



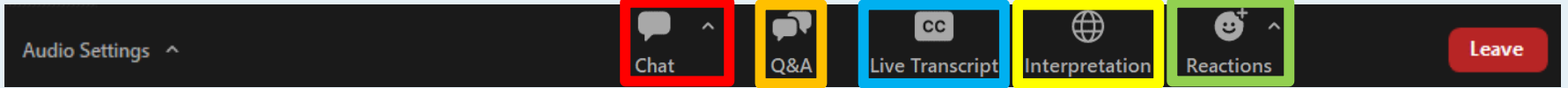
EPA CLEAN SCHOOL BUS

ESB Training, Maintenance, & Myths vs Facts w/ Joint Office of Energy and Transportation

July 26, 2023 @ 3 PM ET

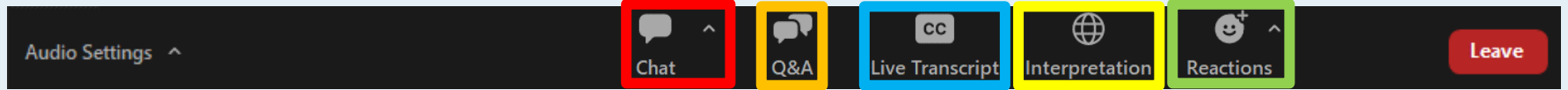
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

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Logística de seminarios web en Zoom



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Interpretation



Agenda



Overview of the Clean School Bus (CSB) Program

2023 CSB Grant Program Overview

Utility Engagement Pledge

Training & Maintenance Considerations with Joint
Office of Energy and Transportation

Question & Answer Session

Next Steps and Resources

Overview of the Clean School Bus Program

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.

These new clean school bus replacements will produce either **zero or low tailpipe emissions** compared to their older diesel predecessors.

School bus upgrades funded under this program will result in **cleaner air on the bus, in bus loading areas, and in the communities in which they operate.**

The first funding opportunity was the **2022 Clean School Bus Rebate Program**. The second funding opportunity is the **2023 Clean School Bus Grant Program Notice of Funding Opportunity (NOFO)**, which opened on April 24, 2023, and will close on **August 22, 2023**.



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2023 CSB Grant Program Overview



EPA anticipates awarding approximately **\$400 million** in CSB funding under this FY23 Notice of Funding Opportunity (NOFO).

This NOFO **includes two sub-programs**, one for school district and Tribal applicants (**School District Sub-Program: 15-50 buses**) and one for third-party applicants benefitting at least four school districts (**Third-Party Sub-Program: 25-100 buses**).

Eligible activities include the replacement of existing internal-combustion engine (ICE) school buses with **electric, propane, or compressed natural gas (CNG) school buses**, as well as the purchase and installation of **electric vehicle supply equipment (EVSE) infrastructure**.

EPA is prioritizing applications that will replace buses serving **high-need local education agencies, Tribal school districts funded by the Bureau of Indian Affairs or those receiving basic support payments for students living on Tribal land, and rural areas**. EPA is committed to ensuring the CSB Program delivers on the **Justice40 Initiative to ensure that at least 40% of the benefits of certain federal investments flow to disadvantaged communities**.



Application packages must be submitted to EPA via [Grants.gov](https://www.grants.gov) no later than 8/22/23 at 11:59 p.m. ET.
For more information, please visit www.epa.gov/cleanschoolbus.



**EPA CLEAN
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CSB Funding per Replacement Bus

School District Prioritization Status	Replacement Bus Fuel Type and Size					
	ZE* – Class 7+	ZE* – Class 3-6	CNG– Class 7+	CNG – Class 3-6	Propane – Class 7+	Propane – Class 3-6
Buses serving school districts that meet one or more prioritization criteria	Up to \$395,000 (Bus + Charging Infrastructure)	Up to \$315,000 (Bus + Charging Infrastructure)	Up to \$45,000	Up to \$30,000	Up to \$35,000	Up to \$30,000
Buses serving school districts that are not prioritized	Up to \$250,000 (Bus + Charging Infrastructure)	Up to \$195,000 (Bus + Charging Infrastructure)	Up to \$30,000	Up to \$20,000	Up to \$25,000	Up to \$20,000

Vehicle and Infrastructure Costs: Eligible project costs include the purchase price of eligible vehicles as shown on this slide and electric vehicle supply equipment (EVSE) infrastructure for new electric buses

Project Implementation Costs: Eligible additional project costs also include those costs directly related to the implementation, management, and oversight of the project. Please refer to the NOFO for additional specific information.

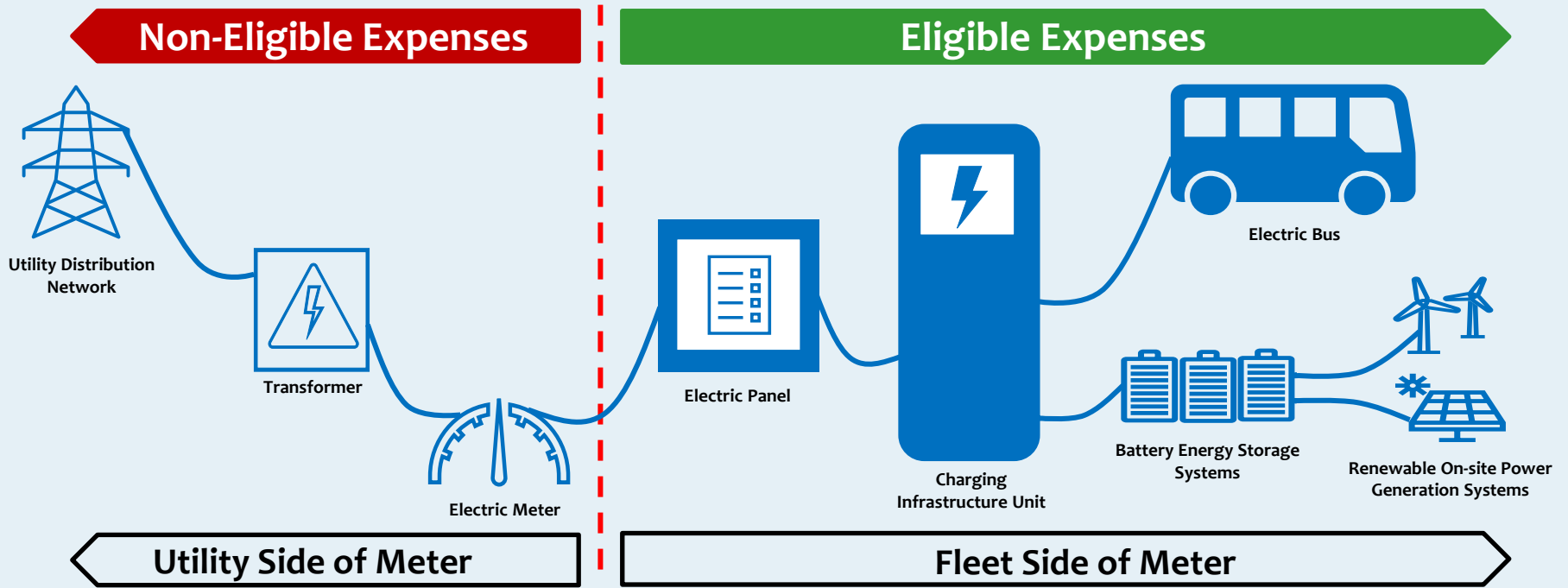
*Funding levels include combined bus and EV charging infrastructure. Recipients have flexibility to determine the split between funding for the bus itself and the supporting infrastructure.



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EPA CLEAN SCHOOL BUS



- EPA funding for infrastructure is **limited to the fleet's side of the meter**. May include installation, upgrades (including software and telematic equipment) and permits. Funds may also be used for battery energy storage systems (BESS) associated with new electric school buses, and renewable on-site power generation systems to power the buses and equipment, if on the fleet side of the meter.
- **All Level 2 charging infrastructure purchased under this program must be EPA ENERGY STAR certified chargers.** EPA recommends that all other charging infrastructure (e.g. DC Fast-Charge) purchased under this program be listed by a Nationally Recognized Testing Laboratory (NRTL).

Utility Engagement Pledge



A primary barrier school districts are facing is uncertainty around charging infrastructure deployment and how to engage with electric companies

- **Installation of charging infrastructure can undergo long lead times and requires close coordination with the local utility**



EPA is working with national electric utility company organizations to support school districts through a Utility Pledge that includes:

- **Facilitating Communication Between Electric Providers and School Districts**
- **Providing Technical Support and Assistance**
- **Increasing Funding and Deployment**



Additional information on the Utility Pledge and other technical assistance resources are available on: [epa.gov/cleanschoolbus technical assistance](https://www.epa.gov/cleanschoolbus/technical-assistance)



Joint Office of
**Energy and
Transportation**

EPA Clean School Bus Webinar Training, Maintenance, and Myths vs Facts

July 26, 2023

driveelectric.gov

Clean School Bus Technical Assistance



The Joint Office of Energy and Transportation (Joint Office) is providing technical assistance for the EPA's Clean School Bus program

Technical Assistance Offerings:

- **Fleets receiving funds or planning to apply are eligible**
- Proactive and reactive, hands-on assistance tailored to each fleet
- New and updated tools and resources.

Key Resources

[DriveElectric.gov](https://driveelectric.gov)
[AFDC.energy.gov](https://afdc.energy.gov)



Joint Office of Energy and Transportation

Clean School
Bus Technical
Assistance

CleanSchoolBusTA@nrel.gov





Training and Maintenance Considerations

Why is Training Important?

Ensure a smooth transition

Driver comfort and range anxiety

Maximize vehicle range

Teach safe maintenance practices

Ensure staff is educated on new technology



Identify for each type of training:

Who

- Who should attend the training and/or learn the material

What

- What topics should the training include

Where

- Where can you find the different types of training

Basic Safety and Electric School Bus Familiarization

Who

- Drivers
- Dispatch
- First responders
- Technicians
- Managers
- Support staff

What

- High level overview of electric school buses (ESBs)
- Identifying labels and stickers
- High voltage (HV) hazards and protection

Where

- Original equipment manufacturer (OEM)/Dealer
- Transportation Learning Center's Battery Electric Bus (BEB) Familiarization Course
www.transittraining.net/courseware/details/battery-electric-bus-familiarization



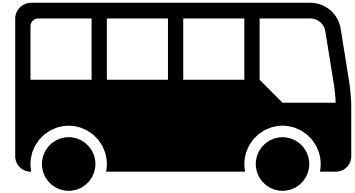
Driver/Operator Training

What

- Pre-trip routine
- Start up procedures
- Efficient driving
- Regenerative braking
- Understand instrument cluster and icons
- Understand range and state-of-charge (SOC)
- How to charge

Where

- OEM/Dealer
- Consider train the trainer or mentor program
- Web-based driver training course coming soon!



Technician Training

What

- Component overview – HV battery, battery thermal management system (BTMS), air compressor, etc.
- Personal protective equipment (PPE)
- Lockout/Tagout procedures
- HV disconnect and measurement
- Preventive maintenance task and schedule
- Troubleshooting and diagnostic codes

Where

- OEM/Dealer
- Local community or technical colleges
- National Fire Protection Association's 70E Training Series

catalog.nfpa.org/NFPA-70E-Standard-for-Electrical-Safety-in-the-Workplace-2015-Online-Training-Series



Charging Station Training

Who

- Drivers
- Dispatch
- First responders
- Technicians
- Managers
- Support staff

What

- How to charge
- Safety and hazard overview
- Cable management
- Preventive maintenance
- Repairs
- Monitoring

Where

- Charger manufacturer
- OEM/Dealer
- World Resources Institute's All About Charging Infrastructure Video Guides

<https://electricschoolbusinitiative.org/all-about-charging-infrastructure>



First Responder Training

What

- How to identify ESBs
- Emergency shut down procedure
- HV component layout
- How to move the bus



Where

- OEM/Dealer
- National Fire Protection Association www.nfpa.org/EV
- Clean Cities Coalitions cleancities.energy.gov/
- NFPA Emergency Response Guides
 - <https://www.nfpa.org/Training-and-Events/By-topic/Alternative-Fuel-Vehicle-Safety-Training/Emergency-Response-Guides>

Other Training Considerations

Towing

Refresher
training

Staff turnover

Train the trainer

Dispatch/routing

Weather
extremes

ESB Maintenance

- Electric motor and HV batteries should be maintenance free
- Monitor for cable issues and fluid leaks on a regular basis
- Maintenance intervals – air compressor, coolant system, power steering system, mounting hardware
 - Ensure you have a maintenance schedule from OEM
- ESBs share most chassis and body components with conventional buses



ESB Maintenance Pros and Cons

Pro	Con
No aftertreatment systems	Accelerated tire wear
No oil	Educational curve
Fewer moving components	Update some tools and PPE
Ease of access to components	
Reduced use of braking system	
Reduced labor costs	
Reduced regular maintenance	

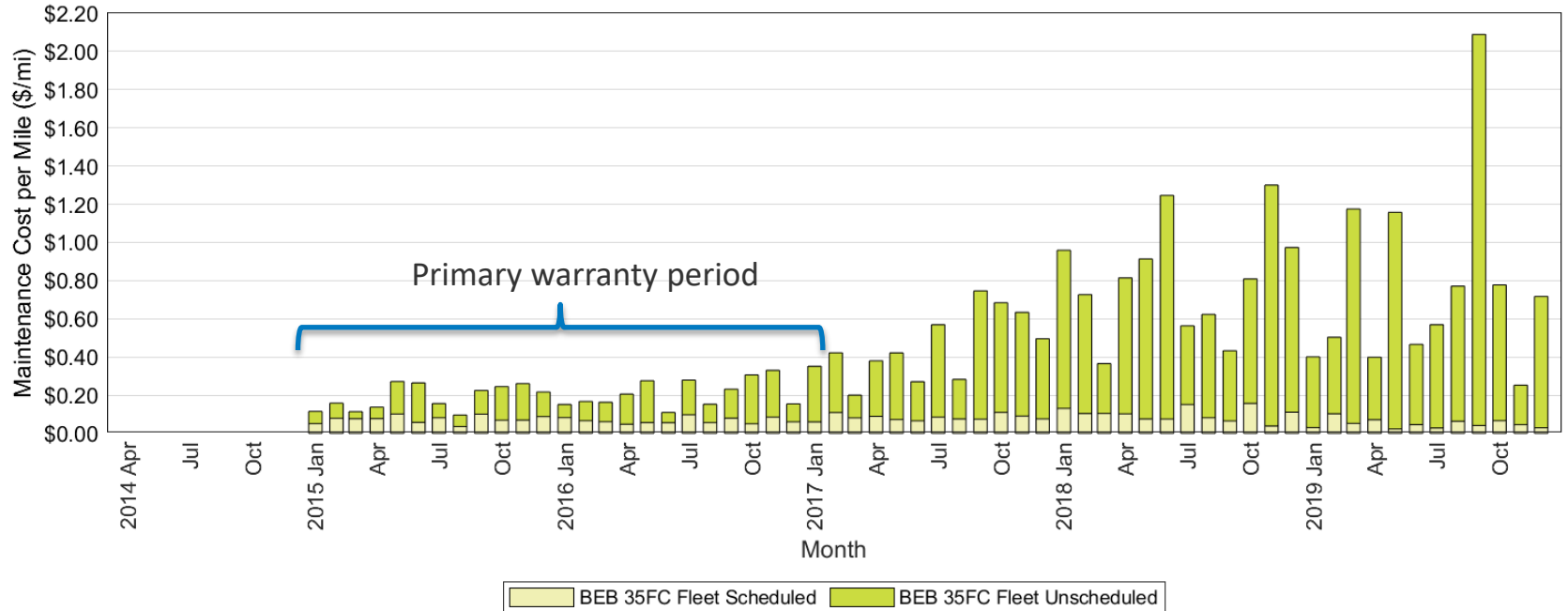
NREL Maintenance Analysis

Maintenance costs = labor for maintenance technicians + parts costs

Cost per mile = [(labor hours * labor cost) + parts cost] / mileage

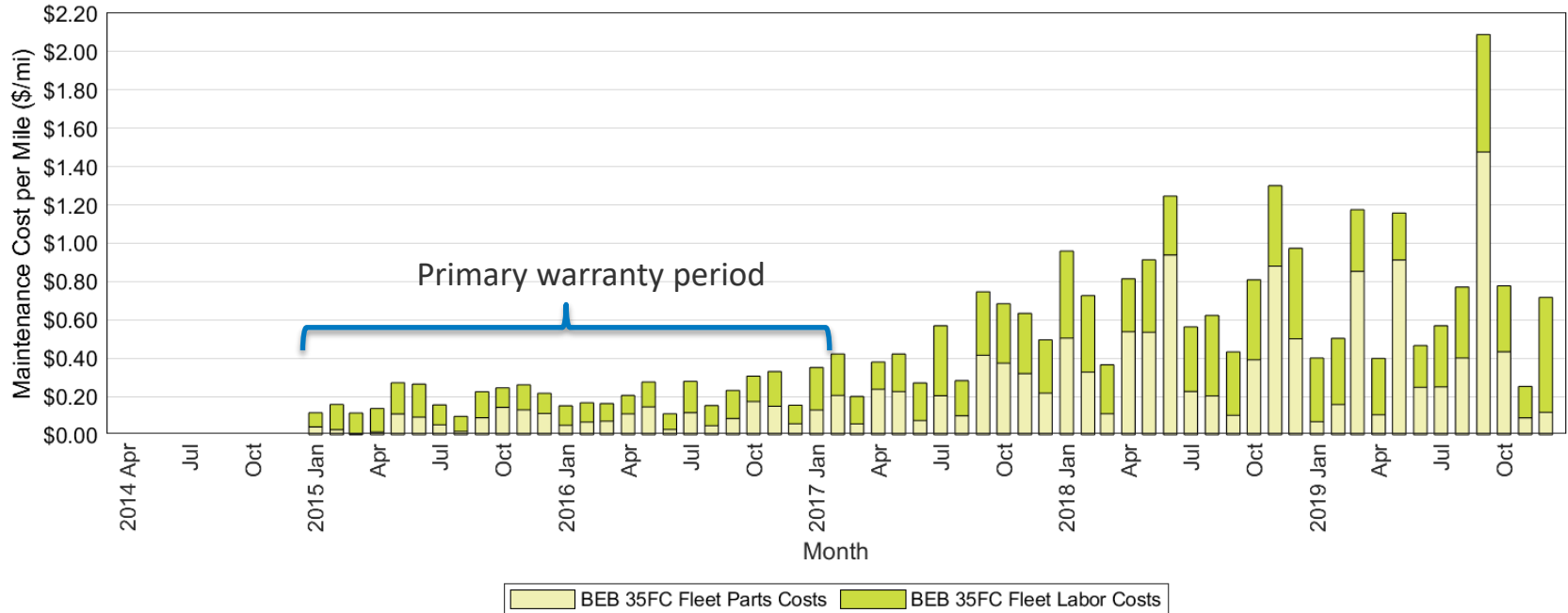
- NREL calculates total cost per mile, scheduled maintenance cost per mile, and unscheduled maintenance cost per mile.
- Propulsion-related vehicle systems include the exhaust, fuel, engine, battery modules, electric propulsion, air intake, cooling, non-lighting electrical, and transmission systems.
- These systems have been separated to highlight maintenance costs most directly affected by the different advanced propulsion systems for the buses.

Monthly Scheduled and Unscheduled Maintenance Cost



- Scheduled costs are low and consistent over time.
- The warranty period ended in 2017, and transit staff are handling all the maintenance work.
- Issues with the low-voltage batteries result in increasing costs.

Monthly Parts and Labor Maintenance Cost



- Most parts are covered by the manufacturer during the warranty period.
- Expensive parts and lower mileage accumulation in the later months result in higher per-mile costs (traction motor, air compressor, low-voltage batteries).
- Labor costs include time to troubleshoot issues; expected to decrease with the learning curve for staff.

Key Takeaways



- ✓ Reduced maintenance and maintenance labor costs
- ✓ Expect a learning curve
- ✓ Update tools and PPE
- ✓ Tires experience accelerated wear
- ✓ Maintenance costs (costs/mile) = [(labor hours * labor cost) + parts cost] / mileage
- ✓ Understand maintenance costs per system to help reduce total cost of ownership



Electric School Bus Myth Busters

MYTH:

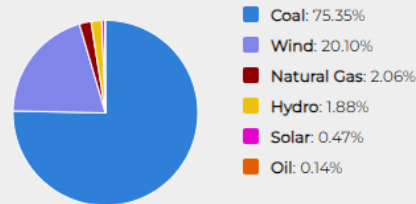
Electric school buses
don't reduce greenhouse gas emissions

The greenhouse gas emissions associated with an electric bus **over its lifetime** are typically lower even when accounting for emissions from manufacturing and electricity generation.

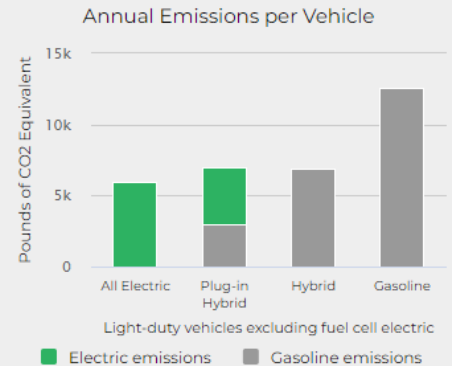
FACT:

Electric vehicles typically **produce fewer greenhouse gas emissions**, even when accounting for the source of electricity

Electricity Sources



State Averages for Wyoming



MYTH:

Electric school buses
can't drive far enough on a charge

FACT:

Electric school buses can service most
daily routes
on a single charge

- Current ESB models can travel as far as **200 miles on a single charge**.
- One study found that **an average bus drives 64 miles** in a day, and about **90% drive fewer than 110 miles**.
- With mid-day charging, ESBs can drive up to **100 extra miles per day**.

MYTH:

Electric school buses
won't work in winter

FACT:

Electric school buses already **operate
in extremely cold climates**

- Today's ESBs have the **range to complete most school routes even in the cold.**
- Operators **manage the effects of cold weather** on ESBs, like they already do for diesel buses.
- Just like engines use thermostats and engine block heaters, **ESBs warm their batteries to maintain good performance** year-round.

MYTH:

Electric school buses
require **high-powered DC fast chargers**

FACT:

Electric school buses
can use **lower-cost slow charging**
in most cases

- Many fleets operate ESBs without any fast chargers.
- Depending on ambient temperature:
 - A **low-power DC** charger can add **100 to 250+ miles** per day.
 - A **Level 2** charger can add **65 to 180+** miles per day.
- Some ESBs are only compatible with DC fast chargers.

MYTH:

An electric school bus
battery will need to be replaced

FACT:

Most batteries will
last for the life of the vehicle

- All major manufacturers offer **8-year battery warranties or longer**.
 - Warranties typically cover degradation from 70% to 80% of original capacity.
- **Batteries degrade gradually** and rarely fail completely.
- Old buses may be **assigned to shorter routes** as their range decreases.

MYTH:

There is
no good way to dispose of batteries
from an electric school bus

FACT:

Vehicle batteries can have a **second life**, and there are **several options for recycling**

- Retired vehicle battery cells are **up-cycled into stationary energy storage** systems for the electric grid.
- There are **multiple battery recycling methods** currently available.
- The Infrastructure Investment and Jobs Act includes **\$335M for battery recycling programs**.
- ReCell Center: www.recellcenter.org/

MYTH:

Vehicle-to-Grid (V2G) or Vehicle-to-Building (V2B) is not a proven strategy for ESBs

FACT:

School districts are already taking advantage of resilience benefits and cost savings of V2G

- V2G can provide cost reimbursement from your utility, electric back-up to your buildings or the grid, and/or help reduce bus electricity costs if coupled with battery storage.
- Enabling V2G requires buses and charger with bidirectional capabilities, and an interconnection agreement with your utility.
- If considering V2G be mindful of effects on battery degradation and warranty coverage.

MYTH:

Electric school buses
are just a fad

FACT:

School buses are an ideal use case for
electric vehicles

- Electric vehicles are best for applications with **predictable routes, low daily mileage, and long dwell times.**
- The federal government has dedicated **\$5B directly to ESBs** and many billions more to support the development and manufacturing of electric vehicles of all types.
- As of December 2022, **over 895 school districts** across the US have either received or committed to ESBs.
- With zero tailpipe emissions, **no other technology will ever produce better local air quality for kids.**

Clean School Bus Technical Assistance



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- **Fleets receiving funds or planning to apply are eligible**
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Key Resources

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AFDC.energy.gov



Joint Office of Energy and Transportation

Clean School Bus Technical Assistance

CleanSchoolBusTA@nrel.gov





Joint Office of
**Energy and
Transportation**

Thank You

July 24, 2023

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

Next Steps – *How to Apply*



1. Visit the Clean School Bus Website for Tools & Resources



2. Register your Organization with Grants.gov and SAM.gov



3. Prepare Application Package



4. Submit Application Package on Grants.gov by August 22nd at 11:59PM ET



Application packages must be submitted to EPA via Grants.gov no later than 8/22/23 at 11:59 p.m. ET.
For more information, please visit www.epa.gov/cleanschoolbus.



**EPA CLEAN
SCHOOL BUS**

2023 CSB NOFO

- Application packages must be submitted to EPA via Grants.gov no later than **8/22/23 at 11:59 p.m. ET.**
- Dates and topics for future webinars are on our website under the 'Webinars' section.

Future Funding Opportunities

- EPA encourages school districts to consider which competition structure (grants or rebates) best suits their needs.
- EPA anticipates opening a rebate program in fall 2023.

Resources

- [EPA's CSB Program website](#)
- The Joint Office of Energy and Transportation (cleanschoolbusTA@nrel.gov)
- The CSB helpline (cleanschoolbus@epa.gov)

Stay in Touch

- View the full 2023 CSB Grant NOFO at epa.gov/cleanschoolbus/clean-school-bus-program-grants
- Submit questions to cleanschoolbus@epa.gov
- Don't miss any updates! To sign up for the listserv, please visit epa.gov/cleanschoolbus.



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