Appendix 1. Scope of Work for Feasibility Strategy

Scope of Work and Planned Deliverables:

- Scope includes three (3) tasks that will provide a thorough assessment and recommendation on the optimal steps to approach electrification, including:

    - Task 1 – Route Modelling and Schedule Optimization;
    - Task 2 – Facility Assessment;
    - Task 3 – Full Fleet Electrification Transition Plan; and

Task 1 – Route Modelling and Schedule Optimization

Route modelling:

- Predictive energy consumption modelling along all routes or blocks within the transit network, using current service schedules, to determine range requirements and expected operating energy efficiency. Model includes a review of existing conventional and specialized transit fleet, service schedules, annual vehicle mileage, annual fuel consumption, and consideration of a new facility location.

- Modelling includes various BEB manufacturer models as requested as well as considerations for seasonal variation, route topography, passenger loads, road speeds, auxiliary HVAC loads, battery degradation, and other relevant considerations.

- Modelling outputs identify:

    - (1) Percentage of routes or blocks that could be electrified using in-depot charging and with no modifications to the service schedule;
    - (2) Percentage of routes of blocks that could be electrified using in-depot charging and with modification of the service schedule to include layover times for mid-day charging; and
    - (3) Percentage of routes or blocks that would require high-powered opportunity charging to be electrified.

Schedule optimization:

- Modelling tool to optimize service schedules to accommodate electrification, based on existing and planned facility locations. The service schedule shall be optimized to maximize BEB operations using only in-depot charging, with on-route charging strategies only used where in-depot charging is not feasible.
- Model to consider service growth projections, route/block assignments, service levels, bus redundancy, staff availability, and any other relevant considerations.

Deliverables for Task 1 include:

1. Recommendation on the optimal battery sizes required for BEB vehicles, considering the trade-off between range requirements and the additional cost, weight and size of larger battery packs.
2. Phased and optimized service scheduled for electrification, including the recommended charging schedule for all buses.

3. Recommended phased approach for BEB route/block assignment, based on the ease of electrification for each route/block. The phased approach should correlate to the schedule of planned vehicle procurements and facility upgrades, clearly indicating which routes/blocks each BEB should be deployed on as it enters service.
4. Identification of location and quantity of chargers if high-powered opportunity charging is required for electrification.
5. Identification of any subset of routes/blocks that are not feasible to electrify based on the range constraints of current-day technology.

Task 2 – Facility Assessment

- Review of proposed Milton Transit fleet facility, including a review of site drawings and facility records.

- Evaluation of constraints and capabilities to support fleet electrification and review of site servicing plans to determine necessary upgrades for fleet electrification infrastructure.

- Assessment for Task 2 focuses on the planning for a new transit facility that will be designed and built to support the transition to an electric fleet. The assessment includes a comparative analysis of multiple in-depot charging systems to determine the optimal alternative.

- Assessment includes considerations such as:

    1. Fleet breakdown (e.g. vehicle type and service, maintenance spares, relief buses).
    2. Forecast and projected plans for service, fleet, and facility expansion and/or facility relocation.
    3. Historical power and energy loads and future projections.
    4. Evaluation of space availability in the facility to accommodate electric buses and charging systems.
    5. Evaluation of required structural reinforcements to support additional fleet and infrastructure weight (e.g. floor concrete, roof structure).
    6. Any other bus storage, maintenance, accessibility, or other considerations deemed relevant.

- Engagement with local electricity distribution company (Milton Hydro) to determine power capacity of existing grid infrastructure and evaluation of necessary infrastructure upgrades and/or plans to accommodate a BEB fleet. The study shall evaluate the back-up power requirements to support a BEB fleet based on the risk tolerance and back-up power duration requirements. The costs and benefits of using battery storage systems and rooftop solar panels shall also be evaluated for added resiliency, cost savings, clean energy, and opportunities to sell power back to the electricity grid.

- If high-powered opportunity charging is deemed necessary for electrification, the study shall assess site(s) where on-route charging may occur. The study shall outline space requirements, electricity grid upgrades, energy storage feasibility, back-up power requirements, and any other considerations deemed relevant.

- Provision of conceptual drawings for all facilities, including the recommended layout for parking and equipment, single line diagrams, and major equipment lists for costing. The conceptual drawings shall include consideration of any planned facility or fleet expansions and future proofing and be developed in collaboration with the Town of Milton – Milton Transit and

external facility owners/operators, where applicable. The layouts shall consider multiple options and evaluate any trade-offs between costs and impacts to operations and/or maintenance. The design shall be realistic to minimize under-sizing, over-sizing or stranded assets. The implementation approach for each facility should be included in Task 3. All drawings will be signed and sealed by a professional engineer who is registered in the relevant design specialties.

- Phased implementation plan for all upgraded or new infrastructure required at the transit facility to support fleet electrification. The plan shall coordinate construction to minimize costs and operational disruption, and clearly outline a step-by-step implementation schedule.

Deliverables for Task 2 include:

1. Type and quantity of charging systems that best suit the facility layout, fleet size, and any local requirements.
2. Electrical grid infrastructure upgrade requirements and costs, including installation, capital, and operating costs, phased in alignment with the vehicle procurement schedule.
3. Upgrades to meet safety codes, regulations or best practices.
4. Mechanical equipment requirements.
5. Back-up power requirements, including the recommended source of back-up power, phased in alignment with the vehicle procurement schedule.
6. Recommendation on energy storage and/or rooftop solar panel systems, including unit size, capital and installation costs, construction requirements, and any expected cost saving or revenue opportunity.
7. Conceptual site drawings for each facility and on-route charging location, outlining the infrastructure and parking layout at each facility and single line diagrams, with consideration of future proofing and operational impacts.

Task 3 – Full Fleet Electrification Transition Plan

- Overall electrification plan that outlines a step-by-step process to achieve full fleet electrification over the specified timeline, combining the information and deliverables developed in Task 1 and Task 2.

- The following information shall be included in the plan:

    1. Recommended high-level electric bus specifications, charging systems, and software solutions best suited to the operations of the transit agency.

        a. Recommended electric bus high-level specifications to meet the service requirements of each transit agency, including but not limited to the recommended battery pack size considering a heavy-duty cycle along all routes/blocks.
        b. Recommended charger type, power levels, and quantity of electric charging units to optimally support an electric bus fleet at each facility and on-route charging location.
        c. Recommended software solutions for management, control, and optimization of asset usage, including: vehicle and charging equipment monitoring; smart charging and control; dispatch and operations control such as CAD/AVL system requirements to manage vehicle range and change-offs; and integration capacity of new systems with existing software, including transit scheduling and fleet management/maintenance software.

2. Maintenance and staff training for electric buses and infrastructure.

    a. Maintenance requirements for the buses, including expertise (e.g. tradesperson qualifications), resources (e.g. tools, equipment, personal protective equipment), maintenance operations (e.g. best practices, towing requirements), and vehicle spare ratios.
    b. Maintenance requirements for charging infrastructure, including expertise (e.g. tradesperson qualifications) and role identification for internal staff and external contracted services, where applicable.
    c. Training programs for maintenance staff.
    d. Driver training program.
    e. Emergency services training program.
    f. Electrical safety requirements and training for all personnel within each facility.
    g. Identification of any skills or resource gaps on the current workforce needed to support an electric bus fleet. Evaluation must consider both internal staff and external contract workers, where applicable.

3. Detailed timeline for fleet electrification, coordinating fleet and charging infrastructure procurement timelines, service requirements, operational considerations, and construction schedules. Deliverable includes a detailed timeline outlining the specifics of each step and milestone, as well as an editable summary timeline.

    a. Vehicle procurement schedule that considers existing fleet retirement plans, projected service growth, lead times, and any additional BEB fleet vehicles required to meet service levels.
    b. Charging infrastructure procurement schedule that considers the vehicle procurement schedule and include an overview of the recommended construction schedule, and operational disruptions at the facility. This schedule should be developed in coordination with the local electricity distribution company to incorporate timelines for electrical grid infrastructure upgrades.
    c. Construction schedule outlining the required work at an existing or new transit facility to support fleet electrification.

4. Detailed budget showing all capital, construction, and operating and maintenance expenses for vehicle and infrastructure for the full timeline of fleet electrification.

    a. Budget that considers scenarios with and without the current carbon tax rates.
    b. Project costs presented in nominal and net present value terms, shown against the baseline scenario of business as usual.
    c. Recommendations on the viability of partnership models for ownership and operation of charging infrastructure.
    d. A budget presented in a clear Excel format that can be used as a working document to update predicted costs with actual costs upon commencement of vehicle and infrastructure procurements.

5. Greenhouse gas and criteria air contaminant emissions saving for each year over the full electrification timeline.

    a. Emissions savings shall be calculated and presented in the methodology and/or model

b. Calculations shall be provided in an easy-to-follow Excel format that can be used to perform future calculation as timelines and/or the energy generation mix in Ontario changes.

6. Operational implementation plan that considers resource allocation, project risks and change management.

    a. Assessment of existing resources to support the operational transition to a BEB fleet and identification of any skills or labour gaps.
    b. Best practices for change management in support of a transition to an electric fleet.
    c. Risk assessment highlighting potential areas of risk, suggested mitigation pathways and assigned personnel responsible for managing each risk.