

**COUNTY OF MILWAUKEE
INTEROFFICE COMMUNICATION**

DATE: April 19, 2019

TO: Theodore Lipscomb, Sr., Chairman, Milwaukee County Board of Supervisors

FROM: Donna Brown-Martin, Director, Department of Transportation

SUBJECT: Informational Report - MCTS Battery Electric Bus & Facility Improvements Analysis

POLICY

The 2019 Capital Improvement Budget directed the Milwaukee County Transit System (MCTS) to initiate the transition of its vehicle fleet to battery-electric buses (BEBs) and away from fossil fuels to lessen exposure to volatile diesel fuel prices, achieve savings over the total lifecycle of the new vehicles, provide clean air and quieter operational benefits to the citizens and neighborhoods in which the County operates our transit fleet and wider community.

BACKGROUND

To facilitate this transition, MCTS has engaged M.J. Bradley & Associates' (MJB&A) Transportation Group, which has extensive experience conducting strategic analysis, feasibility studies, economic and life cycle cost analyses, safety analysis, emissions testing, emissions inventory development, technology assessments, and management of prototype deployments and retrofit programs for a wide range of vehicle types, including commercial trucks, transit and school buses, construction equipment, locomotives, and marine vessels. It is anticipated that the final report will be available in late summer or early fall of 2019.

Project Approach

TASK 1 – Vehicle Type Alternatives Analysis

For this task MJB&A will consolidate data on all current commercially available 40-ft BEB models from different manufacturers that sell into the US market and will model the expected performance of the different BEB models for MCTS service. Specific parameters that will be modeled include:

- Effective passenger capacity for different bus models
- Projected energy use (kWh/mi) for different MCTS routes and garages
- Projected range per charge (miles) for different MCTS routes and garages
- Required “replacement ratio” for electric buses, if overnight garage charging is used. Range restrictions of current BEB models will likely require more than one BEB to replace one diesel bus when using garage charging. MJB&A will estimate replacement ratios specifically for MCTS based on MCTS route characteristics and scheduling policies
- Projected charging load (kW) for implementation of garage charging at each MCTS facility
- Projected cost of electricity (\$/kWh)
- Projected greenhouse gas emissions from BEB charging

Based on the above analysis, MJB&A will compare the projected performance of current and future BEBs to diesel buses in MCTS service, including:

- Energy Costs (\$/mi)
- Maintenance Costs (\$/mi)
- Amortized Capital Cost (\$/mi)
- Charging Infrastructure Cost (\$/mi)
- Total life Cycle Cost (\$/mi)
- GHG Emissions (g/mi)

TASK 2 – Capital Cost Analysis

For this task the project team will develop cost estimates for the purchase of BEBs, and for necessary facility investments to accommodate BEBs, including necessary charging infrastructure, as well as modifications to maintenance facilities to accommodate BEB maintenance.

The transition to BEBs will require significant investments in charging infrastructure. There are two basic approaches for BEB charging – “garage-based charging” and “in-route charging”. With garage-based charging, buses are charged at the garage, mostly at night, but potentially also during late morning/early afternoon for some buses.

With in-route charging buses are not routinely charged while parked at the garage. All necessary energy is added periodically while buses are in service, at a series of high-power on-route chargers. These on-route chargers are typically located at the end(s) of routes, at normal bus layover or turn-around locations; during scheduled in-route layovers each bus is charged for 5 – 10 minutes.

It is the experience of the project team that the requirements and cost of BEB charging infrastructure are highly site specific. Site-specific issues that can affect charging infrastructure cost include:

- Existing facility electrical service
- Availability of excess capacity in the local utility’s distribution system.
- Existing site layout and space availability for chargers
- Building structure(s), and capacity for handling the weight of ceiling-hung equipment
- Local building codes

TASK 3 – Cost-Benefit Analysis

MJB&A will use the information developed in Tasks 1 and 2 to develop life cycle cost and emission estimates for BEBs to be operated in MCTS service. Based on the life cycle cost and emissions analyses, MJB&A will develop business plan option(s) for MCTS to consider with respect to fleet electrification, including trade-offs and advantages/disadvantages of each option. Issues to be explored via definition of different options include:

- Most advantageous bus types/models
- Choice of charging strategy
- Pace and scale of fleet conversion to electric buses

- Potential alternative business models that could be applied to fleet electrification – for example battery leasing and purchasing charging services from a third party rather than owning charging infrastructure.

TASK 4 – Business Plan for BEB Implementation

MJB&A will develop a Business Plan and Implementation Road map for the fleet electrification option(s) chosen by MCTS. The Business Plan and Implementation Road map will include:

- A fleet replacement schedule for replacement with BEBs,
- Specific infrastructure investments necessary to support BEBs
- An estimate of total capital funding needs each year, for BEB purchases and infrastructure
- An estimate of annual savings in maintenance and fuel costs due to BEBs
- A summary and quantification of operational changes required due to fleet electrification:
 - Annual training requirements
 - Annual changes in total staffing requirements
 - Changes to bus/driver scheduling practices necessary to accommodate electric buses
- A summary of funding sources that could be used to pay the incremental cost of fleet electrification compared to business as usual, including grants and incentive programs
- A preliminary analysis of options for procurement of necessary electricity to charge electric buses, with advantages/disadvantages, potential cost savings, and recommendations.

In addition to the Business Plan and Implementation Road map, the MJB&A project team will develop BEB technical specifications for inclusion in request for proposals during future bus procurements. All tasks and the final report are anticipated to be available by the end of summer or early fall of 2019.

RECOMMENDATION

This Report is for Informational Purposes Only.

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Approved by:



Donna Brown-Martin
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