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Electric School Bus Charging Station Planning Considerations

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Assessing Charging Infrastructure Needs for Electric School Buses:
A Workshop for Clean School Bus Program Applicants



Driven by purpose, committed to impact

**VEIC is on a mission
to generate the
energy solutions
the world needs.**

- VEIC works with organizations across the energy landscape to create immediate and lasting change
- We serve as an objective partner for our clients as they navigate complex energy challenges
- Every challenge is different, but our commitment is the same: make an impact

Mid-Atlantic Electric School Bus Experience Project

Background:

- Awarded by US Department of Energy
- Led by Virginia Clean Cities
- Partnership of school bus manufacturers, Clean Cities coalitions and others
- Providing free electric school buses for demos in selected school fleets in VA, DC, MD, PA, and NJ through 2023

**Mid-Atlantic
Electric School Bus
Experience Project (MEEP)**



Project Goals:

- Increase awareness and adoption of electric school buses in the project region
- Build local support for ESBs through direct staff experience
- Gather operational data to support future decision-making and competitive funding applications for ESBs

Agenda

- Introductions
- Overview of ESB Charging Options
- Major Implications
- Evaluate Your Options
- Questions



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Overview of ESB Charging Options



AC Level 2 vs DC Charging Stations

AC Level 2

- Uses: Alternating Current (AC)
- Power: up to 19.2kW
- Charging time: 6-8 hrs
- Requires – Single-phase power
- Costs
 - Purchase: \$3K-\$5K
 - Install - \$3K-\$10K+



Source: ClipperCreek



Source: Nuvve

AC Level 2 vs DC Charging Stations

Mid-powered DC

- Uses: Direct Current (DC)
- Power: ~25kW
- Charging time: 4-6 hrs
- Optional: 3-phase power
- Costs
 - Purchase: \$10K-\$15K
 - Install: \$4K-\$25K+



Source: ABB

AC Level 2 vs DC Charging Stations

High-powered DC

- Uses: Direct Current (DC)
- Power: 50-125+ kW
- Charging time: 2 hrs
- Requires – 3-phase power
- Costs
 - Purchase: \$40K+
 - Install: \$30K+



Source: emobilityplus.com/

Networked vs Non-Networked Charging Stations

Networked

- Monitor and manage charging from a distance
- Easier to set charging schedules and limits to reduce electric bills
- Require internet access (hardwire, wifi or cellular)
- Annual subscription fees

Non-networked

- Simpler
- Less expensive to buy and maintain
- Less oversight/flexibility in how they're used
- Greater demands on staff to manage charging/ electricity costs

Other Considerations

Managed Charging

Any strategy to control:

- when charging occurs; and/or
- the amount of charging done at any given time

Aim to minimize:

- costs (such as demand charges) and
- strain on the electric grid

Typically uses software to coordinate charging schedules among multiple networked chargers

Other Considerations

Vehicle-to-Grid (V2G)

- Enables an electric school bus to partially discharge its battery to the grid while idle and plugged-in
- Ideally: could save money for the utility and still allow for a fully charged vehicle when needed
- May enable utility financial incentives to the fleet to help offset the cost of the electric bus
- Technologies are still new; more info needed on extra cost savings from V2G
- Adds a lot of complexity to an electric school bus project

Vehicle-to-Building (V2B)

- Enables an electric school bus to partially discharge its battery to the adjacent building while idle and plugged-in
- Useful for power outages, and also potential building electricity “peak shaving”
- Simpler to implement than V2G

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Major Implications



Major Implications of Charging Station Options

Costs

- DC charging stations are more expensive to purchase, install and operate than L2s
- Higher-powered chargers will likely increase your electricity demand costs, especially if used during the day
- Operating/maintenance and electricity costs can range from \$6K - \$15K/charger/year

Operational Flexibility

- If you want flexibility to cover multiple long-distance trips in a single day, higher-powered charging may be a good choice
- If not, fast chargers could be overkill for an initial deployment

Site and Vehicle Restrictions

- Is 3-Phase power at/near current bus parking lot?
 - If not, high-powered DC charging may be cost-prohibitive
- Do you have a preferred bus make/model, and can it accept a L2 charge?

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Evaluating Your Options



How will we use our electric school bus?

For potential routes:

- Morning, afternoon, total daily miles traveled
- How long is bus parked:
 - Midday?
 - Overnight?
- How big is your bus battery (kWh)?
- How much will it be depleted during a shift and entire day?
- Can you complete morning and afternoon shifts without charging midday?



Route analysis considerations

Average daily mileage = 66 miles across 4-5 hours (VT pilot planning for 75 miles/day)

Battery range for Type C – 120-155 miles (under mostly ideal conditions)

Factors that affect ESB operating range:

- Outside temperature
- Terrain
- Loading
- Driving style

Are you comfortable primarily using your ESB on your shorter, more predictable routes for the first year or two of use? Doing so may allow you to:

- Familiarize yourself and your team on ESB performance and operating range variations, and achieve initial success
- Save money by selecting a base model battery configuration
- Save money with L2 charging
 - either charging just overnight, or also midday

What power is available at my facility?

Call utility as soon as you think about going electric

Ask for help to:

- Assess your site for charging
- Explain your rates and ways to manage fuel costs
- Plan for future expansion
- Managed charging
- Are there programs that can help pay for facility upgrades or installation costs?
- What is the timeframe for any necessary utility upgrades?



Bus-specific considerations

Do you have a strong preference for a specific bus manufacturer, or will you select based on how well the features and costs meet your needs?

Ask:

- Can your bus charge with L2, or only with DC?
- Will your bus OEM only support the EVSE make/model/power that they recommend, or will they work with anything that meets their specs?



Should I opt for Networked Charger Stations?



Costs:

- Cost more than simpler, non-networked charging stations
- Often require ongoing monthly fees

Benefits:

- Help save significantly on electric bills
- Simplify charging protocols for your drivers and other staff

Should I consider V2G or V2B?






Talk to your utility:




- Does your utility have programs ready to go for V2G, and can provide you with detailed estimates of revenue?
- Do anticipated grid or building peak periods align with when the bus is likely to be parked, mostly charged, and ready to be dispatched to the grid?

Want to Learn More? VEIC ESB Resources

<https://www.veic.org/clients-results/reports/electric-school-bus-resources>



	<u>Getting Started</u>
	<u>Compare bus models</u>
	<u>Know your utility bill</u>

	<u>Charging guide</u>
	<u>Funding buses</u>
	<u>Electric vs. diesel vs. propane buses</u>



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**Questions &
Discussion**



An aerial photograph of a lush green field, possibly a vineyard or agricultural field, with a road or path cutting through it. A large, bright orange arc graphic is positioned on the right side of the image, partially overlapping the field and road.

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Thank you

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