Going Electric: A Start-Up Plan for School Buses

As the value of electric vehicles increases, districts should consider these steps as they plan procurement.

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After a slow rollout, manufacturers are gearing-up for a race to fill orders for hundreds of new electric school buses. One of the largest procurements is for Montgomery County Public Schools in Maryland, which leased 25 electric buses that will join its fleet in September 2021, followed by 61 additional buses in 2022 and then 120 in each of the two years after that with a goal of converting the entire fleet of 1,422 buses by 2035 (Mufson and Kaplan 2021).

What's more, Canada recently announced $2.75 billion in funding to enhance the country's public transportation systems, specifically in supporting the purchase of zero-emission public transit and school buses (Metro 2021).

For everyone concerned with the health and safety of our children, the end of diesel fuel buses cannot come soon enough. As documented a generation ago in research by the National Resources Defense Council, "A child riding inside of a diesel school bus may be exposed to as much as four times the level of toxic diesel exhaust as someone riding in a car ahead of it. Under federal law, these exposures translate into a *significant risk* of cancer to children and could contribute to respiratory problems among sensitive children, such as asthmatics" (Solomon 2003, 1).

By contrast, the improved indoor air quality is the most striking feature of an electric school bus, followed by the quiet ride that allows students to concentrate on schoolwork using the bus's Wi-Fi Internet connection. In addition, the source of propulsion or "powertrain" in internal combustion engine vehicles (ICE) is quite different from that in electric vehicles (EVs). In an EV, major ICE components such as engines, transmissions, exhaust,

and fuel systems are replaced by batteries, electric motors, and power electronics.

A report from the United Auto Workers suggests that "EV powertrain vehicles will become price competitive, without subsidies, with ICE powertrains *between 2025 and 2030*. The cost of electric vehicles is expected to steadily decline due to technology improvements, infrastructure investment by the government, and increased production capacity of the manufacturers" (UAW 2019, 9).

Planning for Purchase

For these reasons and more, electric buses may eventually replace America's fleet of 480,000 diesel buses. However, districts have a reasonable amount of time to plan for their purchase, since a rapid and widespread swap-out of diesel to electric is unlikely. In fact, many districts may begin by purchasing a single electric bus.

School boards are adopting "climate action plans" and are appointing personnel to environmental sustainability committees (SusComs), including citizens and students. SusCom goals include moving districts to use 100% clean renewable energy by specific calendar dates and reducing sources of greenhouse gas emissions. (Transportation remains a culprit as parents, staff, and students rely on privately owned ICE vehicles.)

SusComs should be aware of the district's long-standing transportation policies and procedures as they impact climate action planning. Districts and their teams might consider questions such as: Which neighborhoods, schools, and grades will receive that first new electric buses? Will the district commit to purchasing an adequate number of Type A buses with wheelchair lifts or will preschool students and those with special needs be passed over by students who ride the full-size Type C or D buses?

Important First Steps

School districts can look toward purchasing EVs with these first steps:

Partner with your electricity provider. Many electric utility companies in the United States collaborate with state and local government agencies to provide electric buses for schools. Contact your electricity provider to learn whether they offer incentive programs and grants. Ideally, your district may have the same opportunity as did four school district customers of Portland General Electric (PGE), which announced it would pay for the incremental cost of four new electric school buses as well as charging infrastructure. PGE also plans to provide "site assessments, cost-benefit analysis, installation, driver and mechanic training, utility rate optimization and stakeholder engagement, as well as other technical assistance" (Portland General Electric 2020).

Parents see their children zipping down the street in an electric bus; the utility company sees them rolling along in a "battery on wheels." That's because the value of the bus extends beyond its function as a transportation vehicle to a backup energy source for the utility. The buses' powerful batteries can be harnessed to supply electricity to the electric power grid during off-hours, such as during the summer when the bus fleet sits idle and utility customers' demand for power rises for their air conditioning.

Before procuring your electric bus, determine how it will be assigned in your fleet.

An emerging technology called "vehicle to grid" (V2G) allows the bidirectional inverters, or chargers, to recharge the batteries or send surplus electricity to the grid. In Westchester County, New York, Consolidated Edison, Inc., partnered with the New York State Energy Research and Development Authority to contract with a school bus service to provide five electric buses for White Plains School District (Green Car Congress 2020). The charging and discharging takes place at the bus contractor's depot in North White Plains.

Due to the complexity of coordinating school personnel, a state agency, a local bus contractor, the new bus' manufacturer, and the hardware and software vendors of the emerging technology equipment, Consolidated Edison Inc. recruited an outside company to develop and manage the project.

Procure your buses. The sticker price of an electric bus is approximately three times that of an ICE bus, not including the charging station. This has created uncertainty among the independent contractors who are concerned that higher electric bus costs will have to be passed on to customers.

Although the biggest cost-driver for the new buses are the lithium-ion batteries, as battery technology improves each year, extended driving ranges between charges will lead to more affordable buses.

The other major cost-driver is the density and weight of the bus itself; the outside shell is constructed mostly of welded steel sheets with minimal riveting. Built to government standards, school buses are considered the safest passenger vehicles on the roads today because they are the most-regulated vehicles (NHTSA n.d.)

It may be necessary to install electric transformers to renovate facilities to accommodate multiple charging stations. The utility might eventually pay contractors who utilize the V2G technology for the right to use their school buses as a "grid asset" (Clukey 2019).

Draft your own RFP detailing electric bus specifications or use your state's procurement contracts as examples; many states are now including listings of EVs. By reviewing contract bid documents, you will better understand the scope of electric bus procurement.

Consider your bus routes. Before procuring your electric bus, determine how it will be assigned in your fleet. Are your buses driven one, two, or three tiers to and from school in the mornings and in the afternoons? The number of tiers affects the safe driving range of the bus. Manufacturers provide estimated mileage before recharging for each of their models.

When writing your bid specifications, remember that any additional feature that requires use of electricity could lower the bus's driving range. Although manufacturers consider air-conditioning units to be an add-on to the bus's basic sticker price, many states require school buses to be air-conditioned, making it a feature that requires additional electricity

Train your drivers and mechanics. Include in your bid specifications a requirement for the contractor or manufacturer to provide adequate training for bus drivers and mechanics, including techniques for maximizing efficient power usage.

Mechanics will continue to do tire rotation and wiper blade replacement, but electric buses do not require diesel, oil, belts, or air filters. The financial services firm UBS commissioned a "teardown" analysis of a popular EV and determined it had 80% fewer moving parts than a comparable ICE powertrain vehicle. With improved technology and design there will be greater powertrain integration leading to even fewer parts (Chatelain, Erriquez, Mouliere, Schafer 2018).

Install charging stations. The expense of diesel fuel may become obsolete, but somebody must pay the electric bill. The current "fast-charging" systems can recharge a bus battery in approximately three hours—but at a price. Weekday "on-peak" electric rates are generally higher than night and weekend "off-peak" rates. Work with your utility supplier to avoid "demand charges" or temporary spikes in the rate charge during the brief time in the late morning when you are recharging bus batteries. If you contract-out busing services, the bid specifications should clearly articulate the contractor's obligation and cost commitment for recharging.

If you are starting out by acquiring only one electric bus, an electric contractor can install a bus charging station on a pole or a building's exterior wall. As you acquire more electric buses, you can build charging stations in school or municipality parking areas. Further expansion would justify hiring an architect to provide plans for a more expansive bus yard layout; this would constitute a capital project. Perhaps your municipality would partner with your district to provide electric service for the buses and numerous other soon-to-be acquired electric vans and trucks.

In Conclusion

As diesel buses wear out or become obsolete, districts will replace them with electric buses. Greenhouse gas emissions will be sharply reduced, making for healthier air for everyone to breathe. And as Darlene Steward, an engineer with the National Renewable Energy Laboratory in Colorado shared, "Eventually, 'electric buses' will just be called 'buses'" (Clukey 2019).

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