

UNITRANS ZERO EMISSION TRANSITION PLAN



September 20, 2022

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SECTION A: Transit Agency Information

1. Transit Agency's Name	University of California, Davis – ASUCD Unitrans
2. Mailing Address	1 Shields Avenue South Hall, Room 5 Davis, California, 95616
3. Name of Transit Agency's Air District	Yolo-Solano Air Quality Management District (YSAQMD)
4. Name of Transit Agency's Air Basin	Sacramento Valley
5. Total Number of Buses in Annual Maximum Service	35 (pre-pandemic) 25 (as of May 2022)
6. Population of Urbanized Area Transit Agency Services	76,948 (2020 American Communities Survey for Davis, CA Urbanized Area)
7. Contact Information	Jeff Flynn General Manager 1 Shields Avenue, South Hall Room 5 Davis, California 95616 530-752-2877 jfflynn@ucdavis.edu
8. Is your agency part of a Joint Group (13 CCR§2023.1 (d) (3))?	No, we are not part of a joint zero-emission group.

SECTION B: Rollout Plan General Information

1. Does your transit agency's Rollout Plan have a goal of full transition to zero-emission technologies by 2040 that avoids early retirement of conventional transit buses (13 CCR § 2023.1(d)(1)(A))?

Yes.

2. The ICT regulation requires 100% ZEB purchase in 2029. Conventional transit buses that are purchased in 2028 could be delivered in or after 2029. Please explain how your transit agency plans to avoid potential early retirement of conventional buses in order to meet the 2040 goal.

UC Davis and the City of Davis have strong commitments to carbon neutrality. As the City and University's local public transit provider, Unitrans is committed to purchasing only zero-emission buses (ZEB) starting in 2022. Unitrans plans on replacing each conventionally fueled bus with a ZEB at the end of their useful life. No early retirements are planned, and the entire fleet is scheduled to be zero-emission by 2033 depending on funding availability and other challenges.

3. When did your transit agency's board or governing body approve the Rollout Plan?

a. Rollout Plan's approval date: September 20, 2022

b. Resolution number: 22-147

c. Is a copy of the board approved resolution attached to the Rollout Plan submitted to CARB (13 CCR § 2023.1(d) (2))? TBD

4. Please provide contact information for CARB to follow up on details of the Rollout Plan, if needed.

a. Contact name: Jeff Flynn

b. Title: General Manager

c. Phone Number: 530-752-2877

d. Email: jiflynn@ucdavis.edu

5. Who assisted in creating the Rollout Plan?

UC Davis Unitrans staff worked with the UC Davis Design & Construction Management division and consultants including Fehr & Peers, Systra Group, and Laugenour & Meikle to review power demand and infrastructure requirements to inform the creation of this plan. Unitrans staff led the 10-year capital plan update which includes the future bus fleet procurement and replacement schedule. Unitrans staff also led review and creation of sections regarding Workforce Training, Potential Funding Sources, and Start-up and Scale-up Challenges.

SECTION C: Technology Portfolio

1. What type(s) of zero-emission bus technologies does your transit agency plan to deploy through 2040? (13 CCR § 2023.1(d)(1)(B))

Unitrans' long-term fleet management plan calls for pursuing a 100% battery electric fleet. As stated in Unitrans' Short Range Transit Plan and Transit Asset Management plan, all current and future capital funding needs prioritize vehicle replacement to zero emission technology and related infrastructure necessary to operate zero emission vehicles.

Unitrans intends to deploy Battery Electric Buses (BEBs) as our selected zero emission bus technology as of FY2021-2022. The transition to a full battery electric bus fleet will be dependent on the battery power storage improvements and possible space and power infrastructure constraints. Currently, BEBs have a nominal fully charged range of over 200 miles. However, real-life experience from peer agencies shows that current (FY2021-2022) BEBs get 165-175 miles between charges. Most daily Unitrans vehicle assignments operate for less than 165 miles per day. Pre-pandemic, the Unitrans maximum vehicles in service was 35 buses with 89% of vehicles (31 of 35 vehicle assignments) operating 165 miles per day or less. The average daily mileage was 118 miles. The maximum Unitrans FY2021-2022 daily bus mileage is 195 miles which is within the nominal range but not the real-life experienced range. If battery technology and real-life experienced mileage does not improve over time, fuel cell electric buses or an alternative future ZEB technology may need to be considered in the outer years of the fleet replacement plan to ensure a 100% ZEB fleet transition.

Table 1: Pre-Pandemic Vehicle Mileage Information (FY2019-2020)

Weekday Maximum Buses in Service	35	
Average Mileage per Vehicle Assignment	117	
Maximum Daily Mileage	195	
# of Assignments 100 Miles or Less	10	29%
# of Assignments 150 Miles or Less	29	83%
# of Assignments 165 Miles or Less	31	89%
# of Assignments 175 Miles or Less	33	94%

This plan assumes that the battery technology will continue to evolve and improve over time and that future BEBs will be able to accommodate a real-life operating range of 200+ miles per charge. Unitrans does not plan on opportunity charging or on-route charging at this time.

In addition, the transition to 100% BEBs assumes that the UC Davis power supply infrastructure will be upgraded over time to accommodate charging for the full Unitrans bus fleet and that Unitrans will be able to accommodate the charging infrastructure within the available facility footprint. Unitrans may be required to expand our current facility into the dirt lot occupied by UC Davis Fleet Services to the southeast corner of the facility to accommodate charging infrastructure. If the campus power supply cannot accommodate charging needs or the facility footprint cannot support the charging infrastructure, Unitrans may need to consider fuel cell electric buses or future alternative ZEB technology.

SECTION D: Current Bus Fleet Composition and Future Bus Purchases

Table 2 presents Unitrans fleet as of spring 2022. The Unitrans bus fleet includes three functional and one non-functional vintage London Double Decker Buses that are used in revenue service. These buses are not planned for replacement with ZEB technology or retrofit with a ZEB at this time. In addition, 13 of 25 2009 CNG buses are currently in a fully funded engine rehabilitation program through Cummins. The 13 buses are being fitted with new near-zero emission CNG engines, extending the useful life of the vehicles for six years. Six of 13 buses in the rehabilitation program are completed as of spring 2022.

Table 2: Current Bus Fleet Information (As of spring 2022)

Bus Model Year	Engine Model Year	Number of Buses	Fuel Type	Bus Type	Notes
1948-1954	No Engine	1	Diesel	Vintage Double Decker Bus	Not included in ZEB Plan / Under major refurbishment
1948-1954	2006	1	Diesel	Vintage Double Decker Bus	Not included in ZEB Plan
1948-1954	2008	1	Diesel	Vintage Double Decker Bus	Not included in ZEB Plan
1948-1954	1999	1	CNG	Vintage Double Decker Bus	Not included in ZEB Plan
2006	2006	4	CNG	Standard 40' Bus	Will be retired in 2022
2009	2009	17	CNG	Standard 40' Bus	Two will be retired in 2022
2009	2020	2	CNG	Standard 40' Bus	Engine Rehabilitation in 2020
2009	2021	6	CNG	Standard 40' Bus	Engine Rehabilitation in 2021
2009	2009	2	Diesel	Double Decker Bus	
2014	2014	3	CNG	Standard 40' Bus	
2017	2017	4	CNG	Standard 40' Bus	
2019	2019	2	Gasoline	Cutaway	
2019	2019	2	Diesel	Double Decker Bus	
2020	2020	5	CNG	Standard 40' Bus	
2022	2022	6	Battery Electric	Standard 40' Bus	Replace 2006 CNG Buses + 2 2009 CNG Buses

As stated previously, Unitrans plans to purchase only zero emission buses starting in 2022 with full fleet conversion to zero emission technology by 2033 depending on funding availability and other challenges

Table 3 presents the Unitrans expected future bus purchases, including the number of buses expected to be purchased by year. The future bus purchase table assumes a 12-year useful life for standard 40' buses, a 14-year useful life for modern double decker buses/high-capacity buses, and a 10-year useful life for cutaway vehicles. While Unitrans uses high-capacity double decker buses currently, Unitrans plans to study the feasibility of operating articulated buses in the future which may replace future double decker buses. In Table 3, high-capacity bus may include either a double decker bus or articulated bus and a replacement of some 40' standard buses for high-capacity buses is planned in the future. Note that Table 3 does not include any fleet expansion but shows a status quo fleet size. If expansion occurs in the future, Unitrans is committed to only purchasing zero emission buses. For the vintage London double decker fleet, Unitrans will need to review before the 2040 deadline to either retire, convert, or request exemption for the historic bus fleet.

The planned replacement year may not exactly correspond to the useful life to spread fleet purchases over many years to create a stable average fleet age.

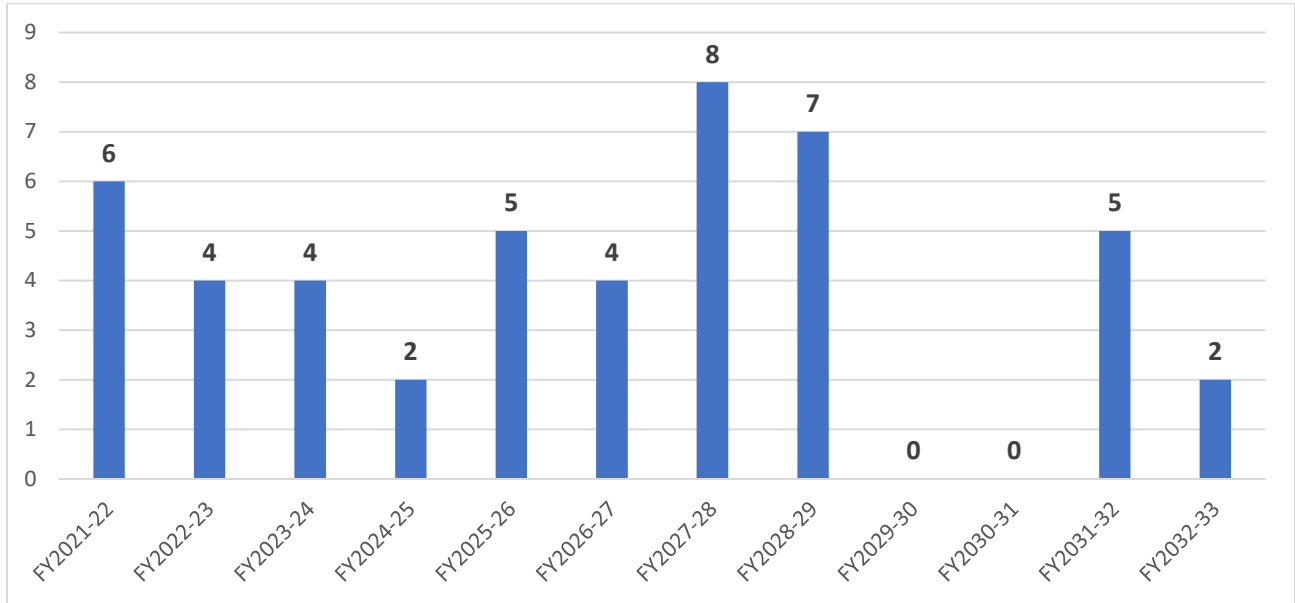
Table 3: Future Bus Purchases (Detailed)

Timeline (Year)	Total # of Buses to Purchase	# of ZEB Purchases	Percentage of Annual ZEB Purchases	ZEB Bus Type	ZEB Fuel Type	Number of Conv. Bus Purchases	Percentage of Annual Conv. Bus Purchases
FY2021-22	6	6	100%	Standard 40' Bus	Battery Electric	0	0
FY2022-23	4	4	100%	Standard 40' Bus	Battery Electric	0	0
FY2023-24	4	4	100%	4 Standard 40' Buses	Battery Electric	0	0
FY2024-25	2	2	100%	2 High Capacity Buses	Battery Electric	0	0
FY2025-26	5	5	100%	Standard 40' Bus	Battery Electric	0	0
FY2026-27	4	4	100%	Standard 40' Bus	Battery Electric	0	0
FY2027-28	8	8	100%	6 Standard 40' Buses 2 High Capacity Buses	Battery Electric*	0	0
FY2028-29	7	7	100%	5 Standard 40' Buses 2 Cutaways	Battery Electric*	0	0
FY2029-30	--	--	--	--	--	--	--
FY2030-31	--	--	--	--	--	--	--
FY2031-32	5	5	100%	Standard 40' Bus	Battery Electric*	0	0
FY2032-33	2	2	100%	High Capacity Bus	Battery Electric*	0	0

**If battery electric bus technology cannot support daily mileage requirements or power/space constraints cannot be overcome, Unitrans may need to consider alternative zero emission bus technology.*

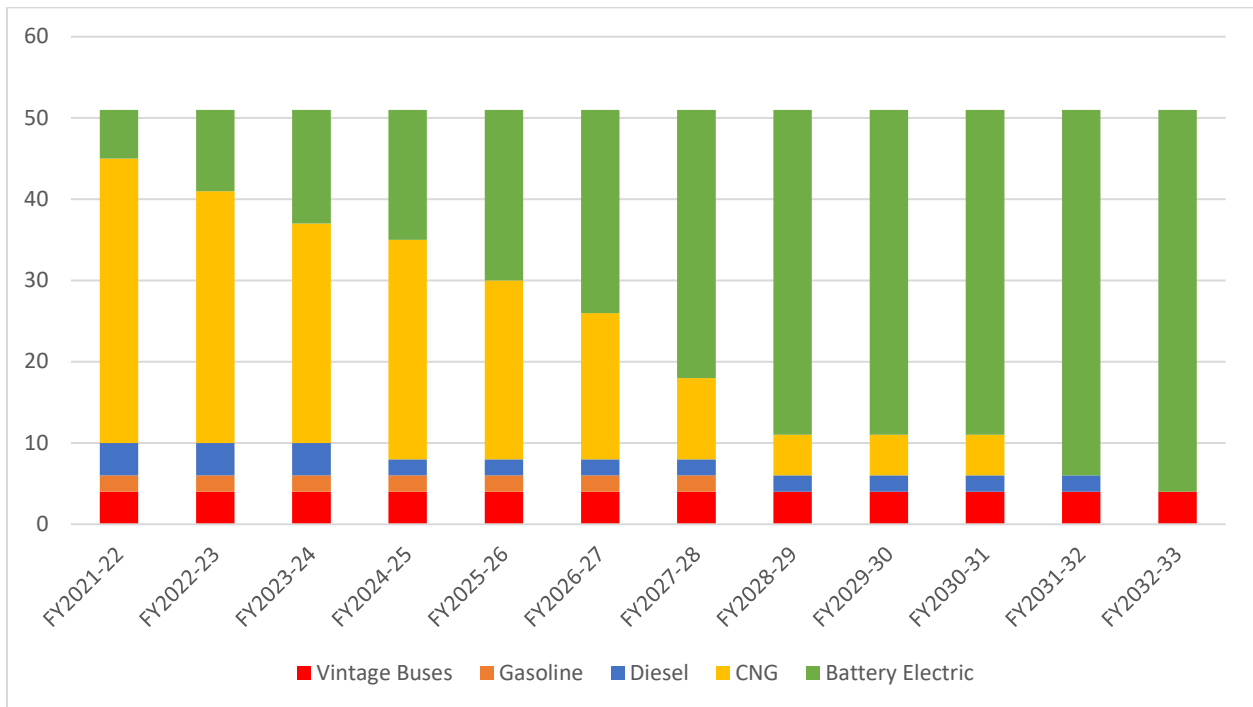
Chart 1 presents the number of planned zero emission bus purchases by year through FY2032-33 when full fleet transition to zero emission technology is expected. Chart 2 shows the make up of the fleet by engine technology through FY2032-33.

Chart 1: Planned Zero Emission Bus Purchases by Fiscal Year



Projected through FY2032-33 when conversion to zero emission buses is expected to be completed for all revenue vehicles except the four vintage London Double Decker buses.

Chart 2: Projected Fleet Composition by Fuel Technology by Fiscal Year



Projected through FY2032-33 when conversion to zero emission buses is expected to be completed for all revenue vehicles except the four vintage London Double Decker buses.

Following the same bus purchase schedule as identified in the Table 3, please identify in the Table 4 the required operational range your future zero-emission buses should have to be able to serve in your fleet. Please provide the estimated cost of each bus with that required operational range.

Based on pre-pandemic service levels and vehicle assignment mileage (shown in Table 5), Table 4 presents the required range for each projected ZEB purchase by year. Estimated cost per vehicle is based on the most current vehicle cost information that Unitrans has available with an inflation assumption of 5% through FY2023-24 and a 2.5% annual inflation rate starting in FY2024-25. Unitrans has the standard 40' battery electric bus cost locked in place through FY2023-24 under a contract with New Flyer of America for 14 battery electric buses.

Table 4: Range and Estimated Costs of Future ZEB Purchases

Timeline (Year)	# of ZEBs	Bus Type	Required Range (miles)	Estimated Cost of Each Bus
FY2021-22	6	Standard 40' Bus	150	\$950,000
FY2022-23	4	Standard 40' Bus	150	\$950,000
FY2023-24	4	4 Standard 40' Buses	150	\$950,000
FY2024-25	2	2 High-Capacity Buses	150	\$1,500,000
FY2025-26	5	Standard 40' Bus	150	\$1,100,000
FY2026-27	4	Standard 40' Bus	150	\$1,128,000
FY2027-28	8	6 Standard 40' Buses 2 High-Capacity Buses	150-165	Standard 40' Bus: \$1,156,000 High-Capacity Bus: \$1,825,000
FY2028-29	7	5 Standard 40' Buses 2 Cutaways	165+	Standard 40' Bus: \$1,185,000 Cutaway: \$220,000
FY2031-32	5	Standard 40' Bus	195+	\$1,245,000
FY2032-33	2	High-Capacity Bus	195+	\$1,276,000

Table 5: Pre-Pandemic Vehicle Assignment Mileage Information (FY2019-2020)

Required Mileage by Daily Assignment	# of Buses	# of Maximum Daily Peak Requirement
# of Bus Assignments 150 Miles or Less	29	83%
# of Bus Assignments 165 Miles or Less	31	89%
# of Bus Assignments 175 Miles or Less	33	94%

Is your transit agency considering converting some of the conventional buses in service to zero-emission buses (13 CCR § 2023.1(d)(1)(E))?

No. For buses purchased after 2005, Unitrans is not considering converting conventional buses to zero emission buses. Unitrans plans to replace buses purchased after 2005 with zero emission bus technology as they reach their useful life.

Unitrans may review and consider retiring, converting the fuel technology, or requesting an exemption to the ZEB requirement for the vintage London Double Decker bus fleet in the future.

SECTION E: Facilities and Infrastructure Modifications

Unitrans has one facility – our Operations and Maintenance Facility located at 800 Garrod Drive in Davis, California on UC Davis campus. The facility is where all buses park and where all operations, maintenance, and fueling is performed.

The Unitrans facility has a parking capacity of up to 50 buses¹ and is constrained on all sides by university facilities and infrastructure except to the southeast corner of the facility. To prepare for a future 100% battery electric bus fleet, in 2019, Unitrans hired Fehr & Peers to provide conceptual parking plans and cost estimates for electric bus charging infrastructure. The conceptual plans reviewed how chargers and infrastructure could be arranged to accommodate a future full battery electric bus fleet. In 2021, the concepts were updated to provide concepts and cost estimates if the facility is expanded to the southeast.

Based on the current facility footprint and infrastructure needs to accommodate electric chargers for each bus, the Unitrans facility footprint may need to be expanded or parking capacity may be reduced. The current facility footprint can also not support any fleet expansion.

Based on the future fleet purchasing timeline and conceptual parking and infrastructure plans, the electric charging infrastructure construction plan is split into three phases.

Phase 1 constructed and installed the chargers and infrastructure for an initial 14 battery electric bus roll-out. The underground and power infrastructure were completed in December 2020 and the 14 chargers were installed in April 2022. This will accommodate the current Unitrans bus fleet and planned battery electric bus purchases through 2024. The estimated project cost is \$5.5 million.

Phase 2 is currently planned to expand the Unitrans facility footprint slightly to the southeast and current options provide for 11-17 additional bus parking and charging stations with the option of accommodating up to 60' articulated buses. Phase 2 is contingent on the University allowing Unitrans to expand into the dirt lot adjacent to the Unitrans facility that is currently assigned to UC Davis Fleet Services. No land acquisition would be required but reassignment of the right-of-way is required by the University. This plan would accommodate possible future fleet expansion and account for any parking loss from charging infrastructure in the main Unitrans bus parking area located on the northern half of the Unitrans facility. This phase is planned to occur in 2024-2026 to accommodate the arrival of new battery electric buses in FY2025-26. The estimated project cost is \$3.5 million to \$5.0 million.

Phase 3 will expand charging infrastructure into the northern half of the Unitrans facility and will support a full 100% battery electric bus fleet. This phase is planned for 2027-2028 when future fleet purchases require additional chargers. To reduce possible parking loss by chargers, Unitrans staff will be pursuing reviewing the feasibility of an overhead charging gantry. Current concepts show parking loss of two to 12 spaces. Any lost parking capacity will need to be added elsewhere.

¹ The Unitrans facility can accommodate parking for 48 standard 40' buses and two cutaways. Note that Unitrans has 49 buses and two cutaways. One vintage London Double Decker bus is parked inside the maintenance facility and undergoing a long term refurbishment.

In addition to the on-site improvements, the University may need to upgrade other electrical infrastructure to accommodate the electrical load to charge the bus fleet and other University electricity demand changes.

Table 6: Facilities Information and Construction Timeline

Division/Facility Name	Address	Main Function	Type of Infrastructure	Service Capacity	Needs Upgrade? (Yes/No)	Estimated Construction Timeline
Unitrans Operations & Maintenance Facility	800 Garrod Drive Davis, California	Bus Operations & Maintenance	Electric Chargers (Depot Charging Only)	51 Buses	Yes	Phase 1: Support 14 Buses (Completed) Phase 2: Supports 11-17 buses (2024-2026) Phase 3: Supports charging remainder of fleet (2027-2028)

Do you expect to make any modifications to your bus parking arrangements? Explain the modifications and why they are needed.

Do you expect to need additional parking spaces for completing the transition to zero-emission technologies?

Parking Capacity Changes Compared to 2022 Capacity:

- With Phase 1, there was no change in parking capacity. Parking arrangement was changed from perpendicular pull in/back out spaces in the southeast corner of the facility to angled back in/pull out spaces. The changes were necessary to keep the Phase 1 infrastructure within Unitrans’ current facility footprint and accommodate the space needed for the chargers.
- With Phase 2, up to an additional 11 to 17 parking spaces are added to the facility by expanding parking to the dirt lot to the southeast of the Unitrans facility. Expanded parking may be necessary based on possible parking loss in Phase 3 and possible future fleet expansion needs. This phase would add either angled pull in or angled back in spaces to minimize space needs.
- With Phase 3, possible loss of up to eight parking spaces. Depending on the Phase 3 layout, parking loss of two to 12 spaces may occur. Through use of an overhead gantry system, parking loss may be minimized or eliminated. The parking arrangement would be the same as today under current concepts.
- Net parking change: -1 to +15 parking spaces from 2022 capacity depending on the parking arrangements and charging infrastructure.

Please identify the propulsion system (e.g. diesel, CNG, battery electric, fuel cell) of all buses that will be dispatched from the facilities identified.

All buses dispatched from the Unitrans Operations and Maintenance Facility are currently gasoline, CNG, diesel, and battery electric. Future modern fleet purchases are planned to be 100% battery electric by 2033 however Unitrans may still have up to four vintage London Double Decker Buses that operate with diesel or CNG.

The Unitrans Operations and Maintenance Facility is not located in an NOx Exempt Area.

Please identify the electric utilities in your transit agency's service area.

UC Davis primarily supplies its own power on a microgrid. This is supported by the local power and gas utility, Pacific Gas and Electric (PG&E). The University and PG&E coordinate as needed. However, the University is the primary power supplier for electricity on UC Davis campus and coordinates infrastructure needs internally. As Unitrans is part of the University, internal coordination is continuous. PG&E will be engaged as needed on fleet electrification efforts. Unitrans and University does not foresee future close coordination with PG&E.

Section F: Providing Service in Disadvantaged Communities

Unitrans does not serve one or more disadvantaged communities as listed in the latest version of CalEnviroScreen.

SECTION G: Workforce Training

Please describe your transit agency's plan and schedule for the training of bus operators and maintenance and repair staff on zero-emission bus technologies (13 CCR § 2023.1(d)(1)(G))

The transition to an all ZEB fleet will significantly alter Unitrans service and operations due to different maintenance needs, operational best practices, and the change in technology. The conversion to battery electric buses from the existing traditional internal combustion engine is logistically complicated and will impact all aspects of Unitrans' transit service. Unitrans has known skill gaps on electrical systems related to battery-electric bus propulsion, operations and maintenance of chargers, and computer systems related to the increasing number of technologies driven equipment on the buses and chargers.

The original equipment manufacturer (OEM) of the ZEB equipment (e.g., bus, charge management software, battery charging equipment, etc.) will provide training prior to operations of the zero emission buses. For initial battery electric bus roll-out, New Flyer of America will provide operator training materials and extensive hands-on maintenance training and materials. Maintenance mechanic training embodies imperative technical bumper to bumper training focusing on preventive maintenance, high voltage hazards, personal protective equipment (PPE), component training, lock-out/tag-out inspections, diagnostic/troubleshooting, and charging/refueling source training. Proficiency in high voltage safety and proper use of PPE is required to minimize the risk of electrical shocks and arc flashes.

Initial roll-out training by New Flyer of America is a multi-day program that all career mechanics will be required to attend. Student mechanics will be trained by Unitrans career maintenance staff. For each bus purchase, Unitrans will work with the OEM to provide classroom and hands on training to maintenance staff to maintain the vehicles properly and safely.

For operations, training management will develop, and train training staff based on OEM information and provide familiarization training to all drivers. Types of internal driver training courses include Driver Refreshers, Bus Familiarization, New Operator, and New Bus Training. Bus driver training incorporates pre-trip inspections, door operators, emergency equipment operator, steering, operational concerns, DMV pre-trips, bus components and other related bus functions, and operations technology. Transit supervisors will receive additional troubleshooting training and emergency procedure training.

For the charging infrastructure, Unitrans facilities management staff will also receive extensive training from the charger OEM for each phase of the zero-emission transition plan. Charging infrastructure training incorporates emergency shut off procedures and monitoring systems and will be provided by the OEM (ABB). Transit supervisor will also receive training on chargers which will focus on how to connect and disconnect buses safely from chargers and emergency procedures whereas maintenance training will provide more background on day-to-day charger operations and monitoring.

In addition to Unitrans staff, Unitrans staff will work with the OEMs to provide UC Davis and City of Davis first responders training on emergency procedures for the battery electric buses.

Training will occur prior to implementation of new bus fleet and new technologies. Refresher training will occur annually. As needed training will be identified and implemented based on

needs. Unitrans does not foresee a need to displace the existing workforce as zero emission technology is deployed.

SECTION H: Potential Funding Sources

Please identify all potential funding sources your transit agency expects to use to acquire zero-emission technologies (both vehicles and infrastructure) (13 CCR § 2023.1(d) (1) (H)).

Unitrans aggressively pursues discretionary funding for fleet replacement, rehabilitation, and infrastructure programs as well as saves a portion of federal formula funding when possible to capital reserves dedicated to specific planned fleet and infrastructure programs.

Unitrans plans to use a diverse range of funding comprised of formula and discretionary programs to fund our continued roll-out of zero emission buses. By not relying on one or two sources, Unitrans believes that we will be able to successfully fund a 100% zero emission bus fleet. Funding for the Phase 1 battery electric bus program which includes implementation of 14 battery electric buses and associated infrastructure is completed.

Unitrans will continue to work closely with partners at the City of Davis, UC Davis, the Sacramento Area Council of Governments (SACOG), the Yolo Solano Air Quality Management District, and other partners to identify and pursue funding.

Feasible Funding Sources for the Unitrans Zero Emission Bus Program

- Federal Transit Administration (FTA) 5307 Urbanized Area Formula Funds
- FTA 5339 Bus and Bus Facilities Formula Program
- FTA 5339 Bus and Bus Facilities Discretionary Program
- FTA 5339 Low or No Emission Vehicle Discretionary Program
- Sacramento Area Council of Governments (SACOG) Regional Discretionary Program
- California Congestion Mitigation Air Quality (CMAQ) Program
- Air District Discretionary Grant Funding through Yolo Solano Air Quality Management District (YSAQMD) and Sacramento Metropolitan Air Quality Management District (SMAQMD)
- Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) Funding
- California State Senate Bill 1 – State of Good Repair (SGR) Funding
- California State Low Carbon Transit Operations Program (LCTOP) Funding
- UC Davis Undergraduate Student Fee funds (annual, stable, dedicated funding for capital projects provided directly through student fees to Unitrans for local match funding)

For illustrative purposes, below is a summary of the diverse funding sources used for the first 14 battery electric buses and the bus charger procurement and installation. Note that the information presented below does not include the underground electrical infrastructure and other facility improvements implemented for the Phase 1 ZEB rollout.

Table 7: Funding Sources Used to Date

Source	Total
FTA 5307 Urbanized Area Formula Funding	\$3,655,971
FTA 5339 Bus & Bus Facilities Formula Funding	\$731,308
FTA 5339 Bus & Bus Facilities Discretionary Funding	\$3,760,000
California LCTOP Funding	\$170,429

SACOG Regional Discretionary Program Funding	\$2,523,000
UC Davis Undergraduate Student Fee Funding	\$3,071,915
Bus Procurement Total	\$13,912,623
FTA 5307 Urbanized Area Formula Funding	\$247,780
Congestion Mitigation Air Quality (CMAQ) Program	\$738,317
Air District Discretionary Grant Funding from Sacramento Metropolitan Air Quality Management District (SMAQMD)	\$986,097
Electric Charger Total	\$1,972,194

The Phase 2 electrification effort is expected to cost \$8.5 million in chargers and related infrastructure to support up to 16 buses. The buses are expected to cost between \$1 million and \$1.5 million each. As stated previously, Unitrans plans to follow an aggressive funding strategy to pursue as many discretionary programs as possible to fund the program. As with Phase 1, the focus will be to fund the infrastructure first and then the buses to ensure the buses can charge when they are procured.

Source	Total
FTA 5307 Urbanized Area Formula Funding	\$4,800,000
UC Davis Undergraduate Student Fee Funding	\$1,700,000
Funding TBD	\$2,000,000
Electric Chargers and Infrastructure	\$8,500,00
Congestion Mitigation Air Quality Funding (CMAQ)	\$2,656,000
UC Davis Undergraduate Student Fee Funding	\$344,000
Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) Funding (\$125,000/vehicles)	\$2,000,000
Funding TBD	\$11,000,000- \$19,000,000
Bus Procurement Total	\$16,000,000- \$24,000,000

Cost estimates are not known at this time for Phase 3 which will fully convert the fleet to zero emission technology but are assumed to be approximately the same as the Phase 2 project dependent on inflationary pressure and external factors.

SECTION I: Start-up and Scale-up Challenges

Please describe any major challenges your transit agency is currently facing in small scale zero-emission bus deployment.

Please describe any challenges your transit agency may face in scaling up zero-emission bus deployment.

For the initial Phase 1 14-bus implementation, Unitrans does not expect any short term, small scale zero emission bus deployment issues. As Unitrans implements future zero emission vehicles beyond Phase 1, Unitrans expects numerous challenges. Funding is the primary driver that may impact timeline however other challenges may impact our ability to rely solely on battery electric bus technology and may require Unitrans to consider fuel cell electric buses or alternative future zero emission technology.

Funding: Unitrans relies on a mix of formula and discretionary funding for capital programs. Implementation of a 100% zero emission bus fleet will require a significant capital investment. Funding is often subject to economic conditions and as a result, can be unpredictable resulting in uncertainty in our ability to meet the timelines presented in this plan.

Space Constraints: The Unitrans Operations and Maintenance Facility is constrained by other university facilities on all sides. Current battery electric bus charging infrastructure requires space and will result in lost parking capacity. With parking already 100% utilized, Unitrans cannot lose any parking to infrastructure and may need to expand its facility footprint. If space constraints prevent full battery electric bus implementation, alternative technologies like fuel cell electric buses may need to be considered to minimize the facility footprint.

Power Supply: Future charging demand and university power needs may require upgrading UC Davis campus power infrastructure. The feasibility of upgrading electrical infrastructure is unknown at this time. If power supply in future years becomes an issue, alternatives to a 100% battery electric bus fleet may need to be considered.

Vehicle Range Expectations: While 89% of current Unitrans vehicle assignments are projected to be comfortably supported by today's battery electric bus technology, the plan assumes battery range will improve over time. If this does not occur, Unitrans will need to consider fuel cell electric buses or other future technologies.

Policy and Legislation Considerations: The current legislative and policy climate in California and federally is supportive of adopting zero emission technologies and there are many programs that help pay for the transition. These programs include the State of California Hybrid & Zero-Emission Truck & Bus Voucher Incentive Program (HVIP) which provided a 10-20% discount for new zero emission vehicles and the Bipartisan Infrastructure Law which includes temporarily increasing formula funding and discretionary grant funding. If the funding and policy climate changes, Unitrans would reconsider replacing all future bus purchases with zero-emission vehicles and would instead look to extend the life of our older compressed natural gas and diesel buses or purchase new fossil-fuel powered vehicles which are lower cost and require no new infrastructure.