Recharging Campus Energy Conserv

ESCOs and Demand Side Management at

This is the story of a good campus energy conservation program that is getting better. It's happening at the State University of New York (SUNY) at Buffalo, known locally as the University at Buffalo or UB. UB has two campuses with more than 8 million gross square feet in eighty campus buildings. Our annual energy bills are $19 million.

Over the years we've done a lot of energy conservation. Our project log identifies more than 300 energy conservation projects resulting in total annual energy savings or "cost avoidance" of more than $3.5 million. We are now immersed in a large energy conservation project with the potential to shave an additional $2 million to $2.5 million off our energy bills each year.

As at other schools, however, progress in the energy area has not been steady. There have been slow times when this campus energy officer despaired. In fact, it was only a few short years ago when our forward momentum seemed to actually stop.

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SUNY Buffalo

by Walter Simpson

Tighter SUNY budgets resulted in less campus money for everything, including energy conservation projects. Conservation efforts also suffered because of a statewide utility budgeting mechanism that discouraged conservation by not allowing individual SUNY campuses to keep the savings they produced through conservation.

New York's governor, Mario Cuomo, issued an executive order calling on state facilities to reduce energy consumption by 20 percent by the year 2000. But there seemed to be no way for us to get from here to there. Now, thanks to a number of recent developments, UB's energy conservation program has bounced back.

UB Joins the Negawatt Revolution

A watt saved is a watt earned. Energy analyst Amory Lovins called it a "negawatt." Years ago he began preaching that it makes more sense—economically and environmentally—to save energy than to produce it. This simple insight sparked an energy revolution nationwide, now evident in the demand side management (DSM) programs encouraged by state utility commissions and being conducted by numerous electric power utilities.

The demand side management program of our local utility, Niagara Mohawk Power Corporation (NiMo), has come to UB, and none too soon. It was just what the doctor ordered.

NiMo's program offered us two DSM options: 1) conventional and custom equipment rebates, and 2) an incentive program administered through CES/Way International, an energy service company (ESCO) under contract with NiMo to reduce the utility's demand by approximately 8 megawatts.

We opted to work with CES/Way and primarily utilize NiMo's incentive program, which offers substantial subsidies

per kW of reduced demand (in excess of $1,000/kW). To obtain these subsidies, the ESCO and its clients must guarantee that all energy conservation measures (ECMs) financed through the program will stay in place for a minimum of fifteen years (a provision acceptable to UB).

It is important to avoid "cream-skimming," the practice of doing only easy, quick payback measures. Our ESCO's agreement with NiMo stipulates that a "comprehensive approach" to energy conservation must be taken, using quick payback measures to leverage the longer payback ones—so more gets done. This approach is "win-win," benefiting not only UB, but also the utility, the ESCO, the general public, and the environment.

We are now at the end of the detailed engineering analysis stage of a project on our North Campus. The current scope projects capital improvements of approximately $12 million, and $2 million to $2.5 million in annual energy savings for UB. Approximately $4 million of the project cost will be covered by incentive funds from our utility, bringing the overall payback of the project into the three-to-four-year range.

Why Work with an ESCO

A good energy service company can quickly study a campus and identify many cost-effective conservation measures. It can also package these measures into a larger project, then serve as the design consultant and general contractor to see a project through to completion. In addition to technical skills and knowledge of the energy field, an ESCO can offer colleges and universities attractive financing alternatives, often including DSM incentives.

ESCOs have found their niche by providing whatever is needed to make energy conservation projects happen. Thus, they provide an important service, but at a cost. The value of this service to a college or university can be measured by the savings benefit an ESCO produces for that institution, minus the fee it charges for the service. Time frame is also a factor.

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While our initial contact with ESCOs left us skeptical, our experience with CES/Way International has been a positive one. Even for a university center with as much in-house technical capability as we have, working with an ESCO can make a lot of sense. Our collaboration will enable us to take a giant leap forward and do as much in a few years as we might be able to do in ten or fifteen years if we tried to go it alone.

This opportunity is so extraordinary that it has served as a catalyst to begin resolving our system-wide budgetary incentive problem. UB will keep the savings generated by this project, and a substantial positive cash flow is expected as soon as construction is complete.

A variety of ECMs are contemplated, including lighting modifications (T-8 lamps, electronic ballasts, and reflectors in some applications), installation of high efficiency motors and variable frequency drives, energy management system improvements, HVAC measures (night setback, heat recovery, etc.), and gas conversion of space and/or water heating systems in some of our electrically heated buildings.

Our ESCO's contract with our utility permits the ESCO to include gas conversion ECMs in their projects (although the utility will not provide DSM incentive funding for this type of ECM). This flexibility is valuable to UB since many of the buildings on our North Campus are all-electric.

Better Lighting at Half the Cost

Lighting technology has come a long way in the last few years. While compact fluorescent lights may have received most public attention, the real story is the T-8 lamp coupled with electronic ballasts and reflectors. T-8 lamps have a higher color rendering index (CRI) than T-12 lamps, making colors look more natural and vibrant. We expect to maintain existing light levels throughout our North Campus, while reducing lighting wattage by 30 to 50 percent.

In order to evaluate the performance of reflectors, our staff is working with our ESCO to conduct tests in ten different campus buildings. So far we have found that we are about 10 percent shy of obtaining equivalent light from reflectorized two-tube T-8 fixtures when compared to our existing conventional four-tube T-12 fixtures with energy saver 34-watt tubes. While a 10 percent footcandle reduction is acceptable for most corridor applications, it may not be for our offices and labs. Hence, we are looking for a little more light either through better designed reflectors, the use of higher output electronic ballasts, or less delamping (e.g., going from four tubes to three tubes).

As many as 50,000 light fixtures may be retrofitted. To minimize disruption of campus business activities, we may specify that much of the work needs to be done during the second or third shift or on weekends.

A lighting project this size is going to create a lot of solid waste. To minimize this waste we have asked our ESCO to avoid wholesale replacement of fixtures. We would like to keep the existing fixtures and just change their "guts," i.e., lamps and ballasts. As a matter of environmental responsibility, we are also investigating recycling options. Of course, PCB-containing ballasts will require special handling.

Variable Frequency Drives and IAQ

Our ESCO has identified 200 possible variable frequency drive (VFD) applications. Some of these involve using VFDs to

operate our variable air volume (VAV) fan systems, instead of relying on fan inlet vanes. But the larger savings come from retrofitting constant volume fan systems with VFDs to reduce air flow seasonally and during times of the day when occupancy is low.

The fan law—which says that energy is saved in proportion to the cube of fan speed reduction—guarantees huge savings from even small reductions in fan speed and air flow. A 20 percent reduction in air flow can result in nearly a 50 percent reduction in fan horsepower. This is the basis of most VFD savings.

One potential pitfall associated with converting constant volume buildings to VAV is the possible reduction of outside air, which could result in an indoor air quality problem. To address this concern, we plan to install air quality sensors in the affected fan systems. These will modulate building outside air dampers and guarantee sufficient outside air when the VFDs slow down building fans.

A Creative Solution to Our Worst Energy Problem

Laboratory buildings with high ventilation requirements are our biggest energy consumers. UB's worst are Cooke and Hochstetter Halls, two connected lab buildings with numerous fume hoods and a continuous ventilation rate of 300,000 cfm of outside air. This facility consumes $1.8 million worth of electricity a year. By working closely with our ESCO's engineers, we have been able to develop an ECM that will reduce this amount by $650,000 a year.

Generally speaking, we found strategies for reducing energy costs associated with lab ventilation systems: air flow reduction, heat recovery, and fuel switching. After many months of analysis and discussion, we decided to use all three methods!

We plan to install a glycol "run around" loop heat recovery system on Cooke-Hochstetter's exhaust and supply air systems, which will eliminate substantial amounts of electric preheat. Additional "free heating" will be provided by heat extracted from water circulated in our underground campus chilled water loop; this loop is warm enough (55-60 degrees) in the winter to heat outside air when circulated through fan cooling coils. Our ESCO's design will enable us to add supplemental gas heat from a process steam boiler when necessary. We are also investigating sash stops as a way of reducing air flow through the fume hoods while maintaining safe face velocities.

Good News For South Campus

While the CES/Way DSM project may reduce UB's North Campus energy consumption by 25 million kilowatt-hours or more, our South Campus may soon be the beneficiary of energy improvements from another source: cogeneration.

Guidelines for a Successful ESCO Project

1. Select an energy service company (ESCO) the same way you would professional services, not like a low-bid contractor. Choose a company that has a good track record, is able to effectively employ utility DSM financing, and offers a comprehensive (non-cream-skimming) approach to campus energy savings.
2. Negotiate a contract that reasonably limits ESCO profit-making and establishes a win-win arrangement. Carefully weigh the pros and cons of performance contracting and shared savings versus fees for services and other alternative contractual arrangements.
3. Work with your ESCO to secure top-level administrative support by clearly demonstrating your project's potential short- and long-term financial benefits. Remember to consider non-energy savings, e.g., maintenance savings and avoided capital improvements.
4. While contract negotiations are by their nature adversarial, once the work has commenced it is essential that both facilities and ESCO staff work as partners in a collaborative process.
5. Organize an in-house facilities project team to work with the ESCO to mutually develop ECM proposals, prepare bid specs, prequalify prospective bidders, etc.
6. Work with the ESCO to conduct tests of questionable technologies in order to determine their performance and applicability and to maximize available benefits while avoiding costly mistakes.
7. Ask your ESCO to incorporate extended product warranties and expanded personnel training into your bid specs as price alternates. If your project is sizable, ask the ESCO to use your buying power to obtain these extras at no additional cost to you.
8. Consult with faculty and other building occupants and modify ECMs accordingly.
9. Design the project and coordinate construction in a way that minimizes disruption of campus academic and business functions.
10. Catalog both energy and non-energy benefits of your project and be prepared to "sell" it to the campus community.

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eral ways to resolve this potential conflict and allow the power of TQM to benefit campus energy conservation.

First, energy conservation should be explicitly included in your TQM program. Applying TQM to energy conservation means improving and strengthening the conservation program, moving toward energy excellence and a less wasteful, more efficient campus. We have recognized this principle at UB by incorporating resource efficiency in our facilities mission and vision statement.

Second, the TQM process should lead to the development of official temperature and fan operation policies that are reasonable and endorsed by campus top-level administration. If you already have these energy policies, it is essential—in light of TQM—that your campus recommit to them. TQM should mean doing a progressively better job implementing energy policies (not abandoning them).

Good communication is fundamental to TQM. Campus energy policies and the good reasons for them should be effectively communicated to the campus community via top-level memoranda as well as by your energy awareness program.

Finally, it is essential that TQM be defined broadly in terms of public service and environmental responsibility.

Our TQM philosophy has definitely made our facilities operation more customer-oriented. But who are facilities' customers? Are they just our colleagues? The faculty? The current enrollment of students? Or are they also members of the wider community, including our children and the next generations? And what does it mean to provide quality service?

In order for TQM to really inspire, it must be expansive in its ethical commitments and be ultimately rooted in public service and concern for the wider community—for the future and for the earth itself. Once TQM obtains that kind of depth and maturity, it will bolster campus energy conservation, not threaten it.

Campus energy conservation is one of the most important things a school can do to meet its environmental obligations. Energy production and consumption do so much harm: polluting air and water, contributing to acid rain and global warming, causing the destruction of wilderness areas, and even leading to energy wars that nobody wants to fight. Conserving energy not only mitigates those problems, but also saves money. It is time to take campus energy conservation off the back burner and get serious again. ■