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Here Comes the (Electric) School Bus! Early Experience at Electric Co-ops

By Katherine Dayem and Catherine Mercier, Xergy Consulting

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NRECA
America's Electric Cooperatives

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SUBJECT MATTER EXPERT ON THIS TOPIC

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ARTICLE SNAPSHOT

WHAT HAS CHANGED IN THE INDUSTRY?

Electric school bus models are now available to purchase from the major school bus manufacturers, with important features for some co-ops like cold weather packages. Although the cost of an electric school bus is about three times more than a comparable diesel school bus, school districts are leveraging Volkswagen diesel settlement funding to purchase buses. EPA's Diesel Emissions Reduction Act (DERA) program funds grants and rebates for electric school buses. Additional federal funding in the Infrastructure bill and, if passed, the Clean Commute for Kids Act, is designed to accelerate adoption of electric school buses. Meanwhile, some communities are becoming sensitive to the impact of burning fossil fuels on student health.

WHAT IS THE IMPACT ON COOPERATIVES?

Like electric passenger vehicles, electric school buses will increase electricity demand. If planned for and managed, electric school buses can add a large, predictable, and flexible load to a co-op's system. To realize this benefit, however, co-ops will need to help educate school districts and the communities they serve about the benefits, operation and maintenance, and funding of electric school buses. Funding a bus that costs significantly more than a diesel model will continue to be a challenge, with or without government funding; co-ops should explore other value streams like bus-to-building (B2B) or bus-to-grid (B2G) that can offset the initial costs of electric buses. Co-ops may also need to improve distribution infrastructure to serve school bus charging.

WHAT DO COOPERATIVES NEED TO KNOW/DO ABOUT IT?

Co-ops should connect with the schools and school district(s) in their service territory and begin a conversation about electrifying their school bus fleet. The process of educating and deciding to purchase an electric school bus can take several years, so starting the conversation early will be beneficial. It is also advantageous for co-ops to stay up to date on funding opportunities, investigate value streams to reduce the initial cost of electric buses, and learn from the experiences of other co-ops.

Background

Electric school buses are available from the major school bus manufacturers, and a few newer names, in standard (Type C and D) and minibus (Type A) sizes (see Table 1). Standard size electric school buses cost $300,000 to $400,000, depending on battery pack size. In comparison, a standard sized diesel school bus costs about $100,000. Consequently, initial cost is a large barrier to the adoption of electric school buses. School districts have leveraged funding from the Volkswagen diesel settlement trust fund to purchase their first electric buses. Administered by states, the funds generally cover the cost difference between the electric bus to be purchased and a comparable diesel model. In some instances, the grants may cover charging infrastructure.

Some school districts are beginning to purchase and evaluate electric buses to determine whether they can perform as well as diesel models. Buses serving rural communities can face challenges like extreme weather and challenging driving terrain (ice, snow, steep terrain, dirt or muddy roads), and testing an electric bus's ability to deliver students to school safely and on time is an important first step in evaluating this new technology. School districts that decide to adopt electric buses as part of their fleet will need to explore how to cover the high initial cost by exploring traditional funding streams like bonds and grants, as well as nascent ones, like the value of stored energy in the bus batteries for grid or building backup (B2G or B2B). Several co-ops are launching B2G and/or B2B school bus pilots. Typically, the programs would operate when school is not in session. Often this will be during a storm.

Co-ops are key players in the transition to electric vehicles, and school buses are no exception. School buses offer co-ops a predictable and flexible load, but co-ops will need to plan for their adoption by ensuring the infrastructure is ready and able to handle bus charging demand, and to help school decision-makers through the process. Co-ops will also play a critical role in assessing value streams of electric school buses to help school districts overcome initial cost barriers.

TABLE 1: Electric School Bus Models Available. The three models highlighted in green are subjects of case studies in this article.

Manufacturer	Model	School Bus Type	Battery Size (kWh)	Rated Range (miles)	MSRP ($)
Blue Bird	Micro Bird	A	88	100	225,000
	Vision Electric	C	155	120	346,000
	All American RE Electric	D	160	120	363,000
IC Corporation	CE Electric School Bus	C	315	200	290,000
Lion Electric	LionA	A	160	150	330,000
			80	75	260,000
	LionC	C	220	155	395,000
			176	125	365,000
			132	100	335,000
			88	65	305,000
	LionD	D	220	155	395,000
			176	125	365,000
			132	100	335,000
Motiv	EPIC E-450	A	127	105	201,000
Thomas Built	Saf-T-Liner C2 Jouley	C	226	138	325,000

Data compiled and updated from Atlas Public Policy's Dashboard for Rapid Vehicle Electrification (https://atlaspolicy.com/dashboard-for-rapid-vehicle-electrification-drve/)

This article shares the electric school bus experience to date of three electric co-ops. These case studies illustrate a range of challenges, motivations, and approaches to the adoption of electric school buses, but also contain common themes, including:

- The main barriers are high initial cost and lack of familiarity with electric vehicles,
- Co-ops can play a key role in educating decision-makers,
- Electric school buses are so far performing well in a range of climates and terrains, saving fuel costs, and
- Drivers and kids love the smooth, quiet ride of an electric school bus.

Co-op Case Studies

MOUNTAIN PARKS ELECTRIC, GRANBY, COLORADO

Mountain Parks Electric, Inc. (MPE) is a small co-op headquartered in Granby, Colorado (elevation 8,500 feet), serving the Fraser Valley and surrounding areas in north central Colorado. MPE's service area experiences some of the coldest winters in the U.S., averaging 79 nights of temperatures below 0°F annually. Rugged terrain with steep and sometimes icy roads add to difficult operating conditions for school buses.

Goals and Business Case

After facing stagnant or declining electric load over the past decade, MPE has identified electrification of the transportation sector as a key strategy to replace load. In addition to building out public EV charging for passenger vehicles, MPE views electric school buses as an electrification opportunity. "They are big, bright, and on the road twice a day," notes Chris Michalowski, Power Use Advisor at MPE, making them a good marketing tool that normalizes electric transportation. MPE also wanted to gain firsthand experience with electric school buses to prepare for their eventual adoption. "We know it's coming, and it'll start with one bus," says Michalowski. The co-op and school districts must develop experience to understand the benefits of electric school buses, and how to optimize those benefits as the fleet becomes increasingly electrified. MPE was also interested in the community-wide benefits, including improved local air quality and fuel and maintenance cost savings for the school district over the life of the vehicle.

In 2019, MPE approached the West Grand School District (WGSD), a school system in their service area, about acquiring an electric school bus. The school district was concerned about the ability of the bus to transport kids to and from schools in their mountain-area community. Would the bus perform as well as a diesel model on the area's rugged terrain, particularly during the cold winter months? MPE had many discussions with the school board to teach them about electric school buses. In addition, MPE developed a funding strategy that would allow the school district to acquire its first electric school bus at no cost. In late 2020, WGSD was ready to move forward with adopting the first electric school bus to serve a rural, mountainous region of Colorado.

Funding

WGSD chose a 78-passenger, 120-mile range Bluebird All American as their first electric school bus (**Figure 1**), which cost about $400,000. The school district obtained a Colorado State Energy Office grant funded by the Volkswagen settlement to cover the $264,000 incremental cost of the electric bus over a comparable diesel model. Wishing to relieve the school district of any cost burden or other pressures associated with this new technology, MPE and its generation and transmission (G&T) co-op, Tri-State, contributed funds to cover the remainder of the cost. MPE used their education fund, which is funded through unclaimed capital credits, to cover their $75,000 contribution. The school district took delivery of the bus in March 2021 and added the bus to daily routes in the fall of 2021.

Charging

The school district charges the bus using a 19-kW Clipper Creek Level 2 Electric Vehicle Supply Equipment (EVSE), located in the school district's bus garage, where all school buses are parked and protected from extreme cold and snow. MPE provided EVSE installation and the associated electric service upgrade and charges its flat electricity rate.

FIGURE 1: WGSD's first electric school bus. Photo credit: Chris Michalowski, MPE.

To avoid charging during MPE's evening peak from 4 to 10 p.m., MPE installed a Clipper Creek-recommended timer on the EVSE, which was set to begin charging at 10 p.m. Unfortunately, the timer prevented the bus from accepting charge if power had been interrupted by a power outage or the timer while the bus was connected to the EVSE. WGSD removed the timer and now relies on the driver to initiate charging manually. Michalowski notes that a turnkey solution for scheduling charging—whether through the EVSE or the bus itself—is an important feature that schools should look for when purchasing a bus. This fall, the bus has been using about 120 to 150 kWh per day, requiring about 3 to 4 hours to recharge. To use the bus on longer sports team trips, WGSD's transportation director is in discussions with a neighboring district with an electric bus about how they can provide charging when teams are visiting.

Benefits

The school district and community served by MPE are already experiencing benefits associated with the electric school bus, including the following:

A quieter and safer ride. Because the bus is quiet, the kids need not raise their voices to be heard. The driver can better hear the traffic around the bus, making the ride to school safer and easier on the drivers.

No tailpipe emissions, resulting in cleaner air in the neighborhoods through which the bus drives.

Better performance than a diesel bus. Electric vehicles offer faster acceleration and more torque than diesel models. WGSD has noticed the superior performance especially on steep terrain, and now operates the electric bus on their steepest route. The district has found that the bus performs well in snow, easily handling an unplowed road with 6 inches of snow, and maintaining good traction and handling with the regenerative braking. The bus can be scheduled to be preconditioned in the garage while it is plugged in, allowing the driver to start the route with a warm, fully charged bus.

Lower fuel and maintenance cost. MPE expects the school district will save on fuel and maintenance costs and will quantify the savings once the bus has operated through its first winter.

Normalizes EVs. The highly visible bus is seen carrying its precious cargo by a large portion of the community every school day. If the community has confidence that an electric school bus can transport its kids safely, Michalowski believes that EVs in general will gain acceptance.

Challenges and Barriers

MPE has identified several challenges and barriers that will need to be overcome to achieve broad adoption of electric school buses.

High initial cost. The largest barrier to electrifying school bus fleets is the high initial cost. WGSD's electric bus cost about three times more than a diesel model. In the near term,

school districts can leverage Volkswagen settlement funds to purchase a small number of buses, but additional funding will be necessary if entire fleets are to be electrified. MPE has not yet determined how this challenge will be met, says Michalowski.

Knowledge gap. Adoption of any new technology requires decision makers to learn and become comfortable with it. Even though the WGSD would be responsible for none of the bus's purchase cost, its board members had many questions, especially related to safety, that needed to be answered before they would consider the electric bus. MPE filled the role of educator, meeting with the board and transit director to understand the school district's goals and answer questions. This collaboration is a critical step in electric school bus adoption.

Range on steep terrain and in cold temperatures. Like any electric vehicle, the WGSD bus's range is expected to be impacted by cold temperatures, steep terrain, and driving style. So far, Michalowski estimates the bus has about 95 miles of useful range under normal operation, assuming a small reserve to avoid emptying the battery on a regular basis, compared to the 120-mile rated range. MPE will continue to evaluate energy use during the winter to better quantify the impact of temperature and winter driving on range.

Staying warm. Blue Bird installed a cold-weather package, which includes battery insulation and a higher output cabin heater, on the WGSD bus. So far, the heating systems work well, causing a small reduction in range that does not impact the bus's ability to drive its daily 80-mile route. MPE will continue to evaluate the ability of the bus to maintain comfort and have enough range to complete its route over the coming winter.

The inevitable learning curve. WGSD experienced a range of small, unexpected issues due to inexperience in operating an electric bus. In one notable example, the bus was left unplugged over the summer and would not start when staff returned in the fall. Troubleshooting revealed that the 12-volt battery had died, preventing the main battery from powering the bus. Co-ops can play a role by building a partnership with the school district and manufacturer to train drivers and mechanics on the unique requirements of an electric bus.

Overcoming their concerns that the bus would not adequately perform in their area, the experience with the bus has been positive so far, and WGSD would like to add more electric buses to their fleet. So far, it performs well in their high-altitude, cold snowy climate.

LEWIS COUNTY REC, LEWISTOWN, MISSOURI

Lewis County Rural Electric Cooperative (LCREC) is a small co-op in rural Missouri serving about 7,000 meters, primarily residential and some larger electricity consumers, such as schools and agriculture. The area experiences all four seasons: cold winters with snow and ice, muddy springs, hot summers, and cool autumns.

Goals and Business Case

LCREC's primary goal related to school bus electrification is to maintain and grow their electric load. In recent years, the co-op has been impacted by load reduction related to farms closing, people moving away, and members installing behind-the-meter solar systems. To address the challenge of replacing or growing load, the co-op needs to think outside the box, says Travis Mathes, Manager of Member Services at LCREC. Electric school buses represent one opportunity to replace or grow load, and are of particular interest because they are predictable and large; the load of three school buses is comparable to a small subdivision.

In 2019, LCREC began exploring the idea of purchasing an electric school bus with Knox County R1 School District (KCSD), one of their members. School district decision makers had many questions about electric school buses, especially regarding their performance in extreme temperatures and on challenging terrain such as mud, snow, or ice. Within about six months of beginning their research, the district and LCREC were in contact with Lion Electric. The company allowed KCSD to demo a bus that was on route for delivery in California. On a cold, snowy, icy day in December 2019, LCREC and KCSD got first-hand experience with an electric bus. Demoing the bus

in some of the most demanding conditions it would face in the area answered important questions about the bus. Bus drivers, who were particularly skeptical of the bus and its performance in difficult driving conditions, found that it drove well, and after the demo, KCSD and LCREC began working together to explore funding options to purchase an electric school bus.

Funding

In March 2021, KCSD took delivery of its 65-passenger Lion C, the first electric school bus in Missouri. The Missouri Department of Natural Resources (DNR) Volkswagen Trust Fund covered half of the $338,000 purchase cost, and a USDA grant covered another 34%. LCREC and its G&T, Associated Electric Cooperative, Inc., together contributed $45,000, and the school district covered $7,500.

To help other co-ops gain first-hand experience with electric school buses, LCREC held an open house in April 2021 (Figure 2). Co-ops from three states gathered with Lion Electric, school district, and co-op representatives to share information, ask questions, and ride in or drive the KCSD bus. As a result of the open house, another school district in LCREC's service territory, began the process of purchasing an electric school bus. Lewis County C-1 School District (LCSD) obtained funding from the DNR Volkswagen Trust Fund and rural development grants. These grants lowered the cost of the electric bus to $86,000—in this instance, making it cheaper than a comparable diesel bus.

Charging

LCREC purchased Cripple Creek Level 2 EVSE for each bus and covered installation costs. The school districts schedule charging from the bus, rather than from the EVSE. LCREC offers the districts a reduced rate for overnight (10 p.m. to 6 a.m.) charging, and their standard flat rate for daytime charging to incentivize off-peak charging, but not penalize daytime charging.

Benefits

Besides adding a large, predictable, overnight load to the co-op's system, the buses have yielded several other benefits:

Generating buzz. A major unexpected benefit of electric school buses is the excitement they generate within the community. The new technology has energized everyone involved in the decision-making process. KCSD initially rotated the bus through all the routes, so that every child had a chance to ride in it. Kids of every age were excited about riding in the electric bus and were disappointed when their turn was over. KCSD maintains a website with

Figure 2: KCSD's first electric school bus on display at the LCREC open house.
Photo credit: Travis Mathes, LCREC.

information on the bus, including daily performance data.[1] And, to meet the requirement of decommissioning a diesel bus to receive VW settlement funds, the district repurposed an old bus to be a student-run coffee shop outside the school.

An improved ride. With a smooth, quiet ride that includes on-board Wi-Fi and device charging, kids can work on homework during their commute. To alert kids that it is approaching, the KCSD bus plays the school fight song below 20 mph, a safety feature that also generates excitement and school pride.

Convenience and comfort. Because their batteries are climate-controlled, the buses do not need to be stored inside. The bus can be pre-conditioned while it is plugged in, so the driver starts the route with a comfortably warm or cool bus, without having to get there early to turn on the bus.

Fuel cost savings. The bus is expected to provide significant fuel and maintenance cost savings over time to the school districts. As of mid-October, the KCSD bus has averaged 65 miles, 1.6 kWh consumed per mile driven, and $11.80 fuel cost savings per school day.

Building experience. The KCSD bus is used for sports team and other school trips when within the range of the bus. It drives in the full range of the area's weather and road conditions. So far, the districts and co-op are very happy with the Lion Electric buses. The company has responsive customer service, often able to address issues remotely, and when needed can provide repair and service guidance to the district's mechanics.

Challenges and Barriers

Initial cost. As is often the case, the initial cost is a large barrier. LCREC played an important role in researching funding opportunities for the school districts; in both cases, most of the initial cost was covered by external funding sources.

Lack of familiarity with new technology. Education was key to the successful deployment of the electric school buses. Mathes notes that a large portion of the community is involved—from the 5-year-old kindergartener to the parents and the 75-year-old driver. It is "crucial to have the buy-in of all these folks and educating them on the front end is the best thing you can do," says Mathes. He also found that open houses were highly effective in helping other co-ops and school districts learn about and gain experience with electric school buses.

B2B and B2G Use Cases

Lewis County REC is beginning to explore ways they might implement bus-to-building (B2B) power delivery in the future. One idea they may explore is providing backup power to the rural nursing home across the street from a KCSD school. The district will need to expand its fleet, however, to power the facility; Mathes estimates that three school buses would be needed to power the nursing home.

So far, the buses are performing as the districts expected, and perhaps even a little better. KCSD is already expanding its electric fleet; they recently received funding from Missouri DNR and USDA for two additional electric buses.

HOLY CROSS ENERGY, GLENWOOD SPRINGS, COLORADO

Holy Cross Energy (HCE), headquartered in Glenwood Springs, CO, serves more than 57,000 meters and has a unique load profile containing ski resorts, residential, and commercial meters. Located in a wildfire-prone region, HCE has been focused on building resilience and emergency operation plans into their power supply portfolio since 2018, when the Lake Christine fire burned over 12,500 acres and damaged transmission lines.

Goals and Business Case

HCE has a goal of achieving 100% renewable energy by 2030, and is actively pursuing projects, including transportation electrification, that will add flexible loads to match variable supply on its system. Recognizing the potential of electric school buses, HCE joined Aspen Country Day School (ACDS) and electric bus manufacturers at a roundtable discussion at Rocky Mountain Institute in 2019 to explore electrification of school buses in their service territory. Because school buses in their area

[1] https://sites.google.com/knoxr1.us/busproject/home

generally drive a short distance, HCE does not expect that a viable business case can built around the operation of electric school buses alone; fuel and maintenance cost savings will not be large enough to offset the incremental cost of an electric bus over a diesel model. However, since school buses are parked 90% of the time, often when electric demand peaks, such as holidays or evenings, HCE is exploring value streams related to load shifting and B2B, including providing mobile power during emergencies. HCE also aims to further support the communities it serves by promoting clean air.

Funding

HCE investigated a unique ownership strategy in which the co-op would buy and own the school bus battery using RESP funds and the school would own the non-battery portion of the bus. This would allow the co-op to own the grid resource component of the vehicle, while greatly reducing the school's cost. Unfortunately, RESP funds could be applied only to stationary batteries and, therefore, could not be applied to the bus batteries. Instead, ACDS purchased its 77-passenger Thomas Built electric school bus using a $285,000 grant from the Regional Air Quality Council. HCE supplied funds for the EVSE and service upgrades. The bus arrived in November and is now transporting students on a daily schedule (Figure 3).

Charging

The bus will charge on the ACDS campus, where it returns after its route. Two of the school's other buses, however, operate on routes with endpoints far from the school, and do not return to campus at nighttime. Observing how the buses are used has led Chris Bilby, Research and Programs Engineer at HCE, to start thinking about where school bus charging should be located within HCE's service territory. For buses that do not return to a campus or bus barn overnight, satellite EVSE may be necessary, and they should be installed in locations that are convenient for the driver and where they have existing or planned infrastructure that can support both the charging of and the potential discharge of the buses. In addition, he has realized that it could be cheaper to move the bus barn to the infrastructure than bring the infrastructure to the existing bus barn.

HCE will encourage off-peak charging of the bus by applying its normal time-of-use rate: $0.24 per kWh during peak hours from 4 pm to 9 pm, $0.06 per kWh for off-peak hours, and no demand charge.

Challenges and Barriers

Initial cost. Electric school bus adoption is primarily an economic problem in Bilby's view; maintenance savings and fuel savings will not offset the extra cost of an electric bus. An increasing market share of electric school buses and decreasing battery costs will help reduce the initial cost, but other grid benefits like load shifting and B2B may ultimately be needed to make electric buses cost effective, particularly in the absence of large pools of funding like the Volkswagen Settlement Fund.

FIGURE 3: ACDS's first electric school bus. Photo credit: Chris Bilby, HCE.

A knowledge gap. Schools are very familiar with diesel buses and think in terms of miles per gallon, says Bilby. HCE has an important role in teaching schools and transportation decision-makers about electric buses, how to charge them on time-of-use (TOU) rates, how to maintain them, and how to compare their benefits to diesel models. School districts need information to understand the importance of spending the extra money on an electric bus.

Performance. Any school bus must first and foremost be able to transport kids to and from school safely and on time. HCE and Aspen Country Day School will be evaluating the bus's performance, particularly whether it can handle snow and cold, and if it can keep the batteries and cabin warm enough in the winter.

FEDERAL FUNDING

Many electric school bus purchases to date have been made using state grants that leverage Volkswagen settlement funds to cover the incremental cost of the electric bus over a comparable diesel model. Until the initial cost or the total cost-of-ownership of an electric bus is lower than a diesel bus, school districts will need to find funding to cover the incremental cost of electric buses as they electrify fleets. One potential source is funding allocated by the federal government.

The **Infrastructure Investment and Jobs Act**, signed into law on November 15, 2021, allocates $500 million annually for the next 5 years for funding the purchase of electric school buses, and an equal amount for alternative fuel—CNG, propane, biofuels—buses. **The Clean Commute for Kids Act of 2021*** would have an even greater impact if it becomes law. Introduced last spring, the Act would provide $25 billion over the next 10 years ($2.5 billion per year) toward electric school bus purchases. Schools that serve disadvantaged communities and/or a high proportion of low-income students would have priority for awards, with further priority given to those that have funds contributed by other sources, such as the utility or municipal bonds. Awards would be allocated as grants, rebates, or low-cost revolving loans up to 110% of the incremental cost of an electric bus over a comparable diesel model. The funds can be used toward the bus, charging infrastructure, workforce development and training for operation and maintenance of the bus, and planning and technical activities to support the purchase of the bus.

*Co-ops can follow the Act's progress through Congress here: **https://www.congress.gov/bill/117th-congress/house-bill/2721**

B2B and B2G Use Cases

Although creating value streams for the electric school buses will accelerate their adoption, HCE's first goals related to the bus are getting kids to school safely and on time and assessing the performance of the bus, especially in mountain and winter driving conditions. Once they collect performance data, HCE will assess the benefits of the batteries compared to the costs to understand whether owning the batteries is a viable business case. Once those goals are accomplished, HCE will turn to investigating how the buses can be used as grid assets, including B2B or B2G, starting with proof-of-concept studies in the lab, and eventually creating a value stream for the buses.

Conclusions

Co-ops have identified a variety of reasons to electrify school buses, but to realize any of those benefits, the buses must perform by safely driving kids to and from school. At MPE and LCREC, electric buses have been performing well even in challenging driving conditions, and will continue to be tested over the winter. The bus in HCE's territory has just arrived, in time for ACDS and HCE to evaluate its performance during the winter.

Given the positive experience of these early adopters, other co-ops may wish to start the school bus electrification journey. The case studies in this article present valuable lessons related to bus purchasing and operations. Co-ops that wish to encourage adoption of electric school buses should consider taking the following actions:

- **Electric co-ops should stay informed of potential funding options and explore value streams for electric buses.** The biggest obstacle to electric school bus adoption is initial cost. Costing about three times as much as a diesel school bus, an electric bus can be out of reach without additional funding. Schools have generally been using Volkswagen settlement funds, and additional federal funding is on the way (see Federal Funding sidebar). Co-ops should help schools identify funding opportunities and help them explore other value streams for electric buses, including B2B/B2G or creative ownership structures—for

example, co-op ownership of the batteries as HCE has explored.

- **Electric co-ops can play a major educational role in supporting the transition.** Electric school bus adoption is an education process for the entire community. Co-ops may need to take the first step by asking schools or school districts if they have plans to electrify buses. Once the conversation has started, co-ops can help school decision-makers learn to think in terms of kWh instead of mpg, mechanics and drivers learn how to operate and charge the bus, and the entire community to understand the benefits of electric buses, which is especially important if the school district will use bonds for future electric bus purchases.
- **Electric co-ops should consider funding some portion of the upfront cost of the bus,** such as providing EVSE and installation, service upgrades, or direct funds toward the bus purchase. Not only is it important to show the community that the co-op believes in the technology, but funding opportunities like the Clean Commute for Kids Act prioritize applicants that have additional funding from the utility or other sources.
- **Electric co-ops should begin planning for infrastructure upgrades to serve bus charging.** Fleets of electric school buses will have a significant impact on a co-op's electric demand and infrastructure. Planning for electric bus adoption will help co-ops be ready as fleets electrify. Co-ops may want to consider where to locate infrastructure to serve bus charging. As Chris Bilby of HCE has found, a central location to charge all buses may not be the best solution.
- **Cost savings are significant.** Currently, the cost of an electric school bus is higher than that of the traditional bus. According to a 2016 pilot conducted by the Clinton Global Initiative, an electric school bus will save nearly $2,000 in fuel costs and $4,400 a year in maintenance costs. The average lifespan of a school bus in the United States is 12 to 15 years. Lifetime savings could be between $76,000 and $100,000.

As highlighted by the case studies in this article, electric school bus adoption can yield benefits to a wide range of the community they serve. Drivers and kids alike appreciate the smooth, quiet ride of an electric bus. The buses perform well in challenging conditions, and at the same time educate communities and the next generation of drivers about electric vehicles. Co-ops can benefit from adding the flexible and predictable loads that electric school buses provide, and potentially broaden benefits by using bus batteries as grid resources. To realize these benefits, co-ops will need to form partnerships with school districts and communities to secure funding, provide education, and investigate creative ways to overcome cost barriers. The journey from beginning conversations about electric school buses to purchasing one can take a several years, so co-ops should start the conversation early and prepare to guide school decision makers throughout the process. ■

ABOUT THE AUTHOR

Katherine Dayem, PhD is Principal of Xergy Consulting. She helps US and global clients analyze and cultivate emerging clean energy resources at the grid's edge. Her research is focused on identifying impactful ways to save energy and reduce carbon emissions and has contributed to deep energy savings through utility programs and energy efficiency regulations. Her recent work has investigated how electrified technologies, including vehicles and space heating, can be adopted and integrated onto the grid to yield benefits for consumers, utilities, and the environment. A former member of La Plata Electric Association, she now resides in the Pacific Northwest.

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