Driving Change

A State Playbook for Equitable Electric School Bus Policy

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This Playbook was created by the Alliance for Electric School Buses in collaboration with World Resources Institute's Electric School Bus Initiative

ALLIANCE FOR ELECTRIC SCHOOL BUSES

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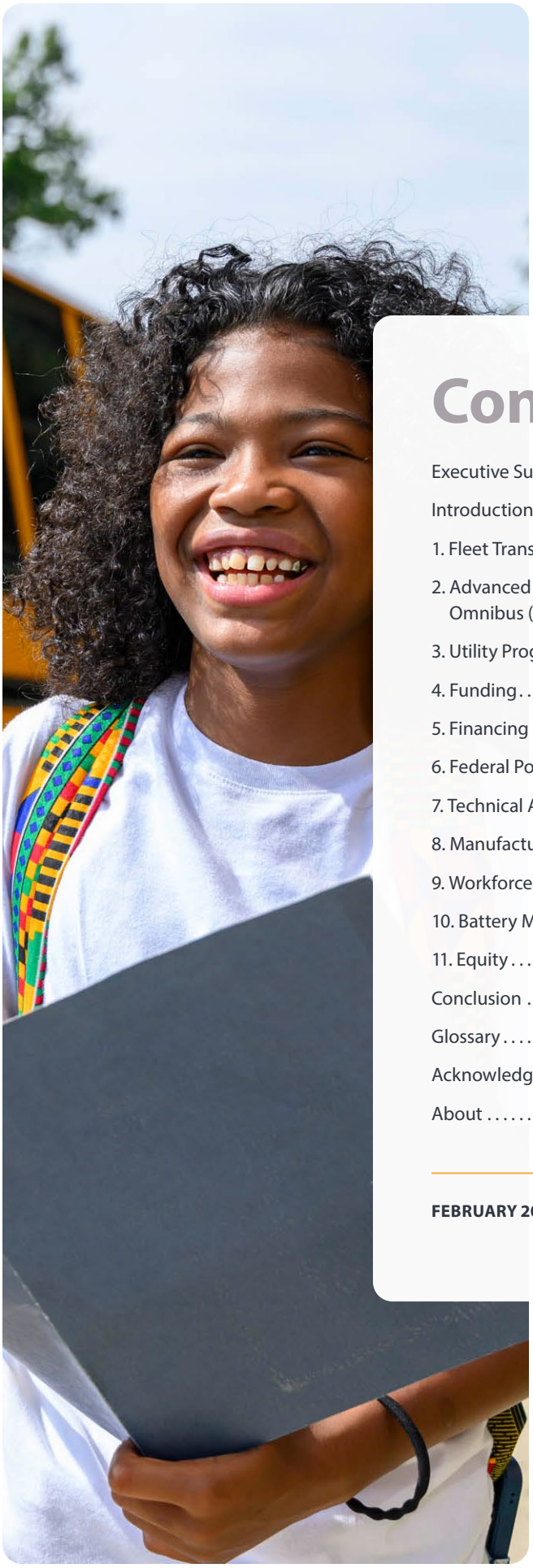

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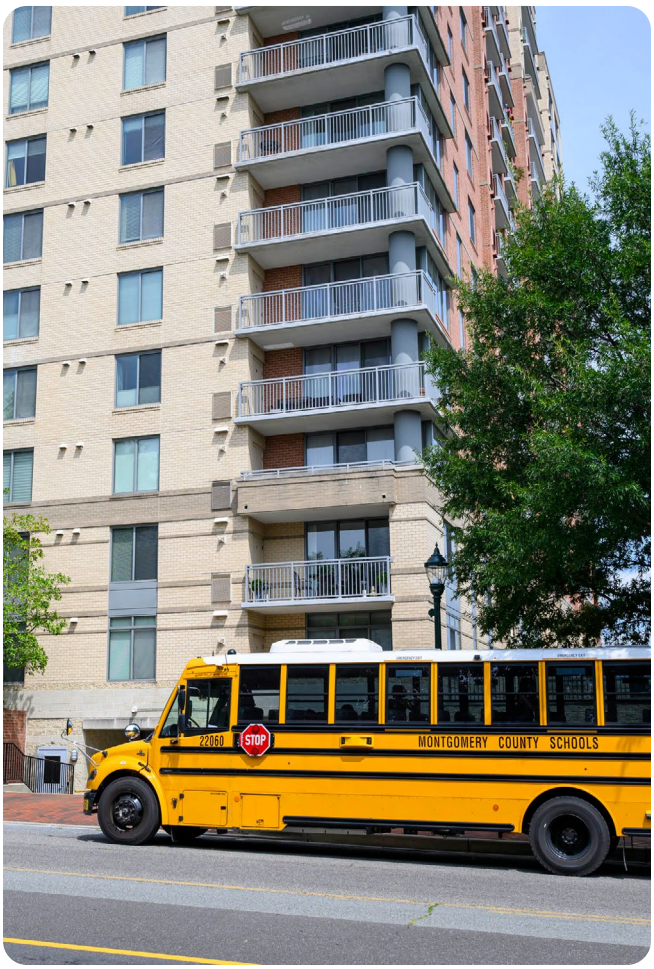
Each school day, more than 20 million children in the United States ride in nearly half a million diesel-burning school buses, breathing in toxic exhaust that harms their health and cognitive development. While children are particularly vulnerable to these toxins, drivers and the communities these buses pass through experience them too. Diesel-burning school buses pollute the air we breathe and worsen air quality in the communities already most harmed by transportation pollution.

Fortunately, schools are increasingly turning to electric school buses (ESBs), which have no tailpipe emissions and result in less than half the greenhouse gas emissions of other school bus types. On average, each electric school bus saves over $100,000 in fuel and maintenance costs over its lifetime, compared to an equivalent diesel-burning bus. Additionally, electric school buses have the potential to enhance infrastructure and grid resiliency and create new job opportunities across the country.

Multi-billion dollar investments at the federal level have accelerated the movement towards zero-tailpipe-emissions school buses. All major school bus manufacturers now offer electric versions, and production capacity is growing. Still, further action is crucial to fully transform this significant segment of the medium-and-heavy-duty (MHDV) transportation sector to zero-emission vehicles (ZEVs). While the number of electric school buses on the road or on their way soon has tripled in the past two years, less than 1% of school buses operating today are electric. With students taking around 7 billion combined trips on school buses each year, electric school buses offer a compelling way to clean up air quality and improve community health.

State lawmakers now have an opportunity to leverage federal funding and industry momentum to pass complementary policies that will bring a clean ride for kids to their communities. As described throughout this Playbook, several states have already taken decisive action on school bus electrification. Requirements to transition a state's fleet to electric school buses represent an important step to guide adoption rates. In addition, states must ensure that there are adequate funding and financing options available, that they actively engage and coordinate with utilities and their regulators, and that they provide technical assistance and workforce training opportunities to support school districts while prioritizing the communities most harmed by transportation pollution. State action now can produce benefits for students, drivers and communities that will last decades.



About "The Playbook"

The Playbook serves as a comprehensive guide for state lawmakers, regulators, agencies, utilities and advocates to equitably electrify their state's school bus fleet. It presents a range of approaches, best practices and resources, recognizing the vital role state-level policymakers play and the need for a coordinated effort both within states and with federal and local decision-makers.

The Playbook highlights critical areas for successful and equitable state action on electric school buses: **Fleet Transition Requirements; Advanced Clean Trucks (ACT) and Heavy-Duty Low NOx Omnibus (HDO) Rules; Utility Programs and Enabling Regulatory Policies; Funding, Financing and Federal Policy Interactions; Technical Assistance for School Districts; Manufacturing; Workforce Development; Electric School Bus Battery End of Life Management; and Equity Considerations.** From across these critical areas, the following are 10 key state actions:

1. Provide upfront funding and low- or zero-cost financing for public school districts and fleet operators to transition to electric school buses (and only to electric models, the cleanest and best option for children).
2. Set aside at least 50% and up to 100% of funding to prioritize the transition in the communities most harmed by transportation pollution. Engage these communities in decision-making throughout program design, adoption and implementation.
3. Establish statewide requirements for the transition of the state's school bus fleet.
4. Adopt Advanced Clean Trucks (ACT) and Heavy-Duty Low NOx Omnibus (HDO) rules to ensure manufacturer supply of electric school buses.
5. Direct utilities to create and regulators to approve plans for programs that fund or finance electric school bus charging infrastructure, vehicle-to-everything technology, technical assistance and fleet advisory services at fair, equitable rates that do not raise costs for vulnerable customers.
6. Ensure state funding complements, and can be stacked with, federal programs and incentives.
7. Provide robust technical support, especially for school districts in underserved communities.
8. Establish strong labor standards for manufacturing workers through manufacturer commitments to job quality and community benefits.
9. Fund workforce development programs that adequately train drivers, mechanics and first responders and build a diverse talent pipeline for school transportation workers.
10. Establish battery second life and end-of-life management plans as part of electric school bus funding programs.

Fleet Transition Requirements

A fleet transition requirement establishes a date by which a state's school bus fleet, or a percentage of it, needs to be either electric or ZEVs. It is a foundational policy tool that sends a strong signal to industry and other interested parties of the move toward a zero-emissions economy. It also signals a commitment to protecting public and environmental health for all communities, especially for those disproportionately harmed by transportation pollution.

Six states — California, Connecticut, Delaware, Maine, Maryland and New York — have adopted such policies to date. They include a mix of new sales and full fleet electrification requirements, with target percentages ranging from 30% to 100% and dates ranging from 2025 to 2035 (and beyond, if accounting for potential extensions). Equity provisions include prioritized support for accompanying incentives and technical assistance.

BEST PRACTICES for establishing fleet transition requirements include establishing interim transition goals and allowing for reasonable extensions; providing accompanying funding, with at least 50% and up to 100% of funding reserved for school districts in underserved communities (i.e., communities that are most affected by environmental and socio-economic challenges, including those communities historically disadvantaged and most harmed by transportation pollution, such as Black, Indigenous, Latine and Asian communities, and communities of color, as well as those with fewer resources, such as low-income and rural communities); identifying a responsible agency to conduct a fleet assessment and develop technical assistance programming; and engaging communities most harmed by transportation pollution in program design and implementation.

Advanced Clean Trucks (ACT) and Heavy-Duty Low NOx Omnibus (HDO) Rules

While establishing fleet transition requirements advances demand for ESBs, adopting ACT and HDO rules can help ensure supply. As part of broader efforts to address air quality, health, climate and equity concerns, states across the country are adopting these rules and setting clear goals for the electrification of all medium-and-heavy-duty vehicles (MHDV), which generate a disproportionate amount of on-road vehicle pollution. The ACT rule requires manufacturers to sell ZEVs as an increasing proportion of sales starting in 2024, while the HDO rule requires deep cuts in nitrogen oxide (NOx) emissions from new heavy-duty diesel-burning vehicles sold by 2027. Together, they collectively enable a state's long-term vision of a zero-emission medium-and-heavy-duty fleet and address toxic transportation pollution in the near term. School buses are included under both rules.

As of February 2024, 11 states — California, Colorado, Massachusetts, Maryland, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont and Washington — have adopted the ACT rule, and ten states — California, Colorado, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont and Washington — have adopted the HDO rule. Studies show that **people of color, regardless of where they live or their income, are exposed to more particulate matter pollution** from cars, trucks and power plants than their white peers — and therefore stand to benefit the most from these rules.

BEST PRACTICES for creating a strong ESB-enabling environment include adopting both ACT and HDO rules, including a fleet reporting requirement to allow states to track indirect MHDV vehicle pollution changes over time, and partnering with the communities most harmed by transportation pollution to ensure these changes are improving air quality where they live.

Utility Programs and Enabling Regulatory Policies

In the transition to electric school buses, utilities and regulators are involved in several key activities, including providing electricity service, planning and constructing infrastructure, advising fleet operators, connecting and servicing charging stations, designing and approving rates, and recovering costs.

While ESBs create additional demand on the electric grid, they also make the grid more resilient through managed charging and various grid services, benefiting both utilities and ratepayers. ESB charging patterns, typically during off-peak hours and seasons, help stabilize increasing demand on the grid. When paired with bidirectional chargers, ESBs can enhance grid resiliency by providing power back to the grid or buildings during peak demand or emergencies.

BEST PRACTICES include adopting legislation that directs utilities to plan for school bus electrification in their integrated resource and other plans. Policymakers should also direct regulators to authorize a set amount of funding that utilities can spend on infrastructure readiness and/or on buses, batteries and chargers in the form of make-ready programs and incentives, with at least 50% and up to 100% of funding set aside for the communities most harmed by transportation pollution. Utilities should also establish teams to provide school districts and bus operators with technical assistance and fleet advisory services that can help them plan for both short-term and long-term electrification goals.

Regulators, in turn, can approve equitable, fair rates for electric school bus charging, including time-of-use rates and demand charge holidays, while ensuring that the costs of make-ready or other incentive programs are recovered without raising rates on those who can least afford it, such as through inclusive utility investments. They can also compel utilities to explore vehicle-to-building or vehicle-to-grid (collectively known as V2X) services from the batteries onboard ESBs through pilots and programs, with benefits targeted to underserved communities. They can require utilities to advance equitable program design and implementation through community needs assessments, culturally- and linguistically-appropriate community engagement, hiring Electric Vehicle Infrastructure Training Program (EVITP)-certified contractors, and prioritizing communities most harmed by transportation pollution for funding and technical assistance.

Funding, Financing and Federal Interactions

States should provide the funding and financing needed to overcome the currently higher upfront purchase costs associated with ESBs and their charging infrastructure, prioritizing funding for the communities most harmed by transportation pollution. Additionally, there are significant new sources of federal funding included in the Infrastructure Investment and Jobs Act (IIJA) and Inflation Reduction Act (IRA) that states can leverage in conjunction with state funding to help support school bus electrification. Encouraging the combination of state funding with federal programs as stackable incentives, alongside low- or zero-interest financing from government lending or state green banks, will benefit public school districts that might struggle with high borrowing costs and allow funds to go further. Financing mechanisms for electric school buses include public loans, public bonds, inclusive utility investments and private loans.

BEST PRACTICES for designing equitable funding and financing programs include dedicating at least 50% and up to 100% of funds to the communities most harmed by transportation pollution. Policymakers should provide these communities with funding to cover the full upfront cost of an electric school bus. Meanwhile, awards to less impacted communities can be lower, such as the cost difference between an electric school bus compared to an equivalent diesel model. This helps reflect the operating savings that accrue from electric school buses. Likewise, policymakers should consider contextual factors like transportation funding practices, costs of operating diesel and electric buses, and the progress towards price parity with diesel buses, with the goal of maximizing the number of ESBs funded over time. Policymakers should use data-driven criteria to identify priority school districts, including race, income, air pollution, health disparities, and state and local definitions of underserved communities.

Funding should also be provided to cover charging infrastructure costs on the customer side of the meter and support technical assistance and workforce development, particularly in underserved communities. Additional funding should be available for accessible school buses, such as those with wheelchair lifts.

To avoid inadvertently encouraging price inflation, policymakers should invite participation from a wide range of dealers and manufacturers, establish annual reporting requirements for pricing, set award and price caps, and promote aggregated procurement where possible.

Technical Assistance for School Districts

Robust technical assistance (TA) is critical to a successful transition to ESBs and should cover topics such as community engagement, creating an electrification roadmap, accessing funding and financing, procuring buses and chargers, assessing district facilities, installing charging infrastructure, training district staff, deploying and maintaining new technology, and monitoring equipment performance. Dedicated TA can help ensure successful implementation and maximize the impact of policy efforts.

BEST PRACTICES for establishing robust TA include prioritizing assistance for school districts in underserved communities, with efforts tailored to meet their unique challenges. ESB adoption requires extensive coordination within districts among school boards and departments responsible for transportation, facilities and procurement. TA programs should include support from relevant state agencies focused on these areas to ensure efficient and cooperative planning. State agencies should look to partner with external parties who may already be providing TA to school districts, such as professional associations, manufacturers, utilities, Clean Cities Coalitions and other community-based organizations to complement and support state-led efforts.

State TA programs should also help school districts understand what funding is available, how to access these funds and how these funds may interact in different ways. They should also focus deeply on charging infrastructure, since school districts typically lack experience with this topic. TA programs can play a critical role in educating districts about the benefits of ESBs, clearly debunking myths and clarifying concerns, while actively seeking district feedback and data to tailor assistance effectively. Support must be adaptable, accessible and offered through various platforms to align with school districts' diverse needs.

Manufacturing

A just transition to ESBs presents an opportunity to create new clean energy jobs and improve job quality for thousands of manufacturing workers in states across the country. As the market grows, workers are adapting to changing industry dynamics. While electric school buses have fewer parts, they require specialized components, necessitating new skills for production and installation. To meet the increasing demand, manufacturers are constructing new factories and expanding existing production capacity. While workers at most incumbent companies are now unionized, efforts need to continue to ensure robust wages, benefits and protections are available to workers there and moreover at new companies where often workers are not yet unionized. For the transition to electric school buses to be truly equitable, it's vital that communities that have been historically excluded from the manufacturing industry be prioritized for well-paying electric school bus jobs.

BEST PRACTICES for ensuring a just transition include requiring manufacturers to publicly commit to strong workforce standards, including fair wages, benefits and inclusive employment practices. These commitments, verified by state agency scoring and regular reporting, should be a prerequisite for funding program participation, with higher funding amounts directed to purchases from top-rated manufacturers. Manufacturers that benefit from state funding should be encouraged to sign Community Benefits Agreements (CBAs). These CBAs, formed through collaboration with local organizations and unions, stipulate that manufacturers adhere to strong labor standards and offer community-specific benefits. Policymakers should foster partnerships with diverse educational institutions and community organizations to establish training programs for manufacturing workers.

Workforce Development

ESBs bring benefits not only to students and communities but also to the workers who operate and maintain them. For drivers and mechanics who are exposed to toxic diesel exhaust pollution, electric school buses mean a significantly cleaner and quieter working environment and new skills in a growing industry. For electricians, electric school buses represent millions of jobs installing equipment like charging stations and other infrastructure. However, adequate training is crucial for successful deployment. Driver training can impact performance and maintenance of buses through techniques like regenerative braking, while mechanics need specialized skills for electric powertrains and handling high voltage vehicles. First responders also need specialized training for battery safety. Unfortunately, few standardized training programs currently exist, affecting retention during labor shortages.

BEST PRACTICES for encouraging equitable workforce development include providing funding for training to ensure worker readiness and prevent job displacement. States should require and support school bus operators receiving funding to submit workforce impact assessments to evaluate job impacts, identify skills gaps and establish detailed training plans—with a focus on fair wages and inclusivity for traditionally disadvantaged workers. States should take all possible steps, including providing funding, user-friendly templates and technical assistance, to ensure this assessment achieves its objectives without overly burdening school districts. Workers who may face job insecurity if districts outsource services should be protected in terms of salary, benefits and collective bargaining agreements.

As part of funding award conditions, policymakers can require that training needs are outlined in Requests for Proposals (RFPs), Invitations for Bids and in purchase agreements with dealers, manufacturers or other vendors. Funding programs can also stipulate Electric Vehicle Infrastructure Training Program (EVITP) certification for electricians, with efforts to maintain certification affordability and accessibility, especially for workers who come from the community where electric school buses will be deployed. First responder training should be specialized for electric school buses, given the differences compared to diesel-burning or other internal combustion engine vehicles. Additionally, policymakers should build partnerships with diverse educational institutions and community organizations to build a diverse talent pipeline for school bus drivers and mechanics, often in short supply.

Electric School Bus Battery End of Life Management

To ensure an equitable transition to electric school buses, lawmakers need to consider battery refurbishment, repurposing and recycling. Establishing and deploying a responsible battery end of life management (EOL) plan early in the move to electric school buses is a key step. Such a plan will help extend the life of batteries and avoid them ending up in a landfill, **leaching toxic chemicals that contaminate the soil and water or leaking gasses** that cause respiratory issues in surrounding communities—particularly the low-income communities and Black and Latine communities and other communities of color where landfills are **disproportionately sited**. An EOL plan also helps limit the **existing environmental and social harms borne by developing countries** caused by mineral extraction to make the battery in the first place.

BEST PRACTICES to ensure responsible ESB battery end of life management include establishing battery EOL management plans as part of electric school bus funding programs. This would require working with bus manufacturers to set up an industry-led **Extended Producer Responsibility (EPR) program**, such as already **exists for e-bikes** and other consumer products. If these programs are not led voluntarily by manufacturers, lawmakers should consider requiring them from bus manufacturers as a condition of being eligible to receive incentive funding for their electric school buses. In the absence of industry-led programs, policymakers should fund battery EOL management for school districts. WRI's Electric School Bus Initiative estimates that costs for dismantling, testing and transporting a single 150kWh **school bus battery for recycling or refurbishment** can be around $3,000 or more. This cost should not be borne by public school districts.

Equity Considerations

A focus on equity must be central to all ESB state policy. Diesel exhaust pollution has significant and detrimental effects on children, particularly heart, lung and brain health. It can negatively impact school attendance and academic performance. This pollution disproportionally affects low-income children, Black children and children with disabilities who are more likely to take the bus to school. Moreover, Black, Latine and other children of color are up to **3.7 times** more likely to live in counties with dirtier air, particularly due to their proximity to cars, trucks and power plants. To ensure all children have access to clean air regardless of race, ethnicity, socioeconomic status or zip code, an equitable transition to ESBs is crucial. By prioritizing the adoption of ESBs in communities with the highest levels of air pollution, and supporting their engagement and decision-making throughout the process, we can significantly improve the health and well-being of the children most harmed by pollution.

BEST PRACTICES for ensuring a focus on equity include leading with meaningful community engagement and prioritizing the deployment of electric school buses in the communities most harmed by transportation pollution: low-income school districts serving predominantly Black, Latine and Indigenous students and communities of color. Set aside at least 50% and up to 100% of state and utility funding and zero-cost financing, as well as dedicated technical assistance, for these communities. Provide funding upfront, allow for stacking with other funds, and avoid matching funds requirements and a first come, first served approach. Fund only electric school buses, rather than non-diesel fossil fuel-burning school buses which worsen the air and climate pollution that already disproportionately harms Black, Indigenous, Latine and low-income communities. Electric school buses should also be prioritized for routes in the areas with the worst air quality. When assessing air pollution, do so by race and ethnicity, which are the best predictors of air pollution exposure in the U.S. Tracking data on bus performance, route information and improvements in air quality will inform the effectiveness of these endeavors.

State-led electric school bus programs should also address community-specific transportation needs, ensuring student access, especially for those with disabilities, to the safest transportation available. Additionally, utility programs should be designed to avoid undue rate impacts on vulnerable communities.

Driving Change

Each section of the Playbook includes best practices aimed at guiding states towards equitable and effective ESB policy, while tailoring and creating the ESB programs that best fit their needs. The momentum for electric school buses is growing stronger, with unprecedented investments from the federal government and an increasing number of states. Demand for electric school buses is coming from school districts all across the country, serving students in urban, rural and suburban settings. With a wide range of policy tools available, and approaches for centering equity throughout the transition, it's time for all states to get on board with electric school buses.

Background

The State Playbook for Equitable Electric School Bus Policy was developed by the **Alliance for Electric School Buses** in collaboration with **World Resources Institute's Electric School Bus Initiative** to offer best practices to state lawmakers, regulators, agency officials, utilities, advocates and others aiming to advance equitable policies for electrifying school buses. It draws upon the experience of the Alliance for Electric School Buses and WRI's Electric School Bus Initiative working across the country on state policy adoption and implementation alongside school districts and in partnership with community organizations.

Introduction

The iconic yellow school bus can be seen rolling down the roads of every state in the country. With nearly half a million operating nationwide, these buses travel over two and half billion miles every year, ensuring the safe transportation of over 20 million students. Not only is the sight of these buses familiar, but so are the accompanying sound and smell. Unfortunately, according to industry reports, over 90% of school buses still rely on diesel fuel, posing significant health risks to our children and communities.

The dangerous consequences of diesel exhaust pollution are well-documented and are directly linked to respiratory illnesses such as asthma and cancer, especially in children. This exhaust can also adversely impact students' academic performance and school attendance. Particularly concerning is the disproportionate burden borne by Black and Indigenous communities and other communities of color, low-income students and children with disabilities who suffer the brunt of this pollution. Studies show that people of color, regardless of where they live or their income, are exposed to more particulate matter pollution from cars, trucks and power plants than their white counterparts. These exposure disparities hold true across individual U.S. states, within urban or rural areas, across incomes and even across exposure levels.

Electric school buses are the only school bus type with zero tailpipe emissions, so students aren't exposed to harmful pollutants from their own bus on their ride to and from school every day. Even after considering the upstream emissions of electricity generation, they account for less than half the greenhouse gas emissions of any other school bus type. On average, each electric school bus saves $100,000 in fuel and maintenance costs over its lifetime, compared to an equivalent diesel-burning school bus. Additionally, electric school buses have the potential to enhance infrastructure and grid resiliency and create new job opportunities. And, their quieter ride has been hailed by school bus drivers as providing a calmer experience.

With these many benefits, it's no surprise the electric school bus market is rapidly advancing, with thousands of electric school buses on the road or on their way to school districts across the country and strong signals of increased deployment in the coming years. All major school bus manufacturers now offer electric versions, and production capacity is growing. At the federal level, the passage of the Infrastructure Investment and Jobs Act and Inflation Reduction Act provided billions of dollars of funding for school districts to electrify their school buses, particularly in low-income, rural and Tribal communities.

Still, further action is crucial to fully transform this significant segment of the medium-and-heavy-duty transportation sector to zero-emission vehicles (ZEVs). While the number of electric school buses on the road or on their way soon has tripled in the past two years, less than 1% of school buses on the road today are electric.

States have an essential role to play in the equitable transition to electric school buses. Over a dozen states across the country already have taken decisive action, establishing requirements collectively requiring more than **35% of school buses serving 29% of school bus riders** to be electric in the coming years. These transition requirements represent an important step, providing certainty for the market, and other states can follow suit. For these measures to be successful, states must ensure that there are adequate funding and financing options available; that they actively engage and coordinate with utilities, especially around the deployment of charging infrastructure; and that they provide technical assistance and workforce training opportunities to support school districts while making sure to consult and prioritize the communities most harmed by transportation pollution.

The progress underway on school bus electrification is promising, but many more states need to act to ensure the health and safety of their children and communities. This playbook champions a coordinated shift towards electric school buses, recognizing the vital role various state decision-makers play in facilitating this transition effectively, including working alongside local leaders. It serves as a comprehensive guide with tangible best practices, empowering states to take meaningful action toward a cleaner, healthier and more equitable transportation future.

1. Fleet Transition Requirements

Summary

A fleet transition requirement establishes a date by which a state's school bus fleet, or a percentage of it, will be either electric or zero-emission vehicles (ZEVs). It is a foundational policy tool that sends a strong signal to industry and other key parties about the move toward a zero-emissions economy. It also signals the state's commitment to protecting public and environmental health, especially for those disproportionately harmed by transportation pollution. When all school bus operators within a state have the same requirement, state agencies and utilities can offer transition planning assistance comprehensively, while customizing support for districts who need it most.

Transition requirements can apply to new school bus purchases and contracts, all school buses operating within a state, or both. For example, New York state set a transition requirement for all new school bus purchases to be electric by 2027 and a requirement for full fleet electrification by 2035.

Currently, six states have statutorily enacted transition requirements, as detailed in Table 1.

Best Practices

- **Select the Right Agency:** Ensure that the legislation assigns the responsibility to enforce the transition requirements to the agency best equipped (with staffing capacity, expertise and experience with enforcement) to manage such a program.
- **Plan for the Transition:** Instruct the responsible agency to conduct an assessment of the state's fleet to identify ways to best achieve the transition goals.
- **Provide Accompanying Funding:** Provide funding in conjunction with transition requirements and ensure that school districts understand support for the transition will be available. School districts in low-income communities that may face more challenges in transitioning their fleets and school districts in communities most harmed by transportation pollution should be prioritized for funding. States should set aside at least 50% and up to 100% of accompanying funding programs for these school districts. Please see Section 4 for additional recommendations on funding.

TABLE 1 | **Statutorily-enacted state electric and zero-emissions school bus transition requirements**

STATE	TRANSITION REQUIREMENTS	DEDICATED FUNDING	DATE ENACTED
NY	100% of new school buses ZEV by 2027; all school buses ZEV by 2035.	$500 million	4/9/2022
MD	100% of new school buses ZEV by 2025, if there is available federal or state funding.	$200 million	4/9/2022
ME	75% of new school buses ZEV by 2035.	Funding available under existing School Bus Purchase Program ($9.05 million in FY23 for all bus types)	5/2/2022
CT	100% of all school buses electric by 2040 (or 2030 for buses operating in environmental justice communities)	$20 million	5/10/2022
DE	30% of new school buses electric by 2030.	No information	8/3/2023
CA	100% of new school buses ZEV by 2035, with a 10-year extension available to rural school districts	$1.5 billion	10/8/2023

- **Provide Technical Assistance:** Instruct the responsible state agency to provide workforce training and other resources to support school districts in transition planning, electric school bus operation, deployment and charging, and identifying funding and/or financing. Technical assistance should be prioritized for school districts in communities most harmed by transportation pollution and school districts with fewer personnel and capacity to meet the requirements. New York's Electric School Bus Guidebook offers one example of a resource for school districts; Oregon also has a School Bus Electrification Guidebook. Please see Section 7 on technical assistance and Section 9 on workforce development for details.
- **Set Interim Goals:** Instruct the responsible state agency to set interim goals to allow for gradual adoption and ensure timely progress toward meeting targets. Consult state education data or other sources on the state's existing school bus replacement rate, as well as utilities and regulators on grid readiness, when setting interim goals. The goals can then be used to determine long-term targets and a timeline with proportionate amounts of funding tied to these goals. This can provide both timely support throughout the transition toward electric school buses and the opportunity to evaluate and build up manufacturing capacity, infrastructure readiness and other complementary preparations.
    - Require Interim Reports: Require school bus fleet operators to provide simple, regular reports tracking their progress to meet the transition requirements.
- **Allow for Reasonable Extensions:** Consider extensions for school bus fleets challenged by funding availability, cost, bus availability, infrastructure availability, route length, terrain challenges or other factors. Consult with advocates and school districts to determine what makes sense within your state.
- **Engage Impacted Communities:** Ensure the communities that will be most impacted by meeting the fleet transition requirements and the communities that are most harmed by transportation pollution are an active part of the decision-making process, from development to adoption and implementation. Please see Section 11 for additional recommendations.

Resources

- WRI's Electric School Bus Initiative - Dataset of US School Bus Fleets
- WRI's Electric School Bus Initiative - Electric School Bus Data Dashboard
- WRI's Electric School Bus Initiative - Electric School Buses Win Big in US State Legislative Sessions
- WRI's Electric School Bus Initiative - The Electric School Bus Moment Arrived in States Nationwide in 2023

2. Advanced Clean Trucks (ACT) and Heavy-Duty Low NOx Omnibus (HDO) Rules

Summary

As part of broader efforts to address air quality, health and climate change, states across the country are setting clear goals for the electrification of all medium-and-heavy-duty vehicles (MHDV), which generate a disproportionate amount of on-road vehicle pollution. In 2020, the California Air Resources Board (CARB) adopted the Advanced Clean Trucks (ACT) rule. The ACT rule requires manufacturers to sell zero-emission vehicles (ZEVs) as an increasing proportion of sales starting in 2024. According to CARB, "by 2035, zero-emission truck/chassis sales would need to be 55% of Class 2b – 3 truck sales, 75% of class 4 – 8 straight truck sales, and 40% of truck tractor sales." School buses are included under the ACT rule as class 4-8 vehicles.

Based on its pollution history, California has the ability under the federal Clean Air Act to set its own vehicle tailpipe pollution standards, if they are at least as stringent as federal standards. Under Section 177 of the Clean Air Act, other states can adopt California's standards. Ten additional states have adopted the ACT rule (Colorado, Massachusetts, Maryland, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont and Washington), and two others are in the process of doing so as of January 2024 (Connecticut and Maine). The ACT rule provides states with the opportunity to ensure that manufacturers are selling and servicing electric MHDV in their state.

The Heavy-Duty Low NOx Omnibus (HDO) rule was passed by California alongside the ACT rule and has been adopted by nine other states (Colorado, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont and Washington). This rule requires deep cuts in nitrogen oxide (NOx) emissions from heavy-duty diesel vehicles sold in the state by 2027. The HDO rule is expected to cut NOx emissions from heavy duty vehicles by 75% below current standards beginning in 2024 and by 90% by 2027. In addition to cleaning up NOx emissions, the HDO rule looks to institutionalize particulate matter pollution controls and prevent backsliding by adopting a more stringent standard that aligns with current industry certifications.

While the ACT rule works year-over-year to gradually increase the share of new truck sales that are zero-emission, the HDO rule curtails toxic air pollution from new diesel-burning vehicles that will continue to be sold in the interim and operate over years or decades. The ACT and HDO rules are two sides of the same coin: together, they collectively enable a state's long-term vision of a zero-emission MHDV fleet and address toxic transportation pollution in the near-term.

School buses are covered under both rules (although school districts are exempt from a separate fleet reporting requirements rule), but this does not mean that 75% of all school bus sales in a state that adopts the ACT rule will be zero emission by 2035. The ACT rule governs all vehicles each manufacturer sells, not just electric school buses. It is possible that an electric school bus manufacturer may choose to meet their sales requirement with vehicles other than school buses. However, given the availability of electric school buses compared to some other MHDV electric vehicles, and the funding and momentum for their adoption, electric school buses present an attractive option for manufacturers to meet the requirements.

Transition requirements, described in the previous section, can play a role in advancing ACT rule adoption goals by signaling to manufacturers and dealers upcoming market shifts toward electrification. As fleet transition requirements address demand, the ACT rule helps stimulate and encourage supply.

Best Practices

- **Adopt the ACT and HDO Rules:** Adopt both rules to clean up the state's MHDV fleet and send a clear signal to the market to scale up production of electric vehicles, including school buses. California, Colorado, Massachusetts, New Mexico, New Jersey, New York, Oregon, Rhode Island, Vermont and Washington have adopted both the ACT and HDO rules.
    - In July 2023, CARB announced the Clean Truck Partnership between the agency and industry members. Its aim is to strengthen regulatory certainty for producers by guaranteeing:
        - Alignment with federal standards for NOx emissions and giving a longer lead-time (at least four years) to industry and at least three years of regulatory stability. In exchange, industry signatories agreed not to legally challenge California's ability to set these standards.
        - Exploration into allowing credit pooling across ACT states, including for school buses. Credit pooling enables manufacturers to leverage overcompliance of the ACT rule in one state to support meeting these requirements in an underperforming state. This concept is practiced within the light duty vehicle space through the Advanced Clean Cars rules. It is currently a proposed regulatory amendment still in development and could impact ZEV sales and emissions across ACT signatory states.

- **Include a Fleet Reporting Requirement:** Call on businesses that operate diesel-burning MHDV trucks to report characteristics of their fleets. States should require annual reports to track relevant, timely data for ongoing program development and innovation. Annual reports will also allow states to track indirect MHDV pollution changes over time and ensure that these changes are improving air quality for communities most harmed by transportation pollution. While this does not apply to school districts, we recommend it as a best practice for any state adopting the ACT rule.
- **Partner with Impacted Communities:** Prioritize deployment of electric school buses sold under these rules for the communities most harmed by transportation pollution. Engage these communities, as well as those that may be most impacted by the adoption of the rules, at the start and throughout policy development, adoption and implementation to ensure that they are part of decision-making.
    - In August 2023, the City of Seattle launched its Electric Trucks Incentive Pilot. The pilot program targets electrifying heavy-duty vehicles in the Duwamish Valley, the region's largest cluster of freight-related jobs and activities. This comes as a result of the state's passage of the ACT rule and calls from the Duwamish River Community Coalition during that process to focus implementation in their neighborhood. Studies have found that neighborhoods in this geographic area have higher levels of air pollution and childhood asthma rates. This example could be applied to electric school buses as well.
- **Design and Enact Supportive Programs:** Establish agency and legislative programs that can support implementation of the ACT and HDO rules, especially to assist with coordination of interested parties; infrastructure deployment; the prioritization of communities most harmed by transportation pollution and those that may encounter challenges with the adoption of the rules; and the provision of funding to cover upfront costs, technical assistance and workforce training, among other needs that the rules do not directly address but that will be part of the their enactment. One example of this practice is the Oregon Department of Transportation (ODOT), which is organizing resources for the buildout of its section of the West Coast Electric Highway. Upon completion, this plan will provide sufficient public charging stations for MHDVs across the state. ODOT is directing over $100 million worth of investment from federal and state funding sources to this effort.

Resources

- CARB - Advanced Clean Trucks
- Charge EVC - New Report Shows Significant Health, Economic, and Environmental Benefits of Medium and Heavy-Duty Vehicle Electrification
- Electric Trucks Now - Home Page
- Environmental Defense Fund - How Manufacturers Are Positioned for Zero Emission Commercial Trucks and Buses in North America
- NESCAUM - Multi-State Medium- and Heavy-Duty Zero Emission Vehicle
- RMI - Understanding California's Advanced Clean Truck Regulation
- Sierra Club - Clean Vehicle State Tracker
- Sierra Club - Multi-State MHDV MOU and ACT advocacy toolkit

3. Utility Programs and Enabling Regulatory Policies

Summary

Utilities play a vital role in school bus electrification and are responsible for providing at least some of the electrical infrastructure needed to charge electric school buses. This may require utilities to upgrade their distribution system and on-site electrical infrastructure to ensure the depot or lot can receive (and in some cases discharge) the necessary power. Multiple utilities may be involved in an electrification project, depending on the exact location of where buses will charge and if there are multiple depots or charging sites. The speed at which utilities install charging infrastructure may impact the timeline of the transition, and the affordability and structure of the rates utilities charge for electricity usage can also impact the cost-savings electric school buses provide.

For utilities, electric school buses represent a business opportunity to **increase their revenue**, even after accounting for additional infrastructure and grid updates needed to charge larger fleets of electric vehicles. Electric school buses are usually charged during typical off-peak hours and off-peak seasons, which **studies** in multiple states have demonstrated benefits all ratepayers. This predictable charging schedule can be optimized through "managed charging" to help stabilize demand on the grid, increasing total revenue paid to the utility and spreading power generation costs over more ratepayers. Additionally, electric school bus batteries can store energy and, when paired with bidirectional chargers, provide power back to the grid or to buildings during peak demand or grid emergencies. This helps utilities ensure continuous service for customers and contributes to community resilience.

There are several ways utilities are engaged in school bus electrification that can be directed or encouraged by state legislation or regulation:

- Provide Electricity Service: Utilities connect charging stations to the electrical grid, provide electric service and bill the electric school bus operator. They also respond to service problems.
- Plan for Charging Infrastructure: Utilities provide an analysis of electrical and distribution infrastructure needed to charge electric school buses based on school bus operators' charging plans and the existing site capacity. This is typically conducted through a site visit, after a service request is made.
    - Fleet Advisory Services: Ideally, utilities guide school bus operators in creating their charging plans, now and for the future. Utilities could also advise on vehicle-to-grid or vehicle-to-building (V2X) technology, battery storage or renewable energy solutions that are compatible with electric school buses.
- Construct Charging Infrastructure: Utilities must upgrade infrastructure and facilities as needed to support the load of charging electric school buses on their side of the meter (often called "in front of the meter") and sometimes help with infrastructure and equipment on the customer's side of the meter (often called "behind the meter"). Utilities also coordinate with the electrical contractors that install electric vehicle service equipment (EVSE). This can be done through programs that "make-ready" the infrastructure and charging stations needed for electric school buses.
    - Provide Charging Infrastructure Incentives or Rebates: Ideally, utilities offer incentives or financing for fleet operators who purchase buses and chargers.
- Plan the Cost Recovery: Utilities present their investment programs, such as new electric school bus charging programs, make-ready programs or charger rebates, as proposals to regulatory commissions and must receive their approval before moving forward. The cost borne by a utility to deliver a program or service determines what rates will be charged to ratepayers. While evaluating the programs to be proposed for electric vehicle infrastructure, utilities should assess

different cost recovery mechanisms and how they will impact customer rates. Regulators often require utilities to submit benefit-cost analyses to demonstrate how any proposal benefits all customers, or at least those that may be subject to a resulting rate increase. The quality of the benefit-cost analyses and how the utility proposes allocating costs will impact whether regulators approve or reject programs. For electric vehicle services, utilities will often need to begin with a pilot, build datasets that support impact assessments and use that to justify permanent programs.

- Set Supportive Rate Structures: Utilities propose, and receive regulatory approval for, rate structures for commercial customers such as school bus operators or school districts through regular rate cases. The rates set may incentivize or discourage electrification. Demand charges, for example, can dramatically increase operating costs, while Time-of-Use rates encourage charging at times of low demand, and lower cost, on the grid.
- Offer Grid Services Through ESB Batteries: Through V2X or similar programs, utilities can offer incentives for purchasing bidirectional chargers and create programs to discharge energy from electric school bus batteries and send it back to the grid or to buildings during times of peak demand or electric system emergencies. School bus operators can save on their utility bills or possibly receive payment for agreeing to provide such services.

Best Practices

For State Agency Staff:

- **Include ESBs in State-Led EV Charging Planning:** State-led charging plans, including those funded by the federal government such as the National Electric Vehicle Infrastructure (NEVI) Program, should include features at all sites with at least one charger placed in "pull-through" design to accommodate usage by school buses (and other longer vehicles) and, if deploying overhead charging, should be tall enough to accommodate buses. Planning should also focus on how to prioritize services and support for underserved communities (please see glossary for more information).

For Legislators:

- **Require ESBs in Utility Planning:** Direct utilities to plan for school bus electrification in their Integrated Resource Plans (IRPs), Transportation Electrification Plans, Beneficial Electrification Plans and/or Grid Modernization plans, if not already doing so. This is a long-term solution as the regulatory planning and approval process can take many years but has the benefit of not changing with short-term rate decisions.
    - Utilities also could be ordered to share maps or locations that indicate power capacity at existing school district facilities, which would make it clear where industrial-grade, high-capacity (3-phase) power for EV infrastructure already exists. This kind of power will likely be needed for fast chargers, which may not be needed initially but may be part of a full fleet electrification plan, depending upon various considerations. While these maps often are not up-to-date due to time lags around data collection and other factors, they give an idea of where power may be available and clearly indicate where power is not available, and thereby help communities make decisions about infrastructure siting. This is not to suggest that the areas best prepared for upgrades should be prioritized; underserved communities may have more urgent need for upgrades due to historical underinvestment. Policy makers should consider how to equitably prioritize infrastructure upgrades.
- **Authorize Funding or Financing Assistance for Infrastructure:** Direct regulators to authorize a set amount of funding that utilities can spend on infrastructure readiness and/or on buses, batteries and chargers. Incentives should be sizable enough to encourage school districts to electrify and cover at least incremental costs.
    - Make-Ready Programs. If approved by regulators, utilities can establish programs to directly fund electric vehicle infrastructure upgrades to make sites ready for charging equipment and thereby reduce the costs for school bus operators. Such programs can cover the full or partial cost of infrastructure on both the utility and customer sides of the meter. A listing of these programs is available in the Electric Vehicle (EV) Make-Ready Programs guide.

- Incentives (Grants, Rebates and Vouchers). If approved by regulators, utilities can offer opportunities for interested school districts to apply for funding to cover all or some of the incremental cost of electric school buses, their batteries and their charging stations.
  - In at least one program, the utility owns the bus batteries, allowing the utility to use the batteries both for V2X and in their second life. If the utility retains ownership of the battery, it is recommended that language specify when the battery and bus are to be used, to prioritize school district operations and clarify which party is responsible for the corresponding costs.
- In all programs, at least 50% and up to 100% of funding should be set aside for the communities most harmed by transportation pollution. Funding should be provided upfront and should allow for stacking with other funds, but should avoid matching funds requirements and first come, first served approaches. These approaches present barriers for underserved school districts and prevent equitable distribution of funds.

- **Direct Regulators to Authorize Technical Assistance and Fleet Advisory Services:** School districts need support to determine infrastructure costs, plan and procure infrastructure, optimize bill management and understand other new aspects of school bus electrification. Utilities should create teams to handle these needs and to help school districts develop short-term and long-term electrification plans, and should target assistance to school districts in the communities most harmed by transportation pollution.
  - Utilities should proactively reach out to school districts to provide contact information for key vehicle electrification staff and help break down barriers between internal teams. Ideally, utilities establish and communicate a single point of contact for electric school bus-related programs and assistance.
- **Direct Regulators to Authorize V2X Programs:** Ensure that electric school bus operators who own the batteries can benefit by being eligible for compensation for grid services provided to the utility through V2X programs. Legislators also can provide funding for V2X demonstration projects.

For Utility Regulators, Boards and Commissions:

- **Approve Fair and Equitable Rates for ESB Charging:** Approve rates that recognize the value electric school buses provide to utilities and the grid and that adequately incentivize fleet electrification and optimized off-peak charging. Examples could include any of the following:
  - Time-of-Use (TOU) rates that charge lower prices for charging when demand on the grid is lowest. TOU rates are especially important if demand charges apply so that the buses can be encouraged to charge on a schedule to avoid them.
  - Offer demand charge holidays. Demand charges apply when a customer is drawing power, such as for charging electric vehicles, during times of peak electricity demand. Demand charges can raise costs for school districts, cutting into expected cost savings. Temporarily eliminating demand charges via a "holiday" when electric vehicles are still in their early stages will reduce cost barriers and help the technology scale quickly. Regulators can consider eliminating demand charges entirely, with appropriate examination, as buses are charged on predictable schedules.
  - Establish managed charging as the default where possible. Using software and equipment to charge the buses efficiently and during low-cost times, known as managed charging or smart charging, can help keep energy bills lower for electric school bus operators and stabilize demand on the grid.
  - Establish subscription rates, in which school districts pay in advance for the demand they are expected to place on the grid. Such programs can offer convenience and help save time and money, depending on their design. School districts should be offered initial grace periods (three billing cycles, for example) while they learn to optimize their charging to match their subscription level.
- **Approve Equitably Designed Utility Programs:** As part of establishing programs that not only incentivize school bus electrification but also benefit the communities most harmed by transportation pollution, and other forms of discrimination, regulators should require utilities to:
  - Conduct a community needs assessment. Utilities should devote resources to learn more about the communities that will be served by electric school buses and their needs, priorities and historic struggles and how those have led to disparate outcomes. Understand and acknowledge the relationship between the community and the utility, especially related to rates, interconnection/disconnection, grid failures, infrastructure upgrades and more. Plan for how the community can be prioritized to receive electric school buses.
  - Gather and incorporate community input in designing, implementing and measuring electric school bus pilot programs. This requires utilities to actively engage communities in culturally and linguistically competent ways. Such outreach, engagement and feedback sharing enables communities to be part of the decision-making process for deploying electric school buses in their neighborhoods and schools.
  - Prioritize electric school buses and their charging infrastructure for the communities most harmed by transportation pollution. This can be done by providing early access to funding, awarding them higher amounts of funding, allocating a certain percentage of funding (at least 50% and up to 100%), and/or offering dedicated technical assistance and fleet support. Require the utility to set goals for directing funding to the communities most harmed by transportation pollution and track progress to meet those goals. Such communities can be defined through data on race/ethnicity, air quality, income, health impacts and other metrics. Funding should always be provided upfront or as close to the point of expense as possible.
  - Hire Electric Vehicle Infrastructure Training Program (EVITP)-certified contractors to install electric school bus charging infrastructure, and partner or contract with local businesses and workers, particularly those that come from the communities most harmed by transportation pollution. See Section 9 on workforce development for additional recommendations.
  - Plan for how utilities can help communities electrify their fleets past the piloting stage. Utilities should support the communities most harmed by transportation pollution in preparing for full-fleet electrification, helping them save time and money in the process.

- **Consider Rate-Neutral Cost Recovery Mechanisms:** Ensure that the costs of make-ready or other incentive programs are recovered without raising rates for those who can least afford it. Across-the-board rate hikes disproportionately impact low-income households, who already pay a higher share of their income on monthly energy bills in comparison to other households. A 2023 study found that utilities can design efficient make-ready programs for heavy-duty fleets without raising rates on their customers by using managed charging to charge vehicles at optimal, off-peak times and better distribute the impact on the grid.
    - Adopt Inclusive Utility Investments: Regulators should encourage utilities to adopt inclusive utility investments, where utilities recoup the expenses of their investments in charging infrastructure or on-board batteries through a time-bound tariff that a school bus operator pays on its electricity bill. This tariff is capped to be less than the operational savings school bus operators see by switching from diesel to electric school buses. This way, ratepayer rates are not impacted, school bus operators still see cost savings and utilities finance programs that make school bus electrification easier.
        - For example, the Michigan Public Service Commission in the most recent rate case for DTE Energy, a utility company based in Detroit, approved the expansion of its E-Fleet Battery Support Program, initially for electric transit buses and soon expanding to electric school buses. This is an inclusive utility investment program for the on-board batteries.
- **Approve and Collect Data from V2X Programs:** Data and lessons learned from pilot programs will help inform how future V2X opportunities are structured and give school bus operators reliable research into the benefits and challenges they can expect.

Resources

- ACEEE - Utility Transportation Electrification Planning - Emerging Practices
- CALSTART & Exelon - The Electric School Bus Transition: Accelerating Equitable Deployment Through Understanding Grid Impacts and Policy Solutions
- Clean Energy Works - Inclusive Utility Investments
- EEI and NRECA - Preparing to Plug In Your Fleet: 10 Things to Consider
- Environmental Law & Policy Center - Electric School Buses & Utilities: New Partnerships for Cleaner Air
- Joint Office of Energy & Transportation - NEVI Utility Finder
- Michigan Public Service Commission - Case No. U-21297 DTE Rate Case Decision On Its "Efleet Program" re Inclusive Utility Investments, see page 259
- The National Association of Regulatory Utility Commissioners - Best Practices for Sustainable Commercial EV Rates and PURPA 111(d) Implementation
- National Association of State Energy Officials and The National Association of Regulatory Utility Commissioners - Guide for Transport Electrification
- SEPA Smart Electric Power Alliance - Benchmarking Equitable Transport Electrification
- U.S. PIRG Education Fund - Electric School Buses and the Grid
- WRI's Electric School Bus Initiative - Electric Vehicle (EV) Make-Ready Programs
- WRI's Electric School Bus Initiative - Utility Activities to Support Equitable School Bus Electrification
- WRI's Electric School Bus Initiative - The Electric School Bus Transition Must Take Inequitable Electric Grids Into Account

4. Funding

Summary

The current higher upfront price of electric school buses and costs associated with deploying charging infrastructure (compared to their fossil fuel-burning counterparts) can be a barrier to fleet electrification – preventing school districts and private fleet operators from experiencing the significant cost savings that electric school buses provide across their lifetime (on the order of **$100,000 per bus according to an analysis by WRI's Electric School Bus Initiative**). To mitigate this challenge, state and federal governments have set up funding programs to support school districts and other operators in acquiring and deploying electric school buses and charging infrastructure. This funding is most needed during this initial phase of the transition, as electric school buses approach but have not yet reached total lifetime cost parity (also known as "total cost of ownership" or TCO parity) with diesel-burning school buses.

Funding programs are typically supported through general funds, industry fees and/or legal settlements, among other sources. Many types of funding mechanisms have been used for electric school bus programs, including those outlined in Table 2 below.

Regardless of the funding mechanism, program design should address: an awardee ranking process, eligible costs and timing of when awardees receive funds.

The U.S. Environmental Protection Agency's (EPA's) Clean School Bus Program (CSBP), Volkswagen Settlement funds and California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Program (HVIP) are among the largest sources of electric school bus funding to date.

TABLE 2 | The different mechanisms available to support districts in acquiring electric school buses

TYPE	DEFINITION	ADVANTAGES	DISADVANTAGES
Grant	An award made to qualifying applicants, for a specific purpose or use case, deemed the worthiest based on set criteria.	Generally directs aid to priority districts; often cover planning and project management costs.	Applications can sometimes be time intensive and onerous.
Rebate	A reimbursement after certain eligible purchases of pre-approved equipment.	Limited paperwork. A pre-approved equipment list reduces the burden on applicants and simplifies purchase decisions.	Requires the recipient to pay full price at the time of purchase; lower-resourced districts may not be able to cover these initial costs.
Voucher	A credit applied "on the hood" immediately at purchase that lowers the price paid by the recipient.	Least amount of paperwork. Eliminates the burden of delayed reimbursement.	Programs risk inducing unintended consequences like inflated prices.
Financing (e.g., loans)	An arrangement that provides capital for costs today, to be paid back over a future period, often with a small premium (interest).	Enables districts to make cost-effective investments.	Districts with poor credit or lacking capacity to issue public bonds might face higher interest rates.

Best Practices

- **Fund Only Electric Solutions:** Allocate funding only for electric school buses, which are the healthiest, cleanest and only zero-tailpipe-emissions school bus option.
- **Prioritize Impacted Communities:** Dedicate a minimum of 50% of program funds and up to 100% to the communities most harmed by transportation pollution.
    - Policymakers should provide the communities most harmed by transportation pollution with funding to cover the full upfront cost of an ESB. Meanwhile, awards to less impacted communities can be lower, such as the cost difference between an ESB compared to an equivalent diesel model. This helps reflect the operating savings that accrue from electric school buses. Likewise, policymakers should consider contextual factors like transportation funding practices, costs of operating diesel and electric buses, and the progress towards price parity with diesel buses, with the goal of maximizing the number of ESBs funded over time. Policymakers should use data-driven criteria to identify priority school districts, including race, income, air pollution, health disparities, and state and local definitions of underserved communities.
    - Apart from funding, buses should be prioritized for routes in the areas with the worst air quality. Community members should be meaningfully engaged in choosing electric school bus routes, as well as in other elements of deploying electric school buses. For additional guidance, see Section 11 on Equity.
    - Create set-asides for public school district applicants and include equity criteria. First come first served applications favor commercial applicants and well-resourced districts and should be avoided.
- **Provide Funding at the Point of Expense:** Provide funding upfront so as not to disadvantage low-income school districts who do not have the capital to cover the full upfront cost of an electric school bus. Consider upfront vouchers or grants as the preferred funding mechanism for incentive programs.
    - Vouchers tend to require less paperwork for school districts and provide funding at the time of purchase – eliminating the burden of delayed reimbursement. However, vouchers only cover the costs of the vehicle and charging station. Grants, which may be more cumbersome in their requirements, can provide funding for a wider range of implementation costs. Grant programs should include technical assistance for applications and should fund workforce training.

- **Avoid Inadvertently Encouraging Price Inflation:** To avoid unintended consequences such as price inflation, policymakers should consider various funding design elements, including:
  - Ensure a wide range of dealers and manufacturers are encouraged to participate in the program to prevent a limited number of dealers from managing most school bus orders. Please see Section 8 for details on how to incentivize procurement from high-road manufacturers.
  - Establish an annual reporting requirement for dealers and original equipment manufacturers (OEMs) in which they provide information about pricing for both diesel-burning and electric school buses, pricing changes, warranty problems and vouchers provided to communities most harmed by transportation pollution.
  - Set an award cap (i.e., a maximum award from the program). This encourages school districts to stack funds, incentivizing local governments and other entities to contribute.
  - Set a price cap (i.e., the maximum price of the bus the program will cover), as is done with some tax credits. This will likely result in lower bus prices and could help with broader market price trends. This will also use public dollars more efficiently.
  - Encourage aggregate procurement where or when possible, which will direct manufacturers to scale up production to economies of scale.
- **Fund Charging Infrastructure:** Cover the costs of charging infrastructure on the customer side of the meter.
  - To offset some of these costs, pair the program with other infrastructure funding available, such as utility make-ready programs, to ensure project success and leveraging of available funding. Please see Section 3 on Utility Programs and Enabling Regulatory Policies for more details.
- **Prioritize Accessibility:** Prioritize funding for accessible school buses as students with disabilities face greater exposure to diesel fumes and rely on diesel-burning school buses more than students without disabilities. Lawmakers should provide higher funding levels to applicants purchasing accessible buses, to cover any increased costs associated with adding accessible options. The EPA's 2023 CSPB rebates, for example, offer up to an additional $20,000 per bus if buses are equipped with American Disabilities Act-compliant wheelchair lifts. Please see Section 11 on Equity for additional information.
- **Provide Adequate Technical Support:** Allocate funds to cover technical assistance and project management costs, prioritizing school districts in the communities most harmed by transportation pollution. Outreach and technical assistance during the application, award and implementation stages is crucial to support school districts' access to funding. Not all school districts have dedicated project managers and other staff with the available time and capacity to navigate the application and implementation processes. In some cases, required training to support deployment should be considered. Please see Section 7 on Technical Assistance for additional recommendations.
- **Fund Workforce Training:** Allocate funds to provide workforce training and other resources, including critical high voltage personal protective equipment, to support schools' electrification projects. Educational programs should partner with existing worker and apprenticeship programs, including unions and automotive training centers. Ensuring a smooth transition will mean investing in the training of existing workers to help them adapt their skills for the new electric vehicle economy. Please see Section 9 on Workforce Development for details.
- **Provide Flexibility with Scrappage:** Incorporate flexible scrappage requirements in the program guidelines. Funding programs may have requirements for vehicles to be replaced or scrapped. Awardees may need to submit details on vehicles being replaced. Scrappage requirements may involve cutting frame rails or drilling into the engine block to ensure the bus that is being replaced doesn't continue polluting. Scrappage requirements can have unintended consequences for school districts that rely on third party contractors, who may not be willing to scrap a diesel bus in exchange for an electric school bus. At the same time, not requiring the scrappage of older, polluting vehicles often results in the vehicles being sold or passed on to lower-income communities, both within and outside the United States. Providing flexibility in scrappage for school districts that do not own their buses will ensure the program does not unintentionally exclude some public schools, while also ensuring responsible vehicle retirement. EPA's first round of CSBP grant awards offers an example of scrappage flexibility.

- **Fund Repowers:** Include repowered electric school buses as an eligible expense. The lower upfront cost of a repowered bus allows programs to support the purchase of a greater number of buses. To that end, funding should cover the electric drive system kit with batteries, labor to install, warranty and modest refurbishing costs. In 2023, WRI's Electric School Bus Initiative documented these upfront costs to range from $110,000 to $180,000.
- **Allow Broad Use of Funds:** Consider allowing program funding to be utilized on services from private transportation, infrastructure companies and leases to diversify the ways school districts can reduce the upfront costs of electrification. Such services can include transportation-as-a-service, charging-as-a-service or even turnkey asset management. Some of these new business model approaches are presented in Table 3 below.

Resources

- Atlas EV Hub - Public Funding Dashboard (requires subscription)
- WRI's Electric School Bus Initiative - Clearinghouse: Electric School Bus Funding and Financing Opportunities
- WRI's Electric School Bus Initiative - All About Funding and Financing Options for Electric School Buses
- WRI's Electric School Bus Initiative - Powering Electric School Bus Adoption with Complementary Funding and Financing Solutions
- WRI's Electric School Bus Initiative - 8 Things to Know about Electric School Bus Repowers

TABLE 3 | Business models emerging for school bus electrification and the parties responsible

	BUSINESS MODELS				
	Roles within all business models		Roles that are specific to electrification		
	Bus owner (& maintenance)	Bus operation	Charger owner (& maintenance)	Energy manager (software)	Electricity Customer
School ownership	SD	SD	SD	SD or 3rd party	SD
Lease	3rd party	SD	SD	SD or 3rd party	SD
Charging-as-a-Service	SD	SD	3rd party	3rd party	SD
Turnkey asset management	3rd party	SD	3rd party	3rd party	3rd party
Transportation-as-a-Service	3rd party	3rd party	3rd party	3rd party	3rd party

5. Financing

Summary

As described in the previous section, funding programs, in which awards do not need to be repaid, have been the primary policy support to date, with significant new sources at the federal and state levels. This funding has been crucial in spurring the electric school bus transition thus far.

With nearly half a million school buses in the United States, the current $9.3 billion in funding established by states and the federal government covers the electrification of less than 10% of the U.S. school bus fleet. Funding programs are also finite in nature and not necessarily renewed.

Financing is an important policy lever for the school bus transition. Combining financing with funding can extend public funds and support full fleet electrification and other goals at scale, maximizing the health, environmental and grid benefits of electric school buses.

Financing can also help districts overcome the current upfront price differential between electric and diesel-burning buses. Savings from low electricity prices and fewer maintenance needs can be financed and allow districts to restructure school bus electrification costs so that they more closely resemble the operational budget and cash flow characteristics of diesel school buses. Financing provides capital upfront, to be paid back over a longer period at a set interest rate. Financing mechanisms include those detailed in Table 4.

Financial entities and sources of capital include private lenders such as retail and commercial banks, credit unions, savings and loan associations, investment banks and companies and public lenders such as state clean energy funds, federal institutions, green banks and community development financial institutions (CDFIs). Additional private financing includes leases through the original equipment manufacturer (OEM) or dealer and as-a-service firms that offer transportation electrification services at a monthly or annual fee to school districts.

TABLE 4 | Financing mechanisms

PUBLIC LOANS	Financial arrangement where the government or other public entity provides funds to a school district with the expectation of repayment over a specified period of time. Terms and conditions are set by the lender and may include project eligibility criteria to meet the lending entity's fund goals. Public loans have the potential for lower-interest rates than from private firms.
PUBLIC BONDS	In most cases this is a municipal bond issued by a school district to raise funds from the public, typically through the sale of bonds, to finance educational infrastructure and other projects. Public bonds are usually repaid through future tax revenues or other specified revenue sources. A bond for a school district typically needs to go to the voters for approval.
INCLUSIVE UTILITY INVESTMENTS	These investments from utilities in charging infrastructure and/or the on-board batteries of electric buses are recovered through a site-specific cost recovery tariff (charged only to the bus operator) that is paid via an approved, time-bound tariff that is less than the operational savings from switching from diesel-burning to electric school buses over a specific period of time. See Section 3 for details.
PRIVATE LOANS	Private loans provide a wide variety of lending opportunities to individuals and commercial customers, including school districts and private fleet operators. Terms and conditions are set by the lender.

Best Practices

- **Prioritize Most Impacted Communities for Zero-Cost Financing:** Low-income school districts and communities most harmed by transportation pollution more often have smaller tax bases and higher borrowing costs, which can pose a barrier to accessing the long-term benefits and operational savings from electric school buses. Therefore, funds from public funding programs, which do not need to be repaid, should be prioritized for low-income communities to help offset the high upfront costs of electrification. Extending public dollars with financing allows policymakers to direct other types of funding toward communities most in need.
- **Provide Low/Zero Interest Rates:** Make electric school buses eligible for low or zero interest financing in government public lending programs and green banks.
    - Green banks can leverage public and private capital to provide low-cost loans to school districts, whose creditworthiness may be classified as riskier than traditional borrowers depending on the repayment timeline, revenue streams or debt limits.
- **Reduce Financing Costs for School Districts:** States and green banks should provide credit enhancement tools to help reduce financing costs. Several states have permanent funds, state aid intercepts, or guarantee programs that both enhance credit ratings for school districts and lower interest rates for capital projects. Green banks, similarly, have credit enhancement mechanisms and financial tools to help de-risk the sector for traditional financial institutions.
- **Educate School Districts:** Provide educational resources on financing and connect school districts with appropriate resources including state or local green banks.
- **Collaborate with State Utility Commissions and Regulators on Inclusive Utility Investment Programs:** When pursuing inclusive utility investment programs, collaborate with state utility commissions, regulatory boards and other regulators to include investor owned-utilities, rural electric cooperatives or municipal utilities. A broader network of utilities encompasses more school districts.

Resources

- Nevada Clean Energy Fund - Electric School Bus Program
- USDA - Community Facilities Programs
- WRI's Electric School Bus Initiative - Powering Electric School Bus Adoption with Complementary Funding and Financing Solutions
- WRI's Electric School Bus Initiative - All About Total Cost of Ownership
- WRI's Electric School Bus Initiative - All About Funding and Financing Options for Electric School Buses

6. Federal Policy Interactions

Summary

There are significant new sources of federal funding from the 2021 Infrastructure Investment and Jobs Act (IIJA) and 2022 Inflation Reduction Act (IRA) that provide states and local communities with funding for school bus electrification projects. These programs can work in conjunction with state programs. The most significant programs are:

- EPA's Clean School Bus Program (CSBP), established under the IIJA (also known as the Bipartisan Infrastructure Law), provides $5 billion in funding through September 2026 for electric school buses and associated charging infrastructure through grant and rebate application cycles. As directed by Congress, CSBP prioritizes awarding applications to schools in low-income and high need areas, rural areas and Tribal schools.
- The Department of Transportation (DOT) and Federal Highway Administration's (FHWA) National Electric Vehicle Infrastructure (NEVI) Formula Program, established under the IIJA, provides $5 billion in funding through September 2026 to states to strategically deploy EV charging stations across the country to increase access and reliability. The first round of funding focused on building interconnectivity along designated Alternative Fuel Corridors, mainly on interstate highways.
- DOT and FHWA's Charging and Fueling Infrastructure (CFI) Grants, established under the IIJA, provide $2.5 billion in funding through September 2026 to states for publicly available electric charging infrastructure and alternative fuel charging infrastructure in urban and rural communities.
- EPA's Climate Pollution Reduction Grants (CPRG), established under the IRA, provide $5 billion through September 2031 in funding for states, local governments, tribes and territories, to develop and implement climate plans aimed at reducing greenhouse gas emissions and other air pollutants. One of the funding sectors under the CPRG is transportation, which could include electric school buses and associated charging infrastructure.
- EPA's Greenhouse Gas Reduction Fund (GGRF), established under the IRA, provides $27 billion through September 2024 in funding for states to mobilize financing and private capital to reduce greenhouse gas emissions and other air pollutants. The GGRF will provide grants to help establish "Green Banks" across the country. The structure of the Green Banks will vary based on application structure and potential proposals, but banks will have the goal of rapid deployment of low- and zero-emission technologies.

- EPA's Clean Heavy-Duty Vehicle Program, established under the IRA, provides $1 billion through September 2031 to help replace eligible vehicles with zero emission vehicles (ZEVs), including electric school buses.
- The Department of Energy's (DOE) Renew America's Schools Program, established under IIJA, provides $500 million through 2026 to promote the implementation of clean energy improvements at K-12 public schools across the country and aims to help school communities make energy upgrades to lower utilities costs and improve indoor air quality.

- Inflation Reduction Act Tax Credits
  - The Qualified Commercial Vehicle Tax Credit (45W) aids schools in purchasing clean medium-and-heavy-duty vehicles (MHDV), which can include school buses or other vehicles owned and operated by school districts. The amount of the tax credit depends on the type of vehicle and the weight of the vehicle, with the total potential credit amount up to 30% of the price of an electric vehicle or the incremental cost relative to the price of a comparable vehicle, whichever is less. For vehicles more than 14,000 pounds (like an electric school bus) the credit will be up to $40,000 per vehicle.
  - The Alternative Fuel Refueling Property Tax Credit (30C), which was extended and modified under the IRA, provides a tax credit for alternative fuel refueling property, which includes electric charging stations on school district property (such as schools or bus depots) and others used to charge electric school buses. Low-income and non-urban school districts can utilize this credit through direct pay. The credit provides up to 30% of the cost of each item of refueling property (i.e., each charger) for a maximum credit of $100,000.
  - Elective Pay (also known as 'direct pay') is a provision in the IRA that provides a mechanism for tax-exempt entities, including school districts, to receive a direct payment for certain credits they qualify for and fulfill.

Best Practices

- **Provide Timing Flexibility and Streamlined Application Process:** Be aware that stacking funds can present logistical and timing difficulties. Within state programs, state agencies should provide timing flexibility and should streamline application processes. This can reduce the burden on districts and ensure that schools are incentivized to apply for the state program and stack state funding with federal funding when eligible.
- **Consider Matching Funds:** Consider streamlined matching funds for federal funding awardees, so that school districts that receive federal awards can receive automatic matching funds from state programs. These matching funds can cover additional costs for charging infrastructure, workforce development, project management, bus battery second life use and recycling or other needs for a successful transition.
- **Consider Bridge Financing:** In cases where federal funding mechanisms take time to distribute and school districts do not have the funds needed to pay upfront for electric school buses and infrastructure, state green banks can provide important bridge financing.
- **Assist with Tax Paperwork:** State agencies should assist school districts with IRS paperwork and filing processes for 45W and 30C by providing educational resources and notices for key tax filing deadlines.
- **Collaborate with Federal Offices and State Agencies:** State agencies should coordinate with each other within the state, and with regional EPA offices and other federal agencies, to support school district transportation electrification projects and to ensure that schools receive assistance when applying to federal funding opportunities.
- **Deploy Federal Charging Infrastructure Funds to Meet School Bus Needs:** Include pull-through design and overhead height requirements when planning for infrastructure funded by federal programs.

Resources

- Alliance for Electric School Buses - New Tax Credits & Elective Payment for School Districts
- U.S. Department of the Treasury - FACT SHEET: Inflation Reduction Act Tax Credits Can Fund School Facilities Upgrades and Reduce School District Energy Bills
- WRI's Electric School Bus Initiative - Tax Credit for Qualified Commercial Clean Vehicles (section 45W): An Explainer
- WRI's Electric School Bus Initiative - Tax Credit for Alternative Fuel Refueling Property (section 30C): An Explainer
- WRI's Electric School Bus Initiative- All About the Clean School Bus Program
- WRI's Electric School Bus Initiative- Maximizing Clean Energy Opportunities in the Inflation Reduction Act: A Roadmap for U.S. Local Governments

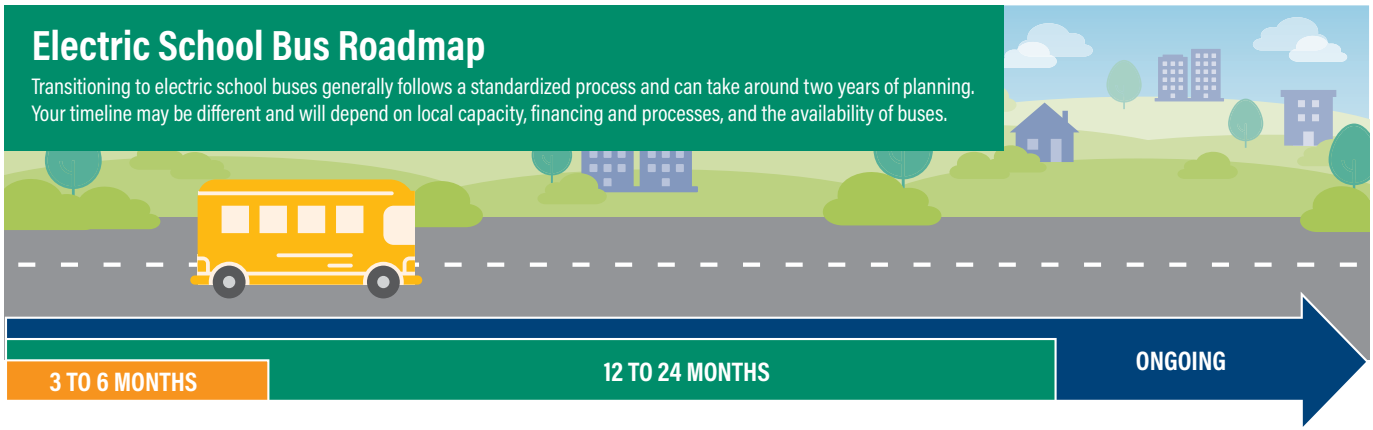
7. Technical Assistance for School Districts

Summary

School bus electrification is a long-term and multifaceted endeavor, and school districts and other fleet operators must take on new roles and responsibilities. Robust technical assistance from state agencies is critical to a successful transition to electric school buses, especially for low-income, rural, Tribal and other under-resourced districts.

School bus operators have many years of experience with some tasks related to electrification, such as purchasing vehicles, managing operations and training their drivers and staff, but these tasks will look different when adopting electric vehicles. Other tasks may be new to them altogether, such as planning for and installing charging infrastructure, as well as engaging with those in their communities who have firsthand experience with air pollution. For example, Salt Lake City School District, in pursuing electric school buses, prioritized deployment in communities most impacted by seasonal pollution.

FIGURE 1 | This Electric School Bus Roadmap presents the typical steps involved in school bus electrification



In addition, there are many new interested parties that school districts and other operators will need to engage for school bus electrification projects. Some examples include:

- Providing students with new learning opportunities related to electric vehicles within their curriculum.
  - For example, EPA has created **educational resources for students** on electric school buses.
- Addressing concerns among parents and community members about the reliability of new technology and where new electric school buses will operate.
- Training drivers, maintenance technicians and first responders to equip them with the new knowledge and skills needed for their day-to-day work, including topics such as battery safety, high-voltage equipment and the use of regenerative braking.
- Coordinating with electric utilities on rate planning, make-ready programs, purchasing incentives and other fleet advisory services.
- Procuring electric school buses and chargers from vehicle dealers and manufacturers – including new manufacturers focused exclusively on electric options – with different maintenance and training needs and bus specifications, such as battery capacity.
- Working with new vendors for charging infrastructure installation and maintenance, managed and bidirectional charging and even turnkey fleet electrification services.
- Cooperating with other school districts to share lessons learned, pursue funding or cooperative purchasing and plan for using each other's charging infrastructure for field trips or activities.
- Engaging with city and state governments, regional planning bodies, public utility commissions and other policymakers to communicate electrification plans and needs.

As school districts begin adopting electric school buses – whether deploying their first bus or electrifying their entire fleet – they will need help each step of the way. Technical assistance programs should support districts at all stages of electric school bus adoption, including creating an electrification roadmap, accessing funding and financing, procuring buses and chargers, assessing district facilities, installing charging infrastructure, training district staff, deploying and maintaining new technology and monitoring equipment performance (see Figure 1 for details). When done well, technical assistance can help ensure successful implementation and maximize the impact of policy efforts.

Best Practices

- **Prioritize Underserved Communities:** Prioritize technical assistance for school districts serving communities most harmed by transportation pollution and those that may have difficulties accessing resources. Engage with these communities to tailor implementation to fit their specific needs. Please see glossary for more information on how the term "underserved communities" is defined.
- **Convene Internal Partners:** Electrification requires extensive coordination within school districts among school boards and departments responsible for transportation, facilities and procurement. Similarly, state technical assistance programs should include support from relevant state agencies, such as:
  - Departments of Education for student transportation funding and regulation.
  - Departments of General Services for procurement options.
  - Departments of Energy for infrastructure planning and complementary technologies like renewable energy generation and battery storage.
  - Departments of Environment for vehicle incentive programs and air quality concerns.

  Coordination with agencies that focus on other modes of transportation - such as public transit, biking and walking - is important as well to ensure efficient and cooperative planning for electrification.
- **Partner with External Parties:** School districts may already be seeking technical assistance from other entities in the state, such as other school districts, professional associations, vehicle dealers and manufacturers, electric utilities, Clean Cities Coalitions and community-based organizations focused on air quality, environmental justice and equity. These entities may be valuable partners for supporting or complementing technical assistance efforts from state agencies.
- **Engage with School Districts:** School districts may have concerns about the reliability of new technology – such as electric school buses' ability to operate in extremely hot or cold temperatures or on mountainous terrain, the range of these buses or the safety of their batteries – which may be based on anecdotal or inaccurate information. States have a key role to play in educating districts about their motivations for electrifying school bus fleets and the short- and long-term benefits electric school buses provide for students, district staff and communities. Beyond simply providing information, states also need to solicit input from districts – especially those already operating electric school buses – about the barriers they are currently experiencing or foresee in the future. Doing so will ensure that technical assistance programs are responsive to districts' concerns and provide support that meets their needs.

- **Offer Flexible Support:** School districts have many competing priorities and may struggle to focus on electrification as other immediate needs emerge throughout the school year. As a result, technical assistance should be easily accessible and available in a variety of formats. This can include static resources, interactive tools and templates, webinars, events, regularly occurring "office hours," peer-to-peer learning opportunities and on-the-ground, in-person support.
- **Help Navigate Funding Landscape:** Technical assistance programs need to help school districts understand what funding is available, how to access these funds and how these funds may interact in different ways. School districts have constrained budgets and must navigate a complex funding landscape to pursue electrification. This includes various funding streams and financing options from a variety of sources with many applications, reporting requirements and points of contact.
- **Add Capacity:** School districts have limited staff capacity to manage the new roles and responsibilities that electrification requires. Taking on a more centralized role at the state level can help reduce the burden on individual districts. Examples include applying for federal funding on districts' behalf; standing up statewide staff training programs for school bus drivers, maintenance technicians and first responders; building awareness of battery second-life and recycling solutions; and providing statewide contracts or requests for proposals (RFPs) for procuring electric buses and chargers.
- **Plan for Data Collection:** Once the school districts get electric school buses, school districts should be prepared to collect data that can ultimately be used to inform future operational decisions. Offer training on how to find the data that needs to be collected. This may require schools to work with their utility or OEM in obtaining this information.
- **Focus on Charging Infrastructure:** School districts will need help understanding and planning for charging infrastructure. This is typically where districts have the least knowledge and experience, potentially leaving them vulnerable to misguided advice from vendors motivated to sell products. Technical assistance needs to help districts assess how much electrical capacity is currently available at their depots, what potential site upgrades may be needed, how much charging power is needed to support their electric buses and routing needs, and when to charge their buses to minimize electricity costs, among other considerations.
- **Provide Maintenance Support:** School districts likely have concerns about their ability to provide or seek out timely maintenance, especially once equipment is beyond its warranty period. When districts face extended timelines for maintenance on buses and chargers, they can create major operational and cost issues for their fleets. As a result, state technical assistance programs should help ensure that districts can access the maintenance services they need. This includes supporting districts' efforts to both train their own maintenance technicians and hire qualified professionals in their area.

Resources

- Alliance for Electric School Buses - Directory of Resources for School Districts
- CALSTART - Electric School Bus Network National Forum
- EPA - Clean School Bus Program Technical Assistance Resources
- EPA - Clean School Bus Program Charging and Fueling Infrastructure Resources
- The Joint Office of Energy and Transportation, request technical assistance - Contact Us
- The White House - Fact Sheet on Technical Assistance Resources and Federal Funding Opportunities
- WRI's Electric School Bus Initiative - Step-by-Step Guide for School Bus Electrification
- WRI's Electric School Bus Initiative - Electric School Bus Market Study and U.S. Buyer's Guide
- WRI's Electric School Bus Initiative - Request for Proposal (RFP) Template
- WRI's Electric School Bus Initiative - Power Planner for Electric School Bus Deployment
- WRI's Electric School Bus Initiative - Schedule a call with the Electric School Bus Initiative (office hours)

8. Manufacturing

Summary

A just transition to electric school buses presents an opportunity to create new careers and improve job quality for thousands of U.S. manufacturing workers.

As the electric school bus market gains momentum, manufacturing workers are adapting to a changing industry. Electric buses have fewer parts, but electronic components take more time and require new skills to produce and install. Manufacturing companies are building new factories and expanding existing ESB production capacity to keep up with electric school bus demand while evolving their vehicle designs. While workers at most incumbent companies are now unionized, efforts need to continue to ensure robust wages, benefits and protections are available to workers there and moreover at new companies where often workers are not yet unionized. The kind of wages, benefits and protections these companies provide impact all workers. For the transition to electric school buses to be truly equitable, it's vital that communities that have been historically excluded from the manufacturing industry be prioritized for well-paying electric school bus jobs.

State lawmakers must ensure that policies create a high-road manufacturing industry, where workers can enjoy well-paid jobs with family-sustaining benefits and the training necessary to thrive in their careers. High-road manufacturing also means creating safe working conditions and developing inclusive practices for worker hiring, retention, promotion and apprenticeship – especially for workers historically excluded from the manufacturing industry, such as women, Black and Latine workers, workers with disabilities and those impacted by the criminal justice system.

Best Practices

- **Reward Manufacturer Commitments to Job Quality:** As part of eligibility to participate in electric school bus funding programs, state lawmakers should require manufacturers to make public commitments to a strong workforce, detailing wage and benefit levels by employee classification, as well as how they practice inclusive hiring, retention, training, promotion and apprenticeship.
    - Agencies score manufacturer commitments and school buses purchased from high-scoring manufacturers receive additional funding.
    - Manufacturers provide regular reporting to demonstrate compliance with job quality and hiring commitments, which is tracked on public government websites.
    - This incentivizes procurement from manufacturers that create and maintain good jobs for U.S. workers, without limiting purchasing choices.
- **Support Community Benefits Agreements (CBAs):** Manufacturers that receive public subsidies from the state, such as tax credits, should be encouraged to sign CBAs, which are legally binding agreements between companies and communities to secure strong labor standards and benefits.
    - CBAs are negotiated through coalitions of community-based organizations, workforce development agencies, unions and other impacted parties.
    - Benefits should be customized for the local community and can be related to collective bargaining and unionization, diverse hiring, jobs pipelines, environmental mitigations, affordable housing and more.

- **Partner in Training:** Partner with community colleges, Historically Black Colleges and Universities (HBCUs), Hispanic-Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), Asian American and Pacific Island Serving Institutions (AAPISIs), trade schools and community-based organizations to develop training centers for manufacturing workers on managing high-voltage electric vehicle components.
- **Bolster Domestic Supply Chain and Build U.S. Job Market:** Incorporate policies to promote the development of the domestic supply chain and create good U.S. jobs in the medium and heavy-duty (MHDV) electric vehicle sector.

Resources

- Alliance for Electric School Buses - Why High Road Manufacturing
- Jobs to Move America - U.S. Employment Plan
- Jobs to Move America - About CBAs
- Jobs to Move America - Driving the Future: How to Electrify Our School Buses and Center Kids, Communities, and Workers in the Transition
- World Resources Institute & Data for Progress - US Clean Energy Projects Need Public Buy-in. Community Benefits Agreements Can Help

9. Workforce Development: Drivers & Maintenance Staff

Summary

Electric school buses bring benefits not only to students and communities, but also to the workers who operate and maintain them each day. For drivers and mechanics who are exposed to toxic diesel exhaust pollution, electric school buses mean a significantly cleaner and quieter working environment and new skills in a growing industry. For electricians, electric school buses represent millions of jobs installing EVSE like charging stations and other infrastructure.

Drivers, mechanics and electricians need adequate knowledge and training to successfully and efficiently deploy electric school buses. Driver training can impact range, regenerative braking and maintenance, as well as safety and performance in extreme weather, difficult terrain or high traffic. Some drivers are even tasked with charging electric school buses, whether on the lot or at home. Mechanics will be learning specialized skills to maintain and repair electric powertrains and handle high-voltage vehicles. Their success in doing so can impact buses' reliability and uptime. Rural districts, in particular, face challenges with timely access to external maintenance and would benefit from in-house capacity-building.

Manufacturers and dealers typically provide training for drivers and mechanics, just once upon delivery of the electric school bus. Few external training programs exist. Because electric school bus training is not standardized, its quality and robustness can vary widely. This can impact school bus operators' ability to retain mechanics and drivers during nationwide shortages of both. State lawmakers should ensure workforce development needs are specified, funded and met.

Best Practices

- **Fund Training:** Electric school bus programs must cover expenses for training and tools to set up workers to succeed with this new technology and to prevent job losses or displacement.
- **Require Workforce Impact Assessments:** States should require and support school bus operators receiving funding to submit workforce impact assessments to evaluate job impacts, identify skills gaps and establish detailed training plans—with a focus on fair wages and inclusivity for traditionally marginalized workers. States should take all possible steps, including providing funding, user-friendly templates and technical assistance, to ensure this assessment achieves its objectives without overly burdening school districts.
  - Assessments can evaluate how many jobs would be changed or created, the skills gaps of the existing workforce, the training necessary to close those gaps and plans to train and retain workers. Assessments should also disclose the minimum wages offered.
  - Assessments should consider how to upskill workers of color, women and people with disabilities who may face additional barriers (e.g., language, transportation, childcare and accessibility) in participating in training and who already face gaps in pay and lack of upward mobility within the industry. For example, Black workers make up a higher share of school bus drivers and are especially affected by the switch to electric.
  - Some school districts outsource their school bus maintenance, operations or charging to private contractors. Workers should be able to maintain their positions along with their previous salaries, benefits, working conditions and collective bargaining agreements through these transitions.
- **Require Training in Procurement:** As part of funding award conditions, require that training needs are outlined in Requests for Proposals (RFPs), Invitations for Bids (IFBs) and in purchase agreements with dealers, manufacturers or other vendors.
  - Contracts should specify what kind of training school bus operators need and how often, where and by whom. Some considerations include:
    - How: written materials, videos, presentations, test drives, charging demonstrations, hands-on practice and more.
    - How often: once or recurring, with recurring preferred.
    - Where: in person or virtually.
    - By whom: ideally a driver or mechanic, not a sales representative.
  - Training deliverables should also account for training first responders, who must prepare for possible emergencies.
  - State lawmakers could encourage standardized training objectives and curricula.

- **Specify Maintenance in Warranty:** As part of funding award conditions, warranty policies should clearly state what maintenance and repairs are covered by the manufacturer or dealer and which are the electric school bus operator's responsibility. Contracts may also need to specify maximum response times as well as where or how far buses would be taken for repairs or maintenance if not performed on-site.
- **Build a Diverse Talent Pipeline:** Partner with high schools, community colleges, Historically Black Colleges and Universities (HBCUs), Hispanic-Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), Asian American and Pacific Island Serving Institutions (AAPISIs), trade schools and community-based organizations to develop training centers and create a jobs pipeline for electric school bus mechanics, drivers and other essential staff.
  - Engage students to attract them into the workforce and address gaps in skilled labor.
  - Set and track targets to intentionally recruit, train and promote workers from communities historically excluded from the automobile industry, such as workers of color, women and workers with disabilities.
- **Require Electric Vehicle Infrastructure Training Program (EVITP) Certification:** To ensure safe and proper installation, funding awards should require that electricians who install EVSE be certified through EVITP. To encourage a diverse workforce, it is important that this certification be affordable and accessible.
- **Require First Responder Training:** Electric school buses should be dealt with differently than internal combustion engine vehicles, so first responders should receive specialized training.

Resources

- Joint Office of Energy and Transportation - ESB Training and Maintenance Considerations
- Jobs to Move America - Driving the Future: How to Electrify Our School Buses and Center Kids, Communities, and Workers in the Transition
- School Transportation News - School Bus Drivers Discuss Real-Life Experiences Driving Electric Buses
- School Bus Fleet - 5 Tips for Electric School Bus Training with First Responders
- WRI's Electric School Bus Initiative - Reskilling the Workforce: Training Needs for Electric School Bus Operators and Maintenance Technicians
- WRI's Electric School Bus Initiative – Request for Proposal (RFP) Template
- WRI's Electric School Bus Initiative - All About Electric School Bus Battery Safety
- WRI's Electric School Bus Initiative - All About Service Level Agreements (SLAs) for Electric School Buses and Chargers
- WRI's Electric School Bus Initiative - Prioritizing Workers in the Transition to Electric School Buses
- For training:
  - California Energy Commission - The Electric School Bus Training Project
  - Colorado Department of Transportation - HEV/BEV Safety and Operation
  - Electric Vehicle Infrastructure Training Program - About and Apply
  - First Student -The Best Drivers Behind the Wheel
  - National Alternative Fuels Training Consortium - Courses and Workshops
  - National Fire Protection Association – Electric Vehicle Safety Online
  - Transportation Learning Center - Battery Electric Bus (BEB) Familiarization Course
  - VA Clean Cities - Electric School Bus Training Connections: Best Driving Practices
  - Workforce Development Institute - Electric School Bus
  - WRI's Electric School Bus Initiative - Electric School Bus Technician Training Database

10. Battery Management

Summary

Establishing and deploying a responsible battery end of life (EOL) management plan early in the move to electric school buses is a key part of an equitable transition. Such a plan will help extend the life of batteries and avoid them ending up in a landfill, leaching toxic chemicals that contaminate the soil and water or leaking gasses that cause respiratory issues in surrounding communities, including low-income communities and Black, Latine and other communities of color where landfills are disproportionately sited. An EOL plan also helps limit the existing environmental and social harms borne by developing countries and Indigenous communities caused by mineral extraction to make the battery in the first place. In addition, advanced planning enables bus battery owners to realize the remaining value of their used batteries and lower their total cost of ownership.

Over time and with use, batteries will degrade and lose capacity. Based on other electric vehicle batteries, it's expected electric school bus batteries will be replaced when they still have around 70% remaining useful capacity. Batteries can have second-life applications; for example, they can be repurposed as stationary storage by utilities to support grid resilience. If repurposing or refurbishment is not possible, batteries can be recycled.

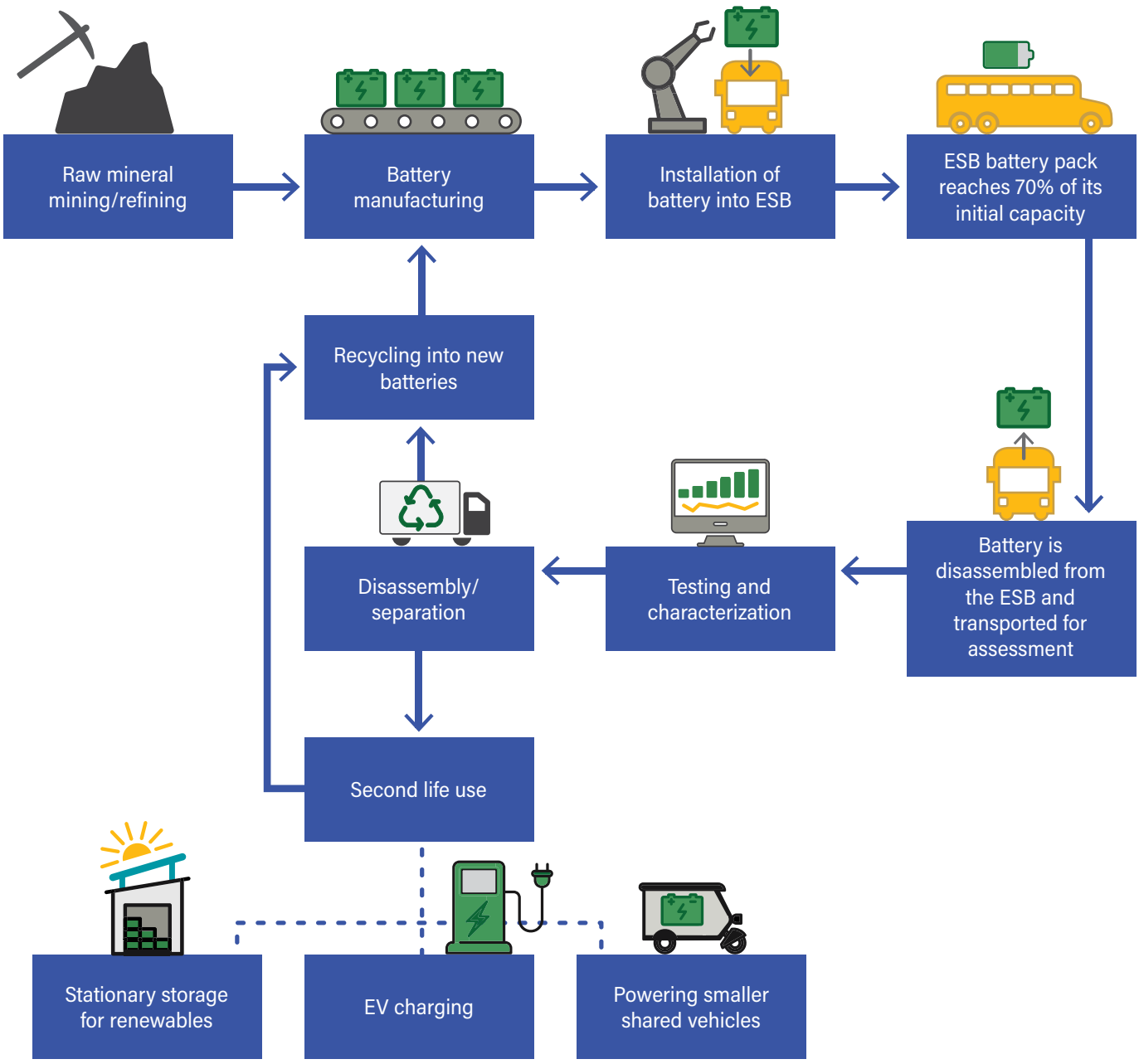
End-of-life management includes both second-life applications as well as recycling and final disposal of the battery. The full lifecycle of a battery, including material sourcing, production, consumption and disposal/recycling processes is referred to as its "value chain" (see Figure 2 for more details).

To ensure an equitable transition to electric school buses, policy makers should encourage or require battery refurbishment, repurposing or recycling. Efforts are already underway globally and across the transportation sector.

Best Practices

- **As part of electric school bus funding programs, establish battery EOL management plans:** This would require working with bus manufacturers to set up an industry-led Extended Producer Responsibility (EPR) program, such as already exists for e-bikes and other consumer products. The plans would clarify roles of parties involved, indicate costs/revenue for the school district and spur manufacturer partnerships with battery second-life use and recycling companies.
    - If these programs are not led voluntarily by manufacturers, lawmakers should consider requiring them from bus manufacturers as a condition of being eligible to receive incentive funding for their electric school buses.
    - When designing and implementing such programs, lawmakers should also engage communities near any prospective recycling sites and those most impacted by battery sourcing.
    - These plans can incentivize improvements towards better battery designs in the manufacturing phase to ease dismantling, testing, second-life use and recycling. Such improvements can limit waste and accelerate a closed loop or circular economy for batteries.
- **In the absence of industry-led programs, fund battery EOL management for school districts:** WRI estimates that costs for dismantling, testing and transporting a single 150kWh school bus battery for recycling or refurbishment can be around $3,000 or more. Public school districts should not be responsible for this cost.
    - Funding pilot projects and demonstrations in the near term can help develop preliminary lessons and build the necessary experience to achieve scale.

FIGURE 2 | **Electric school bus battery value chain**



Resources

- Congress - **Strategic EV Management Act of 2022 (passed in the Senate)**
- The European Parliament - **European Parliament Regulation on Batteries and Waste Batteries**
- Union of Concerned Scientists - **Guiding Principles for EV Battery Recycling Policy**
- WRI's Electric School Bus Initiative - **Electric School Bus Battery Resources**

11. Equity

Summary

Diesel exhaust pollution negatively impacts heart, lung and brain health, especially for children. Consequently, for students, it can even impact their school attendance and test performance. These effects are not experienced equally by all children. Low-income children, Black children and children with disabilities are more likely to ride the bus to school, meaning they are more likely to be disproportionately exposed to toxic diesel exhaust pollution from their school bus. Moreover, low-income children and especially Black and Latine children are up to 3.7 times more likely to live in counties with dirtier air than white neighborhoods, particularly due to their close proximity to cars, trucks and power plants. Furthermore, Black, Latine and Indigenous children are more likely than their white peers to suffer, and even die from, asthma, the number one chronic condition for kids.

All children deserve to breathe clean air, no matter their race, ethnicity, family income or zip code. Electric school buses emit no tailpipe emissions, which means children experience no exposure to pollution from their school bus ride. Replacing fossil fuel-burning buses with electric school buses in the communities with the dirtiest air can greatly improve the health and wellbeing of children most harmed by transportation pollution. Lawmakers can ensure that an equity-centered transition to a clean ride for kids accomplishes the most possible good with public funds.

Best Practices

- **Champion Electric Only Solutions:** Invest in the healthiest, cleanest and only zero-tailpipe-emission fuel available. Electric school buses are the best option for the communities most harmed by transportation pollution.
- **Prioritize Impacted Communities:** Prioritize the deployment of electric school buses in the communities most harmed by transportation pollution. Set aside at least 50% and up to 100% of state and utility funding and low-cost financing for the communities most harmed by transportation pollution: low-income school districts serving predominantly Black, Latine and Indigenous students and communities of color.
  - Use data-driven criteria to identify such school districts with the highest needs. Criteria can include:
    - race, such as racial/ethnic groups that have been historically and systemically disadvantaged;
    - income, such as targeting Title I-funded schools and/or schools that a have a majority of students eligible for free and reduced-price meals;
    - air pollution such as particulate matter and ozone pollution;
    - health disparities caused by diesel exhaust pollution, such as asthma rates.
  - Funding should be provided upfront (or as close to the point of expense as possible), allow for stacking with other funds, and avoid matching funds requirements and a first come, first served approach. These present barriers for underserved school districts (please see glossary for more information) and prevent equitable distribution of funds.
  - Policymakers should provide the communities most harmed by transportation pollution with funding to cover the full upfront cost of an ESB. Meanwhile, awards to less impacted communities can be lower, such as the cost difference between an ESB compared to an equivalent diesel model. This helps reflect the operating savings that accrue from electric school buses. Likewise, policymakers should consider contextual factors like transportation funding practices, costs of operating diesel and electric buses, and the progress towards price parity with diesel buses, with the goal of maximizing the number of ESBs funded over time.

- Electric school buses should also be prioritized for routes in the areas with the worst air quality.

- **Assess Air Pollution by Race and Ethnicity:** Race and ethnicity, not income, are the best predictors of pollution exposure. Ignoring race in policymaking will worsen pollution in the communities already most harmed by air contaminants. Due to historically racist lending practices, such as redlining, Black communities and other communities of color often live in highly polluted areas, such as areas close to highways, factories, power plants and other pollution sources.
- **Ensure Accessibility:** Ensure that the transition to electric school buses addresses the needs of children with disabilities, who must be among the first to see the benefits of the transition as they rely on diesel-burning school buses more than students without disabilities. Students in wheelchairs also face greater exposure to diesel fumes due to the location of wheelchair lifts near the tailpipe. Lawmakers should provide higher funding levels to applicants purchasing accessible buses, to cover any increased costs associated with adding accessible options. For example, both the EPA's Clean School Bus Program and New York School Bus Incentive Program provide additional funding for accessible electric school buses, such as electric school buses with wheelchair lifts.
- **Provide Adequate Technical Support:** Technical assistance should be prioritized for low-income school districts with fewer personnel and less capacity, who otherwise may not be able to pursue the transition to electric school buses. These school districts need adequate support and capacity to navigate and apply for funding opportunities, implement funding and reporting, and deploy and maintain electric school buses and their charging infrastructure. Support should be flexible, considering school districts' many competing priorities. States can partner with a variety of internal and external parties, from various state and federal agencies to nonprofits and community-based organizations, to streamline and coordinate assistance. Please see Section 7 on Technical Assistance for additional recommendations.

- **Design & Implement Equitable Utility Programs, Rates & Cost Recovery Mechanisms:** Ensure that utility funding and financing for electric school bus programs do not increase rates for residents with a higher energy burden, who are already paying a disproportionate share of their income on electricity bills. Utility participatory budget funding, a process in which community members participate in the allocation of funds, can ensure a diversity of interveners in rate case dockets to protect the most vulnerable communities from rate impacts.
  - Inclusive utility investments are a mechanism in which utilities recoup the costs of investing in charging infrastructure or on-board batteries for electric school buses through a limited tariff on the school bus operators' monthly bill (and only on their bill). The tariff is made to be lower than the operational cost savings generated by switching from a diesel-burning bus to an electric school bus. This ensures that utilities help facilitate school bus electrification without raising rates on all customers.
  - Additionally, as part of establishing electric school bus programs, utilities should conduct community needs assessments; integrate community input into electric school bus program design, implementation and evaluation; prioritize electric school buses and charging infrastructure for the communities most harmed by transportation pollution; and plan for how utilities can help these communities electrify their fleets beyond pilot programs. See Section 3 on Utility Programs and Enabling Regulatory Policies for more details.
- **Lead with Meaningful Community Engagement:** Conduct meaningful community engagement when crafting state and local policies and require it in deploying and routing electric school buses. Communities disproportionately harmed by transportation pollution who would most benefit from school bus electrification should be an active part of the decision-making process, from development to adoption and implementation. Effective public engagement takes into account the racial, cultural and socioeconomic complexities of a community.
  - Expand outreach beyond the "traditional stakeholders."
  - Engage in culturally and linguistically appropriate ways.
  - Make the process accessible, including developing resources in multiple languages.
  - Be proactive and engage early in the policymaking process (e.g. agenda building, formulation, etc.).
  - Build relationships with community-based organizations and community leaders.
  - See communities as experts in their own lived experiences, especially when identifying problems and solutions.
- **Design & Implement Equitable Workforce Policies:** Workers who manufacture electric school buses, as well as those that drive and maintain them, are greatly impacted by the transition to a clean ride for kids. They can benefit from cleaner, healthier working environments and gain thriving careers in the new electric vehicle economy. Lawmakers can ensure that workers receive the necessary training to develop new skills and protections to maintain or improve their job quality, wages and benefits. Please see Sections 8 and 9 for additional information on Manufacturing and Workforce Development.
  - Reward manufacturer commitments to job quality by requiring them to make public commitments to a strong workforce, scoring their commitments and providing higher levels of funding to buses purchased from high-scoring manufacturers.
  - Support Community Benefits Agreements that enforce manufacturer commitments to strong labor standards and benefits for the surrounding communities of new productions facilities.
  - Create job opportunities in the communities most harmed by transportation pollution by partnering with community colleges, Historically Black Colleges and Universities (HBCUs), Hispanic-Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), Asian American and Pacific Island Serving Institutions (AAPISIs), trade schools and community-based organizations to develop training centers and develop a diverse talent pipeline for school bus manufacturing workers, drivers, mechanics and other staff.
  - Include training and workforce development for drivers and mechanics in state funding programs, and require school bus operators receiving funding to submit workforce impact assessments to evaluate job impacts, identify skills gaps and establish detailed training plans—with a focus on fair wages and inclusivity for traditionally

disadvantaged workers. States should take all possible steps, including providing funding, user-friendly templates and technical assistance, to ensure this assessment achieves its objectives without overly burdening school districts. Ensure bus operators require training to be provided in the procurement process as part of purchase agreements for electric school buses, both for their staff and for first responders.

  - Require that charging infrastructure electricians are certified by the Electric Vehicle Infrastructure Training Program (EVITP). See Sections 8 and 9, on manufacturing and workforce development, for details

- **Support Responsible Supply Chains:** Promote the development of a domestic and responsibly sourced supply chain, creating good U.S. jobs in the medium-and-heavy-duty (MHDV) electric vehicle sector and adding reporting requirements for battery sourcing and recycling. See Section 10 on batteries for details.
- **Strengthen Data Collection & Track Progress:** Collect, monitor and report relevant data to help measure progress towards goals, such as:
  - Performance and operational efficiency of electric school buses
  - Specific locations where buses will be parked
  - Information on routes of buses, mapped and/or areas served by them
  - Air quality and health outcome improvements in bus locations, routes and areas served, disaggregated by race and income if possible.

Resources

- Alliance for Electric School Buses - Equity Framework
- Alliance for Electric School Buses - Electric School Buses & Equity
- Joint Office of Energy and Transportation - Community Engagement Tips for EV Infrastructure Deployment
- WRI's Electric School Bus Initiative - Dataset of Electric School Bus Adoption in the United States
- WRI's Electric School Bus Initiative - Dataset of U.S. School Bus Depots
- WRI's Electric School Bus Initiative - Equity Framework
- WRI's Electric School Bus Initiative - Equity in the Electric School Bus Value Chain
- WRI's Electric School Bus Initiative - How School Districts Can Include Equity When Choosing Where to Deploy Electric School Buses First
- WRI's Electric School Bus Initiative - How to Ensure a Sustainable Future for Electric School Bus Batteries
- WRI's Electric School Bus Initiative - The State of Electric School Bus Adoption
- WRI's Electric School Bus Initiative - The Transition to Electric School Buses Must Center Equity. Here's Why.

Conclusion

The momentum for electric school buses is growing stronger, with unprecedented investments from the federal government and an increasing number of states. Demand for electric school buses is coming from school districts all across the country, serving students in urban, rural and suburban settings.

As they look to bring the benefits of clean electric school buses to their communities, states can consider a range of actions detailed throughout this playbook, and especially the following:

1. Provide upfront funding and low- or zero-cost financing for public school districts and fleet operators to transition to electric school buses (and only to electric models, the cleanest and best option for children).
2. Set aside at least 50% and up to 100% of funding to prioritize the transition in the communities most harmed by transportation pollution. Engage these communities in decision-making throughout program design, adoption and implementation.
3. Establish statewide requirements for the transition of the state's school bus fleet.
4. Adopt Advanced Clean Trucks (ACT) and Heavy-Duty Low NOx Omnibus (HDO) rules to ensure manufacturer supply of electric school buses.
5. Direct utilities to create and regulators to approve plans for programs that fund or finance electric school bus charging infrastructure, V2X technology, technical assistance and fleet advisory services at fair, equitable rates that do not raise costs for vulnerable customers.
6. Ensure state funding complements, and can be stacked with, federal programs and incentives.
7. Provide robust technical support, especially for school districts in underserved communities.
8. Establish strong labor standards for manufacturing workers through manufacturer commitments to job quality and community benefits.
9. Fund workforce development programs that adequately train drivers, mechanics and first responders and build a diverse talent pipeline for school transportation workers.
10. Establish battery second life and end-of-life management plans as part of electric school bus funding programs.

With a wide range of policy tools available, and approaches for centering equity throughout the transition, it's time for all states to get on board with electric school buses.

Glossary

3-Phase power	Three-phase power allows for sites to increase their available site power to deploy faster, and more energy intense, electric vehicle charging infrastructure.
Bidirectional charging	"A two-way energy flow in which batteries are charged and later discharged using a bidirectional charger." (**All About Managed Charging and "Vehicle-to-Everything" or V2X**)
Clean Air Act	Primary federal air quality law, enacted in 1970 and amended in 1977 and 1990 to reduce and control air pollution nationwide.
Clean Truck Partnership	An agreement made in 2023 between the California Air Resources Board, truck manufacturers and the Truck and Engine Manufacturers Association that commits to a zero-emission vehicle (ZEV) trucking industry contingent on the flexibility for manufacturers to meet emissions requirements.
Community benefits agreements (CBAs)	Legally enforceable agreements between developers and community groups that outline the benefits a community will receive from a development project in exchange for project support, as well as the commitments developers will make to address any potential negative impacts.
Community Facilities Programs	Federal programs established under the U.S. Department of Agriculture that provide funding for the development of essential community facilities in rural areas.
Credit pooling	Enables manufacturers to leverage overcompliance of the Advanced Clean Trucks rule in one state to support meeting these requirements in an underperforming state.
Demand charge	An additional charge on an electricity bill reflecting the top rate paid by a customer.
Electric Vehicle Infrastructure Training Program (EVITP)	A program that trains and accredits electricians in skills needed to install and maintain electric vehicle charging infrastructure.
Electric vehicle service equipment (EVSE)	The infrastructure needed to charge electric vehicles, such as charging stations and associated components.
Equity	As described in its Equity Framework, the Electric School Bus Initiative "defines equity as the guarantee of fair treatment, access, opportunity, and advancement while striving to identify and eliminate barriers that have prevented the full participation of some groups" (**Equity Framework to Guide the Electric School Bus Initiative**). The Alliance for Electric School Buses is guided by its own Equity Framework. (**AESB Equity Framework**)
ESB	Electric school bus or electric school buses.
Grid modernization plans	Strategic initiatives aimed at updating and enhancing the electrical grid infrastructure through the integration of advanced technologies, innovative concepts and improved tools for increased resilience, efficiency and adaptability to evolving energy needs. (**About the Grid Modernization Initiative**)
Grid resiliency	Refers to the ability of the power grid to respond to and recover from major power disruptions.

High-road manufacturing	Manufacturing practices that prioritize quality jobs, environmental sustainability and community benefits.
Hybrid and Zero-Emission Truck and Bus Voucher Incentive Program (HVIP)	A California-based program launched in 2009 offering vouchers to reduce the cost of purchasing hybrid or zero-emission trucks and buses.
Inclusive utility investments	Investments by utility companies in community projects, including energy efficiency or renewable energy projects, often with cost recovery through customer billing.
Infrastructure Investment and Jobs Act (IIJA)	A U.S. federal law signed in 2021 aimed at investing in the nation's infrastructure, including transportation, broadband and energy systems.
Inflation Reduction Act (IRA)	Federal law enacted in 2022 focused on reducing inflation, promoting renewable energy and addressing climate change, among other economic issues.
Integrated resource plans (IRPs)	Comprehensive strategy employed by utilities to make informed and balanced decisions about future energy resource investments, considering factors such as demand, cost-effectiveness and environmental concerns.
Invitations for bids (IFBs)	Formal invitations to suppliers to submit a bid for the supply of goods or services.
Make-ready	"Programs to accelerate the installation of charging equipment for electric vehicles (EVs), making sites "ready" for electric vehicle supply equipment (EVSE) installation and operation." (**Electric Vehicle (EV) Make-Ready Programs Guide**)
Managed charging	"Managed charging refers to any form of control over when vehicles are charging, integrated either into the charger itself or through some outside switch, which allows the site owner to remotely control activation and deactivation of the charger. Proper application of managed charging not only enables the site owner to take advantage of potentially cheaper energy but also may allow for planned fleet management where higher-priority vehicles are charged first. Networked and controlled charging may also offer the ability to distribute charging across the chargers in use as more vehicles plug in, the total available energy can be distributed at a lower level to more vehicles. This scenario can work well for overnight charging where vehicles sit for long periods without use. Overall, managed charging offers site owners and fleet managers many more options to optimize fleets than chargers without controls." (**Electric School Bus Market Study**)
Medium-and-heavy-duty vehicles (MHDV)	Vehicles weighing over 10,000 pounds. Vehicle Classes 3-6 are classified as Medium Duty, and Classes 7-8 are Heavy Duty vehicles. Electric school buses are primarily Class 6-8.
Nitrogen oxides (NOx) emissions	The release of nitrogen oxides, including nitric oxide (NO) and nitrogen dioxide (NO_2), into the atmosphere during combustion processes, contributing to air pollution and environmental concerns.
Original equipment manufacturer (OEM)	A company that produces components or finished goods that are used as components in another company's end product, incorporating the original manufacturer's specifications and branding.
Peak hours	Refer to the periods of the day when the demand for electricity or other services is at its highest, often resulting in increased costs or potential strain on the infrastructure. Off-peak refers to the opposite, or non-peak hours.

Pull-through charging	Pull-through charging refers to a design of electric vehicle charging stations that allows vehicles, especially larger ones like electric school buses, to drive directly through to the charging point without needing to reverse.
Regenerative braking	Technology in electric vehicles for energy recovery during braking.
Repower	"Removal of a vehicle's internal combustion engine that runs on a fossil fuel like diesel, gasoline, propane or natural gas and replacing it with an electric drive system, transforming the vehicle to one that is fully battery-electric with no tailpipe emissions." **(The Electric School Bus Series Repowering the Transition to Electric in New York and Lowering Total Cost of Ownership)**
Requests for proposals (RFPs)	Documents issued by organizations to solicit proposals from potential suppliers or service providers.
Stackable funds	Funds that allow other incentives, rebates or vouchers to be stacked together to reduce the cost of purchasing.
Subscription rates	Rates school districts pay in advance for the demand they are expected to place on the grid.
Time-of-use rates (TOU)	"Utilities charge a customer on total energy consumed based on the time of day the energy is used. Utilities send price signals to customers to shift consumption from when electricity demand is high to times of day when energy supply is the least expensive to produce or most abundant from specific resources. Customers can save money if they align consumption with off-peak times. TOU rates often are designed specifically to support programs such as electric vehicle charging or encourage the use of abundant renewable energy. TOU rates vary by region and utility, and not all utilities offer TOU rates." **(Electric School Bus Market Study)**
Total cost of ownership (TCO)	"Sum of all current and future capital and operating expenses associated with the ownership of an asset. In the case of school buses, TCO includes: • upfront purchase price of the vehicle • upfront purchase price and operating cost of refueling infrastructure (e.g. charging infrastructure for an ESB) • upfront grants or incentives to subsidize purchases • future annual fuel expenditures • future cost of maintenance and repair • registration fees and insurance • any revenues from energy or environmental market payments" **(All About Total Cost of Ownership (TCO) for Electric School Buses)**
Transportation electrification/ beneficial electrification plans	Plans that involve strategic efforts to replace traditional fossil fuel systems with electricity in sectors like transportation and heating, aiming to achieve environmental and economic benefits such as lower emissions and higher energy savings.
Underserved communities	Communities that are most affected by environmental and socio-economic challenges, including those communities historically disadvantaged and most harmed by transportation pollution, such as Black, Indigenous, Latine and Asian communities, communities of color, as well as those with fewer resources, such as low-income and rural communities.

Value chain	The full lifecycle of a battery, including material sourcing, production, consumption and disposal/recycling processes.
Vehicle-to-X (V2X)	"V2X stands for vehicle-to-everything, an all-encompassing energy technology concept in which an electric vehicle is viewed as a mobile battery, and stored energy in the vehicle can be discharged for some benefit." Applications include: • "Vehicle-to-Building/Home (V2B/H): Stored energy is discharged to a building or home, usually to provide backup power or avoid peak energy use demand charges." • "Vehicle-to-Grid (V2G): Stored energy is discharged beyond the site meter out to the greater electric grid with the purpose of mitigating peak energy demand and/or for compensation of the site owner." (**All About Managed Charging and "Vehicle-to-Everything" or V2X**)
Volkswagen Settlement	A legal agreement in 2016 resulting from Volkswagen's violation of emissions standards, leading to investments in clean vehicle technology and environmental mitigation.
Workforce impact assessments	Evaluations of how a project or policy will affect the local or national workforce, particularly in terms of job creation or loss.

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About The Alliance for Electric School Buses

The Alliance for Electric School Buses is a diverse partnership of not-for-profit organizations committed to an equitable electrification of the U.S. school bus fleet. Since 2017, the Alliance has worked with local community members, community leaders and elected officials to help school districts transition from dirty diesel to zero-tailpipe-emission electric school buses, prioritizing communities most harmed by air pollution and workers who make the transition possible. Our coalition includes over two dozen members who work across 40 states as well as at the federal level. Together, we push for an equitable distribution of over $9 billion in state and federal funding for electric school buses and organize local communities and school districts to pursue a clean ride for kids.

To learn more, visit us at: **electricschoolbuses4kids.org**.

Please visit our website to review the digital version of this publication and to easily access all linked resources.

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