CASE STUDY

Student Housing Takes First Steps to Cut Energy Use

SMART BUILDINGS CENTER
A project of NEEC

Summary

Green River Community College (GRCC) has taken the first steps to understand and cut energy use in its Campus Corner student housing complex, while maintaining the comfort of its students. With the help of the Smart Buildings Center (SBC) Advanced Technology Deployment (ATD) program, the college is actively learning how a mix of energy efficient heating and smart building technologies can create greater visibility and control over energy use for facility managers and the students.

Business Challenge: Not enough time in the day to tackle all the challenges

The Green River Community College (GRCC) Foundation knew it had an energy problem and could prove it with six years of higher than expected utility bills from a decade-old international student housing complex. Facility managers already had a lot on their plates with 85 apartment units and 340 bedrooms and a constant stream of students moving in and out over the course of their studies, which are often as short as three to six months. This has made reducing energy use feel unattainable at times, even though a number of ideas swirled among

Potential Solution: Adding hands on deck to test a mix of solutions

GRCC's first move was to add specialized expertise to investigate and help solve the problem. It engaged Distributed Energy Management (DEM), a company that acts as a business' "chief utility officer," aligning utility use with business goals to improve efficiency and reduce costs. Working with the GRCC, DEM mapped out a six to nine month plan that started with assessing baseline energy consumption, investigating existing heating and cooling systems, and studying energy use behavior patterns. The plan has now shifted to gradually introducing and testing a mix of energy technologies that reduce costs and allow the college to reinvest in the student experience (GRCC's ultimate priority).

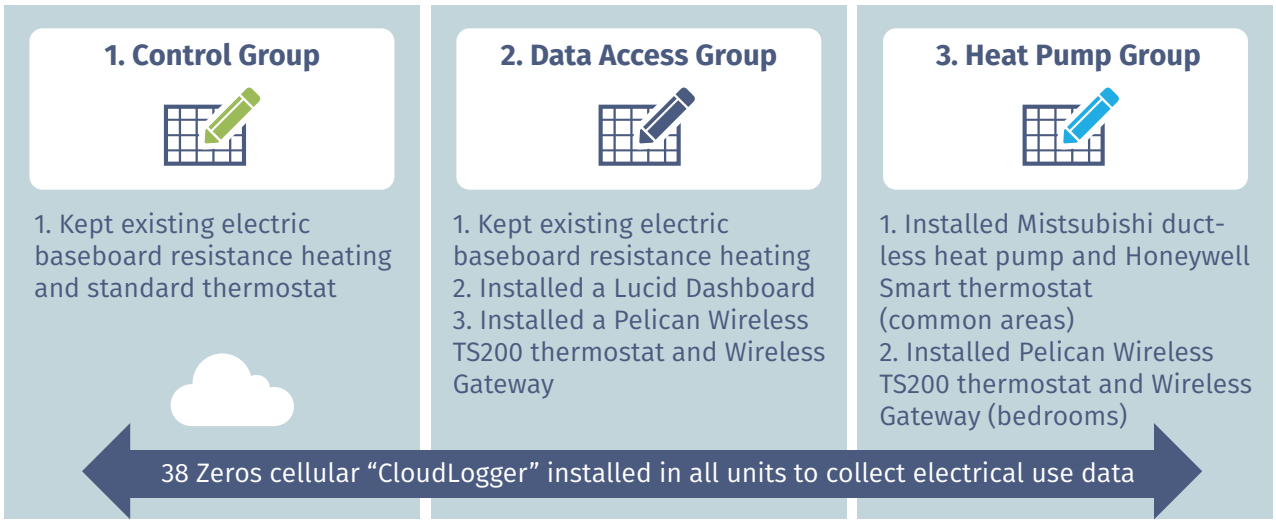
GRCC's decision to participate in the SBC ATD program opened the door to additional technical resources in this early evaluation phase. The SBC worked with Ecotope, an energy efficiency engineering and analysis service provider, to help identify, deploy, and evaluate a combination of heating and behavior-influencing technologies.

Together, the SBC, Ecotope, and DEM selected a suite of different technologies to install and evaluate over a five-week period during the winter of 2015 with the intention of measuring comparative impacts. The technologies were installed within three different "test groups," each consisting of two residential units similar in size, layout, occupancy, and location in the Campus Corner complex. The technologies were selected for two general reasons:

1. They were anticipated to directly deliver energy efficiency improvements over the existing electric resistance baseboard heating system

2. They were expected to influence resident behaviors that impact energy use and/or energy management by facility managers through greater access to and visibility of data

Test Group Profiles



The "control" group was established as a base case against which to compare the impact of the technologies, and received only a data logger to provide the same level of information about energy use across all test groups.

Data was tracked on total electricity use for each unit by a 38 Zeros CloudLogger as well as by sub-circuits associated with different zones. Pelican Wireless thermostats tracked indoor temperature data and a separate logger obtained outdoor temperature data.

Technology profiles

Each of the technologies selected and installed brought a unique value proposition to Campus Corner.

Heating system efficiency technology

The **Mitsubishi Ductless Heat Pump (DHP)** was a straightforward and relatively proven heating system solution for Campus Corner. Heat pumps have indoor and outdoor units that utilize heat transfer technology to heat a space two to three times more efficiently than electric baseboard heat. The team anticipated that after installation, the DHP would outperform the electric baseboard heaters in terms of energy efficiency without compromising comfort.

Data-sharing technologies

The other technologies installed presented opportunities for greater control and visibility of energy use—for occupants and eventually also for the facility managers charged with managing energy use and facility operations and maintenance. Inasmuch as the DHP is simply more efficient heating equipment, the data-sharing technologies rely on the power of accessible and understandable information to influence behavior to lower energy consumption.
These technologies included the **Pelican Wireless TS200** and **Honeywell Smart Thermostat**, members of a new breed of "smart thermostats" designed to optimize how occupants and facility managers use a heating system.

Pelican Wireless Gateways were also installed to facilitate internet connections. As the Pelican thermostat was not compatible with the DHP (it is rare for most third-party thermostats to work with DHPs), the project team selected a comparable Honeywell thermostat to control those units. The large digital screen on the thermostats creates easier visual cues with current temperature settings, more data, a more engaging display, and an online interface. Savvy users can also tap the mobile interface to adjust settings remotely—for example, a resident could turn his room heat down while away on a trip if he forgot to do so before leaving town. Pelican features remote programmable settings as well as temperature and energy use data tracking so that facility managers can establish desired temperature ranges, receive alerts when settings are adjusted out of those ranges, and make adjustments remotely.

The Lucid Building Dashboard is a web-based tool designed to create greater transparency of real-time energy use and energy consumption trends over time, pulling directly from building systems and sub-meters. With a highly graphic, intuitive, and customizable web interface (also available as kiosk touch-screens), Lucid makes visible what is otherwise invisible, particularly to residents who do not pay building utility bills themselves. The dashboard also translates the information into more common metrics, such as equivalent carbon emissions from average car miles driven instead of lesser understood kWh, and creates opportunities to leverage social motivators, such as friendly competitions or targeted social

campaigns. For this deployment, the two apartments in the Data Access Group were compared side-by-side on the dashboard.

Finally, the **38 Zeros CloudLogger** demonstrates leading data logging technology. The product acquires energy use data using compact, low-cost hardware installed on-site adjacent to the electrical panel, and transmits it to the cloud via cellular transmission. For GRCC, the CloudLogger will give building operators a clearer picture of energy use to inform decision-making, particularly as the college assesses different technologies and other strategies deployed in the SBC pilot. When the GRCC facility managers become more actively involved in monitoring energy use, this type of logger will offer real-time feedback, prompting proactive management rather than waiting for utility bills to reveal problems. The CloudLogger product also helps alleviate network security concerns by removing Wi-Fi-connected loggers that represent potentially vulnerable access points to organizational systems.

Promising results warrant further exploration

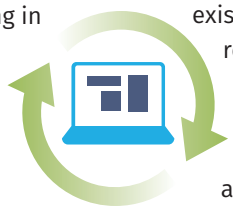
Results

The short test period and small number of test groups limited the extent of the trial, as did challenges associated with installation timing and abnormal data trends. The unusually mild winter meant that results were not as dramatic as they may be during colder spells. Even so, it was immediately clear that the DHP offered energy savings compared to the preexisting baseboard heaters, with estimates of 3-5 kWh savings per unit per day, which is significant savings when the average heating day usage is 20 kWh. By Ecotope's analysis, the efficiency of the heat pumps was confirmed at an estimated coefficient of performance of 2.7-3.0 (2 to 3 times more efficient than conventional baseboard resistance heaters), providing confidence to GRCC for future installations of heat pumps.

In follow-up surveys conducted by DEM, students reported satisfaction in terms of thermal comfort and amount of control they had over their environment, indicating that DHPs could contribute to energy savings while maintaining resident comfort, regardless of who is living in the housing units.

Opportunities

Because the College is only in the initial trial period, DEM provided just very basic resident training on how to use the smart thermostats and did not introduce the full mobile or web capabilities. Neither the students nor community coordinators were introduced to the opportunities presented by the Lucid dashboard, which could provide a platform to hold friendly competitions that track and celebrate savings. Because community coordinators charged with engaging students at Campus Corner in resident activities are already using online tools such as a resident portal and Facebook, there is potential for the data-sharing technologies to tap into existing engagement forums. The remote thermostats, data logger, and dashboard all make use of rapid feedback, instant information, and mobile access—elements that are core to communicating with the exact demographic that the college is trying to engage at Campus Corner.



Conclusion: Plans to take it to the next level

The SBC project laid a foundation for the GRCC to continue to fine-tune its approach to energy efficiency in student housing. DEM is already experimenting with using ASHRAE temperature set point ranges to see how both occupant comfort and energy use are affected. Thanks to the setup of the smart thermostats and data logger in this first phase, DEM will be able to measure and monitor the impacts on energy use across seasons. Plans are also underway to incrementally introduce the different capabilities of the smart thermostats and the dashboard to students.

With this first phase of testing, the college has created momentum to continue on its path towards addressing its nagging energy challenges. Time will tell which behavior and engagement strategies are effective enough to be seamlessly introduced alongside efficient heating technologies to all 340 units of Campus Corner. In the words of a DEM representative, Carey Gersten, "We're still learning—this is just the start."

About the Smart Buildings Center

The Smart Buildings Center (SBC) is a project of the Northwest Energy Efficiency Council (NEEC), which is a non-profit industry association of the energy efficiency industry. The SBC supports growth and innovation in the Pacific Northwest's energy efficiency industry, serving as a hub for industry activities and raising the visibility of energy efficiency companies and projects.

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