Appendix A:

Emission Reductions Quantification Methodology

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Contents

Overview

In Fiscal Year (FY) 2021-22 the California Air Resources Board (CARB) received $595 million for the Low Carbon Transportation Program from the Greenhouse Gas Reduction Fund, $838 million from the General Fund, $86.45 million from the Air Pollution Control Fund, and $28.64 million for Air Quality Improvement Program (AQIP) from the Air Quality Improvement Fund for projects. The conservative estimates presented in this appendix are the emission reductions in the Funding Plan's projects and provides additional details on the applied methodology and assumptions used. Assembly Bill (AB) 8 (Perea, Chapter 401, Statutes of 2013) and published Greenhouse Gas Reduction Fund (GGRF) quantification methodologies[1] guided this analysis.

It is important to note that these estimates are illustrative examples of potential emission reductions that can be achieved with the allocated funding to these projects. Refined emission reduction estimates will be quantified as projects are implemented and data becomes available.

Table A-1 summarizes the funding allocations for the projects proposed in the Funding Plan and the potential emission reductions over the project life.

[1] Cap-and-Trade auction proceeds quantification materials are available https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/quantification.htm.

Table A-1: Summary of Proposed Projects in FY 2021-22 Funding Plan and Total Potential Emission Reductions

Project Category	Proposed FY 2021-22 Allocation (millions)	# of Vehicles or Equipment Funded	Total Potential Lifetime Emission Reductions (tons)			
			GHG	NOx	PM 2.5	ROG
Vehicle Purchasing Incentives - CVRP	**$525**					
CVRP Standard Rebates	$257.5	130,500	1,040,600	67.66	45.18	13.42
CVRP Increased Rebates for Lower-Income Consumer	$257.7	56,900	430,931	27.89	19.67	5.53
Electric Bicycle Incentives	$10	TBD	TBD	TBD	TBD	TBD
Clean Transportation Equity Investments	**$150**					
Clean Cars 4 All	$75	6,400	75,896	47.95	2.64	9.67
Financing Assistance	$23.5	2,470	20,380	1.42	0.91	0.29
Clean Mobility Options	$10	236	2,136	0.12	0.09	0.03
Clean Mobility in Schools	$10	51	19,087	18.28	1.33	5.60
Sustainable Transportation Equity Project (STEP)	$25	N/A	1,109	0.18	0.05	0.05
Outreach, Community Needs Assessments, Technical Assistance, and Access Clean California	$5	N/A	N/A	N/A	N/A	N/A
Workforce Training and Development	1.5	N/A	N/A	N/A	N/A	N/A

Project Category	Proposed FY 2021-22 Allocation (millions)	# of Vehicles or Equipment Funded	Total Potential Lifetime Emission Reductions (tons)			
			GHG	NOx	PM 2.5	ROG
Heavy-Duty and Off-Road Equipment	**$873.09**					
HVIP	$569.5					
HVIP – Standard	$269.5	2,658	138,024	198	6.36	2.88
HVIP – Transit	$70	425	50,439	24	0.12	0.55
HVIP – School Buses	$130	300	12,087	21	1.96	0.20
HVIP – Drayage	$75	580	29,760	77	0.68	0.96
HVIP – Innovative Small e-Fleets	$25	TBD	TBD	TBD	TBD	TBD
Clean Off-Road Equipment Vouchers (CORE)	$194.95	675	97,717	71	3	51
Drayage Truck and Infrastructure Pilot	$40	180	39,760	11.34	0.49	0.59
New Demonstration & Pilot Projects	$40	TBD	TBD	TBD	TBD	TBD
Truck Loan Assistance Program	$28.64	3,300	N/A	851	N/A	51.15
Total	**$1,548.09**					

Emission Factor Development

To support the emission reductions analysis from the proposed projects, staff developed a set of emission factors for a variety of different vehicle classes. The emission factors and assumptions used in the analysis were derived from a number of sources. These sources include CARB's California-modified Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (CA-GREET 3.0) Model,[2] CARB's Emission Factor (EMFAC2017) Model,[3] information from CARB regulation staff reports and emissions inventories, publicly available technical reports, and staff assumptions. Greenhouse gas (GHG) emission factors were developed on a well-to-wheel (WTW) basis because greenhouse gases are global pollutants. Criteria pollutant and toxic emission factors were calculated based solely on tailpipe emissions because of their localized impact.

Staff developed emission factors for the following vehicle classes:

- Light-duty vehicles (LDV)
- Light heavy-duty vehicles (LHD2)
- Medium heavy-duty vehicles (MHD)
- Heavy heavy-duty vehicles (HHD)
- Urban buses
- School buses
- Cargo-handling equipment (CHE)
- Transport refrigeration units (TRU)
- Off-road mobile agricultural equipment (tractors)
- Locomotives

GHG Emission Factors

Fuel economy is an important component of the GHG emission reduction analysis, as the value determines the GHG emissions generated based on the consumption of each unit of fuel for the miles traveled or in the case of off-road applications, unit of fuel consumed per hour of use. Fuel economy values were derived from EMFAC 2017[4] and CARB's off-road mobile source emissions inventories[5], specifically the 2011 Cargo Handling Equipment Inventory, and the 2011 TRU Emissions Inventory models. Table A-2 provides a summary of the fuel economy values for baseline gasoline or diesel powered on-road vehicles, while Table A-3 provides a summary of fuel economy values for baseline diesel powered off-road vehicles. These values were used in the analysis for conventional vehicles.

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[2] http://www.arb.ca.gov/fuels/lcfs/ca-greet/ca-greet.htm

[3] https://www.arb.ca.gov/emfac/2017/

[4] https://www.arb.ca.gov/emfac/2017/

[5] https://www.arb.ca.gov/msei/msei.htm

Table A-2: On-Road Fuel Economy Values of Baseline Conventional Vehicles

Vehicle Class	Fuel Type	Fuel Economy Values (mpg)			
		2000	2014	2018	2021
LDV	Gasoline	24.0	27.3	33.3	36.7
LHD	Gasoline	-	-	-	
MHD	Diesel	-	-	-	10.8
HHD	Diesel	-	-	-	8.4
Urban Bus	Diesel	-	-	-	8.7
School Bus	Diesel	7.4	-	-	10.3

Table A-3: Off-Road Fuel Economy Values of Baseline Diesel Vehicles

Vehicle Class	Horsepower Range	Tier 4 Final Fuel Economy (gal/hr)
Forklift	100-174	1.4
Yard Truck	175-299	3.5
TRU	23-25	0.7

As shown in Formula 1, a vehicle's fuel economy was paired with carbon intensity (CI) in units of CO2 weight per unit energy from the Low Carbon Fuel Standard (LCFS)[6] and the lower heating value (LHV) in units of energy per mass of the applicable fuel to calculate the WTW GHG emission factor for each project type. This was done so that the upstream (well-to-tank) emissions of the fuel were representative of the fuel used, paired with an illustrative potential technology. For on-road vehicles, the GHG emission factor is in units of grams of carbon dioxide (CO2) equivalent per mile (gCO2e/mi), and for off-road vehicles, the GHG emission factor is in units of grams of CO2e per hour (gCO2e/hr).

Formula 1: GHG Emission Factors

$$GHG\ Emission\ Factor\ \left(\frac{gCO2e}{mi}\ or\ \frac{gCO2e}{hr}\right) = \frac{LCFS\ carbon\ intensity * LHV\ of\ fuel}{fuel\ economy\ of\ vehicle}$$

For alternative-fueled vehicles, the baseline fuel economy values were converted for a given alternative fuel, using LHVs of the baseline and alternative fuels and the energy economy

[6] https://www.arb.ca.gov/fuels/lcfs/lcfs.htm

ratio (EER) value, as shown in Formula 2. EER values were derived from the LCFS Regulation[7] or based on a study comparing efficiency of battery-electric vehicles and conventional diesel vehicles operating on the same duty cycle.[8]

Formula 2: Alternative Fuel Vehicle Economy

$$Alt.\,Fuel\,Vehicle\,Economy\,\left(\frac{miles}{fuel\,unit}\,or\,\frac{hours}{fuel\,unit}\right)$$

$$=\,fuel\,economy_{baseline}\,*\frac{LHV_{alt.fuel}}{LHV_{baseline\ \ fuel}}*EER$$

Lifecycle emission factors adopted from the LCFS Program's carbon intensities represent the average or typical production processes for each fuel used in California. Staff assumed the following pathways for the fuels analyzed:

- Gasoline: California reformulated gasoline (CaRFG) from the LCFS Lookup Table[9];
- Diesel: ultra-low sulfur diesel (ULSD), also from the LCFS Lookup Table;
- Compressed Natural Gas (CNG): volume-weighted average CI of CNG from North American natural gas consumed in California in 2020 from LCFS Reporting Tool (LRT)[10] data;
- Electricity: California grid average mix, which meets the Renewable Portfolio Standard (RPS) requirements, from the LCFS Lookup Table; and
- Hydrogen: SB 1505 compliant gaseous hydrogen reformed on-site at the refueling station from a mix of North American natural gas and 33 percent biomethane from landfill gas, from the LCFS Lookup Table.

It should be noted that as more renewables are introduced into the transportation fuel mix, lowering the average CI of the fuel, additional GHG benefits may be achieved, which may lower the emission factors. As the fuel mix changes, staff will reflect those changes in future analyses.

Criteria Pollutant and Toxics Emission Factors

To determine criteria pollutant emission factors for on-road vehicles, staff applied CARB's EMFAC 2017 model to calculate the tailpipe emissions and associated emissions of the supported vehicles or equipment, such as idling emissions and PM 2.5 emissions from brake

[7] https://www.arb.ca.gov/regact/2015/lcfs2015/lcfsfinalregorder.pdf
[8] https://www.arb.ca.gov/msprog/actruck/mtg/170425eerdraftdocument.pdf
[9] https://www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm
[10] https://www.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm

and tire wear, when applicable. For off-road equipment, staff applied CARB's 2011 Cargo Handling Equipment Inventory and 2011 TRU Emissions Inventory to develop emission factors associated with the usage of the supported vehicles or equipment.

When available, staff incorporated deterioration for on-road and off-road vehicles. Staff also applied a 50 percent reduction in brake wear emissions for on-road vehicles that implement regenerative braking.[11] The emission factors developed for advanced technology vehicles are supported by the proposed projects when appropriate, along with emission factors for baseline conventional vehicles.

Quantification Methodology for Projects

To quantify the potential emission reductions for each project, staff must first determine the annual per-vehicle emission reductions for each technology weighted by the amount of each technology funded in the project. Once the annual per-vehicle emission reductions are determined, staff estimate the average project costs to determine the number of vehicles or equipment that may be funded by the allotted funding amounts. Finally, to determine the total potential emission reductions for each project, the average annual per-vehicle emission reductions is multiplied by the number of vehicles or equipment funded and the project life. As noted in the individual project write-ups, staff have quantified emission reductions based on an illustrative example due to the uncertainty in the vehicle and equipment types that will be funded.

Annual Per-Vehicle Emission Reductions

Annual emission reductions are first calculated for each eligible or representative technology in the project using the emission factors that have been developed for each project. Annual emission reductions are in units of tons per year (tpy) for the emissions reduced and are calculated by taking the difference in emission rates between the baseline vehicle and advanced technology vehicle and then multiplying by usage. This value is then converted from grams per year to metric tons per year for GHG emissions and tons per year for criteria pollutants and toxic air contaminants.

For on-road projects, annual emission reductions are calculated using Formula 3, where emission factors ($EF_{baseline}$ meaning baseline emission factors and EF_{ATV} referring to alternate vehicle emission factors) are in terms of grams per mile (g/mi) and usage is based on annual vehicle miles traveled (VMT) or miles per year (mi/yr). For off-road projects, annual emission reductions are also calculated using Formula 3, however, emission factors are in terms of grams per hour (g/hr) and usage is in terms of hours per year. Additionally, the vehicle or equipment's load factor, which is an indicator of the nominal amount of work done by the

[11] NREL, BAE/Orion Hybrid Electric Buses at New York City Transit, http://www.afdc.energy.gov/pdfs/42217.pdf, March 2008

engine for a particular application, and the horsepower rating of the engine are included when developing emission factors for off-road projects.

Formula 3: Annual Per-Vehicle Emission Reductions

$$Annual\ Per\ Vehicle\ Emission\ Reductions\ (tpy) = (EF_{baseline}\ - EF_{ATV}) * Usage$$

Once the annual per-vehicle emission reductions are calculated for the eligible technologies in each project, technology splits are factored in so that the emission reductions on a per-vehicle basis are representative of an average vehicle or equipment replaced under the project, as shown in Formula 4. The technology splits or mix for each project are determined based on historical project data or projected demand.

Formula 4: Average Annual Per-Vehicle Emission Reductions

$$Average\ Annual\ Per\ Vehicle\ Emission\ Reductions\ (tpy)$$

$$= \Sigma(annual\ emission\ reductions\ per\ vehicle\ type * fraction\ of\ vehicles\ funded)$$

Project Costs

Once staff have identified the incentive cost for each technology and potential technology split for a given project, staff can calculate the average incentive amount for each project, using Formula 5.

Formula 5: Average Incentive Cost

$$Average\ Incentive\ Cost\ (\$) = \Sigma(cost\ per\ vehicle\ type * fraction\ of\ vehicles\ funded)$$

Once the average incentive amount is determined, the allotted funding for the project minus the administrative cost can be divided by the average incentive amount to estimate the number of vehicles or equipment likely to be funded, as shown in Formula 6. Staff evaluated the appropriate administrative cost for each project, which vary depending on the amount of oversight necessary to implement the project.

Formula 6: Number of Vehicles Funded

$$Number\ of\ Vehicles\ Funded = \frac{(Proposed\ Funding\ Allocation - Administrative\ Cost)}{Average\ Incentive\ Cost}$$

Total Lifetime Emission Reductions

Once the average per-vehicle emission reductions are determined, it is multiplied by the potential number of vehicles funded and the project life to determine the total potential lifetime emission reductions for a project, as shown in Formula 7.

Formula 7: Lifetime Emission Reductions

$$\begin{aligned} Lifetime\ Emission\ Reductions\ (tons) \\ &= average\ per\ vehicle\ emission\ reductions * number\ of\ vehicles \\ &* project\ life \end{aligned}$$

Light-Duty Vehicle and Transportation Equity Investments

CARB's LDV and transportation equity investments are grouped into two broad project categories: the Clean Vehicle Rebate Project (CVRP) and transportation equity projects. CVRP supports increasing the number of zero-emission vehicles (ZEV) on California's roadways to meet the State's ZEV deployment goals and achieve the large-scale transformation of the light-duty fleet. The transportation equity projects are designed to increase access to clean vehicles in disadvantaged communities and lower-income households. The transportation equity projects proposed in this year's Funding Plan include: Clean Cars 4 All, Financing Assistance for Lower-Income Consumers, Clean Mobility Options for Disadvantaged Communities, Clean Mobility in Schools, Outreach, Technical Assistance, Access Clean California, the Sustainable Transportation Equity Project (STEP), and Workforce Training and Development.

All light-duty vehicle and transportation equity investment projects use the light-duty automobile classification in EMFAC 2017 for the development of emission factors. Clean Mobility in Schools and Clean Mobility Options are the lone exceptions since they can fund different types of vehicles. It may use heavy-duty factors as needed.

Quantification of the LDV and transportation equity investment projects proposed in this year's Funding Plan are described in more detail below.

CVRP

CVRP achieves emission benefits by providing incentives for plug-in hybrid electric vehicles (PHEV), battery-electric vehicles (BEV), and fuel cell vehicles (FCV) to help motivate consumer purchasing decisions and support widespread adoption. When estimating emission benefits for CVRP, staff assumed that the consumer was purchasing or leasing a new vehicle. As a result, emission reductions for CVRP are calculated as the difference between an average 2021 model year conventional LDV and an average 2021 model year advanced technology LDV that was purchased or leased.

Project data from December 2020 through May 2021 show that approximately 77 percent of standard CVRP rebates went to BEVs, 21 percent went to PHEVs, and 2 percent went to FCVs. Project data for low-income applicants for the same period show that 65 percent of rebates went to BEVs, 33 percent went to PHEVs, and 2 percent went to FCVs. There are no changes in rebates to either the standard or increased rebate programs for FY 2021-22.

Table A-4 shows the emission factors for the selected baseline vehicle and PHEV, FCV, and BEV replacements. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

Table A-4: CVRP Emission Factors

Pollutant	2021 Gasoline (g/mi)	2021 Plug-in Hybrid Electric Vehicle (g/mi)	2021 Battery Electric Vehicle (g/mi)	2021 Fuel Cell Vehicle (g/mi)
NOx	0.0144	0.0062	0	0
PM 2.5	0.0186	0.0103	0.0099	0.0099
ROG	0.0028	0.0012	0	0
GHG	313	168	70	141

Staff generated vehicle usage assumptions for CVRP through literature review for each of the vehicle types evaluated. The annual usage assumptions for CVRP are shown in the Table A-5 below.

Table A-5: CVRP Annual Usage Assumptions

Technology	Usage (mi/yr)
PHEV	14,855[12]
BEV	14,400[13]
FCV	12,445[14]

[12] Based on 40.7 miles per day. Smart, J., Powell, W., and Schey, S., "Extended Range Electric Vehicle Driving and Charging Behavior Observed Early in the EV Project," SAE Technical Paper 2013-01-1441, 2013, doi:10.4271/2013-01-1441. (*http://papers.sae.org/2013-01-1441/*)

[13] Based on EMFAC 2017 Volume III- Technical Documentation, California Air Resources Board *https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-iii-technical-documentation.pdf*

[14] Hardman, S., Tal, G., 2019, Understanding the Early Adopters of Fuel Cell Vehicles, NCST (forthcoming)

Using the emission factors, technology mix, and the annual usage assumptions above, staff calculated the potential annual per-vehicle emission reductions for CVRP, as shown in Table A-6.

Table A-6: CVRP Annual Emission Benefits on a Per-Vehicle Basis

Type of Rebates	Pollutant	Supported Technologies	Per Vehicle Annual Emission Reductions (tpy)	
			Per Technology	Average
Standard Rebates	GHG	PHEV	2.16	3.19
		BEV	3.50	
		FCV	2.15	
	NOx	PHEV	0.00013	0.00021
		BEV	0.00023	
		FCV	0.00020	
	PM 2.5	PHEV	0.00014	0.00014
		BEV	0.00014	
		FCV	0.00012	
	ROG	PHEV	0.00003	0.00004
		BEV	0.00005	
		FCV	0.00004	
Rebates for Low-Income Applicants	GHG	PHEV	2.16	3.03
		BEV	3.50	
		FCV	2.15	
	NOx	PHEV	0.00013	0.00020
		BEV	0.00023	
		FCV	0.00020	
	PM 2.5	PHEV	0.00014	0.00014
		BEV	0.00014	
		FCV	0.00012	
	ROG	PHEV	0.00003	0.00004
		BEV	0.00005	
		FCV	0.00004	

Staff is allocating at least $257.5 million to CVRP rebates for low-income applicants for FY 2021-22. Based on project data, staff anticipate the average rebate cost to be $4,220 for low-income applicants and $1,840 for standard rebates.

With the $257.5 million budgeted for classic CVRP included in the 2021-22 State Budget and the average cost discussed above, staff estimate that approximately 130,500 vehicles can be funded, in addition to the 56,900 vehicles that can be funded with the $257.5 million allocation for CVRP rebates for low-income applicants. Staff assumed a 6.75 percent administration rate to process rebates for both the standard and increased programs. CVRP has a 30 month (2.5 years) ownership requirement; therefore, total potential emission reductions for the project are quantified over the course of 30 months and shown in Table A-7.

Table A-7: Total Potential Emission Reductions for CVRP

Type of Rebates	Pollutant	Per Vehicle Average Annual Emission Reductions (tpy)	Number of Vehicles	Average Annual Emissions (tpy)	Project Life (years)	Lifetime Annual Emission Reductions (tons)
Standard Rebates	GHG	3.19	130,500	416,240	2.5	1,040,600
	NOx	0.00021		27.06		67.657
	PM 2.5	0.00014		18.07		45.184
	ROG	0.00004		5.37		13.421
Rebates for Low-Income Applicants	GHG	3.03	56,900	172,373	2.5	430,931
	NOx	0.00020		11.16		27.889
	PM 2.5	0.00014		7.87		19.667
	ROG	0.00004		2.21		5.532

Electric Bicycle Incentives Project

The Electric Bicycle Incentives Project will achieve GHG emission benefits by providing low- to moderate-income individuals incentives for electric bicycles (e-bikes) to help motivate consumer purchasing decisions, support active transportation, and displace VMT with bike trips.

At this time, not enough is known about how the Electric Bicycle Incentives Project will be implemented to make the valid assumptions needed to quantify benefits. Emission reductions and other benefits of funded projects will be quantified during project implementation.

While methodologies do exist to calculate GHG emission reduction estimates for e-bikes, this project is currently under development and as such, program parameters have not been established. Staff will coordinate internally to develop GHG emission reduction methodologies for the Electric Bicycle Incentives Project and provide reduction estimates in the next year's Funding Plan.

Clean Cars 4 All

Clean Cars 4 All (CC4A) achieves emission reductions by incentivizing the scrap and replacement of old, high-emitting vehicles with cleaner advanced technology vehicles. To calculate the emission reductions for this project, staff used past project data to determine the model year of the baseline vehicle and the replacement vehicle. Based on project data through the 2020 calendar year, on average, a 2000 model year vehicle was being scrapped and replaced by an average 2018 model year advanced technology vehicle.

Project data for the 2020 calendar year shows that 58 percent of the funding went to BEV purchases, 7 percent went to PHEV purchases, and the remaining 35 percent went to conventional hybrid vehicle purchases. For the purposes of this analysis, staff assumed that FY 2021-22 funding would continue to incentivize those technologies at similar rates. Table A-8 reflects the emission factors for the selected baseline conventional hybrid, PHEV and BEVs. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

Table A-8: Clean Cars 4 All Emission Factors

Pollutant	2000 Gasoline (g/mi)	2018 Conventional Hybrid (g/mi)	2018 PHEV (g/mi)	2018 BEV (g/mi)
NOx	0.1918	0.0157	0.0085	0
PM 2.5	0.0208	0.0116	0.0108	0.0099
ROG	0.0388	0.0033	0.0018	0
GHG	480	276	185	78

Staff generated vehicle usage assumptions for CC4A through literature review for each of the vehicle types evaluated, similar to CVRP. The annual usage assumptions for CC4A are shown in Table A-9.

Table A-9: Clean Cars 4 All Annual Usage Assumptions

Technology	Usage (mi/yr)
PHEV/Conventional Hybrid	14,855[15]
BEV	14,400[16]

Using the emission factors and technology mix mentioned above and the annual usage assumptions, staff calculated the potential annual per-vehicle emission reductions for CC4A, as shown in Table A-10.

Table A-10: Clean Cars 4 All Annual Emission Reductions on a Per-Vehicle Basis

Pollutant	Supported Technologies	Per-Vehicle Annual Emission Reductions (tpy)	
		Per Technology	Average
GHG	Conventional Hybrid	3.02	4.73
	PHEV	4.38	
	BEV	5.79	
NOx	Conventional Hybrid	0.00288	0.00299
	PHEV	0.00300	
	BEV	0.00305	
PM 2.5	Conventional Hybrid	0.00015	0.00016
	PHEV	0.00016	
	BEV	0.00017	
ROG	Conventional Hybrid	0.00058	0.00060
	PHEV	0.00061	
	BEV	0.00062	

Based on proposed funding amounts and past project data, staff anticipates the average incentive amount to be $9,925 per vehicle. With proposed $75 million allocation for CC4A, staff estimates that approximately 6,400 vehicles can be funded. Staff assumed a 15 percent

[15] Based on 40.7 miles per day. Smart, J., Powell, W., and Schey, S., "Extended Range Electric Vehicle Driving and Charging Behavior Observed Early in the EV Project," SAE Technical Paper 2013-01-1441, 2013, doi:10.4271/2013-01-1441. (http://papers.sae.org/2013-01-1441/)

[16] Based on EMFAC 2017 Volume III- Technical Documentation, California Air Resources Board https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-iii-technical-documentation.pdf

administration rate would go to the districts for administering the programs. CC4A has a 30-month ownership requirement; therefore, total potential emission reductions for the project are quantified over the course of two and a half years. The total potential emission reductions for CC4A are shown in Table A-11 below.

Table A-11: Total Potential Emission Reductions for Clean Cars 4 All

Pollutant	Per-Vehicle Average Annual Emission Reductions (tpy)	Number of Vehicles	Average Annual Emission Reductions (tpy)	Project Life (years)	Lifetime Annual Emission Reductions (tons)
GHG	4.73	6,400	30,358	2.5	75,896
NOx	0.00299		19.18		47.95
PM 2.5	0.00016		1.06		2.64
ROG	0.00060		3.87		9.67

Financing Assistance for Lower-Income Consumers

The Financing Assistance for Lower-Income Consumers project (Financing Assistance) achieves emission reduction benefits by assisting lower-income consumers in purchasing clean vehicles by improving access to more affordable financing options. For this year's quantification, staff quantified the statewide and local programs separately. For the statewide program, the Clean Vehicle Assistance Program (CVAP), the average model year purchased was 2020. For the local program, the Driving Clean Assistance Program (DCAP), the average model year purchased was 2018. Accordingly, the baseline vehicle for these calculations is a 2020 and 2018 conventional gasoline vehicle, respectively.

CVAP project data from December 2020 through May 2021 shows that approximately 79 percent of vehicle grants went to BEVs, 20 percent went to PHEVs, and 1 percent went to conventional hybrids. DCAP project data from the same time period shows that approximately 32 percent of vehicle grants went to BEVs and 68 percent went to PHEVs; there were no conventional hybrid vehicles purchased through DCAP from December 2020 through May 2021. For this analysis, staff assumed that rebates for FY 2021-22 would continue to fund BEVs at a similar rate; however, with the graduation of conventional hybrids from the programs, staff assumed that those who would have purchased a conventional hybrid would shift their purchase to a PHEV. Emission factors for CVAP and DCAP are shown in Table A-12 and Table A-13 respectively. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

Table A-12: Clean Vehicle Assistance Program Emission Factors

Pollutant	2020 Gasoline (g/mi)	2020 PHEV (g/mi)	2020 BEV (g/mi)
NOx	0.0159	0.0069	0
PM 2.5	0.0192	0.0105	0.0099
ROG	0.0032	0.0014	0
GHG	324	173	73

Table A-13: Driving Clean Assistance Program Emission Factors

Pollutant	2018 Gasoline (g/mi)	2018 PHEV (g/mi)	2018 BEV (g/mi)
NOx	0.0196	0.0085	0
PM 2.5	0.0199	0.0108	0.0099
ROG	0.0041	0.0018	0
GHG	346	185	78

Staff generated vehicle usage assumptions for Financing Assistance through literature review for each of the vehicle types evaluated, similar to CVRP. The annual usage assumptions for Financing Assistance are shown in Table A-14.

Table A-14: Financing Assistance Annual Usage Assumptions

Technology	Usage (mi/yr)
PHEV	14,855[17]
BEV	14,400[18]

Using the above assumptions and emission factors, staff calculated the potential annual per-vehicle emission reductions for both CVAP and DCAP, as shown in Tables A-15 and A-16, respectively.

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[17] Based on 40.7 miles per day. Smart, J., Powell, W., and Schey, S., "Extended Range Electric Vehicle Driving and Charging Behavior Observed Early in the EV Project," SAE Technical Paper 2013-01-1441, 2013, doi:10.4271/2013-01-1441. (http://papers.sae.org/2013-01-1441/)

[18] Based on EMFAC 2017 Volume III- Technical Documentation, California Air Resources Board https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-iii-technical-documentation.pdf

Table A-15: Clean Vehicle Assistance Program Annual Emission Reductions on a Per-Vehicle Basis

Pollutant	Supported Technologies	Per Vehicle Annual Emission Reductions (tpy)	
		Per Technology	Average
GHG	BEV	3.62	3.33
	PHEV	2.24	
NOx	BEV	0.00025	0.00023
	PHEV	0.00015	
PM 2.5	BEV	0.00015	0.00015
	PHEV	0.00014	
ROG	BEV	0.00005	0.00005
	PHEV	0.00003	

Table A-16: Driving Clean Assistance Program Annual Emission Reductions on a Per-Vehicle Basis

Pollutant	Supported Technologies	Per Vehicle Annual Emission Reductions (tpy)	
		Per Technology	Average
GHG	BEV	3.86	2.86
	PHEV	2.39	
NOx	BEV	0.00031	0.00022
	PHEV	0.00018	
PM 2.5	BEV	0.00016	0.00015
	PHEV	0.00015	
ROG	BEV	0.00007	0.00005
	PHEV	0.00004	

For both programs and technologies, the maximum grant amount is $5,000 plus an additional $2,000 for participants who choose the charging grant options. To be conservative, staff estimated the average incentive for both programs is $7,000.

Based on the proposed $23.5 million allocation for Financing Assistance, a 25 percent administration fee for CVAP, a 40 percent administration fee for DCAP, and the average cost shown above, staff estimate that approximately 2,470 vehicles can be funded through both programs, collectively. CVAP would receive $21.5 million of the proposed allocation and DCAP would receive the remaining $2 million allocation. Financing Assistance has a 30-month ownership requirement; therefore, total potential emission reductions for the project are quantified over the course of two and a half years, as shown in Table A-17 for CVAP and Table A-18 for DCAP.

Table A-17: Total Potential Emission Reductions for the Clean Vehicle Assistance Program

Pollutant	Per-Vehicle Average Annual Emission Reductions (tpy)	Number of Vehicles	Average Annual Emissions (tpy)	Project Life (years)	Lifetime Annual Emission Reductions (tons)
GHG	3.33	2,300	7,662	2.5	19,156
NOx	0.00023		0.53		1.327
PM 2.5	0.00015		0.34		0.845
ROG	0.00005		0.11		0.269

Table A-18: Total Potential Emission Reductions for the Driving Clean Assistance Program

Pollutant	Per-Vehicle Average Annual Emission Reductions (tpy)	Number of Vehicles	Average Annual Emissions (tpy)	Project Life (years)	Lifetime Annual Emission Reductions (tons)
GHG	2.86	170	490	2.5	1,224
NOx	0.00022		0.04		0.096
PM 2.5	0.00015		0.03		0.065
ROG	0.00005		0.01		0.020

Clean Mobility Options for Disadvantaged Communities

Clean Mobility Options for Disadvantaged Communities (Clean Mobility Options) projects achieve emission reduction benefits by implementing car share programs that use advanced technology vehicles instead of conventional light-duty vehicles in disadvantaged communities. Clean Mobility Options projects also offer alternate modes of transportation that encourage the use of zero-emission and plug-in hybrid vehicles, vanpools, and other mobility options. While a number of strategies can be employed, the use of advanced technology vehicles instead of conventional light-duty vehicles in a car sharing component provides the primary GHG reductions resulting from a project. For this analysis, staff estimates reductions from the emissions offset between a brand new, conventional light-duty vehicle and an advanced technology vehicle. As project data becomes available, staff anticipate updating this analysis to also reflect alternate modes of transportation – this includes adding bikeshare which would eliminate car use altogether.

The Clean Mobility Options Voucher project will award small mobility projects statewide using the proposed allocation of $10 million. Because future projects are unknown and each project is different, for this analysis, staff assumes that the light-duty vehicles funded will be 95 percent BEVs and 5 percent PHEVs. Additionally, for this analysis, staff assumes that light and medium heavy-duty vehicles funded will be BEVs. Moreover, staff assumes that 90 percent of the vehicles will be light-duty and the remaining 10 percent will be light and medium heavy-duty. Table A-19 shows the emission factors for the selected baseline vehicle and PHEV and BEV replacements. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

Table A-19: Clean Mobility Options Emission Factors

Vehicle Class	Pollutant	2021 Gasoline (g/mi)	2021 Diesel (g/mi)	2021 Plug-in Hybrid Electric Vehicle (g/mi)	2021 BEV (g/mi)
LDA	NOx	0.0144		0.0062	0
	PM 2.5	0.0186		0.0103	0.0099
	ROG	0.0028		0.0012	0
	GHG	313		168	70
LHD	NOx	0.0310	0.0771		0
	PM 2.5	0.0371	0.0438		0.0099
	ROG	0.0111	0.0728		0
	GHG	1,149	635		319

Staff generated an annual usage assumption of 8,200 miles per year for Clean Mobility Options based on data from other car sharing programs in the United States.[19] Using the above assumptions and emission factors, staff calculated the potential annual per-vehicle emission reductions for Clean Mobility Options, as shown in Table A-20.

Table A-20: Clean Mobility Options Annual Emission Reductions on a Per-Vehicle Basis

Pollutant	EMFAC Vehicle Class	Supported Technologies	Per Vehicle Annual Emission Reductions (tpy)
GHG (metric tons CO2e per year)	LDA	PHEV	1.05
		BEV	1.86
	LHD	BEV	6.81
NOx	LDA	PHEV	0.0001
		BEV	0.0001
	LHD	BEV	0.0003
PM 2.5	LDA	PHEV	0.0001
		BEV	0.0001
	LHD	BEV	0.0002
ROG	LDA	PHEV	0.0000
		BEV	0.0000
	LHD	BEV	0.0000

Based on the proposed $10 million allocation for Clean Mobility Options and 15 percent of the allocation going to grant administration and processing fees, staff estimates that up to 235 vehicles can be funded.

For the purpose of this analysis, staff conservatively assumed that emission reductions will occur over the course of three years for light duty vehicles and over the course of six years for light heavy-duty vehicles. The total potential emission reductions for Clean Mobility Options are shown in Table A-21.

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[19] Martin, E., Shaheen, S., and Lidicker, J. "Impact of Carsharing on Household Vehicle Holdings," *Transportation Research Record: Journal of the Transportation Research Board, No. 2143,* Transportation Research Board of the National Academies, Washington, D.C., 2010, pp. 150–158. DOI: 10.3141/2143-19. https://escholarship.org/content/qt0850h6r5/qt0850h6r5.pdf

Table A-21: Total Potential Emission Reductions for Clean Mobility Options

Pollutant	EMFAC Vehicle Class	Supported Technologies	Per Technology	# of Vehicles	Annual Emission Reductions (tpy)	Project Life (years)	Lifetime Emission Reductions Per Vehicle Class (tons)	Project Total Lifetime Emission Reductions (tons)
GHG (metric tons CO2e per year)	LDA	PHEV	1.05	10	10.5	3	31.52	2,136
		BEV	1.86	202	374.9	3	1,125	
	LHD	BEV	6.81	24	163.4	6	980	
NOx	LDA	PHEV	0.0001	10	0.001	3	0.002	0.12
		BEV	0.0001	202	0.026	3	0.079	
	LHD	BEV	0.0003	24	0.007	6	0.040	
PM 2.5	LDA	PHEV	0.0001	10	0.0007	3	0.002	0.09
		BEV	0.0001	202	0.0160	3	0.048	
	LHD	BEV	0.0002	24	0.006	6	0.035	
ROG	LDA	PHEV	0.0000	10	0.000	3	0.000	0.03
		BEV	0.0000	202	0.005	3	0.016	
	LHD	BEV	0.0001	24	0.002	6	0.014	

Clean Mobility in Schools Pilot Project

The Clean Mobility in Schools Pilot Project (Clean Mobility in Schools) achieves emission reduction benefits by funding deployment of synergistic GHG emission reduction technologies at schools located in disadvantaged communities. The Clean Mobility in Schools allocated FY 2021-22 funds will go to the next highest ranked applications from the 2019 Solicitation. For quantification purposes, the two projects will be designated School Project A and the other School Project B. Approximately $1.8 million of the Clean Mobility in Schools allocation will be used to replace four school buses with electric school buses for School Project A, as shown below in Table A-22. The remaining $8.2 million will be used to fund eight electric school buses, eight passenger EVs for ride sharing, eight off-road utility vehicles, four electric vanpool vans, 16 pieces of lawn and garden equipment, one solar photovoltaic installation, one medium heavy duty delivery van, and one heavy-duty class 8 truck for School Project B, as shown below in Table A-22.

Because this project has already undergone the solicitation and application process, staff is providing the estimated reductions calculated with the quantification tool provided by CARB in their applications. The tool can be found on CARB's website: *https://ww2.arb.ca.gov/resources/documents/cci-quantification-benefits-and-reporting-materials*.

The proposed FY 2021-22 $10 million allocation for Clean Mobility in Schools will procure 34 vehicles, 16 pieces of lawn and garden equipment, and one solar photovoltaic installation.

For calculating the potential emission reductions, light-duty vehicles were given a project life of 3 years, consistent with applicant assumptions for the light duty vehicles, and medium heavy-duty vehicles and school buses were given a project life of 12 years, consistent with applicant assumptions. Table A-22 provides the emissions reductions estimates for the two school projects that will be funded through Clean Mobility in Schools.

Table A-22: Total Potential Clean Mobility in Schools Emission Reductions

Project Component Name	GHG Emission Reductions from Total GGRF Funds (MTCO2e)	Diesel PM Reductions from Total GGRF Funds (tons)	NOx Reductions from Total GGRF Funds (tons)	PM 2.5 Reductions from Total GGRF Funds (tons)	ROG Reductions from Total GGRF Funds (tons)
School Project A					
School Bus Replacement (1988 buses)	427	0.005	3.79	0.131	0.107
School Bus Replacement (1993 buses)	356	0.003	3.69	0.111	0.053
School Project B					
ZEV Garden & Lawn Equipment	0.52	N/A	0.00	0.001	0.004
ZEV Utility Vehicle Deployment	608	0.00	6.71	0.045	4.756
Zero-Emission Medium Duty Van Deployment	106	0.00	0.82	0.011	0.033
New Electric School Buses (Type A)	7,584	0.001	1.13	0.453	0.244
New Electric Delivery Truck (Class 8)	90	0.000	0.17	0.000	0.000
All-Electric Car Share Service for District Employees	8,206	0.002	1.32	0.423	0.297
Zero-Emission Vanpool Program	339	0.000	0.06	0.019	0.013
Solar PV Deployment	2,155	N/A	0.60	0.137	0.095
All Project Elements	**19,087**	**0.012**	**18.28**	**1.33**	**5.60**

Sustainable Transportation Equity Project (STEP)

STEP projects achieve GHG emission reductions through implementing a wide variety of capital and infrastructure, operations, planning, policy, and outreach projects. The FY 2021-22 funds allocated to STEP will go to the next highest ranked applications from the 2020 STEP solicitation. STEP has a proposed allocation of $25 million. With the FY 2021-22 funds, staff expect to fund three projects with a mix of quantifiable and unquantifiable components. The quantifiable components of STEP projects include: vehicle carshare, transit incentives, micromobility, and an EV on-demand neighborhood shuttle, a community shuttle, pedestrian improvements, a bicycle resource hub, and transit access improvements. Approximately, $6.8 million of the STEP allocation will be used for Project 1, $10.6 million will be used for Project 2, and the remaining $7.6 million will be used for Project 3.

Because this project has already undergone the solicitation and application process, staff is providing the estimated reductions calculated with the quantification tool provided by CARB in their applications. The tool can be found on STEP's Solicitation website under Appendix I: https://ww2.arb.ca.gov/sustainable-transportation-equity-project-step-solicitation.

Table A-23 provides the emissions reductions estimates for the three projects that will be funded through STEP.

Table A-23: Estimated Benefits of the Proposed Projects from STEP Funds

Project Component Name	Net GHG Emission Reductions (MTCO2e)	NOx Reductions (tons)	PM 2.5 Reductions (tons)	ROG Reductions (tons)	Net Passenger Auto VMT Reductions (miles)	Travel Cost Savings ($)	Net Fossil Fuel Use Reductions (GGE)
Project 1							
Electric Mobility: Electric Vehicle Carshare Expansion	236	0.045	0.005	0.012	-301,975	$275,668	19,857
Mobility Wallet (Rail)	13	0.002	0.001	0.001	31,387	$57,678	1,229
Mobility Wallet (Bus)	29	0.005	0.002	0.002	69,214	$198,040	2,711
Micromobility (e-Bike Library)	77	0.018	0.005	0.005	349,213	$202,544	7,393
Electric Mobility: EV On-Demand Neighborhood Shuttle	-1	0.001	-0.001	0.001	26,047	$15,107	-361
Project 2							
Community Shuttle Service	341	0.056	0.011	0.015	1,173,139	$533,778	24,925
Project 3							
Pedestrian Improvements & Urban Greening	16	0.002	0.001	0.001	44,736	$25,947	1,377
Bike Resource Hub	126	0.028	0.008	0.006	585,000	$339,300	10,919
Project 3 Transit Access Improvements #1	154	0.011	0.011	0.002	531,524	-$132,492	13,378
Project 3 Transit Access Improvements #2	118	0.017	0.007	0.004	299,300	$1,469,594	10,257

Project Component Name	Net GHG Emission Reductions (MTCO2e)	NOx Reductions (tons)	PM 2.5 Reductions (tons)	ROG Reductions (tons)	Net Passenger Auto VMT Reductions (miles)	Travel Cost Savings ($)	Net Fossil Fuel Use Reductions (GGE)
All Project Elements	1,109	0.183	0.047	0.045	2,807,585	$2,985,164	91,685

Outreach, Community Needs Assessments, Technical Assistance, and Access Clean California for CARB's Equity ZEV Replacement Incentives

In addition to the light-duty vehicle investment projects described previously, CARB is proposing to allocate up to $2 million to support technical assistance and capacity building to community-based organizations and priority communities to increase outreach of LCTI funding programs, assess community transportation needs, convene networking session to strengthen partnerships and develop clean mobility projects, and provide application assistance to prospective equity project applicants. The goal of this project is to support implementation of SB 350 key recommendations to reduce barriers faced by low-income residents in accessing clean transportation and mobility options, which includes increasing outreach and awareness of low carbon transportation investments. Because this project helps enable ZEV adoption by low-income residents through other incentive projects, such as CVRP and Financing Assistance, as well as support development of clean mobility projects, such as Clean Mobility Options for Disadvantaged Communities and STEP, staff is not quantifying any direct emission reductions for this project. Instead, this project is expected to help achieve the emission reductions projected for CARB's clean vehicle ownership and clean mobility projects.

Additionally, CARB is proposing to allocate at least $3 million (up to $5 million) to support the Access Clean California program, a pilot project creating a single application tool for accessing incentive project funding and to coordinate outreach across all these projects in order to support ZEV adoption in disadvantaged communities, low-income communities, and low-income households. The goal of this project is to enable more efficient implementation of CARB's equity ZEV incentives and to expand participation by low-income households. Because this project enables ZEV adoption through other incentive projects, such as CVRP and Financing Assistance, staff is not quantifying any direct emission reductions for this project. Instead, this project is expected to help achieve the emission reductions projected for CVRP and Financing Assistance.

Workforce Training and Development

The goal for investment in Workforce Training and Development is to maximize economic opportunities and benefits for low-income and disadvantaged communities by expanding and increasing priority population residents' connections to good quality clean transportation jobs, training opportunities, and career development. Investment in Workforce Training and Development pilot projects will not only support current and future ZEV development in low-income and disadvantaged communities, but will also further support job training and career advancement opportunities in the communities where CARB incentivized ZEV deployment is occurring. These investments aim to reduce community barriers and increase access to good quality jobs in the most impacted and underinvested communities. As CARB expands investments that support a green workforce, such as zero-emission job training and career development, CARB staff will work with our state and local partners and communities to determine a process to define, collect, and use data to measure and report on these investments. This includes identifying direct and measurable community benefits, such as socioeconomic, job access, zero-emission technology and environmental literacy, and other quality of life and social impact improvements. Staff is not quantifying any direct emission reductions for this project.

Heavy-Duty Vehicle and Off-Road Equipment Investments

CARB continues to support a diverse portfolio of investments in heavy-duty and off-road technologies. This year's Funding Plan proposes investments in the deployment of commercialized on-road advanced technologies through the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), deployment of commercialized off-road advanced technology equipment in the Clean Off-Road Equipment Voucher Incentive Project (CORE), new Heavy Duty Advanced Technology Demonstration and Pilot Projects, and legacy vehicle improvements, including assistance for cleaner trucks through the Truck Loan Assistance Program.

Quantification of the emission reduction benefits for each of the heavy-duty vehicle and off-road equipment investment projects is described in more detail below.

Clean Truck, Bus, and Equipment Vouchers

Clean Truck, Bus and Equipment Vouchers are intended to encourage and accelerate the deployment of zero-emission trucks, buses, and off-road equipment in California. There is a total of $569.5 million available for Clean Truck and Bus Vouchers or HVIP. HVIP provides vouchers for on-road battery-electric or fuel cell vehicles and CORE is the off-road corollary to HVIP. There is $194.95 million in vouchers available for CORE eligible off-road trucks and equipment.

HVIP

HVIP achieves emission reduction benefits by reducing the up-front cost of zero-emission trucks and buses, allowing fleet owners to secure a voucher through their local dealer as part of their vehicle purchase. This year, funds will be set aside for drayage trucks, transit buses, and school buses. In line with legislative direction, these set-asides will be administered through HVIP. Additionally, staff is introducing another set-aside through HVIP called Innovative Small e-Fleets that will focus on lowering barriers to zero-emission technology adoption for owner operators and small fleets. For the purposes of this analysis, staff estimated reductions from the emissions offset between a new, 2021 model year conventional truck or bus, and an advanced technology vehicle.

HVIP - Standard

As of July 2021, the current voucher redemptions are 39 percent for MHD battery-electric trucks, 25 percent for HHD battery-electric trucks, 13 percent battery-electric urban buses, 17 percent for battery-electric school buses, and approximately 3 percent for electric power takeoff (ePTO) systems. This year, staff is not quantifying fuel-cell trucks; currently, fuel-cell trucks make up less than 1 percent of HVIP vouchers. As demand for fuel-cell trucks grow, staff will calculate those benefits. These percentages were weighted by voucher amount and then applied to the proposed $269.5 million FY 2021-22 Low Carbon Transportation allocation funding to estimate the number of vehicles.

For baseline transit bus emission factors, staff used diesel and CNG urban bus emission rates, since the current California fleet utilizes a mix of the two fuel types. EMFAC2017[20] now employs a CNG urban bus category, so these factors were applied.

Based on discussions with manufacturers, ePTO systems automatically prevents engine idle by shutting the engine off while in park or neutral, preventing unnecessary engine usage during PTO operation. For emission factors associated with ePTOs, staff utilized the emission factors found in EMFAC2017 to quantify the emissions reduction associated with ePTO systems that are currently eligible in HVIP. The emission factor used is the emissions associated with the usage of PTOs powered by a diesel engine. Emission factors for HVIP are shown in Table A-24 and emission factors used to quantify PTOs are shown in Table A-25. For more information on how these emission factors were developed, please see the Emission Factor Development section at the beginning of this appendix.

Table A-24: HVIP Emission Factors

Vehicle Class	Pollutant	2021 Diesel (g/mi)	2021 CNG (g/mi)	2021 BEV (g/mi)
LHD2	NOx	0.0961		0
	PM 2.5	0.0554		0.0221
	ROG	0.0805		0
	GHG	688		104
MHD	NOx	1.4489		0
	PM 2.5	0.0657		0.0309
	ROG	0.0110		0
	GHG	1169		177
HHD	NOx	2.5476		0
	PM 2.5	0.0564		0.0222
	ROG	0.0499		0
	GHG	1,592		241
Urban Bus	NOx	0.5792	0.5792	0
	PM 2.5	0.0549	0.0549	0.0272

[20] https://arb.ca.gov/emfac/2017/. EMFAC2017 Web Database

Vehicle Class	Pollutant	2021 Diesel (g/mi)	2021 CNG (g/mi)	2021 BEV (g/mi)
	ROG	0.0130	0.0130	0
	GHG	1555	1,362	235
School Bus	NOx	1.7532		0
	PM 2.5	0.3268		0.1626
	ROG	0.0163		0
	GHG	1,319		199
Drayage	NOx	3.3349		0
	PM 2.5	0.0518		0.222
	ROG	0.0417		0
	GHG	1,679		254

Note: MHD and HHD emission factors are based on population-weighted averages of the T6 and T7 diesel vehicle classes in EMFAC2017, respectively, excluding out-of-state vehicles.

Table A-25: ePTO Emission Factors

Vehicle Class	Pollutant	2021 Diesel (g/mi)	2021 Battery Electric (g/mi)
ePTO	NOx	72.8414	0
	PM 2.5	0.0693	0
	ROG	0.4171	0
	GHG	37,795	5,770

For urban buses, staff used data provided by previous HVIP voucher recipients to determine the average annual usage. Data for ePTO systems were obtained from NREL's Fleet Test and Evaluation Team.[21] Based on the information, staff assumed that a vehicle typically operates in PTO mode for 4 hours a day and 250 workdays a year. Additionally, staff assumed the fuel consumption rate of 2.825 gallons per hour for ePTO systems based on data from EMFAC. For all other battery-electric vehicle classifications, the annual usage assumption was based on the California Hybrid, Efficient and Advanced Truck Research Center (CalHEAT) Research Center's report on

[21] https://www.nrel.gov/transportation/assets/pdfs/67116.pdf

"Battery Electric Parcel Delivery Truck Testing and Demonstration."[22] The annual usage assumptions for HVIP are shown in Table A-26.

Table A-26: HVIP – Standard Annual Usage Assumptions

Vehicle Class	Technology	Usage (mi/yr)
LHD2	BEV/FCV	12,000
MHD	BEV	12,000
HHD	BEV	12,000
	ePTO	1,000 hours/yr
Urban Bus	BEV	30,000
School Bus	BEV	12,000

Using the emission factors, technology mix, and the annual usage assumptions above, staff calculated the potential annual per-vehicle emission reductions for Standard HVIP, as shown in Table A-27.

[22] Gallo, Jean-Baptiste, Jasna Tomić. (CalHEAT). 2013. Battery Electric Parcel Delivery Truck Testing and Demonstration. California Energy Commission.

Table A-27: HVIP – Standard Annual Emission Benefits on a Per-Vehicle Basis

Pollutant	EMFAC Vehicle Class	Supported Technologies	Per Vehicle Annual Emission Reductions (tpy)	
			Per Technology	Average
GHG (metric tons CO2e per year)	LHD2	BEV	7.01	17.31
	MHD	BEV	11.90	
	HHD	BEV	16.22	
		ePTO	32.40	
	Urban Bus	BEV	39.59	
	School Bus	BEV	13.43	
NOx	LHD2	BEV	0.0013	0.0248
	MHD	BEV	0.0192	
	HHD	BEV	0.0337	
		ePTO	0.0803	
	Urban Bus	BEV	0.0192	
	School Bus	BEV	0.0232	
PM 2.5	LHD2	BEV	0.0004	0.0008
	MHD	BEV	0.0005	
	HHD	BEV	0.0005	
		ePTO	0.0001	
	Urban Bus	BEV	0.0009	
	School Bus	BEV	0.0022	
ROG	LHD2	BEV	0.0011	0.0004
	MHD	BEV	0.0002	
	HHD	BEV	0.0007	
		ePTO	0.0005	
	Urban Bus	BEV	0.0004	
	School Bus	BEV	0.0002	

Applying the proposed voucher amounts and the technology mix from the current HVIP data, staff calculated the average voucher cost for Standard HVIP as shown in Table A-28.

Table A-28: HVIP – Standard Average Incentive Cost

EMFAC Vehicle Class	Supported Technologies	Cost Per Technology	Average
LHD2	BEV	$45,000	$113,865
MHD	BEV	$79,200	
HHD	BEV	$123,800	
	ePTO	$24,200	
Urban Bus	BEV	$153,300	
School Bus	BEV	$173,000	

Next, the total emission reduction benefits for the $269.5 million FY 2021-22 proposed allocation to HVIP – Standard were estimated over the useful life of each vehicle. The number of vehicles was estimated based on current voucher requests weighted by the funding amount. Staff assumed a 7 percent administration rate would be incurred to administer the vouchers. While staff recognizes that trucks and buses can have useful lives of over 15 years[23,24], HVIP has a 3 year ownership requirement. Staff assumed a conservative project life of 3 years and quantified HVIP's total potential emission reductions over the course of 3 years, as shown in Table A-29 below.

Table A-29: Total Potential Emission Reductions for HVIP – Standard

Pollutant	Per Vehicle Average Annual Emission Reductions	Number of Vehicles	Average Annual Emissions	Project Life (years)	Lifetime Annual Emission Reductions
GHG	17	2,658	46,008	3	138,024
NOx	0.0248		65.86		197.58
PM 2.5	0.0008		2.12		6.36
ROG	0.0004		0.96		2.88

[23] http://www.calstart.org/Libraries/CalHEAT_Documents/Baseline_and_Preliminary_Pathways_Whitepaper.sflb.ashx

[24] https://www.afdc.energy.gov/uploads/publication/case-study-propane-school-bus-fleets.pdf

HVIP – Public Transit

The State budget includes the first installment of incentive funding to deploy 1,000 zero-emission transit buses in California over the next three fiscal years. The FY 2021-22 State budget includes $70 million for transit bus incentives, to be administered through HVIP. These funds will assist public transit fleets, including those who were initially on a diesel compliance pathway for the Innovative Clean Transit regulation, purchase zero-emission public transit buses. By providing these funds, HVIP reinforces its continued support for emission reductions of diesel particulate matter in communities disproportionately impacted by air pollution. Once depleted, HVIP will continue to allow standard HVIP applications for all public transit bus fleets.

Staff assumed a 7 percent administration rate would be incurred to administer the vouchers. Using an average incentive amount of $153,300 and accounting for administration costs, staff estimate that approximately 425 transit buses can be funded through the HVIP – Public Transit set-aside. Using the emission factors for urban buses from Table A-27, staff quantified the total potential emission reductions for the project over the course of 3 years, as shown in Table A-30.

Table A-30: Total Potential Emission Reductions for HVIP – Public Transit

Pollutant	Per Vehicle Average Annual Emission Reductions	Number of Vehicles	Average Annual Emissions	Project Life (years)	Lifetime Annual Emission Reductions
GHG	40	425	16,813	3	50,439
NOx	0.0192		8.133		24.40
PM 2.5	0.0009		0.039		0.12
ROG	0.0004		0.182		0.55

HVIP – School Bus

The Rural School Bus Pilot Project will now be administered as an ongoing set-aside within HVIP. The State Budget includes the first installment to support incentives to the deployment of 1,000 zero-emission school buses in California over the next three years. HVIP will set aside $130 million for zero-emission school buses. These funds would be exclusively available to California public school bus fleets purchasing zero-emission buses. Some of the existing program criteria from the pilot will migrate to HVIP. Currently, purchasers can request funding for up to three school buses, up to $400,000 each. Once depleted, HVIP will continue to allow standard HVIP applications for all school bus fleets following HVIP eligibility criteria and funding amounts.

Using an average incentive amount of $400,000 and an assumed 7 percent administration rate to administer the vouchers, staff estimate that approximately 300 school buses can be funded through the HVIP – School Bus set-aside. Using the emission factors for school buses from Table A-27, staff quantified the total potential emission reductions for the project over the course of 3 years, as shown in Table A-31.

Table A-31: Total Potential Emission Reductions for HVIP – School Bus

Pollutant	Per Vehicle Average Annual Emission Reductions	Number of Vehicles	Average Annual Emissions	Project Life (years)	Lifetime Annual Emission Reductions
GHG	13	300	4,029	3	12,087
NOx	0.023		6.957		20.87
PM 2.5	0.002		0.652		1.96
ROG	0.0002		0.065		0.20

HVIP – Drayage

The Governor's May Revision to the Proposed Budget includes a total of $220 million to CARB to support the deployment 1,000 zero-emission drayage trucks in California over the next three fiscal years. The FY 2021-22 State budget includes $75 million for zero-emission drayage truck incentives, which will be implemented through HVIP. This funding will provide the additional resources needed to build on the momentum of the Project 800 initiative to support orders for at least 800 zero-emission drayage trucks in 2021 and continue supporting equitable access to zero-emission options for more fleets.

Using an average incentive amount of $120,000 and a 7 percent administration cost, staff estimate that approximately 580 drayage trucks can be funded through the HVIP – Drayage set-aside. Using the emission factors for HHD BEV trucks from Table A-27, staff quantified the total potential emission reductions for the project over the course of 3 years, as shown in Table A-32.

Table A-32: Total Potential Emission Reductions for HVIP – Public Transit

Pollutant	Per Vehicle Average Annual Emission Reductions	Number of Vehicles	Average Annual Emissions	Project Life (years)	Lifetime Annual Emission Reductions
GHG	17	580	9,920	3	29,760
NOx	0.0441		25.585		76.76
PM 2.5	0.0039		0.227		0.68
ROG	0.0006		0.320		0.96

HVIP – Innovative Small e-Fleets

The Innovative Small e-Fleets set-aside would provide $25 million in pilot funding for incentives geared towards small truck fleets and independent owner operators. Adding Innovative Small e-Fleets to HVIP would allow CARB to implement innovative mechanisms including, but not limited to: flexible leases, truck as a service, assistance with infrastructure, individual owner planning assistance, as well as other mechanisms. This set-aside is currently under development and as such, program parameters have not been established. Staff will coordinate internally to develop GHG emission reduction methodologies for the Innovative Small e-Fleets set-aside and provide reduction estimates during project implementation.

CORE

The Clean Off-Road Equipment Voucher Incentive Project (CORE) achieves emission reduction benefits by accelerating deployment of cleaner off-road technologies. It provides a streamlined way for fleets ready to purchase specific zero-emission equipment to receive funding. This project specifically targets zero-emission off-road freight equipment that is currently in the early stages of commercial deployment. Eligible project types include on and off-road terminal tractors (i.e., yard trucks), transport refrigeration units (TRUs), forklifts, container handling equipment, airport cargo loaders, wide-body aircraft tugs, railcar movers, rubber-tired gantry cranes, among others. Because this project includes a variety of eligible types of vehicles, equipment, and technologies, it is important to note that this analysis is an illustrative example of the potential emission reductions that may be achieved through this project. For FY 2021-22, CORE is considering allocating $164.95 million. While staff anticipates using approximately $30 million of the FY 2021-22 appropriate to fund vouchers on the waitlist for the CORE program, staff quantified the entirety of $164.95 million since there are no proposed program changes.

For this analysis, staff estimated the potential reductions for four project types that have been the majority under this project, based on data from the start of the project to June 2021: yard trucks, forklifts, TRUs, and railcar movers. Emission factors for these project types are shown in Table A-33.

Table A-33: CORE Emission Factors

Vehicle Class	Pollutant	Tier 4 Final Diesel (g/hr)	BEV
Forklift	NOx	0.781	0
	PM 2.5	0.281	0
	ROG	1.748	0
	GHG	19,303	3,840
Yard Truck	NOx	8.2376	0
	PM 2.5	0.4842	0
	ROG	4.2710	0
	GHG	47,150	6,480
TRU	NOx	47.261	0
	PM 2.5	1.699	0
	ROG	36.849	0
	GHG	8,863	1,218
Railcar Mover	NOx	8.00	0
	PM 2.5	0.552	0
	ROG	4.052	0
	GHG	51,200	9,283

Staff generated annual usage assumptions using CARB's cargo handling equipment (CHE) inventory model for forklifts and yard trucks as well as the TRU inventory model for TRUs as shown in Table A-34.

Table A-34: CORE Annual Usage Assumptions

Vehicle Class	Usage (hrs/yr)
Forklift	800
Yard Truck	2,400
TRU	1,300
Railcar Mover	800

Applying the emission factors and usage assumptions above, staff calculated the potential annual per-vehicle emission reductions for CORE as shown in Table A-35.

Table A-35: Clean Off-Road Equipment Voucher Incentive Project Annual Emission Reduction Benefits on a Per-Vehicle Basis

Pollutant	Vehicle Class	Supported Technologies	Per Vehicle Annual Emission Reductions (tpy)	Average Vehicle Annual Emission Reductions (tpy)
GHG	Forklift	BEV	12.37	48.41
	Yard Truck	BEV	97.61	
	TRU	BEV	9.94	
	Railcar Mover	BEV	33.53	
NOx	Forklift	BEV	0.0006	0.035
	Yard Truck	BEV	0.0198	
	TRU	BEV	0.0614	
	Railcar Mover	BEV	0.0064	
PM 2.5	Forklift	BEV	0.0002	0.001
	Yard Truck	BEV	0.0012	
	TRU	BEV	0.0022	
	Railcar Mover	BEV	0.0004	
ROG	Forklift	BEV	0.0014	0.025
	Yard Truck	BEV	0.0103	
	TRU	BEV	0.0479	
	Railcar Mover	BEV	0.0032	

From the most recent vouchers requested, TRUs received 42.9 percent, large forklifts 8.6 percent, railcar movers 6.6 percent, and yard trucks 41.9 percent. The expected cost per technology for the four project types are shown in Table A-36.

Table A-36: CORE Average Incentive Cost

Vehicle Class	Supported Technologies	Cost Per Technology
Forklift	BEV	$220,591
Yard Truck	BEV	$174,418
TRU	BEV	$282,866
Railcar Mover	BEV	$313,475

CORE has a 3 year ownership requirement. Based on the expected cost per technology, the aforementioned funding portions for each vehicle class, a 3 year project life, and an 8 percent administration rate, staff expect to fund about 60 forklifts, 280 yard trucks, 45 railcar movers, and 290 TRUs resulting in the total emission reductions outlined in Table A-37.

Table A-37: Total Potential Emission Reductions for CORE

GHG	Forklift	12.37	60	713	3	2,138	97,717
	Yard Truck	97.61	280	27,491		82,473	
	Railcar Mover	9.94	290	1,498		4,493	
	TRUs	33.53	45	2,871		8,612	
NOx	Forklift	0.0006	60	0		0	71
	Yard Truck	0.0198	280	6		17	
	Railcar Mover	0.0614	290	0		0	
	TRUs	0.0064	45	18		53	
PM 2.5	Forklift	0.0002	60	0		0	3
	Yard Truck	0.0012	280	0		1	
	Railcar Mover	0.0022	290	0		0	
	TRUs	0.0004	45	1		2	
ROG	Forklift	0.0014	60	0		0	51
	Yard Truck	0.0103	280	3		9	
	Railcar Mover	0.0479	290	0		0	
	TRUs	0.0032	45	14		42	

CORE – Small Off-Road Engine Incentives

This year, staff is proposing that CORE support Small Off-Road Engine Incentives, which will achieve GHG, criteria pollutant, and toxicity emission benefits by providing landscaping professionals and general consumers incentives for small off-road engine equipment (SORE). SOREs are found in lawn and garden equipment, generators, and small agricultural equipment. To help motivate consumer purchasing decisions, provide safer working conditions for landscape professionals, and reduce toxicity and criteria pollutant exposure this incentive project will help transition these equipment types from internal combustion engines of less than 19 kW into battery-electric power.

For FY 2021-22, SORE is considering allocating $30 million. At this time, not enough is known about what the Small Off-Road Engine Incentive Project will fund to make the valid assumptions needed to quantify benefits. Emissions reductions and other benefits of funded projects will be quantified during project implementation.

While methodologies do exist to calculate GHG emission reduction estimates for SOREs, this project is currently under development and as such, program parameters have not been established. Staff will coordinate internally to develop GHG emission reduction methodologies for the Small Off-Road Engine Incentives Project and provide reduction estimates in the next year’s Funding Plan.

Heavy-Duty Advanced Technology Demonstration and Pilot Projects

Demonstration and pilot projects are geared towards accelerating the introduction of advanced technologies, feeding the innovation pipeline, as well as helping to cover the costs of technology development. Because a variety of types of vehicles, equipment, and technology could be funded, it is important to note that the analyses in this section are an illustrative example of the potential emission reductions that may be achieved through these projects as well as acknowledgment of which potential technologies lacking in data to enable robust emission reductions quantification.

For this analysis, staff used the emission reductions for zero-emission drayage trucks which were provided to CARB during the application process for the Zero-Emission Drayage Truck and Infrastructure Pilot Project joint solicitation with the California Energy Commission. To learn more about the calculations, emission factors and submitted applications in response to the solicitation, please refer to the *California Energy Commission’s website*. Table A-38 provides the potential reductions for these projects.

Based on the proposed $80 million allocated for Heavy-Duty Advanced Technology Demonstration and Pilot Projects, $40 million will fully fund the second highest rank project and the next three highest ranked applications from the Zero-Emission Drayage Truck and Infrastructure Pilot Project. Of the remaining $40 million, staff anticipate funding projects including a green zone concept that includes zero-emission construction equipment, ocean-going vessel emissions reduction capture and control systems, a battery electric locomotives, and zero-emission cargo handling equipment.

The first project listed in Table A-38 provides the potential emissions reductions for the Center for Transportation and the Environment Hydrogen Fuel Cell project. The Center for Transportation and the Environment will be awarded approximately an additional $4 million from this year's advanced technology and demonstration projects allocation to fund an additional 8 fuel-cell electric drayage trucks from their original request of 30 trucks. Table A-38 provides the potential emissions reductions for the San Joaquin Valley Air Pollution Control District's South Central Fresno Pepsi Delivery Truck Electrification project. San Joaquin will be awarded $8.6 million from this year's advanced technology and demonstration projects allocation to fund 50 battery electric drayage trucks.

The third project listed in Table A-38 provides the potential emissions reductions for the San Joaquin Valley Air Pollution Control District's Grocery Operations for Carbon Emission Reductions project. San Joaquin will be awarded approximately $13 million from this year's advanced technology and demonstration projects allocation to fund 50 battery electric drayage trucks. The fourth project listed in Table A-38 provides the potential emissions reductions for the California Hispanic Chamber of Commerce Foundation's GLI Electrification project. The California Hispanic Chamber of Commerce Foundation will be awarded approximately $14 million from this year's advanced technology and demonstration projects allocation to fund 50 battery electric drayage trucks.

Table A-38: Total Potential Emission Reductions for Heavy-Duty Advanced Technology and Demonstration and Pilot Projects: Drayage Trucks

Project Component Name	GHG Emission Reductions (MTCO2e)	NOx Reductions (tons)	PM 2.5 Reductions (tons)	ROG Reductions (tons)
Hydrogen Fuel Cell				
30 Fuel Cell Trucks	8,120	2.28	0.098	0.119
Pepsi Delivery Truck Electrification				
50 BEV Trucks	4,290	1.37	0.059	0.072
Grocery Operations for Carbon Emission Reductions				
50 BEV Trucks	18,750	5.26	0.226	0.275
GLI Electrification				
50 BEV Trucks	8,600	2.43	0.104	0.127
All Projects	**39,760**	**11.34**	**0.487**	**0.593**

For ocean-going vessels, there exists a wide variety of methods to reduce at-berth emissions. These include grid-based shore power, non-grid based shore power, such as distributed generation equipment, emission controls installed on the vessels, such as particulate control traps, selective catalytic reduction units, use of alternative fuels, and emission controls installed at the wharf.

While staff expects a capture and control system funded through this project to reduce criteria pollutant and GHG emissions, this funding plan does not quantify the potential emission reductions. At this time, not enough is known about the specifications or the engineering design of a potentially funded capture and control system to make the valid assumptions needed to quantify benefits.

Emissions reductions and other benefits of funded projects will be quantified during project implementation. Furthermore, staff plan on using the data gathered from a funded capture and control system to develop and refine capture and control system quantification methodologies and project assumptions for use in future funding plans.

Similar to ocean-going vessels, there exists a wide variety of methods to reduce locomotive emissions. While staff expects a battery electric locomotive funded through this project to reduce criteria pollutants and GHG emissions, this funding plan does not quantify the potential emission reductions. At this time, not enough is known about the specifications or the engineering design of a potentially funded battery electric locomotive to make the valid assumptions needed to quantify benefits.

Like ocean-going vessels and battery electric locomotives, there exists a wide variety of cargo handling equipment. While staff expects cargo handling equipment funded through this project to reduce criteria pollutants and GHG emissions, this funding plan does not quantify the potential emission reductions. At this time, not enough is known about the specifications or the engineering design of potentially funded cargo handling equipment to make the valid assumptions needed to quantify benefits.

Truck Loan Assistance Program

The Truck Loan Assistance Program aids small business truckers affected by CARB's In-Use Truck and Bus Regulation[25] by providing financing assistance for fleet owners to upgrade their fleets with newer trucks. Program data from the 2020 calendar year through June 2021 shows that, on average, funds were directed toward the replacement of 2006 model year diesel trucks in both the MHD and HHD vehicle classifications.

Only used and new trucks with 2010 or newer model year engines can now be purchased through the Truck Loan Assistance Program. From the 2020 calendar year through June 2021, 11 percent of purchases went towards MHD vehicles, and 89 percent towards the purchase of HHD vehicles. On average, fleet owners purchased trucks with 2016 model year engine trucks.

Staff used this engine model year information to develop the emission factors as shown in Table A-39. For more information on how these emission factors were

[25] https://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm

developed, please see the Emission Factor Development section at the beginning of this appendix.

Table A-39: Truck Loan Assistance Program Emission Factors

Vehicle Class	Pollutant	2006 Diesel (g/mi)	2016 Diesel (g/mi)
MHD	NOx	8.4938	1.2603
	ROG	0.8590	0.0093
HHD	NOx	12.9835	2.3246
	ROG	0.7378	0.0530

Note: MHD and HHD emission factors are based on population-weighted averages of the T6 and T7 vehicle classes in EMFAC 2014, respectively, excluding out-of-state vehicles.

Staff generated annual usage assumptions based on the average use of a 2006 model year, conventional MHD and HHD diesel truck in EMFAC 2017. The annual usage assumptions for the Truck Loan Assistance Program are shown in Table A-40.

Table A-40: Truck Loan Assistance Program Annual Usage Assumptions

Truck Category	VMT (mi/yr)
MHD	13,000
HHD	21,000

Using the emission factors and annual usage assumptions above, staff calculated the potential annual per-vehicle emission reductions for the Truck Loan Assistance Program, as shown in Table A-41. Please note that PM reductions for the Truck Loan Assistance Program are not quantified because PM reductions are required by the Truck and Bus Regulation through the use of diesel particulate filters. Additionally, GHG emission reductions are not quantified because this program is funded through AQIP, which focuses on criteria pollutant and toxics emission reductions, and the trucks do not achieve a significant fuel economy improvement.

Table A-41: Truck Loan Assistance Program Annual Emission Reduction Benefits on a Per-Vehicle Basis

Pollutant	Vehicle Class	Supported Technologies	Per Vehicle Annual Emission Reductions (tpy)	
			Per Technology	Average
NOx	MHD	2016 MY	0.1199	0.2759
	HHD	2016 MY	0.2942	
ROG	MHD	2016 MY	0.0122	0.0155
	HHD	2016 MY	0.0159	

In the Truck Loan Assistance Program, staff found the average loan contribution amount per loan since the contribution rates were increased in March 2020 had risen to approximately $8,000 as of the second quarter 2021. With the proposed $28.64 million allocation for the Truck Loan Assistance Program, including administration costs staff estimate that approximately 3,330 vehicles can be funded. To achieve NOx reductions, the Truck and Bus Regulation requires the replacement of 2006 engine model year trucks with 2010 or newer engines by January 1, 2022. Therefore, when calculating the emission reduction benefits for this program, staff used a project life of one year to estimate emission reductions that have occurred prior to what is required by the Truck and Bus Regulation.

The total potential emission reductions for the Truck Loan Assistance Program are shown in Table A-42.

Table A-42: Total Potential Emission Reductions for the Truck Loan Assistance Program

Pollutant	Per Vehicle Average Annual Emission Reductions (tpy)	Number of Vehicles	Average Annual Emission Reductions (tpy)	Project Life (years)	Lifetime Annual Emission Reductions (tons)
NOx	0.2759	3,300	851.07	1	851.07
ROG	0.0155		51.15		51.15

AB 8

AB 8 extended the funding for AQIP through 2023, refined the evaluation criteria for projects supported by AQIP, and introduced the following requirements that staff followed to develop the project scoring criteria:

- The state board shall provide preference in awarding funding to those projects with higher benefit-cost scores that maximize the purposes and goals of the Air Quality Improvement Program.[26]
- "Benefit-cost score" means the reasonably expected or potential criteria pollutant emission reductions achieved per dollar awarded by the Board for the project.[27]
- The state board also may give additional preference based on the following criteria, as applicable, in funding awards to projects:[28]

    1. Proposed or potential reduction of criteria or toxic air pollutants.
    2. Contribution to regional air quality improvement.
    3. Ability to promote the use of clean alternative fuels and vehicle technologies as determined by the state board, in coordination with the Energy Commission.
    4. Ability to achieve climate change benefits in addition to criteria pollutant or air toxic emission reductions.
    5. Ability to support market transformation of California's vehicle or equipment fleet to utilize low carbon or zero-emission technologies.
    6. Ability to leverage private capital investments.

[26] Health & Safety Code Section 44274(b)
[27] Health & Safety Code Section 44270.3(e)(1)
[28] Health & Safety Code Section 44274(b)

Statute directs CARB to annually evaluate potential project categories to assign preference for AQIP funding, based upon the specific criteria identified above. The analysis and methodology in this section of the appendix describes the implementation of the provisions that require CARB to assign preference to projects with a higher benefit-cost score. The AB 8 analysis is fully executed for the lone project that will be funded through AQIP: the Truck Loan Assistance Program.

Overview

Conservative estimates for criteria pollutant and toxic air contaminants were developed using guidance provided in AB 8. Because criteria pollutant and toxic air contaminant emissions are geographically localized, criteria pollutant and toxic air contaminant emissions reductions reported in this appendix are estimated at the tailpipe. The AQIP project does not have Greenhouse gas emission reductions so these were not tabulated. Building upon the emission reductions and cost information from the Project Quantification section, this section of the appendix provides information on the following:

- Benefit-Cost Score Analysis;
- Additional Preference Criteria Scores; and
- Total Benefit Index Scores.

Benefit-Cost Score Analysis

Staff analyzed the expected costs and developed cost-effectiveness values the AQIP-funded project using well-established cost-effectiveness calculation methodology for incentives, consistent with that used in the Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program). In addition, to calculate cost-effectiveness, staff also applied an appropriate discount rate and utilized a capital recovery factor (CRF) in the analysis based on 2017 Carl Moyer Program Guidelines.[29] The one percent discount rate was used and the corresponding CRF was determined based on the assumed usage life of the vehicles or equipment supported by a given project.

For the Truck Loan Assistance project funded by AQIP, a cost-effectiveness value was calculated. The cost-effectiveness of a project is determined using Formula 8 below.

Formula 8: Cost-Effectiveness

$$Cost\ Effectiveness\ (\frac{\$}{ton}) = \frac{Incentive\ Amount\ per\ Vehicle\ or\ Equipment * CRF}{Annual\ Per\ Vehicle\ Weighted\ Emission\ Reductions}$$

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[29] https://www.arb.ca.gov/msprog/moyer/guidelines/2017gl/2017_cmp_gl_volume_1.pdf

Weighted emission reductions are calculated using Formula 9, consistent with Carl Moyer Program Guidelines:

Formula 9: Annual Weighted Emission Reductions

$$Annual\ Weighted\ Emission\ Reductions\left(\frac{weighted\ tons}{year}\right) = NOx\ reductions + ROG\ reductions + (20 * PM\ reductions)$$

Table A-43 provides the inputs and the resulting weighted criteria pollutant and toxic air contaminant cost-effectiveness, in terms of dollars per ton of weighted emission reductions, for projects funded by AQIP.

Table A-43: AB 8 Analysis – Weighted Criteria Pollutant and Toxic Air Contaminant Cost-Effectiveness

Proposed Project	Project Life	CRF	Average Annual Per-Vehicle Weighted Emission Reductions (tpy)	Average Incentive Cost	Cost-Effectiveness ($/ton)
Truck Loan Assistance	1	1.010	0.291	$8,000	$27,728

The cost-effectiveness value for projects were given points based on a scale of one to five points. The bins were determined by taking the high and low resulting benefits and scaled to develop an equal distribution of scores. A cost-effectiveness of less than $5,000 per ton of weighted emission reductions received a high of five points. The remaining bins were increased by $5,000 increments with the least cost-effective projects, those projects that cost over $20,000 per weighted ton of emissions reduced, receiving the lowest points possible. The cost-effectiveness of Truck Loan Assistance was scored based on the following scale:

5: Less than $5,000 per ton

4: $5,000 to $9,999 per ton

3: $10,000 to $14,999 per ton

2: $15,000 to $19,999 per ton

1: $20,000 per ton or more

The resulting score from the scale shown above were then used in the "Total Benefit Index" for AB 8 project selection. Finally, per AB 8, the cost-effectiveness values were converted to benefit-cost values based on pound of weighted emission reductions per dollar spent. The cost-effectiveness, benefit-cost value, and resulting score of Truck Loan Assistance is shown in Table A-44.

Table A-44: AB 8 Analysis – Benefit-Cost Value and Score for Total Benefit Index

Proposed Project	Cost-Effectiveness ($/ton)	Benefit-Cost Value (lbs/$)	Benefit-Cost Score
Truck Loan Assistance	$27,728	0.072	1

Additional Preference Criteria

Per AB 8, additional preference criteria may be used to provide additional funding preference in conjunction with the benefit-cost score summarized in Table A-42. The additional preference criteria includes:

- Proposed or potential reduction of criteria and toxic air pollutants;
- Contribution to regional air quality improvement;
- Ability to promote the use of clean alternative fuels and vehicle technologies;
- Ability to achieve GHG reductions;
- Ability to support market transformation of California's vehicle or equipment fleet to utilize low carbon or zero-emission technologies; and
- Ability to leverage private capital investments.

Recognizing the range of potential benefits and to ensure a robust mix of proposed projects to be funded, staff analyzed the associated data and equally divided the results into scores between 0 and 5 for quantitative preference criteria. The quantitative preference criteria for each project includes the proposed or potential reduction of criteria and toxic air pollutants, contribution to regional air quality, and the ability to achieve GHG reductions. Staff used the following steps to develop scoring scales and final scores for the quantitative preference criteria:

1. Quantify the results for each additional preference criteria for the proposed projects;
2. Establish scoring scale increments to generate an equal distribution in points for the proposed projects; and
3. Rank the proposed projects based on the established scoring scale, which is then used in the "Total Benefit Index."

Staff anticipate that the scales for the quantitative additional preference criteria may change each year depending on the mix of projects proposed, due to differences in the range of expected benefits or when additional information becomes available to refine the evaluation. The data and rationale used to establish each of the criteria weighting factors for the associated scores are described below.

Proposed or Potential Reduction of Criteria or Toxic Air Pollutants

This analysis considered the magnitude of emission reductions by quantifying the direct criteria pollutant and toxic air contaminant emission reductions expected per average vehicle or equipment supported under each project. With the benefit-cost score analysis primarily driven by overall project incentive amounts, this additional criteria allowed staff to make direct comparisons of the emission reductions expected by the different proposed projects, independent of the associated incentive amounts.

For this additional preference criterion, staff analyzed the emission benefits on a per-vehicle basis to account for the differences in vehicle sales volumes and statewide populations of the various vehicles supported by AQIP. Resulting total lifetime emission reductions ranged from less than one ton to almost three tons of lifetime criteria pollutant and toxic air contaminant emission reductions per-vehicle. The scoring scale for this criterion was established by evaluating the range of lifetime tons of emission reductions between the highest and lowest value to try to have an equal distribution of scores. As a result, the bins were scaled in half ton increments. Projects with less than or equal to one ton of criteria pollutant and toxic air contaminant emission reductions received one point, while those projects with greater than two and a half tons of criteria pollutant and toxic air contaminant emission reductions received a score of five points. The resulting scale for criteria pollutant and toxic air contaminant emission reductions on a per-vehicle basis is shown below.

5: Greater than 2.5 tons of criteria and toxic emission reductions per vehicle

4: 2 to 2.49 tons of criteria and toxic emission reductions per vehicle

3: 1.5 to 1.99 tons of criteria and toxic emission reductions per vehicle

2: 1 to 1.49 tons of criteria and toxic emission reductions per vehicle

1: Less than 1 ton of criteria and toxic emission reductions per vehicle

Based on the information described above, Table A-45 summarizes the results and the corresponding score for this additional preference criterion.

Table A-45: AB 8 Analysis – Potential Reduction of Criteria or Toxic Air Pollutants

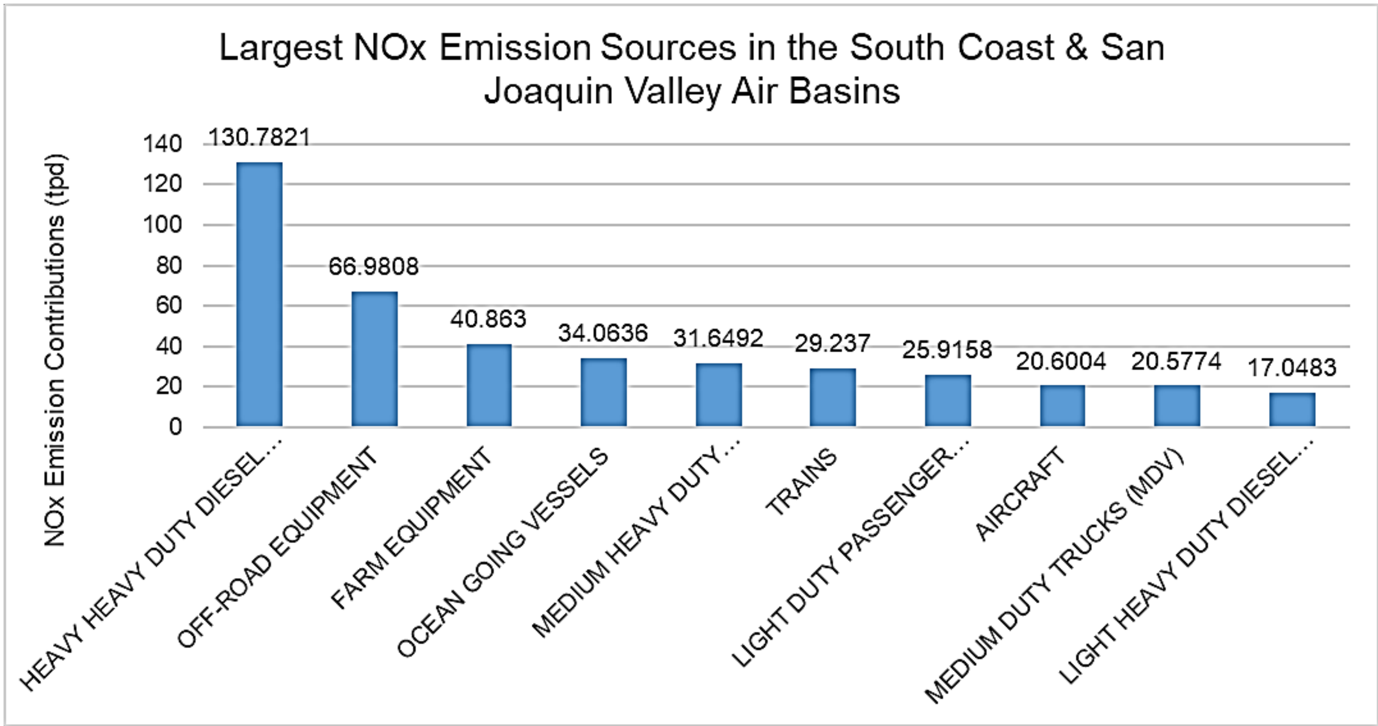
Proposed Project	Annual Per-Vehicle Emission Reductions (tpy)	Project Life (years)	Per-Vehicle Lifetime Emission Reductions (tons)	Score
Truck Loan Assistance	0.291	1	0.29	1

Contribution to Regional Air Quality Improvement

Staff developed a scoring scale based on CARB's emissions inventory for the South Coast and San Joaquin Valley air basins, two of the state's extreme nonattainment regions, and ranked projects based on their corresponding emissions contributions from highest to lowest. Specifically, staff used the NOx emissions inventory in tons per day from the 2016 State Implementation Plan (SIP) emission projection data for the South Coast and San Joaquin Valley air basins.[30] The ranking scale is based on the emissions inventory shown in Figure A-1.

[30] https://www.arb.ca.gov/ei/maps/2017statemap/abmap.htm

Figure A-1: Largest NOx Emission Sources in the South Coast & San Joaquin Valley Air Basins



The top ten NOx emission sources were ranked in tons per day for various vehicle and equipment types, ranging from heavy heavy-duty diesel trucks, at 131 tons per day, to light heavy duty diesel trucks, at 17 tons per day. Because the HHD diesel truck category is the largest emission source by far, the scoring scale for this criterion was established for the range of NOx emissions between the second highest and lowest value. As a result, the bins were rounded and scaled in 25-ton per day increments. Projects corresponding to inventory sources with less than or equal to 25 tons of NOx per day receive one point, while those projects with greater than 100 tons of NOx per day receive five points. Each project's potential contribution to regional air quality improvement was ranked based on the scale below.

5: Category contributes more than 100 tons of NOx per day

4: Category contributes 75 to 99 tons of NOx per day

3: Category contributes 50 to 74 tons of NOx per day

2: Category contributes 25 to 49 tons of NOx per day

1: Category contributes less than 25 tons of NOx per day

Based on the information described above, Table A-46 summarizes the results and the corresponding score for this additional preference criterion.

Table A-46: AB 8 Analysis – Contribution to Regional Air Quality Improvement

Proposed Project	Annual Per-Vehicle Emission Reductions (tpy)	Project Life (years)	Per-Vehicle Lifetime Emission Reductions (tons)	Score
Truck Loan Assistance	0.291	1	0.29	5

Ability to Promote the Use of Clean Alternative Fuels and Vehicle Technologies

Clean alternative fuels are fuels that have lower well-to-wheel emissions compared to conventional fuels, such as electricity, hydrogen, and renewable fuels. Clean vehicle technologies are technologies that emit zero tailpipe emissions, such as battery-electric and fuel cell vehicles, or enabling technologies, such as vehicles that utilize conventional hybrid or plug-in hybrid systems. This qualitative analysis ranked projects by whether or not they used a clean low carbon alternative or renewable fuel or utilized clean vehicle technologies. Staff scored this additional preference criterion on the scale below.

5: Projects that use low carbon alternative fuels and clean vehicle technologies

3: Projects that use low carbon alternative fuels or clean vehicle technologies

1: Projects that do not use low carbon alternative fuels nor clean vehicle technologies

Based on the information described above, Table A-47 summarizes the results and the corresponding score for this additional preference criterion.

Table A-47: AB 8 Analysis – Ability to Promote the Use of Cleaner Alternative Fuels and Vehicle Technologies

Proposed Project	Annual Per-Vehicle Emission Reductions (tpy)	Project Life (years)	Per-Vehicle Lifetime Emission Reductions (tons)	Score
Truck Loan Assistance	0.291	1	0.29	3

Ability to Achieve GHG Reductions

Similar to the methodology established in the first preference criterion for criteria pollutant and toxic air contaminant emission reductions, staff conducted a full well-to-wheel GHG emissions analysis for the vehicles and equipment supported by the proposed projects. Staff determined expected lifetime GHG emission reductions achieved for each vehicle or equipment funded by the proposed projects and found that there were no GHG emission reductions. Because staff are proposing to use AQIP funding for Truck Loan Assistance replacements without reduction in fuel usage, staff found that there were no GHG emission reductions funded by AQIP. The scoring scale for GHG emission reductions is shown below.

5: Greater than 200 metric tons of CO_2e per vehicle

4: 150 to 199 metric tons of CO_2e per vehicle

3: 100 to 149 metric tons of CO_2e per vehicle

2: 50 to 99 metric tons of CO_2e per vehicle

1: Less than 50 metric tons of CO_2e per vehicle

Based on the information described above, Table A-48 summarizes the results and the corresponding score for this additional preference criterion.

Table A-48: AB 8 Analysis – Ability to Achieve GHG Emission Reductions

Proposed Project	Annual Per-Vehicle GHG Emission Reductions (tpy)	Project Life (years)	Per-Vehicle Lifetime GHG Emission Reductions (tons)	Score
Truck Loan Assistance	N/A	1	N/A	1

Ability to Support Market Transformation of California's Vehicle or Equipment Fleet to Utilize Low Carbon or Zero-Emission Technologies

This qualitative analysis ranked projects by whether or not technologies with the potential for market transformation are supported by the proposed projects. Staff used CARB's Three-Year Investment Strategy for Heavy-Duty Vehicles and Off-Road Equipment from Low Carbon Transportation and Air Quality Improvement Program Investments as a key reference in scoring technologies used for this evaluation. Battery-electric and fuel cell electric vehicle technologies, for example, are considered transformative technologies that will help the State meet its air quality goals. Staff scored this preference criterion based on the scale below.

5: Technologies that support market transformation

0: Technologies that do not support market transformation

Based on the information described above, Table A-49 summarizes the results and the corresponding score for this additional preference criterion.

Table A-49: AB 8 Analysis – Ability to Support Market Transformation of California's Vehicle or Equipment Fleet to Utilize Low Carbon or Zero-Emission Technologies

Proposed Project	Annual Per-Vehicle Emission Reductions (tpy)	Project Life (years)	Per-Vehicle Lifetime Emission Reductions (tons)	Score
Truck Loan Assistance	0.291	1	0.29	0

Ability to Leverage Private Capital Investments

Staff is proposing not to include this criterion for FY 2021-21as staff works on developing methodologies to analyze the private capital investments leveraged by projects. Staff intends to identify information sources and may include this preference criterion in future years.

Total Benefit Index

Staff utilized the benefit-cost/cost-effectiveness scores of the proposed projects and the additional preference criteria in the consideration of the projects to be given funding preference under AB 8. Staff developed the Total Benefit Index (TBI) score that preferentially weights the benefit-cost score (at 75 percent of the total score) with additional preference scores (at 25 percent of the total score). Staff weighted the benefit-cost/cost-effectiveness scores in this manner because AB 8 identified the benefit-cost score as the primary metric to assign funding preference for proposed projects.

Table A-50 summarizes the individual scores and the TBI scores for all of the AQIP projects currently proposed in the FY 2021-22 Funding Plan.

Table A-50: AB 8 Analysis – Project Scores and Total Benefit Index Score of Proposed Projects

Proposed Project	Additional Preference Criteria					25% of TBI	75% of TBI	Total Benefit Index Score
	Potential Reduction of Criteria or Toxic Air Pollutants	Contribution to Regional Air Quality Improvement	Ability to Promote Use of Clean Fuels and Technologies	Ability to Achieve GHG Emission Reductions	Ability to Support Market Transformation	Average of Additional Preference Criteria Score	Benefit-Cost Score	
Truck Loan Assistance	1	5	3	1	0	2	1	1.25

Jobs Co-Benefits

CARB's Low Carbon Transportation Investments yield a whole host of co-benefits including an impact on jobs – directly and indirectly. Quantifying direct, indirect, and induced jobs at the start and during a project allows stakeholders to take a much more holistic and robust approach while assessing the positive impacts from these projects. Furthermore, job quantification could help shape programmatic changes. Job co-benefits refer to California jobs supported. A job is defined as one full-time equivalent (FTE) employee position over one year, equal to approximately 2,080 hours of work. Jobs supported include direct, indirect, and induced employment:

- Directly supported jobs refer to labor to complete projects, through direct employment or contracted work paid with Low Carbon Transportation investment dollars (e.g., housing construction, ecosystem restoration, or technical assistance) and labor to produce equipment or materials purchased with Low Carbon Transportation investment dollars (e.g., manufacturing zero-emission vehicles or anaerobic digesters).
- Indirectly supported jobs exist in the supply chains supporting Low Carbon Transportation investment projects. Funding a project generates demand for intermediate inputs of materials and equipment needed to complete the project, leading to expanded production and employment in the relevant

upstream industries (e.g., manufacturing construction equipment, zero-emission vehicle parts, or solar panel components).

- Induced jobs are linked to the spending of income from directly and indirectly supported jobs. The personal consumption expenditures of workers in jobs directly and indirectly supported by Low Carbon Transportation investment projects (i.e., increased household spending) stimulate demand for goods and services in the wider California economy.

The methodology for assessing the number of jobs supported was developed by CARB in consultation with the Center for Resource Efficient Communities at the University of California, Berkeley (UC Berkeley). CARB first released the Job Co-benefit Assessment Methodology and Modeling Tool in January 2019 and has since updated this tool. A detailed documentation of the methodology itself and the comprehensive steps that went into its development can be found on CARB's California Climate Investments (CCI) Co-benefit Assessment Methodologies page: https://www.arb.ca.gov/resources/documents/cci-methodologies.

Based on inputs such as proposed funding allocation, allocation fraction going to the actual vehicle and/or equipment procurement, the allocation fraction going to implementation and administrative expenses, among other inputs, staff determined the number of jobs supported for each of the Low Carbon Transportation project categories using the aforementioned jobs assessment methodology. For projects where there was not a methodology to quantify emissions reductions, the number of supported jobs was not assessed. The results for FY 2021-22 are shown in Table A-51.

Table A-51: Estimate of the Number of Jobs Supported by Low Carbon Transportation Investments FY 2021-22

Project Category	Directly Supported Jobs	Indirectly Supported Jobs	Induced Jobs	Total Supported Jobs
Clean Vehicle Rebate Project (Standard and Increased)	321	188	324	**833**
Financing Assistance for Lower Income Consumers	24	18	46	**88**
Clean Mobility Options for Disadvantaged Communities	10	8	21	**39**
Clean Mobility in Schools	20	15	33	**68**
STEP	223	51	85	**359**
Clean Truck and Bus Vouchers (HVIP)	362	274	473	**1,109**
Demo/Pilot	120	76	102	**298**
Clean Cars 4 All	72	55	172	**299**

Project Category	Directly Supported Jobs	Indirectly Supported Jobs	Induced Jobs	Total Supported Jobs
Clean Off-Road Equipment Voucher Incentives (CORE)	242	153	193	**588**
Total	1,171	786	1,364	**3,321**

As previously mentioned, the jobs modeling tool was not available before 2019. CARB staff has since applied this same job modeling methodology to the previous Low Carbon Transportation funding allocations by each fiscal year since FY 2014-15. The results totaling the amounts of supported jobs by each project since FY 2014-15 to the current FY 2021-22 is displayed in Table A-52.

Table A-52: Estimate of the total Number of Jobs Supported by Low Carbon Transportation Investments from FY 2014-15 to FY 2021-22

Project Category	Total Supported Jobs
Clean Vehicle Rebate Project (Standard and Increased)	5,375
Financing Assistance for Lower Income Consumers	259
Clean Mobility Options for Disadvantaged Communities	306
Agricultural Worker Vanpools	98
Rural School Bus Pilot	224
Clean Mobility in Schools	169
STEP	359
Clean Truck and Bus Vouchers (HVIP) + Low NOx	4,080
Zero Emission Truck & Bus Pilots	734
Demo/Pilot	3,751
EFMP Plus-Up / Clean Cars 4 All	618
CORE / Zero Emission Freight	1,003
Public Fleets Pilot	35
Zero & Near Zero Emission Freight Facilities	764

Project Category	Total Supported Jobs
Total	**17,773**

Californians have begun to see the economic benefits of these Clean Transportation Incentives by the thousands number of jobs created as California has become a hub for the manufacture and deployment of clean technologies and associated green jobs. CARB staff shall continue to keep a cumulative job creation total moving forward and direct job data will continue to be collected through the project reports.

AB 1550: Disadvantaged Community, Low-Income Community, Low-Income Household Investment Targets

In the proposed Funding Plan, staff proposes that at least 50 percent of CARB's Low Carbon Transportation appropriation be invested in projects meeting one of the AB 1550 criteria with the following targets:

- At least 35 percent of funds for projects located within and benefiting disadvantaged communities.
- At least 15 percent of funds for projects within and benefiting low-income communities or benefiting low-income households. The subset of these funds meeting the additional AB 1550 requirement for low-income community/ household investments that are within ½ mile of a disadvantaged community would be determined based on program implementation and reported in future Annual Reports to the Legislature on California Climate Investments.

Staff considers the investment targets to be a floor and expects to exceed them. This section provides additional detail showing how CARB will meet, and very likely exceed these targets, based on a historical performance of Low Carbon Transportation funded projects and the project criteria established in this Funding Plan.

This minimum CARB commitment of at least 50 percent would exceed the overall target set in AB 1550 for the State's collective California Climate Investments in disadvantaged communities, low-income communities, and low-income households. AB 1550 does not set targets for individual agencies, but requires that the State, overall, invest at least 25 percent in project located in and benefiting disadvantaged communities, at least 5 percent in and benefiting low-income communities or benefiting low-income households, and at least 5 percent low-income communities located within one half mile of a disadvantaged community for a total AB 1550 investment of at least 35 percent of California Climate investment funds.

Table A-58 shows staff estimates of the minimum percent of funds for each project expected to be spent within and benefiting disadvantaged community census tracts as well as the non-overlapping minimum percent of funds expected to be spent within and benefiting low-income communities. Staff only counted an investment as being in a low-income community if it had not already been counted as being spent in disadvantaged communities because AB 1550 does not allow funds to be counted twice for reporting purposes. Staff used several different methods for these estimates.

For ongoing projects with several years of implementation data such as CVRP and HVIP, staff used the historical percent of funds spent in disadvantaged communities as reported in the *2021 Annual Report on California Climate Investments* to project future performance. For other programs, such as Financing Assistance, staff used the most recent reporting period to estimate the implementation in disadvantaged communities and low-income communities. In the case of the Rural School Bus program, staff used the data from the life of the project to estimate the implementation in disadvantaged and low-income communities.

As shown in Table A-58 several project categories are limited to disadvantaged and low-income communities, so staff can say with certainty 100 percent of these funds will be spent in these communities. These include Clean Mobility in Schools, Clean Mobility Options, STEP, and Advanced Vehicle Technology Demonstration Projects.

There are also a number of proposed projects that lack sufficient historical data upon which to make an informed estimate of the percent of funds that will be spent in disadvantaged and low-income communities, such as Access Clean California and Workforce Training and Development. In these cases, staff took the most conservative approach and left the estimates as "to be determined" even though staff expects an appreciable amount of this funding will meet one of the AB 1550 criteria. For example, the Access Clean California is designed to support individuals in disadvantaged and low-income communities, but it has yet to launch. Staff expects 75 percent of this funding will be spent in disadvantaged communities, in low-income communities, or for consumers meeting the AB 1550 low-income household definition.

Even with these conservative estimates, staff estimates that nearly 47 percent of the proposed Low Carbon Transportation funds would be spent in disadvantaged communities and over 15 percent in non-overlapping low-income communities for a total of over 50 percent meeting one of the AB 1550 criteria as shown in Table A-53. When data are included for all the projects based on actual performance including those for which no AB 1550 is estimated at this time, staff expects CARB will exceed its AB 1550 targets by a considerable margin. CARB will report on these projects' performance in future Annual Reports to the Legislature on California Climate Investments as funds are awarded and spent.

Table A-53: Estimate of the Minimum Proposed FY 2021-22 Low Carbon Transportation Investments in Disadvantaged Communities, Low-Income Communities, and Low-Income Households

Project Category	Allocation (millions)	% in DC	$ in DC (millions)	% in LIC (non-overlapping)	$ in LIC (non-overlapping) (millions)	%DC/LIC Combined	$DC/LIC Combined (millions)	Data Source for Disadvantaged Community (DC)/Low-Income Community or Household (LIC) Estimates
Clean Vehicle Rebate Project	$100	11%	$11.0	29%	$29.0	40%	$40	11% spent in DCs and 29% spent in LICs in 2020 from 2021 Annual Report of California Climate Investments, page 50.
Light-Duty Equity Projects								
Clean Cars 4 All	$75	49%	$37	43%	$32.3	92%	$69	49% spent in DCs and 43% spent in LICs in 2020 from 2021 Annual Report of California Climate Investments, page 44.
Financing Assistance for Lower-Income Consumers	$23.5	32%	$7.5	66%	$15.5	98%	$23	32% spent in DCs and 66% spent in LICs in 2020 from 2021 Annual Report of California Climate Investments, page 51.
Clean Mobility Options	$10	79%	$7.9	21%	$2.1	100%	$10	79% spent in DCs and 21% spent in LICs in 2020 from 2021 Annual Report of California Climate Investments, page 47.
Clean Mobility in Schools	$10	100%	$10	0%	$-	100%	$10	This project is limited to DCs.
Sustainable Transportation Equity Projects	$25	100%	$25	0%	$-	100%	$25	This project is designed to support DCs and LICS. Staff estimates 100% of funding will go to DCs.

Project Category	Allocation (millions)	% in DC	$ in DC (millions)	% in LIC (non-overlapping)	$ in LIC (non-overlapping) (millions)	%DC/LIC Combined	$DC/LIC Combined (millions)	Data Source for Disadvantaged Community (DC)/Low-Income Community or Household (LIC) Estimates
Workforce Training and Development	$1.5	50%	$0.75	50%	$0.75	100%	$1.5	This project is designed to support DCs and LICS but has not launched.
Outreach, Community Transportation Needs Assessments, Technical Assistance and Access Clean California	$5	45%	$2.3	30%	$1.5	75%	$3.8	This project is designed to support DCs and LICS. Staff estimates 45% of funding will go to DCs.
Heavy-Duty, Freight, Off-Road Projects								
Advanced Vehicle Technologies for Freight	$40	100%	$40	0%	$-	100%	$40	This project is designed to support DCs. Staff estimates that 100% of funding will go to DCs.
Clean Truck and Bus Vouchers (HVIP)	$197	63%	$123.8	10%	$19.7	73%	$143.4	63% spent in DCs and 10% spent in LICs in 2020 from 2021 Annual Report of California Climate Investments, page 49.
CORE	$78.5	64%	$50.2	7%	$5.5	71%	$55.7	64% spent in DCs and 7% spent in LICs in 2020 from 2021 Annual Report of California Climate Investments, page 48.
Total	**$565**	**46.9%**	**$265**	**17.8%**	**$101**	**64.7%**	**$366**	

DC *means disadvantaged community as described in Health and Safety Code Section 39711.*

LIC *means low-income community (or low-income household in the case of CC4A) as defined in Health and Safety Code Section 39713. "% in LIC" shown in this table means the percent of funds spent in low-income communities that have not already been counted as being spent in disadvantaged communities because AB 1550 does not allow funds to be counted twice for reporting purposes.*