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University transforms energy management with big data solution

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—Jim Jackson, Assistant Vice Chancellor, University of Nebraska-Lincoln

A strong proponent of environmental sustainability, the University of Nebraska-Lincoln (UNL) set an ambitious goal of reducing energy use by 15 percent across many of its buildings. In collaboration with Microsoft CityNext partner ICONICS, the university monitors building performance in real time with a solution that combines big data with the Internet of Things. With the insight to troubleshoot problems immediately, UNL is boosting energy efficiency, saving money, and proactively maintaining mechanical equipment at optimal levels.

University of Nebraska-Lincoln

www.unl.edu

6,487 employees

United States

Education

The University of Nebraska-Lincoln (UNL) is a public research university based in Lincoln, Nebraska. The state’s oldest university, UNL currently serves more than 25,000 students.

Partner

ICONICS

www.iconics.com



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—Chris Walsh, Director of Buildings Systems Maintenance, University of Nebraska-Lincoln

The man behind the curtain

Jim Jackson is the man behind the curtain, like the Wizard of Oz in the American film classic. He and his team may not always be visible to students, faculty, and staff at the University of Nebraska-Lincoln (UNL). But it's because of the behind-the-scenes work of his Building Systems Maintenance (BSM) team that classroom temperatures are comfortable. And alarm systems function. And the lights turn on when you walk into a building. “We love what we do, and our passion is great customer service,” says Jackson, Assistant Vice Chancellor at the University of Nebraska-Lincoln. “And while folks may not know why their buildings are comfortable, it's because of the staff behind the curtain.”

Like their predecessors, Jackson and university leadership believe in fiscal responsibility and minimizing the university's environmental footprint. And at a time of growing environmental and fiscal concerns, they want to continue to accelerate the culture of stewardship—both for current students and future generations. “Sustainability is a huge buzzword, but the reality is that we need to continuously improve our resource management,” says Jackson. “And for a university like ours with 16.5 million gross square feet of building space, energy savings is a natural focus.”

A few years ago, UNL facilities adopted an ambitious goal of reducing energy consumption in many of its buildings by more than 15 percent. To do so, Jackson and the BSM team turned to advanced technology. “We were good at a lot of things, but at some point you recognize that you can only do so much with existing resources and systems,” says Jackson. “We realized that the only way to move forward was through innovation and technology.”

Stopping building deterioration

To reduce energy consumption, the BSM team had been installing energy-efficient equipment and automating building systems to ensure that mechanical and electrical equipment—including heating, ventilation, and air conditioning (HVAC) systems—minimized energy waste. The team installed more than 60,000 sensors and control devices on equipment throughout the university, collecting about 7.4 million records every day to help maintenance workers reduce energy use and perform predictive maintenance.

With these systems in place, UNL was well on its way to minimizing building energy use. Yet just like a brand-new car that's driven off the lot, building equipment starts to deteriorate as soon as it's installed, losing energy efficiency over time. To mitigate deterioration, UNL had in the past performed ad-hoc recommissioning, but was now developing a comprehensive recommissioning program.

In 2014, Jackson attended a Big Ten Universities directors meeting and learned about “constant commissioning,” which involved keeping mechanical systems operating at optimum levels even as they age—and capturing the same energy savings over time. “If you look at a building, you'll see a big decline in its performance roughly every five years,” says Jackson. “We wanted to find a way to maintain optimal performance without the expense of periodic recommissioning.”



“With the ICONICS FDD technology in place, we are often able to catch anomalies, show up, and say, ‘Hey, your room’s not quite working right.’ Students, faculty, and staff appreciate when we respond before they become aware of a problem.”

—Lalit Agarwal, Director of Facilities Systems, University of Nebraska-Lincoln

Fixing equipment before it reaches a crisis point

Jackson and the BSM team decided to implement a fault detection and diagnostics (FDD) solution developed by Microsoft CityNext partner ICONICS. Built on Microsoft technologies such as SQL Server database for configuration and runtime operations, the solution combines big data with the Internet of Things (IoT) to help UNL identify and fix problems well before mechanical equipment breaks down.

From air handlers to pumps to fan motors, UNL has attached sensors to equipment in buildings across its campus to monitor performance in real time. When a sensor captures a reading outside of designated parameters set by the BSM team, an alert is triggered and sent to the university’s maintenance control center, where the issue is either fixed remotely or a technician is dispatched to the building.

“In the past, an alarm would be triggered only when the equipment was running out of control or had already broken,” says Jackson. “Now, we are catching problems much earlier on the degradation curve, so when something starts to drift we can immediately respond.” For example, one time a variable air volume damper cooling a room was stuck on open, causing a reheat valve to overcompensate by generating excessive heat. Since the room maintained a comfortable temperature, the problem wouldn’t have been detected without the FDD solution in place and would have created unnecessary costs.

UNL began installing the ICONICS FDD solution in early 2016 and currently uses it to monitor 52 buildings. In the next few years, the university plans to track as many as 80 major university buildings with FDD, along with five campus utility plants. “As we construct new buildings, we implement FDD to prevent the degradation of building equipment,” says Chris Walsh, Director of Building Systems Maintenance at the University of Nebraska-Lincoln.

Maintaining energy efficiency gains as the years pass

Thanks to FDD, UNL is avoiding catastrophic breakdowns, while maintaining energy efficiency gains. Rather than recommissioning campus buildings every five years and watching energy efficiency diminish over time, the BSM team now continuously commissions mechanical systems—making small adjustments to preserve building equipment performance. “We try to resolve issues as soon as equipment moves off its optimal performance—preventing it from reaching a crisis point,” says Walsh. “Our goal is to minimize or avoid equipment degradation and related energy waste.”

By resolving issues as soon as they occur, the university is also cutting energy costs. For example, it is possible for a single air handler that’s running close to the point of failure to run so inefficiently that it can generate as much as US\$30,000 in energy costs per year. Because an FDD alert can trigger when an air handler slips below optimal performance, it’s possible to avoid energy costs of as much as \$25,000 per air handler each year—a savings of 84 percent.

Improving service to students and faculty

The BSM team has also transformed how it operates. When an alert is triggered, engineers often fix the issue remotely, at little to no cost. If technicians need to physically travel to the building, they have detailed information about the problem before they arrive, allowing them to repair issues faster.

What's more, the team can now easily prioritize maintenance projects according to their importance, ensuring that limited staff is deployed to the highest-priority problems.

By addressing issues before they become critical, BSM helps maintain a more comfortable learning atmosphere for UNL students and faculty, which also improves relations. "In the past, if a room's temperature got warm, the instructor or students would have to report the problem and wait for the maintenance technician to arrive," says Lalit Agarwal, Director of Facilities Systems at the University of Nebraska-Lincoln. "With the ICONICS FDD technology in place, we are often able to catch anomalies, show up, and say, 'Hey, your room's not quite working right.' Students, faculty, and staff appreciate when we respond before they become aware of a problem."

An energy efficiency leader

With its FDD solution in place, the university is well on its way to meeting its energy efficiency goals. In the first year of implementation, for example, the solution detected about 1,100 faults on average each month. Left uncorrected for a year, these would have added up to almost \$200,000 in wasted energy. "Using technology to monitor our buildings, we are improving the way we use our resources during a time of both environmental and budget concerns," says Jackson.

Jackson says the results have captured the attention of the university leaders, while generating positive momentum for UNL as a whole. "Our efforts are a great recruiting tool—especially for the growing number of energy-conscious students."

He may be the man behind the curtain, but Jackson and his team are leading the way as colleges and universities across the United States transform their energy futures. "We don't want to be just your traditional maintenance organization," says Jackson. "We want to be innovative and cutting edge, and in collaboration with Microsoft partner ICONICS, we are able to continue achieving our goals as an energy efficiency leader."

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