

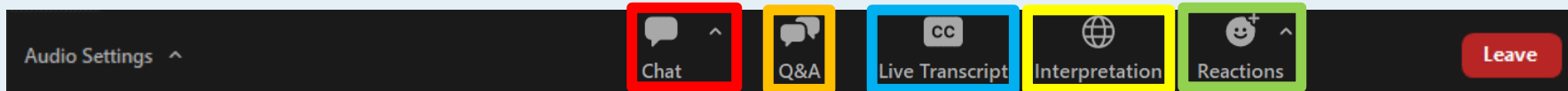


# **EPA CLEAN SCHOOL BUS**

**Fleet Planning and Route Analysis**  
**October 8th, 2024 @ 1 PM ET**

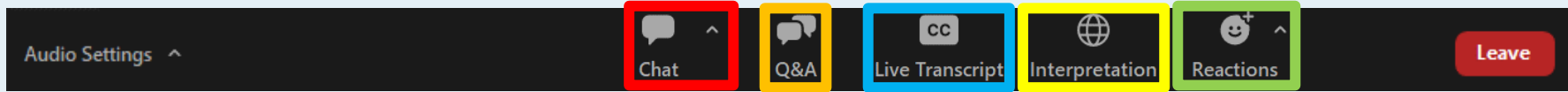
Office of Transportation and Air Quality  
U.S. Environmental Protection Agency

# Zoom Webinar Logistics



- **This presentation is being recorded.** The slides and recording will be posted to [epa.gov/cleanschoolbus](https://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.
- **Live interpretation:** Live Spanish interpretation is available by clicking the “Interpretation” icon and selecting Spanish. Click “Mute Original Audio” to mute English audio when listening in Spanish.
- **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](mailto: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](https://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].
- **Interpretación en vivo:** Hay interpretación en español disponible haciendo clic en el icono “Interpreting” [Interpretación] y seleccionando el español. Haga clic en “Mute Original Audio” [Silenciar audio original] para silenciar el audio en inglés al escuchar en español.
- **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](mailto: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.

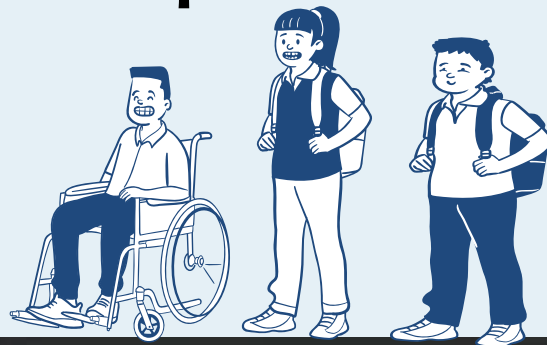
# Live Transcription / Transcripción simultánea / Live Spanish Interpretation / Interpretación simultánea



Live transcript is available

CC

Live Transcript



✓ Off

English

Spanish

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Interpretation

# AGENDA

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Overview of the Clean School Bus  
(CSB) Program

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CSB Technical Assistance Resources

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Fleet Planning and Route Analysis

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Q&A

---

Next Steps and Resources

# Overview of the Clean School Bus Program

## Bipartisan Infrastructure Law

- Under 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.

## CSB Funding Opportunities

- The EPA has offered rebates and grants in [past funding opportunities](#).
- The EPA is offering another round of rebate funding.
- The 2024 CSB Rebate Program is the fourth CSB funding opportunity.



**EPA CLEAN  
SCHOOL BUS**



# Why Clean School Buses?

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

## **Reduced Greenhouse Gas Emissions**

CSBs emit zero or low tailpipe emissions.

A blue circular icon containing a white silhouette of a person breathing or air flowing.

## **Cleaner Air**

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

A green circular 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 red circular icon containing a white silhouette of a lightning bolt.

## **Resiliency**

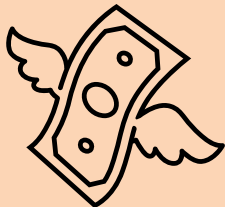
Vehicle-to-Grid (V2G) capable CSBs can provide power to the grid or buildings during power shutdowns.

A purple circular icon containing a white silhouette of a teacher standing next to a group of students.

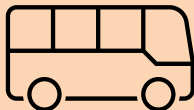
## **Improved Student Attendance & Achievement**

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

# 2024 CSB Rebate Program Overview



The EPA is offering up to \$965 million for clean school buses and ZE school buses. The EPA may modify this amount based on the applicant pool and other pertinent factors. Funds are subject to availability and total awards may be higher or lower than the anticipated funds offered update if changed.



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.



The EPA is prioritizing applications that will replace buses serving high-need local education agencies, Tribal school districts funded by the Bureau of Indian Education 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.



**Changes from 2023 CSB Rebate Program:**  
Increased bus maximum (50 buses) and decreased funding per bus.



Application packages must be submitted to EPA no later than 1/9/25 at 4:00 p.m. ET.  
For more information, please visit [www.epa.gov/cleanschoolbus](https://www.epa.gov/cleanschoolbus).



**EPA CLEAN  
SCHOOL BUS**



# CSB Program Website Tools and 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](#)

All links can be found on: [epa.gov/cleanschoolbus](https://www.epa.gov/cleanschoolbus)

# Technical Assistance Webinar Playlist

A screenshot of a YouTube video player. The video title is "Clean School Bus: JOET - TA Overview & U...". The video thumbnail shows a yellow school bus with a green bumper. A red play button is overlaid on the thumbnail. The video is from the EPA Clean School Bus channel, as indicated by the logo in the top left corner. The video has 1/3 shares and a timestamp of 2023-10-12 13:13:38.

- 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

## Technical Assistance via the Joint Office of Energy and Transportation



Joint Office of  
**Energy and  
Transportation**

# Fleet Planning and Route Analysis

Clean School Bus Program Webinar

Oct. 8, 2024

[driveelectric.gov](https://driveelectric.gov)

# Electric School Bus Technical Assistance

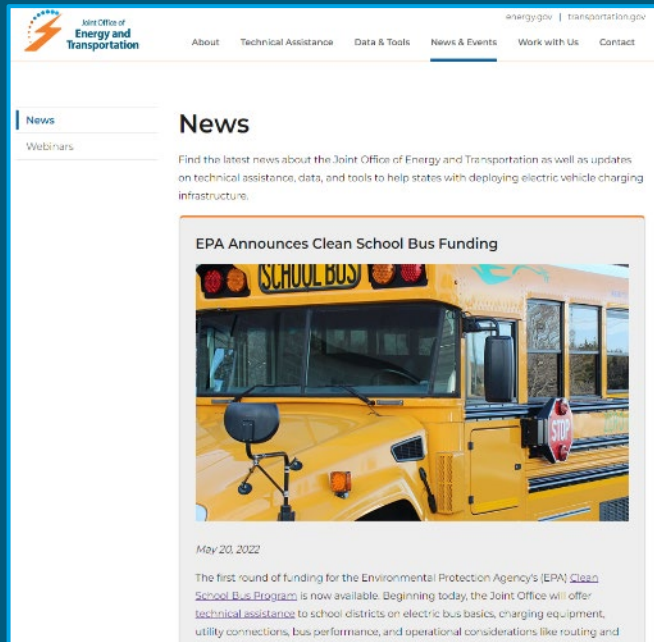
NREL and the Joint Office of Energy and Transportation (Joint Office) are partnering with the U.S.

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](mailto:CleanSchoolBusTA@nrel.gov)  
[driveelectric.gov/contact](https://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

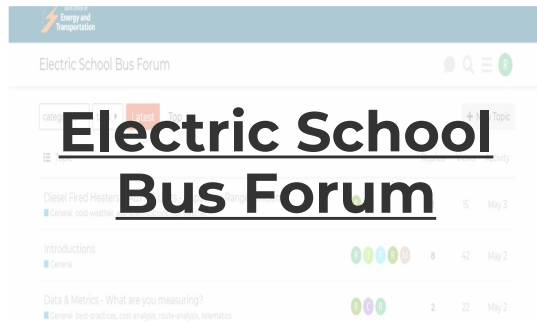
Assisting with  
training and  
workforce  
development

Opportunities  
for resiliency  
(V2X)

Discussing  
concerns with  
stakeholders

Identifying  
solar and  
battery storage  
opportunities

# ESB Resources



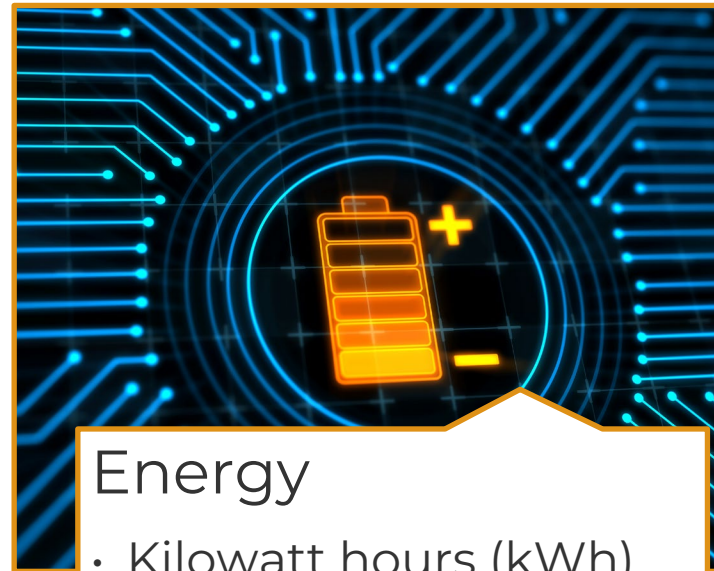


- Electric School Bus (ESB) Fleet Planning



## Power (kW)

- Kilowatts (kW)
- Charging station ratings



## Energy

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

# Battery Size (kWh)

- ESB battery sizes range from under 100 kWh to over 300 kWh
- Larger batteries = longer range
- Some ESB models offer multiple battery sizes



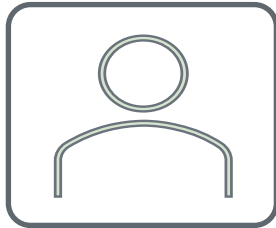


# Bus Range



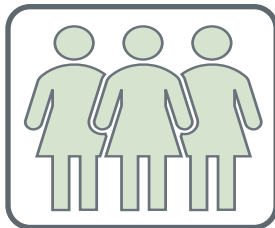
## Duty Cycle

- Traffic, average speed, number of stops, terrain



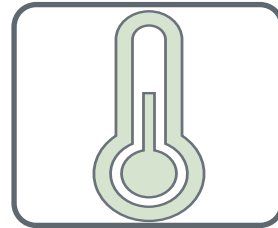
## Driver Style

- Aggressive drivers will lower range



## Bus Loading

- More weight/riders = less range



## Ambient Temp.

- HVAC affects efficiency



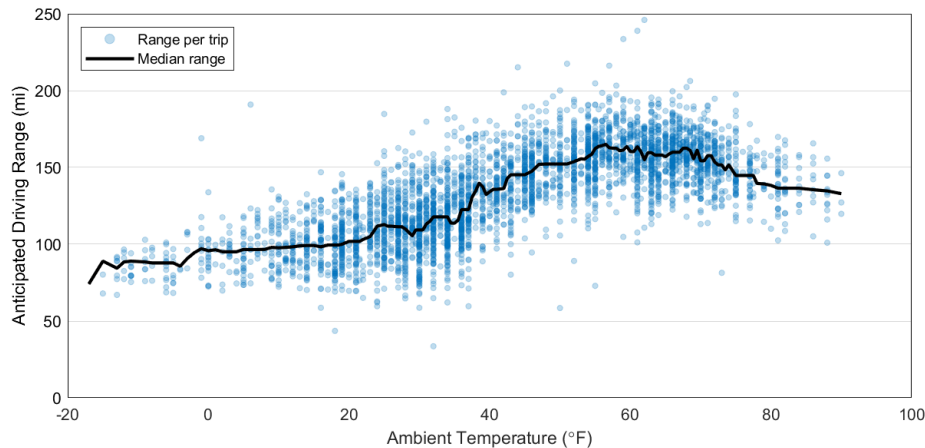
## Adverse Weather Conditions

- Snow and rain

# Real World Cold Weather Examples: ESB and Battery Electric Bus (BEB) Fleets

## Duluth Transit Authority – Duluth, MN

- 2019-2021 study saw a range decrease of approximately 33% for a temperature decrease of 30°F.  
(<https://www.nrel.gov/docs/fy22osti/83038.pdf>)
- BEBs are approximately 3x as energy efficient as the diesel fleet.
- BEBs utilize auxiliary cabin heaters in colder weather.



## Tok Transportation – Tok, AK

- Has operated one Type C ESB since 2020 with only electric heat.
- Successfully completing routes under -35° F.
- Experiences an efficiency decrease of 20%-25% for every temperature decrease of 30°F, which maxes out around 55% efficiency decrease at negative 10-20°F.
- Bus is stored and charged inside.

- ESB  
Range  
Impacts

- Best Case
  - 60-70°F day
  - Little/no HVAC usage
  - Perform pre-trip while charging
  - Efficient regenerative braking capture (20%-30%)
  - These days you can experience at or within 10%-15% of OEM rated efficiency

- Worst Case
  - Extreme cold/heat
  - Forget to pre-condition while charging
  - Traffic/long stops
  - Poor regenerative braking/aggressive driving
  - These days MAY cause range to be reduced by 50%-60%

# How to Maximize Range in ESBs

Train your drivers  
on good habits

Pre-condition the  
bus prior to each  
route while  
plugged in

Consider indoor  
storage and  
charging

Turn off cabin heat  
when students exit

Monitor telematics  
to identify  
inefficiencies

Minimize door  
opening times

Consider auxiliary  
heaters in extreme  
cold

# Bus Efficiency (kWh/mile)

- Efficiency = battery size ÷ range
- More efficient bus = lower efficiency number

## OEM Rated Efficiencies

Type	Make/Model	Usable Battery Size (kWh)	Range (miles)	Efficiency (kWh/mile)
A	Bluebird Microbird G5	88	100	0.88
A	BYD Type A Achiever	141	105	1.34
A	Collins Ford E-Transit	68	100	0.68
A	Greenpower Nano Beast	118	140	0.84
A	Motiv Epic E-450	127	105	1.21
C	BYD Type C Creator	259.9	175	1.49
C	Bluebird Vision Electric	155	120	1.29
C	IC Bus Electric CE (210 kWh)	210	135	1.56
C	IC Bus Electric CE (315 kWh)	315	200	1.58
C	LionC (126 kWh)	126	100	1.26
C	LionC (168 kWh)	168	125	1.34
C	Thomas C2 Jouley	221.1	150	1.47

# Example Range/Efficiency Impacts

Battery Size:  
150 kWh

OEM Rated  
Range: 100  
miles

OEM Rated  
Efficiency:

•  $150 \text{ kWh} / 100 \text{ miles} = 1.5 \text{ kWh/mile}$

20% Less  
Range:

•  $150 \text{ kWh} / 80 \text{ miles} = 1.875 \text{ kWh/mile}$

50% Less  
Range:

•  $150 \text{ kWh} / 50 \text{ miles} = 3.0 \text{ kWh/mile}$



# Route Analysis Step 1:

- Understand your bus efficiency (kWh/mile) in worst case scenario

## ESB Resources

- [AFDC Vehicle Search Tool](#)
- [School Transportation News Buyer's Guide](#)
- [CALSTART ZETI Tool](#)

Consult with your OEM/dealer.

Consult with local ESB fleets.

Reach out to [cleanschoolbusTA@nrel.gov](mailto:cleanschoolbusTA@nrel.gov).

**ENERGY** | Energy Efficiency & Renewable Energy

### Alternative Fuels Data Center

Search the AFDC  **SEARCH**

**FUELS & VEHICLES** **CONSERVE FUEL** **LOCATE STATIONS** **LAWS & INCENTIVES** **Maps & Data** **Case Studies** **Publications** **Tools** **About** **Home**

[EERE](#) » [AFDC](#) » [Tools](#) » Vehicle Search [Printable Version](#)

#### Alternative Fuel and Advanced Vehicle Search

Find and compare alternative fuel vehicles, engines, and hybrid/conversion systems. Some of the light-duty vehicles may count toward vehicle-acquisition requirements for [federal fleets](#) or [state and alternative fuel provider fleets](#) regulated by the Energy Policy Act. For downloads of past model years, see the [publications search](#).

Light-Duty Vehicles   
 All Vehicles

**Search Results - 1 - 8 of 17 vehicles** [New Search](#) | [Download](#) | [Print](#)

Filter by: Model Year: 2023 Fuel/Technology: Electric | Class/Type: School Bus | Manufacturer: All View:

**Blue Bird All American RE Electric**   
 Electric

**Blue Bird Micro Bird G5 Electric**   
 Electric

**Refine Your Search**

**Model Year**

☒ 2023   
 ☐ 2022   
 ☐ 2021

# Bus Efficiency Example



OEM has seen buses in region with your specs up to 2.1 kWh/mile.



Local ESB fleet has seen a max of 30% range/efficiency reduction in their similar buses.

- $150\text{kWh} \div 70 \text{ miles} = 2.14 \text{ kWh/mile}$

A circular inset image showing a screenshot of a table from the website driveelectric.gov. The table is titled "User Selections" and "Energy/Power Results". It has columns for "Afternoon Return Time", "Cabin Heater", "Mid-Day Charging", "Max Energy Used (kWh)", and "Estimated Minimum Charger Power Level (kW)". The table shows data for three different times: 30 PM, 2 PM, and 1 PM. The "Max Energy Used (kWh)" values are 157.5, 90.3, and 86.1 respectively. The "Estimated Minimum Charger Power Level (kW)" values are 20.7, 11.1, and 10.9 respectively.

User Selections			Energy/Power Results	
Afternoon Return Time	Cabin Heater	Mid-Day Charging	Max Energy Used (kWh)	Estimated Minimum Charger Power Level (kW)
30 PM	Electric	Yes	157.5	20.7
2 PM	Electric	Yes	90.3	11.1
1 PM	Electric	Yes	86.1	10.9

NREL/Joint Office calculates lowest efficiency at 2.3 kWh/mile.





## Route Analysis Step 2:

- Determine your Route Energy Usage (kWh)

Route Energy Usage (kWh) =

Bus Efficiency (kWh/mile) x Route Distance (miles)

- Bus Efficiency 2.3 kWh/Mile
- 25-mile morning route/25-mile afternoon route

- Mid-Day Charging
  - 2.3 kWh/mile x 25 miles = 57.5 kWh
- No Mid-Day Charging
  - 2.3 kWh/mile x 50 miles = 115 kWh

### Why Mid-Day Charging?

- Can reduce battery size needed
- Can reduce charger size needed
- Can enable longer routes

### Why Not?

- If you are subject to prohibitive time-of-use rates or demand charges

# Route Analysis Step 3:

- Determine if your bus battery size meets your requirements

## Consider battery degradation

- All batteries will lose capacity over time
- Most batteries are now warrantied to 80% for 8-12 years

## Consider minimum State-of-Charge (SOC)

- Give drivers extra confidence on range
- Build in a buffer

Battery Size (kWh) x (Degradation % - Minimum SOC %) = Usable Battery Capacity

$$150 \text{ kWh} \times (.8 - .1) = 105 \text{ kWh}$$

- Mid-Day Charging = 57.5 kWh route energy

- No Mid-Day Charging = 115 kWh route energy

## Route Analysis Step 4:

- Determine your Power Needs (kW)

Charger Power Needed (kW) =

Route Energy Usage (kWh) ÷ Charging Time (hours)

- Example Charge Times
  - Mid-Day: 9 a.m. return/1 p.m. depart = 4 hours
  - Evening: 4 p.m. return/6 a.m. depart = 14 hours

- Charge battery to 100% during mid-day:
  - 57.5 kWh ÷ 4 hours = 14.4 kW

- Charge battery to 100% during evening:
  - 57.5 kWh ÷ 14 hours = 4.1 kW

### Additional Considerations:

- Not all ESBs are compatible with Level 2 AC charging.
- BTMS will use charger power to maintain battery temperature on cold days (≈5-10kW), consult OEM.

# Determine Optimal Charging Power Level

	Variable	Formula					
A1	Charger Power Level (kW)		6.2	6.3	6.4	6.5	6.6
A2	Battery Size (kWh)		150	150	150	150	150
A3	Range (Miles)		100	100	100	100	100
A4	Route Energy (kWh)		57.5	57.5	57.5	57.5	57.5
A5	Mid-Day Charge Time		4	4	4	4	4
A6	Evening Charge Time		14	14	14	14	14
A7	Battery After Morning Route (kWh)	A2-A4	92.5	92.5	92.5	92.5	92.5
A8	Battery Before Afternoon Route (kWh)	A1*A5+A7	117.3	117.7	118.1	118.5	118.9
A9	Battery After Afternoon Route (kWh)	A8-A4	59.8	60.2	60.6	61	61.4
A10	Battery After Evening Charge (kWh)	A1*A6+A9	146.6	148.4	150.2	152	153.8

- Additional Considerations:
  - Not all ESBs are compatible with Level 2 AC charging.
  - BTMS will use charger power to maintain battery temperature on cold days ( $\approx 5\text{-}10\text{kW}$ ), consult OEM.

Questions?? – [cleanschoolbusta@nrel.gov](mailto:cleanschoolbusta@nrel.gov)

# NREL/Joint Office 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	
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)
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
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
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
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

Charger Selection	
Charger Size (kW)	Expected Minimum SOC (%)
20.0	11%
19.2	48%
19.2	20%
19.2	58%

<https://driveelectric.gov/school-districts>

# ESB Route Analysis Tool – Main Inputs

- Risk Factor (Low/Medium/High)
  - Efficiency loss from driving and other factors
  - Default – High Risk

**Risk Factor:** **High Risk**

- Battery Degradation Level (%)
  - Expected % of original battery capacity expected at the end-of-life
  - Default – 80%, \*Typical battery warranties cover 80% of original capacity

**Battery Degradation Level (%):** **80%**

- Minimum State-of-Charge (%)
  - The lowest % capacity that the battery should experience on each route
  - Default – 10%

**Minimum State-of-Charge (%):** **10%**

- Temperature (°F)
  - Drop down selection
  - Select the lowest expected temperature

**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>

# ESB Route Analysis Tool – Route Specific Inputs

- Bus Info
  - Class and Make/Model
  - Drop down selections

- Route Info
  - Route #
  - Mileage and dwell times
  - Unique entries

- User Selections
  - Heater type
  - Mid-day Charging Options

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	6:11 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%

# 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	
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	6:11 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%



# ESB Route Analysis Tool – Compare Bus Models

- Requires DCFC indicates this specific model is not compatible with Level 2 charging

- Not compatible indicates route energy is higher than battery capacity
  - Select larger bus battery option

- Red lettering indicates SOC lower than desired

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	Bluebird Vision Electric	1	35	6:30 AM	9:00 AM	40	2:00 PM	4:30 PM	Electric	Yes	86.1	12.6	19.2	31%
TypeC	BYD Type C	1	35	6:30 AM	9:00 AM	40	2:00 PM	4:30 PM	Electric	Yes	109.9	16.7	19.2	33%
TypeC	IC Bus Electric CE (105 kWh)	1	35	6:30 AM	9:00 AM	40	2:00 PM	4:30 PM	Electric	Yes	100.0	NOT COMPATIBLE	19.2	-17%
TypeC	IC Bus Electric CE (210 kWh)	1	35	6:30 AM	9:00 AM	40	2:00 PM	4:30 PM	Electric	Yes	103.7	13.5	19.2	28%
TypeC	LionC (126 kWh)	1	35	6:30 AM	9:00 AM	40	2:00 PM	4:30 PM	Electric	Yes	84.0	15.9	19.2	22%
TypeC	Thomas C2 Jouley	1	35	6:30 AM	9:00 AM	40	2:00 PM	4:30 PM	Electric	Yes	93.3	12.1	19.2	38%

\*REQUIRES DCFC

# ESB Route Analysis Tool – Evaluate Bus Options

Lowest Expected  
Temperature (°F):

10°

\*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 (210 kWh)	1	25	6:30 AM	9:00 AM	32	2:00 PM	4:30 PM	Electric	Yes	95.7	14.2	19.2	44%
TypeC	IC Bus Electric CE (210 kWh)	1	25	6:30 AM	9:00 AM	32	2:00 PM	4:30 PM	Auxiliary	Yes	77.8	11.9	19.2	51%
TypeC	IC Bus Electric CE (210 kWh)	1	25	6:30 AM	9:00 AM	32	2:00 PM	4:30 PM	Electric	No	170.5	NOT COMPATIBLE	19.2	-1%
TypeC	IC Bus Electric CE (210 kWh)	1	25	6:30 AM	9:00 AM	32	2:00 PM	4:30 PM	Auxiliary	No	138.5	11.9	19.2	14%



Thank You

Oct. 8, 2024

*[CleanSchoolBusTA@nrel.gov](mailto:CleanSchoolBusTA@nrel.gov)*

[driveelectric.gov](https://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](mailto:cleanschoolbus@epa.gov)

[epa.gov/cleanschoolbus](https://epa.gov/cleanschoolbus)

## Upcoming Webinars

October 8, 2024 at 1pm ET	JOET: Fleet Planning and Route Analysis
October 16, 2024 at 1pm ET	JOET: Technical Assistance Overview & Utility Planning
November 7, 2024 at 1pm ET	Panel Discussion with CSB Rebate selectees and Utility Providers
November 18, 2024 at 1pm ET	2024 CSB Rebate Program Frequently Asked Questions Overview with Live Q&A
January 30, 2025 at 1pm ET	2024 CSB Rebates Feedback and Next Steps for Selectees

*\*Please note: Webinar topics are subject to change. 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](https://www.epa.gov/cleanschoolbus/events-related-clean-school-bus-program)*



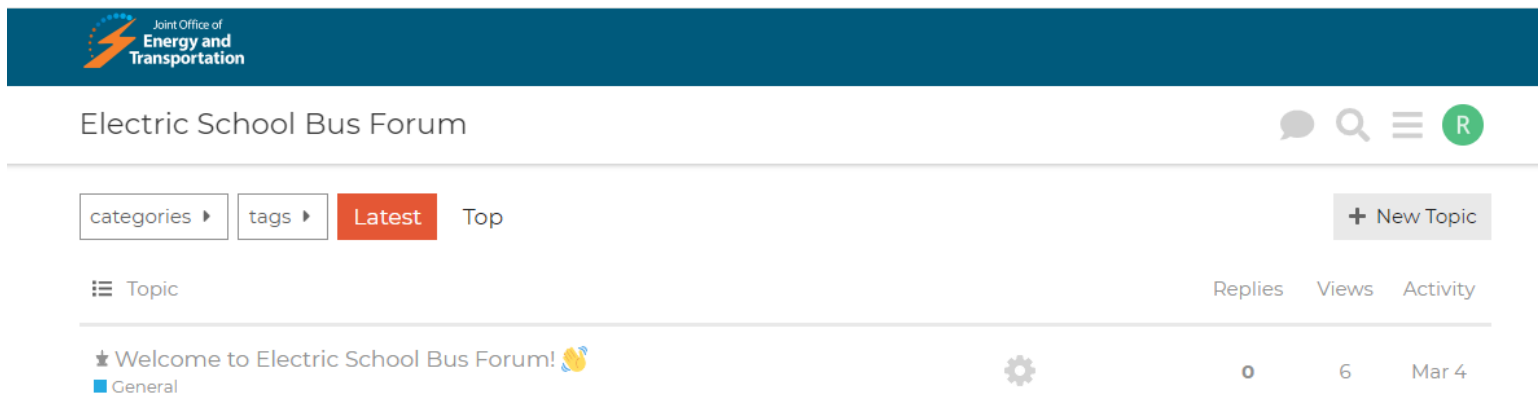
Application packages must be submitted to EPA no later than 1/9/25 at 4:00 p.m. ET.  
For more information, please visit [www.epa.gov/cleanschoolbus](https://www.epa.gov/cleanschoolbus).



**EPA CLEAN  
SCHOOL BUS**

# Electric School Bus Forum

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



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

# How to Apply — Overview



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



2. Register your Organization with SAM.gov



3. Complete your Application Form and Supplemental Applicant Forms



4. Submit Application Package by **January 9th , 2025 at 4:00pm ET**

## 2024 CSB Rebates

- Applications must be submitted to EPA no later than **1/9/25 at 4:00 p.m. ET.**
- Dates and topics for future webinars are on our website under the 'Webinars' section.

## Future Funding Opportunities

- The EPA encourages school districts to consider which competition structure (grants or rebates) best suits their needs.
- The EPA anticipates opening additional CSB funding opportunities.

## Resources

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

## Stay in Touch

- Learn more about 2024 CSB Rebates at [epa.gov/cleanschoolbus/school-bus-rebates-clean-school-bus-program](https://epa.gov/cleanschoolbus/school-bus-rebates-clean-school-bus-program)
- Submit questions to [cleanschoolbus@epa.gov](mailto:cleanschoolbus@epa.gov)
- Joint Office Technical Assistance Helpline: [cleanschoolbusTA@nrel.gov](mailto:cleanschoolbusTA@nrel.gov)
- Don't miss any updates! To sign up for the listserv, please visit [epa.gov/cleanschoolbus](https://epa.gov/cleanschoolbus).





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SCHOOL BUS**

**cleanschoolbus@epa.gov**  
**epa.gov/cleanschoolbus**