

DEPLOYMENT SPOTLIGHT

MOTIV ON FORD E-450 PLATFORM SCHOOL BUS



PROJECT SUMMARY

Eleven 2016 Motiv E-450 electric school buses (ESBs) were deployed in a pilot project to transport children in the Greater Sacramento Region. These ESBs, which consisted of Ford E-450 platforms upfitted with Motiv Powertrain Control Systems, were distributed by Trans Tech as Type A “SST-e” buses and operated from January 2018 to December 2019 in disadvantaged communities in the Elk Grove (EGUSD), Sacramento City (SCUSD), and Twin Rivers (TRUSD) school districts. After the project, each district expanded its fleet of ESBs.

DUTY CYCLE



Vocation
Student Transit



Average Daily Distance
46 miles



Average Daily Speed
15 miles per hour



Maximum Capacity
32 seats / 24 seats and one wheelchair



Average Temperature – Summer
74 F



Average Temperature – Winter
59 F

Operational routes varied in length from 38–70 miles daily. Routes were mostly flat and involved urban, residential, rural, and freeway driving. Each ESB was allotted 1.5 hours for pick-up in the morning and 1.5 hours for drop-off in the afternoon.

During the data collection period, temperatures in the Greater Sacramento Region were 59-94 F in summer months and 46-74 F in winter months.

CHARGING



Charger Type
Level 2



Charging Methodology
Depot Day/Night 5-7 hours per charge

The ESBs charged at on-site private locations, with an average of 1.54 charging events per day in use. Each bus had a nominal battery capacity of 106 kWh and fully charged in 4.4 hours using 19.2-kW Clipper Creek Model CS-100-3 Level 2 chargers or in 5.4 hours using 16.8-kW EV Connect/BTC Power Level 2 chargers. Both chargers had non-standard, 3-phase designed plugs. Each ESB had an average daily energy consumption of 71.3 kWh.

PERFORMANCE



Energy Efficiency
*1.6 kWh/mile**



Miles per Gallon Equivalent
*21.6 MPGe**

**Certain factors can significantly affect the range and efficiency of electric vehicles (EVs), especially ambient temperature, topography, speed, and load. These factors must be considered when selecting a suitable EV to meet a specific duty cycle.*



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FUNDING

This deployment was funded by the California Air Resources Board to the Sacramento Metropolitan Air Quality Management District through the Greenhouse Gas Reduction Fund and the California Climate Investments program.



TRAINING AND WORKFORCE DEVELOPMENT

Trainings included technical sessions on vehicle driving and operation, charging, and maintenance and repair. At TRUSD, the district's instruction staff developed their own training program for drivers, which focused on vehicle operation, charging, and driving, with an emphasis on safety protocols for operating electric powertrains and methods to maximize vehicle range. Although manufacturer-sponsored training was limited at the onset of this project, industry working groups have since focused on improving training availability and quality, and current ESB deployments typically involve more robust training.



RECOMMENDATIONS FOR FUTURE DEPLOYMENTS

1. Prior to purchasing ESBs, school districts must work with dealers to determine the right model to match the district's specific needs. As part of this exercise, districts should anticipate potential route changes and consider cost-saving strategies to control demand charges and reduce energy usage during peak hours. Visit Microgrid Labs' [EVOPT](#) tool to develop a managed charging strategy that works for your fleet. Use the [School Bus Fleet Infrastructure Planning Tool](#) guide and check out CALSTART's [Infrastructure INSITE](#) tool for more information on zero-emission infrastructure development process, appropriate equipment, and cost and time estimates.
2. School districts must pilot ESBs to gain experience and overcome challenges in deploying these vehicles. EGUSD modified their routes from 100 miles to 60 miles to accommodate the buses' ranges, with conventional buses supporting the remaining 40-50 miles. SCUSD also upgraded their Motiv E-450 buses to five battery packs to support a 70-mile range. TRUSD experienced unexpected range issues with their Motiv E-450 buses due to increased power needs and found that the buses needed to be plugged in when parked to maintain battery temperature. Although each district expressed frustration with the real-world range of the ESBs, all three districts have expanded their electric fleets with contracts for new buses. TRUSD has procured a variety of ESB models, including from Lion Electric, Thomas Jouley, and Micro Bird, as well as Blue Bird transit buses and Collins cutaway vans.