



Going All-In on Electric School Buses: Sacramento Fleet Transition Success Story

Twin Rivers Unified School District is gaining momentum in transitioning their school bus fleet from diesel to electric using creativity and strong technical knowledge.

The district serves 25,000 students attending 52 schools across an 82-square-mile area. Tim Shannon, the Director of Facilities, Planning, and Efficiency, has led the district's adoption of electric school buses (ESBs) for its fleet over the last 7 years. The fleet already includes buses from Lion Electric, Blue Bird, and Thomas Built and is expecting some IC and Green Power buses, including several Type A buses with powertrains from Motiv Power Systems. This affords Twin Rivers a well-rounded idea of how buses from different manufacturers operate. Now, the fleet of 130 buses includes 57 ESBs as well as 26 compressed natural gas buses.

Using Innovation and Flexibility to Navigate Cost and Technical Assistance Challenges

Twin Rivers has been innovative and flexible in navigating many technical challenges with regenerative braking, bus passenger climate control, and high-mileage trips. The electric buses save 8% on fuel costs alone compared to traditional diesel buses. The district pays \$0.12/kwh for electricity, in part by using solar and geothermal power sources and leveraging managed charging to avoid demand charging costs. They are also able to track the range of their vehicles by using GPS to closely monitor the routes each bus takes in the morning and afternoon, allowing for optimal charging levels and timing. Drivers know their vehicles well, and Twin Rivers trains drivers as they transition to driving ESBs.



Photo from Getty Images, 149408096

While the extended brake life the fleet is realizing is expected with electric vehicles, Twin Rivers has also found that tires are lasting longer on the ESBs than on conventional buses. This is likely because the vehicle weight is distributed more evenly across the vehicle, decreasing the impact during turning on any one area.

Fleet managers in Sacramento's mild climate found that the temperature control units on all buses decrease range by around 6%. To combat this, drivers use preheating strategies. They preheat Lion Electric buses on cold days by turning on preheaters in plugged-in buses before starting routes so that the buses start their day with a prewarmed passenger compartment without impacting the range.

After use, all buses return to the yard where there are 26 DC fast chargers and 57 Level 2 chargers with charge management software. Charging times are staggered using a system that analyzes telematics and duty cycles to determine when and for how long buses will need to charge. Twin Rivers has vehicle-to-grid capability on all the DC fast chargers for the Lion Electric, Blue Bird, and Thomas Built buses. Use of the DC fast chargers and vehicle-to-grid

capabilities has had a lower impact on bus battery life than expected.

Trips that extend beyond a 50-mile radius, or 100-mile range, can be challenging for the Twin Rivers fleet due to the need to charge during the trip. For trips over that radius, Twin Rivers charts traditional buses to avoid the risk of charger unavailability. For trips closer to the 50-mile range, they are providing one-on-one charging training for drivers that covers all charging capabilities so that drivers are comfortable returning to the yard to charge mid-trip.

Building Workforce Capability and Resources Through Strong Partnerships

When Shannon first started looking into ESBs in 2016, the fleet transition process was largely unknown. He got senators and legislators involved and sent letters to the Twin Rivers school board presenting the advantages of ESBs, including cleaner air and lower asthma rates in children.

"The magic key was forming a huge team of people in all the different industries that would be impacted by a transition to ESBs and getting their support," Shannon

said. Team building is still an integral part of Twin Rivers' success today, as they capitalize on partnerships and connections with key providers and vendors, including Sacramento Municipal Utility District (SMUD), California Energy Commission, Power Electronics (an electric vehicle charging equipment provider), and Lion Electric.

When Twin Rivers first presented SMUD with an ESB vision, SMUD approached its board of directors. The board supported Twin Rivers wholeheartedly and assisted in offsetting ESB implementation costs by paying them for advertising SMUD on the buses. SMUD also goes the extra mile to help Twin Rivers use their [low-carbon fuel standard](#) credits and apply for grants. Twin Rivers has tapped into a wide variety of grant opportunities, receiving funding from SMUD, California Air Resources Board, the board's [Carl Moyer Memorial Air Quality Standards Attainment Program](#), California Energy Commission, and the [Hybrid and Zero-Emission Truck and Bus Voucher Incentive Program](#), all of which have contributed about \$50 million toward their ESB fleet implementation.

"The utility is an important player in this," Shannon said. "Utilities want to be a part of it because they don't want to be left behind, and they want to be ready when people start electrifying on a large scale."

The school district also has a strong partnership with Lion Electric, who established a service center near the Twin Rivers ESB facility to provide rapid service and support for any issues that arise with the Lion Electric buses. While most repairs have been under warranty, Twin Rivers hopes to bring many repairs in-house



Photo by Getty Images, 1263121345

by working with original equipment manufacturers to train technicians to specialize in electric school buses. Training will take a hands-on approach, with experienced staff helping to train new technicians. However, high-voltage repairs will still be handled by original equipment manufacturers for the near future.

This hands-on approach also helps handle driver anxiety about using advanced equipment. For example, Twin Rivers drivers try to optimize their use of regenerative braking and have learned to tap the brakes to turn on the brake light while using it, improving safety on the road. According to Shannon, "as drivers learn how to use things like regenerative braking, that anxiety goes away."

Twin Rivers is also incorporating workforce development by creating courses for high school students to learn about ESB

technologies and developing apprenticeship programs to start careers in technical education for young people.

Paving the Way Forward

Bolstered by their success, Twin Rivers is thinking about more innovative ways to maximize efficiency and minimize cost. Continuing their commitment to sustainability, the school district plans to add solar and energy storage in the near future for buses to charge when they have down time between drop-offs and pick-ups. The added capabilities of solar and storage will serve to raise visibility of Twin River's fleet program in the community by giving students and visitors to the school an additional entry point to see and learn about the district's electrification efforts.