



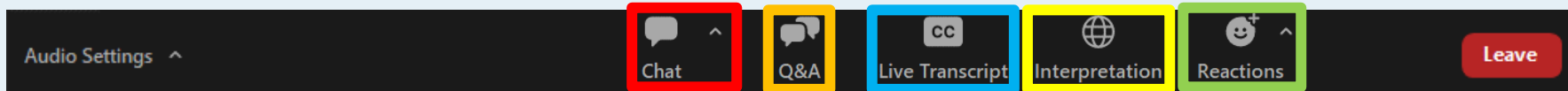
EPA CLEAN SCHOOL BUS

Electrification Process

September 25, 2024 @ 1 PM ET

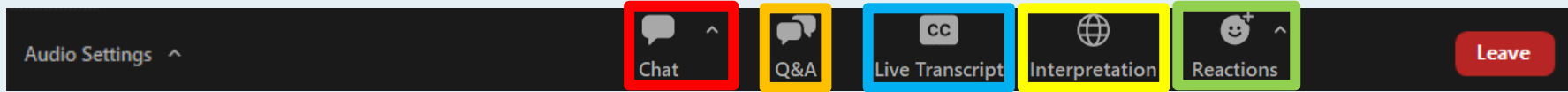
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Zoom Webinar Logistics



- **This presentation is being recorded.** The slides and recording will be posted to epa.gov/cleanschoolbus as soon as they are processed for posting.
- **All attendees are in listen-only mode.** Audio is available through your computer speakers or by phone. The presenter will ask you to come off mute if applicable.
- **Live transcription:** Live captioning is available by clicking the “Live Transcript” icon.
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- **Questions:** Use the Q&A feature to ask questions during the presentation. We will address as many as possible after the presentation. If we are unable to answer your question at this time, we will list all questions and answers in the Q&A document available on our website. You can also submit written questions to the EPA Clean School Bus Program helpline at cleanschoolbus@epa.gov.
- **Chat:** Chat is disabled, but the presenters might share links through the chat feature.
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Logística de seminarios web en Zoom



- **Esta presentación es grabada.** Las diapositivas y la grabación se publicarán en epa.gov/cleanschoolbus tan pronto sean procesadas para su publicación.
- **Todos los asistentes se encuentran solo en modo escucha.** Hay audio disponible a través de los altoparlantes de su computadora o por teléfono. El presentador le pedirá que quite el silencio si corresponde.
- **Transcripción en vivo:** Hay subtítulos disponibles haciendo clic en el icono “Live Transcript” [Transcripción en vivo].
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- **Preguntas:** Use la función Q&A [preguntas y respuestas] para hacer preguntas durante la presentación. Abordaremos todas las que sea posible después de la presentación. Si no podemos contestar su pregunta en este momento, anotaremos todas las preguntas y respuestas en el documento Q&A correspondiente disponible en nuestro sitio web. Puede también enviar preguntas por escrito a la línea directa de ayuda del Programa de Autobuses Escolares Limpios de la EPA en cleanschoolbus@epa.gov.
- **Chat:** Se encuentra inhabilitado el chat, pero los presentadores podrían compartir enlaces a través de la función de chat.
- **Reacciones:** Las reacciones están habilitadas para que usted interactúe con el presentador.

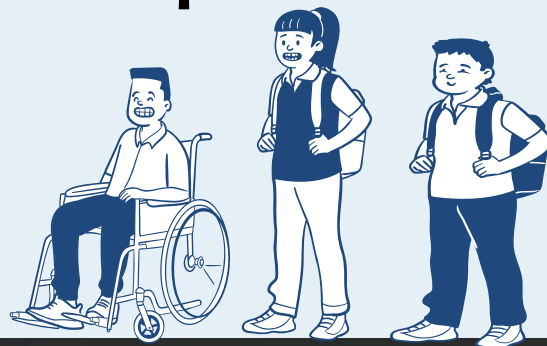
Live Transcription / Transcripción simultánea / Live Spanish Interpretation / Interpretación simultánea



Live transcript is available

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Interpretation

AGENDA

Overview of the Clean School Bus
(CSB) Program

CSB Technical Assistance Resources

Electrification Process

Q&A

Next Steps and Resources

Overview of the Clean School Bus Program

Bipartisan Infrastructure Law

- Under **Title XI: Clean School Buses and Ferries**, the Bipartisan Infrastructure Law (BIL) provides **\$5 billion** over five years (FY22-26) for the replacement of existing school buses with zero-emission and clean school buses.

Future Funding Opportunities

- EPA has offered rebates and grants in past funding opportunities.
- EPA *anticipates* opening a CHDV grant program in Spring 2024 and a CSB rebate program in Fall 2024.



**EPA CLEAN
SCHOOL BUS**



Why Clean School Buses?

A circular orange icon containing a white silhouette of a factory with smokestacks.

Reduced Greenhouse Gas Emissions

CSBs emit zero or low tailpipe emissions.

A circular blue icon containing a white stylized symbol representing air or wind.

Cleaner Air

CSBs result in cleaner air on the bus, in bus loading areas, and in the communities in which they operate.

A circular green icon containing a white silhouette of a money bag with a dollar sign.

Cost Savings

Replacing older diesel school buses with CSBs often reduces maintenance and fuel costs.

A circular red icon containing a white lightning bolt symbol.

Resiliency

Bidirectional charging capable CSBs can provide power to the grid or buildings during power shutdowns.

A circular purple icon containing a white silhouette of a teacher standing next to a whiteboard with three students.

Improved Student Attendance & Achievement

The transport of students with CSBs has been linked to student attendance and academic achievement improvements.

CSB Program Technical Assistance Resources



Technical Assistance

- [Clean School Bus Technical Assistance](#)
- [Coordinating with Electric Utilities](#)
- [Clean School Bus Case Studies](#)
- [Tax Credits](#)



Workforce Development

- [Bus Manufacturer Job Quality and Workforce Development Practices](#)
- [Workforce Development and Training Resources](#)



Educational Materials

- [Clean School Bus Reports to Congress](#)
- [Benefits of Clean School Buses](#)
- [Resources to Engage Your Community](#)

Technical Assistance Webinar Playlist



Clean School Bus: JOET - TA Overview & U...

- Introductions
- Technical assistance overview
- Utility interconnection
 - Utility infrastructure
 - Utility rates and solutions
- Working with your utility
 - How to talk with your utility
 - Electric School Bus (ESB) Charging Station Planning Form

Watch on  YouTube



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Technical Assistance via the Joint Office of Energy and Transportation



Joint Office of
**Energy and
Transportation**

Electrification Process including a Step-by-Step Guide for New Adopters

Clean School Bus Program Webinar
September 25, 2024

driveelectric.gov

Electric School Bus Technical Assistance

NREL and the Joint Office of Energy and Transportation (Joint Office) are partnering with the U.S.

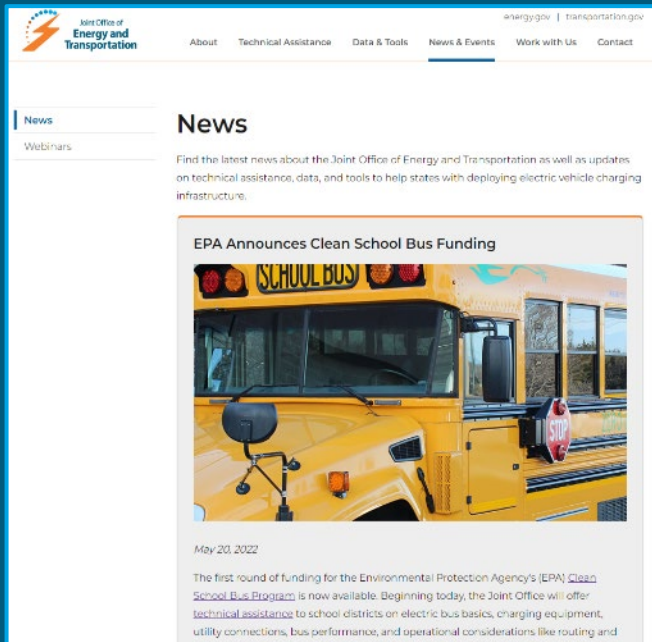
Environmental Protection Agency to offer **FREE** clean school bus technical assistance to school districts receiving funds or planning to apply.

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

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

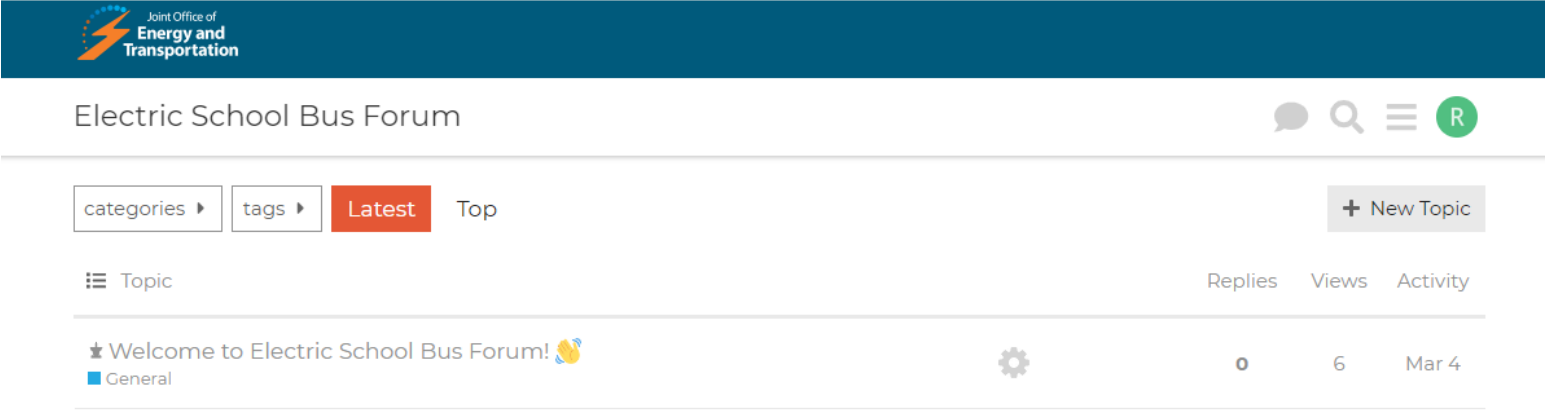
Opportunities
for resiliency
(V2X)

Discussing
concerns with
stakeholders

Identifying
solar and
battery storage
opportunities

Electric School Bus Forum

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



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

ESB Familiarization Training Series

Part 3 – High Voltage Safety Considerations for Technicians Oct. 1, 2pm EST

Register at:

<https://driveelectric.gov/webinars/ev-school-bus-module-3-webinar>

Brought to you by:

- Joint Office
- 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.
 - Live Q&A during each session.
 - Recordings with testing materials for internal training programs.
- <https://driveelectric.gov/webinars>



Alternative Fuels Data Center

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— School Bus — Electrification Center

A step-by-step guide to the school
bus electrification process.



<https://afdc.energy.gov/guides/electric-school-bus>

Phase One: Learn

Overview

1 - ESB Basics

2 - Charging Basics

3 - Utility Basics

4 - Gauge Support

5 - Define Goals

6 - Identify Team

Learn Resources

Step 1 - ESB Basics

Aside from the electric powertrain, ESBs are very similar to conventional buses. Fleets should select a model that meets their existing safety regulations, size, and other requirements. The video series [Flipping the Switch: Electric School Bus Introduction](#) contains helpful information on the basics of adopting ESBs. Major considerations unique to ESBs include:

Battery Size/Range/Efficiency



Heating, Ventilation, and Air Conditioning



Maintenance and Support



Warranties



[Back to Top](#) ^

Phase Two: Scope

Phase One: Learn

Overview

1 - ESB Basics

2 - Charging Basics

3 - Utility Basics

4 - Gauge Support

5 - Define Goals

6 - Identify Team

Learn Resources

Step 1 - ESB Basics

Aside from the electric powertrain, ESBs are very similar to conventional buses. Fleets should select a model that meets their existing safety regulations, size, and other requirements. The video series [Flipping the Switch: Electric School Bus Introduction](#) contains helpful information on the basics of adopting ESBs. Major considerations unique to ESBs include:

Battery Size/Range/Efficiency

Battery Size: ESB batteries are rated in kilowatt hours (kWh). Larger batteries will typically equate to increased range.

Range: Depending on the model, ESBs can travel up to 150 miles on a single charge. Range will be impacted by operator driving style, heating and cooling use, terrain, and payload. Driving ranges provided by manufacturers are usually calculated for ideal operating conditions.

Bus Efficiency: The bus battery size (kWh) divided by the range (miles). A lower kWh/mile value indicates a more efficient bus.

Heating, Ventilation, and Air Conditioning

Effect on Range: Heating and cooling needs will impact vehicle range (especially heating). In extremely cold weather, heating needs can decrease range up to 50%. Discuss options with your bus manufacturer if you are concerned about extreme cold.

Maintenance and Support

Warranties

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Phase One: Learn

Overview

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Learn Resources

Step 5 - Define Goals

Common goals associated with ESB deployment include:

Test ESBs

State or Local Mandate

- **Many cities and states are now mandating that school districts adopt ESBs.** If you do not know if you are subject to an ESB mandate, check with your state or local energy and/or environmental department.
- If you are attempting to meet a mandate to transition to ESBs, **ensure that your plan addresses the long-term turnover of your fleet.** A crucial element to this will be coordinating with your utility early about the power needs for full fleet electrification.
- Resources for ESB policies include:
 - The federal and state ESB laws compiled on the [AFDC Laws & Incentives Page](#)
 - The [ESBI State Legislative Tracker](#) that follows ESB state legislation
 - The Center for Climate and Energy Solutions that maintains a [Policy and Incentive Map](#).

Emissions Reduction Goals

Cost Savings

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Phase One: Learn

Overview

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4 - Gauge Support

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Learn Resources

Learn Resources

Step 1 - ESB Basics

- Alternative Fuels Data Center's (AFDC) [Flipping the Switch: Electric School Bus Introduction](#) – Video series with information on the basics of adopting ESBs

Step 2 - Charging Basics

Step 3 - Utility Basics

Step 4 - Gauge Support

- ESBI's [Frequently Asked Question](#) – Document that can answer many of the initial questions raised during the electrification process
- Beneficial Electrification League's [Electric School Bus Initiative](#) – Video about why an electric school bus is a better option for schools
- ESBI's [Why We Need to Transition to Electric School Buses](#) – Article on the benefits of school bus electrification

Step 5 - Define Goals

Step 6 - Identify Team

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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





Phase 1: Learn

Step 1 – ESB Basics

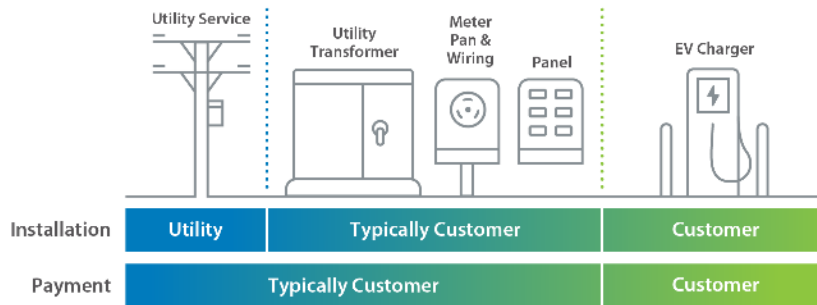
- Do you understand the basic differences between ESBs and conventional buses?
- Battery size, range, efficiency, HVAC, maintenance, and warranties

Step 2 – Charging Basics

- Do you understand the basics of charging infrastructure?
- Components, power levels, connectors

Step 3 – Utility Basics

- Do you understand utility rates and how your utility providers service?





Phase 1: Learn

Step 4 – Gauge Support

- School Board/Leadership
- Community
- Contracted Fleets
- Workforce

Step 5 – Define your goals

- Test ESBs, State/local mandate, emissions reduction, cost savings
- This will help you build support and scope your project

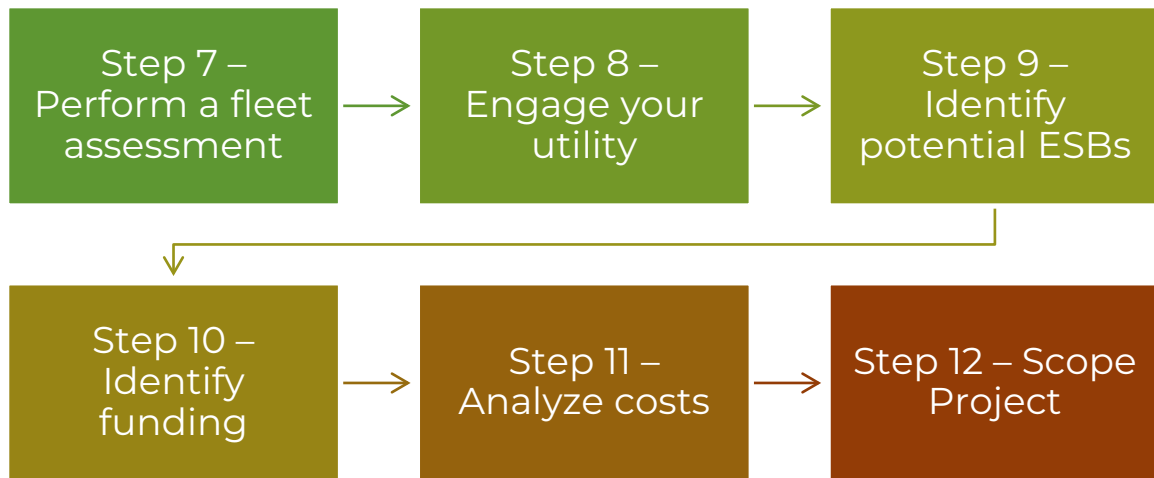
Step 6 – Identify your team

- Internal stakeholders
- Research potential partners



Phase 2: Scope

This is your preliminary electrification assessment that ends with a go or no-go decision





Phase 3: Plan

Clean Bus Planning Awards
provide fleets free
electrification transition plans

Step 13 – Route Analysis



What buses are compatible
with your chosen routes?



What size chargers do you
need?



[ESB Route Analysis Tool](#)

Step 14 – Charging Considerations



Are your chargers and buses
interoperable?



Should you consider
networked and/or managed
charging?



Who will be your charge
management partner?



Phase 3: Plan

Step 15 – Utility check-in

- Provide updates to your utility:
 - # of buses, # of chargers, charger power levels
 - Confirm the need for a new service
 - Ask if your utility provides onsite assessment services
 - Discuss incentives or make-ready options

Step 16 – Infrastructure design

- Refine your plans (typically with the help of your charging provider)
- Site layout, equipment specs, futureproofing, network and charge mgmt., training, and maintenance



Phase 3: Plan

Step 17 – Procurement

Understand the complete costs of infrastructure before committing to bus procurement

Ensure your buses and chargers are interoperable

Understand the full timeline for charger installation and utility/facility upgrades

Understand your warranty

Consider service capabilities for both bus and charger providers

Step 18 – Utility Upgrades

1 Submit required documentation



2 Visit site



3 Utility provides project breakdown



4 Secure easements



5 Authorize new service



6 Complete site work



7 Utility completes work



8 Electrical inspection

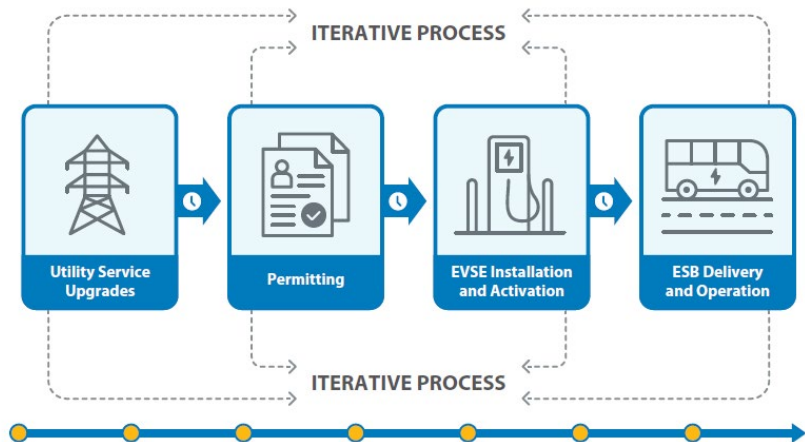


9 Energize new service



Phase 4: Implement

Step 19 – Coordinate Timelines



Step 20 – Train Staff

- **Basic safety and familiarization**
 - [**ESB Familiarization Training**](#)
- **Drivers/Operators**
- **Technicians**
- **Charging Stations**
- **First Responders**
- [**CSB TA Webinar: How to Develop a Training Plan and Where to get Certified Training**](#)



Phase 4: Implement

Step 21 – Install and Activate Charging Infrastructure

- Keep project on track with regular check-ins
- Utility upgrades, site work, permitting, inspections
- Receive commissioning documents, set up network accounts, create a maintenance plan

Step 22 – Activate ESBs

- Update standard operating procedures
- Update pre-trip inspection checklist
- Finalize route planning





Phase 5: Improve

Step 23 – Community and Student Engagement

Consider a
community
action plan

AESB: [State Electric School Bus Campaigns](#)

NY League of Conservation Voters Education Fund: [Clean Bus Guide](#)

ESBI: [The Transition to Electric School Buses Must Center Equity. Here's Why.](#)

Student
involvement

ESBI: [School Buses in the Circular Economy](#)

Highland and Children's Environmental Literacy Foundation: [Civic Science and Environmental Justice Lesson Plans](#)

Thomas Built Bus: [electric school bus curriculum](#)

[Great School Electrification Challenge](#)

Now that your buses are on the road, provide a way for students and the community to learn about them to help ensure long-term support and buy-in.



Phase 5: Improve

Step 24 – Evaluate Performance

Efficiency Data

- kWh/mile
- Regenerative braking %
- State of Charge

Electricity Costs

- Analyze utility bills
- Electricity vs. traditional fuels
- Time-of-use or demand charges

Maintenance

- Cost per mile
- Downtime
- Parts

Air Quality and Emissions

- Use [AFLEET tools](#)
- Consider air quality monitors in high-risk areas

Chargers

- Downtime
- Service request response times

Beaverton School District (OR) Environmental Efforts



Contact us
CleanSchoolBusTA@nrel.gov
for data analysis assistance



Phase 5: Improve

Step 25 – Investigate advanced technologies

- Solar Photovoltaics (PV) and Battery Energy Storage Systems (BESS)
- Bidirectional Charging or Vehicle-to-Everything (V2X)
- Webinar: [Charging Best Practices, Incorporating Charge Management, Solar, Battery Storage, and Vehicle-to-Grid \(V2G\)](#)

Step 26 – Battery End-of-Life

- Second life as stationary storage
- Battery recycling
- Webinar: [Battery Overview, Recycling/End-of-Life Options, and Warranties](#)



General Best Practices/Advice

Review the [AFDC School Bus Electrification Center](#)

Don't be afraid to start a pilot.

Take advantage of unprecedented funding.

Utilize lower powered charging when possible.

Join the [ESB Forum](#) and connect with peers.

Reach out to cleanschoolbusTA@nrel.gov





Joint Office of
**Energy and
Transportation**

Thank you

September 25, 2024

CleanSchoolBusTA@nrel.gov

driveelectric.gov

Question & Answer Session



Upvote and comment on questions similar to your own.
Type your full thought so we can follow-up with an answer.
Speak slowly and clearly for the captioner/interpreter.

cleanschoolbus@epa.gov

epa.gov/cleanschoolbus

Upcoming CSB Webinars

September 25, 2024	Electrification Process including a Step-by-Step Guide for New Adopters
October 1, 2024	Electric School Bus Familiarization: High Voltage Safety Considerations , presented by JOET
TBD	Stay tuned for an announcement about upcoming Clean School Bus Program webinars!



To view the most up-to-date list of CSB webinars and register, please visit:
www.epa.gov/cleanschoolbus/events-related-clean-school-bus-program



**EPA CLEAN
SCHOOL BUS**

Clean Bus Planning Awards (CBPA) Program

- In addition to the free technical assistance provided by NREL for CSB applicants and selectees, **the \$5M Clean Bus Planning Awards Program provides **FREE** technical assistance** to create comprehensive and customized bus electrification plans for fleets across the United States.
- **Applications for assistance are open on a rolling basis through Sept. 30, 2024**, giving fleets an opportunity to fully understand their needs before applying for support. **This new program will reduce the burden of electrification by helping fleet managers create a step-by-step plan to transition their bus fleet.**
- Learn more at <https://driveelectric.gov/clean-bus-planning-awards> and <https://www.nrel.gov/news/program/2024/clean-bus-planning-awards-support-fleet-electrification-with-custom-transition-plans.html>

Current Funding Opportunities

- The EPA has begun announcing 2023 Rebate selections.
- The CHDV grant program application period closed on July 25, 2024, at 11:59 PM ET.

Future Funding Opportunities

- The EPA encourages school districts to consider which competition structure (grants or rebates) best suits their needs.
- The EPA *anticipates* opening another round of CSB rebate funding in Fall 2024.

Resources

- The Joint Office of Energy and Transportation (cleanschoolbusTA@nrel.gov)
- The CSB helpline (cleanschoolbus@epa.gov)

Stay in Touch

- Learn more about the EPA Clean School Bus Program at epa.gov/cleanschoolbus
- Learn more about the JOET Clean Bus Planning Awards Program at driveelectric.gov/clean-bus-planning-awards
- Sign up for the CSB listserv at <https://lp.constantcontactpages.com/su/dgrhRed/cleanschoolbus>



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epa.gov/cleanschoolbus