



IN CONTROL®

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Case Study for School Campus

40,000 square feet
34 HVAC zones
T12 and T8 lighting
Permanent buildings
Modular buildings

Campus Profile



This elementary school consists of six permanent and four modular buildings built on a four-acre campus. It serves over 500 students in kindergarten through fourth grade, and includes special needs classes, a separate pre-school program, and a computer lab with 30 stations and associated server room. Each of these services operates on a

separate schedule, and each has its own environmental requirements. Also, and as to be expected, teachers have individual preferences, from temperature control to the operation of noisy fans that interfere with instruction. Finally, the combination of multiple schedules and open public access means that outdoor safety lighting is critical.

The existing HVAC systems include roof-top units (RTU's) with electric A/C and gas heat, modular electric heat-pump BARD units, and furnaces providing only heat.

Installed Solution

Wireless electric usage monitors were placed on 220 circuits in the buildings at 14 service panels. Every 15 seconds, each monitor communicates with the i'm in Control (IIC) local controller, and its consumption is stored permanently, both on-site and off-site. This provides a level of actionable detail far superior to the 15 minute information available from utility smart meters.

The thermostat for each zone was replaced with a wireless thermostat that communicates with the local controller every minute. Each interaction informs the central system of the status for the room and equipment and allows enforcing rules and optimizations for that specific zone. Finally, to accommodate individual preferences, the system allows a limited level of local control of temperature, fans, and a "bonus period" to operate outside of normal occupied hours.

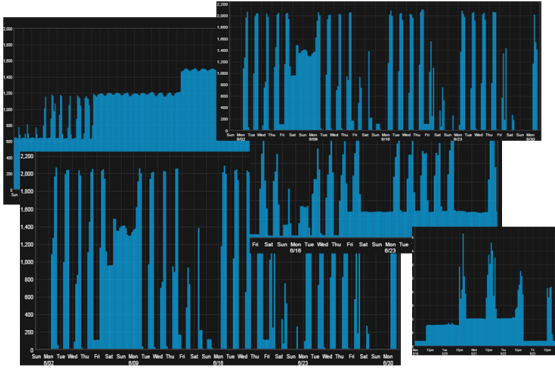
To ensure savings (with no attention required from facilities or education personnel), holidays, breaks, and summer operations are specified and scheduled globally – still allowing teachers that come in on holidays or odd hours to trigger a bonus period.

The system generates 1,200,000 data points every day. This information is used to discover additional savings opportunities, learn activity in each zone, optimize the controlled equipment and provide fault diagnostics. Data is viewed in multiple graphs and automatically analyzed at various levels of grouping, such as type of usage, area of the building, and specific equipment to identify activity, savings and ongoing operational faults.



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Savings from Identified Waste



As part of California’s Proposition 39, energy audits were performed by a certified engineering consultant on each of the district’s schools. Typically, such audits would rely on 15-minute utility interval data, site visits, and a small number of circuits being monitored for a short period of time. However, the IIC system’s detailed electric monitoring allowed for far more precision. As a result, it identified multiple issues that otherwise would have gone undiscovered. The IIC system recognized 39 energy-saving opportunities at this campus totalling 8.5% of total energy spend, such as:

Eliminate waste:
Savings 8.5% of
annual energy spend

- Multiple spaces where lights and loads were left on all night or over the weekend.
- A fan internal to an RTU ran continuously, and had probably done so for years.
- Ventilation fans on some HVAC units were on 24 hours a day or excessively.
- One building with 6% of the campus floor area accounted for 14% of the electric bill.
- Consumption for two modular units of the same size and usage varied by a factor of 3.

Savings from Maintenance Operations

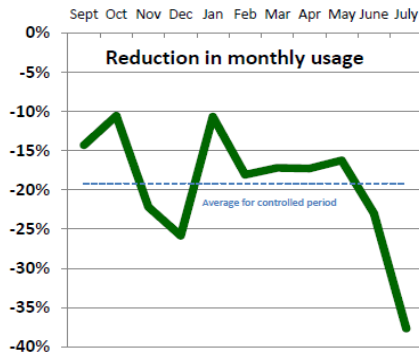
Reduce maintenance:
Savings \$5,000
annually

The integrated energy and equipment monitoring produced notifications of equipment and usage failures continuously in real time. As a result, faults were repaired quickly, and often before they were even noticed by teachers or administrators. The reduction of truck rolls and equipment wear and tear is estimated to save \$5,000 annually.

Savings from HVAC Control

Optimize HVAC:
Savings 19% of
annual energy spend

Once the IIC system “learned” each zone of the building, its advanced scheduling, calculated ramping and continuous monitoring resulted in a 10% to 37% reduction in usage each month, averaging 19% annually.



For occupants, now all zones are comfortable when they arrive in the morning. Teachers actively adjust HVAC operation during school hours and can enable heating and cooling when they work evenings and weekends.

Finally, the modular units with external BARD units were highlighted as an opportunity – their energy intensity (kWh per square foot) was two to three times that of the other buildings, which emphasizes the importance of carefully monitoring and controlling these inefficient structures.

Very important, the savings were persistent – IIC’s automated control ensured that equipment and settings did not “drift” over subsequent years.

