

Liberty Plugins HYDRA-R: The Brookwood Atlanta, Georgia



Property Profile

The Brookwood has 219 residential apartment units and three underground parking levels for residents and two levels above ground for commercial tenants (Figure 1). The two charging stations (two plugs total) were installed in 2015 in the residential garages in shared parking spots. Charging stations are for the use of the residents only. The building currently has approximately 15 regular electric vehicle (EV) users.

The Brookwood was one of the first in the Atlanta area to install charging stations. Having charging stations at The Brookwood is a big selling point for attracting new residents and retaining current residents. The homeowners' association (HOA) board wants to stay ahead of the EV adoption curve, so the property will add more charging stations at some point. New residents have been trending towards younger residents, so more EVs are likely. The Brookwood did some futureproofing when they installed the two charging stations, by adding capacity/wiring for a 3rd charging station at the same time. Since the primary goal is to provide a service to residents and to recruit new tenants, residents are charged \$1/hour which is roughly covering the electricity usage costs. The Brookwood is not focused on making revenue from the charging stations.

The property has 33 guest parking spots, and management stated that it is rare to have all spots full. To date, the property has had no issues/complaints with not having enough guest parking and taking shared spots for charging.

Charging Barriers

Residents had initially requested the installation of charging in their individual spaces. However, this was not possible due to the cost and difficulty of getting conduit and wiring through concrete on the multi-level parking structure. The Brookwood conducted a lot of research on different technology solutions before purchasing. In pursuing a shared use arrangement, the ability to charge individual residents a fee for

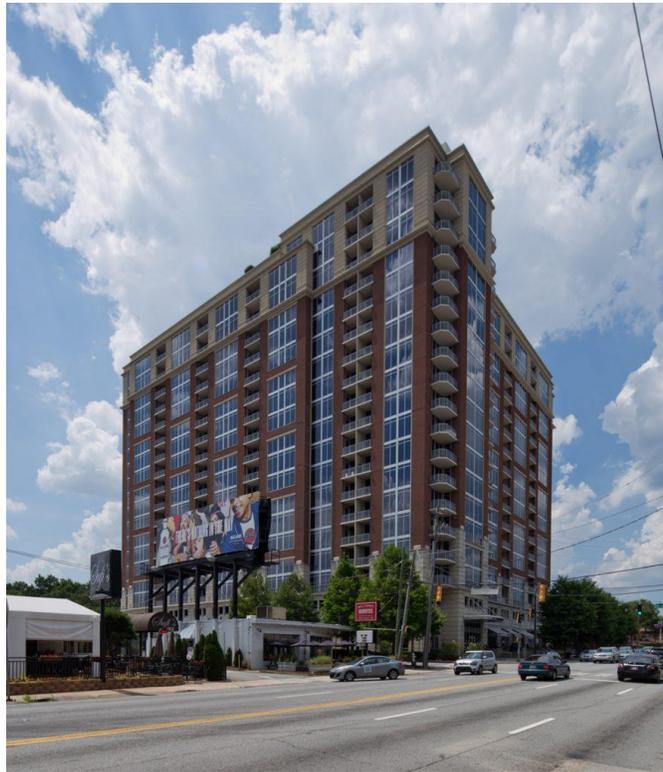


Figure 1. The Brookwood in Atlanta's Midtown-Buckhead neighborhood

charging was important. They also wanted options that provided flexibility to expand. And they considered both the hardware costs and the ongoing operational costs, including network fees. They found that solutions geared towards commercial public charging were more expensive than the Liberty Plugins solution using very low-cost stations. The local installation contractor was very helpful in securing incentives from Georgia Power and coordinating the permitting so the installation could proceed as quickly as possible.

Technology Solution Summary

In a typical charging station installation, each charging station requires a dedicated power line from the distribution panel to each charging station (Figure 2). Limited usage per charging station and conduit installation costs, in addition to electrical capacity upgrades, can be very costly. Unmanaged charging can lead to high demand charges when many vehicles charge at the same time (e.g., when many residents return home after work and immediately begin charging). Both can lead to high capital and operating costs.

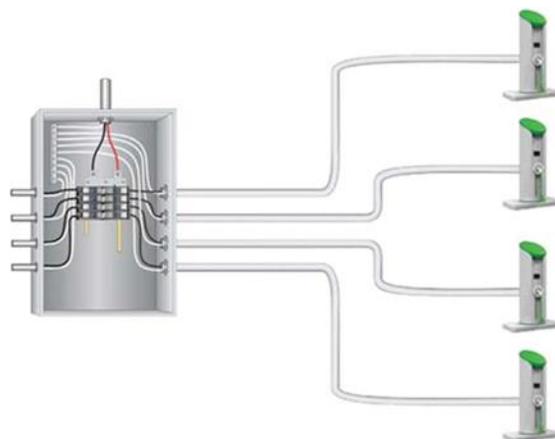


Figure 2. Typical charging station power wiring schematic

One solution approach to this barrier is Liberty Plugins’ HYDRA-R system (<http://www.libertyplugins.com/products/hydra-r-multi-charger-control-system>) that electrically connects/multiplexes up to 10 charging stations to share a single electric power line (Figure 3). The HYDRA-R switches power to the multiple connected charging stations in a “round-robin” scenario, with power incrementally rotating on a programmable timed basis to each vehicle to manage the load and limit the load below the threshold.

Although not currently utilized at the Brookwood, the multiplex systems will allow for the installation of more stations in the future using the same electrical capacity. Multiple HYDRA-R units can be installed at a single property (adjacent to each other or at different locations) as more charging stations are needed/installed. The HYDRA-R controls the charging stations via a relay meter module to turn the charging stations on/off via Open Charge Point Protocol commands. The HYDRA-R activates the charging station and, if the vehicle is charged (low/no power

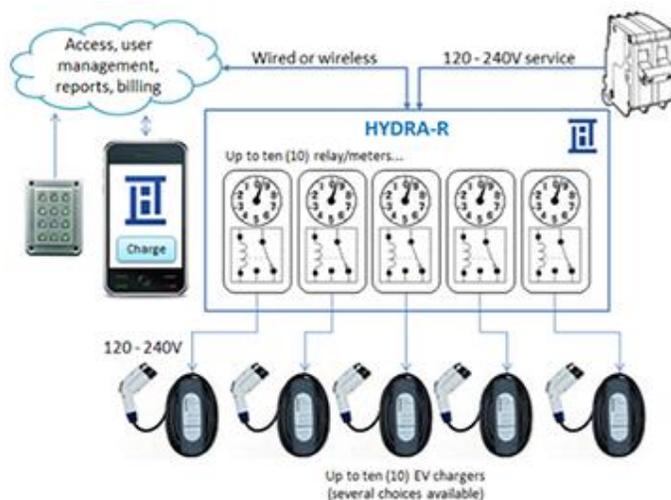


Figure 3. Liberty Plugins HYDRA-R charging station power wiring schematic

demand), the system moves on to the next vehicle in line. When charge is needed it turns the charging station on/off based on the algorithm. The simple approach enables the system to control any charging station. This allows multi-unit dwelling (MUD) properties/users flexibility to select the charging station that best meets their requirements (cost, design, etc.). This includes low-cost non-networked charging stations. The HYDRA-R can be paired with charging stations of any type and from any manufacturer. The HYDRA-R's utility grade electric meter enables the collecting of usage data on each charging station. The result is, the HYDRA-R upgrades the functionality of quality of low-cost, non-networked charging stations into full-feature "smart" charging stations.

There are several HYDRA-R access control options including: mobile app, an RFID tag, a building access card (The Brookwood's selected approach), or a central keypad (user assigned fixed PINs). The system does not notify users (e.g., by mobile app) when their session ends, or the battery has a full charge. However, most modern EVs have a mobile app from the vehicle manufacturer that has this feature, so Liberty relies on this functionality. Notification is useful for shared charging station applications like The Brookwood to encourage users to move their vehicles to 1) open the charging station for others, and 2) avoid idle fees (if the MUD property opts to use this feature).

The HYDRA-R system is also able to react to utility programs and rate structures such as high time-of-use rates, demand charges, or more complicated Open ADR commands from the utility.

Liberty stated that the on/off cycling control method is sufficient and well-received by customers in long-dwell parking/charging applications like MUDs. Liberty has seen that average daily charge times for early generation EVs (e.g., first generation Nissan Leaf) were consistently approximately 2.5 hours/day, while newer higher driving range EVs may only charge every few days.

Each HYDRA-R connects to Liberty Plugins' data service via a smart gateway through an internet connection (ethernet, cellular, Wi-Fi, Bluetooth, etc.). MUD properties frequently have concrete parking structures (above or underground) so poor network signal often requires expensive networking equipment to boost/relay signal around the garage to the charging stations. **A key Liberty Plugins innovation is its use of Bluetooth to connect to a driver's phone, via the Liberty Plugins app to the charging station.** Charging station data transfer, charging session history, billing, utility pricing signal, etc. are transferred between the devices when the user's cell phone has a cellular network connection (then or later). The result is simpler installation without network requirements – the site only needs to mount the charging station and connect power.

Liberty Plugins' data visualization dashboard displays the system status, usage, totals, etc. Data can also be downloaded for analysis by the property. The data portal provides access to and combines all Liberty devices installed at a property/account together for easy MUD Property Manager usage visualization, oversight, and management.

Charging Analysis

The Brookwood supplied data for 2019 and 2020, totaling more than 12,000 kilowatt-hours (kWh) of charging across 27 unique users. Charging sessions averaged approximately 11 kWh with, on average, 2-3 sessions per day. It is anticipated that newer longer-range vehicles will charge less frequently. But these longer range (higher battery energy capacity) vehicles may have longer dwell times. The result is that they could have fewer, but longer charging sessions. As shown in Figure 4 some days showed up to five sessions by unique users, and those days had the highest average energy use, at 77 kWh.

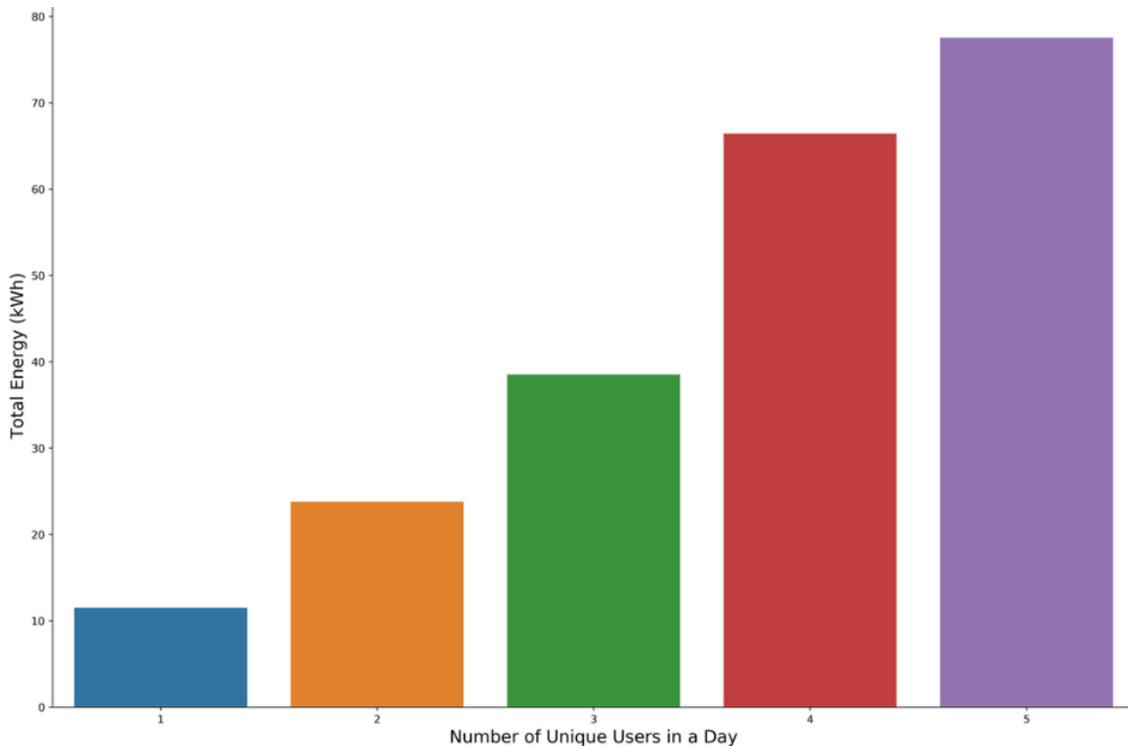


Figure 4. Average total energy by unique users in a day at The Brookwood

Looking at the maximum energy use days, total usage topped 100 kWh with 3, 4, and 5 unique users. However, on all the maximum use days, one user accounted for approximately one half of the total energy use, as shown in Figure 5. This, along with many days showing very little charging activity, indicates that some drivers of long-range electric vehicles would wait until they were at a lower state-of-charge before plugging in. Given the longer ranges of many newer all-electric vehicles, the less frequent but longer charge times will probably become more common.

Figure 6 shows total charging time by user. From this graph it is apparent that a few users made most use of the charging. The lower use users may indicate people who have access to workplace or other public charging, or residents with occasional EV driving guests.

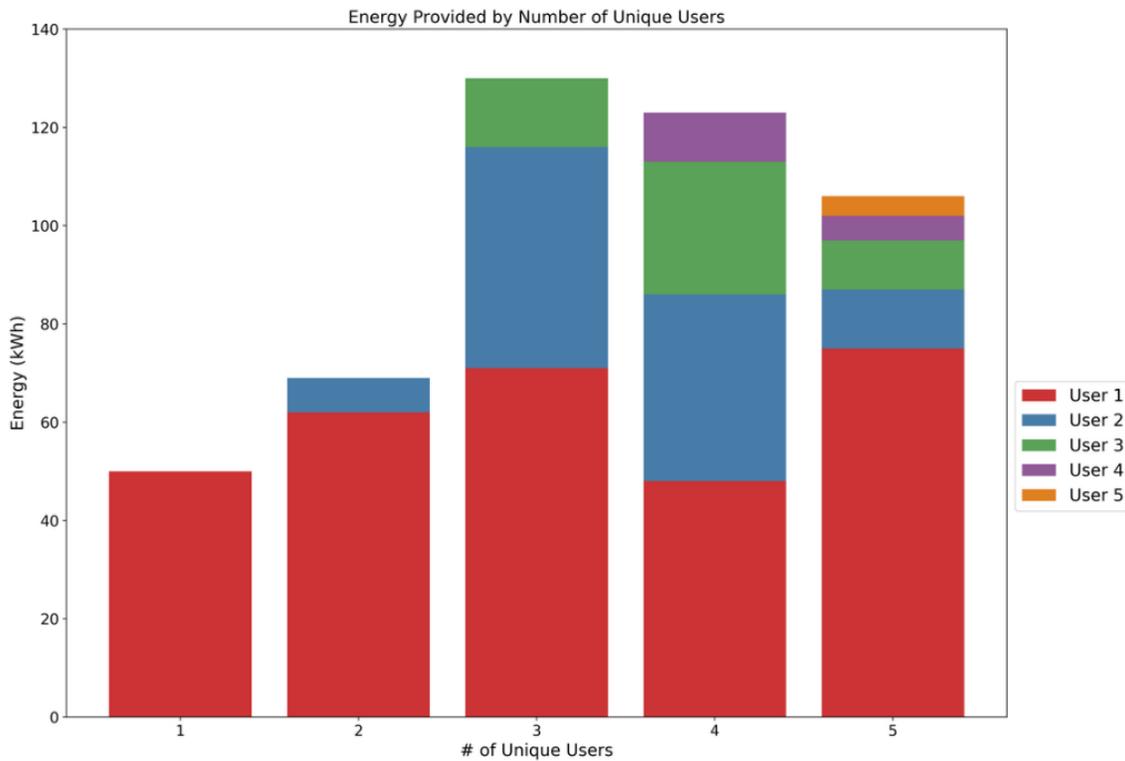


Figure 5. Maximum daily energy provided by number of unique users at The Brookwood

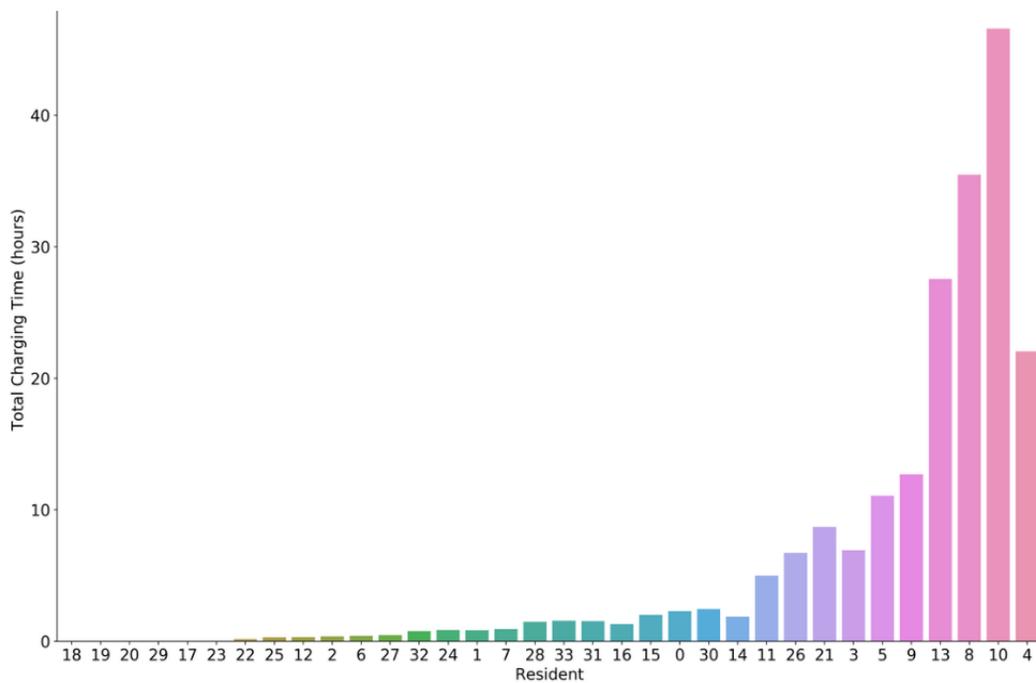


Figure 6. Unique resident charging times at The Brookwood. Each bar represents the total time spent charging by one unique user

Business Case Analysis

Liberty Plugins' service fees to the MUD property are \$35/month per HYDRA-R unit + \$8/plug/month. Liberty Plugins does not charge a fee for access to charging data. Demand response/load management functionality is also included in the standard service fee. The MUD property sets the usage cost as they wish to (\$/kWh, \$/session, \$/time, \$/session, etc.).

Liberty Plugins has several business model/billing options to meet customers' needs, the most typical options are: 1) users pay Liberty Plugins via the app and Liberty Plugins reimburses the MUD the amount collected, less the monthly service and transaction fees, or 2) users pay the MUD property directly and the MUD property pays the monthly service fees to Liberty Plugins.

The property management handled billing manually at the start. Residents deposited funds into a debit account to pay for their charging station use. They had to manually add funds to the account when it was low, so it was challenging for all parties. To simplify the process The Brookwood may migrate to an auto-billing method to each residents' debit/credit card.

Unlike some other charging vendors, Liberty Plugins does not own the accrued low carbon fuel standard (LCFS) program credits that are created (where relevant). Liberty Plugins does track LCFS credits and can monetize the credits and reimburse the MUD for them, if desired.