NJHEPS Energy Case Studies

The College of New Jersey:
Metering and Management for Energy Savings

Technology:
Digital energy monitors; an energy management system and energy information database and analysis tools; utilized existing available campus-wide copper-wire network (eliminated requirement to run additional network infrastructure).

CO_2 Emission Reductions:
2400 tons annually.[1]

Investment:
$200,000

Annual Savings:
$300,000

Lessons Learned:

- Effort invested in measuring and intelligently controlling energy use brings substantial savings and quick payback, particularly from the ability to automatically load shed (cycle heating and cooling equipment) during periods of peak demand.
- Secure and inexpensive networking for energy management can be achieved through existing campus copper-wire infrastructure.

Funding Sources:
Internal operational budget.

Introduction
The College of New Jersey (TCNJ) is a 2.5 million square-foot campus in Ewing, New Jersey that encompasses fifty buildings, with new construction in progress or planned for ten more. Administrators, recognizing that energy was one of their largest operating expenses, resolved to find ways to analyze and manage these costs. In 1999, TCNJ began applying a state-of-the-art integrated information platform and metering technology to collect and analyze facility information, including total energy consumption. This capability enabled the Energy and Central Utilities staff to diagnose, recommend and implement timely solutions that help reduce costs, increase system reliability, and improve the facility environment.

Project Description
As a first step, TCNJ implemented a campus-wide energy management system. The campus electric distribution system utilizes six electrical feeders over the entire campus. TCNJ has a 5.2 MW gas turbine cogeneration plant, which currently produces approximately 90% of the total campus load. The existing building automation system allowed for energy monitoring and central control, but was not able to respond to rapidly changing conditions in a way that automatically reduced campus demand and energy consumption. The new system enables TCNJ to achieve four goals:

1. **Feeder Analysis**: By installing ION™ digital energy monitors in each building, actual electric peak demand and energy usage data was available for each separate building, which helped facility managers identify which feeders were operating at capacity and which had significant excess capacity. Not only does this data show where current usage is being distributed across the six campus feeders, it also aids in planning for future system upgrades (a 26 kV primary service upgrade is currently underway).

2. **Automated Electric Demand Management**: Meters in each building continuously collect electric demand and usage data, which is then fed to the central server located in the Energy

Management central office. This software interfaces with the building management control system, which allows continuous automated electric demand management (load shedding), utilizing twelve load groups of 150 - 200 kW each, through a carefully-developed strategy for load shedding at times of peak demand. By cycling HVAC systems in a prescribed manner over these groups, the system maintains comfort, complies with New Jersey and ASHRAE codes, and reduces coincident demand costs in peak situations that would previously have incurred a hefty demand charge. "Typically, a 500 - 900 kW reduction is achieved during peak period when the cogeneration plant output cannot meet campus demand," states Bill Dilts, Building Management Specialist at TCNJ's Office of Energy and Central Utilities.

3. **Custom Reports:** TCNJ and Enerwise Global Technologies (makers of the ION™ monitors) worked together to develop custom daily, weekly, or monthly reports: total kWh consumption per building; total kWh per sq. ft. per building; time and date of peak kW demand per building; time and date of campus coincident peak kW demand; total consumption cost per building; and kWh consumption and peak data by electric feeder. This information helps identify energy-intensive buildings and enables staff to develop targeted, building-specific energy conservation plans.

4. **Historic Load Profile Archives**: Past data can be used to analyze and identify system problems, and to measure improvement results from energy conservation plans.

TCNJ considered several strategies for enabling the information exchange needed to make this information and management network operational: satellite, wireless, cable, or even radio frequencies. TCNJ discovered that it could utilize unused existing standard copper telephone wires to link this energy management network, thereby utilizing infrastructure already in place and keeping both the management system and energy settings securely within the jurisdiction of the Office of Energy and Central Utilities.

The Results

The energy management efforts have paid off. The system cost approximately $200,000 to install; from October 2002 - October 2003 it produced an electricity usage reduction, through load shedding, of 5 million kWh. Based on this savings alone, the payback period was less than 8 months. Actual savings are larger, as energy savings also accrue from reduced usage of steam and chilled water, in addition to the electricity savings from cycling the HVAC equipment. This corresponds to at least 2,400 tons of avoided carbon dioxide -- a substantial climate-change benefit in addition to the project's enormous contribution to TCNJ's budget.

The system also helps TCNJ recover more quickly from power outages. By being able to check load profile archives for the level of operation prior to power loss, the cogeneration plant can be matched with campus demand and the Energy and Central Utilities staff can decide which buildings to bring back online first. TCNJ also can now allocate energy costs properly among various budget lines -- a capability the managers previously did not have.

Future Commitments

Because of its success with this system, TCNJ plans to expand metering to both steam and chilled water

systems, so that in future all campus utilities can be monitored, problems identified, and costs better managed across the entire campus. (The payback period for steam and chilled-water monitoring is likely to be longer, as they cannot provide the immense benefit of peak-demand load shedding).

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Additional resource:
Submetering Energy Use in Colleges in Unversities, ENERGY STAR, www.energystar.gov/index.cfm?c=higher_ed.bus_highereducation.

Notes:
[1]Based on PJM figures of .0005919 tons/kwh.