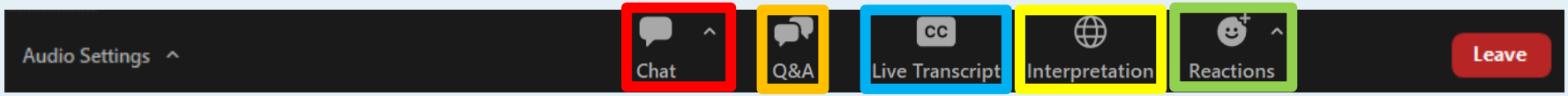
EPA CLEAN SCHOOL BUS

Incorporating Charge Management, Solar, Battery Storage, and Bidirectional Charging
w/ Joint Office of Energy and Transportation
April 24, 2024 @ 1 PM ET

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

Zoom Webinar Logistics



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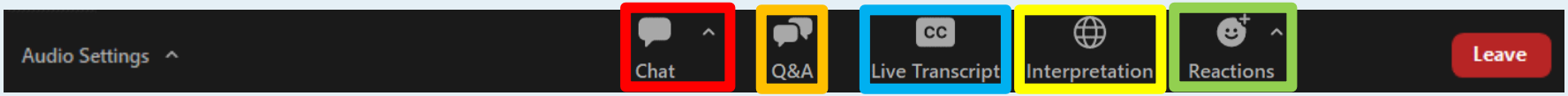
Logística de seminarios web en Zoom



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- **Chat** Se encuentra inhabilitado el chat, pero los presentadores podrían compartir enlaces a través de la función de chat.
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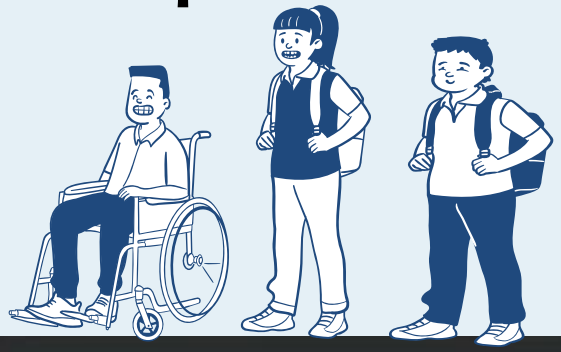

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English

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Interpretation

AGENDA

Overview of the Clean School Bus (CSB) Program

CSB Technical Assistance Resources

Incorporating Charge Management, Solar, Battery Storage, and Bidirectional Charging w/ JOET

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

EPA CLEAN SCHOOL BUS

Why Clean School Buses?

Reduced Greenhouse Gas Emissions
CSBs emit zero or low tailpipe emissions.

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

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

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

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
- Charging and Fueling Infrastructure Resources
- Clean School Bus Case Studies
- NEW 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

EPA

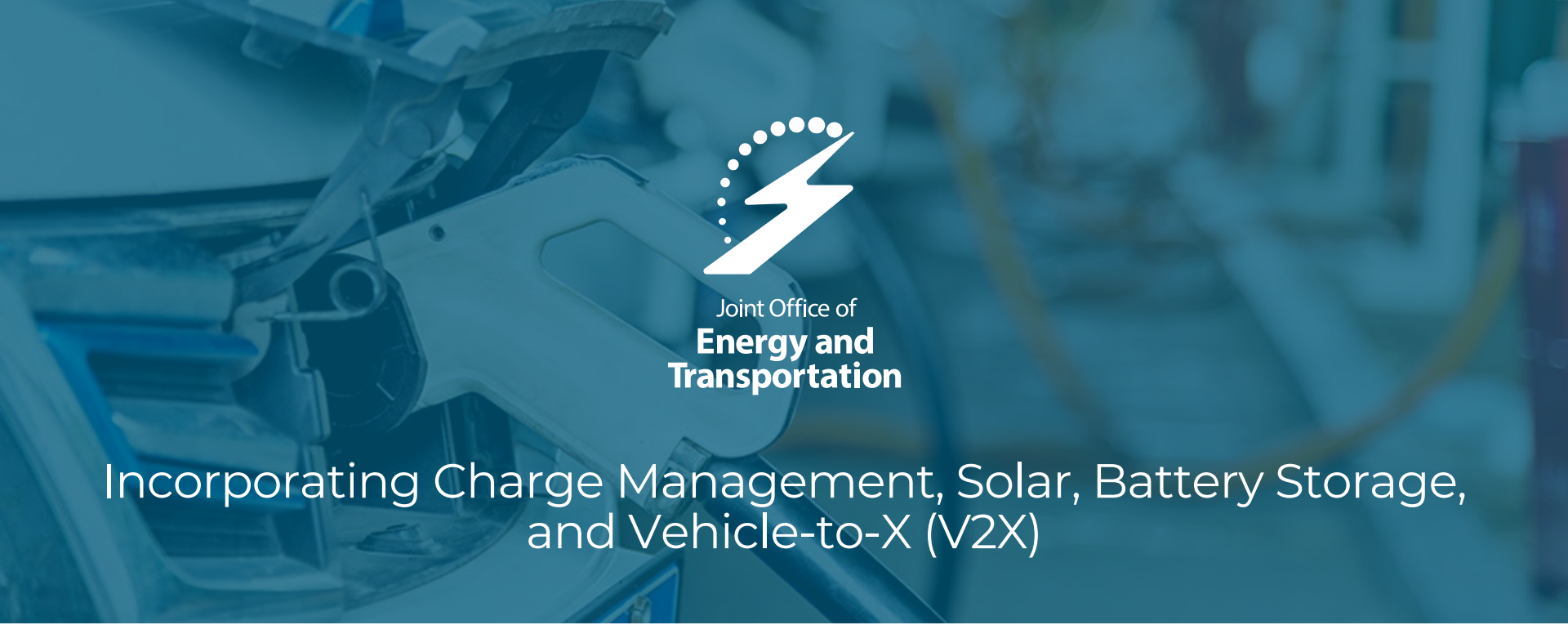
All links can be found on: *epa.gov/cleanschoolbus*

EPA CLEAN SCHOOL BUS

Technical Assistance Webinar Playlist

Technical Assistance via the Joint Office of Energy and Transportation

https://www.epa.gov/cleanschoolbus/clean-school-bus-technical-assistance



Joint Office of
Energy and
Transportation

Incorporating Charge Management, Solar, Battery Storage, and Vehicle-to-X (V2X)

Clean School Bus Program Webinar
Apr. 24, 2024

driveelectric.gov

Electric School Bus Technical Assistance

NREL and the Joint Office of Energy and Transportation 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

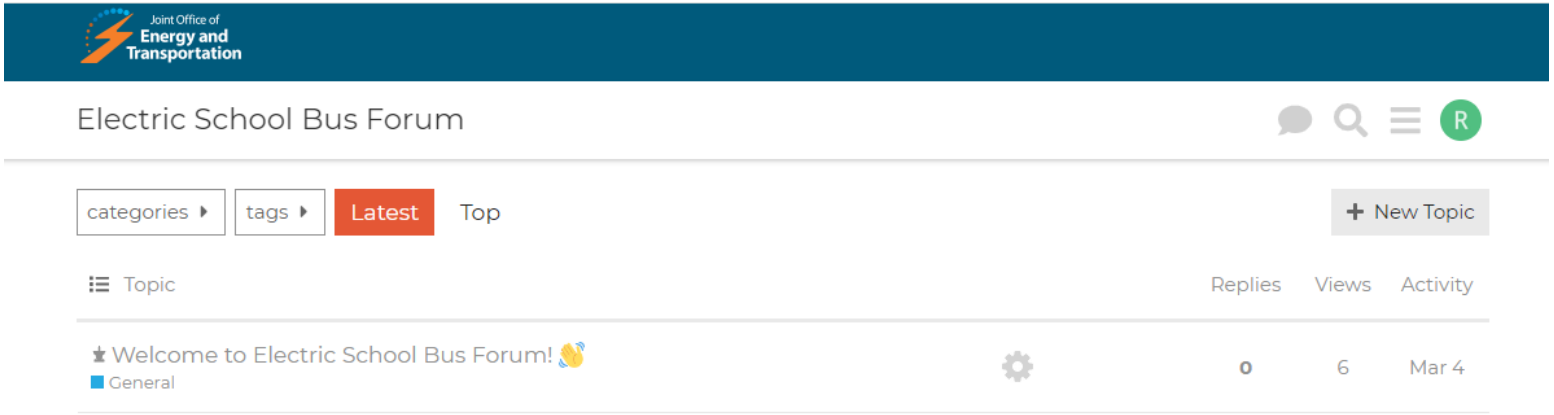
driveelectric.gov/contact

Examples of How We Can Help

- Coordinating with electric utilities
- Identifying available funding and incentives
- Analyzing charging infrastructure needs
- Conducting route analysis and planning
- Conducting training and workforce development
- Opportunities for resiliency (V2X)
- Analyzing energy needs and grid impact
- Identifying solar and battery storage opportunities

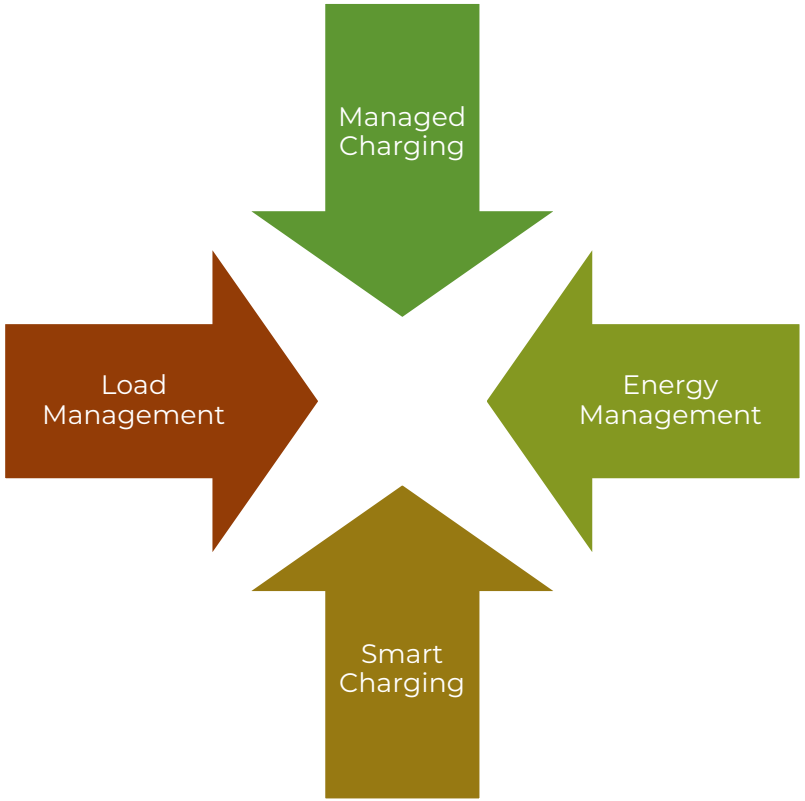
Electric School Bus Forum

- 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/

What is Managed Charging



The process of controlling the time and/or power level of electric vehicle charging through network connected charging stations and software.

What is needed

Smart Chargers

Network

- Cell Network
- Wi-Fi
- Ethernet

Partner

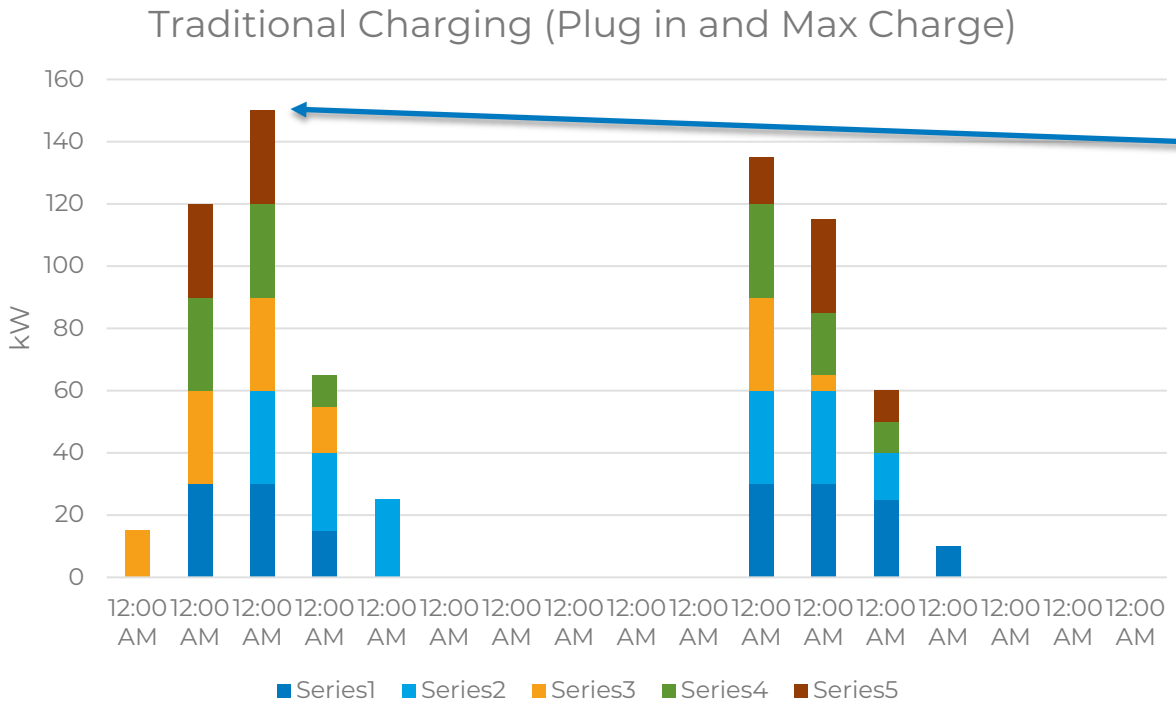
- Most Important Piece!
- Charger OEM/EVSP/Integrator/Aggregator
- ESBI Charge Management Software Catalog

Benefits of Charge Management

Utility Rate Terminology

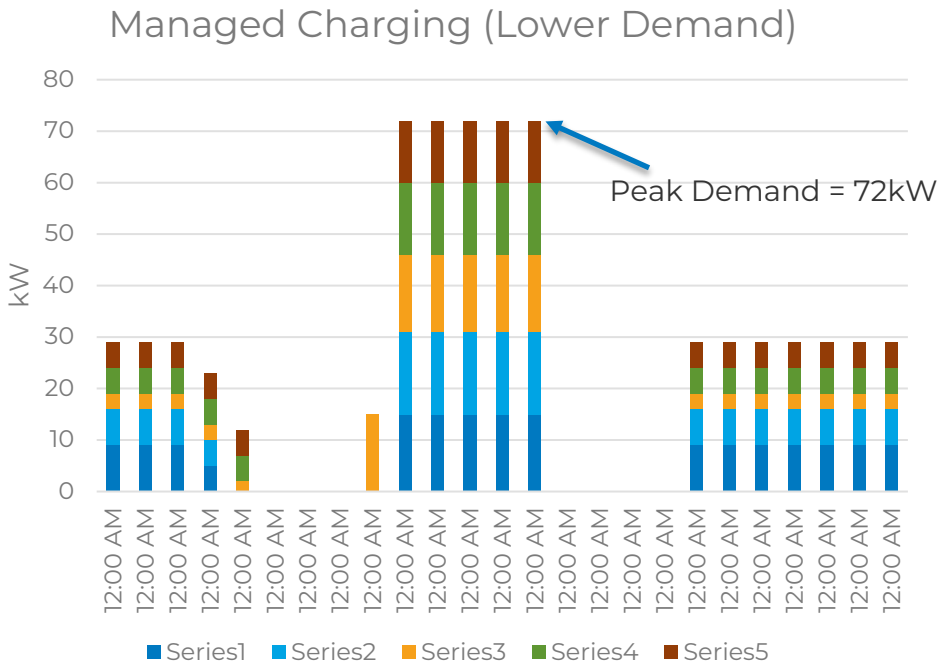
Energy Charge	• Price rate of energy per unit consumed, ($/kWh)
Demand Charge	• Price rate of peak power in a given period, ($/kW)
Fixed Charge	• Constant fee applied each billing period, ($/month)
Time-of-use (TOU)	• Price rate of energy dependent on time and/or season, varying ($/kWh) or ($/kW)
Tiered	• Each unit up to a base amount is charged one unit price, with additional energy charged at a higher unit price, increasing ($/kWh) or ($/kW)

Traditional Charging Example



- Peak Demand = 150 kW
- Daily Energy Usage = 695 kWh (kW * hours charging)

Alternative Charging Strategy - Demand



Energy Charge	$.14/kWh
Demand Charge	$15/kW
Days/Month	22

Traditional Charging

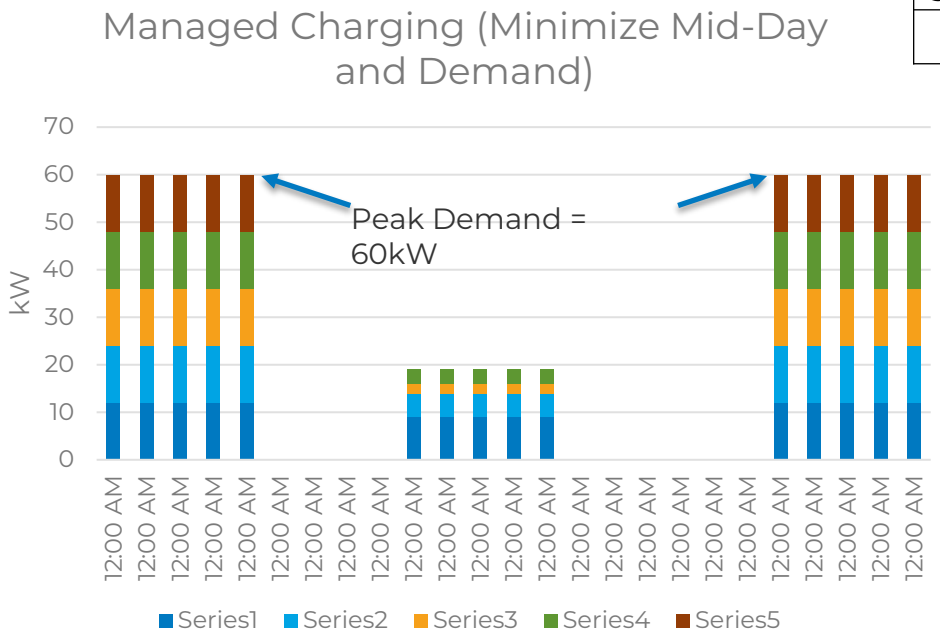
- Monthly Energy Charge = $2,141
- Monthly Demand Charge = $2,250
- **Total Charging Costs = $4,391**

Managed Charging

- Monthly Energy Charge = $2,141
- Monthly Demand Charge = $1,080
- **Total Charging Costs = $3,221**

Alternative Charging Strategy – Demand/TOU

On-Peak Energy Charge (4am-8pm)	$.17/kWh
Off-Peak Energy Charge (8pm-4am)	$.07/kWh
Demand Charge	$15/kW



Traditional Charging

- Monthly On-Peak Charge = $2,338
- Monthly Off-Peak Charge = $108
- Monthly Demand Charge = $2,250
- **Total Charging Costs = $4,696**

Managed Charging

- Monthly On-Peak Charge = $355
- Monthly Off-Peak Charge = $924
- Monthly Demand Charge = $900
- **Total Charging Costs = $2,179**

Charging Strategy

Understand your rates and ask your charging partner how to maximize your savings.

- They should be able to formulate a plan
- Understand that rates can change

Mitigate equipment upgrades

- Can you reduce equipment costs by maintaining a power ceiling?

Ask your partner how they automate the strategy.

- Seek references, demo the product. https://electric-school-bus-forum.nrel.gov/

Communicate your requirements.

- Ex. Full charge by AM pull out

Software

User Interface, Reporting, and Metering

Dashboard

Charging Sessions

Metering Energy Usage

Custom Reports

Requirements

FMIS and Telematics Integrations

User Training

Real-Time Monitoring and Alerts

Custom Notifications → Charge Status → Charger Health → Fault Codes

Over-the-Air Updates

Third-Party Remote Monitoring

Maintenance (Charger and Software)

- What options do you require?
- Are there additional costs?

Automate Pre-Conditioning

- In extreme temperatures it can take time to condition the battery thermal management system
- Pre-conditioning from grid power will increase range
- Can the software maintain the handshake between the bus and charger?

Bus-Charger Compatibility

Consider current and potential bus-charger combinations

Does your partner have a list of chargers and buses they work with?

- Flexibility and proof points with multiple OEMs is key

What will your partner be responsible for?

- Avoid finger pointing
- Easiest to have one point of contact

OCPP compliant does not necessarily mean interoperable!

- Open Charge Point Protocol (OCPP) standards can enable interoperability
- Bus-charger combinations need to be tested in the field to demonstrate compatibility

Solar Photovoltaic (PV) and Battery Storage

Charge Management partners can help with incorporating solar and battery storage to:

Reduce demand on the grid

Reduce energy costs

Reduce emissions

Solar PV and Battery Storage Resources

PVWatts Calculator

- https://pvwatts.nrel.gov/index.php
- Estimate size and performance of potential PV installations

REopt Web Tool

- https://reopt.nrel.gov/tool
- Evaluate economic viability of PV, battery storage, and other energy solutions

Database of State Incentives for Renewables & Efficiency

- https://www.dsireusa.org/

Battery Second Use

- Using former EV batteries as grid-connected energy storage
- https://www.nrel.gov/transportation/battery-second-use.html

Vehicle-to-X (V2X) Components

Bus

- Must have bidirectional capability

Utility

- Must accept bidirectional capability

Charger

- Bidirectional capable
- Does the utility have an approved equipment list? https://www.epri.com/vpl

Software/EVSP

- Must manage the integration with all parties

Utility Interconnection

- The process of connecting a new electricity generator to the grid

This is different from a new service

What is your utility's process?

Involve a third-party provider

What does a fleet need to start the interconnection process?

What size bus batteries

What size chargers

Electrical parameters

Safety standards!

V2X Program Design

Payment Structures Vary

- Rates may differ with participation

Agreements

- Ex. minimum guarantee from utility

Approvals

- Automated vs manual
- These programs are options not obligations

Barriers to V2X

Still a new technology

- Utilities may not be aware

Requires updates to policies and rates

- These are complex processes for utilities

Fleets do not have the right information

- Talk to your utility early

Parties fail to get on the same page

- Partners are key!

How does V2X impact battery degradation and warranties

Projects, permitting, and maintenance all become more complex and costly

How to talk to your utility about V2X

- Develop leadership support
  - Association of schools
  - Governor's Office
  - PUC

- Explain quickly and early what your solution is
- Quantify the value proposition
- Schools are an important customer!

Joint Office of
Energy and Transportation

Thank you

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 JOET TA Webinars

May 22, 2024	Equipment Overview, Future Proofing, EVSE RFPs, and Best Practices
June 26, 2024	Differences Between ESBs and ICE Buses, ESB Maintenance, and Bus RFP Best Practices
July 24, 2024	Battery Overview, Recycling/End-of-Life Options, and Warranties
August 28, 2024	Building a Case For ESBs in your Fleet including Benefits, Total Cost Of Ownership (TCO), and Emissions Calculators
September 25, 2024	Electrification Process including a Step-by-Step Guide for New Adopters

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

Summary

2023 CSB Rebates

- EPA *anticipates* announcing 2023 Rebate selections in May 2024.
- 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 CHDV grant program in Spring 2024 and a CSB rebate program 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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