SENIOR DESIGN PROJECT: SOLAR CHALLENGE ABSTRACT

This team project centered around creating the most effective, commercial-scale photovoltaic (PV) system we could for the Auraria campus in Denver, Colorado, as part of an annual challenge from the National Renewable Energy Lab. Solar power generation is one of the most widely used renewable energy sources in the world. For applications in commercial markets, the implementation of PV is non-trivial in that system control optimization can account for a large percentage of economic viability. The objective of implementing a commercial scale PV system for a campus was driven by economic viability via control optimization. The main parameters of optimization used were Number of Cells/Configuration, capacity and style of energy storage, and control of battery charging and discharging.

PV modeling software solutions such as S.A.M. (system advisor model) and Aroura were used to iteratively test design solutions. Major portions of the learning done in this work were through iterative problem solving. Major design hurdles were crossed by proposing unique solutions and modeling via the mentioned software. General models were made and then modified to quickly iterate through these proposed design solutions. For commercial applications where power is generally charged at a flat rate, it was found that some known strategies of system optimization such as “peak-shaving” yield less benefit than in cases where more complex rate structures apply. This led to the minimization of battery storage capacity and more of a focus in increasing grid robustness by targeting demand spikes. Though this simplifies portions of the control model for the team, it removes the possibility for some novel design strategies. The implementation of a more complex rate structure will potentially yield room for better design strategies and larger savings for the customer.

Auraria Photovoltaic (PV) System Power Generation and Storage System Optimization