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ELECTRIC SCHOOL BUS
C O A L I T I O N

Electric School Buses:

A Practical Resource Guide for School Districts

TIPS ON USING THE GUIDE

- Some of the sections build on information in other parts, but each one can also stand on its own, so if you are working with a team, you can split up the project among the group.
- Although we put these sections in a rough order that could work for your district, feel free to use them however works best to meet your specific needs.
- Finally, while this guide provides most of what you will need, many other resources exist that may offer further details, and we point some of them out along the way.
- For even more assistance, please explore our website at **eschoolbus.org** or contact us at **info@eschoolbus.org**.

Electric school buses (ESB) offer advantages over internal combustion models. They cost less to operate and maintain than vehicles powered by fossil fuels. ESBs also have no harmful tailpipe emissions that degrade air quality and impact the health of students, drivers, and other staff.

School districts that consider updating their fleets face many challenges. They must research and select the best bus model, set up charging systems, and, possibly the most significant challenge, budget for the upfront cost – a problem that federal and state funding programs increasingly are helping many school districts overcome.

With these issues in mind, the Electric School Bus Coalition is aware that many transportation managers and school officials are looking for a straightforward guide to help them lead successful electrification projects. This is that guide.

As you begin the journey to electrify your school bus fleet, we want to help you understand every important part of the process, including:

ELECTRIC SCHOOL BUSES: AN OVERVIEW OF BENEFITS, CHALLENGES AND OPPORTUNITIES

School districts across the U.S. are considering adding electric school buses (ESB) to their fleets. This overview summarizes key facts to remember, including benefits, opportunities, and challenges that an ESB will bring to your bus fleet.

Benefits

- ESBs **eliminate pollution** emitted into the air around schools from diesel and gas engines, helping protect the health of students and staff, especially those who have existing breathing problems. Pollution levels inside diesel buses average 5-10 times higher than the neighborhoods in which they travel.[1]
- Replacing a diesel bus with an ESB will **save your school district** as much as $2,000 in fuel costs each year.
- The average ESB **costs 60% less per year to maintain** compared to a fuel-powered bus, considering items like oil changes and other repairs.[2]

Contact the Electric School Bus Coalition at **eSchoolBus.org** for more information about the benefits of ESBs.

Opportunities

- There is $5 billion available for districts to replace conventional buses with ESBs under the Clean School Bus Program.
- In the Inflation Reduction Act passed in August 2022, electric school buses can qualify for additional federal funding and incentives.
- Several states have also established funding programs to subsidize purchasing of ESBs, including California, Massachusetts, and New York.
- While the cost to buy ESBs remains higher than conventional buses, the price gap is narrowing as production volumes increase and batteries become more affordable.[3]
- The cost of chargers and electricity remain steady, while diesel and gas prices are volatile and difficult to plan for.
- Many electric utilities run programs that allow ESB batteries to provide backup power to the grid, commonly known as "Vehicle-to-Grid" (V2G) programs.

Challenges

- The initial purchase price of an ESB can exceed $250,000 depending on size and features. By comparison, buses powered by conventional fuel are priced at approximately $110,000 at the time of writing.
- Current ESB battery technology provides a range of about 100 to 150 miles on average.
- In climates that have cold weather, hot weather, or both, controlling the temperature inside ESBs may reduce their effective operating range.
- ESBs have charging requirements that may not be widely available away from their home base. This adds a step to configuring a fleet, setting routes and planning trips.

1 https://www.vox.com/future-perfect/2021/4/6/22364385/one-small-idea-in-bidens-infrastructure-plan-with-big-benefits-electric-school-buses, https://elpc.org/projects/electric-school-buses-safe-ride-for-kids/, https://nylcv.org/news/report-shows-electric-school-buses-reduce-pollution-create-jobs-benefit-kids/

2 https://blogs.edf.org/climate411/2021/02/26/a-teachable-moment-zero-emission-school-buses-are-a-winning-proposition/

3 https://www.edf.org/media/new-study-finds-rapidly-declining-costs-zero-emitting-freight-trucks-and-buses

QUESTIONS TO ASK WHEN PLANNING FOR ELECTRIC SCHOOL BUS INTEGRATION

School districts need to answer many questions before integrating electric school buses (ESBs) into their fleet. This section includes a set of questions to help discover what you need to know about your district, the students and families it serves, and the routes and individual vehicles that make up your overall fleet.

The answers will not only give you and others a better idea of what to expect from the process, but may also help identify issues you want to address now, rather than discovering them later on. This information can also help you qualify for funding to buy ESBs and chargers, since many programs now require districts to show they have looked at all the important issues when they apply.

Critical questions and planning fall into five areas:

1	Evaluating environmental and social challenges
2	Assessing current and future fleet requirements
3	Defining performance and cost factors for new vehicles
4	Configuring the charging systems needed to provide for ESBs
5	Looking beyond the first wave of grants to plan for future ESB procurement

These sample questionnaires are a good start, but consider whether you may want to dig deeper in certain areas to help make better decisions and make a successful ESB plan.

Evaluating Environmental and Social Factors Affecting Your District

School districts in low-income areas often serve students with significant needs, while at the same time having more limited resources. If your district faces this challenge, then documenting it will help you fulfill an important qualification for needs-based funding models.

- What is the percentage of students living in poverty at each school?
- What is the air quality around each school and in the community at large?
- What is the condition of the existing fleet? Are current buses well maintained?
- How do the funding resources for your district compare to state and national averages?

Assessing Your Current School Bus Fleet and Future Fleet Requirements

As you develop short- and long-term plans for updating your bus fleet, you will want to gather the following data to determine your budget needs and opportunities to save money in the future.

- How many school buses are in your fleet currently?
- What are the ages and conditions of the buses?
- How many total miles are driven by the fleet each year?
- What is the average fuel economy (miles per gallon) for the buses?
- How many gallons of fuel does the fleet use each year and how much does the school district spend on fuel in a year?
- What is the average number of oil changes that the buses receive each year and how much money is spent for oil and filters per bus? How much money is spent on antifreeze?
- How much does the school district spend repairing school buses each year?
- How many schools does the district have and how many buses are in service for each school?
- How many miles per year are involved in the individual bus routes and what is the total number of miles driven for each school?
- What is the length of time between each bus's morning and afternoon routes?
- How many buses does your district need to maintain to handle long-distance travel for field trips, athletic events, and similar requirements?

Assessing Plans for the Future

- Do you plan to electrify your entire bus fleet? If so, what is the target date for this transition? (Some districts have set a date of 2035 to complete this process.)
- What are your district's plans for adding (or removing) schools, bus routes, and buses in the next 5-10 years?
- How long will your district need to maintain diesel/gas school buses before your charging infrastructure would be able to handle a fully electric fleet?
- How much does a new school bus with a gas or diesel engine cost?
- How much money does the school district allocate to purchase/lease new school buses each year?
- How many years does your district plan to keep an average diesel/gas school bus in service? How long is the warranty?
- What is the average expenditure to purchase, fuel, maintain, and insure a gas/diesel school bus for the life of the vehicle?

Defining Your ESB Needs

Bus manufacturers have a tremendous amount of information they can provide to help in the decision-making process. Here are some of the questions you will want them to answer. Most are fairly clear, but some are less obvious.

- What is the cost of the vehicles we will purchase?
- How long is the total vehicle warranty?
- What is the expected life of the ESB?
- Who will service the vehicles while they are under warranty? Where will service occur?
- What is the expected average cost to purchase, fuel, maintain and insure an electric school bus for the life of the vehicle?
- What size is the battery on the school bus?
- What is the battery made of?
- How long (time and/or mileage) is the battery warranty?
- What is the fastest charging rate they can handle?
- What is the recommended level of charge needed to preserve the life of the battery? 80%? 90%? 100%?
- How long should it take to charge from 20% to the highest level of recommended charge?
- How many miles does the bus get per kilowatt-hour of electricity from the battery at normal temperatures?
- How many miles at temperatures above 90 degrees Fahrenheit? How many miles at temperatures below 40 degrees Fahrenheit? (*See range discussion, page 9*)

Configuring ESB Charging Infrastructure

Electric charging may be less familiar to you, with many factors to consider. Charging providers and utilities will be essential partners in setting up a system that will provide good, reliable service – and probably save your district significant amounts of money.

Basic Specifications

- What level of power will be needed to charge the electric school buses? 19.2 KW? 30 KW? 50 KW or higher?
- How much do the chargers cost?
- How long is their warranty?
- How much will it cost to install each charger?
- Who will install and maintain the chargers while they are under warranty?
- How much power must be supplied to each changer?
- How much will it cost to get the required electrical service to the chargers? Who will do that work?
- How many school buses can a single charger be reasonably expected to fully charge in a single day?
- What is the ratio of chargers needed per bus?
- Should we have chargers at multiple locations to reduce the chance that a weather emergency could knock out all the school's chargers for an extended period?
- Is external battery storage an option?
- Where will the chargers be installed? At the current bus area? At some of the schools?
- How much space will be required for each charger?
- What is the safest and most economical place to install the chargers?
- Could the school district partner with municipal government to create one or more electric bus charging stations that could service both school and city buses?

Configuring Vehicle to Grid (V2G) Capabilities

Because ESB batteries can store significant amounts of energy, they could provide a meaningful improvement to the stability of local power grids. This technology installs equipment that can reverse the flow of power from batteries back into buildings or the grid. In this case, your school district might be able to charge for the cost of supplying that energy and help the local community recover from outages or withstand periods of high demand. Most such systems are still in early phases of deployment, but are worth exploring.

- Does your local utility support V2G or bi-directional charging?
- Will the ESBs and chargers you are installing have bi-directional capabilities?
- Can the charging infrastructure be used as a distributed energy resource (DER)?
- Is there a companion inverter that can redirect power from the school bus's battery back to the grid in the event of power outages or emergencies like tornadoes and ice storms?

Planning Future Funding

As noted elsewhere in this guide, paying for ESBs represents a hurdle to integrating them into many school's bus fleets (*see page 17*).

- How will we fund additional buses and infrastructure after the EPA Clean Bus program has ended?
- Can we use cost savings generated from the first buses to support future purchases?
- Can we use savings from the district's standard annual allocation for new school buses and standard projected costs for yearly maintenance, repairs and gasoline to purchase additional electric school buses, chargers and infrastructure each year until the fleet is fully electrified?
- What other programs exist to support purchase of ESBs and charging equipment?

ESSENTIALS FOR INTRODUCING ELECTRIC SCHOOL BUSES INTO YOUR FLEET

This section provides a high-level description and a template plan showing the steps you should take to create and carry out a plan to bring electric school buses (ESB) into your district.

Your plan will in turn help:

- Set realistic expectations
- Define a timeline for the project and for subsequent phases in the future
- Identify budget requirements and ways to save the district money over time
- Determine where and when your district should add ESBs to its fleet in each phase
- Find the right vehicles to purchase/lease
- Select who you should partner with for sales and service
- Design your charging infrastructure
- Answer questions from teachers and staff, school and community leaders, and students and their families

The lists of questions provided elsewhere in this guide will provide essential information to shape each part of the plan (*see page 6*). We suggest that your plan addresses each step in the following order, but this isn't the only approach—your district may need to modify the sequence or tackle some issues at the same time. You may even decide to skip some steps (but please only do this after careful consideration).

STEP ONE: Understand the School Bus Electrification Timeline

Electrifying an entire school bus fleet will likely take several years. A typical district will purchase vehicles and charging equipment on a rolling basis while decommissioning existing diesel and gas vehicles. You can expect the process of selecting, purchasing and commissioning your first ESB to take a year or more, depending on your district's budgeting requirements, your ability to build positive momentum, and lead times for ordering and delivery of vehicles and equipment.

Defining and communicating your specific timeline will shape expectations from others in your district and the school community as a whole. The case studies offered elsewhere in this guide (*see page 18*) may provide example timing and help you estimate how long the process could take in your district.

STEP TWO: Assemble a Team, Partner with Experts, and Explore Your Options

"Many hands make light work," as the saying goes. We recommend you involve at least the following on your ESB team, adding them to the team as early as it makes sense to do so:

- Utility Representative: Contact at your local utility provider (*ESSENTIAL for planning charging infrastructure – see page 12*)
- Supplier Representatives
  - Contact(s) from the ESB supplier company or companies who will provide vehicles and maintenance
  - Contact(s) from the charging infrastructure supplier company or companies who will supply charging infrastructure, whether purchasing equipment outright or supplying charging as a service (CaaS). Some companies offer vehicles, charging equipment, and services as a package, often referred to as Fleet Electrification as a Service.
- School Leaders: Representative from the administration and/or staff at the school(s) whose students will use the ESB
- Bus Drivers and/or Managers: A designated person who can communicate with the bus drivers who will operate the ESBs
- Private Entities (optional)
  - Electrification-as-a-Service (EaaS) Providers
  - Consultants
  - Others

Check out these partners carefully, so you can rely on their expertise and experience once you have them on the team. They may be able to help you answer key questions about your needs (*see page 5*), establish and finalize your initial plan, and identify next steps for the future.

STEP THREE: Identify Current Routes and Daily Range Requirements

Many school districts have route information available from past years of service. If you want to reconfirm or update your district's data, many ESB vehicle and equipment partners can assist with this part of the process. In the U.S., the average driving distance per shift for a typical school bus is about 32 miles, with a total of about 73 miles per day (source: NREL), over the course of about 5 hours. All ESBs currently on the market are more than capable of serving most districts' short- to medium-length routes.

You will want to plan to have a buffer of at least 15-20 miles to account for delays, detours and other factors. Also note that air temperature can reduce maximum driving range, because the battery often runs the heating/cooling equipment to make the cabin comfortable for students and maintain the battery itself at optimal temperature. Some buses do have separate power systems for heating and cooling.

Prioritizing routes that are shortest and most predicable is a good way to begin integrating ESBs into your service. For example, a route that is 30 miles or less could be easily covered by a bus with a standard range of 100 miles – even after accounting for worst-case cold weather range reductions and leaving plenty of buffer for your drivers. Since many routes end by midmorning and don't restart until early afternoon, you may be able to recharge ESBs at least partially between shifts and extend the total distance they can cover in a day.

STEP FOUR: Determine ESB Passenger Capacity and Size

Types of ESBs – A, B, C, and D – match those of existing gas and diesel buses, which are designed for a range of passenger and weight capacities. Mirroring the school bus industry as a whole, ESB versions Type C designs are most common and have a large number of options from manufacturers, although multiple versions of electric Type A's and Type D's are also available.

Here are four types used often by school districts:

TYPE A buses are typically built on a cutaway van chassis, usually feature a passenger door located behind the front wheels, and may have a separate door for the driver. They may be equipped for wheelchair and/or ambulatory access and can carry from 10 up to 20 passengers. This type has two subgroups. A-1 buses have a weight rating (GVWR) under 10,000 lbs. A-2 buses have a weight rating over 10,000 lbs.

TYPE B buses are less common than some other types. They usually feature a design in which the passenger section of the bus attaches to a vehicle chassis with a section of the engine beside the driver's seat. The entrance door for students appears behind the front wheels of the bus. This bus type can typically carry up to 30 passengers, and also falls into two subgroups. B-1 buses have a weight rating under 10,000 lbs. and B-2 have a weight rating over 10,000 lbs.

TYPE C buses represent the most common and traditional school-bus design, with the engine located at the front of the vehicle and the entrance door behind the front wheels. These buses have a capacity of up to 80 passengers, with typical weight ratings between 23,500 and 29,000 lbs.

TYPE D buses have a flat front that resembles a transit or commuter bus and are the largest school bus type. They have a capacity of up to 90 passengers with typical weight ratings between 25,000 and 36,000 lbs.

If you are replacing an existing bus, you may choose to purchase an ESB with similar capacities to the bus currently used for that route.

As noted above, you will want to consider range in addition to passenger and weight capacity. 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 options for each bus type to meet the driving range requirements of a given fleet. Driving ranges under standard operating conditions (65 degrees and relatively flat terrain) typically start at 100 miles, with 150 miles or even 200+ mile ranges available with larger battery packs.

STEP FIVE: Identify Parking Locations and Daily Dwell Times

For ESBs, "dwell time" refers to how long the vehicle is plugged into a charger. Since ESBs typically remain parked overnight, as well as several hours during the day between shifts, they have the advantage of being able to use this time to recharge.

You should incorporate this into your charging infrastructure plan (*see page 12*) by placing chargers at ESB parking locations, because the long dwell time of ESBs may allow you to install Level 2 chargers rather than direct current fast chargers, which are more expensive. Charging overnight when demand is lower may also help you negotiate favorable rates for electricity with your utility.

STEP SIX: Partner with Your Electric Utility

Contacting your local electric utility early in discussions of ESB planning will be critical to the success of your ESB project. As you design ESB charging stations and charging management systems, utility representatives can evaluate whether changes to the electrical supply at that location may be needed. If they do need to upgrade transformers and/or switch gear, the utility will likely want to allow for potentially long lead times to purchase and install these electrical components.

You may also wish to talk to your utility about adding vehicle-to-grid (V2G) technology in the future. V2G capabilities allow vehicle batteries to act as backup power sources for key school or community facilities during outages or when demand may be unusually high. *See page 12 for more details.*

STEP SEVEN: Inform the Community and Stakeholders

Share your ESB plans with others in the school community to address their questions and build trust and excitement in the arrival of this new technology to your district. Holding town-hall style meetings and webinars will ensure that they have the facts, understand the plan, and have the opportunity to ask questions.

Additional Resources

- World Resources Institute: Electric School Bus Roadmap
- Environmental Defense Fund: New Study Finds Rapidly Declining Costs for Zero-Emitting Freight Trucks and Buses

Electric School Bus Roadmap

Transitioning to electric school buses generally follows a standardized process and can take around two years of planning. Your timeline may be different and will depend on local capacity, financing and processes, and the availability of buses.

3 TO 6 MONTHS	12 TO 24 MONTHS		ONGOING
1. ROADMAPPING	**2. PLANNING & PROCUREMENT**	**3. CHARGING INFRASTRUCTURE**	**4. TESTING & TRAINING**
1.1 Visioning & market study	2.1 Facility & site assessment	3.1 Utility coordination for rates & interconnection requirements	4.1 Fleet & equipment testing
1.2 Community & stakeholder engagement	2.2 Operations, fleet & infrastructure plans	3.2 Bus depot upgrades & solar pairing	4.2 Driver & mechanic training
1.3 Funding & financing research	2.3 Procurement evaluation & RFI/RFPs	3.3 Charger installation & evaluation	**5. DEPLOYMENT & SCALING**
1.4 Roadmap creation			5.1 Fleet deployment
			5.2 Monitoring, tracking & reporting
			5.3 Community outreach & sharing of lessons learned
			5.4 Scaling strategy

Source: World Resources Institute

REQUIREMENTS FOR ELECTRIC SCHOOL BUS CHARGING INFRASTRUCTURE

Selecting, commissioning, and managing charging infrastructure for your fleet of electric school buses (ESB) may prove one of the most challenging tasks to plan and execute. Done right, it can also prove to be one of the most rewarding, offering excellent opportunities for collaboration, savings, and efficiency. This section recommends some approaches to try and lists things to consider.

Recommendations

- When setting up ESB charging infrastructure, you need to involve several stakeholders. In addition to the person or people responsible for managing the school district's bus fleet, you should work with representatives from your local utility; experts in the design, installation and operation of charging systems; and others from the district such as the person responsible for the site where chargers will be installed.
- Rural school districts especially should consult with their utility early in the process, because these areas often have limited electric grid capacity. In addition, ESBs in rural areas may have higher range requirements if they drive longer routes. On the other hand, an ESB could help give these communities more experience and resources to support electric vehicles, an important step toward future development.
- Have your group of stakeholders discuss long-term fleet electrification plans in addition to short-term goals. This is an area where the team's different perspectives can help you find the optimum solution for charging location and equipment, not just the most obvious one. In addition, upgrading electrical systems to accommodate future charging loads can generate significant cost savings in the longer term.
- Analyze school bus routes to determine your charging needs and find the best solutions. An electrification expert can help explore the advantages and cost impact of all options. Some items they can help you with:
  - Determining the number of chargers you will need now and in the future
  - Evaluating different charger models and charging rates
  - Considering the pros and cons of smart networked chargers vs. non-networked chargers.
- The specific needs of ESBs are different from company to company and model to model. Check that the chargers you specify will support the types of vehicles you purchase. Ask about how the vehicle telematics work, and discuss the vehicles' maintenance needs and overall lifespans. Discuss future usage as well as your current needs.
- Design your fleet vehicle replacement plan to consider a period of 10 years, rather than just looking at your first few buses. Ask partners what changes they expect in both vehicle and charging technology. What is coming next?
- Explore whether vehicle-to-grid (V2G) systems could be added to your charging system now or in the future. Your utility may be interested in partnering with you to add V2G capabilities, because this emerging technology allows ESBs to "function as giant rolling batteries to support the power grid, enabling greater renewable electricity generation and providing disaster relief," according to the World Resources Institute. Could your community benefit from being able to tap into ESB batteries to power critical facilities during power outages or when demand for electricity is extremely high?

Considerations

- Right-sizing your charging infrastructure should be one of your highest priorities. Creating a system that is underpowered or has too few chargers will cause service gaps, especially if one piece of equipment goes down. Putting in too much equipment for your needs isn't just a waste of initial resources; it will also increase your ongoing maintenance. There is no one-size-fits-all approach. You should partner with fleet electrification experts to determine your district's specific needs.

- As mentioned elsewhere in this guide, chargers for ESBs may draw a sizable electrical load. In many cases, the electrical system must be upgraded to ensure safe and reliable service. Here are some of the most important questions you will want to discuss when setting up your ESB charging system (*see page 7 for many more questions to ask about chargers*)
  - Does the school district lease or own the property where the buses are stored?
  - What permits and approvals may be needed to install the system?
  - Have you consulted the local utility?
- The specific needs of ESBs are different from company to company and model to model. Check that the chargers you specify will support the types of vehicles you purchase. Ask about how the vehicle telematics work, and discuss the vehicles' maintenance needs and overall lifespans. Discuss future usage as well as your current needs.
- Research the operation and maintenance costs of your charging equipment. Charging equipment is simple to use once installed, but like most equipment it requires maintenance to continue to operate throughout its lifetime. The electrification expert on your team should explain these requirements and the associated costs.
- While it often takes the most time to receive delivery of ESBs, it's also important to consider the procurement process and lead time for equipment. Your electrification expert can often manage this aspect of the project to ensure charging systems timelines align with the overall project schedule.

Additional Resources

More assistance with charging infrastructure is available from the resources listed below.

Charging Equipment and Options

- Alternative Fuels Data Center: EV Charging Infrastructure
- Virginia Clean Cities: Charging Station Considerations
- Virginia Clean Cities: Planning Charging Stations
- Virginia Clean Cities: Charging Stations Info

Help for Rural Locations

- U.S. Dept. of Transportation: Toolkit for Rural Electric Vehicle Infrastructure

Saving Money Using Smart Charging

- Enel: How to Maximize EV Charging Cost Savings

V2G Information

- World Resources Institute: Design Considerations for Electric School Bus Vehicle-to-Grid Programs

GETTING SUPPORT FROM YOUR LOCAL UTILITY

Electric school buses (ESB) will add significant demand for power to your local facilities, as well as to your community's electrical grid. In addition, however, ESBs could help your local utility enhance the sustainability, resiliency and energy efficiency of its operations.

To gain the most benefit (and head off possible problems), you should include your utility at the very earliest idea stage of your ESB project and work closely with them throughout the project. Utility partners will not only help optimize your vehicle charging system, but also may help offset the costs and grant favorable electrical rates that save the school district thousands of dollars each year.

This section explains these opportunities in more detail. If you haven't already, you should also take a look at the sections on charging infrastructure (*page 12*) and questions to ask about charging (*page 7*).

Working with Your Utility to Handle the Power Demands of ESBs

Estimating electrical load for a fleet of ESBs will depend on several issues, including:

- The size of the buses and especially their batteries (150 KW batteries are typical for ESB);
- How much power they consume while driving their routes;
- The type and speed of the chargers they use; and
- What electrical capacity (including power type, wires, transformers and other components) is available.

Balancing all these and other considerations will take some research – plus a lot of discussion. A free online tool, EVI-Pro Lite, is available from the Department of Energy to help with planning charging infrastructure for states and municipalities. This resource may be overkill for your district, so consider starting out by talking to your utility to see what they recommend. Also include representatives from your charging supplier(s) and vehicle manufacturer(s). Two rules of thumb that may be helpful:

1. Plan to have enough power for your needs 5 years from now.
2. Configure your charging site(s) to have power available for at least twice as many chargers as you are currently planning to install.

Ways that ESBs Can Help Your Utility Improve Operations

The benefits of adding ESBs and their batteries go both ways. Electric buses can help your school district run more sustainably and at lower cost, but they can also improve how the local utility runs its business. Here are some of the reasons why:

- Electric vehicles represent a large potential source of stable power demand. That helps the utility pay for its generation plants and distribution systems.
- Nearly all the power ESBs need can be provided during off-peak hours, making it much easier for utilities to offer that supply without needing to add new capacity.
- Utilities are working now to add battery capacity to their systems that will store energy from variable clean energy sources like wind and solar. With new Vehicle to Grid (V2G) systems now in development, ESB batteries could be part of that solution (*see page 12, Requirements for Electric School Bus Charging Infrastructure*).

How Utility Partnerships Will Save You Money

Because utilities benefit by adding ESB and other electric vehicles, one of the first ways they can help you save money is by directly paying for or subsidizing the cost of electrical upgrades, charging equipment, and even the buses themselves. Some utilities even want to own the charging systems, carrying that cost in exchange for being able to manage the system.

Another way utilities will assist districts is by providing lower electricity rates. Contracting favorable cost terms saves the school district even more money on bus operations, and on the other hand helps the utility strengthen its basic level of power usage. Be sure to fully investigate discounts, incentives and rate structures with your local utility.

Of all the ways talking to your utility can help, identifying potential mistakes is probably the biggest. For example: If you install an electrical panel only large enough to supply power for your current needs, then you will either have to start sharing chargers (adding hassle and planning burden to bus operations), or pay to upgrade or replace your panel when needed. Avoiding that cost will save thousands of dollars in equipment and labor costs.

Of all the ways talking to your utility can help, identifying potential mistakes is probably the biggest.

Additional Resources

- Blink: How Planning Helps Save on Charger Installation

MONEY MATTERS: CREATING REQUESTS FOR PROPOSAL AND LOOKING FOR FUNDING

As noted elsewhere in this guide, getting the long-term cost savings of electric school buses (ESB) requires a significant initial investment to purchase and support. On the other side of the equation, you will want to explore funding possibilities to help offset the cost of ESBs and charging equipment. This section looks at both areas, and you'll see that many options are available to help you maximize the benefits to your district.

Items to Include in RFPs

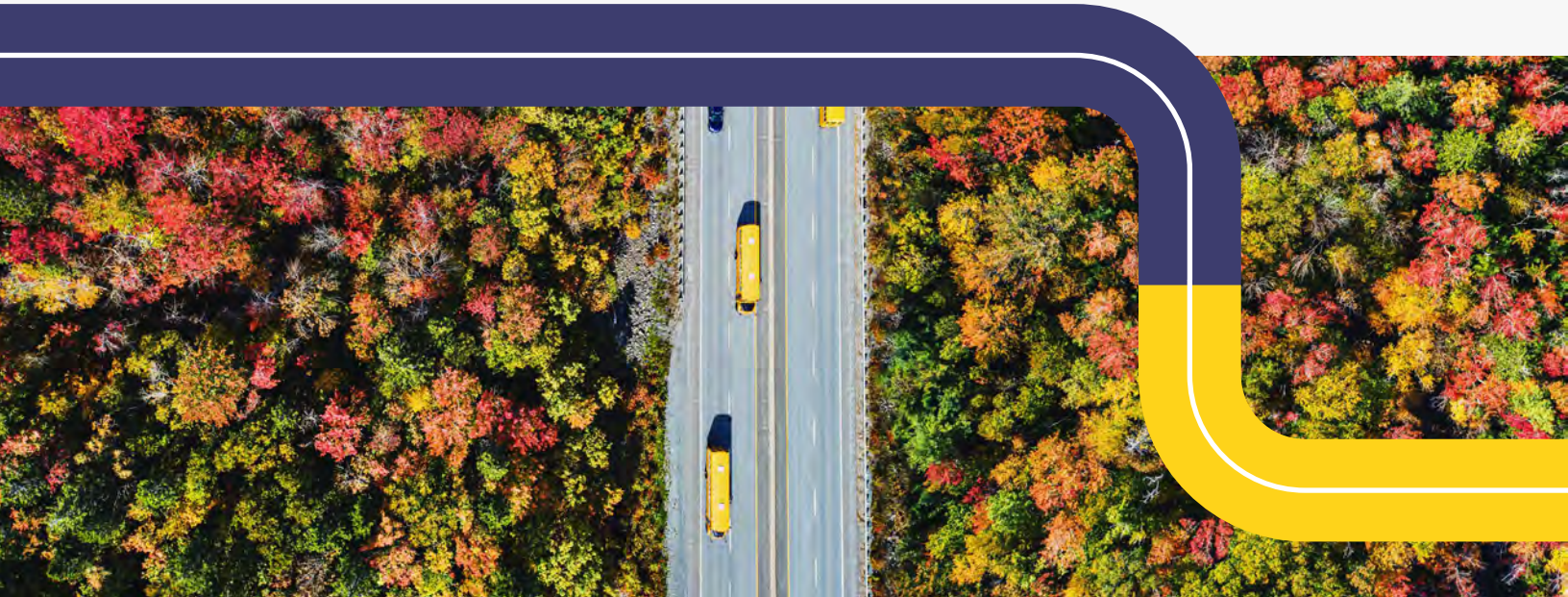
The process of requesting proposals to purchase electric school buses (ESB) will likely be specific to your district, based on budgets, ownership models, state-specific procedures, school board processes, and other considerations. Since ESBs have requirements and options that are different from conventional buses, this section provides a list of suggested items to include:

Scope of Agreement

- Number and description of vehicles
- Number and description of charging stations
- Other equipment
- Maintenance terms and costs
- Cost of electricity and electrical equipment
- Training of drivers and maintenance personnel
- Fleet management system and telematics
- Term of lease or purchase agreements
- Conditions of lease or purchase agreements
- Schedule of planned deployment

Description of Current Fleet

- Location(s) of bus depot(s)
- Number of buses
- Routes
  - Length
  - Frequency
  - Schedule
  - Annual mileage
- Operating hours (times when the vehicles must be available)
- Seasonal variations in school bus usage (For example, summer vs. school year usage)
- Insurance



Sample RFPs

World Resources Institute: **Electric School Bus Procurement Request for Information (RFI) template**

See **eschoolbus.org** for downloadable RFP samples.

Funding Options

Many different models exist to help school districts afford to add ESBs to their fleets. They fall into four main categories:

State and federal grants: These programs allocate funds to districts to directly purchase and/or subsidize the cost of purchasing vehicles and equipment. They generally require an application process, and sometimes give preference to disadvantaged communities.

Utility partnerships (*see page 15*): In this approach, utilities offset some or all of the costs associated with setting up and operating ESBs. Examples include Pay As You Save (PAYS) arrangements that finance the cost of ESBs through the district's power bill and pay it off from incremental savings; direct incentive payments provided by the utility to support its vehicle-electrification programs; and service-provider models in which the utility owns the charging infrastructure and the district purchases access. Some Vehicle to Grid (V2G) models project that districts could earn money by selling power stored in ESB batteries back to the grid during times of need.

Private-public arrangements: A wide range of options exist in this area, including financing options, many of which offer rates at lower than the current lending rates; pay-as-you-drive programs in which a private company owns and/or operates the ESB fleet in exchange for mileage charges; and lease-to-purchase programs similar to those offered for passenger cars.

Local bonds and taxes: Many municipalities and districts choose to fund upgrades and purchases of equipment and facilities through bonds, and local option transportation taxes are often used to fund transit programs at the state and municipal level. It is possible that your district could use either or both methods. In combination with incentives and grants, they could help pay at least a portion of the cost of ESBs.

Additional Resources

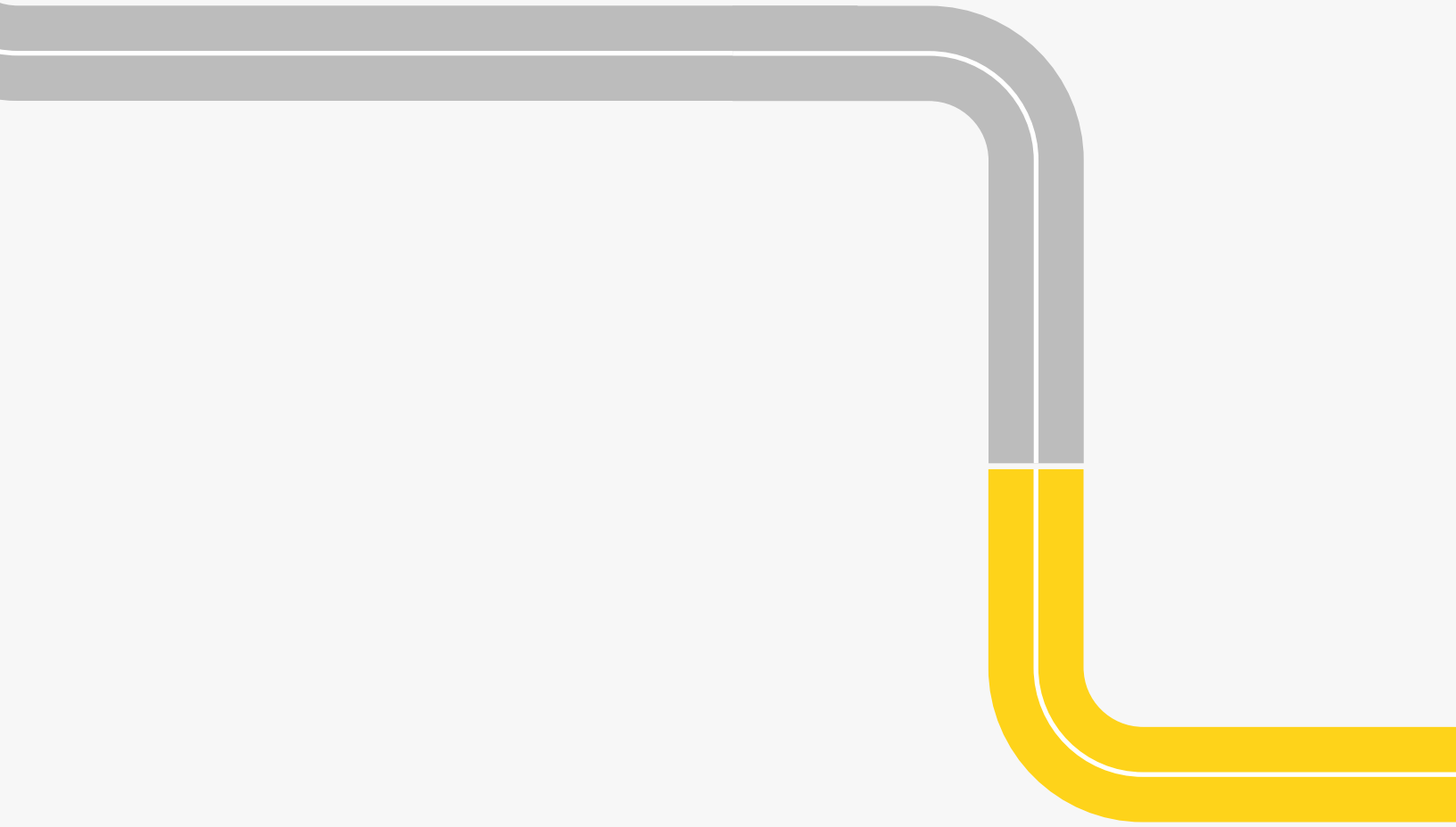
- Chargepoint: EPA School Bus Rebate Program
- PIRG: Paying for Electric Buses

USEFUL ELECTRIC SCHOOL BUS CASE STUDIES

While ESB adoption is still in an early phase nationwide, more and more districts have completed pilot projects, providing valuable insights on what works. This section provides several examples with key takeaways and best practices.

Selected Case Studies

- NRECA: Minnesota district secures valuable funding through utility partnership
- Proterra: Virginia schools use ESBs to reduce emissions
- Proterra: Massachusetts district strengthens local electrical infrastructure with innovative vehicle to grid (V2G) system
- BTC Power: California district uses smart charging to improve local air quality



ADDITIONAL RESOURCES AND POTENTIAL PARTNERS

General help and information

National

Electrification Coalition

World Research Institute

Moms Clean Air Force

Mothers Out Front

World Resources Institute, Power Planner

Regional

Clean Cities Coalition

PIRG

Forth Mobility

Live Green CT

Mid-Atlantic Electric School Bus Experience Project (MEEP)

Electric School Bus Vehicles

Collins

Electrification Coalition DRVE tool for fleet configuration

Endera

Environmental Defense Fund Study on Zero-Emitting Freight Trucks and Buses

KleanBus

Live Green

Proterra

SEA Electric

Thomas

World Resources Institute: Electric School Bus Roadmap

World Resources Institute, Sample Slide Deck: "Why Electric School Buses"

World Resources Institute, Electric School Bus Market Study and Buyers Guide

Funding

Chargepoint: EPA School Bus Rebate Program

Empire Clean Cities: ESB Incentives

PIRG: Paying for Electric Buses

Charging Infrastructure

Alternative Fuels Data Center

Blink blog posts

Blink: How Planning Helps Save on Charger Installation

BTC Power

Chargepoint (blog posts)

Dominion

Drive Electric TN

Enel

Enel How to Maximize EV Charging Cost Savings

Microgrid Labs

Positive Energy

U.S. Dept. of Transportation Toolkit for Rural Electric Vehicle Infrastructure

Virginia Clean Cities Charging Station Considerations

Virginia Clean Cities Planning Charging Stations

Virginia Clean Cities Charging Stations Info

World Resources Institute: Charging Infrastructure Video Series (5 videos)

World Resources Institute: Design Considerations for Electric School Bus Vehicle-to-Grid Programs

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