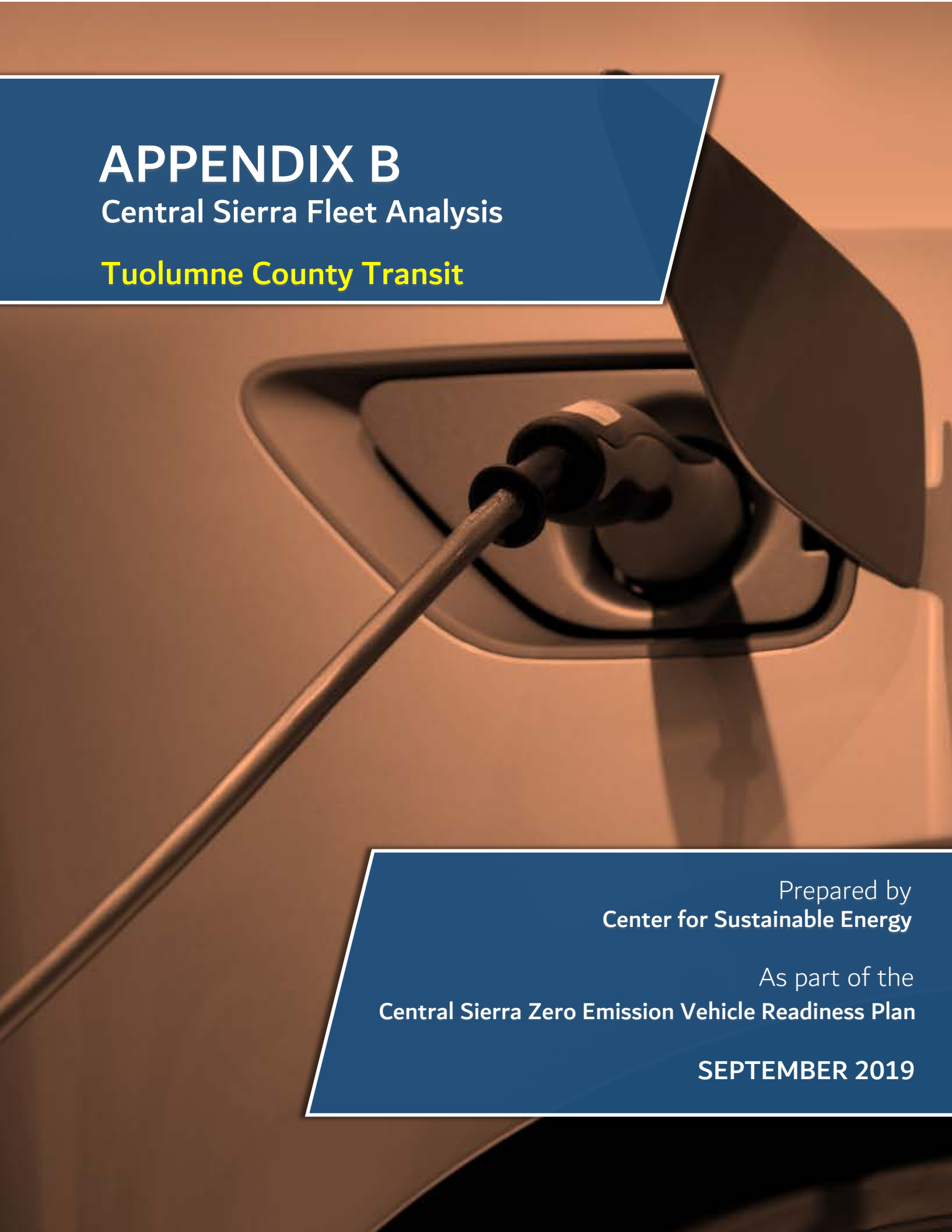

APPENDIX B

Central Sierra Fleet Analysis

Tuolumne County Transit

Prepared by
Center for Sustainable Energy

As part of the
Central Sierra Zero Emission Vehicle Readiness Plan

SEPTEMBER 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 (Region) 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 Region and resolve barriers to the widespread deployment of private and public ZEV infrastructure. In pursuit of this goal, the Tuolumne County Transit (TCT) fleet was analyzed to identify opportunities for electrification. The analysis focused on the following:

- Analyzing the current fleet and identifying inventorythat can be replaced with electric or plug-in hybrid alternatives.
- Estimate the capital cost to replace current/future vehicles with electric or plug-in hybrid alternatives. Identify incentives and other cost savings associated with fleet transition.
- Discuss benefits of replacing internal combustion vehicles with ZEVs.

Findings

- Currently, TCT has **22 vehicles** that have electric replacement options, either available currently or in the very near-term (next 2-4 years).
- The estimated total cost of replacing 22 vehicles with similar, 2019 model-year internal combustion vehicles is approximately $696,000. Of these 22 vehicles, all have appropriate BEV replacements and 2 have appropriate PHEV replacements.
- The following two replacement scenarios (a full-BEV scenario and a PHEV-BEV mix) were identified to provide options for TCT fleet transition:
    - **BEV-Only Scenario**: Replace all eligible vehicles with fully electric alternatives. This will cost approximately $2.47 million (an incremental cost of $1.80 million), save up to $791,450 in fuel costs and abate 3,130 tonnes of GHGs over the vehicles' assumed lifetime of ten years. Using the 40kWh Nissan Leaf as a replacement instead of the Chevrolet Bolt EV would reduce lifetime fuel savings by approximately $1,416 over the total vehicle class, but state rebates would effectively eliminate the incremental cost of the vehicles.
    - **PHEV-BEV Scenario:** Replace two eligible vehicles with PHEVs and replace all others with BEVs. This will cost approximately $2.47 million (an incremental cost of $1.80 million), save up to $557,450 in fuel costs and abate 2,414 tonnes of greenhouse gases (GHGs) over the vehicles assumed lifetime of ten years. Using the Hyundai Ioniq PHEV as a replacement in the light gas car category instead of the Toyota Prius Prime would reduce lifetime fuel savings by approximately $301 over the total vehicle class, but state rebates would effectively eliminate the incremental cost of the vehicles.

- Payback periods ranged from as low as immediate to upwards of 15 years. Light-duty PHEV vehicles tended to display the best payback: the Hyundai Ioniq PHEV (immediate), Toyota Prius Prime (3 years) and Chrysler Pacifica PHEV (5) were standouts, as well as the Chevrolet Bolt (5 years for a van replacement, 15 for a hybrid sedan) and the the Starcraft-bodied Motiv Epic 4 (13 years). More comprehensive results are illustrated in Tables 3a and 3b.
- BEVs/PHEVs typically have lower maintenance requirements/costs, compared to internal combustion engine vehicles, but specific savings are difficult to predict given the nascent state of the market.
- Benefits of converting to ZEVs include reduced environmental impact, reduced maintenance costs, and achieving/maintaining regulatory compliance.

II. Current Fleet Replacement Analysis

CSE examined TCT's current fleet inventory to determine which vehicles may have suitable electric replacement options. This analysis found that there are **22 total vehicles (5 unique models)** that can be replaced with electric vehicles. Table 1 shows the current vehicles identified as candidates for electric replacement:

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

Count	Model Year	Make	Model	Classification	Suitability of Available Replacement (BEV/PHEV)
1	2005	Chevy	Venture	Light Duty Gas Van	Low/High
1	2007	Honda	Accord Hybrid	Light Duty Gas Sedan	High/High
2	2010	Supreme	Freightliner Trolley	Medium Diesel Trolley Bus	High/None
2	2011	Glavel	Ford E450 Universal	Light Gas Bus	High/None
1	2011	Supreme	Freightliner Trolley	Medium Diesel Trolley Bus	High/None
1	2013	Starcraft	Ford E350 Starlite	Light Gas Bus	High/None
2	2013	Starcraft	Ford E450 Allstar	Light Gas Bus	High/None
2	2013	Supreme	Freightliner Trolley	Medium Diesel Trolley Bus	High/None
4	2014	Glaval	Ford E450 Universal	Light Gas Bus	High/None
1	2014	Glaval	Freightliner Legacy	Medium Diesel Bus	High/None
3	2016	Glaval	Ford E450 Universal	Light Gas Bus	High/None
2	2016	Glaval	Freightliner Legacy	Medium Diesel Bus	High/None

Note: "Suitability of Available Replacement" reflects the likelihood that the currently available BEV/PHEV models can serve as a direct replacement for the existing vehicles, considering duty cycle, passenger capacity, and other variables.

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 Engine (ICE) Alternative Guidebook (Appendix C in the Central Sierra ZEV Plan).

III. Replacement Strategy

Vehicles

Each vehicle identified in Table 1 has a replacement option, however, some are more cost-effective than others. Specifically, recommendations for replacement of light-duty trucks are less cost-effective and offer fewer options than recommendations for replacing sedans. That being said, electric light-duty truck options are rapidly being released to the market and we expect that there will be more options available within ten years.

Two replacement strategies were developed to provide the TCT with an all BEV replacement option and a BEV/PHEV option, which will require less capital investment and increase fleet resiliency. In the first scenario, all the eligible vehicles are replaced with BEVs, which maximizes the potential greenhouse gas reductions but will require the greatest capital investment. This scenario is depicted in Table 2a. Table 2b depicts the second scenario where a mix of BEV and PHEVs is identified. Tables 3a and 3b show the existing vehicles, their associated BEV/PHEV replacement vehicles, the estimated vehicle-life and entire-class fuel cost savings, and abated GHG emissions resulting from converting the entire vehicle class.

Table 2a: BEV-only fleet replacement scenario (cost)

Count	Class	BEV/ PHEV	Proposed Make and Model	ICE MSRP (unit)	ZEV MSRP (unit)	Incremental Cost (unit)	Cost of ZEV Replacement	Potential Incentives
3	Medium Diesel Bus	BEV	Starcraft Allstar XL - Motiv Epic 6 (F-53)*	$27,845	$228,095	$200,250	$684,285	$90,000 x3 = $270,000
5	Medium Diesel Trolley Bus	BEV	Hometown Trolley- Motiv Epic 6 (F-53)*	$27,845	$228,095	$200,250	$1,140,475	$90,000 x5 = $450,000
12	Light Gas Bus	BEV	Starcraft Allstar- Motiv Epic 4 Dearborn*	$33,320	$188,570	$155,250	$2,262,840	$80,000 x12 = $960,000
1	Light Gas Sedan	BEV	Chevrolet Bolt	$24,402	$32,572	$8,170	$32,572	$2,500 x1 = $2,500
1	Light Gas Van	BEV	Chevrolet Bolt	$21,897	$32,572	$10,675	$32,572	$2,500 x1 = $2,500
					Subtotal	**$3,483,845**	**$4,152,744**	**$1,685,000**
						TOTAL INCREMENTAL COST (Incremental Cost – Incentives)		**$1,798,845**

*Costs are for chassis only. Representative models have not been tested by Altoona.

Count	Class	BEV/ PHEV	Proposed Make and Model	ICE MSRP (unit)	ZEV MSRP (unit)	Incremental Cost (unit)	Cost of ZEV Replacement	Potential Incentives
1	Light Gas Sedan	BEV	Nissan Leaf (40kWh)	$24,402	$26,614	$2,212	$26,614	$2,500 x1 = $2,500
1	Light Gas Van	BEV	Nissan Leaf (40kWh)	$21,897	$26,614	$4,717	$26,614	$2,500 x1 = $2,500

Table 1b: (2) PHEV – (20) BEV fleet replacement scenario (cost)

Count	Class	BEV/PHEV	Proposed Make and Model	ICE MSRP (unit)	ZEV MSRP (unit)	Incremental Cost (unit)	Cost of ZEV Replacement	Potential Incentives
3	Medium Diesel Bus	BEV	Starcraft Allstar XL - Motiv Epic 6 (F-53)*	$27,845	$228,095	$200,250	$684,285	$90,000 x3 = $270,000
5	Medium Diesel Trolley Bus	BEV	Hometown Trolley- Motiv Epic 6 (F-53)*	$27,845	$228,095	$200,250	$1,140,475	$90,000 x5 = $450,000
12	Light Gas Bus	BEV	Starcraft Allstar- Motiv Epic 4 Dearborn*	$33,320	$188,570	$155,250	$2,262,840	$80,000 x12 = $960,000
1	Light Gas Sedan	PHEV	Toyota Prius Prime (PHEV)	$24,402	$26,096	$1,694	$26,096	$1,500 x1 = $1,500
1	Light Gas Van	PHEV	Chrysler Pacifica PHEV	$27,235	$39,514	$12,279	$39,514	$1,500 x1 = $1,500
					Subtotal	**$3,478,973**	**$4,153,210**	**$1,683,000**
						TOTAL INCREMENTAL COST (Incremental Cost – Incentives)		**$1,795,973**

*Costs are for chassis only. Representative models have not been tested by Altoona.

Count	Class	BEV/PHEV	Proposed Make and Model	ICE MSRP (unit)	ZEV MSRP (unit)	Incremental Cost (unit)	Cost of ZEV Replacement	Potential Incentives
1	Light Gas Sedan	PHEV	Hyundai Ioniq PHEV	$24,402	$22,950	-$1,452	$22,950	$1,500 x1 = $1,500

Table 3a: BEV-only fleet replacement scenario (benefits)

Fully Electric Vehicle 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 Diesel Bus	Glaval Legacy Freightliner	Starcraft Allstar XL - Motiv Epic 6 (F-53)*	3	$2,505	$27,427	>15	$82,281	442.83
Medium Diesel Trolley Bus	Supreme Trolley - Freightliner	Hometown Trolley- Motiv Epic 6 (F-53)*	5	$1,398	$15,308	>15	$76,539	547.68
Light Gas Bus	Glavel Universal - Ford E450	Starcraft Allstar- Motiv Epic 4 Dearborn*	12	$4,700	$51,467	13	$617,604	2097.07
Light Gas Van	Chevrolet Venture	Chevrolet Bolt	1	$940	$10,292	5	$10,292	29.67
Light Gas Sedan	Honda Accord Hybrid	Chevrolet Bolt	1	$432	$4,727	15	$4,727	14.83
		Subtotal	**22**	**$9,975**	**$109,221**	**--**	**$791,443**	**3,132.08**

*Costs are for chassis only. Representative models have not been tested by Altoona.

Alternate Vehicles

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)
Light Gas Van	Chevrolet Venture	Nissan Leaf (40kWh)	1	$935	$9,347	>15	$9,347	29.57
Light Gas Sedan	Honda Accord Hybrid	Nissan Leaf (40kWh)	1	$426	$4,256	>15	$4,256	14.71

Table 3b: (2) PHEV – (20) BEV fleet replacement scenario *(benefits)*

Vehicle 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 Diesel Bus	Glaval Legacy Freightliner	Starcraft Allstar XL - Motiv Epic 6 (F-53)*(BEV)	3	$2,505	$27,427	>15	$82,281	442.83
Medium Diesel Trolley Bus	Supreme Trolley - Freightliner	Hometown Trolley- Motiv Epic 6 (F-53)*(BEV)	5	$1,398	$15,308	>15	$76,539	547.68
Light Gas Bus	Glavel Universal - Ford E450	Starcraft Allstar- Motiv Epic 4 Dearborn*(BEV)	12	$4,700	$51,467	14	$617,604	2097.07
Light Gas Van	Chevrolet Venture	Chrysler Pacifica (PHEV)	1	$629	$5,653	5	$5,653	15.37
Light Gas Sedan	Honda Accord Hybrid	Toyota Prius Prime (PHEV)	1	$573	$5,152	3	$5,152	14.00
		Subtotal	**22**	**$9,805**	**$105,007**	**--**	**$557,448**	**3,117.00**

*Costs are for chassis only. Representative models have not been tested by Altoona.

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)**
Light Gas Sedan	Honda Accord Hybrid	Hyundai Ioniq PHEV	1	$540	$4,851	Immediate*	$4,851	13.19

TCT has access to low-cost, zero-carbon electricity from the New Melones Dam. As such, the Estimated Per-Vehicle Annual Fuel Savings; Vehicle Lifetime Savings; Estimated Payback Period; Total Class Lifetime Fuel Savings; and Total Class Lifetime GHG Savings reflects operating the vehicles using Tuolumne Public Power Agency energy. The following assumptions (Table 4) were incorporated in the above tables:

Table 4: Assumptions underpinning tables 3a and 3b (above).

Assumption	Value
Vehicle Service Life*	10 years
Gasoline Price ($/gallon)	$2.95
Gasoline GHG Intensity (kg CO2e/gallon)	8.78 kg
Diesel Price ($/gallon)	$2.70
Diesel GHG Intensity (kg CO2e/gallon)	10.21 kg
Electricity Price ($/kWh)	$0.110
Electricity GHG Intensity † (kg CO2e/kWh)	0 kg
*Vehicles are frequently kept longer than this value, providing further savings on fuel and GHG abatement	

In general, electric light-duty truck and SUV options are currently limited in the market, and therefore towing capacities, cargo volumes, and other specifications are not an exact match. 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, the upfront costs of purchasing a plug-in vehicle are significantly higher than comparable internal-combustion models. Tables 3a and 3b specify this incremental cost and include available federal and state rebates (where applicable) as a separate column. As government agencies cannot directly claim the federal tax credit, the only method of incorporating the federal PEV incentive is to lease the vehicle. The TCT's light-duty fleet is relatively small, and while additional financial savings may be realized if the vehicle is leased rather than purchased outright, the decision should be made on a case-by-case basis.

The vehicle replacement analysis used average fuel prices reported by TCT, 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.

TCT has significant opportunity to reduce operating costs and GHG emissions by pursuing BEV replacements. Newer model years should be lower priority than older vehicles but do represent similar opportunity for savings.

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

Other Considerations

The procurement of vehicles should be straightforward, and in many cases does not differ significantly from the procurement process for internal-combustion vehicles. More specialized applications (e.g. custom moderate-to-heavy duty and coach-bodied buses) may require direct communication with a manufacturer or an authorized retailer. Authorized retailers are typically listed on manufacturer websites. 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.

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.

TCT 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 in Section IV.

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.

Operating 22 total vehicles, TCT is classified as a small agency, with a rollout plan due on June 30, 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. The regulation includes a phased ZEB rollout requirement, illustrated in Table 5. Key plan elements include:

- Identification of zero-emission technologies targeted for deployment
- A plan for the 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

Table 5: 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 6. Important potential rule alterations are included.

Table 6: Alternative compliance options and potential rule changes

Alternative Compliance options		
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 ○ 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.		

V. Incentives

The California Energy Commission (CEC) and ARB offer alternative transportation grants and rebates through the Clean Transportation Program, formerly known as 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 Clean Transportation 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).

Vehicle Incentives

The calculations that underpin Tables 3a and 3b 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 7, *CVRP Rebate Amounts for Light-Duty Vehicles,* summarizes the rebates available.

Table 7: 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 8: 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 9. Maximum HVIP Voucher Amounts for *Hybrid* Trucks & Buses

Gross Vehicle Weight (in pounds)	HVIP Maximum Voucher
6,001 – 8,500 lbs	$2,000
8,500 – 10,000 lbs	$6,000
10,001 – 19,500 lbs	$9,000
19,501 – 26,000 lbs	$12,000
26,001 – 33,000 lbs	$15,000
> 33,000 lbs	$18,000

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.

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 10, below, outlines the range of costs for the first EVCS port (plug) installed at a given site. Table 11 outlines specific installation variables that are incorporated into the "installation" cost element shown in Table 10. Note that many buses use DC Fast Charging as their default charging method.

Table 10: 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 11: 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 two currently active funding programs for electric vehicle infrastructure. These programs include the FleetReady Program and Fast Charge 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).

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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