UCR College of Engineering- Center for Environmental Research & Technology

SIGI Helps Riverside Public Utility During Peak Historic Demand

UCR Sustainable Integrated Grid Initiative (SIGI)

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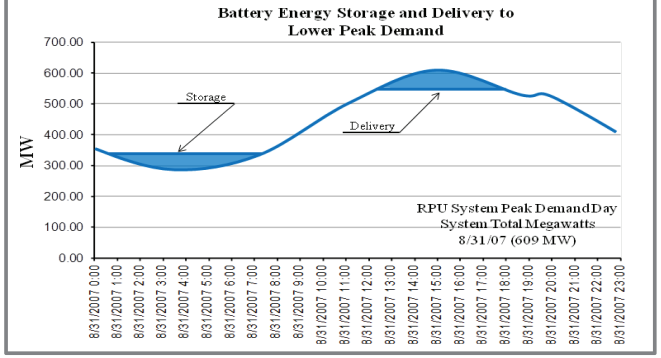
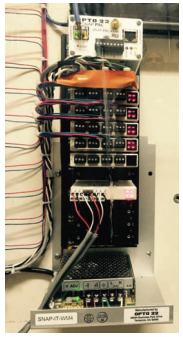
INTRODUCTION

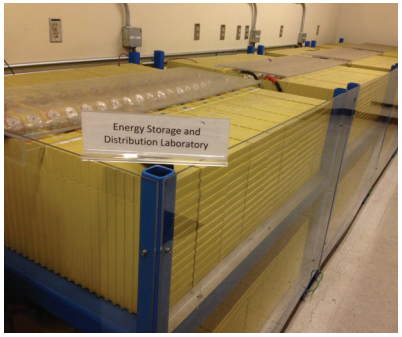
On Monday, September 15, 2014, triple digit temperatures lead Riverside Public Utilities (RPU) to reach a new all-time high electricity demand of 610 megawatts (MW). RPU sent out an appeal to larger customers to conserve electrical energy, especially during peak hours, 2pm to 5pm.



SIGI Renewable Energy and Energy Storage

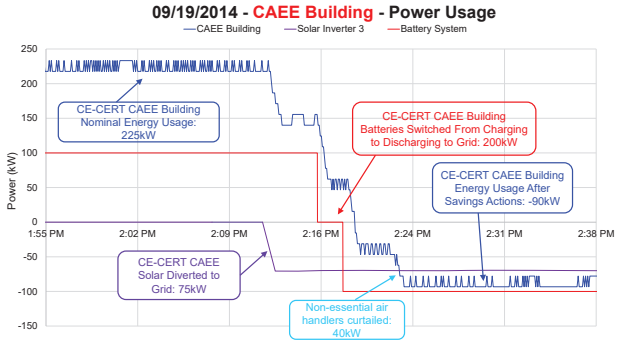
SIGI has flexibility to curtail power consumption by using photovoltaic generation, battery energy storage, and load control. There is 500 kW of photovoltaic power generation capacity distributed between the three buildings at CE-CERT. The administration building (1084) has an energy consumption scheduling system installed that controls large loads and 100kW of the PV capacity. The multidisciplinary research building (1200 or CAEE) has a 500kWh stationary electrical energy storage system that will store or discharge energy in response to a remote command or to a scheduling algorithm and 100kW of the PV capacity. The remaining 260kW PV capacity is allocated to the Atmospheric Processes Laboratory (1086 or APL). Additionally, 500kW of battery energy storage is installed in a trailer for mobile deployment.





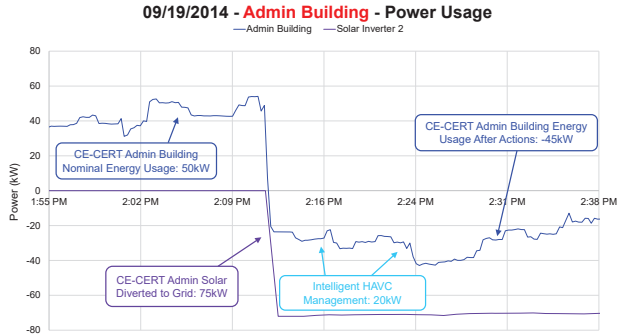
The load control hardware installed in the 1084 building is shown on the left. The 500kWh stationary battery energy storage system installed in the 1200 building is shown on the right.

SIGI Power Consumption Curtailment Actions (CAEE)



This figure shows the power usage of the CAEE building during the curtailment period on September 19th, 2014. This building has a nominal power usage of 225kW before any curtailment actions. First, the solar power was diverted to the grid, resulting in a 75kW curtailment. Then the battery energy storage system was changed from charging at 100kW to discharging at 100kW, resulting in a 200kW curtailment. Lastly, non essential air handlers were turned off to provide an additional 40kW of curtailment. Overall, this building had an approximate swing of 315kW and provided 90kW back to the grid.

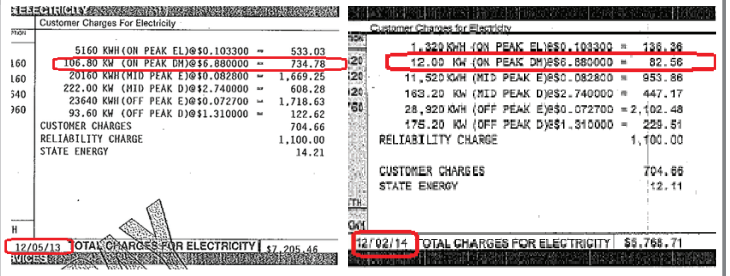
SIGI Power Consumption Curtailment Actions (1084 and 1086)



This figure shows the power usage for the admin building during the curtailment period. The nominal power usage without curtailment is 50kW. First the solar power was diverted to the building grid, then the energy consumption scheduling system reduced the HVAC loads. This resulted in 95kW swing and provided 45kW back to the grid. To curtail power usage in the 1086 building, the solar power was diverted to the building grid resulting in a 180kW curtailment (not shown in figures).

The curtailment actions resulted in not only a 590kW swing on the power grid but also provided power to the grid for the requested on peak hours of the day. This power delivered back to the grid is utilized by other users in the surrounding neighborhood thereby reducing the stress on the transmission and distribution system during peak demand period.

Application of Battery Energy Storage for Demand Reduction



Year	Peak Demand	Cost
2012	102 kW	$701.76
2013	106 kW	$734.78
2014	12 kW	$82.56

SIGI helps reduce the carbon footprint associated with conventional electricity generation by utilizing renewable energy. But is it seen that not only does the environment benefit, CE-CERT (and other users of similar systems) benefit by having a reduced cost of operation. In the snippets of electricity bills shown above, we see that before SIGI integration, the monthly charges for peak demand are hundreds of dollars higher than after SIGI integration. SIGI also shifts the energy usage from times with higher cost to times with lower cost, further increasing the savings.

Conclusion

UCR SIGI was designed as a smart, flexible, micro-grid capable of responding to the critical needs of the electrical grid. As southern California was going through a heat wave in the middle of the month of September 2014, the local utilities were faced with the challenge of satisfying record breaking peak demands. RPU requested their largest customers to reduce electricity use in the afternoon. SIGI responded to this request by utilizing SIGI's battery system, PV generation, and smart demand management controllers. The combined effect of the micro-grids not only curtailed a nominal power consumption of 265kW, but also provided 225kW back to the grid, resulting in a 590kW swing for the critical period three afternoon hours. In addition to the demonstration of these functionalities, UCR CE-CERT's SIGI test-bed has the ability to supply reactive power and voltage support, efficiency evaluation of system components, and islanding operations. The other capacity of SIGI is fast electric vehicle charging, along with vehicle to grid (V2G) energy transfer capability.

ACKNOWDGEMENT

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