UCR College of Engineering- Center for Environmental Research & Technology

Demonstration of High Penetration Solar in an Industrial/Research Building

UCR Sustainable Integrated Grid Initiative (SIGI)

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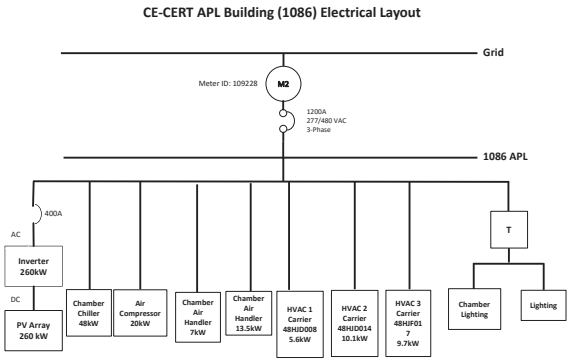
INTRODUCTION

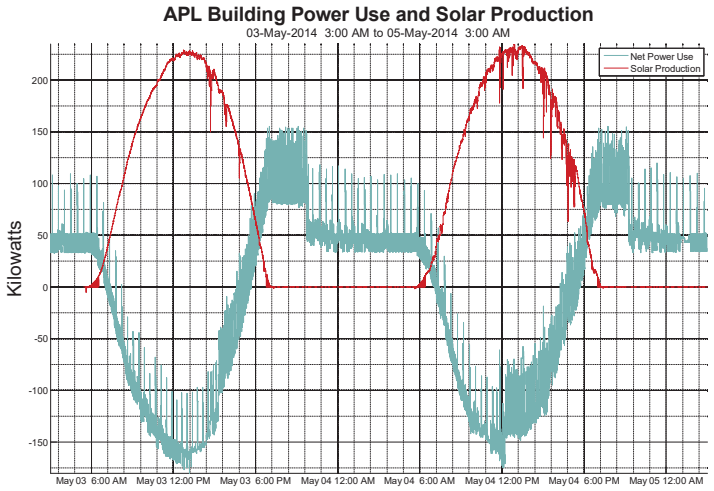
The Atmospheric Processes Laboratory(APL) is a research facility that studies the chemical processes in the troposphere using smog chambers. To simulate such an environment, lots of energy intensive equipment is used. This building has the largest electricity demand of the three buildings at CE-CERT. Photovoltaic generation is implemented to reduce the carbon footprint of the building and to reduce consumption of electricity from the utility company, reducing the cost of operation.



Inverters for SIGI Photovoltaic System

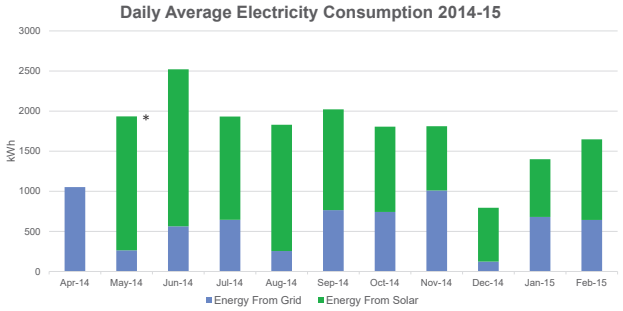
260kW of the 500kW photovoltaic generation capacity at CE-CERT is allocated to the APL building. The solar panels are connected to a grid-tied inverter so that energy production in excess of the building usage can be sent back to the utility company for later use. The rightmost inverter shown in the image services the APL building.

Photovoltaic Generation Over a Two Day Period



The data shows the net power use and the solar production of the APL building over a two day period in a weekend in May 2014. We can see that the solar production is greater than the building usage starting at approximately 6:30AM and ending approximately at 5:00PM during days with sufficient solar irradiance. Less energy is consumed during peak hours and is actually sent back to the utility company. The savings produced could be used to power the building during mid or off peak hours when solar production is low and the price of electricity is lower.

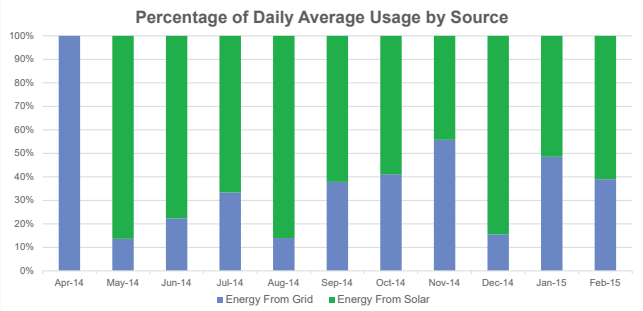
Daily Energy Usage by Source in kWh



This figure represents the daily average electricity use in kWh by the APL building during the various months of the year. The green portion represents energy from the solar system, while the blue represents electricity from the grid. As expected, both solar production and building use are much higher during summer months and lower during the winter months.

* SIGI Project started operation in May, 2014. Billing adjustment in the introductory months produced inconsistent usage data.

Percentage of Daily Energy Usage by Source



In this figure, the daily average electricity use during the various months are represented in percentages.

ACKNOWDGEMENT

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Conclusion

This project successfully integrated a 260kW solar PV system to a research building at UCR CE-CERT. Energy use data has been recorded and analyzed for approximately one year. The system sends power back to the grid during most of the working hours thereby reducing the usual afternoon peak electrical demand. However, a small peak is created at the end of the day when solar production is low. The net power use graph in the figure titled "APL Building Power Use and Solar Production" represents California's "Duck Curve" due to high penetration of renewable energy. A rapid ramp-up of remaining generators is needed to satisfy this new peak in California's electrical system.