CALSTART

# ELECTRIC SCHOOL BUS (ESB) DEMONSTRATION CASE STUDIES

## CALSTART'S REPORT DETAILS FOUR DEMONSTRATION CASE STUDIES:

- Twin Rivers Unified School District – California
- Fontana Unified School District (FUSD) and South Coast Air Quality Management District (SCAQMD) – California
- Three school districts in Massachusetts working with the state's Department of Energy Resources (DOER)
- White Plains City School District, New York; with ConEdison, the New York State Energy Research and Development Authority (NYSERDA), and bus operator National Express

## TWIN RIVERS UNIFIED SCHOOL DISTRICT

- Twin Rivers Unified School District, located in a low-income area near Sacramento, was an early adapter of electric school buses (ESBs). To obtain its initial fleet of 16 ESBs in 2016, Twin Rivers relied principally on external funding sources to make up the marginal costs of the buses and infrastructure.
- The district secured funding from California Air Resources Board, the California Energy Commission, and the Sacramento Air Quality Management District. These agencies awarded Twin Rivers a total of $7.5 million to purchase 16 buses and the accompanying charging infrastructure. Sacramento Municipal Utilities District provided $1 million for charging and preferential electric rates.
- With these subsidies, Twin Rivers purchased eight Lion Electric ESBs and eight ESBs manufactured by Motiv/Trans Tech. Each purchase cost the school district between $60,000 and $100,000 for buses that would typically cost up to $400,000.
- Despite experiencing a few initial charging issues, Twin Rivers judged its initial ESB experience a success, purchasing five Blue Bird buses and four additional Lion Electric buses for a total 25 ESBs in a fleet of 125 school buses.
- The school district's director is an "ambassador for ESBs." The district loans out buses from its fleet to neighboring school districts for their own tests.

## FONTANA UNIFIED SCHOOL DISTRICT (FUSD) AND SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

- FUSD is one of 16 Southern California school districts, plus two charter schools, located primarily in disadvantaged communities that received subsidies from the SCAQMD to purchase ESBs beginning in 2017.
- The SCAQMD program focused on school districts in disadvantaged communities and provided $8.8 million to enable the purchase of 33 ESB: seven from Blue Bird, four from Green Power, five from Lion Electric, and 13 from Motiv.
- FUSD used $496,000 to purchase two type D Blue Bird ESBs. The funding allocation also included an additional $40,000 ($20,000 per bus) for two 19.3 kW charging stations, with Edison International providing technical assistance.
- The project budgeted nine months for infrastructure installation, but some school districts needed more time to address issues like upgrading the power supply and installing a dedicated meter. Some of this work required the competitive bid process, permits, and California Highway Patrol certification, which meant major delays.
- The project's $20,000 budget per charging station proved inadequate for many school districts, including FUSD's. The installation costs did not include the hardware, training costs, technical assistance, or any project management costs.
- A major takeaway from the SCAQMD program and Fontana's experience was that districts buying their first ESBs must budget for total costs, including the purchase and installation of charging infrastructure.

# MASSACHUSETTS DEPARTMENT OF ENERGY RESOURCES (DOER)

- The Massachusetts DOER deployed ESBs to one rural (Amherst), one suburban (Concord), and one urban (Cambridge) school district to explore the feasibility of ESB technologies in a cold-weather climate.
- Each district purchased a Lion Electric school bus for $325,000 and spent $75,000 on AC Level 2 chargers, one made by Tesla and two by Clipper Creek.
- Colder temperatures reduced the ESBs' range by 25%, but all buses were able to complete their routes.
- Driver experience mattered more to range than cold weather. School districts that used the same driver throughout the project had higher and more consistent ranges than those rotating their drivers. Coordinating with the vehicle manufacturers and vendors was critically important to keeping the vehicles available and operational.
- Using diesel-powered auxiliary heaters to warm bus occupants during cold weather preserved range. However, the heaters generated in-cabin air pollutants similar to traditional school buses.
- School districts initially made mistakes with charging, such as plugging in the battery during peak times when energy prices were highest. As they learned to limit recharging to overnight and weekend hours, power costs went down.

# WHITE PLAINS CITY SCHOOL DISTRICT, NEW YORK

- White Plains, a suburb of New York City, tested the applicability and feasibility of vehicle-to-grid (V2G) technology in ESBs.
- V2G enables two-way electricity flow between bus batteries and the utility electrical grid, allowing schools to sell power stored in school bus batteries to the local utility during hours of peak electricity usage. The schools make money while allowing the utility, ConEdison (ConEd), to manage the load more efficiently, at a savings to ratepayers.
- White Plains and its bus operator National Express partnered with the New York State Energy Research and Development Authority (NYSERDA) and the local utility company, ConEd, to purchase five Lion Electric school buses.
- ConEd is paying the school district for the use of its ESB batteries and will also pay for specialized equipment to enable V2G integration, such as adaptors and converters to allow for bidirectional power flow and charging management software to regulate this process.
- The demonstration project is still ongoing, but it is considered a success.
- A ConEd progress report indicates that the ESB operations have been "stable and excellent," noting that drivers tend to prefer operating the ESBs to conventional diesel-powered buses.