Maine Clean School Bus Program

ELECTRIC SCHOOL BUS FACT SHEET

The U.S. Environmental Protection Agency (US EPA) has launched a **Clean School Bus Rebate Program** to fund electric school buses and chargers. Electric school buses (ESBs) offer many benefits including lower operational costs and reduced exposure to harmful emissions. In this Fact Sheet, learn more about electric school buses, how they perform, and how they can benefit your school, students who ride the bus and communities you serve.

Benefits

Operating Cost Savings: cheaper to own and operate over time

Because ESBs are roughly three times as efficient as diesel buses[i], the costs to charge an electric school bus versus fuel a diesel bus is 40 – 75% lower (depending on energy prices, routes, climate and driving style). Based on Maine's recent average diesel price ($6.27/gallon[ii]), and average commercial electric rates ($0.16/kWh[iii]), operating an electric bus in Maine could save nearly two-thirds in energy costs (the equivalent of paying $2.04 per gallon for fuel).

Diesel buses are known for being difficult and expensive to maintain, especially as these buses age. The US EPA recommends prioritizing older school buses for replacement due to greater maintenance concerns, lower fuel economy and less stringent safety equipment.[iv] ESBs have fewer moving parts, so there are fewer repairs and reduced maintenance requirements.[v] As a result, ESBs are expected to provide maintenance savings of up to 40%.[vi]

75% less

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Finally, ESB batteries have the potential to feed electricity back into nearby buildings and the electric grid through a process known as Vehicle-to-Grid (V2G) or Vehicle-to-Building (V2B) - potentially increasing community resilience to power outages and providing financial value to schools and local utilities.[vii]

Health and Emissions: electric school buses are healthier for students, bus drivers, and our communities

Electric school buses have zero tailpipe emissions and improve the air quality inside and outside the bus. This is important for children, who spend between 20 minutes to several hours a day on school buses: air pollution levels **inside** older diesel buses can exceed surrounding areas by 5 – 10 times.[viii] It's also important for school bus drivers, who benefit from cleaner, healthier, and quieter working conditions when driving ESBs.

There is no known safe level of diesel exposure for children. According to the US EPA, children are more susceptible to the harmful effects of diesel emission because they have higher breathing rates and their lungs are still developing.[ix] In addition to being a known carcinogen, diesel emissions have been shown to impact cognitive development in children and respiratory health in both children and adults.[x] Reducing exposure to diesel emissions can pay real dividends to children, bus drivers, and the community at large.[xi]

According to the U.S. Department of Transportation Bureau of Transportation Statistics, 20% of low-income families do not own vehicles and 70% of these children rely on school transportation (low-income is defined as $25,000 for a family of four) whereas 99% of non-low-income families own at least one vehicle and over 50% take a private vehicle to school.[xii] Consequently, students from low-income households are disproportionately impacted by exposure to school bus emissions.

Funding opportunities to reduce upfront costs

Electric school buses (ESBs) cost significantly more than a diesel school bus – but there are now generous funding opportunities that can lower or eliminate the incremental costs of the school bus, charging equipment, and associated installation labor costs.

The US EPA Clean School Bus Rebate Program is offering rebates up to $375,000 per bus and $20,000 per charging station for schools in Maine and around the country.

School Bus and Performance Details

The School Buses: many options that meet the unique needs of school entities in Maine

The ESB market is growing. Over 1,800 ESBs have been committed by over 354 school entities or fleet operators in 36 states.[xiii] Electric versions of all major school bus types are available, with Type C being the most prevalent.

Depending on the size of the bus, battery packs can range in size from 90 kilowatt-hours (kWh) to over 300kWh, with many manufacturers offering multiple battery pack size options for each bus type to meet the driving range requirements of a given fleet.

Electric school buses are currently available on the Maine State School Bus Bid. The Maine State School Bus Bid is conducted by the Maine Department of Administrative and Financial Services Division of Procurement Services for Maine Department of Education. The current Maine State School Bus Bid Master Agreements are posted on the State of Maine Department of Administrative and Financial Services Division of Procurement Services web page, **here** (to view each master agreement, enter "school bus" in the search box). To view the **Master Agreement for Electric Type C school buses, click here**.[xiv]

Range and Routes: ample charge for most routes

Driving ranges for a base model ESB under standard operating conditions (65 degrees and relatively flat terrain) typically start at 100 miles. Since the national average driving distance for a typical school bus is about 32 miles per shift, for a total of about 73 miles (and 5 hours of driving) per

36 states

Electric school buses will soon be deployed across 36 states.

day[xv], ESBs currently on the market are all more than capable of serving most school districts' short to medium-length routes.

Because ESB range is most impacted by air temperature, Maine school bus fleets will not likely achieve the advertised nominal range of ESBs in winter. For fleets new to ESBs, focusing on your shortest, most predicable routes first is often the best way to begin successfully integrating ESBs into your service. For example, a route that is 30 miles or less could be easily covered by a base-model bus with a standard range of 100 miles even after accounting for worst-case scenario winter range reductions and plenty of buffer for your drivers.

That said, because ESBs generate greater operating cost savings the more they are driven, fleets will save the most when they can maximize the miles their ESBs drive. Monitoring the effective range of your ESBs throughout the year and assigning your ESBs to medium-length routes when conditions and range allow will help ensure your fleet maximizes cost savings. For example, Mount Desert Island High School's electric Type C bus maintained an effective average range of 116 miles through the 2022 winter months and was driven approximately 90 miles per day throughout the year (see callout box below).

If there is a need for increased range to support operations on longer routes, school bus fleets can purchase ESBs with larger battery packs, which will increase nominal range to 150 miles or even 200+ mile ranges for some models. Because larger battery packs can add significantly to the cost of ESBs, focusing on shorter to medium-length routes will allow school bus fleets to deploy less expensive (and more cost-effective) base-model buses with smaller battery packs. Another strategy to increase daily range is to recharge the bus midday between morning and afternoon shifts.

Proven Performance Across Hot and Cold Climates

Twenty-four states have deployed electric school buses, including Maine, and other cold-weather states (Vermont, Minnesota, Massachusetts, New York, Michigan, North Dakota, Alaska, Wisconsin, Illinois and Montana) as well as Quebec and Prince Edward Island in Canada.

During warm summer months in moderate climates, nominal range can decrease by 15% due to cooling needs. During cold winter months, nominal range can decrease by 30% to as much as 50% on the very coldest (sub-zero) days, as the batteries draw energy to maintain optimal operating temperature and heat the cabin. Many electric buses can be equipped with optional fuel-fired auxiliary heaters to mitigate most of this range decrease. The US EPA requires that auxiliary heaters used on buses funded through the Clean School Bus Program be vented.

Electric school buses can be parked and charged outside throughout the year, and most can be preheated while still plugged in.

Mount Desert Island High School Electric Bus Pilot

Mount Desert Island High School (MDIHS) purchased and deployed the first electric school bus in Maine in August 2021 and ran the bus through the 2021/2022 winter. The bus (a Lion Type C electric model with a diesel auxiliary heater) traveled a daily average of approximately 90 miles throughout the winter. Effective average range was stable from September through November at 133.6 miles, and dropped by 13% to 116.2 miles during January and February. In all cases, the effective average range was at least 25 miles greater than the average daily miles traveled, providing a buffer of at least 20%. *Note that a final report from VEIC and A Climate to Thrive evaluating the first year of MDIHS' ESB deployment is forthcoming in late-summer 2022*

The electric school bus's performance on snow and ice was comparable to a conventional diesel school bus, according to MDIHS's electric bus driver. They did note that the electric bus's regenerative braking feature could reduce traction in slippery conditions, but that feature is easily disabled at any point by a switch on the driver's console and can be left off during snowy or icy days.

Charging

Each ESB in your fleet will likely need a dedicated charging station. Many ESBs can be effectively charged by either a Level 2 charging station (19 kW, 240 volts Alternating Current (AC)) or a Level 3 Direct Current (DC) fast charging station (at least 25kW, 480 volts DC).

A typical Type C electric school bus with a 150kWh battery pack will be able to fully charge a depleted battery in 6 to 8 hours overnight using 19kW Level 2 charging stations. A 25kW DC charging station will be able to provide a slightly faster charge (4-6 hours). Some fleets with more powerful (and more expensive) DC fast charging stations (60 kW or more) may be able to recharge the same bus in as little as 2 hours, though these faster charging speeds are typically not necessary, and can increase electricity costs considerably due to greater power demands.

Fleets will need to evaluate whether they may need midday charging, how much charging time they will have between morning and afternoon shifts, and how much range they will need to recover during that time, as each factor will influence charging station type selection.

Driver and Maintenance Training

Training for drivers and fleet-based maintenance staff is provided by vehicle vendors when they deliver ESBs to the fleet. School transportation managers can stipulate robust staff training from the ESB vendor of their choice during their procurement process. If your bus vendor has a service agreement with a local service station, it is important to ensure the service station's maintenance staff have been trained in how to service an electric school bus.

Interested? Here's how to apply

1. Begin your application for funding from the **U.S. EPA's Clean School Bus Program**
    - Applications are open now
    - Review program guidance, eligibility, and other details **here**
    - Review application submission guidelines and access the application **here**
    - Check the federal Systems for Award Management (SAM.gov) to ensure your organization is actively registered as an entity
    - Engage with your electric utility (and school bus contractor if using one) about your interest and plans for an electric school bus project
2. Complete **this form** or email Pat Hinckley (pat.hinckley@maine.gov) to get help with your application or to answer questions about ESBs for your school
3. Complete and submit your funding application to the U.S. EPA's Clean School Bus Program before the **August 19, 2022 deadline**

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REFERENCES

[i] Argonne National Lab Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool - **https://greet.es.anl.gov/afleet_tool**

[ii] AAA Maine Average Gas Prices – Accessed 5/11/22 - **https://gasprices.aaa.com/?state=ME**

[iii] US Department of Energy - Energy Information Administration – Average Retail Price of Electricity (Maine, Feb 2022) - **https://www.eia.gov/electricity/data/browser/**

[iv] **https://www.epa.gov/dera/making-school-buses-cleaner**

[v] **https://www.epa.gov/cleanschoolbus/benefits-clean-school-buses**

[vi] Argonne National Lab Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool - **https://greet.es.anl.gov/afleet_tool**

[vii] **https://www.epa.gov/greenvehicles/what-if-electric-school-buses-could-be-used-supply-power-when-duty**

[viii] **https://www.ehhi.org/reports/diesel/dieselintro.pdf**

[ix] **Reducing Diesel Emissions from School Buses | US EPA**

[x] **Traffic-related air pollution and brain development - PMC (nih.gov)**

[xi] **https://www.epa.gov/dera/reducing-diesel-emissions-school-buses**;

[xii] **https://www.bts.gov/topics/passenger-travel/back-school-2019**

[xiii] **https://www.slideshare.net/WorldResources/why-electric-school-buses**

[xiv] For questions or assistance regarding the Maine State School Bus Bid, please contact Pat Hinckley (**Pat.Hinckley@maine.gov**) at the Maine Department of Education.

[xv] **https://www.nrel.gov/docs/fy14osti/60068.pdf**