ABSTRACT

DECISION SUPPORT ANALYSIS FOR A RENEWABLE ENERGY SYSTEM TO SUPPLY A GRID-CONNECTED COMMERCIAL BUILDING

This thesis studies the integration of a solar concentrator photovoltaic array (CPV) system with a commercial building. Solar resource conversion, load characterization, power quality, and grid integration are the primary aspects addressed by the study. Local solar radiation and renewable energy source (RES) conversion data were used to determine a profile for annual energy production of the CPV, which uses a non-traditional method of solar energy conversion. The load was characterized by creating an annual profile for the building's power demand using a combination of historical monthly billing data and a week of detailed real-time power consumption data (real, reactive, and apparent). Various simulation approaches were considered to evaluate the integration of system components with the supply grid. Because of the high time resolution necessary for the study, which evaluates a number of parameters that traditional methods do not address, a custom analysis was performed, both in time segments and total project lifetime figures. This quantifies, at one-minute resolution, the energy produced by the RES, consumed by the building, and metered to and from the supply grid.

The study concludes that the CPV system will make a valuable contribution to the energy supply, it can pay for itself in energy savings over a number of years, and it provides a substantial environmental benefit by reducing pollutant emissions. Financial considerations are dependent upon a number of variables, including the panel quantity, buy/sell prices of grid energy, project lifetime, financing options, and renewable energy credit programs.

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