

ELECTRIC SCHOOL BUSES ARE ROLLING

INNOVATION WEBINAR

April 25, 2024

3:00 - 4:00 p.m. ET

NARUC CPI Innovation
Webinar



Moderator, Davante Lewis,
Commissioner, Louisiana
Public Service
Commission



Sue Gander
Director, Electric School
Bus Initiative,
World Resources Institute



Carolina Chacon
Coalition Manager,
Alliance for Electric
School Buses



Jacob Bolin
Electric Transportation
Specialist, Advanced
Energy



Eva DeCesaro
Senior Product Portfolio
Specialist - Electric
Transportation, Portland
General Electric

About NARUC

- Founded in 1889, the National Association of Regulatory Utility Commissioners (NARUC) is a non-profit organization dedicated to representing the state public service commissions who regulate the utilities that provide essential services such as energy, telecommunications, power, water, and transportation.
- NARUC's members include all 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands.
- Our mission is to serve the public interest by improving the quality and effectiveness of public utility regulation.

About CPI

- The NARUC Center for Partnerships & Innovation (CPI) builds relationships, develops resources, and delivers training to assist state commissions contending with complex current and emerging issues.
- CPI is funded by cooperative agreements with the U.S. Department of Energy (DOE) and the U.S. Department of Commerce's National Institute of Standards and Technology (NIST).
- NARUC CPI conducts work across five key energy areas and many topics within each: generation; transmission; distribution; customers; and critical infrastructure preparedness, response, and resilience.
- For more information, visit: <https://www.naruc.org/cpi/cpi-home/>

Upcoming Events

Virtual Events:

- **EV State Working Group Webinar – April 28**
- **Workshop 3: Integrated Distribution System Planning for ADERs – May 1**
- **Improving Energy Resilience with Rural and Remote Microgrids – May 7**
- **April Innovation Webinar on electric school buses – April 25**
- **Regulators’ Roundtable: Resource Planning and Regulatory Considerations Amidst the Energy Transition - Part 1– May 16**
- **Innovation Webinar on TBD topic – May 30**

In-Person Events:

- **Mid-Atlantic regional energy equity workshop – May 6 – 8, Washington, DC**
- **Coal & carbon management site visit – June 26 – 28, Gillette, WY**

Electric School Buses are Rolling

Moderated by:

Commissioner Davante Lewis, Louisiana
Public Service Commission



Electric School Buses:
How Utilities &
Regulators Can
Maximize Grid Assets

April 2024

Electric
School Bus

INITIATIVE



WORLD
RESOURCES
INSTITUTE

At WRI's Electric School Bus Initiative, we aim to:

- Partner with communities, school districts, industry experts, manufacturers, utilities, and policy makers to **transform and electrify** the school bus market
- Together, build unstoppable momentum to **electrify** 480,000 school buses in the U.S. by 2030
- Ensure an **equitable transition** by focusing on underserved communities



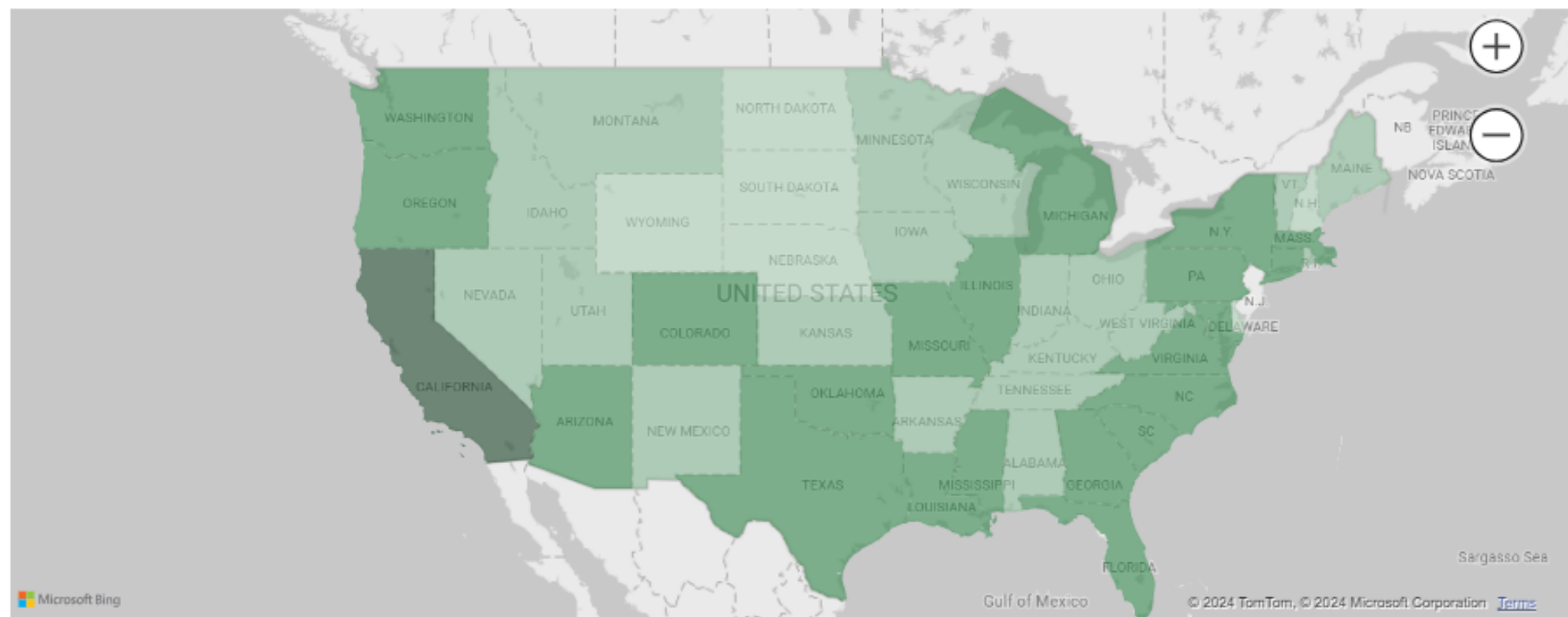
Electric school buses are committed in nearly all states, on the road in 47

Committed electric school buses, by adoption status



Committed electric school buses by state

Number of committed ESBs ● 1-10 ● 11-100 ● 101-500 ● 501+

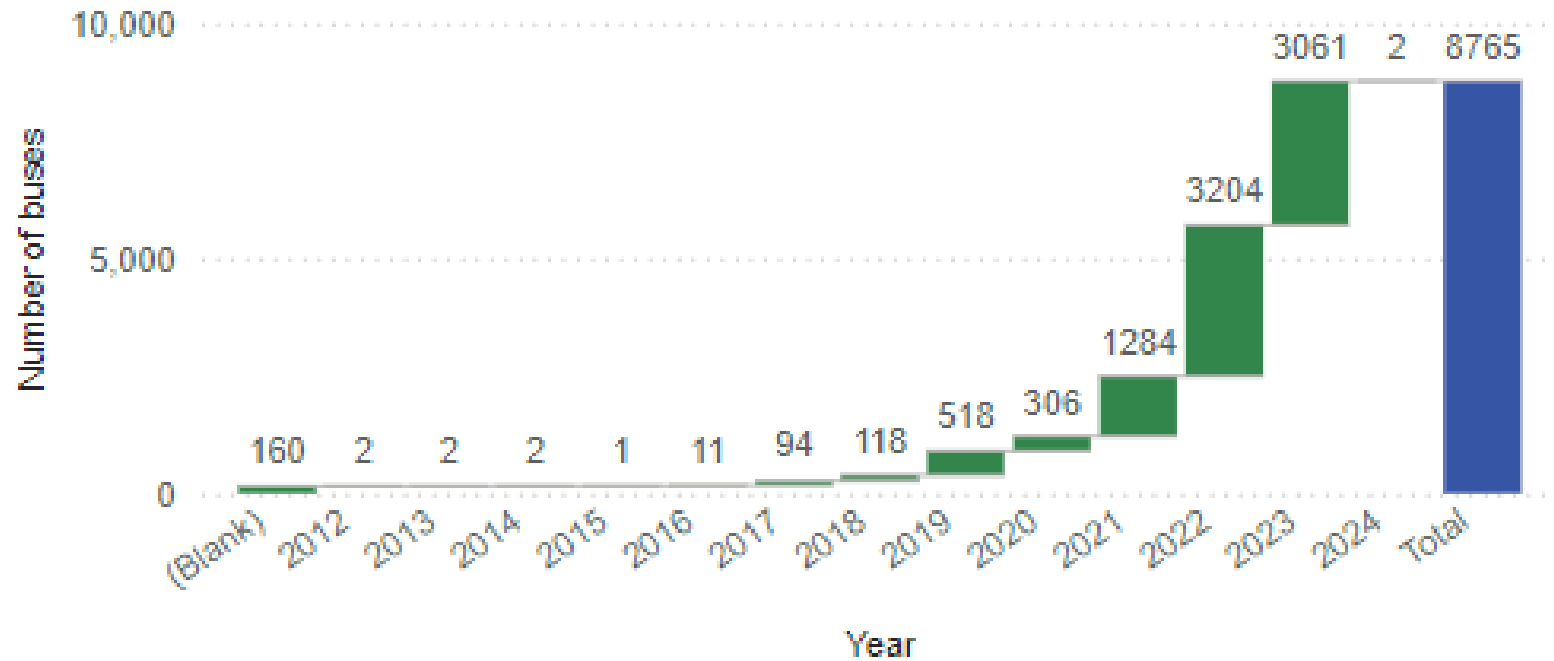


49 states, DC, 4 territories and several tribal nations have committed electric school buses.

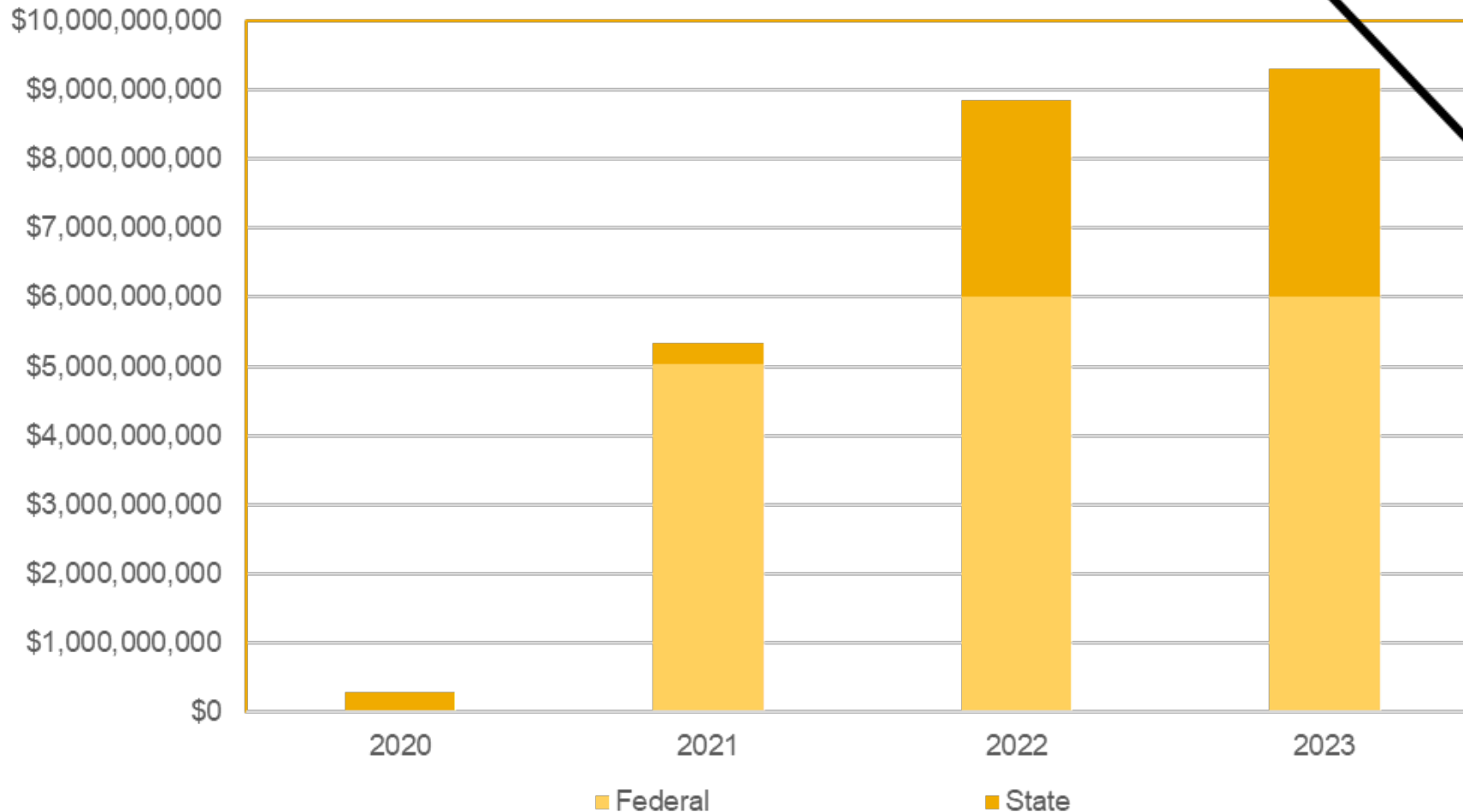
47 states have delivered or operating ESBs.

**There are
3,867 electric
school buses
on the road
today - nearly
1 % of the
fleet**

New electric school buses, by year



\$9B+ in Public Funding for ESBIs



PLUS:

- Federal tax credits
- Additional federal funding
- Greenbank and financing

Also a growing number of utility make ready programs and other support

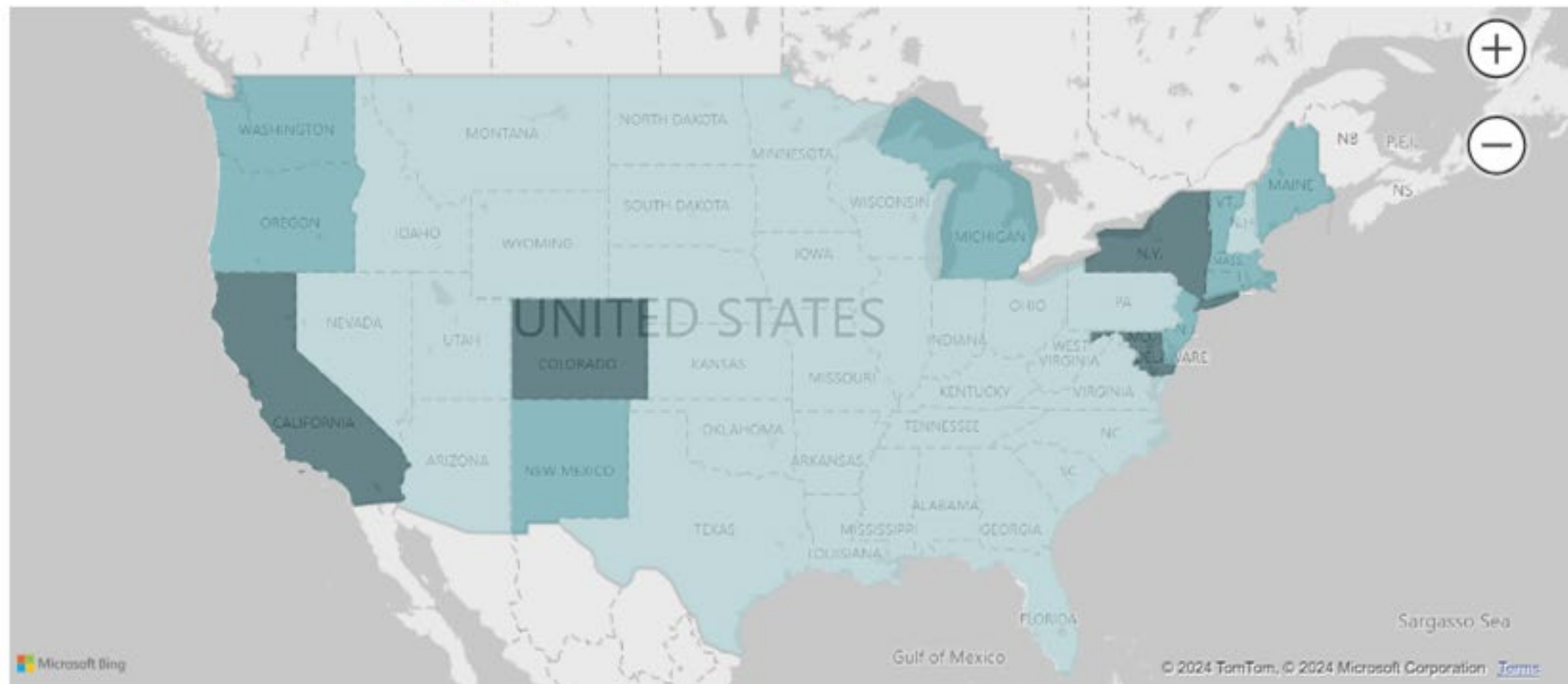
States have begun to adopt zero-emission fleet transition targets

Click on a state to filter

100% of all school buses must be electric by 2040 (2030 for environmental justice communities)

Electrification policies by state

Number of statewide commitments ● 0 ● 1 ● 2



- 6 states have statutorily-enacted zero-emission transition mandates
- 2 states and Washington, DC have non-binding zero-emission transition goals
- 11 states have adopted the Advanced Clean Trucks (ACT) rule; 2 other states are actively considering ACT
- Around **142,700** school buses (30%) and **7,341,000** school bus riders (40%) are impacted by a transition goal or the ACT rule

ACT requires manufacturers who produce medium- and heavy-duty vehicles (including school buses) to sell zero-emission vehicles as an increasing % of their annual sales from 2024 to 2035.

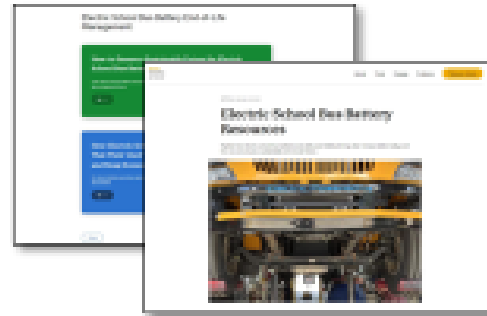
Has binding transition goal

No
Adopted ACT rule?

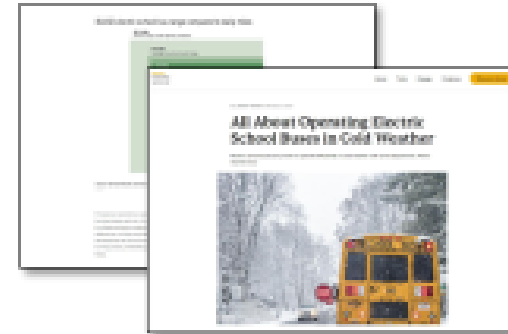
ESB INITIATIVE RESOURCES



"Why Electric School Buses?"
sample pitch deck



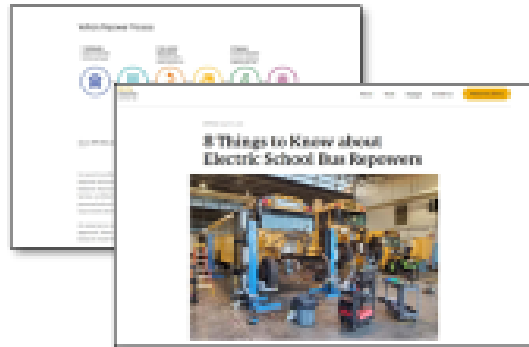
Electric school bus battery
resources hub



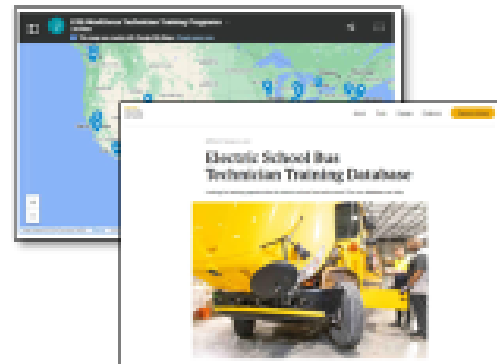
All About Operating Electric
School Buses in Cold Weather



ESB Initiative
Equity Video Series



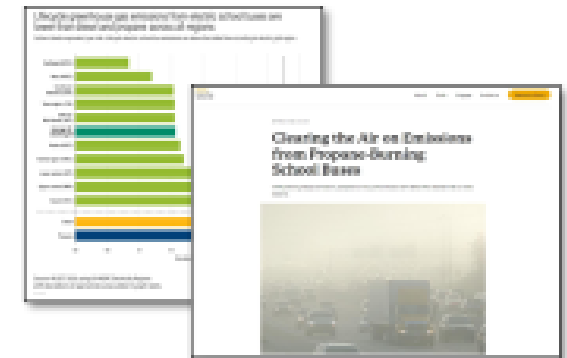
8 Things to Know about Electric
School Bus Repowers



Electric School Bus
technician training database



Electric school bus US Market
Study and Buyer's Guide



Clearing the Air on Emissions
from Propane-Burning School
Buses

ESB INITIATIVE RESOURCES

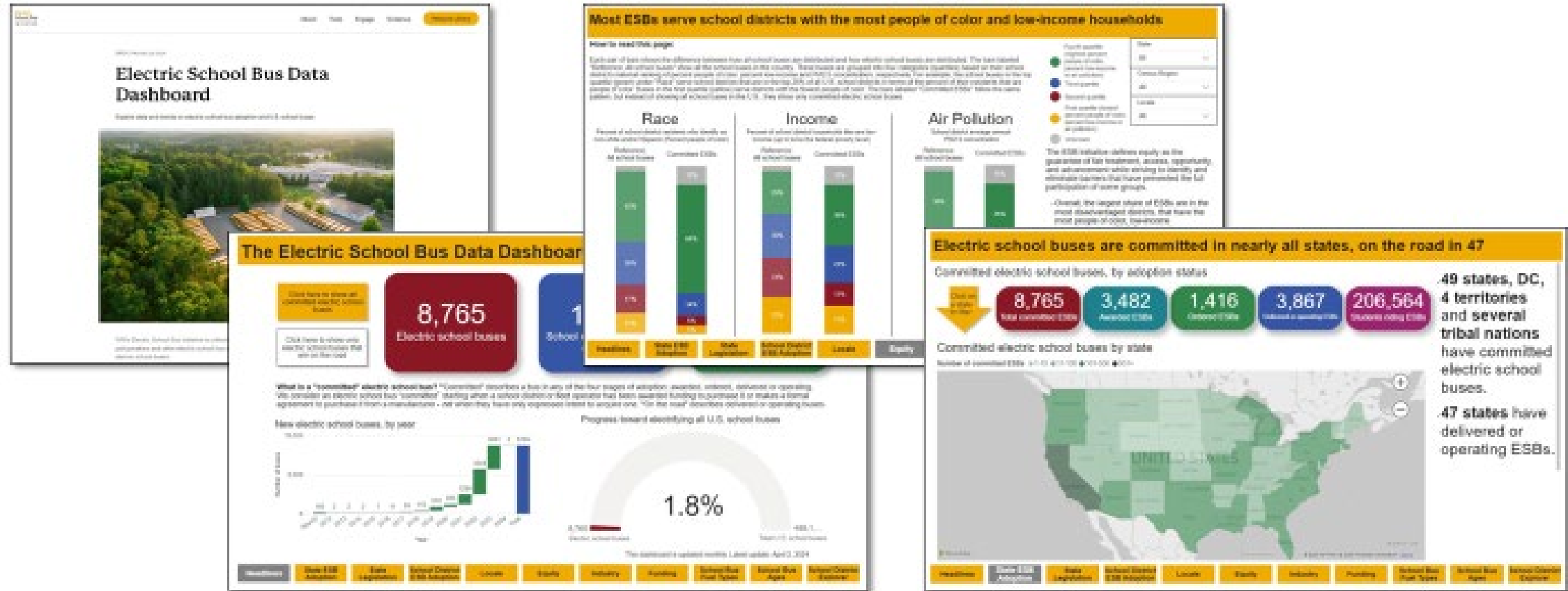
This collage features three overlapping elements. At the top left is the 'Electric School Bus Calculator' interface, showing a 'Your Input' section with dropdown menus for bus type and a 'Calculate' button. Below it is a bar chart titled 'Total cost of ownership (TCO) for Type C diesel and electric school buses', comparing the TCO of a diesel bus (around \$100,000) with an electric bus (around \$80,000). The largest element is a webpage titled 'All About Total Cost of Ownership (TCO) for Electric School Buses', which includes a photograph of a yellow school bus parked at a charging station.

All About Total Cost of Ownership (TCO) for Electric School Buses

This collage includes three overlapping elements. At the top is a spreadsheet with multiple columns and rows of data, likely a list of funding opportunities. Below it is a webpage titled 'Clearinghouse: Electric School Bus Funding and Financing Opportunities', which features a 'Download the Clearinghouse' button and a list of funding opportunities. The largest element is a webpage titled 'All About Clearinghouse', which provides information about the clearinghouse and includes a 'Download the Clearinghouse' button.

Clearinghouse: Electric School Bus Funding and Financing Opportunities

ESB INITIATIVE DATA DASHBOARD



electricschoolbusinitiative.org/electric-school-bus-data-dashboard

COLD WEATHER OPERATIONS



ESBs **successfully operate in cold climates** across North America, and have nameplate ranges up to 210 miles

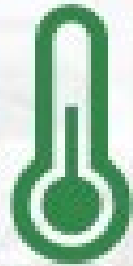


With proper planning & adjustments, ESBs **perform better than diesel-burning buses in snowy conditions**



New technology **prevents cold weather** from negatively impacting ESB batteries

COLD WEATHER OPERATIONS TIPS



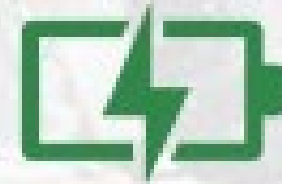
Pre-condition

Warming up the battery & cabin before routine trips



Storage

Keeping school bus indoors improves overall operation



Mid-Day Charging

Allows for faster charge when school bus is warm from afternoon route



Route Planning

Drive ESBs on least demanding routes during first winter of operation



Charger Weatherproofing

Keep charger safe in extreme cold, snow and ice



Training

Drivers should know how to operate ESB in cold weather

Source: [All About Operating Electric School Buses in Cold Weather](#)



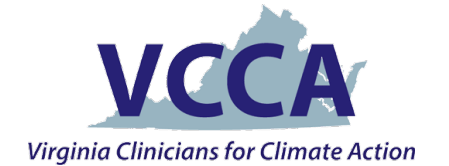


ALLIANCE FOR ELECTRIC SCHOOL BUSES

The Alliance is a diverse coalition of not-for-profit organizations committed to an **equitable transition of the nation's school bus fleet to electric** models.

Our goal is to ensure this transition **prioritizes the highest-need school districts in the most polluted areas** -- which, as data shows, are disproportionately low-income communities and communities of color -- **while creating good-paying careers for U.S. workers.**

OUR MEMBERS





Electric school buses are assets to the grid.

Predictable schedule can help manage loads on the grid

Buses can provide vehicle-to-grid or vehicle-to-building services during peak demand (like hot summers in Massachusetts) or emergencies (such as heat waves in California), making communities more resilient

Potential revenue for operators

Utilities and regulators play a crucial role.

providing
electricity
service

planning and
constructing
infrastructure

advising fleet
operators

education
on ESBs

connecting
and servicing
charging
stations

rate design
and cost
recovery
proposals

V2G
+ resiliency

funding
applications



Here's how utilities and regulators can support school bus electrification.

including ESBs in utility and NEVI plans

make-ready & incentives

- at least 50% and up to 100% of funding for communities most harmed by transportation pollution*
- costs recovered without raising rates on those who can least afford it*

technical assistance and fleet advisory services

equitable, fair rates for electric school bus charging

- time-of-use rates*
- demand charge holidays*

culturally- and linguistically-appropriate community engagement as part of equitable utility programs

grid services (V2X pilots) and programs, with benefits targeted to impacted communities

Challenge

In some cases, school bus fleet operators applying for federal funding are struggling to connect with utilities.

- Need to speed up conversations between utilities and fleet operators.
 - EEl has partnered with EPA to help connect school districts with their utility.
 - EPA requires CSBP applicants to attest to engaging with their utility.
 - EPA has resource on Coordinating with Electric Utility Partners for CSBP applicants.
- Great starts! More is needed.

Potential Solutions

Speeding up connections between utilities and fleet operators.

(Pre-Grant) Fleet Advisory Solutions

- Utilities could **establish teams** to handle new fleet electrification customers who are applying for funding.
 - Identify one account manager
 - Conduct proactive outreach
 - Guide fleet operators in understanding: site capacity, charging options, interconnection estimates.
- Utilities could also **request fleet electrification plans** from fleets.
 - If fleets don't have them, utilities help create them and ensure right sized charging.

Challenge

School bus fleet operators that have secured federal funding are experiencing delays.

- Need strategic build out of infrastructure to meet oncoming federal momentum.

Potential Solutions

Planning ahead for school bus fleet infrastructure needs.

(Post-Grant) Fleet Advisory Services

- Utilities should conduct site visits, engineering analyses, infrastructure planning.
- Utilities should also include ESBs in their long-term plans and build for the coming load.
 - Prioritize where ESBs are committed -- states with transition requirements, school districts already committed to ESBs. “No regrets” investments.

There has never been a better time to invest in a **#CleanRide4Kids**



THANK YOU



www.electricschoolbusinitiative.org

Electric
School Bus

INITIATIVE



Rolling Right: Supporting Effective ESB Adoption in NC

*Jacob Bolin
Electric Transportation Specialist
Advanced Energy*



About Advanced Energy

Advanced Energy is a nonprofit energy consulting firm.

We work with electric utilities, government and a wide variety of private organizations in the residential, commercial and industrial, renewables, motors and drives, and electric transportation markets. Our customized services include research, testing, training, consulting and program design.



Our Role in Supporting Electric School Buses

- Outreach and Education
 - [Plug-in NC](#)
- [Technical Support](#)
 - Infrastructure Planning
 - Utility Program Support and Evaluation
 - V2G Test Plan Design and Implementation



An Idea of Scale: Still at the Bus Stop

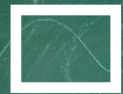
- Currently fewer than 25 electric school buses across the state
- Approximately 100 awarded through:
 - VW Settlement Programs (two phases)
 - EPA Clean School Bus Program
 - Duke Energy Pilot
- 15,000+ total buses in NC
- AE focused on how to get electric school buses to work best for utilities



Anecdotes From the Field

- Today's electric school bus projects require a lot of partners — choose wisely
- We must lighten the load for our educators
- Buses have enough capacity to meet necessary range requirements
 - Typically starting charging sessions above 50% SOC
- V2G use case can pencil out
 - Buses have enough SOC after routes to discharge for grid/demand services
 - Technology still needs some work
- Managed charging isn't happening yet, but it is critically important
 - Building confidence with charging sessions
 - Overcoming driver range anxiety
 - Understanding charging schedules & unique needs

Managed Charging Checklist



EVSE properly sized and reliable? Flawless connectivity with bus?



Software to track station usage and behavior?
Who punches the buttons?

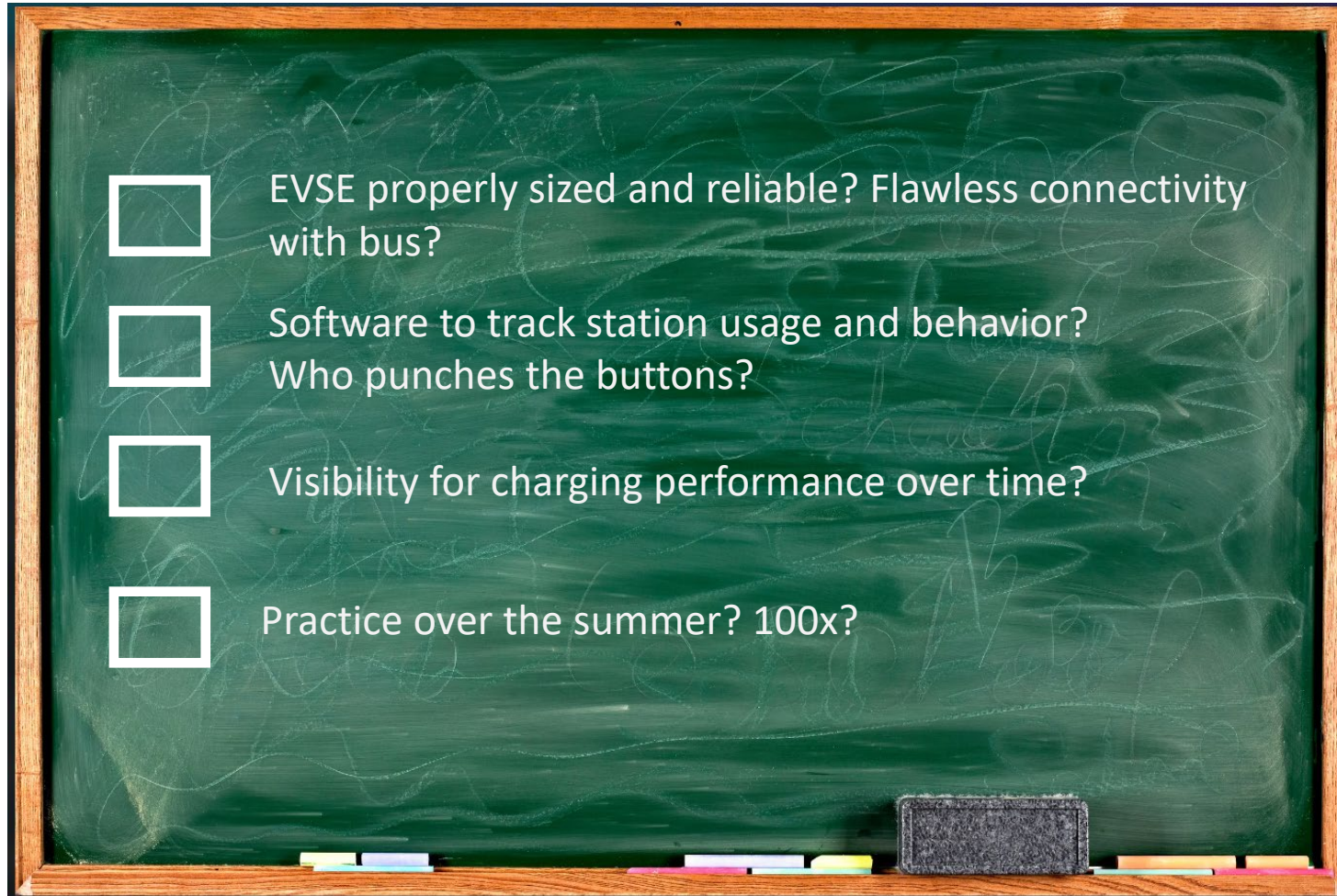


Visibility for charging performance over time?



Practice over the summer? 100x?

Managed Charging Checklist



100

Supporting EV Infrastructure Needs

Is your organization prepared to support the increased demand for EV infrastructure? There is a lot to consider when installing charging stations, including how many, what type, their location, networking capabilities, maintenance plans, policies and more.

Planning well for your current and future needs can save you money and time and decrease interruption to your business. **We offer a customized approach to planning for EV charging, including working to help you identify and secure rebates and incentives for your project.**

Whether it's charging for your fleet vehicles or employees, we will provide you with expert support to get the most out of your journey into electric transportation infrastructure.

[Learn More](#)



Plug-in NC: Success Stories and Resources

A+ Back to School *Electric* plug-in nc with Randolph County's Magic[^] School Bus



With Support From:
Randolph County Schools
Randolph Electric Membership Corporation

About the Routes:
The bus has been used for a number of different routes and schools.

CHEAT SHEET

- Operates in Randolph County, North Carolina
- The same county it was manufactured in!
- Funded with support from the NC Department of Environmental Quality's Volkswagen Settlement Program
- Began Operation: April 11, 2023
- Odometer (to date): 10,000 miles
- Bus Model: Saf-T-Liner C2 Jouley
- Battery Capacity: 226 kilowatt-hours (kWh)
- Charging Equipment: DC fast charging
- Fuel Savings: \$1,000 every 3 months
- Range: 138 miles
- Passenger Capacity: 81
- Horsepower: 295



- Short Route: 30 miles
- Bus returns with ~75% state of charge (SOC)
- Medium Route: 45 miles (for an elementary school)
- Bus returns with ~65% SOC
- Long Route: 65 miles (middle & high school)
- Bus returns with ~50% SOC

- About the Charging:**
- ChargePoint DC fast charge station: 62.5 kilowatts (kW)
 - Occurs overnight
 - Takes three hours to fully charge
 - Typical Monthly Energy Usage: 3,000 kWh (3 megawatt-hours)

- Student and Driver Progress Report:**
- More acceleration
 - Air conditioning works great *Well done!*
 - Quiet cabin – no shouting needed to talk to friends (or, if you're a driver, to tell students to keep it down)
 - Digital dash
 - Plenty of battery capacity – no range anxiety
 - Breathe easy – no tailpipe emissions
 - Saves hundreds of gallons of diesel per month

Extra Credit plug-in nc Lessons Learned from Randolph County Schools

"We spent time as a garage 'bonding' with the bus before we even turned it loose. We drove it. We parked it. We crawled all over it. We put it on the lift and looked at all the parts underneath. We pushed all the buttons. We came out on ridiculously cold mornings to see if it would crank. We hooked it to the wrecker to make sure we could safely tow it. We made all the dash lights come on and called Carolina Thomas to explain what they meant. Basically, we did our best to learn everything we could before we put it out for our drivers/kids/schools/parents/public. We tried to pull off with the charger still attached. We ran the ignition batteries all the way down so we could practice using the built-in jump-box feature. We read the service manual. We took it to a few demos for high school mechanic classes and also invited over the local community college mechanic classes that work in our Central Services building for a ride. We took everyone (salesmen, parents, potential employees, other county employees, etc.) who showed up at our garage out to look at the bus. Carolina Thomas came out for our first responder training and we also met with DOT and NC Highway Patrol about what we were doing. We as a transportation department 'owned' it. Just like all our diesel buses, before it rolled on our roads."



"I think you need to know your community. We have a lot of skeptics, so it was important to us to know what we were doing before people started asking us questions. We were skeptics and had to be comfortable before we would put any kids on it. So far all is going well and we are actually considering adding another electric bus if we can work out the funding. I would highly encourage anyone interested in an electric bus to partner with someone as awesome as Randolph Electric Membership Corporation and to make sure the transportation department is involved early in the conversation and not just after the decision has been made. If you handle it right, the bus will sell itself. We don't spend a lot of time trying to convince people electric buses are wonderful. We just run it and let it speak for itself."

–Wendy Anderson, Randolph County School System's Director of Transportation

Way to lead by example!

www.pluginnc.com





advanced
energy

Thank You

www.advancedenergy.org

919-857-9000

Jacob Bolin

919-857-9048

jbolin@advancedenergy.org

Electric School Bus Fund

Eva DeCesaro, Portland General Electric

April 2024



Portland General Electric

Powering Oregon's clean energy future.



Serving 2 million people in 51 cities



Overview



Gresham School District's first electric bus

Grant Funding for the incremental cost of Electric School Bus and initial funding for chargers and make ready. To-date the ESB fund has supported 50 electric school buses in Oregon

ELIGIBLE EXPENSES

- Incremental cost of an electric school bus
- Charger and any add-on features (cellular connectivity, cable management, etc.)
- Charger's network software fees and maintenance plan

INELIGIBLE EXPENSES

- Fuel costs (i.e. electricity)
- Vehicle or driver insurance costs
- Bus maintenance or extended warranty costs
- Site costs not directly required for electrification (e.g. onsite renewables, energy storage, landscaping)

Funding

The Electric School Bus Fund is not funded through ratepayer sources. It is completely funded through PGE's participation in the Oregon Clean Fuels Program (CFP). This is a statewide low carbon fuel standard that is administered by the Oregon Department of Environmental Quality.

The Oregon CFP mandates a decrease in the carbon intensity of transportation fuel

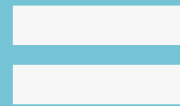
PGE earns credits using a calculation of EV charging at customer residences



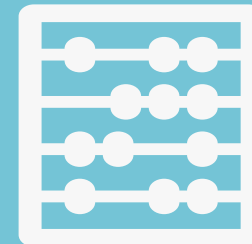
PGE sells credits to importers of diesel and gasoline



More EVs



More Credits



Lessons Learned

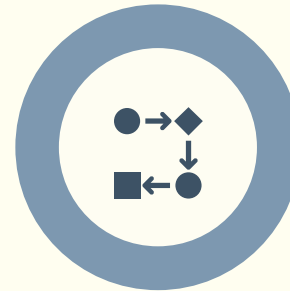
Champion Needed

Districts have competing priorities. Finding a community champion makes all the difference in making the leap to electric.



Technical Assistance

In the planning stage districts have a lot of questions. They need tools and often multiple conversations before committing.



Transportation First

Electric school buses need to fulfill their primary role of student transportation ahead of emerging grid services.



Flexibility

The market continues to evolve rapidly, especially as new technologies and additional funding opportunities emerge, approach needs to evolve too.



Questions

