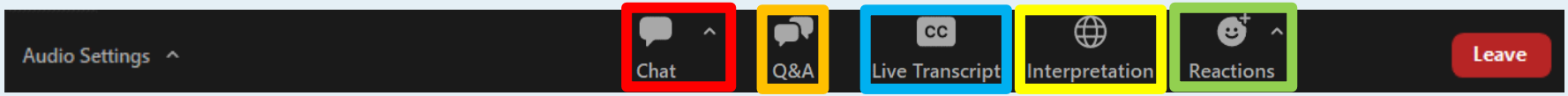
EPA CLEAN SCHOOL BUS

Equipment Overview, Future Proofing, EVSE RFPs, and Best Practices with the Joint Office of Energy and Transportation
May 22, 2024 @ 1 PM ET

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

Zoom Webinar Logistics



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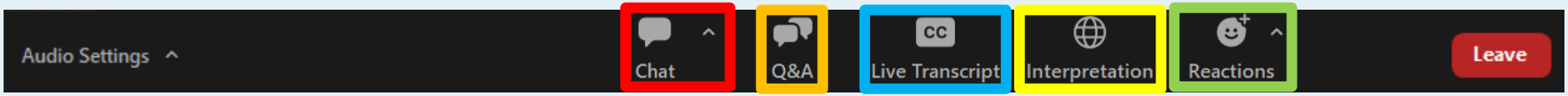

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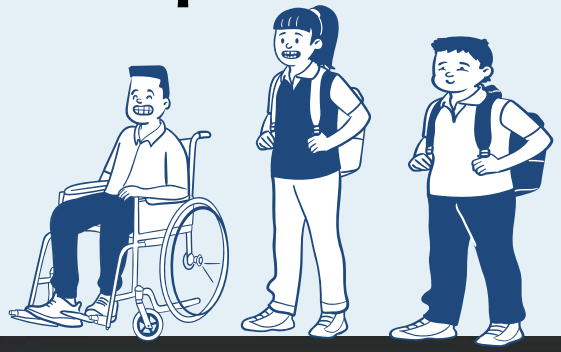

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Interpretation

AGENDA

Overview of the Clean School Bus (CSB) Program

CSB Technical Assistance Resources

Equipment Overview, Future Proofing, EVSE RFPs, and Best Practices 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 opened the CHDV grant program on April 24, 2024. Applications are due by July 25, 2024.
- EPA *anticipates* opening another round of CSB rebate funding in Fall 2024.

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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

Charging Equipment Overview, Future Proofing, EVSE RFPs, and Best Practices

Clean School Bus Program Webinar
May 22, 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

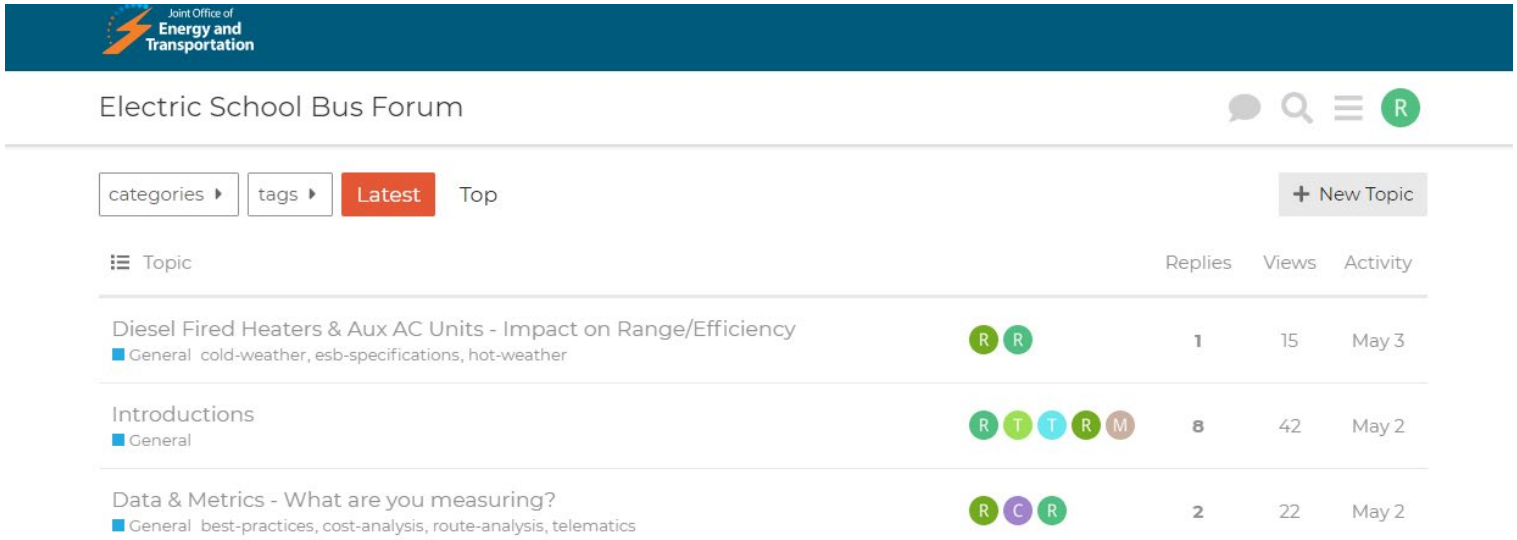
driveelectric.gov/contact

Examples of How We Can Help

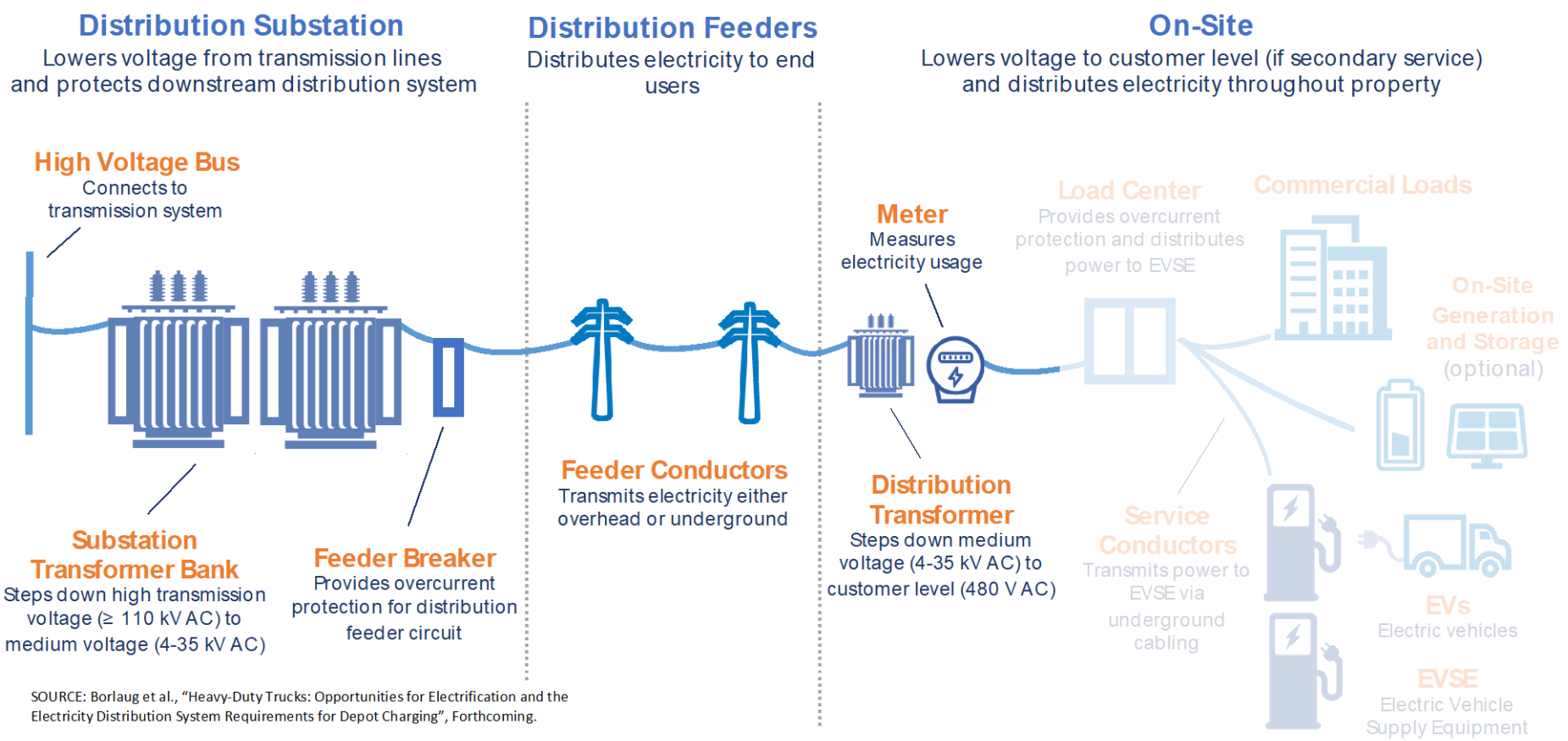
- Coordinating with electric utilities
- Identifying available funding and incentives
- Analyzing charging infrastructure needs
- Conducting route analysis and planning
- Conducting training and workforce development
- Opportunities for resiliency (V2X)
- Analyzing energy needs and grid impact
- Identifying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

Electric School Bus Forum

- Online message board open to school bus operators
- Communicate with peers on all things pertaining to electric school buses



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



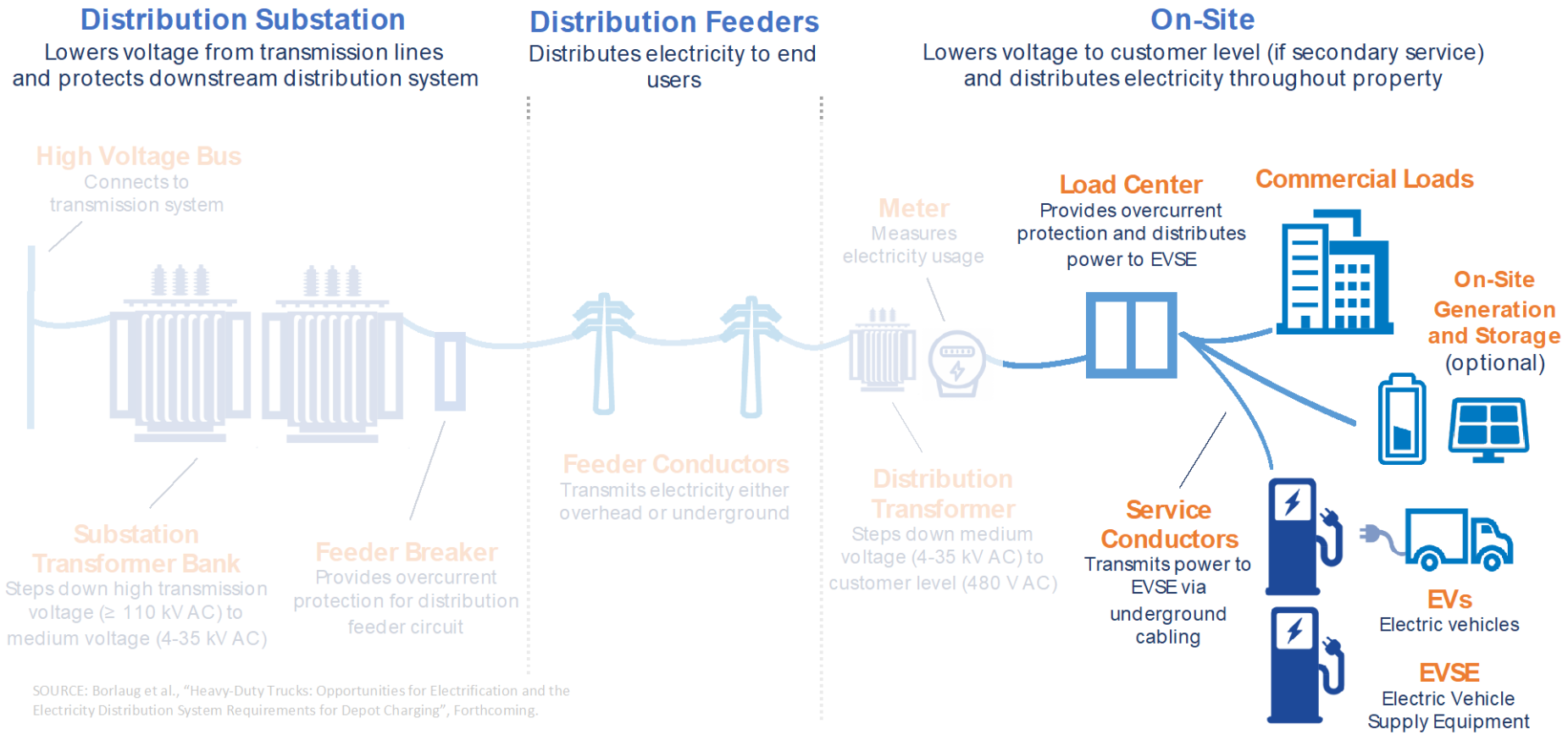
SOURCE: Borlaug et al., "Heavy-Duty Trucks: Opportunities for Electrification and the Electricity Distribution System Requirements for Depot Charging", Forthcoming.

Charging Infrastructure Outline

Talk with Utility Early and Often

- Do you have enough power onsite for your immediate needs? Future plans?
- Do you require a new service?
- Do you require grid upgrades and what are the timelines?
- What rates are you subject to and how may that influence your charger selection?

The electric utility company is most interested in building the grid infrastructure needed to supply the energy and peak power your facilities and new electric vehicle (EV) chargers will require.



Charging Infrastructure Outline

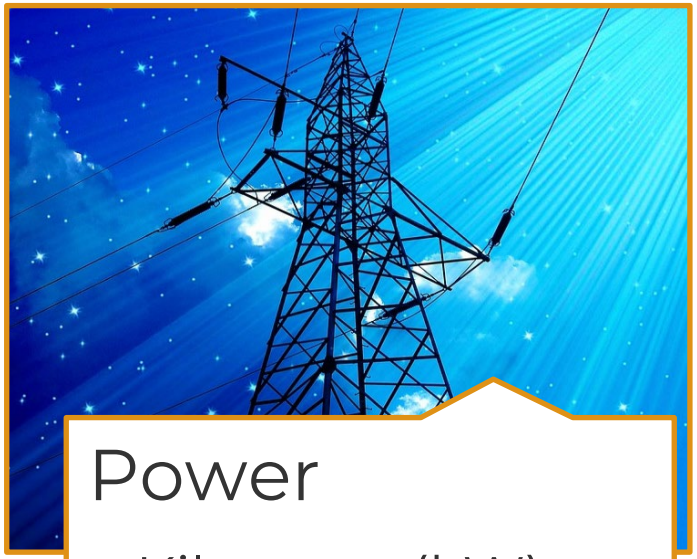
Grid and Facility Considerations

Site Equipment

- **Transformer capacity:** Distribution transformer must be large enough to supply peak load demand.
- **Main breaker:** Must be sized large enough to supply the peak coincident demand from all branch circuits.
- **Panel capacity:** Spare breaker positions must be available.
- **Circuit breaker:** NEC 625.41: overcurrent protection shall be rated for 125% of the maximum EV charger load.

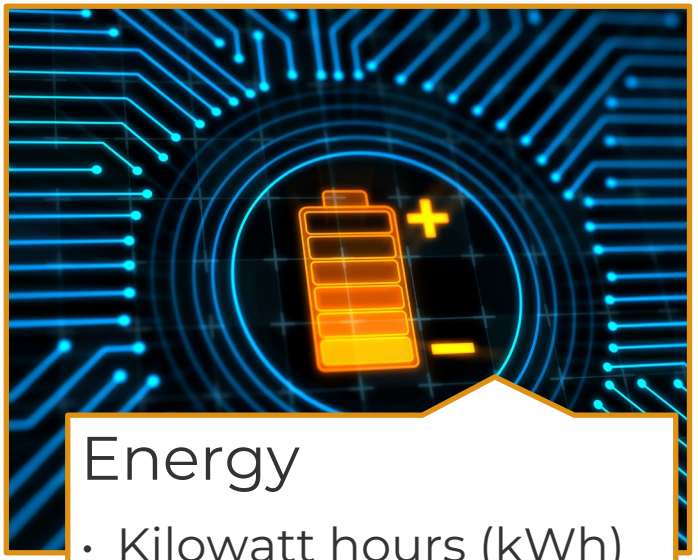
https://electricschoolbusinitiative.org/all-about-charging-infrastructure

Power & Energy



Power

- Kilowatts (kW)
- Charging station ratings



Energy

- Kilowatt hours (kWh)
- Battery size
  - Route energy usage
  - Charge needed

Charger Power Levels – Kilowatts (kW)

Chargers can range from 3 – 350+ kW

- Level 2 AC: 3-19.2 kW
- DC Fast Chargers: 15 – 350+ kW

Higher power levels charge vehicles faster

- Charger power (kW) * dwell time (hours) = Energy delivered (kWh)
- Ex. 15 kW charger * 12 hours (6pm-6am) = 180 kWh

Your energy costs will most likely depend on your peak power

- More high-powered chargers running at once = larger monthly bill
- Ex. 5 – 60kW chargers, $15 demand charge
  - All chargers running at once = $4500 monthly cost on top on energy rates
- Consider charge management to minimize demand

Perform a Route Analysis

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%

https://driveelectric.gov/school-districts

Level 2 AC Chargers

	Level 2 AC
Power Levels	3-19 kW
Facility power	Single or 3-phase
Connector	J1772
Cost	$-$$
Applicability	Lower power, longer durations *should be sufficient for most bus routes
Bus/Charger Ratio	Typically 1:1
Bus compatibility	AC charging not available on certain ESB models
CSB requirements	Energy Star Certified required
Grid impact	Less infrastructure required

J1772 AC Plug

J1772 AC Port

DC Fast Chargers

	DC Fast Charger (DCFC)
Power Levels	15-350+ kW
Facility power	Typically requires 3-phase power
Connector	CCS1
Cost	$$$-$$$$
Applicability	Quick top offs and longer routes that require mid-day charging
Bus/Charger Ratio	1:1 or greater, power sharing, sequential charging, etc.
Bus compatibility	DCFC is compatible on all current ESB OEM offerings
CSB requirements	NRTL Listing recommended
Grid impact	More infrastructure required

CCS DC Plug

CCS DC Port

Charger Options

Networked vs. Non-networked

- OCPP compliance is advisable (at least 1.6)

Make/models

- Ask your bus OEM or charge mgmt. provider about interoperability

Grant and/or utility requirements

- Energy Star, NRTL, BABA compliant equipment, etc.

Electrical parameters

- Amp rating, input current, input voltage, etc.

Single or dual port

Wall mounted or pedestal

Cable length and cord management

Temperature rating

Site Design Options

Where is it easiest and least expensive to deploy your initial chargers?

- Nearby service panel, minimal trenching, wall-mounted chargers

Are you limited by parking (pull-in/back-out)?

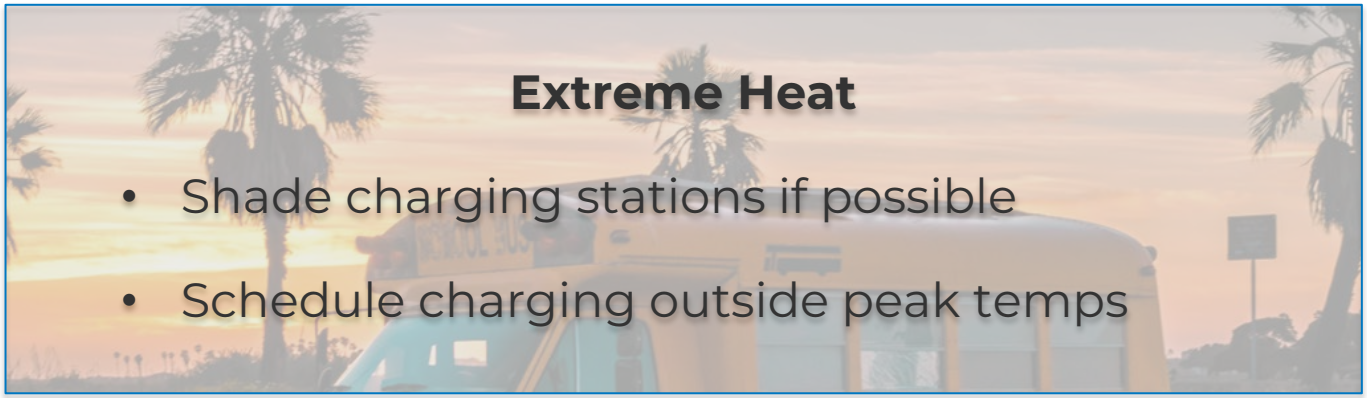
- do you need to require front or rear charging receptacles?

Do you have space for chargers and bollards in and around parking spaces?

[ESBI/VEIC - ESB Facility Assessment Guide]

Extreme Weather

- Understand charger temperature ratings



Extreme Heat

- Shade charging stations if possible
- Schedule charging outside peak temps

Extreme Cold

- Consider charge management
- Cord management

Charger maintenance

Routine/Preventive Maintenance

Level 2 AC

- Inspect cables and connectors
- Inspect and clean cabinets

DC Fast Charger

- Change intake filters
- Retorque AC/DC terminals

High-Powered DCFC

- Coolant replacement and filter changes

Consider monthly/annual maintenance plans

Consider remote monitoring

Ensure access to trained local technicians

- Electricians must be EVITP certified for CSB funded chargers
- Upcoming charging familiarization webinar

Future-Proofing

Plan for more chargers

- Add conduit, stub ups where possible

Consider standardizing charger sizes or models

- Ensure compatibility, standardize maintenance, expand to new routes, and allow flexible parking

Talk with your utility early about future electrification

- Grid upgrades may take years

Purchase OCPP compliant chargers

- Will enable future charge mgmt. options

Incorporate resilience (solar, battery storage, V2B, V2G)

Consider Charge Management

Save Costs

Reduce Required Infrastructure

Data and Reporting

Remote Monitoring

Pre-Conditioning

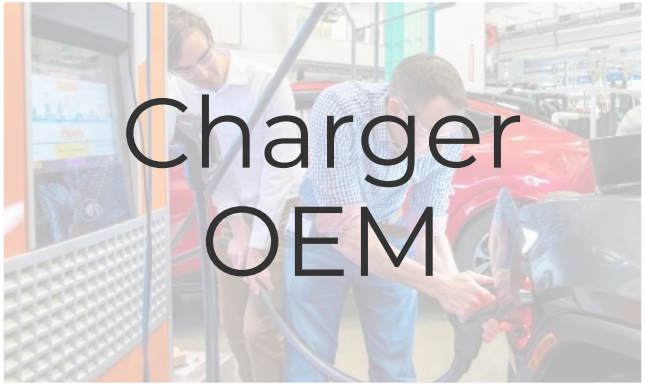
Interoperability

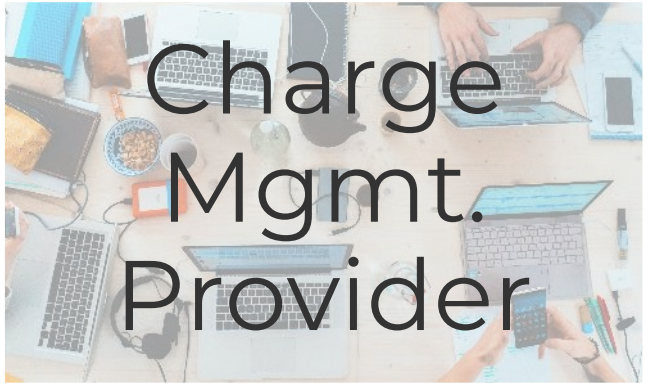
Solar and Battery Storage

V2X

[4/24/24 EPA CSB Webinar - Incorporating Charge Management]

EVSE Providers





EVSE Procurement

Your chargers must be installed before your buses arrive

Talk to your utility early and understand any required upgrades

Understand your complete costs for infrastructure before committing to bus procurement

Ensure your bus and charger models are compatible

Understand who will maintain the chargers

EVSE Procurement Resources

ESBI ESB and Charger Procurement RFP Template

EPRI Vetted Product List

Climate Mayors Purchasing Collaborative

Sourcewell - EVSE

DOE Guidance in Procurement of Electric Vehicle Supply Equipment

General Best Practices/Advice

- Don’t be afraid to start a pilot
- Take advantage of unprecedented funding
- Utilize lower powered charging if possible
- Join the ESB Forum and connect with peers https://electric-school-bus-forum.nrel.gov/
- Reach out to cleanschoolbusTA@nrel.gov

Joint Office of
Energy and Transportation

Thank you

May 22, 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 JOET TA Webinars

June 18, 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

Current Funding Opportunities

- EPA *anticipates* announcing 2023 Rebate selections in May 2024.
- Applications for the CHDV grant program are due by July 25, 2024, at 11:59 PM ET.

Future Funding Opportunities

- EPA encourages school districts to consider which competition structure (grants or rebates) best suits their needs.
- 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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