



CTE Statement of Work & Budget

This Statement of Work details the phases that will be performed to deliver the City of Lawrence's "Electrify Lawrence Transit" - Battery-Electric Bus Deployment Project. This is a Low-No project. Low-No projects require these primary phases to guide successful execution of the proposed project objective and scope. This plan also includes CTE's project control and risk management procedures to guide the effective and efficient management of this project. Many of the components of CTE's Project Management Plan incorporate elements of FTA's Quality Management System. Each phase includes the estimated schedule, payment type and value, milestone deliverables, and a description of the services provided for that phase. A summation table of the phases can be found at the end of this attachment.

Phase 1: Project Planning and Initiation

Estimated Schedule: October 1, 2020 – October 29, 2020

Payment: One Time Payment of \$25,000

Milestone Deliverables:

- ***Project Kickoff Meeting and Materials***
- ***Project Management Plan (Timeline, Milestones, Roles and Responsibilities, and Goals)***

CTE will support the project team in project planning related activities. This phase will result in a formal kick-off of the project with all stakeholders and project team members to align the project team on tasks, assignments, timelines, and expectations to successfully meet project goals and objectives.

Phase 2: Requirements Analysis

Estimated Schedule: November 2, 2020 – March 1, 2021

Payment: One Time Payment of \$55,000

Milestone Deliverables:

- ***Route Modeling Results Presentation***
- ***Charge Modeling, Rate Modeling, and Cost Results Presentation***
- ***Operating and Charging Recommendations Document, including Planned Deployment Strategy***

This phase includes bus modeling, route simulation, charge modeling, rate modeling, and confirmation of the technical specifications for the bus and charging equipment. CTE will model



Lawrence Transit's routes and the GILLIG battery-electric bus to predict the performance of the bus on the selected route. The model uses powertrain simulation software developed by Argonne National Laboratory called Autonomie. The software was developed for the heavy-duty trucking industry and modified by CTE specifically for zero-emission transit buses. CTE will collect data on route by riding the route on an existing Lawrence Transit bus with a GPS data logger to capture time, distance, speed, acceleration, GPS coordinates, and grade. CTE will also collect local environmental conditions, passenger loading profiles, route planning details, and blocking schedules from the agency. CTE will use this data, along with specifications for the GILLIG bus, to simulate bus operations on the selected route. CTE will also simulate various charging scenarios to inform charging equipment decisions. The results of the simulation provide Lawrence Transit with a performance evaluation, range analysis, grid power connection requirements, and energy consumption model that can be used as a guide in making operational decisions and inform equipment specifications.

Additionally, CTE will develop a rate model to assess potential electrical loads, consumption, and estimated "fuel cost" of the proposed service. The results of the route, charge, and rate modeling will be presented to Lawrence Transit and GILLIG to determine if any changes are required to the bus specifications, routes, or passenger service schedules in order to optimize bus operations and operating costs.

Phase 3: Bus Procurement and Build

Estimated Schedule: March 3, 2021 – May 30, 2022

Payment: One Time Payment of \$7,500

Milestone Deliverables:

- ***Bus Specifications***

CTE will assist Lawrence Transit as they finalize the bus and fueling specifications and other documents required for bus procurement. Lawrence Transit and GILLIG will execute a procurement contract for the buses awarded through the Low-No program. GILLIG will submit their final design for Lawrence Transit's approval before proceeding with production. Lawrence Transit and CTE will participate in a pre-production meeting at GILLIG's facilities to confirm the design, and review quality control, quality assurance, and production procedures that will be in place for this order. If needed, CTE (or Lawrence Transit) may engage the services of external vendors to complete the resident inspections, quality assessments, and Buy America audits.



Phase 4: Infrastructure Procurement, Design, and Build

Estimated Schedule: May 3, 2021 – March 28, 2022

Payment: One Time Payment of \$7,500

Milestone Deliverables:

- ***Technical Specifications for Depot Chargers and On-Route Fast Chargers***
- ***Review of Charger RFP and Procurement Documentation***

If not included with the GILLIG contract, CTE shall work with Lawrence Transit to specify and purchase charging equipment. CTE will also work with Lawrence Transit for the procurement of design and construction services for installation of charging equipment. CTE and GILLIG will work with Lawrence Transit during this phase to finalize site plans for the on-route and/or depot charging stations. The project team shall also meet with the utility to review charging requirements and site plans to ensure there are no issues with meeting power requirements. Lawrence Transit will coordinate with KU Facilities and Development for site engineering (including civil, electrical, and mechanical), permitting, construction, and equipment installation, as needed. Once the site preparation is completed and the charging equipment has been installed, the charging station contractor shall coordinate site inspection by the utility and the City of Lawrence. GILLIG will commission the equipment for charging operations.

Phase 5: Bus and Infrastructure Deployment

Estimated Schedule: May 2, 2022 – July 28, 2022

Payment: One Time Payment of \$20,000 upon Completion of Performance Validation

Milestone Deliverables:

- ***Performance Validation Test Plan***
- ***Performance Validation Test Results Report***
- ***Updated Route Models and Operating and Charging Recommendations Document***

Delivered buses will be registered and insured by Lawrence Transit. GILLIG will commission the buses through a series of tests to ensure the buses can be fueled properly with the depot charging equipment. During this phase, Lawrence Transit staff receives the necessary training to operate and maintain the vehicles and fueling equipment. Training will be coordinated through GILLIG. Tests to validate the performance and operation of the buses and chargers also occur during this phase. These tests will include route validation, where buses are operated along the planned route under controlled conditions (temperature, AC load, passenger load, traffic patterns, etc.) to validate the bus against the performance specification and/or modeling results. Next, Lawrence Transit may conduct a Full-Service Validation where buses are placed in shadow service for a period acceptable



to Lawrence Transit to demonstrate full operational capability. Once buses and the charging stations have completed testing and acceptance by Lawrence Transit, they will be transitioned into passenger service.

Phase 6: Deployment Validation and Key Performance Indicators

Estimated Schedule: May 31, 2022 – August 29, 2023

Payments: Twelve Monthly Payments of \$6,000 (Total of \$72,000)

Milestone Deliverables:

- **Monthly KPI Reports**

CTE will collect various data points to measure operational performance and realized benefits (i.e. actual energy savings, cost savings, and greenhouse gas emissions reductions) resulting from deployment of zero-emission buses into passenger service. The data will be used to generate a series of Key Performance Indicators (KPIs) to validate performance of zero-emission buses against other buses in Lawrence Transit's fleet. KPIs may include availability, reliability, energy efficiency, fuel costs, and maintenance costs. By tracking and analyzing these KPIs, Lawrence Transit and FTA may assess the overall impact and benefits of zero-emission buses. Data logging hardware and data access services shall be supplied by CTE, GILLIG, the charging equipment vendor, and/or a third-party vendor under subcontract to a named project partner, and implemented prior to bus delivery to ensure that accurate and effective data is collected. A more detailed explanation of this plan can be found in the *Phase 7: Project Management, Administration, Reporting, and Control* section of this attachment under the *Operational Analysis & Reporting Plan* heading.

Phase 7: Project Management, Administration, Reporting, and Control

Estimated Schedule: October 1, 2020 – November 28, 2023

Payment: Eleven Quarterly Payments of \$15,000 each (Pre-Deployment) and 5 Quarterly Payments of \$3,000 each (Post-Deployment)

Milestone Deliverables:

- **Weekly Meeting Agendas and Meeting Minutes**
- **Project Memos, as needed**
- **Project Presentations, as needed**
- **Quarterly Management Reports (QMRs)**
- **Final Report**



CTE will guide the entire project by the control and risk management procedures detailed below. CTE's centralized management of the work program will enable team members to concentrate on exceeding project goals and ensure production of deliverables in a clear and well-coordinated manner. Details of CTE's processes for ensuring the efficient accomplishment of these tasks are as follows:

- *Coordinating Regular Meetings and Information Sharing between Project Partners and Stakeholders* — CTE will coordinate regular, timely and appropriate meetings with the needed staff. This will include recurring status meetings, as well as focused workshops and other events. Meeting coordination includes detailed agendas, meeting minutes and follow-up. These meetings and communications reduce effort required from agency's staff, increase transparency, and ensure that the agency's interests and goals are prioritized and fulfilled throughout the project term.
- *Advocating for the Transit Agency's Interests* – CTE will act as an advocate and advisor solely focused on Lawrence Transit's interests and concerns. CTE's 25 years of expert experience in electric vehicle technology is crucial when considering the unique requirements of battery electric bus system planning, design, and construction. CTE's unbiased experience and broad network of industry contacts results in rapid and impartial guidance, helping transit agencies select the technology that will best suit their needs and avoid pitfalls of electric bus implementation without being beholden to the bus manufacturer. CTE has proven experience in ensuring transparency on the capabilities, operation, and maintenance of battery electric buses, and ensuring that the final buses meet all specifications and service requirements.
- *Tracking Project Tasks, Risks, Budget and Timeline* — CTE will develop and maintain the project schedule, and ensure that all milestones and deliverables are completed effectively and on time. CTE will also rigorously track and drive the resolution of project risks and action items to ensure project success. The Risk Management and Mitigation Plan (detailed below) ensures timely resolution of critical tasks and active mitigation of project risks.

Additionally, after one year of deployment, CTE will issue a final report summarizing project results, findings, and lessons learned. Lawrence Transit will close out the projects with FTA.

CTE will guide the project by the project and risk management procedures detailed below.



Collaboration Tools

CTE will provide an online, cloud-based, collaborative project management website to share project files and communications, coordinate tasks, track issues, and maintain project calendars.

Communications Plan

Team members will participate in weekly or bi-weekly conference calls to discuss project status and current issues. CTE will schedule and manage the calls using calendar invites. Meeting minutes will be taken and stored on the project website to ensure open access to the proceedings. WebEx will be employed when team members desire a presentation format to share status updates. CTE will schedule additional conference calls with team members, as needed.

Reporting Plan

CTE will provide Lawrence Transit with Quarterly Management Reports (QMRs). The QMRs provide a summary of project status, progress and accomplishments of the previous quarter and projections for the remainder of the project. The QMR will be structured to allow Lawrence Transit to easily incorporate the information into the required FTA Quarterly Report submitted by Lawrence Transit. The QMR will document project progress and activities as well as describe any known risks and plans for mitigation.

CTE will compile the QMRs with input from team members. CTE will provide team members with a QMR template that will include:

- summary narrative of accomplishments by task/milestone during the period,
- estimated percent completion and expected completion date of each task/milestone,
- significant events affecting progress and discussion of project variances, and
- projected activities for the next quarter.

Operational Analysis and Reporting Plan

CTE will collect, analyze, and report on Key Performance Indicators (KPIs) to help track and analyze the performance of the zero-emission buses. These indicators, when combined, will allow Lawrence Transit and FTA to fully understand operational metrics to determine if the projected benefits have been realized from the deployment of the zero-emission buses, including impact on emissions, reductions in fuel consumption and cost, and reductions in maintenance and costs. The analysis will also help to understand any impact that charging of zero-emission buses or range limitations may have on service levels, operations, and



performance. By tracking and analyzing these KPIs, Lawrence Transit and FTA will be fully informed regarding the overall impact of the zero-emission buses.

CTE will conduct a reporting workshop with Lawrence Transit to determine the KPIs they wish to capture and the procedures for collecting data. The following KPI's are a sample of the type of information may be analyzed and tracked:

1. **Agency Energy Performance & Fuel Efficiency:** Agency energy performance will provide an overall energy consumption and fuel efficiency comparison (with diesel, CNG, LNG, LPG, as applicable) pre- and post-zero-emission bus deployment. Overall CO₂ emissions will also be compared.
2. **Fuel Cost:** The fuel cost analysis will provide information regarding the cost of either charging or fueling with hydrogen for the zero-emission buses operating on the chosen routes compared to the cost of operating a non-electric fleet on the same routes.
3. **Maintenance Costs:** The maintenance cost analysis will compare maintenance activities, time, and cost for the zero-emission buses against the transit agency's non zero-emission fleet
4. **Availability:** The bus availability data will be analyzed to determine the overall availability (i.e. uptime) of the zero-emission buses versus non zero-emission fleet.

Schedule Control Plan

CTE developed a high-level schedule as part of this proposal that includes estimated durations for all project phases. During the project's Planning and Initiation phase, CTE will work with each team member to develop a detailed schedule. Based on each team member's inputs, CTE will identify the critical path for the plan and identify any project plan risks. CTE will be responsible for maintaining the overall schedule with input from team members.

Team members will manage the detailed schedule for their assigned tasks and report schedule status for each regular team call. If the actual progress for a task is determined to be behind the planned schedule, CTE will determine if corrective action must be made based on the schedule variance, the amount of work remaining, the impact on other tasks, and impact on the overall schedule. Corrective action, if necessary, will be identified during the team conference calls.

Risk Management and Mitigation Plan

CTE provides strong and engaged oversight of project progress through the suite of management controls and procedure outlined above. CTE's management method ensures



quick recognition of any project risks that arise. CTE's project approach includes identifying, documenting, and tracking issues. Issues are assigned to project team members for research, analysis, and resolution. Issues and related tasks are prioritized to ensure that project team members remain focused on the right activities at the right time. Critical issues that remain unresolved or proposed solutions that impact project timeline, scope, budget or resources are escalated to Lawrence Transit management for immediate attention.

After the data collection period is over, CTE will issue a final report summarizing project results, findings, and lessons learned. Lawrence Transit will close out the project with FTA.



Phase Milestone and Budget Summation Table:

<i>No.</i>	<i>Phase Title</i>	<i>Milestone Deliverables</i>	<i>Billing Frequency</i>	<i>Lawrence Transit Cost per Installment</i>	<i>No. of Installments</i>	<i>Lawrence Transit Total Cost</i>
1	Project Planning and Initiation	Project Kickoff Meeting	One Time	\$25,000	1	\$25,000
2	Requirements Analysis	Modeling Results and Recommendations	One Time	\$55,000	1	\$55,000
3	Bus Procurement and Build	Bus Specifications	One Time	\$7,500	1	\$7,500
4	Infrastructure Procurement, Design, and Build	Charger Specifications and RFP Technical Review	One Time	\$7,500	1	\$7,500
5	Bus and Infrastructure Deployment	Validation Testing Report	One Time	\$20,000	1	\$20,000
6	Deployment Validation and Key Performance Indicators	Monthly KPI Reports	Monthly	\$6,000	12	\$72,000
7	Project Management, Administration, Reporting, and Control	Quarterly Management Reports and Final Report	Quarterly	\$15,000 \$3,000	11 5	\$180,000
<i>TOTAL CTE Budget:</i>						<i>\$367,000</i>