., et al. (2012). "Combining choice modelling and multi-criteria analysis for technology diffusion: an application to the uptake of electric vehicles." *Technological Forecasting and Social Change* 79: 1399-1412.

⁴⁰de Haan, P., et al. (2009). "How much do incentives affect car purchase? Agent-based microsimulation of consumer choice of new cars—Part II: Forecasting effects of feebates based on energy-efficiency." *Energy Policy* 37(3): 1083-1094.

⁴¹Eppstein, M. J., et al. (2011). "An agent-based model to study market penetration of plug-in hybrid electric vehicles." *Energy Policy* 39(6): 3789-3802.

⁴²Morrow, R. W., et al. (2010). "Analysis of policies to reduce oil consumption and greenhouse-gas emissions from the US transportation sector." *Energy Policy* 38(3): 1305-1320.

and lobbying groups.⁴³ Ozaki and Sevastyanova (2011) examined the motivations for British consumers of HEVs (Toyota Prius) and found that, among many factors that influence their decision, London's congestion charge may be a significant influence.⁴⁴ To varying degrees, many researchers all found that gasoline prices and their volatility are important motivators for the adoption of cleaner vehicles.^{45,46,47,48}

- Targeting Niche Markets
 - Some argue that incentives would be more cost-effective if targeted specifically to niche markets, such as car-sharing and fleets in addition to early adopters instead of mainstream consumers.⁴⁹ A co-benefit of PEV car-sharing programs is that they allow a larger number of drivers to experience an electric vehicle, making drivers more comfortable with and interested in PEVs as well as re-evaluate their preferences of different vehicle attributes.^{50,51} Fleets tend to be early adopters because they have high vehicle purchase rates. A survey of fleet managers in the U.S. and the Netherlands determined that their main motivation for their initial PEV adoption was testing new technologies.⁵² However, for financial reasons, half of the fleets decided not to expand their PEV fleets beyond their initial test purchase even with government subsidies. In contrast, a modeling study based on the current travel patterns of their gasoline vehicles determined that it is profitable for a San Francisco taxi company to transition their fleet to PEVs in San Francisco.⁵³ They suggest this may be true for other taxi companies in other cities with similar mobility practices because of the higher cost of electricity in San Francisco compared to the rest of the U.S. Green,

⁴³Brand, C., et al. (2013). "Accelerating the transformation to a low carbon passenger transport system: The role of car purchase taxes, feebates, road taxes and scrappage incentives in the UK." *Transportation Research Part A: Policy and Practice* 49(0): 132-148.

⁴⁴Ozaki, R. and K. Sevastyanova (2011). "Going hybrid: An analysis of consumer purchase motivations." *Energy Policy* 39(5): 2217-2227.

⁴⁵Diamond, D. (2009). "The impact of government incentives for hybrid-electric vehicles: Evidence from US states." *Energy Policy* 37(3): 972-983.

⁴⁶Beresteanu, A. and S. Li (2011). "Gasoline prices, government support, and the demand for hybrid vehicles in the United States." *International Economic Review* 52(1): 161-182.

⁴⁷Gallagher, K. S. and E. Muehlegger (2011). "Giving green to get green? Incentives and consumer adoption of hybrid vehicle technology." *Journal of Environmental Economics and Management* 61(1): 1-15.

⁴⁸Hidrue, M. K., et al. (2011). "Willingness to pay for electric vehicles and their attributes." *Resource and Energy Economics* 33(3): 686-705.

⁴⁹Green, E. H., et al. (2014). "Increasing electric vehicle policy efficiency and effectiveness by reducing mainstream market bias." *Energy Policy* 65: 562-566.

⁵⁰Jensen, A. F., et al. (2013). "On the stability of preferences and attitudes before and after experiencing an electric vehicle." *Transportation Research Part D: Transport and Environment* 25: 24-32.

⁵¹Shaheen, S., et al. (2015). Zero- and low-emission vehicles in U.S. carsharing fleets impacts of exposure on member perceptions, Transportation Sustainability Research Center, UC Berkeley.

⁵²Sierzchula, W., et al. (2014). "The influence of financial incentives and other socio-economic factors on electric vehicle adoption." *Energy Policy* 68(0): 183-194.

⁵³Carpenter, T., et al. (2014). "The return on investment for taxi companies transitioning to electric vehicles." *Transportation* 41(4): 785-818.

Skerlos et al. (2014) proposed replacing the U.S. Postal fleet with PEVs, as the majority of the delivery routes are less than 24 miles and their current fleet is nearing the end of their useful life.⁵⁴

- Staff agrees that targeting incentives specifically to niche markets such as car-sharing, public fleets, and providing financing tools in addition to early adopters instead of mainstream consumers is an important component for successful ZEV adoption. ARB has already begun investments in these areas and recommends ramping them up over time, as outline in the three-year funding forecast.
- Choose Your Incentive
 - Stakeholders agree that different incentives motivate consumers differently in various regions. Therefore limiting consumers with only one state incentive, for instance to choose between financial rebate or HOV sticker, may take the pressure off the growing market by splitting the burden between direct and indirect incentive mechanisms. At this time, staff does not have a clear proposal for how to structure such an approach. However, staff will continue to evaluate this option for consideration in future funding cycles.

Although not the primary concern of an effective incentive program, incentive structures that are easy to evaluate provide policymakers with more straightforward opportunities to adjust and improve the program. It is also much more straightforward to evaluate the effect of an incentive program if it is offered in isolation, as demonstrated by Chandra, Gulati et al. (2010) for Canada's HEV rebate program.⁵⁵ The presence of other incentives and perks that influence PEV purchases (such as HOV access, parking and/or charging access, etc.) can confound analysis of the effectiveness of rebates and other financial incentives programs.

Long-Term Plan Conclusions

In order to achieve the goals identified by SB 1275 and the Governor's Executive Order to place 1.5 million ZEVs in California by 2025, continued significant investments are necessary, at least in the near-term. As the market share of ZEV grows, with a related increase in demand for rebates, ARB is continuing to refine its strategy to most effectively deploy incentives to foster the growth of the clean vehicle market.

Because the market is still in its infancy, staff recommends using the most reliable and available data to evaluate the market based on ZEV sales in comparison to the comparable California new car market. Using this approach, staff believes that the ZEV market won't be sustainable without broad purchase incentives for at least the next

⁵⁴Green, E. H., et al. (2014). "Increasing electric vehicle policy efficiency and effectiveness by reducing mainstream market bias." *Energy Policy* 65: 562-566.

⁵⁵Chandra, A., et al. (2010). "Green drivers or free riders? An analysis of tax rebates for hybrid vehicles." *Journal of Environmental Economics and Management* 60(2): 78-93.

five to ten years. Focused financial incentives, or other types of incentives may still be necessary beyond that point. Staff recommends an approach for ramping down the current incentive over time based both on expected market sustainability and budgetary constraints, and suggests maintaining the primary current incentive structure at least for the next several years.