Better Buildings CHALLENGE
U.S. DEPARTMENT OF ENERGY

INDUSTRIAL PARTNER

LEGRAND, NORTH AMERICA

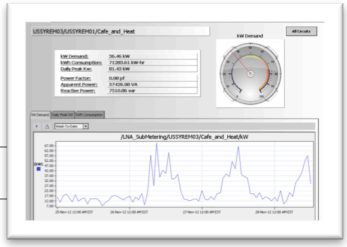
Implementation Model: Submetering Initiative and Energy Dashboards

ORGANIZATION TYPE
Electrical equipment and components manufacturer

BARRIER
Lack of detailed energy use data to drive organizational change

SOLUTION
Installation of submeters and energy dashboards to collect and communicate facility-wide energy use data

OUTCOME
Employees empowered to pursue newly visible energy efficiency opportunities



Overview

Legrand has installed submeters in its 14 largest U.S. facilities to collect detailed energy use data and mine energy saving opportunities. Data collected through the submeters will be displayed through energy dashboards designed to empower Legrand employees to make energy management an integral part of their day-to-day activities. Legrand has written a white paper that summarizes the lessons learned through its submetering effort.

Legrand's Playbook

Policies

Legrand designed a submetering initiative that will leverage technology to drive behavioral change throughout the organization. The submeters help facility managers identify anomalies in building energy use and uncover hidden opportunities for improvement. The initiative will also feed into a broader effort to educate employees and encourage them to act on energy saving opportunities.

Legrand is following these five steps to implement its initiative:

1. **Design and install submeters to collect granular energy use data at all 14 U.S. facilities, which include both manufacturing and non-manufacturing buildings**

Legrand site energy managers worked with the company's project lead to design the installation of submeters at their sites and order equipment. Legrand selected submeters that can monitor eight different electrical inputs plus two pulse inputs—usually water or natural gas—and offer interoperability with existing data systems.

2. **Design of information systems networks and servers**

It is imperative that Information Technology (IT) teams be involved throughout the submetering system's installation and configuration process.

3. **Create energy manager tools**

Energy manager tools provide users with the ability to look at single or multiple meters over selectable time periods.

4. **Design dashboards at each site that will communicate energy data to employees**

In tandem with submeter installations, the Legrand project lead is working with an internal computer application engineer to roll-out an energy dashboard for each site.

The dashboards will utilize a visualization tool that is capable of displaying data from multiple sources on a screen—including non-energy information such as RSS feeds and weather conditions.

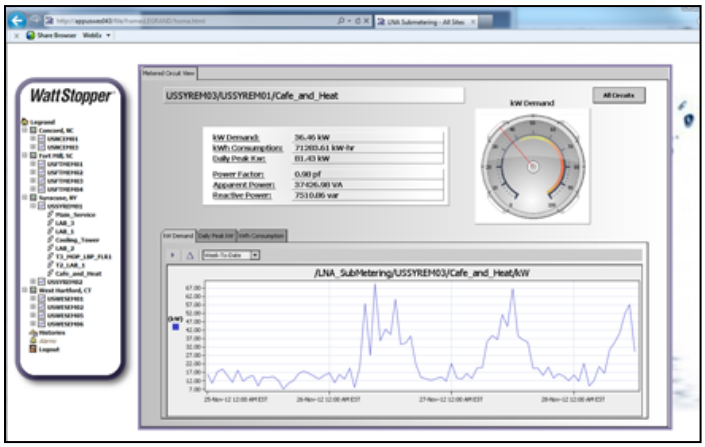


Figure 1: Time-lapse comparisons of energy usage from day to day, is useful to identifying peaks and patterns in energy use.

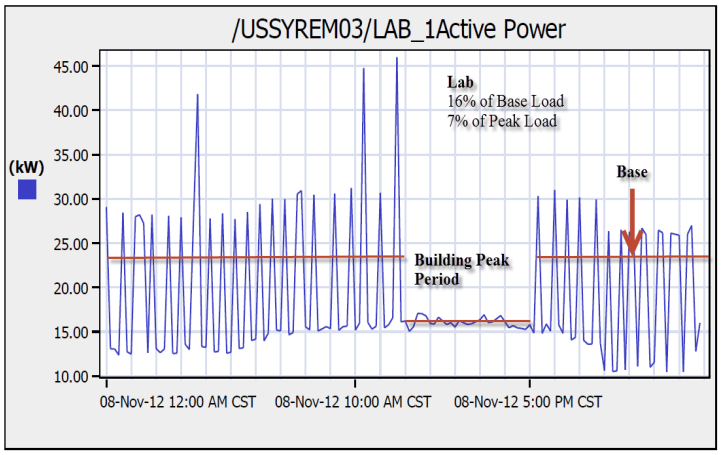


Figure 2: Peak versus baseline energy demand can be analyzed using submeters.

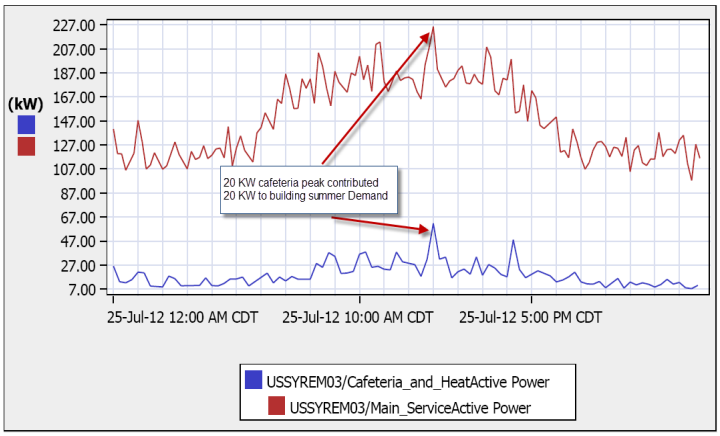


Figure 3: Comparisons of overall building demand to individual submeters targeting specific areas or processes can evaluate contributing factors to peaks in demand.

5. Integrate data into a broader employee awareness campaign designed to empower all employees to become energy managers

Site-specific dashboards via TV monitors in common areas such as cafeterias, and lobbies are put in place to make the information available to all employees and guests in a facility.

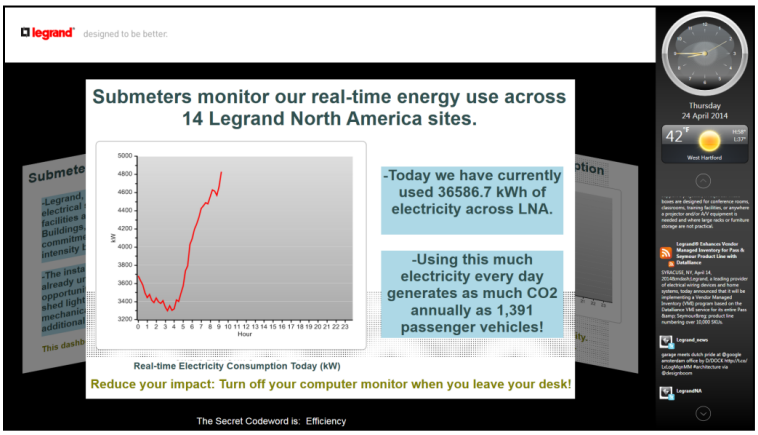


Figure 4: Dashboard displays of real-time energy data help employees to understand the significance of Legrand's energy usage.

Tools:

- A Guide to Submeter Deployment- White-Paper
- "Metering Best Practices: A Guide to Achieving Utility Resource Efficiency," Federal Energy Management Program (Release 2.0)

Process

This process began when a member of the Legrand Energy Technology & Finance Council independently investigated the application of submetering at his site and developed a proposal for corporate-wide deployment of submeters. The council member received support from the Council and the Vice President, Energy Efficiency, Sustainability & Public Policy to present the proposal to the Legrand Executive Team.

Approximately two months later, at a monthly Executive Team meeting, the council member presented the submetering initiative and the following objectives:

1. Increase transparency of energy use to allow energy managers to identify anomalies within buildings' energy consumption and capture energy savings.
2. Design energy dashboards that can be used as tangible tools to educate employees about the everyday impacts of energy consumption.
3. Empower all employees to become energy managers, thereby driving corporate-wide behavior change to reduce energy intensity.

The Executive Team approved the proposal, provided a capital allocation of $192,500 for the installation of submeters at Legrand's 14 U.S. sites, and designated the council member as the Project Lead.

One of the first sites to receive submeters was Legrand's corporate headquarters in West Hartford, CT. The company encountered a few barriers while installing the meters there, including:

- Staff initially struggled with installing submeters in the 100-year old facility due to aging infrastructure. By consulting technical experts and ordering additional electrical components, the submeter hardware was successfully installed. In addition, the site energy manager and engineering team created an implementation template to guide future submeter installations at that location.
- Due to the physical location of the seven submeters, two separate power shutdowns of 8 to 12 hours were required, resulting in attendant costs. Utility engineers, Legrand's facility engineers, and electrical engineers were all required to be present during the installation. To reduce costs, Legrand installed multiple submeters during each shutdown.

Despite these barriers, Legrand was able to install submeters at its 14 locations from 2011-2013.

Tools:

- "Making the Case for Energy Metering," ASHRAE Journal

Outreach

In 2013, Legrand made a concerted effort to educate its employees on personal and work-related energy use; including steps Legrand has taken at individual sites to reduce energy intensity. These

communications occur two times per month broadcast via email, posters, and TV slides and quarterly at the CEO's webcast on Legrand's progress. Legrand has utilized educational charts on residential and commercial energy use provided by the U.S. Department of Energy and some of its monthly success stories can be found on the Legrand website. In 2014, submeter dashboards will further expose associates to Legrand's energy profile.

Measuring Success

The goal of this initiative was to increase energy and dollar savings. The submetering program considers the utilization of power (demand) and energy (consumption) while remaining aware of how these impact costs.

Two variables Legrand asks its facilities to monitor are the **kWh / kW** ratio (where kWh is equal to the monthly consumption, and kW is the utility billing demand for the month) and the daily **Minimum kW / Maximum kW** ratio.

kWh / kW Ratio. Using this formula leaves the variable "hours" (kWh/kW = H). This monthly formula approximates the number of hours the facility operates during a billing period. For most commercial spaces, Legrand expects an hour range of 250 – 300; for multiple shift operations, it expects higher numbers because the consumption of energy, or the numerator, is greater. If the number of hours produced by the ratio changes, the facility manager should understand what is happening in the facility to cause the change.

For example, a commercial office's ratio can be calculated by multiplying operating hours per billing cycle: 50 hours per week and 4.3 weeks per month results in a ratio around 250 (50 x 4.3 = 212, plus miscellaneous nighttime loads). If this facility had an actual ratio of 400, it could indicate excessive loads running at night. On the other hand, ratios less than 250 could indicate excessively high demand, and higher energy costs to match.

Minimum kW / Maximum kW Ratio. The other Key Performance Indicator (KPI) Legrand's energy managers are watching is the daily kW minimum / kW maximum ratio. This may be a seasonal figure that can change during different heating and cooling cycles, but in general Legrand aims for a ratio of 20% or below. (See Figure 5 for an example of how the kW minimum load / kW maximum load ratio is displayed in a dashboard.)

This ratio helps energy managers identify and eliminate energy waste by focusing on a building's unoccupied hours. Based on 50 hours per week and 50 weeks per year, a building is actively running 2,500 hours per year. However, the building carries a base load for close to 8,760 hours per year (24 hours x 365 days) and if a building is operating with a minimum kW / maximum kW ratio of 40%, as in Figure 4, it is wasting 20% of energy for 6,260 hours or over three-quarters of the year.

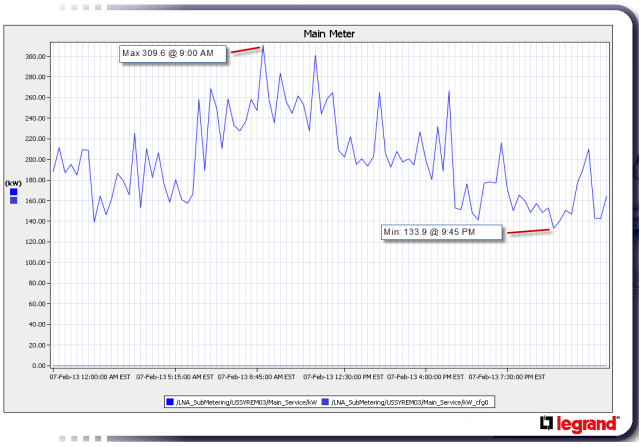


Figure 5: The power demand (kW) for an entire facility for one day.

To better understand the impacts of the kW minimum and kW maximum on this ratio, assume a building has a kW minimum of 20 and a kW maximum

of 100 (20/100 = 20%). While increasing peak demand would lower the ratio (20 kW minimum / 105 kW maximum = 19%), Legrand's efforts are focused on lowering the kW minimum to produce a lower ratio (15 kW minimum / 100 kW maximum = 15%). Ideally, energy managers should work to reduce both the kW minimum and kW maximum (15 kW minimum / 95 kW maximum = 15.8%). In some cases, this effort may yield a slightly higher ratio, but it will have a more positive impact on the company's overall energy management strategy.

While telling, these variables are not the end game for Legrand's energy managers; they are KPIs that can be used to understand how effectively the company is using energy on a daily and monthly interval for each metered point. It is important that the facility as well as the metered devices are understood by the energy manager.

Outcomes

The submetering initiative began in 2011 and results to date have been promising. Many sites are finding that equipment that was scheduled to be off, either manually or automatically, may not be shutting down completely as expected. One site found no scheduled shut-off of the mechanical systems while another found that the lighting was on during unoccupied periods. At Legrand's corporate headquarters, data from the submeters in one building were used to modify the HVAC schedule and alter the building's occupancy sensors. These changes reduced base load power use from 18.5% of peak load to 4.5% in three months.

Although the submetering initiative is still in its early stages, similar opportunities are expected to be uncovered in 2014.

Tools:

- "Becoming Smarter about Energy: A Guide to Submeter Development and Greater Energy Management Insights"