... Seeing Both Kinds of Green: An Analysis of the Benefits

Recent analysis by Itron has given added detail to the cost benefits of optimized EV charging. "We took a school bus use case and dove into the details to quantify the benefit of managed charging for both the end customer and utility," says says Mark Braby, head of eMobility, payments, data for Itron.

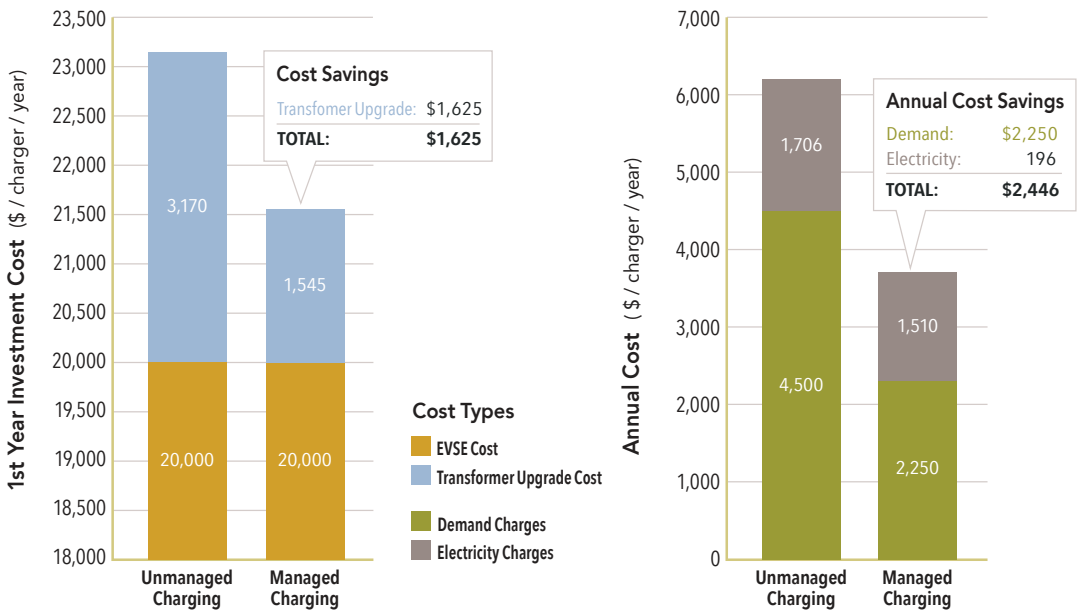

Figure 2. Managed EV charging saves the fleet owner over $244,000 annually and minimizes up-front costs. Itron's projection shows that smaller equipment, less maintenance and off-peak pricing combine for an impressive 38% benefit over the lifespan of a 100-bus fleet and its 100 chargers.

Itron's analysis looked at a 100-vehicle fleet of school buses that serves a standard high school. Its commonsense assumptions about charging drew directly from current practices. For example, most school districts fuel and store buses overnight in centralized facilities. The unmanaged scenario assumes the same practice, with drivers parking their buses in the lot upon completion of their routes in the afternoon or early evening. Instead of gassing up the buses, though, operators plug them in before departing for the day. The bus batteries begin refueling immediately, and they continue at a standard flow until they reach full charge.

Itron performed the analysis based on the bus depot being serviced by a large public utility in California. "In terms of impacts on distribution systems, solar panel use and other aspects, our use case is a great proxy, since it signals the direction the entire country is going," says Braby. Analysis of four other representative utilities confirmed the findings.

Unfortunately, typical school bus plug-in time coincides with peak energy demand across American municipalities, when grids strain under pressure and electron flow is at its costliest. Furthermore, this is typically the time that solar generation starts to wane as the sun sets. All plugged in at about the same time, the buses place additional burden on generation, transmission and distribution capabilities. Their batteries' rate of charge is standard, no matter the strain on the grid or the cost of the electricity. Each bus stops charging when it has reached a full charge, typically in the middle of the night, when electricity is cheapest.

In contrast, managed charging automates and optimizes overnight bus charging. Although buses plug in during the grid's peak-demand period, they do not begin drawing electricity then. (In fact, school districts could provide their buses' excess battery-stored electricity during this time as an added benefit to both them and the power company.) Buses wait to charge off-peak, at significantly cheaper rates and less stress on the grid. They fill up slowly and

deliberately, cycling through in a way that places less stress on batteries and district-owned charging equipment. Charging management algorithms ensure that buses have enough charge and are ready for their morning routes.

"We knew that managed charging would make a difference," Braby says, "but we didn't know how much of a difference." By using a smart charging management system, the representative school district could meet its needs with a smaller, less expensive transformer. Installing a 1650 kVA transformer instead of a 5000 kVA transformer gleaned an initial $162,500 in savings (accounting for hardware and wiring costs, but not costs such as site surveys or grid impact assessments).

The school district saw continuing benefits, too. The smart charging software refueled batteries when electricity was plentiful and inexpensive, saving approximately $244,000 annually ($2,440 per vehicle). This represented a 38% benefit in savings versus unmanaged charging, as shown in *Figure 2*.

This use case, which assumed one EVSE charger per EV bus, provided impressive numbers. Itron modeling showed that plugging multiple buses into the same charger provides further up-front savings.

Itron analysis showed that utilities, too, enjoyed significant cost avoidance. When the school district outfitted its 100-bus depot with a smart charging management system, the utility saved approximately $60,400 in costs annually or $604 per charger per year, as *Figure 3* shows.

Those savings accrued from reduced distribution infrastructure ($16,000 per year), reduced cost of distribution maintenance and replacement ($9,000 per year) and a lower need for electricity ($198,600 per year). Managed charging can save utilities more than 20% a year through targeted grid infrastructure investments and ongoing management.

These benefits are enhanced when an EV fleet's charge optimization platform shares data and cooperates with the utility's grid optimization platform. When that level of system-to-system collaboration occurs, both parties will realize even greater value.

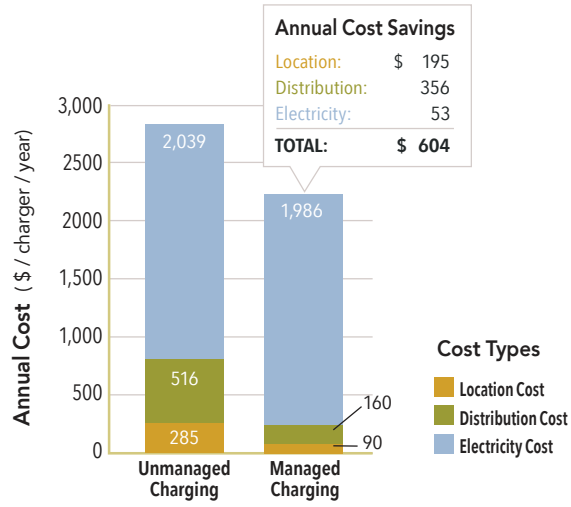

Figure 3: Managed EV charging saves the utility over $600 per charger per year. Itron's projection shows that the utility benefits from both decreased operations and maintenance costs and less-expensive grid components.

Keeping Them on the Edge of Their Fleet: Conclusion

As EV technology continues its advance in American households, it is breaking into the commercial and rental fleet word. Although some fleet owners may purchase the same EVs as households do, how EV-owning businesses refuel those vehicles involves a decidedly different level of consideration.

Companies considering full-scale EV adoption already know the benefits of EVs themselves, among them lower cost of ownership, environmental benefits and increased social capital. But those companies leave money on the table if they procure the basic vehicles and charging equipment, yet fail to carefully consider the process of charging itself.

The best circumstance is one where fleet-operating companies and utilities start talking well in advance of EV procurement. This scenario allows both to appropriately locate and size infrastructure to provide the charge the companies will need while enhancing grid stability. Stakeholders can agree on charging protocols and ways DERs may contribute to grid capacity during peak demand.

After facilities have been built and EVs have been bought, fleet owners' and utilities' optimizing platforms collaborate on a managed charging profile that minimizes battery and equipment degradation, saves maintenance costs and allows EVs to draw electricity when it is most plentiful and least expensive. When that level of cooperation is achieved, we will live not only in a cleaner world, but also a more profitable one.