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# The Green Issue

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# Take Another Look at Energy Efficiency

Retro-commissioning of campus facilities saves time, money, and energy.

The pursuit of energy efficiency and sustainability is a major focus in the U.S. today, influencing our choice of everything from automobiles to windows to the foods we eat. The higher education community is immersed in this drive toward environmental responsibility as well. A great deal of attention on research and development is being directed toward identifying ways to be better stewards of our resources.

Ironically, the very university facilities that host these studies represent significant opportunities to improve energy efficiency. Recognizing this, a number of universities are implementing the process of retro-commissioning to increase energy conservation on their campuses, placing them in a leadership role as environmental stewards. Retro-commissioning is a process that validates that a building performs as it was intended and finds problems that may be masked. During retro-commissioning, the facility is comprehensively tested, adjusted, and calibrated so its HVAC and

plumbing systems are fully functioning as efficiently as possible. In addition, the owner's staff is left with a tool that allows them to maintain systems at peak performance.



## **Campus Buildings Impact Energy Usage**

A quick look at the impact of buildings on energy use in this country reveals that buildings in general demand a significant slice of our resource pie. According to

the U.S. Green Building Council (USGBC), buildings account for:

- 40 percent of primary energy use
- 72 percent of electricity consumption
- 39 percent of carbon dioxide emissions

Conventional laboratory buildings, common on campuses, can consume up to ten times the energy of typical buildings, due to their specialized HVAC requirements. Today's buildings incorporate highly sophisticated equipment and systems that must work in unison to maximize efficiency, simplify operations,

## the sustainable campus | Take Another Look at Energy Efficiency

and satisfy occupants. When these systems are not operating as they were designed to, operations costs increase (as do occupant complaints) and maintenance becomes reactive and expensive.

“Retro-commissioning generally identifies system improvements that can create 20 percent energy savings per building,” according to Randy Wisniewski, principal, director of Contract Administration/Commissioning with Peter Basso Associates. “The return on investment created by a typical retro-commissioning project typically pays for the engineering fees in one to two years, and implementation of the system fixes in four to six years. It doesn’t take long for these efforts to pay off.”

### **Back on Track at Northern Michigan University**

“Right now everyone is short-staffed,” explained Robert Ryan, director of the Heating Plant at Northern Michigan University in Marquette. “With limited staff, preventative maintenance gets postponed, and scheduled mechanical system maintenance and equipment checkups aren’t done as frequently.”

Northern Michigan elected to have retro-commissioning performed on its Learning Resources Center (LRC). The University knew energy costs were increasing more than they should, and they were starting to experience problems with the HVAC equipment, which was resulting in complaints from students and staff. “We talked to a number of companies about what should be done, but we heard different answers. We needed to bring in a firm that specialized in analyzing equipment performance and diagnosing system problems.”

The first phase of the project began in March of 2007, providing an in-depth evaluation of the existing mechanical equipment and its related control systems. Systems covered within this scope included:

- building control system and components
- air-handling equipment

- kitchen make-up air-handling equipment
- air conditioning and steam coils in all air-handling units
- building steam and condensate system
- terminal reheat hot water system
- building perimeter hot water heating system
- building chilled water system

System performance was documented, and a complete list of equipment problems that needed to be addressed to bring the facility back up to speed was prepared, including an operational cost analysis that projected the payback time frame. Working with the University, this list was prioritized, and repair and maintenance activities were budgeted.

“We had numerous discussions on what projects to do out of the almost \$1M worth of projects identified. After much discussion, we identified around \$600,000 worth of projects that would result in \$176,000 in potential annual energy savings. At this point, we’ve worked through about 90 percent of the issues we found, providing about a 3.4-year payback on implementation costs,” said Ryan. “I’m not hearing any more complaints from building occupants, and energy bills have dropped. The maintenance department also is saving money and valuable time by moving away from reactive response and into planned activities.”

### **Michigan State University: “Be Spartan Green!”**

“The Environmental Stewardship program at Michigan State University was developed as a response to President Simon’s ‘Boldness by Design’ challenge, which included the strategic vision of moving the campus from land-grant to world-grant,” said Lynda J. Boomer, University Energy and Environmental engineer, who has been instrumental in organizing the green initiative. “Part of the vision was to move into a leadership role regarding environmental

stewardship in all areas including teaching, education, research, and operations.”

The vice president for Finance and Operations approached this from a systems perspective, and pulled together faculty, students, and staff in a systems team, under the leadership of Kathy Lindahl, to develop recommendations and set environmental stewardship goals for campus. The three “R’s” associated with Reduce, Reuse, and Recycle were expanded to include Research, Re-educate, Redesign, and Rethink, which broadened the perspective for campus and fostered collaboration and institutional support. The University set goals to reduce energy use by 15 percent, reduce greenhouse gas (GHG) emissions by 15 percent, and reduce landfill waste by 30 percent by 2015 (see [www.bespartangreen.msu.edu](http://www.bespartangreen.msu.edu) for more information). More than 70 recommendations were presented to the Board of Trustees to achieve these goals; the retro-commissioning program was one of those recommendations.

The retro-commissioning program is funded through the general fund and is expected to reduce energy consumption, which in turn will reduce the amount of fuel consumed and the amount of GHG emissions for the University. Retro-commissioning is currently taking place as part of an initiative to complete 76 general fund buildings in five years, 36 residential and hospitality services buildings in 10 years, and five athletics buildings in five years. This systematic process

#### **What is Retro-Commissioning?**

The Michigan State University Commissioning Services department has adopted the following functional definition for retro-commissioning:

*Retro-commissioning is a systematic process carried out to optimize the performance, maintenance, operation, and energy consumption of an existing facility with the ultimate goal of meeting the current operational needs.*

## the sustainable campus | Take Another Look at Energy Efficiency

of “tuning-up” existing campus buildings is intended to optimize the performance, maintenance, operation, and energy usage of an existing facility with the ultimate goal of meeting the current operational requirements of the facility and occupants.

The retro-commissioning program is providing tremendous benefits, according to Jason Vallance, commissioning engineer at Michigan State. “This program solves chronic maintenance issues through a holistic evaluation of each facility — the goal is to ‘fix the unfixable.’ The process does not just chase symptoms or energy projects — instead, it assesses the building as a whole.”


All past problem reports and the most recent two years of trouble calls are gathered prior to beginning field evaluations. Systems are then individually evaluated to identify deficiencies and various ways to reduce energy consumption.

The retro-commissioning activities being carried out at Michigan State are not simple energy audits, nor structured as a form of performance contracting. The program is being carried out with the

goal of making each facility meet current operational requirements and improve the overall business operation of the tenant. Information gathered, assessments conducted, and adjustments made are a benefit to the tenant and to the rest of the MSU Physical Plant operation.

“The University will enjoy immediate payback as well,” noted Randy Wisniewski, with Peter Basso Associates. “The flagship project, the Radiology Building, delivered an immediate savings of about \$49,000 from the retro-commissioning process and addressed maintenance/repair. In addition, the University will receive about \$30,000 annual savings from proposed energy conservation measures. Total cost for the entire program was about \$318,000, with approximately a 4.78 year payback.”

Benefits extend beyond money, though. “Updated information on existing buildings helps capital project planners and design teams better conduct their HVAC studies,” says Vallance. “Issues identified during existing building commissioning provide ‘lessons learned’ for

the design and construction staff. Testing and evaluation of various technologies well after warranty periods expire help us to qualify products (‘What should remain or be removed from construction standards?’). Addressing long-standing chronic building issues decreases trouble calls and lowers maintenance costs. Implementation of vibration management and ultra-sonic test procedures help to forecast maintenance outages and forego catastrophic failures of critical equipment. Finally, implementing a comprehensive program such as this will provide accurate building information for future building information models and for the integration of document management, work flow for repairs/maintenance, and the building automation system.” 

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