Power Planner for Electric School Bus Deployment

Nine Key Steps for School Districts

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About WRI's Electric School Bus Initiative

In collaboration with partners and communities, WRI's Electric School Bus Initiative aims to build unstoppable momentum toward an equitable transition of the U.S. school bus fleet to electric by 2030, bringing health, climate and economic benefits to children and families across the country and normalizing electric mobility for an entire generation.

Purpose of this Planner

This document is provided as a resource for school districts to prepare for and engage in discussions with electric utilities about the electrification of school bus fleets. Electrifying your school bus fleet will require a strong relationship with your electric utility. You will work together to develop plans, answer key questions and ensure your new electric school buses (ESBs) have the charging infrastructure they need to handle the very important job of transporting students. With proper planning and engagement, interactions with your power provider can be more productive, saving time in the electric utility connection process. Additionally, a focus on longer-term planning can minimize site disturbances and rework, resulting in cost savings for school districts.

TIPS FOR USING THIS PLANNER

This Power Planner presents nine key steps – and corresponding considerations – that school districts can use to properly plan for electrifying school bus fleets. Please note:

- The key steps are presented in a logical order but do not need to be completed sequentially.
- In some cases, you will be able to answer questions on your own. In others, you will likely need to consult another source, including your utility.
- You should review the entire planner before proceeding, as you may be able to obtain several pieces of information at the same time and from the same source.

Progressing through these steps and answering the corresponding questions will position you for effective engagement with your utility - bringing you closer to the reality of electric school buses and a healthier school commute.

Assess your fleet

Why it Matters

Assessing your existing fleet and the purpose of each vehicle helps you understand what is needed from your future electric school bus fleet.

A. Identify School Bus Operational Practices and Parameters (seasonal variation, routes, distances & passenger numbers).

1. How many bus routes do you have?
2. What are the distances of the routes?
3. How many times per day does each bus repeat the route?
4. When do buses leave in the morning? Return? Depart for the afternoon? Return?
5. What other purposes would the bus be used for during the day, e.g. field trips and sports?
6. What is the longest distance the buses are used for in these other activities?
7. Do the routes have different topography?

> *Elevation gain on routes can affect energy use by the ESB, with steeper gradients using battery capacity at a much faster rate.*

> *Many electric vehicles (EVs) have regenerative braking that can help recharge the battery on downslope routes.*

8. Do routes change periodically?
9. What are the seasonal temperature differences that would require bus cabin heating or air-conditioning?

> *Air conditioning and heating can be additional loads on the bus battery or building electricity requirement and may need to be accounted for in route planning and battery capacity requirements.*

10. Do you have other facilities at your depot that have large heating, ventilation and air conditioning (HVAC) loads?
11. Does the bus depot have heating/cooling where the buses are parked in addition to those identified in #10 above?

Determine your intended pace of bus electrification and charging locations

Why it matters:

Construction, equipment and operation costs vary based on the number of buses you're converting to electric. Planning for the next five years will help you determine what's needed now and what you may consider down the road. While there are clear financial advantages to planning early for future expansion, these investment decisions must be made on a case-by-case basis.

A. Use an online fleet estimation tool and/or engage an EV fleet consultant with experience in project management, electric bus selection, alternating current (AC) and direct current (DC) charger selection, and charging management. Tools and qualified contractors can help identify factors that might otherwise be overlooked.

- *Fleet estimation tool resources:*
  - Fleet Electrification Planning Tool | Electriphi Inc (managedcharging.com)
  - Fleet Electrification (electricfleet.org)
  - PreparingToPlugInYourFleet_pdf
  - Alternative Fuels Data Center: Fleet Application for School Transportation Vehicles (energy.gov)
  - Charging Forward: A Toolkit for Planning and Funding Rural Electric Mobility Infrastructure | US Department of Transportation
  - AFLEET Tool (anl.gov)

B. Answer the following questions:

1. Who makes fleet procurement decisions?
2. Who will be responsible for the charging infrastructure and paying the the resulting electric bill -- and is it the same position that procures current fuel contracts?
3. How many bus stalls do you have at your depot and how are they parked (e.g., inside, outside, nose-to-tail rows)?
4. What is your current and anticipated fleet size?
5. What is your short-term and long-term plan for fleet electrification at your site?
6. Do you have more than one bus depot?
7. Do you have "park outs" or buses that are housed off-site?
8. Do you have space to widen your stalls by 30 to 50 percent?

> *Electric buses may require larger stalls to handle charging cable access and vehicle charging ports that may be on the side of the vehicle.*

9. Who will be charging the bus (e.g., fleet technician, driver or a third-party provider)?
10. What is your target date to have the electrified vehicles in place?
11. Does your electric utility have hosting capacity maps or other publicly available resources to help you understand what infrastructure may be required on their side to provide you with the service you need?
12. Are there lighting or security concerns?

> *Incorporate additional electrical devices like lighting and proper drainage in your fleet conversion and charging placement plans.*

Identify your project priorities

Why it matters:

You may be able to gain more support for ESB adoption and fleet conversion if you are able to align your goals with the priorities of your state, municipality or school district. It is also important to engage community members in your effort to help shape project priorities and to provide feedback and support throughout the deployment process.

A. Identify your school district's top priorities (e.g., cost savings, health impacts, carbon emissions reductions, etc.) and related ESB benefits.

B. Answer the following questions:

1. Are there any targets your district needs to meet, driven by community, corporate, contractual or policy requirements?
2. What are your project priorities?

> *School bus electrification offers a meaningful opportunity to engage the community to correct inequities across the transportation system and broader society. Equity is an example of an important priority to include.*

3. Can priorities be stacked for a larger outcome?

> *Additional priorities to consider: meeting community interest in electrification, serving underserved communities, reducing energy bills, using clean energy or reduction of greenhouse gases, etc.*

4. Are you interested in behind-the-meter (i.e., facility-side) battery storage in the case of onsite renewable energy generation, such as with a solar canopy?

Identify key contacts at your electric utility

Why it matters:

Your main point of contact will help you navigate the full process. While many electric utility employees may review or be involved in an aspect of your project, you will need a central contact to go to for information and project updates.

A. Identify the names of the electric utilities that provide power to your school district. Collect relevant contact information.

B. Answer the following questions:

1. Do you have an existing electric utility point of contact?

   > *This is typically a Key Account, Commercial or Government Affairs Manager.*

2. Are they the right person/people to address ESB efforts?
3. What departments do you need to involve in the distinct phases of your project?

   > *Don't assume that departments share your project information. Unfortunately, you may need to have multiple copies to share and distribute to different people within the electric utility.*

4. Is there an EV champion at the electric utility?

C. Summarize your electric utility meetings in writing through email to the electric utility point of contact. This will help track action items for both the school district and electric utility while providing a record of the interaction should either party have a change in project personnel.

Communicate with your electric utility early and often

Why it matters:

Early communication saves time and money. Engaging with your electric utility early in the process and including a knowledgeable electrical technician or contractor helps you get answers to your questions and properly assess your site electrical requirements. And remember, you are not alone in this: WRI and others may be able to provide free technical assistance, tools and resources to help you navigate the electrical connection process.

Here are some beginning tips to establish a communication bridge with your electric utility.

A. Seek out information on your electric utility.

1. Knowing more about your electric utility may provide information on where they face hurdles or have opportunities. Electric utilities are heavily regulated which may present limitations.
2. Know where your interests align: identify the value of collaborating and help identify the win-win for both parties.

B. Be clear in your request to your utility.

1. Be specific in your ask. Identify your priorities, as well as those areas in which you might be able to be more flexible. Can you have some immediate wins and put off others for later phases of the project?
2. Understand how the timing or content of your request relates to the electric utility's values and goals, as well as electric utility and regulatory processes. Special rates and programs often go through public processes before they can be offered to customers.
3. Be ready to problem-solve together!

C. Identify your potential value to the electric utility such as:

1. School district resources serving as grid resources (see step 9 for details).
2. Increased predictable load.
3. Positive effect on electric utility's image and community relationship.

D. Develop and strengthen your electric utility relationship.

1. Engage with your electric utility often and express your transportation targets and plans, as well as other community or sustainability goals.
2. Invite the electric utility to be your partner in city planning and other processes.

Understand your electric utility rates

Why it matters:

It is important to know how electrifying your fleet is going to affect your electric bill. In addition, there may be rates that are more favorable to electric vehicles that can reduce your costs for electricity.

A. Obtain a copy of your current electric bill with account number(s) listed.

B. Answer the following questions:

1. Are you currently subject to "demand charges?"

> *Demand charges are fees applied to the electric bills of commercial and industrial customers based upon the highest amount of power drawn during any (typically 15-minute) interval during the billing period. Demand charges can comprise a significant proportion of commercial customers' bills.*

2. Does your electric utility have an EV-specific or time-of-use (TOU) rate?

> *This information is typically found on the electric utility website.*

> *Obtain copies of EV-specific rates and tariffs to have all the terms and conditions in writing.*

3. Does the TOU rate require a dedicated/ separate meter?
4. Does the electric utility offer any relevant incentives or rebates for EV chargers, customer-side infrastructure (make-ready infrastructure), customer line extension or service allowances?
5. What is the procedure for incentive or rebate qualification and payment?
6. As a comparison, are there other ESB programs in your state that have more favorable rates and programs that are supported by your public service commission and approved for use by another electric utility?

Understand the construction and installation requirements

Why it matters:

Knowing your charging infrastructure construction and installation requirements up front will save you time and money. Often, these installations require permits and inspections before they can be approved for use.

A. Using a previous electrical design consultant/ contractor with access to existing drawings and site knowledge may save cost and time.

B. Obtain a single line drawing of electrical service connection/entrance into your facility.

> *It is typical to depict the electrical distribution system by a graphic representation called a single-line diagram. A single line can show all or part of a system and can depict simple, direct current (DC) systems or complicated three-phase systems. Visit Learn To Interpret Single Line Diagram (SLD) \| EEP (electrical-engineering-portal.com) for more information. This diagram is often held by site managers or engineering contractors responsible for initial site construction.*

C. Request the electric utility's "Greenbook" or standards of construction for each task or phase.

D. Identify the Inspector of Record (IOR) requirements.

> *The inspector may be an electric utility employee or a contractor hired by the electric utility or government agency to oversee or provide permit inspections.*

E. Identify easement procedures and requirements of your utilities.

> *Utilities like sewer, water and gas are typically installed underground and need to be identified before any trenching at the site.*

F. Incorporate as-built (final) drawings into your project as deliverables so that they can be referenced later with accurate depictions of the above-ground and underground infrastructure installed at the site.

G. There may be additional requirements if the school district leases the site.

> *If the site is leased, you may need to obtain drawings or other necessary site information from the site/depot owner or landlord.*

> *Your electric utility will most likely require site owner signature to proceed with electrical infrastructure alterations or improvements at the depot.*

Determine charging and power requirements

Why it matters:

Not all vehicles and chargers are built the same. It is critical to properly plan for the specifications of the vehicle and the charger to avoid installing the wrong equipment and being unable to charge your vehicles.

A. Answer the following questions:

1. Will you be utilizing existing electrical infrastructure, or will new service be required?

   > *An existing meter may provide a temporary (cost-effective) power connection to commission EV chargers before buses arrive.*

2. How long will the application for new service or upgrade take?

   > *Ask your electric utility point of contact for a detailed process timeline.*

3. Can your project be completed in phases?
4. What type of charging are you requiring?

   > *Level 2 charging takes more time to charge the battery and may require overnight charging.*

   > *Fast charging takes less time but may reduce battery life and is approximately 8-10 times the cost of Level 2 charging.*

   > *Fast charging may also result in demand charges.*

   > *More about charging speeds and types can be found on the Department of Transportation website at Electric Vehicle Charging Speeds \| US Department of Transportation*

5. Where will the chargers be located?
6. Is the charging area close to available power panels or the electric utility service connection?
7. How much panel capacity remains at each depot?

   > *Your electrical panel is rated in terms of amperage (amps).*

   > *Each Level 2 charger requires approx. 40-60 amps.*

   > *Each fast charger will require at least 120 amps.*

8. Do you have any EVs and/or associated charging equipment already installed at your depot?
9. Will you be installing around the edge of the parking lot or will you need to install charging islands?
10. Are you willing to move your buses to the charger(s) or do you need a charger per vehicle?
11. Have you considered ongoing operations and maintenance of the charger and associated equipment through a service-level agreement (SLA) with the charger network provider?

    > *An SLA is a contractual arrangement for services not performed by the receiving entity. For electric vehicle supply equipment (EVSE), important items to include are response times for service and repair, amount of time charger is operational (uptime) or disabled (downtime), updates to software and hardware, spare parts and warranties.*

    > *Especially in rural or remote locations, service technicians may not be readily available to respond to a call about a non-functioning charger.*

    > *As a rule of thumb, the higher the power requirement and capability of your charger, the higher the need for specialized repair services that might not be available locally.*

12. Is there a high voltage (three-phase or single phase) line near your depot?
13. How much onsite transformer capacity remains?

> *The transformer(s) supplying electricity to your site may be outside your fence line.*

> *Transformers vary in size and configuration and may be mounted on power poles or pad-mounted on the ground.*

> *Installing new transformers can quickly add to project cost, so future planning is key if a new transformer is needed.*

> *Transformers tend to be used for a long time – plan for your electrical requirements through the next 10 to 15 years.*

14. How much capacity remains at the electric utility substation?

Consider V2X and disaster response/ resiliency opportunities

Why it Matters

By considering vehicle-to-everything (V2X) and grid resiliency/disaster response capabilities up front, you can set your fleet up to play an important role in a reliable and cleaner grid – while reducing your total cost of ownership (TCO).

V2X is an all-encompassing term describing a scenario in which stored energy in the vehicle is discharged for some benefit and includes vehicle-to-grid (V2G), vehicle-to-building (V2B) and vehicle-to-load (V2L) applications. With predictable schedules and large battery capacities, ESBs are well suited for V2X and offer opportunities to provide additional benefits to the owner and the community through use as emergency mobile power units.

V2X benefits can include:

- Compensation for load management (i.e., not charging at peak periods) resulting in a lower ESB TCO.
- Supporting renewable energy generation by providing a storage opportunity for energy at the time of generation.
- Supporting grid flexibility and emergency response.

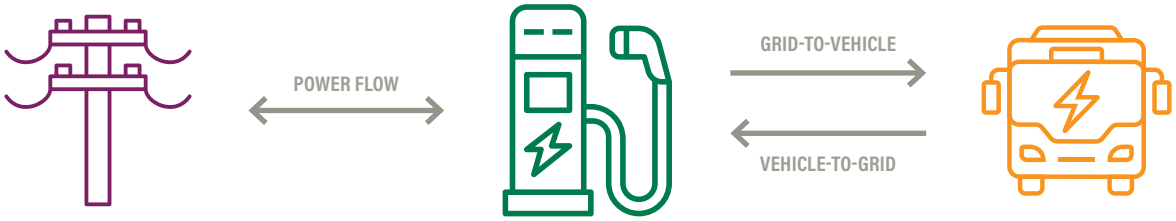
A. Answer the following questions:

1. Does your electric utility offer V2X programs? If so, what are they?

   > *Many utility V2X programs are handled through existing demand response tariffs that pay customers to reduce their load at specific times when energy production is limited.*

2. Does your electric utility ever ask you to curtail power due to a generation shortfall?
3. Are you currently part of an electric utility-run curtailment or power management program, like demand response?
4. Are your current fossil fuel buses used in emergency response, such as to transport non-students in a disaster?
5. What is your role in your local emergency response plan?
6. Are any of your school buildings used as emergency shelters?
7. Can the emergency shelter building(s), like a cafeteria or gymnasium, be electrically isolated from other school buildings and facilities?

BASIC V2G POWER FLOW DIAGRAM



8. Do you have any renewable generation connected to your depot, like solar panels?
9. Is non-vehicle battery storage available or required at your depot?
10. How will you recharge your ESB after it is used for emergency mobile power?

Next Steps

Now that you've planned for your electric school buses, it is time to procure them and to implement your charging infrastructure project so that you can be ready to charge the buses when they arrive. Your utility, as well as projects like WRI's Electric School Bus Initiative, can provide support and assistance during your electric school bus journey.

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