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ECEP 480 Solar Energy Engineering

Assignment 1: Charging Station Research

As part of a larger initiative with the Department of Energy, ORNL (Oak Ridge National Laboratory Campus) the State of Tennessee, the Tennessee Valley Authority, and Nissan. Provided architecture and engineering services for the Electric Vehicle Charging Station shown in figure 1. Opened in May 2011, the charging station is the first of its kind in the region providing space for ORNL to charge electric vehicles on campus, and to provide energy back to the ORNL gird.

The EV charging station has these major components.

* The electric vehicle supply equipment (EVSE)
* The Charging station provides solar-assisted charging for up to 25 vehicles.
* Solar canopy that provides energy to the grid
* Battery and data collection
* Communication equipment

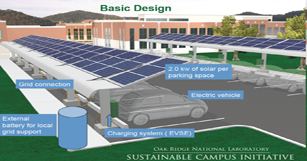


Figure 1: ORNL’s Electric Vehicle Charging Station [1]

The charging stations main component the EVSE is what really makes the system special. Using the AC output, the system can charge a fully drained battery in 6 to 8 hours or, using DC output, charge up to 80% of a vehicle battery in just 30 minutes. Not only is the system have efficiency in mind but also safety, the chargers are equipped with safety and efficiency features such as interlocks that prevent a car from being driven while plugged in and connectors that de-energize if improperly latched or subjected to strain.

The solar canopy consists of a 47kW PV solar array mounted above the charging stations allowing the vehicles to be kept cool in the shade. The DC electricity generated by the solar array is converted to AC power by an inverter and delivered to the ORNL power grid.

The energy that is obtained by the PV array isn’t directly fed to the chargers, but instead the annual efficiency is actually greater by feeding this energy back to the grid. It is enough to offset the electricity required to drive a Nissan leaf or similar vehicle approximately 10,000 miles. The station’s 84 kWh battery bank does not store energy generated by the solar array. Instead, it acquires energy from the grid and functions as a supplement to the charging stations in periods of peak demand, to reduce strain on the system and suppress surge demand.

The most interesting part about this design to me, is that it is functional while at the same time trying to make the charging process as efficient as possible. By using the PV solar array as a canopy for shade while providing energy back to the grid, while taking energy to charge the cars from the grid. This way the process of charging the cars can be quicker while at the same time supply energy back to the grid offsetting every cost. Another feature that I found to be very interesting was the ability to operate by radio frequency identification cards, which are like credit cards.

References

[1]"ORNL’s Electric Vehicle Charging Station," in *Sustainability at oak ridge national laboratory*. [Online]. Available: https://sustainability-ornl.org/Pages/ElectricVehicleChargingStation.aspx. Accessed: Jan. 16, 2017.

[2]Administrator, "Solar electric vehicle charging stations," 2014. [Online]. Available: http://www.bargewaggoner.com/index.php/component/k2/item/145-solar-electric-vehicle-charging-stations. Accessed: Jan. 16, 2017.

[3]"Giving back - ORNL review Vol. 41, no. 1, 2008,". [Online]. Available: http://web.ornl.gov/info/ornlreview/v41\_1\_08/article11.shtml. Accessed: Jan. 17, 2017.