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Case Study for Office Building

17,000 square feet
19 HVAC zones
T12 and T8 lighting
Few motion sensors
Tilt-up construction

Building Profile

This building in San Jose, California, represented a major challenge for an energy management system. Its tenants include a diverse population of medical, mental and administrative services, with equally diverse schedules -- some occupants arrive as early as 5:30 AM; scheduled and ad-hoc group sessions can extend well into the evening; and parts of the building are available for services on weekends and holidays. These were considered "essential services" during the COVID-19 pandemic, requiring additional control and monitoring. To add to this complexity, the building includes a combination of small offices, meeting rooms, and shared open spaces, and as in every building, some occupants prefer it warmer, and others cooler. As an additional challenge, regulations require that a percentage of outside air be circulated year-round, even on the coldest days of winter. Finally, much of the HVAC equipment was dated, with some economizers nonfunctional; and due to different tenants during the building's lifetime, some duct runs make little sense for the current configuration. In addition to these HVAC challenges, specified levels of outside lighting are required for security purposes.

Diverse usage
Medical services
Air quality specs
Varying schedules
Old equipment
Outdoor safety lights

Installed Solution

The IIC solution began with 210 electric usage monitors that were placed on key circuits at seven service panels – these monitors communicate wirelessly with the IIC local controller device. Each circuit is read every 15 seconds and its consumption is stored permanently both on- and off-site. This provides a level of detail far superior to the 15 minute total building information available from utility smart meters.

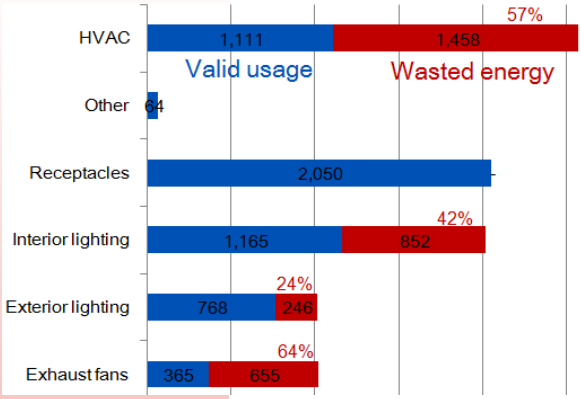
The thermostat for each zone then was replaced with a thermostat which also communicates wirelessly to the IIC controller. Each interaction informs the central system of the status for the room and equipment and allows enforcing rules and optimizations for that specific zone. Local control can be enabled (or disabled) as well.

This results in over one million data items being produced every day for this one building. This information is used to discover savings opportunities, monitor operation of the building and optimize the controlled equipment. The data can be viewed graphically, is automatically analyzed at various levels of grouping, and identifies specific equipment to identify activity, savings and ongoing operational faults.

Through the lifetime of this installation, additions have been made such as sensor averaging to ameliorate the comfort and energy cost challenges of outdated construction.

Monitor 210 circuits
15 second data
Wireless thermostat
Local zone control
1,000,000 items/day
Identify savings
Fault alerts
Ongoing additions

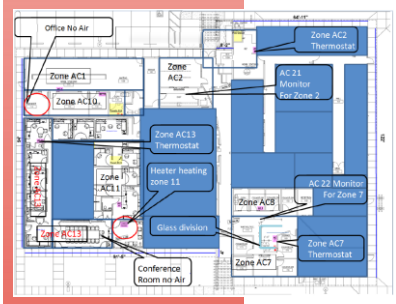
Identified Waste



The detail of the electric monitoring, generated both by frequency and number of circuits, identified multiple opportunities to reduce energy consumption, both electric and gas. Most would not have been otherwise found; and even if they were, it would have been difficult to identify the specific equipment causing the waste. Examples:

- All exterior safety lighting turned on and off at the same time year-round, wasting hours of energy during the summer. Egress lighting was needed only a few hours a day.
- Exhaust fans used 15% of total electricity; one large fan ran 24/7 for two small bathrooms.
- Thermostat schedules were set for the longest work day in the entire building; some weekend settings triggered during the week; many fans were on 24/7.
- HVAC units did not heat/cool zones properly. Multiple economizers were stuck open or closed.
- Multiple thermostats did not correctly control the zone -- in fact, the thermostat for one zone was on the opposite side of a hallway.
- Significant usage occurred nights and weekends for specific equipment and plug loads.

Maintenance Operations

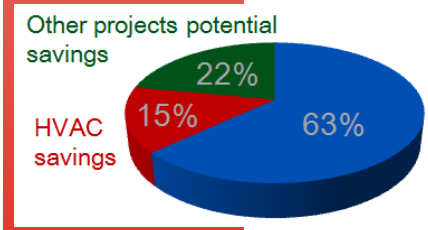


The integrated energy and equipment monitoring also produced notifications of equipment failures continuously in real time. Examples of faults detected in this building, often within minutes, include failure of one stage of cooling, stuck economizers, broken fan belt, breaker left off after preventive maintenance, etc.

Remote information, access, and control have eliminated uncounted truck rolls for comfort calls. After seeing the full status of the zone on a PC, tablet or phone during a "too hot" call, facilities personnel can make short-term changes to HVAC parameters or permanent changes to zone settings from anywhere.

Cost savings are recognized from fielding fewer complaint calls, reduced truck rolls, and lowered damage and wear and tear on equipment. IIC personnel in our Operations Center assist customer engineers on-site to troubleshoot and optimize equipment.

Results



Once the IIC system "learned" the building, zone by zone, 15% energy savings were immediately realized by controlling the HVAC with the system's advanced scheduling, calculated ramping and continuous monitoring capabilities. Recommendations produced from analyzing the baseline (pre-controlled) period identified an additional 22% of potential savings. The result was a payback of less than two years and a five-year ROI of over 200%. Customer HVAC engineers greatly appreciate our troubleshooting assistance.