



ELECTRIC VEHICLE CHARGING INFRASTRUCTURE: THE ATLANTA EXPERIENCE



ELECTRIC VEHICLE CHARGING INFRASTRUCTURE:

INTRODUCTION

In August 2015, Atlanta Mayor Kasim Reed announced that the city would deploy one of the nation's largest municipal fleets of electric vehicles (EV). The measure is part of Mayor Reed's agenda to ensure that Atlanta is one of the nation's leading cities for sustainability, and will reduce the city's dependence on fossil fuels while saving taxpayer dollars. Through an innovative public-private partnership, the City of Atlanta developed an inventive financing structure that bundles together all the expenses of purchasing, fueling and maintaining the electric vehicles into a guaranteed rate that costs less than conventional vehicles.

By the end of 2016 the city will have deployed 60 new electric vehicles in total. The EV fleet will consist of Battery Electric Vehicles (BEV) models, such as the Nissan Leaf, which run on electricity 100 percent of the time and Plug-in Hybrid Electric Vehicle (PHEV) models, such as the Chevy Volt and Ford Fusion Energi, which are capable of operating solely on battery power while also including a conventional gasoline engine that is integrated with the electric drive system.

In order to power the electric drive vehicles, they must be charged by an electricity source. The installation of charging infrastructure, also known as Electric Vehicle Supply Equipment (EVSE), is critical to the successful integration of EVs into any fleet. Atlanta's experience illustrates the myriad scenarios a fleet could encounter when developing and installing charging infrastructure. This case study is intended to help readers think through their own logistical scenarios and to help them prepare a thoughtful infrastructure rollout plan.

EV CHARGING INFRASTRUCTURE: PROCESSES AND COSTS

Developing charging infrastructure for electric vehicles is both an art and a science, with each installation done on a case-by-case basis. Primary decision points relate to the locations and number of charging units to be installed, in addition to the power level of the chargers. Additional considerations include whether or not the station will be for private use (e.g. restricted access for fleet vehicles only) or public use available to other EV drivers, what kind of driver outreach and engagement will be done, and whether or not the fleet will utilize data collected from the charging infrastructure. The last point refers to the decision whether to install "dumb" EV chargers versus "smart" EV chargers, terms which are used to describe if that specific charging station is connected to a network. If the station is connected to a network (smart charger), it will include some software management capabilities which may include pricing, billing, and/or demand management. If the station is not connected to a network (dumb charger), it will be a stand-alone station that does not generate data or monitor any usage, and merely charges the vehicles.

DATA COLLECTION

While considering its own charging infrastructure, the City of Atlanta opted for dumb chargers, primarily due to cost and because the city had another way to monitor the data of electric miles. Atlanta's EV program contractor monitors the charging as well as the usage of electric miles versus gasoline miles through telematics, allowing the city to opt for the cheaper dumb charger option. Besides cost, this also allows Atlanta to manage both the charging and the use of electric miles to ensure the vehicles are performing as intended and to make changes, where necessary, to educate city employees on usage and etiquette when it comes to electric vehicles and using charging stations. The use of telematics was part of the contract as a cost-effective and data-driven route for the City of Atlanta.



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COSTS

This contract also dictates how the City of Atlanta would be funding these charging stations where it has committed \$3,000 per charging station. The average cost of installing a level 2 charging station that is not connected to a network is \$2,000 whereas a level 2 charging station connected to a network is an average of \$4,000. The City of Atlanta made a cost commitment at the mid-point of these two cost averages, and this was a big reason why the city went with dumb chargers on top of the telematics from the contractor.

PUBLICLY ACCESSIBLE CHARGING STATIONS

Publicly accessible charging stations have the most factors to consider when it comes to station use. For example, the first decision a municipality has to make is if it wants to charge users of the charging station at all. A municipality can put in public charging infrastructure itself or encourage utility companies to install it, but their utility company would then have complete control of the station, which would include setting the rates and fees that the consumer would pay. The ultimate factor of whether it will be a station where payment is required is based on who owns the station itself. If the City of Atlanta owns the charging infrastructure there will be no fee attached for public use if it is available to them, but if a business, utility, or enterprise, like Hartsfield-Jackson International Airport, owns the infrastructure then that will be at their discretion. In the case of Atlanta, the city did not want to charge a fee for the use of charging stations put in for the employees that will be using the city's electric vehicle fleet. Usually publicly accessible charging stations that have a fee, that is also charged on an hourly rate for use, are put in by businesses or utility companies and they are connected to a network for monitoring which is run by companies like ChargePoint, EVgo, Tesla, or GA Power, a subsidiary of Southern Company, in the case of Atlanta.

In the end, both private and publicly accessible charging infrastructure will require a variety of decision points prior to installation. The sections below detail logistical considerations specific to Atlanta and illustrate scenarios that fleets could encounter.

DEVELOPING THE EV CHARGING INFRASTRUCTURE

In order to install charging stations, sufficient electrical capacity is necessary to support the number of charging stations needed to fuel EVs at a specific location. That capacity is measured in amperes (amps). The amount of amps that is needed for the breaker to handle a level charging station will vary based on the total watts used. Imagine these in terms of an interstate where the amps are the number of lanes, the speed limit is the voltage, and the cars are electrons. We are building a highway of electricity from your building to your employees' electric vehicles and there needs to be a sufficient amount of lanes. For example, 60 amps is the minimum for 24,000 or fewer watts and the 225 amps is the minimum for 108,001-123,000 watts. The minimum amps requirement will be no less than 60 amps and no more than 225 amps for level 2 charging stations and that will vary from site to site. There is more information and specifics for watts used and amps required at energy-center.org. There are three different levels of charging stations for PHEVs and EVs:

- > **Level 1 which is 110 volts (typical household outlet) takes about 8-9 hours for a full charge**
- > **Level 2 which is 240 volts and takes about 3-4 hours for a full charge**
- > **DC Fast Charge takes about 40-50 minutes for a full charge**

A municipal fleet will need to do a careful analysis of its sites to determine which charging stations are needed. The City of Atlanta determined what level station to install based on the work schedules and patterns of the employees at the respective sites. These vehicles were assigned to administrative duties and miles traveled on a daily basis to make sure that the City of Atlanta and its taxpayers are getting the most out of their dollars being put towards this program. The City of Atlanta has installed level two charging stations at its sites due to the work schedules of its employees who are utilizing the PHEVs and BEVs. They charge the vehicles overnight and/or during the day; a municipality will need to figure out the best charging station based on their own needs.



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WATERSHED AND EMPLOYEE PSYCHOLOGICAL SERVICES AT 72 MARIETTA ST

This site has completed the installation of three level 2, dumb (not connected to a network) stations. Figure two and the picture above the conclusion are pictures of 72 Marietta St. after installation. This site provided only minor logistical challenges, making it relatively easy to adapt and quickly install charging stations. Originally, Atlanta looked at placing the charging stations next to the door at a rear entrance to the building. However, that location was directly adjacent to an ADA Van accessible parking spot. If charging units had been installed here, persons using the handicap parking spot would potentially have had to walk or roll over the charging station cords. Also, in order to add conduit to bring electricity to this location, the installation would have had to cut through concrete and avoid water pipes beneath the spots. For these reasons, alternative parking spots were chosen.

This location sits underneath a viaduct near active rail lines running through central Atlanta. As such, the electrician decided to run the conduit along the viaduct support beams, negating the need to cut through any concrete. This made it easier to add the charging stations to a small extension of the building. Two stations were added in the far corner of the building extension and an additional station was added on the other side of the parking lot on a pedestal.

This site has an additional opportunity to add another port on the pedestal through power sharing which would cut the 30 Amps in half to allow to 15 amp ports to charge the vehicles. This is ample power for a PHEV or an electric vehicle charging overnight.

ATLANTA WORKFORCE DEVELOPMENT AGENCY (AWDA) AT 818 POLLARD BLVD

This is one of Atlanta's most preferred locations for charging stations, because of its prime location. Figure one is aerial view of this location. As a workforce development site, this facility is highly visible to numerous low-income residents, presenting a good opportunity for outreach related to new vehicle technologies to an under-served portion of the community, which is aligned with Atlanta's priority to provide equitable transportation options to all residents.

However, the 818 Pollard site has many logistical issues. The main breaker is in the basement and has 200 amps of power, but 150 amps are being directed elsewhere. That only leaves 50 amps for the two proposed charging stations at this site which falls below the minimum 60 amps. The 50 amps are not enough to power those stations and if this site does not have other power sources then Atlanta will look at other sites for these charging stations because this location requires 200 amps. Other options are currently being determined by electricians at the present moment.

Concerns have been expressed about security at this location, having experienced break-ins in the past, which had an effect on the potential location of the charging stations (labeled by the colored ovals). AWDA's preference was the yellow oval, so that the vehicles and charging stations were in view of security cameras and the security team. However, this option was going to be very costly. The electrician would have had to cut through concrete and asphalt to lay the conduit down, passing through a one-way lane that would have disrupted daily operations. Another location considered was the red oval, this was the least preferred site due to a lack of cameras, security personnel, and heavy foot traffic on that side of the building. The green oval was ultimately selected as the best location for charging stations.



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This location does provide its own challenges. Those parking spots are currently executive parking spots, which would have to be located elsewhere to make space for the electric vehicles. However, the biggest challenge is the cost associated with this site in general. The selected location is about 75 yards away from the main entrance and from there the main breaker is further down in the basement. This requires boring through thick concrete and the possibility of running the conduit through a daycare center located on the first floor next to the main entrance. After running the conduit up from the basement, down the hallway, and through the daycare, there is still 75 yards to go. This could include more boring through the exterior support beams, trenching through the soil, and finally cutting a small slit in the concrete in front of the executive spots to place the charging stations.

Overall, the costs have been increasing at this site because of these logistical hurdles, likely adding at least \$5,000 to the project cost. Currently, the City of Atlanta has a contractual stipend of \$3,000 per charging station. The 818 Pollard Blvd site is going to cost around \$8,000 in total. Since the city plans to add additional ports in the future at this site, the additional costs may be worthwhile. With the electrical supply infrastructure in place, adding additional units (estimated at \$300 each) would improve the economics of this installation. Adding three additional units would even out the overall cost per charging station.

From the city's perspective, there were two major lessons learned from this location. First, intangible benefits like visibility to the community must be weighed with known costs. While difficult to equate real costs to them, the intangible benefits may have a large impact in certain scenarios. Second, policies and incentives to encourage real-estate developers to include "EV ready" electrical infrastructure in new construction is vital to a city's ability to adapt to new and emerging technologies. Both items should be a key component to a resilient, sustainable, 21st century city in the United States.



Figure 1



Figure 2

ELECTRIC VEHICLE CHARGING INFRASTRUCTURE:

DEPARTMENT OF WATERSHED MANAGEMENT AT 651 14TH ST

This site is one of the most ideal locations for charging infrastructure; there are multiple sources of power and plenty of parking spaces which facilitate low installation costs. Figure three shows an aerial view of 651 14th St. The power sources are labeled by blue ovals and the potential locations for charging stations are labeled by green ovals. This site also has six PHEVs currently utilizing level 1 charging stations that the Department of Watershed installed themselves (labeled by orange oval). As the site used to be a mill the power sources have large capacities – at least 800 amps. The power sources are relatively close to parking spots and require minimal cuts into concrete and asphalt or trenching.

This site is ideal for EV charging station placement and was slated to receive six level 2 charging stations and additional EVs. The options and flexibility available at this site are its greatest assets. However, fleet management is concerned that the employees here do not drive the required mileage to make this a cost-effective placement for new EVs: 7,500 miles for BEVs and 10,500 miles for PHEVs. Every site has its flaws.



Figure 3

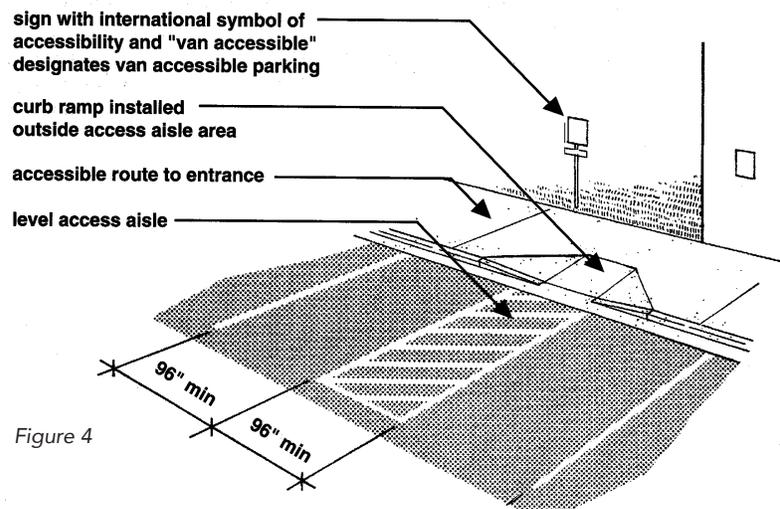


Figure 4

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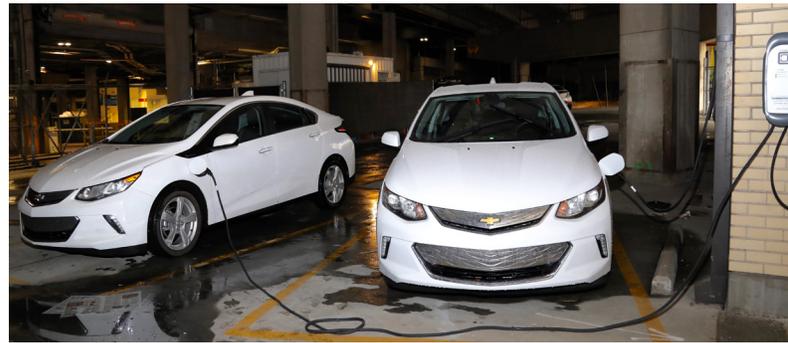
OTHER CONSIDERATIONS:

ADA COMPLIANCE

ADA van accessible parking spots must have 8 feet of space on the passenger side of the vehicle with a walkway to an ADA accessible ramp. The 8 foot requirement is to ensure 5 feet for a wheelchair to exit a vehicle and then have a 3 foot turning radius. When designing PEV charging stations, ADA compliance with parking spots is a necessary component to address when making changes to a parking lot. When selecting locations for your charging stations, do keep in mind of where the cords would lie, as they cannot be an impediment to foot or wheelchair traffic. Figure four is a picture of what an ADA parking spot looks like and its dimensions.

WORKPLACE CHARGING CHALLENGE

The City of Atlanta is a partner of the Workplace Charging Challenge with the U.S. Department of Energy (DOE). This past January, the City of Atlanta was placed 4th nationally for the DOE's Workplace Charging Challenge nationally. The goal of this challenge is to encourage employers, as they transition their own fleets to electric vehicles, to install charging infrastructure for the employees. This shows that the employer is forward thinking, being proactive with new technology, and being a leader in sustainability. This is important for us at the City of Atlanta because when we have had events for electric vehicles we have city employees express interest in purchasing one as their persona vehicle. We want to be ready and provide the needed infrastructure for our employees, current and future. Atlanta recommends that other municipalities join this challenge themselves and encourage other companies within their limits to do the same.



CONCLUSIONS AND TAKEAWAYS

There are many factors that go into selecting sites, including the number of current vehicles, electrical capacity, and mileage driven by employees. When a municipality decides to install charging infrastructure for its own fleet's use, there will need to be an analysis for each individual site. That analysis will include monthly miles traveled by employees, number of current electric vehicles if any there and ones slotted for that location, electrical capacity, and cost of the installation.

From the City of Atlanta perspective, there needs to be a good working relationship and communication between our Office of Sustainability and the other respective city departments including, but not limited to, Fleet Services, Finance, and Legal. Their active participation makes this transition easier and quicker as we make commitments for BEVs and PHEVs in the next 2-5 years. The city has also made it possible through a referendum that any new streetscape projects will include electric vehicle charging infrastructure. From our 818 Pollard Blvd site, municipalities need to be more active and engaged with adaptable buildings and structures for emerging technologies. That can allow a city or local government to bring in new technologies and companies while being proactive for its citizens, future and present.

Atlanta sees electric vehicles as an investment in the environment and reducing our dependency on foreign oil, while saving the taxpayer money over the coming years. We hope other municipalities will do the same and we look forward to providing more on our experiences with electric vehicle charging infrastructure.





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