eC4 Case Study

Intelligent Control of Energy Use

Eliminating Energy Leakage in the Lighting Subsystem of a Large Government Building

Background

Optimizing energy consumption under a dynamically fluctuating energy demand is always a challenge. This is true even in the case of relatively newer buildings with sophisticated building management systems. This case study describes one such building owned by Sunderland City Council in the North East of England where eC4 was installed and mandated to monitor the lighting load to identify energy saving opportunities.

Business Challenge

The monthly energy bills received by the building comprised energy consumption data as derived from the energy meters placed in different areas. However, they carried very little information on the potential reason for such consumption. More specifically, the building's year to year electricity consumption had been increasing and the Sunderland City Council which managed the building needed to understand if there were untapped opportunities for reducing the lighting load which was a significant component of their energy demand.

After considering several alternatives, the Sunderland City Council chose eC4 since it was looking for an energy monitoring solution that could provide an in-depth understanding of energy consumption at the granularity of individual subsystems (such as the lighting subsystem), and at the same time, identify root causes for unexpected energy leakage.

Solution

eC4 was connected to the entire lighting load of the building. More specifically, eC4 was connected to the lighting banks and the lighting controllers to monitor the changes in the control input to the variations in the ambient light conditions.

The dynamic variations of the lighting load for different business needs during the weekdays and the weekends were monitored by eC4 for a period of six months. A baseline signature of the lighting load was established for different scenarios. Strategies were implemented to prevent the losses incurred from unbalances in the electrical system.

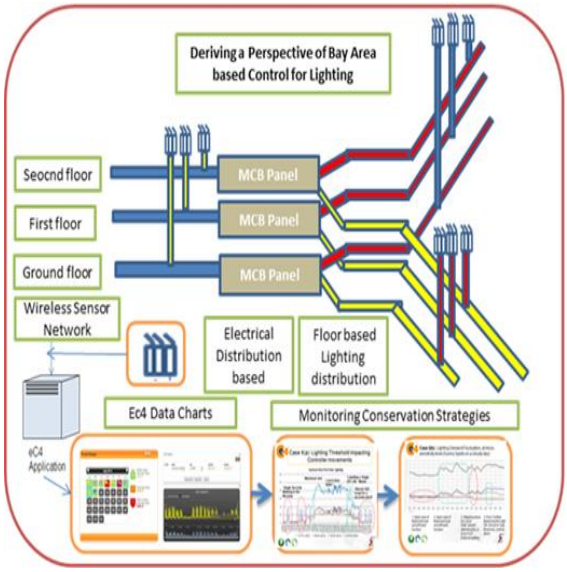

Figure 1: A schematic representation of the eC4 implementation.

Key Findings

eC4 was able to provide "drilled down" correlations between the 24x7 consumption (of various floors, areas/departments within the building) and specific events, activities, external weather conditions and occupancy. Statistical analysis of the trends allowed for predicting an expected value of consumption due to lighting (for a given set of input business conditions). This allowed for the implementation of strategies to opportunistically shed other lower priority loads in order to maintain the lighting load requirement. Also, the understanding of the usage pattern allowed for trimming the peak in the lighting load via appropriate strategies.

A second finding of eC4 was related to the behaviour of the lighting subsystem controller. The figure below illustrates the typical trend observed in the lighting subsystem consumption – while peak hour events were expected to be high, three instances of abnormal spikes were typically observed which are identified by "red circles" below.

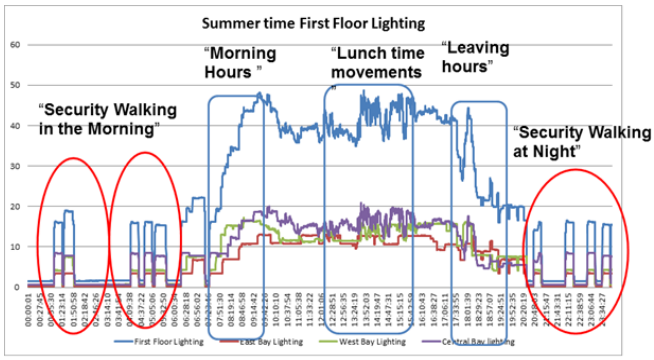

Figure 2: Behavioural anomalies observed in energy consumption of the lighting subsystem.

These specific instances were found to be problems associated with the lighting controller which was behaving erratically. Appropriate tuning of the gains of the control system was recommended to eradicate this problem.

eC4 also found the electrical distribution system to be unbalanced, both during peak and non-peak loading conditions. This was brought to the attention of the appropriate authorities to immediately take action to rectify the undesirable unbalance. It is therefore validates the notion that unbalance not only causes leakage but can also be quite harmful to the equipment in the facility.

Impact

eC4 had helped the customer characterize loads under varying dynamic conditions, predict expected loading and usage in a future time period, build effective strategies to opportunistically reduce load and usage, and in general, lower the energy intensity of lighting under various ambient conditions.

Furthermore, eC4 helped in identifying problems in the lighting controller. Finally, via 24x7 monitoring, eC4 also unearthed an unexpected unbalance in the electrical distribution system and was instrumental in identifying the root cause for such unbalance.

In summary, from the customer's point of view, eC4 was an effective watchdog to identify leakages and behavioural anomalies in their lighting subsystem and enabled the customer to track optimality on a 24x7 basis.

About eC4

Energy costs constitute a high proportion of the overall operational costs of a facility. It is critical to understand the extent and the sources of energy "leaks" and take steps to minimize them. Energy leaks occur all the time due to operational inefficiencies, equipment inefficiencies and process inefficiencies. eC4 identifies such leaks in large facilities. By connecting to different pieces of critical equipment or meters in your facility, eC4 "looks for" opportunistic reduction of energy leaks in real time.

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