EPA Clean School Bus Program Technical Assistance and Resources

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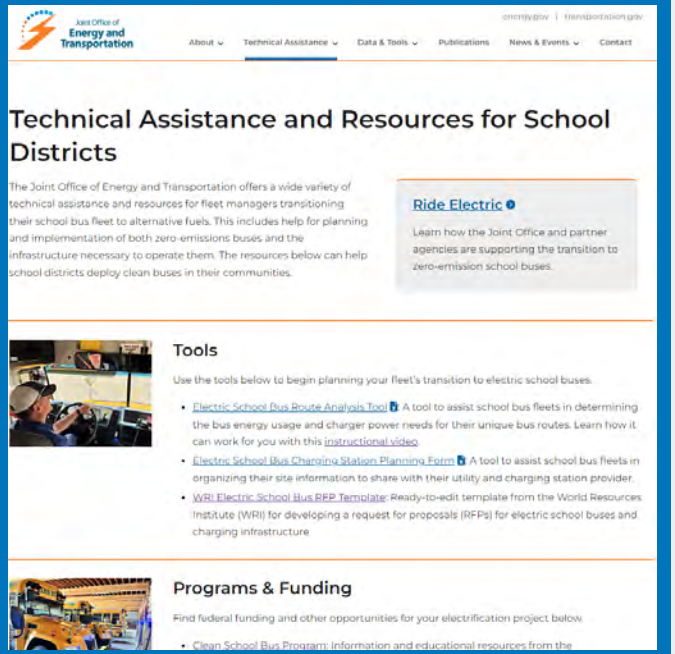
Photo by Josh Bauer, NREL 61725

Clean School Bus Technical Assistance



NREL is partnering with the U.S. Environmental Protection Agency to offer **FREE** clean school bus technical assistance to school districts receiving funds or planning to apply.

Provides school districts with the knowledge, tools, and information needed to successfully plan for and deploy clean school buses.

Clean School Bus Technical Assistance

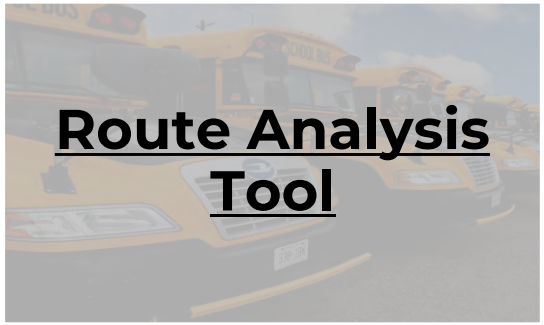
CleanSchoolBusTA@nrel.gov

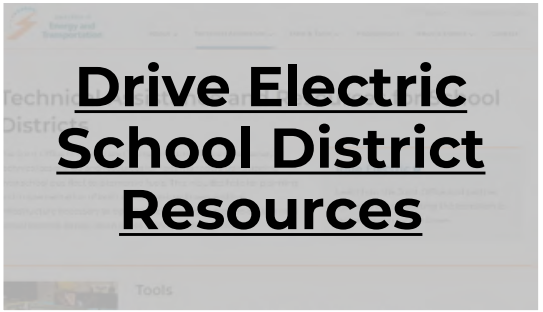
www.driveelectric.gov/contact

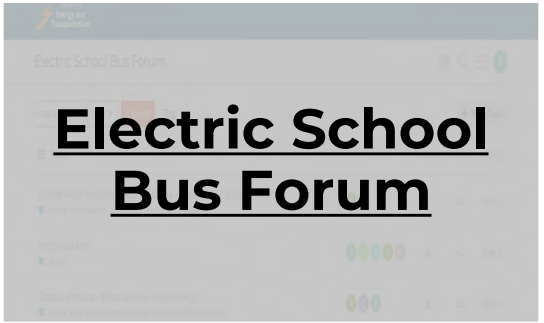
Examples of How We Can Help

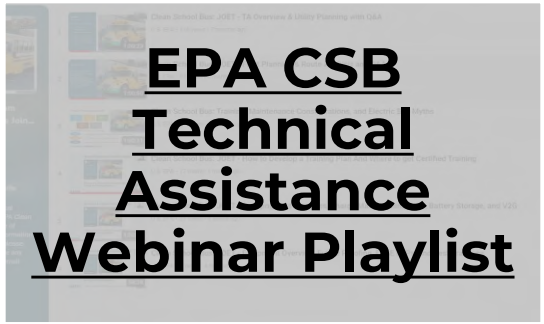
- Coordinating with electric utilities
- Identifying available funding and incentives
- Analyzing charging infrastructure needs
- Conducting route analysis and planning
- Assisting with training and workforce development
- Advanced charging strategies
- Discussing concerns with stakeholders
- Identifying solar and battery storage opportunities

ESB Resources









Onsite Assistance and Success Stories

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School Bus Electrification Center
A step-by-step guide to the school bus electrification process.
SCHOOL BUS
https://afdc.energy.gov/guides/electric-school-bus

Phase Three: Plan

Overview
13 - Route Analysis
14 - Charging Considerations
15 - Utility Check-In
16 - Infrastructure Design
17 - Procurement
18 - Utility Upgrades
Plan Resources

Step 14 - Charging Considerations

Evaluating your charging options begins with the three considerations below. At the very least districts need to ensure that their buses and chargers are compatible or interoperable with one another. Most districts will also want to consider some form of advanced charging like networked chargers or managed charging.

Interoperability

Advanced Charging Methods

Charge Management Partners

If you are interested in networked or managed charging, you will need to select a vendor or business partner who will provide the service and software, and possibly the chargers as well. See the Charge Management Software Catalog from the Electric School Bus Initiative (ESBI) or review the World Resources Institute's directory of providers (for more information, see the Electric Fleet Business Partnerships section of Phase Two: Step 10). As always, talk with local fleets to gain insights from their experiences with charging providers.

A charging provider should offer:

- Flexibility and proof of interoperability between multiple bus and charger manufacturers.
- The ability to manage vehicles, chargers, and utilities. They should be a one stop shop for all your charging needs or issues.
- The ability to maintain the handshake between the bus and charger without requiring onsite support.
- An easy-to-use user interface and any needed training on that interface.
- A customizable alert system for charger health, faults, and other items.
- Options for remote monitoring and diagnosis.
- Vehicle-to-grid capabilities, if desired.

The Incorporating Charge Management, Solar, Battery Storage, and Bidirectional Charging webinar from the EPA's Clean School Bus Program provides more information on selecting a charge management provider.

Visit Step 14 Resources

Electrification Center Phases

1 - Learn

- Basics of school bus electrification
- How to involve internal and external stakeholders

2 - Scope

- Preliminary bus electrification assessment
- Establish buy-in for your project

3 - Plan

- Create a plan that meets your fleet's needs
- Begin the procurement process

4 - Implement

- Train staff and install infrastructure
- Activate your buses

5 - Improve

- Consider new strategies and technologies
- Maximize the effectiveness of your ESB program

[CSB Webinar: Step-by-Step Guide for New Adopters]

ESB Route Analysis Tool

The Electric School Bus (ESB) Route Analysis Tool is a spreadsheet tool designed to assist school bus fleets in determining the bus energy usage and charger power needs for their unique routes.

Lowest Expected Temperature (°F):	30°+	*See NCEI Climate at a Glance for local temperatures:	https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series

Bus Info		Route Info							User Selections		Energy/Power Results		Charger Selection	
Bus Type	ESB Make/Model	Route #	Morning Route Distance (miles)	Morning Depart Time	Morning Return Time	Afternoon Route Distance (miles)	Afternoon Depart Time	Afternoon Return Time	Cabin Heater	Mid-Day Charging	Max Energy Used (kWh)	Estimated Minimum Charger Power Level (kW)	Charger Size (kW)	Expected Minimum SOC (%)
TypeC	IC Bus Electric CE (315 kWh)	1	50	6:30 AM	8:30 AM	60	12:30 PM	4:30 PM	Electric	Yes	157.5	20.3	20.0	11%
TypeC	LionC (210 kWh)	2	30	6:30 AM	8:30 AM	40	12:30 PM	4:30 PM	Electric	Yes	90.3	13.3	19.2	48%
TypeC	Bluebird Vision Electric	3	35	6:30 AM	8:30 AM	40	12:30 PM	4:30 PM	Electric	Yes	86.1	15.2	19.2	20%
TypeC	BYD Type C	4	20	6:30 AM	8:30 AM	40	12:30 PM	4:30 PM	Electric	Yes	109.9	13.8	19.2	58%

Tool and Instructional Video on driveelectric.gov/school-districts

ESB Route Analysis Tool - Results

- Energy/Power Results
  - Maximum energy used (kWh)
    - Factors in mid-day charging selection
  - Estimated Minimum Charger Power Level (kW)
    - Guidance for minimum charger size in yellow section

- Charger Selection
  - Charger Size (kW)
    - Drop down user selection
  - Expected Minimum State-of-Charge (SOC) (%)
    - Reflects the lowest % SOC that the battery will experience during the day based on charger size selected

Bus Info		Route Info							User Selections		Energy/Power Results		Charger Selection	
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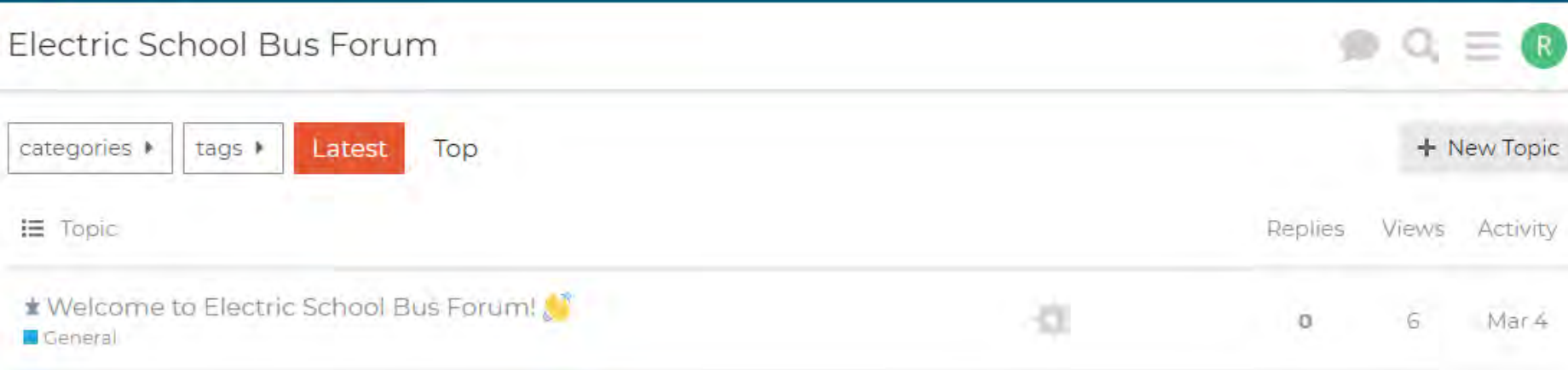
TypeC	IC Bus Electric CE (315 kWh)	1	50	6:11 AM	9:30 AM	45	1:57 PM	4:55 PM	Electric	Yes	151.4	21.4	24.0	20%
TypeC	LionC (210 kWh)	2	30	7:20 AM	10:02 AM	50	2:22 PM	4:24 PM	Electric	Yes	130.3	16.2	19.2	16%
TypeC	Bluebird Vision Electric	3	35	5:57 AM	8:45 AM	28	2:11 PM	5:25 PM	Electric	Yes	86.9	11.1	19.2	24%
TypeC	BYD Type C	4	20	6:30 AM	9:00 AM	21	2:00 PM	4:30 PM	Electric	Yes	66.6	11.3	19.2	55%



Electric School Bus Forum

https://electric-school-bus-forum.nrel.gov/

- Online forum available to school bus operators
- Communicate with peers on all things pertaining to electric school buses

Electric School Bus Familiarization Webinar Series

Brought to you by:

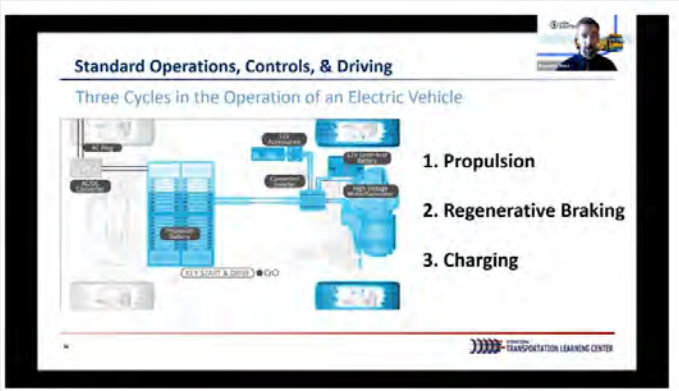
NREL

International Transportation Learning Center (ITLC)

School bus manufacturers

- Four-part module-based series for operators, technicians, and other school bus fleet members.
- Learn fundamentals of electric school bus technology.
- Recordings with testing materials for internal training programs.
- [ESB Familiarization Series YouTube Playlist]

1. Operator Overview (4/10/24)
2. Electric School Bus Technology Overview (8/7/24)
3. High Voltage Safety Considerations (10/1/24)
4. Charging Considerations (11/20/24)



EPA CSB Webinars

[EPA Clean School Bus Program TA Playlist]

Numerous webinars on TA topics

- Utility Planning
- Fleet Planning and Route Analysis
- How to Develop a Training Plan
- Charging Best Practices
- Etc.

Technical Assistance via the Joint Office of Energy and Transportation

The EPA is partnering with The Joint Office of Energy and Transportation and the National Renewable Laboratory to offer technical assistance to Clean School Bus Program applicants and program participants, including information and tools needed to successfully plan and deploy clean school buses and infrastructure. The Joint Office has expertise in a wide range of clean school bus deployment topics, such as school bus basics (electric, propane, and CNG), charging equipment, utility connections, bus performance, and operational considerations like routing and maintenance. Please contact the Joint Office to learn more or to ask a technical question.

Joint Office Technical Assistance Resources

- English and Spanish Technical Assistance Webinar Playlists - A collection of the technical assistance webinar recordings co-hosted by the EPA Clean School Bus Program and the Joint Office of Energy and Transportation meant to assist school districts in the planning and implementation of their clean school bus projects.

ESB Maintenance Analysis

NREL is seeking fleets willing to share work order level data on electric, diesel, and propane buses.

- Individual WO's, FMIS reports, etc.

We are aiming to perform a large-scale analysis of downtime, repair types, costs, etc.

If interested please contact ryan.frasier@nrel.gov

General Best Practices/Advice

- **Review the AFDC School Bus Electrification Center**
- **Don’t be afraid to start a pilot.**
- **Choose partners that can provide the support you need.**
- **Utilize lower powered charging when possible.**
- **Join the ESB Forum and connect with peers.**
- **Reach out to cleanschoolbusTA@nrel.gov**

Thank You

www.nrel.gov

CleanSchoolBusTA@nrel.gov

CleanHDVehiclesTA@nrel.gov

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