

Using Brookhaven National Laboratory's electric vehicle fleet as grid support

Yao Aleke, Engineering Science, Suffolk County Community College, Selden, NY 11784

Rebecca Borrero, Physics & Engineering Physics, Fordham University, Bronx, NY 10458

Raul Martinez, Electrical & Computer Engineering and Computer Science, Syracuse University, Syracuse, NY 13210

Michael Villaran, Sustainable Energy Technologies, Brookhaven National Laboratory, Upton, NY 11973

One of Brookhaven National Lab's (BNL) many research facilities is the Northeast Solar Energy Research Center (NSERC), which is a 1-MW photovoltaic (PV) research facility, with approximately 518 kW of potential capacity currently installed. It is currently used to test integration of high penetrations of solar energy into electrical distribution systems, while future plans include testing a wide range of new PV technologies. The most significant problem with renewable energy is that the energy supply is variable, and it rarely matches demand. This problem can be solved by storing energy when the energy supply is greater than demand, and drawing from storage when demand is greater than energy supply. Our project uses the concept of vehicle-to-grid (V2G) technology (using car batteries for grid support) to deal with this storage deficiency. We designed a V2G system that integrates NSERC's solar grid with three dual electric vehicle chargers that work with electric vehicles the lab already owns. The vehicles will store energy when NSERC's supply is greater than demand and distribute it back to BNL's grid when the demand is higher than NSERC's supply. After researching the capabilities of bi-directional electric vehicle charging stations, which can have power flowing into or out of the car, we developed a plan to connect three dual charging stations to NSERC's support building. Since V2G-capable charging stations are not common, our plan includes cost-effective modifications to the lab's electric vehicles to make them V2G-capable. This plan is discussed in further detail in our report. While doing this project, we learned the specifics of designing a V2G

system that integrates electric vehicles with a renewable energy source. Application of this research would support the Department of Energy's mission by contributing to our nation's energy security, and make the long-term goal of sustainable energy production more realistic by putting an energy storage solution within reach.