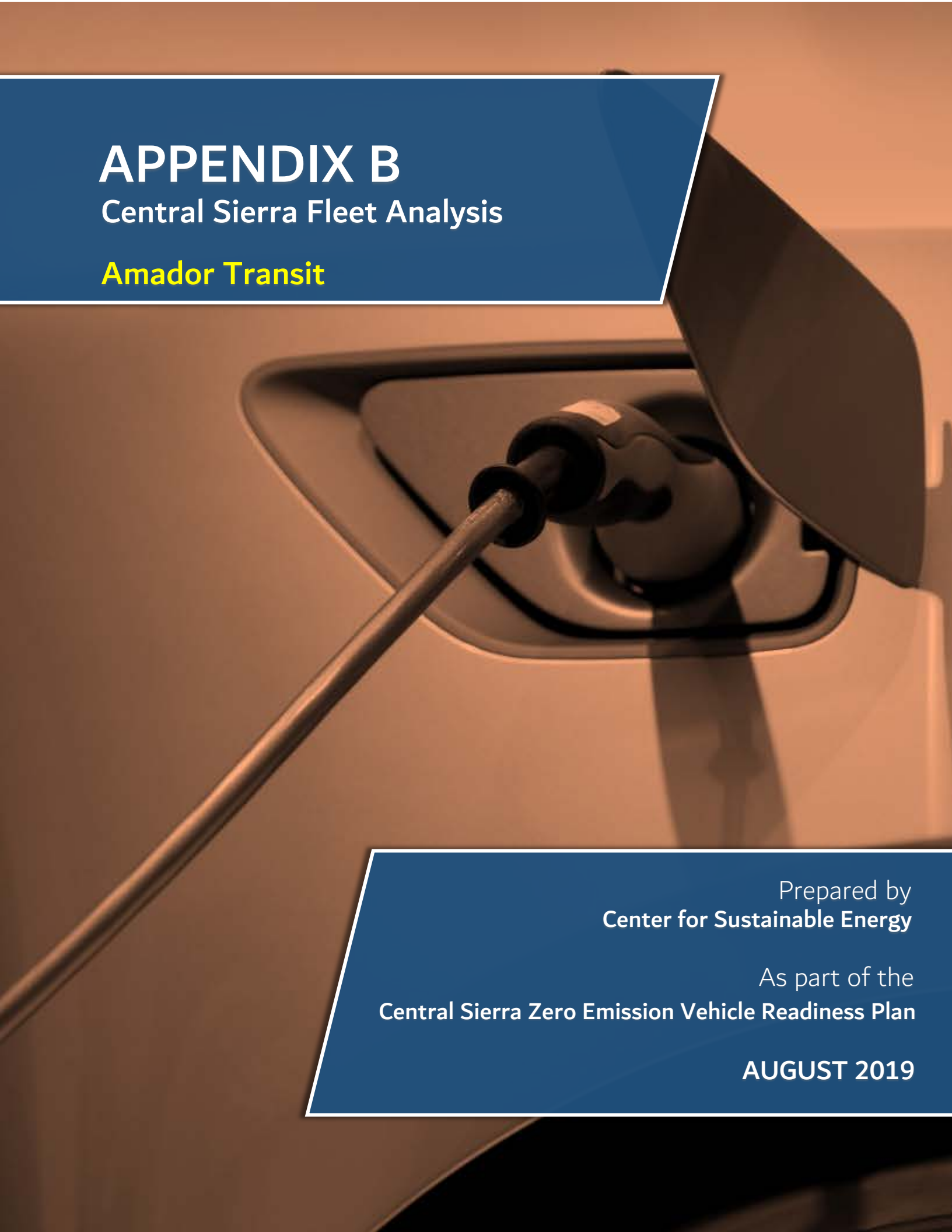

APPENDIX B

Central Sierra Fleet Analysis

Amador Transit

Prepared by

Center for Sustainable Energy

As part of the

Central Sierra Zero Emission Vehicle Readiness Plan

AUGUST 2019

I. Introduction

Governor Edmund G. Brown Jr.'s Executive Order B-48-18 committed to a target of 5 million zero-emission vehicles (ZEVs) registered and operating on California roads by 2030. As part of the Central Sierra region's efforts to comply with the mandates of the Executive Order, the Tuolumne County Transportation Council (TCTC) engaged the Center for Sustainable Energy (CSE) to develop a ZEV Readiness Plan (the Plan) for the four-county Central Sierra region, consisting of the counties of Alpine, Amador, Calaveras, and Tuolumne.

The goal of the Plan is to improve opportunities for ZEV Readiness in the Central Sierra Region (Region) and resolve barriers to the widespread deployment of private and public ZEV infrastructure. In pursuit of this goal, your fleet's composition and characteristics were examined to provide an assessment of electric replacement options for your vehicles. This analysis seeks to answer the following questions:

- Based on your current fleet, which vehicles can be replaced with electric or plug-in hybrid alternatives?
- How much will these vehicles cost to purchase, and which incentives are available?
- What are the quantitative benefits of replacing these vehicles with their electric alternatives?

II. Findings

- There are **17 vehicles** that have been identified as having electric replacement options, either available currently or in the very near-term (next 2-4 years).
- The incremental costs (the additional expense over a conventionally-powered replacement vehicle) of replacing all of the 17 identified vehicles with BEVs would be approximately **$683,000**.
- Replacing all eligible vehicles with electric alternatives would save an approximate total of **$58,000** in fuel costs annually. Note that with EVs' lower maintenance requirements, additional savings will be realized, but due to the nascent state of the market these savings are currently difficult to accurately quantify.

Vehicles Suitable for Replacement

CSE examined Amador Transit's current fleet inventory to determine which vehicles may have suitable electric replacement options. This analysis found that there are **17 total vehicles (6 unique models)** that can be replaced with electric vehicles. The table below shows the vehicles which were identified as having a suitable electric replacement option:

Table 1: Existing fleet vehicles with suitable replacement options (PHEV and/or BEV)

Count of Vehicles	Model Year	Make	Model	Classification	Replacement Model Suitability (BEV/PHEV)
1	2009	Ford	Glaval E450	Medium Duty Gas	High/None
6	2013	Chevrolet	Glaval Titian II	Heavy Duty Diesel	High/None
2	2014	Freightliner	S2C Glaval	Heavy Duty Diesel	High/None
3	2015-2017	Braun	EnterVan	Light Duty Gas	High/Moderate
4	2017	Freightliner	S2C Glaval	Heavy Duty Diesel	High/None
1	2009	Ford	Glaval E450	Medium Duty Gas	High/None

Please note that the recommendations outlined in section 3 are general recommendations based on vehicle size and weight, and may not be direct replacements due to variations in requirements for duty cycle, passenger capacity, and/or other specific considerations. For more information and additional alternatives, please see the Internal Combustion Vehicle Replacement Guide (enclosed as an attachment to the original email). Please assess your fleet's unique needs as thoroughly as possible through data and use monitoring and carefully considering each vehicle's unique service requirements.

III. Replacement Options

While there are electric buses now available from multiple manufacturers, some may be more cost-effective than others. Specifically, vehicles would need to be matched to the range and performance requirements of the given routes, and it is likely that longer range, more expensive buses would be required. However, electric options are beginning to drop in price and we expect that there will be many more options available within the next ten years. The vehicles identified as having suitable electrified and plug-in hybrid (if applicable) replacements are listed in Tables 2a and 2b on the next page.

Table 2a: Battery-electric vehicle replacement table.

Fully Electric Options								
Car Class	**Representative Model Being Replaced**	**Replacement Vehicle**	**Quantity of Eligible Vehicles in Class**	**Estimated Per-Vehicle Annual Fuel Savings**	**Vehicle Lifetime Savings**	**Estimated Payback Period (Years)**	**Total Class Lifetime Fuel Savings**	**Total Class Lifetime GHG Savings (tonnes)**
Heavy Duty Diesel	Freightliner S2C Glaval	Motiv Epic 6*	12	$2,662	$21,292	18.88	$255,509	1,403
Medium Duty Gas	Ford E450	Motiv EPIC 4 Dearborn on Ford E450 Platform*	2	$5,967	$47,738	14.57	$41,325	127
Light Duty Gas	Braun Entervan	Lightning Systems Ford Transit Van	3	$541	$4,327	2.77	$12,980	48

*Chassis only. Representative models have not been tested by Altoona.

Table 2b: Plug-in hybrid vehicle replacement table.

Plug-in Hybrid Options								
Car Class	**Representative Model Being Replaced**	**Replacement Vehicle**	**Quantity of Eligible Vehicles in Class**	**Estimated Per-Vehicle Annual Fuel Savings**	**Vehicle Lifetime Savings**	**Estimated Payback Period (Years)**	**Total Class Lifetime Fuel Savings**	**Total Class Lifetime GHG Savings (tonnes)**
Medium Duty Gas	Ford E450	XL Hybrid Transit Van	2	$5,823	$46,589	2	$46,589	104
Light Duty Gas	Braun Entervan	Chrysler Pacifica	3	$518	$4,147	>15	$12,442	28

Tables 2a and 2b above shows existing vehicles, their associated BEV replacement vehicles, the estimated vehicle-life and entire-class fuel cost savings, and abated greenhouse gas emissions resulting from converting the entire vehicle class.

The following assumptions (Table 3) were incorporated in the above tables:

Table 3: Assumptions underpinning tables 2a and 2b (above).

Assumption	Value
Vehicle Service Life*	8 years
Gasoline Price ($/gallon)	$3.95
Gasoline GHG Intensity (kg CO2e/gallon)	8.78 kg
Diesel Price ($/gallon)	$4.02
Diesel GHG Intensity (kg CO2e/gallon)	10.21 kg
Electricity Price † ($/kWh)	$0.167 / $0.110
Electricity GHG Intensity † (kg CO2e/kWh)	0.215 kg / 0 kg
*Vehicles are frequently kept longer than this value, providing further savings on fuel and GHG abatement † Second number reflects electricity from the New Melones Dam, as applicable	

In general, heavy-duty vehicles are relatively well represented within the battery-electric vehicle market, but certain niches are difficult to replace. For example, cutaway bus models are now on the market, but tend to be rare. Specific suitability depends on several variables, including terrain, use intensity, and passenger capacity requirements. Plug-in hybrid heavy-duty vehicles, such as school buses, are even rarer, and thus are typically excluded from the analysis.

Furthermore, plug-in vehicle costs are significantly higher than gas-powered comparisons. It should be noted that costs outlined within these tables are incremental costs, i.e. a vehicle with an incremental cost value of $0 means that after incentives are factored in, the cost of procuring that vehicle is not more than simply purchasing a direct replacement vehicle.

The vehicle replacement analysis used average fuel prices for the state of California on the date of analysis (March 29, 2019), and divided the fleet's vehicles into classes shown above, using a representative vehicle's mileage and fuel consumption to reflect the "typical" vehicle within each class. The representative vehicle was then compared to the replacement plug-in vehicle.

Replacing large diesel vehicles in Amador Transit's fleets, particularly the 2009-2014 passenger buses, offers the opportunity for large reductions in fuel costs and GHG emissions. According to survey information, these buses operate on routes that will not require them to charge during the day and thus are great candidates for BEV replacement. The newer buses (model year 2017 and newer) also represent a large opportunity for savings but would not be due for regular replacement for many years. As described later in this document, large rebates are available for BEV replacement vehicles of this size, alleviating the incremental cost burden associated with the initial purchase.

In general, vehicles with payback periods longer than 15 years may not offer a good economic return, but can still offer fuel savings, reduce greenhouse gas emissions, and position the fleet as a forward-thinking, environmentally conscious entity.

The procurement of vehicles should be straightforward, and does not differ significantly from the procurement process for internal-combustion vehicles. The Vehicle Replacement Guide enclosed in the email notes several vendors that sell both the CSE-recommended vehicles and alternative options. These are typically secondary vendors, though there are several manufacturers that are able to sell directly to fleets. Some EVs are available and eligible for reduced cooperative purchase through organizations such as Sourcewell. Incentives outlined below as section 4 offer the ability to lower the upfront cost of procurement, but may be subject to additional stipulations and conditions.

Amador Transit should carefully evaluate all fuel types and available incentives when vehicle replacement decisions are made. California offers rebates and incentives for alternative fuel vehicles and infrastructure: currently available incentives are outlined later in this chapter.

Accessible charging and fueling infrastructure are crucial for successfully incorporating ZEVs into fleets. It is a best practice to evaluate, site, and construct enough infrastructure prior to adding ZEV vehicles. Ideally, electricity demand evaluations are completed, and the appropriate number of charging/fueling stations are installed before vehicles are ordered. While charging at lower power levels (2kW - 7 kW) is adequate for the small batteries found in passenger cars, vehicles with high gross vehicle weights typically require larger batteries. These large vehicles may require higher-powered charging (30kW – 500kW) in applications that require minimal downtime.

IV. Innovative Clean Transit Regulations

Transit buses represent an important opportunity to advance clean transportation technologies and fleet sustainability goals, as they are stored and fueled in central locations and benefit from government funding and support. Lessons learned by deploying new technologies in public fleets will aid in their deployment elsewhere in the transportation sector.

The California Air Resources Board Innovative Clean Transit regulation was designed to provide transit agencies with a target and roadmap for meeting the State's air quality, climate, and public health protection targets. With a goal of transitioning to zero-emission technologies by 2040, the rule requires each transit agency to develop a rollout plan detailing how it plans to purchase clean buses, build out necessary infrastructure and train the required workforce. All transit agencies covered in this report qualify as small transit agencies under the rule, allowing for a more gradual transition away from conventionally fueled buses. Each agency is required to submit a ZEB purchase and deployment plan for transit board approval. For small transit agencies, these plans are due on June 30, 2023. Key plan elements include:

- Identification of zero-emission technologies targeted for deployment
- Plan for build out of charging and/or fueling infrastructure
- Planned schedule for bus procurement
- Planned schedule for training of bus operators and technicians
- Identification of potential funding sources

The regulation includes a phased ZEB rollout requirement, illustrated in Table 4:

Table 4: Zero-emission bus purchase requirements

Calendar Year	ZEB Percentage of New Bus Purchases	
	Large Transit Agency	Small Transit Agency
2023*	25%	-
2024*	25%	-
2025	25%	-
2026	50%	25%
2027	50%	25%
2028	50%	25%
2029 and after	100%	100%

* Potential waiver for early compliance

Purchase begins on the date of a Notice to Proceed (NTP) agreement with the bus manufacturer. All buses must be delivered within two years of NTP issuance. Compliance determination is made by December 31 of each year. Recognizing that for many agencies, and for small transit agencies in particular, procurement of ZEBs represents a significant logistical and financial hurdle, CARB has included a number of alternative compliance options and potential circumstantial alterations to the ZEB rollout requirements. Those alternatives that we have identified as potentially useful for Central Sierra Fleets are included in table 5 below. Important potential rule alterations are included.

Table 5: Alternative compliance options and potential rule changes

Alternative Compliance options		
Alternative compliance option	**Description**	**Stipulations/considerations**
Zero-emissions mobility program credits	Transit agencies may earn ZEB purchase credits for other zero emission mobility programs such as bicycles, van pools, and micro transit.	• Vehicles must have a gross vehicle weight rating (GVWR) of 14,000 lbs or less • Vehicles must be operated directly by or through a contractor with the transit agency • Annual zero-emission passenger miles must be tracked and recorded
Service conditions bonus credits	Bonus compliance may be received for each ZEB placed in revenue service under one of the conditions listed	• 2 bonus credits for each fuel cell electric bus (FCEB) placed in service on or before 12/31/2017 and remaining in service as of Jan 1/1/2018 • 1 bonus credit for each FCEB placed in service between 1/1/2018 and 1/1/2023 • 1 bonus credit for each battery electric bus (BEB) placed in service on or before 12/31/2017 and remaining in service as of 1/1/2018 • Each bonus credit is counted the same as a ZEB in the fleet ○ Credits expire on 12/31/2028, and are not transferable
Joint Zero Emission Bus Groups	Agencies may form Joint Zero Emission Bus Groups to pool resources under one of the conditions listed	• Share the same Metropolitan Planning Organization, or; • Transportation Planning Agency, or; • are located within the same Air Basin • The total annual ZEB purchased collectively must equal the sum of the total annual ZEBs required to purchased by each participating transit agency
Potential rule changes and compliance extension/exemption criteria		
The 2023 ZEB purchase requirement percentage will be waived if California transit agencies have collectively purchased 1,000 or more ZEBs by December 31, 2020. Current ZEB order and deployment information can be found on CARB's Innovative Clean Transit website (https://arb.ca.gov/msprog/bus/faqactoverview_1.pdf)		
Cutaway buses, motor coaches, and articulated buses will be excluded until January 1, 2026 and until the applicable bus type has passed and obtained an Altoona bus testing report.		
A transit agency may request a compliance extension under the following conditions: • Delay in the bus delivery is caused by the bus manufacturer • Delay in bus delivery is caused by setback of infrastructure construction schedule • When an available depot charging BEB cannot meet a transit agency's daily mileage needs		
A transit agency may request a compliance exemption required zero-emission bus type is not available for purchase.		

Amador Transit

Operating 17 total vehicles, Amador Transit is classified as a small transit organization, with a rollout plan due by 2023. Starting on January 1, 2026, 25% of new bus purchases must be ZEBs; starting January 1,

2029, all new purchases must be ZEBs (CARB § 2023.1., 2018). If no eligible cutaway buses, motor coaches, or articulated buses have passed Altoona bus testing and received a report by January 1, 2029, these bus types will be excluded from the mandate until options are available.

V. Incentives

a. Low Carbon Transportation Funding

The California Energy Commission (CEC) and ARB offer alternative transportation grants and rebates through under the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) and other low carbon transportation funding. Funding is allocated annually and the 2019-2020 budget for the CEC ARFVTP Program (www.energy.ca.gov/altfuels/) is approximately $95.2 million. ARB managed about $400 million in rebates and projects in FY 2017-18 and 2018-19 through the Air Quality Improvement Program/ Low Carbon Transportation funding plan (www.arb.ca.gov/msprog/aqip/aqip.htm).

The calculations that underpin Tables 2a and 2b use the California Hybrid Truck and Bus Voucher Incentive Project (HVIP) program to offset the incremental cost of electrified buses and trucks. Similarly, the federal $7,500 tax credit is combined with incentives from the Clean Vehicle Rebate Program to offset the incremental cost of electrified or PHEV light-duty vehicles.

Clean Vehicle Rebate Project (CVRP)

CSE manages ARB's Clean Vehicle Rebate Project (CVRP) (https://cleanvehiclerebate.org/), which provides rebates of up to $2,500 for light duty battery electric and plug-in hybrid vehicle purchases. CSE received $120 million in funding for FY 2018-2019. Table 6, *CVRP Rebate Amounts for Light-Duty Vehicles,* summarizes the rebates available.

Table 6: CVRP rebate amounts for light-duty vehicles

Vehicle Class	Maximum Incentive
Light duty zero emission vehicles (ZEV)	$2,500
Plug-in hybrid electric vehicles (PHEV)	$1,500
Zero emission motorcycles (ZEM)	$ 900
Neighborhood electric vehicles (NEV)	$ 900
Note: Eligible vehicles and associated rebate amounts are subject to change. Visit the CVRP program site for eligible vehicle models and associated rebates.	

Hybrid Truck and Bus Voucher Incentive Project (HVIP)

Rebates for commercial vehicles including trucks and buses are available through ARB's Hybrid Truck and Bus Voucher Incentive Project (HVIP) (www.californiahvip.org). As of May 2019, the HVIP estimated fund balance was over $57 million. A summary of the incentives available is provided in the ARB HVIP

Voucher Amounts for Trucks and Buses tables below. Additional incentives are available for transit buses, vehicle conversions, and in disadvantaged communities.

Table 7: HVIP Voucher Amounts for *Zero-Emissions* Trucks & Buses

Gross Vehicle Weight (in pounds)	HVIP Maximum Voucher
5,001 – 8,500 lbs	$20,000
8,501 – 10,000 lbs	$25,000
10,001 – 14,000 lbs	$50,000
14,001 – 19,500 lbs	$80,000
19,501 – 26,000 lbs	$90,000
26,001 – 33,000 lbs	$95,000
> 33,001 lbs	$150,000

Table 8. Maximum HVIP Voucher Amounts for *Hybrid* Trucks & Buses

Gross Vehicle Weight (in pounds)	HVIP Maximum Voucher
6,001 – 8,500 lbs (plug-in hybrids only)	½ incremental cost, up to $8,000
8,500 – 10,000 lbs (plug-in hybrids only)	½ incremental cost, up to $10,000
10,001 – 19,500 lbs	½ incremental cost, up to $15,000
19,501 – 26,000 lbs	½ incremental cost, up to $20,000
26,001 – 33,000 lbs	½ incremental cost, up to $25,000
> 33,000 lbs	½ incremental cost, up to $30,000

Note that HVIP additionally provides incentives for electric vehicle charging infrastructure, as outlined in the following Infrastructure section.

Additional Funding Avenues (Vehicles)

Volkswagen Settlement Funding

The Volkswagen Environmental Mitigation trust provides $130 million to the state of California to "replace eligible Class 4-8 school, transit, and shuttle buses with new, commercially available, zero-emission technologies" (Air Resources Board, 2018). A school bus is eligible for a maximum incentive of $400,000; a transit bus is eligible for a maximum incentive of $180,000 (battery electric) or $400,000 (fuel cell); and a shuttle bus is eligible for a maximum incentive of $160,000. All of these awards additionally cover supportive infrastructure. For more information, please visit https://ww2.arb.ca.gov/resources/documents/californias-beneficiary-mitigation-plan

NOTE: VW Mitigation Funds are not stackable with HVIP funds; it is an either/or rebate.

Federal Transit Administration Low- or No-Emission Program Funding

The Low- or No-Emission Competitive program (Low-No program) is funded by the Fixing America's Surface Transportation (FAST) Act, which provides $55 million in competitive funds per year until fiscal year 2020. The program covers funding for the purchase or lease of low- or zero-emission transit buses, as well as the acquisition, construction, and/or leasing of supporting infrastructure (FTA 2018). Transit agencies will be responsible for at least 15% of transit bus cost, and 10% of project cost for infrastructure and/or facilities. For more information, please visit https://www.transit.dot.gov/funding/grants/lowno.

b. Infrastructure

This analysis only covers the costs and fuel savings associated with the ownership and operation of fleet vehicles themselves. Another crucial component of electrification is the presence of reliable onsite charging infrastructure to ensure that vehicles are present and fueled when they are needed. Table 9, below, outlines the range of costs for the first EVCS port (plug) installed at a given site. Table 10 outlines specific installation variables that are incorporated into the "installation" cost element shown in Table 9. Note that many buses use DC Fast Charging as their default charging method.

Table 9: Approximate costs for non-residential, single-port electric vehicle charging stations (EVCS).
Cost data from Dept. of Energy (2015)

Cost Element	Level 1		Level 2		DC Fast Charge	
	Low	High	Low	High	Low	High
Hardware	$300	$1,500	$400	$6,500	$10,000	$40,000
Permitting	$100	$500	$100	$1,000	$500	$1,000
Installation	$0*	$3,000	$600	$12,700	$8,500	$51,000
Total	$400	$5,000	$1,100	$20,200	$19,000	$92,200

Table 10: Installation component cost ranges
Cost data from SANDAG (2016)

Cost Element	Cost
Conduit	$1.50-$2.50/ft
Trenching	$25-$100/ft
Concrete Patch	$14-$15/sq.ft
Asphalt Patch	$10-$11/sq.ft

Several funding programs exist to reduce the overall cost of installing EVCS at sites.

California Hybrid Truck and Bus Voucher Incentive Program (HVIP)
The HVIP program offers a voucher enhancement of up to $30,000 per vehicle voucher received to reduce the cost of installing EV infrastructure intended to support the ordered vehicles. The enhancements require a separate application, are approved on a case-by-case basis, and can be combined with other funding sources to cover up to 100% of the total capital cost of installation.

Pacific Gas and Electric (PG&E)
PG&E administers three funding programs for electric vehicle infrastructure. These programs include the FleetReady Program, Fast Charge Program and EV Charge Network Program.

- **EV Fleet** – Starting in May 2019. PG&E received $236 million in eligible funds from the California Public Utilities Commission (CPUC) for infrastructure supporting fleet vehicle charging. PG&E is working with fleet managers that request funding across Northern and Central California to install EVCS at 700 sites (pge.com/fleetready).
- **Fast Charge Program** – Starting in summer 2019. PG&E will fund and build infrastructure for public DCFCs, including 25% located within DACs. Furthermore, PG&E will offer rebates for customers in disadvantaged communities (DACs) who wish to purchase DCFCs (CPUC Approves New PG&E Projects to Help Accelerate Electric Vehicle Adoption in California, 2018).
- **EV Charge Network Program** - Started in 2016. The CPUC approved the PG&E EV Charge Network Program to install 7,500 L2 EVCS at MUDs and workplaces. Within the service territory, PG&E will install the infrastructure at qualified locations with at least 10 parking spaces available for charging (pge.com/evcharge).

California Electric Vehicle Infrastructure Program (CALeVIP)
CALeVIP offers financial incentives for eligible EVCS infrastructure installations, and works with local governments and community partners to develop regional EV charging projects statewide. CSE manages each regional project, distributes rebates, and provides outreach and informational materials to assist property owners and service providers. Though funding is not available in the current 2019-2020 funding cycle for the Central Sierra region, new projects are added periodically and the region may be included in future funding. For more information, please see the CALeVIP website and browse the currently available projects.

Congestion Mitigation and Air Quality Improvement (CMAQ) Program
The FAST Act authorizes funding of $2.3 billion to $2.5 billion to the CMAQ program for apportionment to the states. States, local governments and transit agencies can use these funds to invest in transportation projects that support the Clean Air Act. Projects eligible for the funds include alternative fuel vehicles and infrastructure. A project supported with CMAQ funds must demonstrate that the project reduces emissions, is located in, or benefits an EPA designated nonattainment or maintenance area and is a transportation project (23 U.S.C. 149) (Federal Highway Administration, 2017). Projects

located on FAST-designated corridors (including US 395 and SR 120) receive funding priority over those not located on these corridors.

Note: under the current Buy America requirements that apply to projects funded through this avenue, CMAQ funds may prove prohibitively difficult to utilize.

Volkswagen Settlement

- *Electrify America*
  The Electrify America program is a subsidiary of Volkswagen with the goal of investing $800 million into zero-emission vehicle projects between 2017 and 2027. This investment has typically been into Level 2 and DC Fast Charge infrastructure. Communities can suggest locations, but final siting decisions are ultimately up to Volkswagen/Electrify America. Part of Electrify America's second cycle (2019-2021) of funding will be dedicated to installing charging infrastructure specifically for transit in select communities.
- *California Volkswagen Mitigation*
  The Volkswagen Environmental Mitigation Trust provides approximately $423 million for California to mitigate the additional NOx emissions from diesel Volkswagen vehicles equipped with defeat devices. As part of this, $5 million will be allocated in a competitive solicitation for EV infrastructure buildout. The funding cycle will begin inviting solicitations in Q3/Q4 2019 with the goal of filling physical and funding gaps in installed EVCS.

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