



GUIDEBOOK FOR DEPLOYING BATTERY ELECTRIC BUSES

Background

As part of FTA's effort to promote continuous safety and operational improvements in the public transit industry, *Guidebook for Deploying Battery Electric Buses* was developed to provide bus transit agencies with leading transit industry practices for performing these activities. The supporting research report, *Procuring and Maintaining Battery Electric Buses and Charging Systems – Best Practices*, is a resource for the industry that offers a summary of industry reports highlighting the challenges and opportunities encountered during battery electric bus (BEB) deployments. It also discusses the outcomes of federally sponsored deployments, existing standards from the American Public Transportation Association (APTA) and the Society of Automotive Engineers (SAE), and lessons learned through case studies. Also included are findings associated with BEB and charging station procurements, system efficiency and interoperability considerations, and maintenance standards and guidelines.

Additionally, the *Safety and Security Certification of Electric Bus Fleets–Industry Best Practices* supporting research was conducted to give bus transit agencies helpful information on the requirements of a Safety and Security Certification (SSC) program to verify the unique identified risks that will be introduced to a transit agency as a result of initiating a BEB fleet transition. With FTA's adoption of the Safety Management System (SMS) framework, shifting from a reactive to a proactive approach, change management programs such as SSC are critical to ensuring risk is identified and mitigated proactively.

Objectives

Guidebook for Deploying Battery Electric Buses was developed to support transit agencies as they implement BEB deployments through an integrated Safety Management System (SMS) process. The guidance and findings presented are not intended to be prescriptive. All transit agencies should develop procurement, maintenance, and comprehensive SSC programs tailored to their unique operating environments and characteristics. The combined findings from peer agencies provide insight to allow transit agencies to learn from others and avoid facing similar difficulties or prepare for the challenges ahead.

Findings and Conclusions

Guidebook for Deploying Battery Electric Buses provides useful findings to transit agencies as tools to identify likely challenges that should be considered before transitioning bus fleets to electrification, such as specific language to include in procurements to reduce challenges associated with part availability, battery warranty ambiguity, and Safety and Security Certification of BEB procurements.

Safety and Security Certification is a risk-based process paralleling the project's life cycle and schedule. While the process is often misunderstood, SSC acts in the best interest of the bus agency to ensure all hazards and vulnerabilities are appropriately mitigated, and any calculated risk is reduced to the lowest practical level. As such, the evolving dynamics of the battery electric market demand that agencies implement a robust verification process through SSC to identify and mitigate BEB-specific hazards. While most BEB components

are similar to conventional fuel alternatives, new considerations must be made that may not have been incorporated into existing or past BEB and associated infrastructure procurement processes.

Managing the recognized gaps in the Safety Risk Management processes of SSC requires agencies to employ several operational strategies to mitigate unwanted risks. For example, the current code does not specify BEB fleet fire protection requirements. More specifically, nationally recognized codes such as the National Fire Protection Association (NFPA) and International Fire Code (IFC) do not provide the direct language typically used to prescriptively design Fire Life Safety (FLS) systems that would adequately mitigate unacceptable hazardous conditions. This results in inconsequential conditions in past design and installation phases of the procurement's life cycle.

Benefits

This guidebook presents industry guidance to assist transit agencies in identifying likely challenges that should be considered prior to transitioning bus fleets to electrification. The findings, when considered together, provide a compilation of best practices in terms of procurement language, training, interoperability, resiliency, and change and safety risk management approaches.

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This research project was conducted by USF Center for Urban Transportation Research (CUTR). For more information, contact FTA Project Manager Raj Wagley at (202) 366-5386 or Raj.Wagley@dot.gov.

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