



Flipping the Switch on Electric School Buses

Part 3: Vehicle Requirements

Key Information and Resources

Electric school buses are a growing topic of discussion in the transportation industry. The U.S. Department of Energy (DOE) is providing a [technical assistance program](#) aimed at K-12 schools that are interested in implementing electric school buses into their fleets. “Flipping the Switch on Electric School Buses” is a multi-part technical assistance series. Each part contains several modules that discuss key topic areas about electric school buses. Modules can be watched in order, or viewers can select just those that are most applicable to their information needs.

The third part in the series focuses on vehicle requirements. This part provides guidance about currently available electric school bus vehicle models and vehicle cost factors; how to analyze your vehicle routes to determine if electric is a good option for your fleet; vehicle range and efficiency considerations; and information on incentives, battery life, and other considerations like battery recycling. The cost factors covered in this module are separate from those that will be discussed in Part 8. Tune in to Part 8 for in-depth discussion of bus and infrastructure costs, operational and maintenance costs, and a conversation on incentives and financing.

Modules in this part include:

- [Module 1: Vehicle Models and Cost Factors](#)
- [Module 2: Route Analysis, Range, and Efficiency Considerations](#)
- [Module 3: Incentives, Battery Life, and Other Considerations](#)

Key Resources and Highlights

Below is a list of the key tools and resources provided during *Part 3: Vehicle Requirements* of the “Flipping the Switch on Electric School Buses” series.

Module 1: Vehicle Models and Cost Factors

Presented by John Gonzales, National Renewable Energy Laboratory

- **Alternative Fuels Data Center (AFDC) Vehicle Search Tool:** afdc.energy.gov/vehicles/search/
 - Find and compare alternative fuel vehicles and download a list of results. Search by vehicle type (i.e., school bus) and engine and power sources (i.e., electric) to determine current electric school bus availability.
- **Clean Cities Coalition Network:** cleancities.energy.gov/
 - Clean Cities coalitions foster the economic, environmental, and energy security of the United States by working locally to advance affordable, domestic transportation fuels, energy efficient mobility systems, and other fuel-saving technologies and practices.

- **Clean Cities Coalition Contact Directory:** cleancities.energy.gov/coalitions/contacts/
 - Clean Cities coordinators are the primary contacts for their coalitions. Coordinators work with local fleets to advance affordable, domestic transportation fuels and technologies in the cities and counties they serve. Clean Cities coordinators lead more than 75 active coalitions covering nearly every state.
- **Report: Vehicle Electrification Opportunities:** www.nrel.gov/docs/fy22osti/81596.pdf
 - This report provides an overview of telematics analysis across six university fleets and identifies lessons learned that can help other Energy Policy Act of 1992 (EPA)-covered state fleets and other fleets as they increase their fleet electrification.

Module 2: Route Analysis, Range, and Efficiency Considerations

Presented by Laruen Lynch, National Renewable Energy Laboratory

- **Future Automotive Systems Technology Simulator (FASTSim):** www.nrel.gov/transportation/fastsim.html
 - FASTSim provides a simple way to compare powertrains and estimate the impact of technology improvements on light-, medium-, and heavy-duty vehicle efficiency, performance, cost, and battery life.
- **Report: Surat Municipal Corporation Bus Electrification Assessment:** www.nrel.gov/docs/fy19osti/73600.pdf
 - This report examines the potential for Surat Municipal Corporation (SMC) to electrify its bus rapid transit system (BRTS) in Surat, India. Researchers from the National Renewable Energy Laboratory (NREL) partnered with the Sardar Vallabhbhai National Institute of Technology to collect data from SMC, log in-use GPS data of SMC buses, and analyze the results. The ensuing analysis focuses on the operational feasibility and life-cycle costs of battery electric buses (BEBs) compared to diesel buses operated on eight BRTS routes out of four bus depots.
- **Report: National Park Service Bus Electrification Study: 2020:** www.nrel.gov/docs/fy21osti/78012.pdf
 - This report summarizes important considerations for implementing BEBs in the three national park fleets, detailing information about current buses at each fleet, electric bus demonstration vehicles, and performance evaluations of BEBs in Zion, Bryce Canyon, and Yosemite National Parks. Results include in-use data collection metrics such as average bus speed, energy usage per trip, and daily distance traveled. Also covered are effects of high heating, ventilation, and air-conditioning system use for heating and cooling the buses, emissions estimates before and after use of electric buses, operating costs, electric vehicle infrastructure, maintenance, and bus driver user experience survey information.

Module 3: Incentives, Battery Life, and Other Considerations

Presented by Lauren Lynch, National Renewable Energy Laboratory

- **AFDC Laws & Incentives Database:** afdc.energy.gov/laws
 - Find federal and state laws and incentives for alternative fuels and vehicles, air quality, fuel efficiency, and other transportation-related topics.

- **AFDC Tools:** afdc.energy.gov/tools
 - The AFDC offers a large collection of helpful tools. These calculators, interactive maps, and data searches can assist fleets, fuel providers, and other transportation decision makers in their efforts to advance alternative fuels and energy-efficient vehicle technologies.
- **Battery Policies and Incentives Search:** www.energy.gov/eere/vehicles/battery-policies-and-incentives-search
 - Use this tool to search for policies and incentives related to batteries developed for electric vehicles and stationary energy storage. Find information related to electric vehicle or energy storage financing for battery development, including grants, tax credits, and research funding; battery policies and regulations; and battery safety standards.
- **National Blueprint for Lithium Batteries:** www.energy.gov/eere/vehicles/articles/national-blueprint-lithium-batteries
 - This National Blueprint for Lithium Batteries, developed by the Federal Consortium for Advanced Batteries, will help guide investments to develop a domestic lithium-battery manufacturing value chain that creates equitable clean-energy manufacturing jobs in America while helping to mitigate climate change impacts. The blueprint lays out five critical goals and key actions to guide federal agency collaboration to secure the nation's long-term economic competitiveness and create good-paying jobs for American workers, while supporting the Biden Administration's decarbonization goals.
- **ReCell – Advanced Battery Recycling:** <https://recellcenter.org/>
 - The ReCell Center is a national collaboration of industry, academia, and national laboratories working together to advance recycling technologies along the entire battery life cycle for current and future battery chemistries.