Workforce Strategies for Clean School Buses

A Summary Workforce Needs Assessment of School Bus Electrification in New York State.

INTRODUCTION

New York State has emerged as a national leader on zero-emission school buses, unlocking new opportunities for current and future workers in school transportation services. With its bold plans to require all new school buses purchased to be zero-emission by 2027 and to achieve 100% zero-emission school buses by 2035, New York State has demonstrated its commitment by providing school aid toward purchasing or leasing battery-electric buses and to installing the requisite bus charging and support infrastructure.[1] This transition will not be easy. **But with adequate resources and able partners, we can ensure a Just Transition through workforce development that provides strong labor standards, high quality in-demand training, and equitable access to the jobs powered by electric school buses.**

ABOUT WORKFORCE DEVELOPMENT INSTITUTE OF NEW YORK (WDI)

WDI's mission is to strengthen New York's workforce. Our approach combines strong regionalized networks with statewide and national perspectives, all supported by deep expertise in program training, program evaluation, workforce systems, and fiscal administration. Every year, our regional staff meets with unions, businesses, non-profits, and government in every region of the state. We routinely convene and consult with our partners and prioritize interventions that deliver the maximal benefit to communities and populations that need it the most. These models have allowed us to develop innovative, impactful programs in manufacturing, the building and construction trades, energy/climate jobs, and many other areas relevant to school bus electrification.

WDI'S WORKFORCE NEEDS ASSESSMENT

WDI has begun work on an electric school bus workforce needs assessment with goals to: 1) identify the available and anticipated jobs involved with school buses in New York State; 2) understand the impact on this workforce from the transition away from combustion engines to battery-electric buses; and 3) provide recommendations to support and empower the current and future workforce of electric school buses. The needs assessment combines desktop research, labor market data and research, and multiple interviews with subject matter experts and stakeholders in order to examine the impact of the transition on current and future workforce by identifying skill gaps, training needs, and retraining needs to operate and maintain school transportation fleets.

JOBS NUMBERS

As of 2021, there were about 35,000 school bus drivers and about 14,000 bus monitors employed in New York State. In addition, about 1,000 workers were employed as bus mechanics, diesel engine specialists, and dispatchers in the School and Employee Bus Transportation industry. Therefore, the electric school bus transition will directly and indirectly affect more than 50,000 workers across New York State. The following table shows distribution of school transportation workers by New York counties based on 10 New York Regional Economic Development Councils (REDCs).

[1] Governor Kathy Hochul's 2022 State of the State Address. See here.

School Bus Employees in 2021 by New York Regions[2]

REDC REGION[3]	COUNTIES	DRIVERS	MECHANICS*	BUS MONITORS	DISPATCHERS**
Capital Region	Albany, Columbia, Greene, Rensselaer, Saratoga, Schenectady, Warren and Washington	2,156	15	785	Less than 10
Central New York	Cayuga, Cortland, Madison, Onondaga and Oswego	1,565	Less than 10	501	Less than 10
Finger Lakes	Genesee, Livingston, Monroe, Orleans, Ontario, Seneca, Wayne, Wyoming and Yates	3,003	29	1,063	Less than 10
Long Island	Suffolk and Nassau	5,801	220	2,582	65
Mid-Hudson	Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster and Westchester	4,387	162	1,890	47
Mohawk Valley	Fulton, Hamilton, Herkimer, Montgomery, Oneida and Schoharie	1,263	Less than 10	329	Less than 10
New York City	Bronx, New York, Queens, Kings and Richmond	12,084	410	5,515	120
North Country	Clinton, Essex, Franklin, Hamilton, Jefferson, Lewis and St. Lawrence	795	Less than 10	204	Less than 10
Southern Tier	Broome, Chemung, Chenango, Delaware, Schuyler, Steuben, Tompkins and Tioga	1,080	Less than 10	301	Less than 10
Western New York	Allegany, Cattaraugus, Chautauqua, Erie and Niagara	2,906	41	1,054	10

*Represents Bus and Truck Mechanics and Diesel Engine Specialists employed in the School and Employee Bus Transportation Industry.

**Represents Dispatchers, Except Police, Fire, and Ambulance employed in the School and Employee Bus Transportation Industry.

[2] Based on Lightcast data, which is a hybrid dataset derived from official government sources such as the US Census Bureau, Bureau of Economic Analysis, and Bureau of Labor Statistics.

[3] The regions based on classifications of the Regional Economic Development Councils (REDCs).

POLICY HIGHLIGHTS

Electric school buses have positive benefits for pupils, their families, school staff, transportation professionals, and, of course, our shared environment. Electric buses eliminate school bus exhaust, reducing health risks for children whose lungs are still developing, and reduce greenhouse gas emission, which is a known contributor of climate change. To realize the potential, New York State and the federal government are incentivizing development of zero-emission school vehicles for pupil transportation including battery electric school buses. These policies seek to protect and support school transport workers while providing the necessary resources that will enable this technological transition.

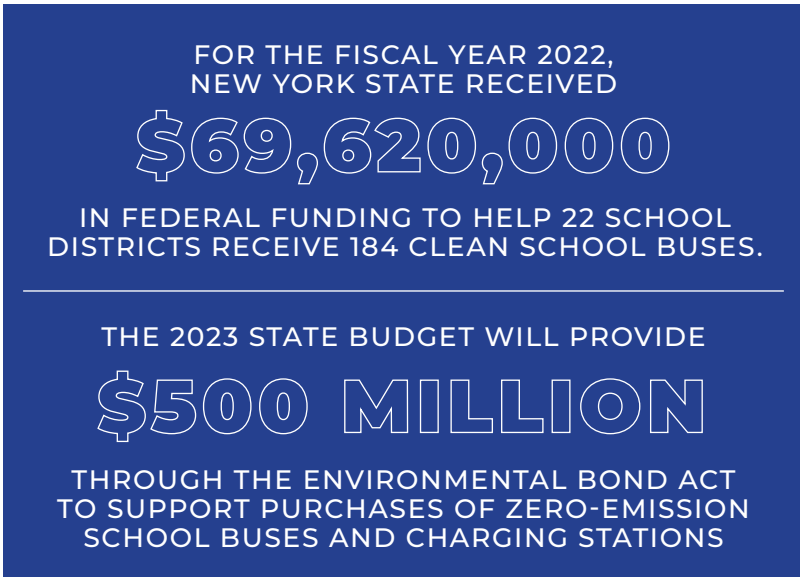
NEW YORK STATE POLICY

According to the 2022-23 Education, Labor & Family Assistance Budget Bill all new school bus purchase/lease should be zero-emission by the beginning of July 2027; all or a substantial part of the components should be Made in the United States, and final assembly must be in the United States. By July 2035, all school buses on the road must be zero-emission. In addition, Labor Protection should not be altered because of the zero-emission requirement, including rights or benefits and privileges including terms and conditions of employment, and collective bargaining unit membership of any current employees of school districts or contractors. In addition, the State Budget will provide $500 million through the recently approved Environmental Bond Act to support purchases of zero-emission school buses and related charging infrastructure.[4]

FEDERAL INCENTIVES

Several state agencies including the New York State Energy Research and Development Authority (NYSERDA), New York Power Authority (NYPA), and the State Education Department (SED) may work together with school districts and school transportation contractors to take advantage of federal initiatives like the Environmental Protection Agency's (EPA) Clean School Bus Program. The EPA has plans of providing $5 billion over the next five years to replace existing school buses with qualifying low- and zero-emission, including electric vehicles. For the Fiscal Year 2022, New York State received $69,620,000 to help 22 school districts receive 184 clean school buses[5].

We expect to see additional school bus electrification announcements from the local, state, and national levels as well as from industry. Our team is continuing its needs assessment and will be actively monitoring and sharing developments while working with our partners on workforce solutions.

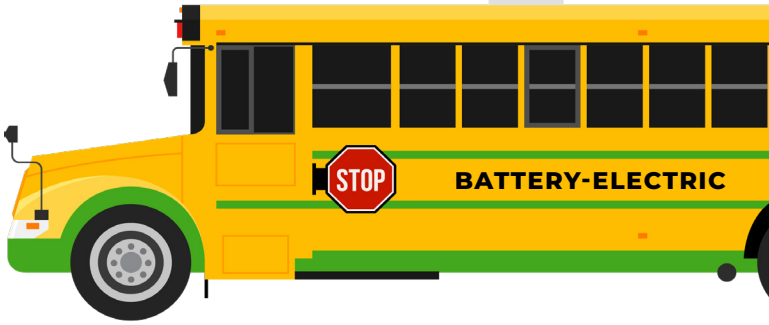


[4] Governor Kathy Hochul's Press Release on FY 2023 Investments. See here.

[5] See EPA News Release for the list of all school districts that have received the funding.

BATTERY ELECTRIC AND INTERNAL COMBUSTION ENGINE SCHOOL BUS COMPARISON

Internal combustion diesel buses and battery electric buses are similar in some ways, but very different in others. Components such as doors and air systems are usually the same, and both types of buses have low-voltage batteries that power auxiliary equipment. In addition, both types of buses have an expected lifetime of about 12 years. However, there are key differences that will affect the way the buses are operated and maintained. The following compares diesel and electric school buses[6]:



DRIVER'S COMPARTMENT	
Key ignition	Most ESBs will have a key ignition, but some may have keyless start.
Familiar dashboard icons	The dashboard on an electric bus, will likely have some unfamiliar icons, such as the state of charge indicator.
MOTOR/DRIVE COMPONENTS	
About 2,000 engine parts	About 20 motor parts
Has a multi-gear transmission	Usually has two or fewer gears. Some vehicles have a direct drive motor, which eliminates the need for a transmission.
Conventional braking	Regenerative and conventional braking
MAINTENANCE NEEDS	
More frequent preventive maintenance	Less frequent preventative maintenance[7]
Requires oil changes	Does not use oil
Maintenance costs average about $0.46-0.88/mile	Maintenance costs average about $0.26-0.64/mile[8]
OPERATIONS	
510 - 690 miles	Up to 210 miles[9]
Horsepower = 200-350, torque = 500 - 1,000 lb-ft	Horsepower = 241-550, torque = 700 - 2,400 lb-ft
Start-up can be affected by extreme ambient temperatures.	Range/batteries can be affected by extreme ambient temperatures.
4.2-8.2 miles per diesel gallon equivalent	17.35-20.87 miles per diesel gallon equivalent[10]
Must idle to keep auxiliary functions running	Does not need to idle the engine to run auxiliary functions
FUEL SYSTEM	
Combustion engine	Has high voltage lithium-ion or fuel cell batteries that power the motor
Refuels in minutes at a pump	Takes 6-8 hours to fully recharge

[6] Details may vary depending on bus model and the environment in which it operates. In addition, electric school bus and bus charging technology is rapidly evolving. This comparison is, therefore, meant as a general, high-level, overview of the two types of buses

[7] Electrifying Transit: A Guidebook for Implementing Battery Electric Buses. April 2021. National Renewable Energy Laboratory. See here.

[8] Financial Analysis of Battery Electric Transit Buses. June 2020. National Renewable Energy Laboratory. See here.

[9] Financial Analysis of Battery Electric Transit Buses. June 2020. National Renewable Energy Laboratory. See here.

[10] Electric school bus: Cleaner, reliable, ready. 2021. Environmental Defense Fund. See here.

WORKFORCE IMPLICATIONS

MOTOR/DRIVE COMPONENTS

Engine / motor parts:
Mechanics must become familiar with the new parts and motor system. Electric buses are widely considered to require less maintenance because they have fewer moving parts. This means less time spent on maintenance, but some time spent developing a solid knowledge of the electric motor and its components. They must also learn to work with the high voltage system safely.

Braking:
Operators have to learn how to make the most efficient use of regenerative braking to get maximum range and energy efficiency. Although aspects of electric bus braking systems are fundamentally the same as diesel buses, mechanics and transportation staff will need to learn about the differences in managing and servicing systems with regenerative braking capabilities.

Transmission / Gears:
Operators have to adjust to a different system. Mechanics have to learn about the single or two-speed transmission or direct drive of electric motors.

DRIVER'S COMPARTMENT

Ignition:
Operators may have to adjust to a different start-up method.

Dashboard Icons:
Operators will have to learn about new dashboard indicators and how that information relates to operating the bus. Being able to interpret the remaining range from the dashboard data is another important skill for drivers.

MAINTENANCE NEEDS

Oil Changes:
Because electric buses do not require oil changes, mechanics will spend less time on maintenance but must learn about new powertrains.

Preventative Maintenance:
Mechanics spend less time per bus on preventative maintenance, but must learn new procedures, using new technical charts and manuals, and interpret diagnostic test results to identify electrical or mechanical problems. They must also learn how to repair or replace malfunctioning electrical or mechanical equipment, following high voltage safety requirements and guidelines. Mechanics must be trained to carefully handle different types of batteries including lithium-ion and fuel cells. They must also learn about safety considerations of recycling and disposing batteries.

OPERATIONS

Range:
Most school bus routes fall within about 150 miles range. However some routes may have to be adjusted and/or chargers installed enroute. Dispatchers will need to learn to adjust their route plans. Operators may have range anxiety, which should be addressed through training on battery state of charge interpretation.

Extreme Conditions:
Operators must learn best practices on how to operate the bus effectively and efficiently under extreme temperature conditions.

FUEL SYSTEM

Voltage:
Mechanics, operators, and first responders must receive various levels of high-voltage safety training. Mechanics will need additional, extensive training on servicing high-voltage equipment.

Charging:
School buses will need access to charging infrastructure at school and depot facilities as well as on public roads and possibly other locations. The various formats and usage of vehicle chargers present an important training challenge for mechanics, operators, fleet managers, and those responsible for installing and maintaining chargers. Knowing when and how to get the most out of chargers, the differences between charger types, and the software used to manage charging will be top training priorities. Some of the building and construction trades perform this work already and will have an important role in integrating electric school buses.

> ***Electric buses eliminate school bus exhaust, reducing health risks for children whose lungs are still developing, and reduce greenhouse gas emissions, which are a known contributor of climate change.***

RECOMMENDATIONS

Based on our needs assessment and consultation with industry and labor partners, we have identified a series of workforce-related recommendations. These recommendations all share a goal of providing the most flexible, equitable, and effective support of the industry's workforce during this important technological transition. We are continuing to work with our partners in labor, government, industry, and education to find ways to promote implementation and worker advancement.

1. **Be proactive in training the workforce:** Because of New York State's aggressive plans to transition to zero-emission school buses, the workforce training should begin before the procurement of new technology vehicles. The school districts should identify skills gaps of the current workforce and plan to transition, train or retrain workers so that the workers are well-oriented to the new technology when the electric school buses reach their garages.

2. **Establish a consortium of Electric School Bus workforce stakeholders:** Include workers' representatives, school administrators, contractors, Original Equipment Manufacturers (OEMs), etc. to coordinate efforts to advance workforce development, worker retention and training programs for underserved communities that have traditionally faced barriers to employment in the pupil transportation industry.

3. **Battery Electric Bus Familiarization Training**: Provide training to help school bus operators and technicians gain a fundamental understanding of zero-emission vehicles, including battery electric buses. The training course would include fundamentals of zero-emission technologies, component identification, similarities and differences between different technologies (battery electric, fuel cells, hybrid, etc.), principles of operation of these technologies, energy storage systems, diagnostics, maintenance, etc.

4. **High Voltage Awareness, Training, and Safety:** Bus mechanics trained in conventional operating systems need additional training, including knowledge and skills on the use of High Voltage (HV) and Personal Protection Equipment (PPE) tools, Zero Voltage Verification Procedures (or de-energizing the system), and knowledge of servicing battery packs, generators, inverters, and motors. Specific training includes general HV Safety awareness and training, orientations for maintenance and operators, high voltage electrical systems training, battery electric propulsion system training, energy storage system orientation, HV personal protection equipment use, first aid, etc. The new training should adhere to the Standard for Electrical Safety in the Workplace.[11]

5. **Electric Bus Charging Training**: Provide training to help school districts or contractors understand various charging options, battery management systems, and charger-to-bus communication. Training should also include orientation of existing and future charging technologies, charging standards and charger maintenance & safety considerations, and up-front planning needed for electric bus facilities & operations.

6. **"Train the Trainer" Program with OEMs:** Maximize skill building and knowledge transfer between manufacturers/dealers and districts/transportation contractors. School districts and transportation contractors should collaborate with electric bus manufacturers, dealers, and service providers to make the most of learning opportunities for district and contractor staff. Manufacturers and dealers are highly knowledgeable about new and repowered electric buses and drivers, technicians, monitors, and dispatchers can learn from their expertise through on-site and online knowledge transfer. Some, though not necessarily all, of this skill building may happen through warranties, service contracts, and similar agreements to the extent they do not violate collective bargaining agreements.

7 **Attract next-generation Workers:** Workforce development agencies and non-profit organizations should initiate advocacy campaigns designed to highlight career tracks and pathways in school transportation services. The campaigns should be focused on demystifying the industry to students from high schools, community colleges, vocational schools and four-year universities.

8 **Develop (pre-) apprenticeship programs:** Apprenticeship readiness education and training is a proven way to provide entry-level workers with high-wage opportunities to gain skills and lifelong careers. Such programs can provide foundational and technical skills for future workers who are underrepresented to gain entry to the pupil transportation industry.

9 **Improve Job Access and Quality:** Because the federal and state laws require manufacturing and assembling of electric school bus components in the United States, there is a need to prepare workers with skills for dynamic career pathways in electric school bus manufacturing, operation and maintenance. Labor organizations should work with employers to ensure that the new opportunities are available for underrepresented workers including women and people of color. The focus must be on improving wages, worker retention, training for new technology, and creating access to good jobs that provide economic security and opportunities for growth.

10 **Explore alternative, innovative workforce opportunities:** As more renewables are added to the grid, energy storage technologies like Vehicle-to-grid (V2G) capable batteries can store surplus energy, and sell it back to the grid. In addition, school bus fleets are centrally managed and located, and driving routes are predictable. This makes school bus fleets an ideal choice for V2G. Workers should be trained to operate and manage these technologies.

[11]National Fire Protection Association, Standard for Electrical Safety in the Workplace (NFPA 70E). See here.

WDI is continuing its workforce needs assessment and actively exploring ways to support our partners. There is much to learn about New York's transition to zero-emission school buses and we are committed to supporting the state's implementation from a worker-centric way. We welcome your feedback and input on our work. To connect with our team, contact Kaubin Neupane at kneupane@wdiny.org.

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SUPPORTERS

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