

Electric School Bus Fleet Charging Best Practices

Overview

Congratulations on choosing to move forward with an electric school bus fleet! Transitioning your school bus fleet to zero-emissions is a big change and there are important infrastructure considerations to keep in mind. Factors such as managing charging, maximizing efficiency, and minimizing costs are critical to successful deployment. This sheet outlines common best practices for bus operators and managers to use as a tool in your electric transition.

Charge Management Planning

Planning with Fewer Plugs: If you have fewer plugs than buses, you should develop a charge management plan. A charge management plan essentially indicates which buses will be plugged in, and when. Work with your staff to ensure the right buses are plugged in at the right time so that each vehicle leaves for its route with sufficient charge.

Managed Charging: This may take the form of ensuring buses are plugged in on a staggered schedule (plugging in buses to charge ~5-10 minutes apart) or planning for the inclusion of smart chargers which can manage this for you.

Planning for 1 to 1: On the other hand, if you have the same number of plugs as you do buses, you may not need to worry about giving each bus a turn at the plug. This may warrant a charge management software, used to manage energy efficiency and optimization. This serves two purposes:

- 1 You do not have to manage plugging and unplugging vehicles.
- 2 Your pre-heat or pre-cool energy can be pulled from the grid instead of the vehicle battery, helping to ensure maximum range of your ESB.

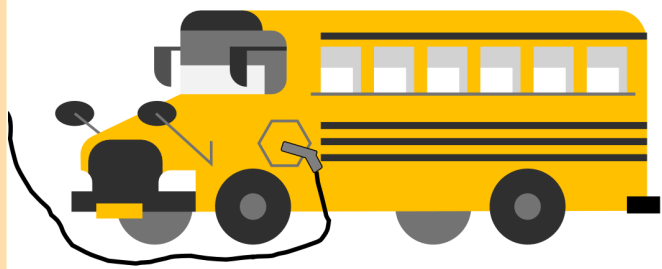


Duty Cycle and Range Considerations

Duty Cycle: First, it is important to identify which diesel buses your electric buses will be replacing. Ideally, electric buses will replace diesel buses one-to-one. You want to ensure your electric bus can meet the needs of your route. For more information on your fleet's duty cycle, you may be able to have vehicle dealers perform a route profile. This will help determine the ideal battery capacity for the electric bus.

Environmental Considerations: It is also important to take into consideration environmental conditions such as topography and ambient temperature. Those conditions can have a significant impact on the range of your electric school bus.

Charging Times: Time of day and charge duration play a large part in determining the electricity costs for your fleet. Whether you opt for overnight charging or opportunity charging (plugging in during short periods of vehicle down-time), you may have to manage charging to ensure that all buses get a turn at the plug. Note that charging times vary by bus model and charger level. An electric school bus at a Level 2 charger may take between several hours or overnight to go from a near-depleted battery to a full charge.



Networked Chargers

Software: After a short set-up process, a charge management system may use software to manage charging for you. For instance, you may choose when charging begins for every connected vehicle, mitigating potentially high demand charges on your energy bill that could result from beginning charging for one's fleet all at once.

Software Capabilities: The Charge Management System can schedule when a charger begins and ends its charging period to avoid demand charges. Using the Charge Management System will ensure that each vehicle is deployed with appropriate cabin temperature and has sufficient charge to meet duty cycle needs.

Involving Your Drivers

Training: Before your school bus drivers take electric buses on the road, it is important to acknowledge the differences between electric and diesel buses and acclimate drivers to the new technology. It is good practice to schedule an initial set of trainings for school bus operators to learn the ins and outs of their new vehicle. They will need to learn to properly operate, manage, and charge an electric bus.

Communicating the Plan: Once a Charge Management Plan has been developed, make sure your drivers know when to plug in their vehicles, when to unplug their vehicles, and how to ensure the next driver arrives to a charged and climate controlled bus ready for their route. Just as you currently maintain and organize your school bus yard, make sure that the charging infrastructure is well maintained and well treated. Keeping plugs organized and off the ground helps ensure the facilities necessary to recharge your vehicles remain in tip top shape.

Temperature Advisory: School districts should note that large changes in temperature or potential bus detours through more difficult terrain may affect a vehicle's range. Communicate these advisories to bus drivers to avoid any buses running out of charge on route.

Range Efficiency: Finally, experienced electric bus drivers are able to adjust their driving to maximize a vehicle's range. Skilled operation of an electric bus (especially avoiding hard braking) allows the battery to recharge intermittently while driving. Consider alerting your drivers of this tip for bus efficiency and encourage drivers to adjust to the specifics of their new electric vehicle.



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