

DEPLOYMENT SPOTLIGHT







LION ELECTRIC LIONC SCHOOL BUS



PROJECT SUMMARY

Sixteen first-generation (model year 2016) Lion Electric LionC school buses were deployed in a pilot project to transport children in the Greater Sacramento Region. These electric school buses (ESBs) 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 this project, each district expanded its fleet of ESBs.


DUTY CYCLE

		
Vocation <i>Student Transit</i>	Average Daily Distance <i>45 miles</i>	Average Daily Speed <i>18 miles per hour</i>
		
Maximum Capacity <i>77 seats</i>	Average Temperature - Summer <i>74 F</i>	Average Temperature - Winter <i>59 F</i>

Operational routes varied in length among the school districts, with daily distances of 28–58 miles. 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 <i>Level 2</i>	Charging Methodology <i>Depot Day/Night 5-7 hours per charge</i>

The ESBs charged at on-site private locations, with an average of 1.25 charging events per day in use. Each bus had a nominal battery capacity of 105 kWh or 132 kWh and fully charged in about 6 hours using 19.2-kW Clipper Creek Model CS-100-3 Level 2 chargers or in 7 hours using 16.8-kW EV Connect/BTC Power Level 2 chargers. Both chargers had SAE J1772 connectors. Each vehicle's average daily energy consumption was 86.6 kWh.

PERFORMANCE

	
Energy Efficiency <i>2 kWh/mile*</i>	Miles per Gallon Equivalent <i>17.9 MPGe*</i>

**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 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 specific needs of the districts' routes. 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 start developing 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 the zero-emission infrastructure development process, appropriate equipment, and cost and time estimates.
2. Piloting ESBs is critical for school districts to gain experience in deploying these vehicles and to overcome challenges. For example, EGUSD modified their ESB routes from 100 miles to 60 miles to accommodate the buses' ranges, with conventional buses supporting the remaining 40-50 miles of the normal routes. Although some of the participating districts expressed frustration with the real-world range of the buses, all three districts have expanded their electric fleets with contracts for new buses. TRUSD found that Lion Electric LionC buses met their duty cycle needs and has since procured additional Lion Electric school buses, as well as a variety of other ESB models, including Blue Bird 40-ft transit buses, Thomas Jouley school buses, Micro Bird school buses, and Collins cutaway vans.