# Cold Weather Electric School Bus Case Studies Collective

Electric school buses (ESBs) offer significant benefits such as lowering operational costs and reducing emissions to improve air quality. However, cold weather can pose operational challenges for ESBs, particularly affecting battery performance, range, and reliable service in rural and mountainous areas.

This overview offers practical tips to help fleets prepare for and manage cold weather operations effectively. Project findings compiled from across North America provide real-world examples of ESB performance in winter conditions, listed below.

- West Grand, Colorado
- Salt Lake City, Utah
- New York State
- Carroll County, Virginia

## WEST GRAND, COLORADO

*A Snowy Colorado Mountain Town's Electric Bus Experience*

*New ESBs in Colorado Provide Safer, Cleaner, Cheaper Rides*

West Grand School District in Kremmling, Colorado, added one Type D ESB to their fleet in 2020. During the winter, the area can endure harsh subzero conditions, with the average temperature during morning commutes falling anywhere between -33 and -18 degrees Fahrenheit. Despite these extreme conditions, cabin heat on the school bus remained responsive, reliable, and comfortable. In addition to withstanding poor weather conditions, the district reports that the school bus has been able to climb the long and steep routes that surpass 9,000 feet in elevation. West Grand utilizes a heated garage to protect the school bus batteries from freezing temperatures so that the school buses are ready to operate immediately in the morning. The school district is so pleased with their ESB experience that they will receive two more ESBs through the Environmental Protection Agency's (EPA's) Clean School Bus program.

***Read more about the West Grand ESB experience:***

*"Grant To Give Kremmling Two ESBs"*

*"Meet the Driver of West Grand School District's Electric Bus"*

## SALT LAKE CITY, UTAH

*"How Students in Salt Lake City Helped Advance an Equity-Centered Plan for ESBs"*

Salt Lake City School District has a total of 12 ESBs, a combination of Type A buses and Type D buses, 8 of which they first received in 2021. Even on the coldest days, when temperatures reach -30 degrees Fahrenheit and electric heater use reduces range by 18%, the school buses can cover the longest routes of about 90 miles per day by utilizing midday charging and regenerative braking.

The battery gain from regenerative braking is especially prevalent in mountainous regions when vehicles drive down a mountain pass. The school district has even deployed the ESBs on field trips to ski mountains and local canyons, finding the school buses are able to cover their most-challenging routes. The transportation department has a goal of a 75% electrified school bus fleet by 2035 — and drivers are eager to receive more ESBs.

## NEW YORK STATE

*Electric School Bus Cold Weather Performance*

In New York State, all new school buses sold will be zero-emission by 2027, and by 2035, the state's entire school bus fleet will be electric. Across rural and upstate New York, school districts are embracing the transition to electric, even in their harsh climates. While cold temperatures can reduce battery range, real-world experience in New York shows that their ESBs are reliably completing their urban and rural routes. At Newfield Central School District, a rural district with less than 1,000 students, drivers noted that diesel buses typically run 5.5 to 6 miles per gallon, while their electric counterparts are delivering 16 to 17 miles per gallon. Drivers also reported improved traction with electric buses, attributed to better weight distribution from batteries located between axles. Additionally, the district spends one-third of the fuel cost on electric buses.

Located off the shores of Lake Erie just south of Buffalo, New York, Lake Shore School District serves 2,200 students, with a ridership rate of 92%. The district operates a fleet of 46 total school buses, 2 of which are electric, with 20 more on the way. Student and driver comfortability are a top priority, especially during the harsh winter months.

> **This is the third year Lake Shore CSD has had zero-emission buses in service. Our students enjoy the quiet ride, drivers appreciate less shouting, and staff have gained valuable experience in safely operating battery electric vehicles.**
>
> *- Perry Oddi, Transportation Supervisor, Lake Shore Central School District, Western NY*

Lake Shore's ESBs are equipped with thermal management systems that regulate cabin temperature without relying on auxiliary diesel heaters. Throughout the winter, the electric buses have performed just as well as their diesel counterparts. One bus driver was impressed by how comfortable the cabin is on the coldest days, saying that it heats almost instantly. In addition to the comfortable and safe ride, the district estimates that a diesel

bus costs about $22 per route to operate, compared to $4 per route with their ESBs — totaling approximately $15,000 in cost savings per bus per year.

***Read more about New York State's ESB experience:***

*"'We Love Them': Newfield Central School District Has Three Electric Buses on the Road"*

*"How a Western New York School District Energized a Community Around ESBs"*

*"Lake Shore Supt.: Electric Buses Make the Grade"*

## CARROLL COUNTY, VIRGINIA

*"First Electric Public School Buses in Carroll Cruised Through Cold Snap"*

In Carroll County, the public school district has seven ESBs and eight charging stations, with additional buses and infrastructure on the way. During a period of Arctic air, the Carroll County Public School District reported that their new vehicles "sailed" through the cold snap without trouble. The transportation manager attributed the buses' reliability to safety features and failsafe design that support operation in extreme temperatures. Carroll's buses also take advantage of the Appalachian Mountains' downhill grades to put charge back into the batteries through regenerative braking. In total, the school district is expected to receive 20 new ESBs and accompanying charging infrastructure through rebate payments from the EPA.

## Cold Weather ESB Tips

### 1. Planning and Preparation

- Assess routes for worst-case cold weather to ensure buses can complete them reliably. Start with shorter or less-demanding routes when temperatures drop.
- Plan your routes seasonally — especially the range reduction that will occur in the winter — and place your ESBs on appropriate routes. Conduct thorough maintenance focused on batteries, brakes, and tires before winter arrives.
- Provide sheltered or indoor parking when possible to protect buses overnight and plan overnight charging for battery and cabin preconditioning while minimizing electricity costs.

### 2. Depot and Operational Practices

- Precondition batteries and cabins by warming buses while plugged in before routes to conserve onboard battery power and enhance comfort.
- Charge buses immediately after routes when batteries are still warm to maximize charging efficiency.
- Equip buses with winter tires or chains for better traction and install heated driver seats to reduce the need for full cabin heating.
- Use auxiliary heaters, but only in extreme cold conditions to preserve emissions benefits.

### 3. Workforce Development and Safety

- Train drivers on safe winter driving techniques, efficient heating system use, and emergency protocols.
- Equip buses with winter emergency kits and ensure drivers understand response procedures for winter incidents.
- Gaining experience and familiarity with the technology will help drivers build confidence and reduce range anxiety.

### 4. Data, Communication, and Collaboration

- Use GPS and communication tools to monitor bus locations and road conditions in real time, enabling rapid response to weather challenges.
- Collaborate with other local ESB fleets to share operational insights and best practices for cold weather performance.

## Get Expert Guidance, Connect With Peers

Join the ESB Network to access the latest industry trends, best practices, and valuable insights from peers on similar journeys.

## CONTACT US:

electricschoolbusnetwork.org
schoolbusteam@calstart.org