Electric School Buses: Supporting Energy Sovereignty and Building a Foundation for Seven Generations

Introduction

For Tribal Nations, transportation involves much more than moving people from one place to another. The systems that support mobility also affect how communities use energy, allocate resources, respond to emergencies, and create opportunities for future generations. The deployment and use of electric school buses (ESBs) by Tribal Nations and the school districts that serve them offer an opportunity to consider transportation as a broader opportunity to build energy and community resilience.

Electric school buses have the potential to strengthen Tribal energy sovereignty by lowering fuel and operating costs, connecting transportation with Tribally owned energy resources, supporting community resilience, creating a cleaner transportation environment, and introducing students to technologies that are now part of the world around them. These benefits may extend well beyond the service life of an individual bus. Together, they can provide Tribal communities with greater ownership over their transportation and energy systems while building infrastructure that can benefit future generations.

Reducing Costs and Connecting Transportation to Tribal Energy

One of the most immediate benefits of electric school buses is the potential to reduce fuel and operating costs, depending on electricity rates, vehicle utilization and charging strategies. For Tribal Nations, the implications can extend much further as electrification creates the possibility of powering transportation with energy generated by the Tribe itself, creating a direct link to energy sovereignty.

The Red Lake Nation provides an example of how these systems can work together. This community is already producing clean energy through solar panels, with additional solar generation planned for the future. As Tribally-owned renewable energy generation expands, that electricity can increasingly contribute to powering electric transportation. Unlike fossil fuels, which are consumed and must

continually be replaced, often from outside sources, electricity can be generated repeatedly from local renewable resources such as the sun.

This distinction is important because fuel prices are influenced by forces largely outside the control of Tribal communities. Changes in global markets and geopolitical events can create significant volatility in fossil-fuel prices, leading to uncertainty in transportation operating costs. Locally produced renewable electricity offers a different model. Energy can be generated closer to where it is used, while more of the infrastructure involved in producing and using that energy can remain under Tribal control.

Savings from lower transportation operating costs can also benefit other areas of the community. Funds that would otherwise be spent on fuel and operating expenses can potentially be redirected toward school programs, essential services, governance, or other community priorities. In this way, transportation electrification can become more than a technological upgrade. It can become one component of a broader strategy for strengthening Tribal sovereignty.

School Buses are Energy and Resilience Assets

An electric school bus can serve a second purpose beyond transportation. It is also a large mobile battery that can provide a Tribe with non-transportation energy services during and after the bus's service life.

Vehicle-to-everything (V2X) technology allows energy stored in an electric school bus to be used for purposes beyond moving the vehicle. During an emergency or power outage, for example, a bus could potentially provide electricity to essential equipment or community services. The possibilities extend beyond simply returning electricity to the utility grid (vehicle-to-grid or V2G). Depending on the infrastructure available, stored energy could support a building (vehicle-to-building or V2B), emergency operations, communications equipment, or other designated critical loads or facilities.

This changes how a school bus can be viewed. Rather than sitting unused when it is not transporting students, an electric school bus has the potential to become part of a community's energy resilience infrastructure.

The battery may also retain value after the bus reaches the end of its service life. Batteries that no longer meet the performance requirements of a vehicle may still retain sufficient capacity for stationary energy storage. These second-life batteries can potentially be incorporated into battery energy storage systems (BESS) and paired with renewable energy generation through a microgrid system.

For Tribal Nations, this second life has important implications for energy sovereignty. A Tribe that owns the vehicle also owns an energy asset that may continue to provide value after the vehicle's transportation role has ended. Rather than viewing the battery as obsolete when the bus is

decommissioned, the community may be able to repurpose the asset according to its own needs and priorities.

Second-life battery storage can also provide benefits during normal operations. Depending on local utility rates and infrastructure, stored electricity may help reduce or even avoid peak electricity demand and associated demand charges. During longer power outages, the same storage could potentially support an emergency or resilience center. Together, developing V2X and second-life battery applications can demonstrate how an investment initially made in transportation can become part of a broader community energy system.

A Cleaner Environment and a Better Experience

The air quality, noise, and service benefits of electric school buses are also experienced directly by students, families, drivers, school staff, and the larger community.

Replacing diesel buses with electric buses eliminates tailpipe emissions during daily bus operations. This is particularly important in areas where buses regularly stop, idle, load, and unload passengers. Respiratory health risks, including asthma and other adverse health effects in children, can be lowered in these areas. Overall, reducing transportation-related air pollution can contribute to a healthier environment for students, drivers, parents, school employees, and others throughout the community.

Electric buses also change the experience of riding and driving a school bus. Electric drivetrains produce substantially less noise and vibration during operation. Reduced noise and vibration may particularly benefit students with sensory sensitivities or other disabilities for whom the sound, vibration, and smell of a diesel bus can make transportation more difficult. For students, this can create a quieter ride. For drivers, reduced engine noise can make it easier to hear and communicate with passengers. Over the long term, reductions in noise and vibration may also have health benefits for people who operate and ride buses every day.

Winter weather creates additional considerations, particularly for Tribal communities and rural school districts in northern climates. Cold temperatures can significantly reduce the range of electric vehicles, making careful route planning essential, although longer-range ESBs are entering the market with some approaching twice the range of current models. At the same time, electric buses offer some cold-weather advantages that can be overlooked when range is the primary consideration.

Unlike conventional buses, electric buses do not require the same engine warm-up or block-heater practices. They also do not produce tailpipe emissions, allowing them to operate closer to hospitals, schools, and other community facilities that may have anti-idling or specific air-quality policies targeted more toward diesel and gas vehicles. In some circumstances, an electric bus that becomes disabled may retain sufficient battery power to keep the cabin heated while passengers wait for assistance, something not available in a fossil-fuel-powered bus. On a rural route many miles from the

nearest community, the ability to keep students and drivers warm while waiting for help in extreme winter temperatures can become an important safety consideration.

Electric school buses do not represent a transportation technology without limitations. Cold-weather range, charging infrastructure, route distances, and local conditions all need to be considered. Strategies for optimizing these potential constraints should be considered and planned for when deciding to put an ESB into service. However, for Tribal communities, the question is how those limitations compare with the particular benefits, resources, and transportation needs of the community using the bus, especially as the technology, performance, and economic value of ESBs continue to improve. As the limitations lessen and the advantages grow, ESBs are developing as a potential pathway for supporting Tribal sovereignty and service.

A Better Pathway

Electric school bus technology is developing rapidly, and the challenges associated with today's buses may not define the options available to Tribal communities in the future. Investing now can build the technical exposure, workforce, and institutional knowledge that will enable our communities to shape these technologies to serve future generations.

Longer-range buses are already entering the market, with some models now reaching 300 miles of range. Greater battery capacity allows electric buses to serve routes and activities that earlier models could not reliably accommodate. This is particularly important in northern communities where winter temperatures reduce vehicle range. For communities such as Red Lake Nation, longer-range vehicles could eventually expand opportunities for intramural activities and transportation for students in outlying areas beyond current electric bus routes. Further, a larger battery means greater capacity to serve as a V2X source while a bus is in service and as a second-life energy asset after decommissioning. Today’s higher cost of larger batteries can be a challenge when planning for acquiring an ESB, but increasingly, emerging additional benefits can help shift this equation.

Costs are changing as well. Electric vehicles and batteries have generally followed a trajectory of improving performance and declining costs. Electric school buses still require a significant initial investment, but continued technological development and market growth could bring the total cost of owning and operating them increasingly close to that of conventional buses.

Investing in these technologies also gives students an opportunity to become familiar with systems that are now part of their lives. Electric vehicles, renewable energy, battery storage, charging infrastructure, and microgrids are no longer simply technologies of the future. Students are growing up alongside them now, and these are the technologies they will use and work with.

This exposure also has implications for workforce development. Students who experience riding on electric school buses and understand how these systems work may eventually become the technicians,

engineers, electricians, planners, energy professionals, and decision-makers who operate and improve them. Just as importantly, that knowledge can remain connected to place. Young people can develop expertise in technologies that are useful within their own communities rather than assuming that technological opportunities exist only somewhere else. This benefits Tribal Nations as well, as they can rely on a local workforce for repair and service rather than having to call in outside service from a long distance away.

These investments can also create opportunities to build more intentional education and workforce pathways. Partnerships with Tribal Colleges and Universities, technical schools, utilities, manufacturers, and other training partners could connect students with internships, apprenticeships, certifications, and hands-on experience in electric transportation and energy systems. Over time, these pathways can help communities develop the local expertise needed to operate, maintain, and expand their own transportation and energy infrastructure.

Sovereignty Over Transportation and Energy Futures

For Tribal Nations, the strongest case for electric school buses ultimately extends beyond the buses themselves. It is about what can be built around them. For example:

- An electric school bus can reduce dependence on fossil fuels while connecting transportation with locally produced renewable energy.
- An ESB battery can potentially provide power during emergencies and may continue serving the community as stationary storage after the vehicle is retired.
- Students and drivers can experience cleaner, quieter transportation, while young people gain exposure to technologies that will shape future career opportunities.
- School districts serving Tribal communities can have greater economic control and certainty, as it is easier to plan for five years of relatively steady electricity costs for transportation than it is to plan for five years of volatile fossil-fuel costs.

Taken together, these and other benefits can give Tribal Nations greater sovereignty over their transportation and energy futures. The goal is not simply electrification for the sake of adopting new technology. It is the ability to make decisions about transportation, energy, infrastructure, and investment that reflect the priorities and long-term needs of the community.

The benefits of these investments can also extend beyond Tribal communities. As Tribal Nations develop clean transportation, renewable energy, charging, and battery-storage infrastructure, those investments can contribute to stronger and more resilient rural systems across the region. Communities throughout these areas may benefit from infrastructure that reduces exposure to fossil-fuel price volatility, increases affordability, expands access to emerging technologies, and supports cleaner transportation systems. In this way, Tribal investments can strengthen the broader

infrastructure that connects communities across the region while continuing to serve the needs and priorities of the Tribal Nation making the investment.

Tribal Nations do not need to adopt electric school buses to demonstrate leadership. For Tribes that choose to make this investment, however, electric school buses can be more than a replacement for conventional buses. The infrastructure and experience developed through these projects can help strengthen local transportation and energy systems, create new opportunities for Tribal communities, and build capacity that extends beyond the life of the buses themselves. In this way, an investment made today can continue creating value for the community and help lay a stronger foundation for the next seven generations.