
State University of New York at Buffalo

Comprehensive Energy and Resource Management

Profile #124

Principal investigators: Barb Hogan and Ted Flanigan

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The State University of New York at Buffalo has implemented one of North America's leading energy and resource conservation programs and stands as a powerful model for the future and as such was selected for inclusion in the Series 4 Profiles by The Results Center Board of Advisors. The Results Center salutes the University at Buffalo for its success; commends Niagara Mohawk Power Corporation for its support and CES/Way International for its implementation work; and most especially congratulates the University Facilities staff for their dedication and their unquestionable success. In particular, we wish to recognize Walter Simpson, UB's Energy Officer.

This Profile is part of a collection of 124 Profiles researched and published by The Results Center over the past four years. It is intended to provide a thorough understanding of the program and its unique elements. This Profile can also be used to compare this program with other programs documented by The Results Center. For a complete listing of the Profile Library see the back page. For additional information please contact The Results Center.

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Executive Summary

University campuses, like large military installations and other types of large institutional facilities, are essentially micro-cities ripe with energy efficiency opportunities. Unfortunately, their budgets tend to be filled with competing interests. Thus efficiency upgrades often fall by the wayside despite the fact that they are investments that pay for themselves over time and which can thus support rather than detract from the educational process. At the State University of New York at Buffalo, thanks in part to the dedication and determination of Energy Officer, Walter Simpson, energy efficiency became a priority which has provided the campus with attractive returns on investment while fulfilling a moral obligation to use energy judiciously. Furthermore, in the process of retrofitting the campus, the University at Buffalo (UB) has educated its student body, faculty, and staff of the importance and potentials for efficiency.

For two decades UB has been engaged in plugging the leaks of energy and dollars from its campus. It has financed efficiency upgrades in a number of ways, leveraging change through a variety of capital sources including the University's own operating and capital budgets, loans from the state, and most recently by engaging the services of an energy service company that drew incentives from the local utility and helped secure financing for the remaining investment through a tax-exempt lease.

Following the energy crises of the 1970s, UB undertook an important and relatively low capital cost energy tune-up. When Walter Simpson became the University's first Energy Officer in 1982 the formal "Conserve UB" program was born and evolved into a program that resulted in over 300 retrofit activities. Then in the 1990s, UB entered a partnership with CES/Way International. Supported by over \$4 million in incentives from Niagara Mohawk, the University engaged in a comprehensive \$17+ million retrofit that has addressed heat recovery, upgrading lighting systems, the installation of high efficiency motors and drives, as well as controls and energy management systems to cut energy use while maintaining if not enhancing the quality of its buildings and facilities.

While many universities have performed energy efficiency retrofits, UB stands out as a model of an integrated approach. It has at once focused on saving energy and dollars in the short term through technical measures that have created annual savings of over \$9 million and \$65 million in cumulative cost savings, while fostering an ethic and awareness on campus related to long-term judicious resource use. The Conserve UB approach has been a dual-pronged effort, drawing upon top-level support while shoring up the foundation with grassroots awareness of efficiency's promise and potentials. Driven by a self-espoused "conservation zealot," UB's comprehensive program is one that contains many rich and inspiring lessons.

STATE UNIVERSITY OF NEW YORK UNIVERSITY AT BUFFALO

Measures: *Broad range of measures including delamping; operations curtailment and shutdown; HVAC modifications; lighting and HVAC retrofits; heat exchanger loop; weatherization; motors and equipment replacement; etc.*

Mechanism: *Comprehensive efforts ranges from no-cost solutions to contracting an ESCO for a campus-wide project. Financial resources include internal sources, state and federal grants, utility incentives, and private sector loans*

History: *Grassroots efforts began in the seventies; Conserve UB was established in 1982; ESCO project began in 1994*

PROGRAM DATA (1973-1996)

Annual energy savings: 167,780 MWh

Cumulative energy savings: 335,560 MWh

Lifecycle energy savings: 2,516,700 MWh

CONVENTIONS

All Series 4 Profiles will report nominal dollar values except where expressly stated as levelized. Levelized figures, used for comparative purposes, are based on 1990 U.S. dollars. Inflation and exchange rates were derived from the U.S. Department of Labor's Consumer Price Index and the U.S. Federal Reserve's foreign exchange rates.

The Results Center uses three conventions for presenting program savings. **ANNUALSAVINGS** refer to the annualized value of increments of energy and capacity installed in a given year, or what might be best described as the first full-year effect of the measures installed in a given year. **CUMULATIVE SAVINGS** represent the savings in a given year for all measures installed to date. **LIFECYCLESAVINGS** are calculated by multiplying the annual savings by the assumed average measure lifetime. **CAUTION:** cumulative and lifecycle savings are theoretical values that usually represent only the technical measure lifetimes and are not adjusted for attrition unless specifically stated.

Program Manager's Perspective

BY WALTER SIMPSON, ENERGY OFFICER

It took an international crisis to wake me up but the commitment to energy conservation that resulted was strong and life-defining. If anything, that commitment has deepened over the years.

In 1979, a few years after the 1973 Arab oil boycott put the "energy crisis" on the map, the Soviet Union invaded Afghanistan. Speculation about Soviet intentions fueled fears that the Russians were after the rich oil fields of the Middle East. In response, the Carter Administration declared that the U.S. would use "any means necessary" to prevent a Soviet takeover of this critical resource.

The "any means necessary" was code for nuclear weapons. While primarily intended to scare the Russians, this announcement scared me plenty. Up until this point, I took energy for granted. Then I realized that our country's energy extravagance and foreign dependence could lead to war, even nuclear war.

My response was amateurish but to the point. I organized an "Energy Conservation Peace Pledge" campaign through which people could commit themselves to simple conserving acts like driving less, turning off lights, and lowering their thermostats – as an alternative to nuclear war! Now this was a "no-brainer" if there ever was one! Energy gluttony and our materialistic lifestyle have limits, a reality this crisis forced me to understand.

Shortly afterwards, I returned to graduate school to study energy issues. I then became a professional energy conservationist here at the University at Buffalo. As a result, I have learned not only how to save energy but why it is so important.

Energy users, including colleges and universities, are primarily interested in energy conservation and efficiency as means of saving money. But of greater significance is the fact that conservation and efficiency mitigate numerous adverse environmental and social impacts associated with energy production and consumption. These include air pollution, acid rain and global warming, oil spills and water pollution, degradation of land and loss of wilderness areas, construction of costly and sometimes dangerous new power plants, and the risk of international conflict and war over energy supplies.

We have already seen the consequences of a full-fledged oil war, following the 1990 Iraqi invasion of Kuwait. Over 100,000 people lost their lives. I believe we should do whatever we can to decrease the chances of future wars involving energy. We

can do that through the steadfast pursuit of energy conservation and efficiency, a commitment which becomes all the more essential as human population escalates and competition for scarce resources increases.

How ironic it is, then, that as the urgency of conservation and efficiency increases, energy policy may be taking a giant step backwards as the electric industry is deregulated. I say this because in many parts of the country the deregulation debate appears to be focused almost entirely on the price of energy, without a adequate concern for energy's true costs.

It is difficult to argue against lower energy prices to anyone paying the bills. However, we do know that if deregulation leads to lower prices, the odds are that more energy will be consumed and wasted – this in a country which already consumes two to three times as much energy per person as Germany and Japan.

What to do? Energy or carbon taxes (to internalize environmental costs) are not politically viable. As an alternative, I believe we must speak out and insist that policy-makers continue and expand incentive programs which promote efficiency. Also, multi-tiered pricing structures which establish lower prices "at the margin" should be rejected since they discount the next kilowatt hour used or saved, thus discounting energy waste and undermining the economics of energy efficiency. Efficiency efforts will be crippled if paybacks are calculated using low marginal rates.

At UB, our energy conservation program has had its ups and downs. The CES/Way project represents a high point. But there is still so much to do. I believe that surviving deregulation is the greatest challenge our campus energy program now faces.

In my personal opinion, it would be a tragedy if our program ceases to implement new conservation measures and merely saves money as a result of lower rates produced by a retail wheeling contract, a utility "buy-out" contract, or the operating profile of our new cogeneration plant. Since the Russians invaded Afghanistan, I've known that much more is at stake than saving money.

Program Context

STATE UNIVERSITY OF NEW YORK AT BUFFALO (UB)

The University at Buffalo, located in the western corner of New York State, was established as a private medical school in 1846. In fact, its first chancellor was Millard Fillmore, who was also serving as President of the United States. The University operated as a medical school for its first forty years and then in the 1880s and 1890s was expanded to include professional schools for dentistry, pharmacy, and law.[R#22]

At the beginning of the twentieth century, the University at Buffalo (UB) acquired the land for its first formal campus, what is now known as the South Campus. In 1919 UB was authorized as a degree-granting college by the State of New York. Then in 1962, UB merged with the State University of New York (SUNY) and became a part of the State University of New York "SUNY" system resulting in a sharp increase in student applications and the expansion of the University. A new campus, commonly referred to as the North Campus, was built in Amherst, New York, just a few miles north of the South Campus. The North Campus opened its first facility, a residence hall, in 1973. By 1977, following a fast growth period, the North Campus had become the central campus for UB.[R#22]

Today the North Campus is made up of 67 buildings totaling 5.6 million square feet spread over 1,192 acres. The North Campus houses 3,872 students and is attended by over 20,000. The smaller and older South Campus has 54 buildings with 3.2 million square feet on 154 acres. It houses 1,146 students and is attended by over 3,000. Together, the two campuses support a total population of 24,493 including undergraduate and graduate students. The University employs 4,981 full-time and 5,083 part-time faculty and staff, adding another 10,064 to the total university population. All told, the two campuses are occupied by 34,557 people.[R#22]

CAMPUS ENERGY USE

Collectively, American colleges spend \$5 billion each year on energy. Campus energy costs typically constitute 30% of a university's total operations and maintenance budget. At UB annual energy expenditures are currently \$17 million. Ap-

UB 1994 STATISTICS

<i>Number of Buildings</i>	121
<i>Total Area (square feet)</i>	8.8 million
<i>Number of Students</i>	24,493
<i>Number of Faculty and Staff</i>	10,064
<i>Electric Consumption</i>	210.3 GWh
<i>Peak Demand</i>	49,800 kW
<i>Total Energy Costs</i>	\$17.0 million

proximately 40% of UB's operations and maintenance budget is spent on utility bills, however this includes water. In terms of electricity, the average annual consumption for the both campuses between 1988-1994 was 208 GWh. [R#8]

Like many facilities built in the seventies, UB's North Campus was originally all-electric. With an average annual consumption of 171 GWh for the North Campus, over a quarter of this (26% or 42.75 GWh) fulfilled the campus' space and water heating requirements. The exclusive use of this costly heating fuel was aggravated by energy-inefficient building designs plagued by insufficient insulation coupled with angular architecture which favored aesthetics but increased surface areas and heat loss. An additional energy burden is placed on the campus by its laboratories which require constant, high volume ventilation for fume hoods. The largest of these facilities is made up of two connected labs, called Cooke-Hochstetter, which demands fresh air for ventilation at a rate of 300,000 cubic feet per minute. This facility alone draws \$1.8 million worth of electricity each year. By performing a comprehensive retrofit on this facility, the University cut this cost by \$650,000.[R#2,8]

Given its earlier construction, the South Campus does not rely on electric resistance heating. Instead, it has a steam plant fueled by coal, oil, and natural gas which provides heat via a steam loop for its facilities. Though preferable to electric heat, the system is old and has high maintenance demands. [R#2,18]

Program Design and Delivery

At the time of the first energy crisis in the 1970s, many Americans first became aware of how much energy impacts our daily lives. Gasoline shortages marked by major gas lines at the pumps hammered home our dependency on energy supplies. This sudden awakening to energy's importance and the uncertainty of supply triggered conservation actions across the country. President Jimmy Carter urged the American public to attack energy waste with "the moral equivalent of war."

One of the most favorable jurisdictions for energy efficiency has been college and university campuses whose scholastic settings are conducive to both global thinking and responsible action. Prompted by Carter's proclamation, not to mention the stark reality of potential supply disruptions, several universities were galvanized into leadership positions in the late 1970s and early 1980s, teaching students, faculty, and staff to use energy more sensibly. Given the size of university campuses, campus efficiency activities have taken many forms. The State University of New York (SUNY) at Buffalo efforts have not only spanned twenty years but have included investing in an Energy Officer, forming committees, and partnering with its utility, Niagara Mohawk, and an energy service company (ESCO) to comprehensively address energy use on campus.

The campus-wide efficiency activities at SUNY Buffalo (UB) can be effectively dissected into three distinct phases: Fueled by the oil crises, UB's first efficiency efforts began in the late 1970s. Basic HVAC and lighting measures were addressed at that time. Then in 1982, a conservation ethos was embedded in UB's system with the establishment of "Conserve UB". Thanks to Walter Simpson's motivation, efficiency efforts have grown and persisted for thirteen years. The University's conviction to efficiency earned UB distinction when it engaged in a major contract with the energy service company CES/Way.

1. THE SEVENTIES

The first energy conservation efforts at UB were the product of actions taken by the Plant Superintendent at the time, Herb Lewis. Prompted by the energy crises, Lewis formed an energy committee within his maintenance staff. This rather informal group met regularly to discuss what could be done to save energy in campus facilities. The groups' first efforts focused on basic conservation of resources. Lewis' group focused on HVAC systems, installing controls, replacing motors on pumps, and modifying the discharge air temperature in HVAC systems throughout the North Campus to eliminate the need for reheating during the summer air-conditioning months. The group also performed UB's first lighting retrofits,

taking rather rudimentary steps to reduce lighting intensities in corridors on the South Campus.[R#1]

The steps taken by Lewis and his energy committee were very well received. Not only had they garnered the philosophical support of University officials, but they had earned their financial support as well. In addition to central office memos distributed to staff throughout the campus calling for the conservation of energy, the facility personnel's dedication to energy conservation and reducing bills resulted in very significant expenditures. All told, the University provided \$2.7 million for a host of energy efficiency initiatives between 1973 and 1981. This capital spurred 63 projects during that time frame. By 1981 these projects produced \$1.7 million in total annual dollar savings based on total annual energy savings of 50,537 MWh.[R#1,14,15]

2. CONSERVE UB

In 1982, UB institutionalized and expanded its energy efficiency efforts by establishing the "Conserve UB" program. Its focus was to make energy efficiency a campus-wide effort through awareness and participation. To spearhead the program the University established a new position, Energy Officer, within the University Facilities Department. The duties of this position were essentially two-fold. First, the Energy Officer was to accelerate the implementation of energy efficiency measures on campus. The second aspect of the new position was more educational. Walter Simpson was hired to effectively communicate what was being accomplished through these efforts and raise awareness on campus of the importance of energy efficiency. This task expanded the program's past focus on technical measures to tap a host of non-technical solutions as well, promoting awareness as a precursor to behavioral changes to enhance efficiency on campus. Simpson's challenge was to catalyze the involvement of students, faculty, and staff alike, while overseeing continual efficiency and maintenance improvements of campus facilities.

While the job description was multi-faceted, Walter Simpson was up to the task. His dedication and enthusiasm were major program drivers. Having spent several years as a volunteer and staff member for the Western New York Peace Center, eventually serving as its Director, Simpson had long felt the connection between global peace and energy use. Simpson also earned a masters degree in environmental studies, focusing on energy policy and technology. This gave Simpson an interesting perspective and set of connections. He progressed from student to staff, working directly within the two spheres that

Program Design and Delivery (continued)

his job description had attempted to link.[R#1,3]

The Conserve UB Committee: Simpson's first action as Energy Officer was to establish the Conserve UB committee which was comprised of 15 members primarily from faculty and staff and included members of the science departments, maintenance staff, and the business office. The function of this committee was to establish environmental outreach on campus. The committee typically took on a new campaign each semester and expanded beyond the confines of campus energy efficiency to include such subjects as global warming, the James Bay power project, and war in the Middle East. Pragmatic concerns such as temperature settings for buildings, computer use, and lighting were addressed as well.[R#1]

Conserve UB approached several dimensions of energy conservation. Its efforts increased the University's focus on technical measures for reducing energy use. In fact, under Simpson's guidance and through the hard work of numerous Facilities staff members, Conserve UB resulted in the implementation of over 300 projects ranging from the installation of energy-efficient lighting to high performance showerheads to automated temperature controls. While these efforts certainly included technical measures such as installing heat pumps, they also resulted in a series of low- and no-tech solutions such as delamping corridors, closing blinds, and shutting down unnecessary mechanical systems over weekends and holidays. For example, Simpson found that 50% of the corridor lights in many buildings on campus could be permanently removed to save 1,064 MWh annually. Similarly, intersession curtailment, which involved shutting down campus operations over the Christmas holidays, saved \$100,000 each year. Most importantly, Simpson was able to link technical measures with an educational element that proved essential to the University's overall conservation strategy and actions. Walter Simpson explained that, "Technical skills are only part of the equation [on campus]; a lot of what I do is really teaching and community organizing." [R#3,14,15]

Raising awareness on campus: Conserve UB was certainly rooted in technical retrofits but also had a major emphasis on raising awareness of the importance and opportunities related to efficiency. By educating the entire campus community of the value of energy efficiency in general and the purpose of Conserve UB in particular, members of the university community became enlisted as the "eyes and ears" to find problematic energy use and to identify promising retrofit opportunities. Simpson helped to raise awareness among faculty and students by posting the annual energy costs and con-

sumption data for each building in its vestibule so that occupants could better understand the facility's energy use. Through this conservation education, building occupants became attuned to the import of a building's consumption and its opportunities to conserve and were encouraged to become part of the solution.

The Conserve UB Committee fulfilled its task in a number of ways. It raised awareness by providing literature on energy efficiency and by sponsoring lectures and workshops. Throughout its tenure the Committee solicited suggestions from the entire campus community on how UB could improve its energy use and continue to cut its energy bills. Conserve UB maintained a very receptive stance, welcoming and encouraging creative thinking to further its mission. While its posture was inviting to its broadest constituency, maintenance staff were always considered key players. These were the professionals who were "on the front lines," closest to the physical operation of the campus. Thus maintenance was kept in close contact with Conserve UB's work.[R#1]

Raising awareness of energy efficiency not only pulled the campus population into the process through active participation, but was also important for developing passive cooperation. Although efforts were made to minimize inconveniences, retrofits are often disruptive. By informing the campus community of what conservation efforts were being done and why, the installations were met with support rather than resistance. When a major campus relamping project was being conducted throughout every campus facility, there were virtually no complaints received from faculty or students on the disruption caused by the project because it was recognized for its merit.

Establishing energy policies: Although it was understood that turning off lights and computers and turning down temperatures all contributed to energy efficiency, the Conserve UB Committee recognized that without regulation, full compliance was unattainable. Simpson realized that the absence of policy was a barrier to energy efficiency. Thus an Energy Policy Committee was formed in 1988 with high level participation from both academic and administrative sides of the University. The ad hoc Committee consisted of five members.

One of the Energy Policy Committee's first acts was to change the University's policies regarding ambient temperature settings for its facilities. For the winter months the Committee established a new winter heating policy; thermostats were adjusted downward from 72 degrees F to 68 degrees F. Similarly, summer cooling temperature setpoints were increased from 74

degrees F to 76 degrees F. This policy initiative alone saved the University 6,747 MWh annually.[R#14,15]

A similar policy initiative involved HVAC system operations in buildings during off-hours. Prior to the policy, HVAC systems were turned on as needed during off-hours. Unfortunately, often ventilation systems were left on unnecessarily as there was little incentive or direction encouraging optimization of efficiency in this area. The policy that ensued required faculty members to get approval for operations during unscheduled hours. By doing so, they became accountable to energy use and systems were properly "put to bed" when not needed. This simple step resulted in energy bill savings of \$600,000 annually.[R#14,15]

The Environmental Task Force: In 1989, the University's president established the Environmental Task Force (ETF) in response to numerous student and faculty requests. The Task Force was made up of approximately 35 faculty, staff, and student members. Its function was and continues to be to investigate UB's overall environmental impact and to incorporate sustainable environmental practices on campus. Given the healthy overlap between activities, Conserve UB and ETF have collaborated on several efforts and supported each others initiatives. Ron Naylor, former ETF chairman and UB's Associate Vice President for University Facilities, called the interface between these two initiatives "a good fit." In fact, because of this overlap the Conserve UB Committee was disbanded and some of its members joined the Environmental Task Force. Despite the amalgamation, under Simpson's direction, Conserve UB maintains its own identity and focus on energy efficiency.[R#9]

The Task Force has helped initiate several environmental actions and programs on campus and lent support to many others through the formation of various subcommittees on energy, recycling, land-use, hazardous waste, transportation, and other resource-related areas. For example, in 1993 the ETF was instrumental in setting policies for University purchasing practices, decreeing that all purchases will be as environmentally friendly as possible. This decree has reinforced efforts to promote the use of recycled, chlorine-free bleached paper as well as many other responsible improvements related to purchasing. The ETF took on a range of related activities such as a campaign to reduce junk mail and to reduce the number of phone books on campus. ETF also introduced a pilot rideshare program on campus, promoted campus-wide recycling, and even supported a community/university coalition effort likely to lead to the construction of a compressed natural gas fueling

station on campus for both campus fleet and community vehicles.[R#9,17]

The ETF continues to develop innovative proposals such as a university land-use policy which will reduce grass cutting and allow certain segments of the campus to return to a more natural state. Carpooling has also been promoted by the ETF as an alternative to new parking lots, though making progress in this area has been difficult. In addition, the ETF and Conserve UB have been the driving forces in organizing and promoting stimulating lectures on energy and resource efficiency as well as environmental stewardship, bringing highly regarded experts such as campus conservation advocate David Orr to the campus. The ETF has also been instrumental in coordinating workshops with the energy efficiency office of its electric utility, Niagara Mohawk Power Corporation.

Integrating campus efficiency and curriculum: Integrating campus efficiency activities with environmental education will be a major focus of the ETF in the coming years through modifying existing curriculum and by adding new environmental stewardship courses. For example, university students conducted an environmental impact audit of the campus as part of their coursework for a class taught by Political Science Professor Claude Welch and Energy Officer Walter Simpson. The audit, in turn, not only has provided the fodder for ETF's next actions but excited participating students so much that many claimed the course was the best class of their college experience. Clearly UB has found a powerful synergy between efficiency retrofits and environmental education. [R#1,9]

UB's efficiency campaign has taken many forms to improve campus energy use. Efforts from the University Facilities staff and organizations such as Conserve UB and the ETF have encompassed a range of methods from technical solutions to energy policies to conservation education. Among the most noteworthy initiatives put forth by these parties are the Building Conservation Contacts network, the Green Computing Campaign, and a \$17.4 million energy efficiency retrofit carried out by CES/Way International with financial support from Niagara Mohawk Power Corporation (NMPC).[R#9]

Building Conservation Contacts: UB's energy efficiency activities have been furthered by a program instigated by the ETF that established Building Conservation Contacts who promote energy conservation and environmental efforts within specific departments. The Building Conservation Contact pro-

Program Design and Delivery (continued)

gram (BCC) was implemented in 1993 and enlists 170 staff and faculty "Building Contacts" to raise environmental awareness within the University's buildings. The contacts represent their academic departments or administrative offices and monitor buildings using a four-page environmental checklist that addresses energy use, water use, transportation, solid and hazardous wastes, and purchasing.

It is the Contacts' job to turn off lights, computers, and office equipment that are not in use and to monitor temperatures to make sure they are in line with prescribed settings. In addition, BCCs flag opportunities for further capital retrofits, identifying areas with more than sufficient lighting and problem areas such as places that are overly hot or cold. The Building Contacts also monitor participation levels and provide information on campus environmental policies and programs. The BCC provides a network for the contacts, including training and a newsletter and keeps the ETF informed on conservation progress and participation for their specific facilities. [R#16,17]

Green Computing: UB is well recognized for its Green Computing Campaign as it is among a handful of campuses that were leaders in addressing the efficiency of this growing "plug load." Following the U.S. Environmental Protection Agency's leadership vis-a-vis its Energy Star Computers program (see Energy Efficiency News & Views, October 1995), Conserve UB and the ETF designed a campaign with the goal to reduce campus computer energy use by as much as fifty percent.

Computers are the fastest growing electric load on UB's campus. With nearly 10,000 computers on campus, UB's electric costs for computing are approximately \$300,000 annually. When run "around the clock," as many computers are, the result is an electrical bill of \$200 per year per computer (assuming an average 300-watt total for the central processing unit, monitor, and printer). By reducing a computer's electricity run-time to 40 hours a week, its annual power cost can be brought down to \$50. Of course, even greater savings are possible by reducing operating hours further. [R#5]

Improved operator use is one of the prime foci of the Green Computing Campaign. Ways that students, faculty, and staff can become more efficient operators are promoted through the "UB Guide to Green Computing: How Your Choices Can Make a Difference." This booklet was produced and distributed by Conserve UB on campus; it is also available externally for \$2. (To date the ETF has distributed about 2,000 copies of the booklet around campus and to as many as 200 other campuses.) [R#1]

The Green Computing guide includes energy-saving recommendations ranging from turning off computers and peripherals when not in use to disabling the unnecessary "test page" printer feature to e-mailing and faxing directly to computers whenever possible. The guide also provides other operational information. For instance, it dispels the myth that it shortens the life of a computer to turn it off – a belief that has led some people to leave their computers on all the time. Most experts agree that turning a PC off a few times a day will not have any adverse effect on the unit and in fact can add to the computer's life since electronic equipment longevity is a function of operating hours, power quality, and heat. [R#5]

Reducing paper waste is also a major emphasis within green computing and has been promoted by recommending editing on screen, using smaller fonts, e-mailing, duplexing, using recycled paper, circulating shared copies of general memos, and recycling waste paper. These tactics not only save UB energy and paper costs by minimizing printing but also save energy and resources at the production level. [R#5]

The Guide to Green Computing also outlines criteria for purchasing new equipment. It first recommends not to buy a new computer if there is no real need or if the needs can be met through new software. If, however, there is need for a new unit, the guide recommends buying an Energy Star computer. Furthermore, the Guide urges purchases to go one step better than an energy-efficient Energy Star computer and supports the purchase of "green computers," which are manufactured with minimal impact, using resources more efficiently, and built with materials that can be recycled. The Guide recommends buying monitors that are only as big as necessary for the desired application; it also recommends use of monochrome monitors wherever possible which use 50% less energy than color monitors. When shopping for printers, the Guide recommends consideration of ink jet printers which use 80-90% less energy than laser jet printers; it also recommends that the University only purchase low or no-ozone emitting laser printers. [R#5]

3. THE CES/WAY PROJECT

By the early 1990s it was clear that Conserve UB had created a significant effect on campus. Its integrated, largely grassroots approach was working; the comprehensive initiative was being effectively driven by Walter Simpson; and UB had become regarded as one of the premier examples of campus efficiency. But UB took a major step in the early 1990s when it teamed up with CES/Way International – an energy service company –

and its local utility, Niagara Mohawk Power Corporation (NMPC). (See Profile #122 for an overview of NMPC.)

The \$17.4 million retrofit: UB's conservation efforts took on a new dimension by contracting CES/Way to proceed with a \$17.4 million capital-intensive retrofit, effectively drawing \$4.3 million in utility incentives to leverage savings. The overall investment would produce savings of nearly \$3.2 million in energy costs annually, a reduction of 18%. This was and still is the most comprehensive efficiency project conducted by any campus in the country. Senior Vice President of CES/Way, Trip Tripathi, remarked that he knows of no other comprehensive university project of this size in the United States.[R#23]

CES/Way first contacted UB's Facilities Department with the proposal for the project in 1991. A preliminary audit of the North Campus by CES/Way engineers provided estimates of potential costs and savings for UB officials. The initial audit found the potential for approximately 15% overall energy savings; the NMPC incentive was enough to convince both UB officials and executives at SUNY's central office in Albany, New York to proceed with the project.[R#12]

In this case, it was CES/Way that solicited UB regarding the campus-wide retrofit. CES/Way had already won a contract to furnish 8 MW of capacity savings for NMPC's Power Partners Program (PPP), a demand-side bidding program. In fact, NMPC's contract with CES/WAY paid the ESCO over \$1,000 for each kilowatt of reduced demand. It furthermore stipulated that the project must be comprehensive – its measures must include both short- and long-term payback measures – and that savings must persist for a minimum of 15 years.

The CES/Way retrofit at UB resulted in \$4.2 million of NMPC's Power Partner's incentive. An additional \$120,000 was provided by the utility through equipment rebates for outdoor lighting and variable speed drive installations. These measures qualified for NMPC funding through the utility's conventional DSM programs. Additionally, CES/Way included some fuel switching measures in the project which were not covered under the Power Partners contract and did not qualify for NMPC incentives.[R#13]

UB assigned a maximum payback period of five years for energy conservation measures considered for the project. This threshold was extended in cases where the measures carried additional non-energy benefits such as improved comfort, better indoor air quality, or reduced maintenance costs. A further stipulation of Niagara Mohawk's PPP contract was that

the overall project have a net simple payback between three and five years. This was established so that "cream skimming" would not occur, where only the most cost-effective, shortest payback retrofit measures are implemented.[R#13]

The project's strategy was to implement both long- and short-term payback measures at the same time so that the dollar savings from the latter will leverage funding for the former. If the short-term payback measures are implemented first and separately, the dollar savings tend to be redirected and the long-term projects become stand-alone projects which may never seem reasonable. By bundling low- and high-cost measures the project avoided cream-skimming and lost opportunities. This was just the sort of arrangement UB sought because it allowed the University to reap the benefits of higher-cost measures which were previously unobtainable when the program was internally funded.

Detailed engineering analysis: After conducting a preliminary site survey to ascertain UB's interest, CES/Way performed a detailed engineering analysis (DEA). Because of the complex nature of energy use on the sprawling university campus, the analysis was necessarily arduous and time consuming, taking over a year to complete. The DEA methodology for identifying efficiency opportunities and estimating potential energy and demand savings included billing and weather analysis; a review of occupancy patterns; interviewing engineering and maintenance staff; identifying HVAC design, equipment, and performance, control patterns, and air distribution; creating an inventory and testing campus lamps and ballasts; and spot metering. Input from both the University Facilities and Residence Life departments was important to this process. UB staff and CES/Way engineers worked hand-in-hand to assess energy use on campus.[R#13]

A draft DEA report was submitted to the University in January 1994 and recommended numerous installations including re-lighting virtually every building and replacing 200 motors. After appropriate reviews and modifications, the final DEA report was submitted in June 1994. Project installation commenced shortly thereafter.[R#10]

Financing the project: Working with an ESCO provided a major boost to the overall efficiency initiative on campus. Not only has the capital-intensive project delivered major savings to the campus, but it is self-financing as well. In addition to the funding provided by Niagara Mohawk, the University received a \$3.2 million loan through the State of New York. The State provided the funding in the form of a COP (certificate of

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participation) loan, made available to assist state agency equipment procurement. The COP loan was a dedicated award for upgrades made to two laboratory facilities with high ventilation requirements.[R#9]

This left UB with a project balance of \$10 million. Seeing no timely source of state or federal funding to cover the remaining costs, UB turned to the private sector. UB secured the necessary capital from GE Capital in the form of a tax-exempt municipal lease. CES/Way assisted in the effort by retaining Oppenheimer as the broker and by providing assurances for investors and working with them on several procedural steps. The lease included a construction loan at 8% interest that covered the costs of construction for up to 24 months as well as a ten-year, tax exempt lease at 6.05%. Through this arrangement, UB approved the payment of construction costs and fees to CES/Way. UB will be able to pay back its municipal lease with GE Capital in monthly payments with the savings generated by the project. And the picture is even brighter: A cash-flow analysis presented in CES/Way's DEA indicated a first year net positive cash flow of \$261,278 or 11%, assuming an estimated first-year savings of \$2,203,232 and financing for all project costs not covered by NMPC incentives.[R#9,13]

In addition to the repayment schedule established with GE Capital, UB pays a monthly service fee to CES/Way of \$80,000 per year. The fee covers CES/Way's ongoing monitoring, technical support, and contract management, required for guaranteeing savings to Niagara Mohawk. This arrangement is required by CES/Way's contract and provides assurance to UB that CES/Way will achieve its projected savings. The service fee is adjusted annually for inflation based on a Consumer Price Index projected rise of 5% annually. The fee will be paid for 15 years, matching the duration of the service contract.[R#10]

Current Status: The measures identified in the DEA collectively represent Phase I of the project. All Phase I activities are expected to be complete by mid-1996. Installations of Phase I measures have followed the DEA recommendations closely with the exception of some gas conversions identified in the report. Currently, only the three largest gas conversions projects have been installed. The rest have been cancelled due to the electric rate structure of UB's current contract with NMPC which makes these conversions cost-ineffective. With the decision not to pursue the balance of the gas conversions, approximately \$2 million has been left "unallocated", a sum that will be redistributed to additional measures planned for Phase II of the project.[R#10]

Future retrofit activities: Armed with the unexpended portion of the project's initial budget and better familiarity with the campus, CES/Way has added a second phase to the project at the request of UB. A detailed engineering analysis has begun for Phase II which will include energy conservation measures identified but not included in the first DEA as well as efficiency opportunities which were discovered in the course of implementing Phase I of the project. In addition, South Campus retrofits are included in this portion of the project. While the specifics of Phase II has not been defined, its budget is set since the capital has already been secured. Phase II's target is to capture the DEA's original savings with its original budget, keeping the project's net simple payback to four years.[R#10]

In another initiative, altogether unrelated to the CES/Way contracts, designs and plans for a new cogeneration plant for the South Campus are scheduled. For the past 60 years the South Campus has been heated by a coal, gas, and oil-fueled steam plant with a capacity of 140,000 pounds of steam per hour. The plant is scheduled to be replaced with an 8 MW gas/oil dual-fuel cogeneration plant which will be constructed by the state. The new plant will be far more efficient, will utilize cleaner fuels, and will also produce enough electricity to satisfy the power needs of the South Campus.[R#1]

MARKETING

Promoting energy efficiency on campus has involved a two-pronged approach. Marketing efficiency at UB has required garnering top-level support for major capital projects and the right to enter into third party contracts. It has also involved an organic, grassroots approach whereby all students, faculty, and facilities personnel have become involved. Thanks to the initial work of Herb Lewis, energy efficiency retrofits were philosophically and financially supported by the University administration. This led to the formation of Conserve UB, an institutionalized program that was effectively expanded to integrate capital retrofits with environmental awareness producing behavioral and policy changes. All this enabled the University to engage in a performance-based contract with CES/Way. In retrospect, the campus-wide efficiency effort evolved over time in terms of awareness and financing strategies, not to mention the technical sophistication of the retrofits themselves.

Marketing the campus retrofit opportunities to both the University administration and SUNY headquarters in Albany was essential. To do so, Ron Nayler, Walter Simpson, and their colleagues presented efficiency in terms relevant to adminis-

trative concerns which have been chiefly financial.

Conserve UB's other prime marketing focus was on campus outreach. Reaching the faculty, students, and staff which made up the majority of the campus population required a variety of strategies. The roles of organizations such as the Conserve UB committee, the Environmental Task Force, and the Building Conservation Contacts network were essential to building a base of campus support. Conserve UB events and activities were also promoted with posters, brochures, newspaper articles, classroom lectures, and other special events. Additionally, Conserve UB flooded the campus with environmental statistics on UB's environmental impact and posted energy records in all campus buildings, sponsored lectures and symposia, even held panel discussions on energy for campus radio broadcast to raise awareness about Conserve UB and conservation in general. To a limited extent, outreach efforts even reached beyond campus property lines with radio programs and television documentaries.[R#2]

Another ingredient in the program's marketing success was its own identity. A logo was developed which appears not only on all program literature and posters, but also on light switches throughout campus and even payroll envelopes. The logo, a lightbulb graphic accompanied with the slogan, "Help keep the cost of education down," is clearly a positive icon on campus, associating Conserve UB's goals with an important cause.

MEASURES INSTALLED

The Seventies: UB's initial efficiency efforts on both the North and South campuses consisted of basic measures such as installing time clocks on ventilation systems. Weatherstripping and caulking was used with significant results. Some delamping also occurred and hot water heaters thermostats were reduced to 110 degrees F. In 1979, Honeywell installed energy management systems on a number of buildings, systems that were later upgraded or replaced during the CES/Way project, primarily to energy management systems equipment manufactured by Andover and Powers. In addition, the South Campus district heating steam loop received valve replacements and steam system maintenance. [R#14,15]

The greatest energy savings during this period was produced by a no-cost modification to the campus-wide HVAC system. Original operations called for drawing outside air into facilities, then bringing the air to a regulated temperature of 55 degrees, before reheating the air. (This practice is quite common to control humidity.) Of course in the winter, the regu-

lated setpoint doesn't matter; in the summer, however, UB was expending far more energy than it needed to. By changing the setpoint to 65 degrees, the measure was able to save 35,000 MWh annually when fully institutionalized on campus.

Conserve UB: By establishing Conserve UB, the University not only brought energy conservation awareness to campus but also stepped up the sophistication of technical measures. During its first decade, Conserve UB completed over 300 projects. Some of the more significant North Campus efforts included fume hood exhaust system modifications and de-commissioning; raising the discharge temperature for HVAC systems; showerhead replacements; installing gas hot water heaters; shutting off fans in winter months; installation of reflective window film; replacement of water chillers; replacement of water purifying stills with reverse osmosis water purification; and air handling units modifications.[R#14,15]

A campus chilled water loop was used as a heat transfer device, delivering excess heat from a library and computing center to laboratory buildings, continuously heating up air needed for ventilation. Energy policies also contributed nicely to Conserve UB such as a complete shutdown of campus over the Christmas holidays, not to mention the establishment of a policy regarding temperature setpoints for heating and cooling. At the same time 50% of the corridor lights in most campus buildings were delamped. The steam system on the South Campus was a prime target. Pipes were insulated and valves and traps replaced. In addition, lighting, showerheads, timers, windows, hot water heaters, and water purification systems were addressed.[R#14,15]

The CES/Way Project: The efficiency measures identified by CES/Way in the DEA for Phase I of the project were grouped into 11 broad measures categories:

Cooke-Hochstetter Heat Recovery: Recovering heat from warm exhaust air from this laboratory has been one of the most important energy efficiency measures at UB. Since the facility has a 24-hours per day operating schedule, the facilities' air handling units have had to make up the vented warmed air. By recycling exhaust heat recovered using a glycol "run-around" loop, the need to warm outside air was significantly reduced. This system is coupled with a gas boiler which safeguards it from freezing in the winter months and reduces further electric heating demands.[R#13]

Lighting: A campus-wide lighting retrofit has been undertaken that complements early delamping initiatives. This has in-

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volved replacing most incandescent bulbs with compact fluorescents and upgrading fluorescent fixtures with advanced lamps, ballasts, reflectors, and controls. (Removed ballasts and lamps were recycled.) LED exit signs are also being installed. All told, the project will replace over 52,000 lights generating approximately 11.3 GWh and 1.58 MW in savings.[R#13]

Motors: The DEA recommended that 260 of UB's 509 motors over three horsepower in size be replaced with new high efficiency motors. Many of these installations will be equipped with variable speed drives.[R#13]

Alumni Arena Heat Recovery: The Alumni Arena pool requires continuous ventilation for dehumidification. This demands constant electric heating to maintain a pool-area temperature of 80 degrees with simultaneous expulsion of 80-degree humid air. A heat recovery system was installed to transfer expelled heat to the incoming outside air, reducing the heating demands.[R#13]

Variable Speed Pumping: Three UB facilities, including Cooke-Hochstetter, have been equipped with variable speed drives on their chilled water pumps.[R#13]

Energy Management & Control System (EMCS): An expansion and upgrade of the existing EMCS was performed on all campus buildings.[R#13]

Lockwood Library VAV Modifications: The existing variable air volume (VAV) control systems in the Lockwood Library were malfunctioning and operating at 85% of their designed capability and offering no variance in volume. CES/Way retrofitted the VAV boxes to improve their performance.[R#13]

Variable Frequency Drives on VAV Systems: Installation of variable frequency drives (VFDs) on supply and return fan motors was recommended for the campus. By installing the variable speed drives, UB facility staff was able to vary the speed of the fan rather than relying on inefficient fan vanes to regulate the air flow.[R#13]

VFDs on Constant Volume Systems: The air volume of a constant volume (CV) system is set according to the peak cooling requirements which is based on maximum occupancy and its related heat gain, plus solar and electrical equipment heat gain. This situation occurs approximately 2% of the building's operating time. Furthermore, as a result of lighting retrofits, the peak cooling load was permanently reduced by approximately

5%. Heating and fan savings were achieved by adjusting the air volume using controls to simulate a VAV system based on seasonal and occupancy factors. Attention was given to ensure that these controls would not result in a ventilation loss. This procedure proved to be far more cost-effective than replacing the entire system with a VAV system.[R#10,13]

Gas Conversion: The DEA recommended limited gas conversions, in particular where electric space heating is distributed by central air handling units, and for water heating where loads are significant or in conjunction with space heating conversion.[R#13]

The DEA identified many other efficiency measures which were not recommended due to long payback periods, excessively high costs, or an inability to quantify and monitor the savings. These measures included replacing remaining motors; installation of a pool dehumidification system; incorporating additional variable speed pumping; installing additional VSDs for fans; investing in an additional heat recovery system; and placing room thermostats throughout a dormitory complex. Some of these measures will be likely revisited in Phase II of the project.[R#13]

STAFFING REQUIREMENTS

Over the years, a number of people have contributed to Conserve UB. Most instrumental to the program has been Energy Officer Walter Simpson who has orchestrated the program since its inception thirteen years ago. Conserve UB's efforts were supported by the 15 members of the Conserve UB committee and later by the 35 members of the Environmental Task Force. Ron Nayler, Associate Vice President for University Facilities and former chair of the ETF, has also played a major part in Conserve UB, as have many members of University Facilities' staff. Approximately twenty University Facilities staff members representing utility operations, trades, and engineering, have contributed many hundreds of hours working on the CES/Way project during its development, design, and construction phases. Overall, University Facilities has played a major role in directing and supporting Conserve UB, the ETF, and the CES/Way project. There are also 170 Building Conservation Contacts who contributed to Conserve UB. Throughout the course of Conserve UB and the ETF there have been countless others who have participated in efforts such as ad hoc committee members, student assistants, and students and faculty whose coursework has contributed to the program.[R#1,9]

Monitoring and Evaluation

UB's energy efficiency efforts were not mandated by either a regulatory commission or an administrative office but instead were pursued because they made fiscal sense and adhered to an environmental ethic adopted by the campus. As a voluntary effort, verification of savings was neither required nor conducted in any sort of rigorous manner. However, UB did maintain a log of its projects and tracks the energy savings from each measure. These savings were calculated using standardized engineering estimates from various sources. However, for the other parties involved, Niagara Mohawk and CES/Way in particular, monitoring and verification was an important consideration and requirement for project involvement.

MONITORING THE CES/WAY PROJECT

Niagara Mohawk's Power Partners Program (PPP) stipulated that energy service companies verify estimated savings and their persistence over a period of fifteen years. CES/Way was required to supply pre- and post-installation energy usage and now must submit annual reports to Niagara Mohawk that verify energy savings.

Pre-installation monitoring: Estimated pre-installation energy consumption was determined by metering conducted during the Detailed Engineering Analysis. Additionally, UB supplied CES/Way with five years of raw submetered data for the North Campus, providing detailed information on the consumption of individual buildings as well as composite data reflecting the entire draw at the University substation. NMPC provided CES/Way with demand profiles for the North Campus based on kW demand data using 15-minute intervals for winter (February and March) and summer (July and August). CES/Way also performed a billing analysis. [R#10,13]

Post-installation monitoring: Post-installation consumption of various measures was determined using spot-metering, trends metering (hourly readings), and engineering estimates. Additionally, temperature and "speed" sensors were installed. Hourly readings of data including temperature and drive speeds are collected, downloaded, and analyzed by CES/Way. This information allow analysts to compare measures performance for given building occupancies and temperatures in order to confirm savings persistence and equipment performance.

CES/Way performed post-installation monitoring on those measurements which were completed in 1995, namely lighting VSD's and Cooke-Hochstetter's heat recovery. Energy savings for these measurements were calculated and reported to NMPC as part of the ESCO's incentive request for the PPP. The completed measures, projected to save 15,445 MWh, have collectively produced an energy savings of 18,843 MWh for a realization rate of 122%. (Lighting retrofits saved 134% of projected savings; VSD installations saved 97% of projection; and Cooke-Hochstetter's heat recovery loop achieved a realization rate of 131%.) These preliminary results suggest that the savings from Phase I of the project may be substantially higher than the DEA estimates. [R#10,28]

Given its energy intensity and disproportionate influence in the overall retrofit, permanent metering was installed in the Cooke-Hochstetter facility. Billing analysis will also be used for on-going monitoring to ensure savings persistence. CES/Way is required by Niagara Mohawk in the PPP agreement to submit yearly reports over the next 15 years, verifying persistence of the project's savings.

Niagara Mohawk's participation: A NMPC representative was on-site for portions of the auditing, installations, and post-installation monitoring processes to confirm compliance with the utility's specifications. After retrofits were completed and verified on one facility, Cooke-Hochstetter, the incentive was processed so that Niagara Mohawk could close the program by year-end 1995. Research Triangle Institute (RTI) an independent consulting firm, was contracted by NMPC to evaluate the PPP projects. As part of its impact evaluation RTI reviewed the reported savings from CES/Way's incentive request for each of its projects, including UB's comprehensive retrofit. RTI's evaluation confirmed the savings reported by CES/Way. Based on the savings achieved by measures which were completed NMPC was able to process the incentive for CES/Way's project at UB. Niagara Mohawk staff continue to monitor project implementation at other UB facilities to ensure that NMPC specifications were being maintained and will continue to verify savings persistence for the project. [R#12]

Program Savings

DATA ALERT: Tables reflect projected data for Phase I of the CES/Way project only. Phase I measures will be complete by mid-1996. Measurements of initial installations indicate actual savings higher than projected savings.

In the eight-year period preceding Conserve UB for which there is documented information, total annual savings of 50,537 MWh were achieved. Since the onset of Conserve UB the Facilities Department has implemented over 300 projects garnering total annual savings of 81,675 MWh. UB's current pursuit with CES/Way is projected to produce another 35,568 MWh in annual savings from Phase I installations. All told, UB's conservation efforts will produce total annual savings of 167,780 MWh for total cumulative savings of 335,560 MWh and lifecycle savings of 2,516,702 MWh. [R#14,15]

If Phase II of the CES/Way project meets its expected goals, the annual savings from the project will be 42,334 MWh and the total annual savings will be 174,546 MWh, bringing the University's cumulative and lifecycle savings to 349,092 MWh and 2,618,190 MWh respectively. [R#10,13]

The only capacity figures available are for the CES/Way project given NMPC's incentives for peak demand savings. The project will produce an estimated summer demand savings of 3,359 kW and a winter demand savings of 8,339 kW. Of the energy efficiency measures installed, academic and residential indoor lighting savings account for the greatest portion with 2 MW of savings in summer and 1.5 in winter, with an annual energy savings of 10,510 MWh. The winter savings were less than the summer because CES/Way engineers factored in electric heating penalties associated with lighting retrofits. (CES/Way engineers were surprised by the magnitude of the numbers from this analysis.) Energy management controls have also been large contributors to the project's annual energy savings while the Cooke-Hochstetter heat recovery loop has had a significant reduction in winter peak demand for the project. [R#10,13]

Gas conversions accounted for the greatest portion of electrical savings, reducing the electric load by 0.6 MW in the summer and 4 MW in the winter for an annual savings of 10,956 MWh. However, these savings do not represent total energy

SAVINGS OVERVIEW	ANNUAL ENERGY SAVINGS (MWh)	CUMULATIVE ENERGY SAVINGS (MWh)	LIFECYCLE ENERGY SAVINGS (MWh)
1973-81	50,537	50,537	758,055
1982	1,450	51,987	21,747
1983	38,586	90,572	578,784
1984	10,621	101,193	159,311
1985	1,395	102,588	20,928
1986	5,389	107,978	80,841
1987	2,491	110,468	37,358
1988	2,016	112,484	30,237
1989	8,781	121,265	131,709
1990	2,381	123,646	35,720
1991	5,717	129,363	85,751
1992	2,850	132,212	42,743
1993-96	35,568	167,780	533,520
Total	167,780	335,560	2,516,702

savings since they have resulted in an associated increase in natural gas consumption of 48,516 MCF annually. Note also that only the three largest identified conversion projects were implemented. Originally, projected savings from gas conversions totaled 17,723 MWh of electricity with a demand reduction of 1 MW in the summer and 7 MW in the winter. [R#10,13]

FREE RIDERSHIP

The CES/Way project would not have taken place without the benefit of NMPC's Power Partners Program incentives and prescriptive rebates, providing a clear example of a utility's economic incentives performing as intended. No free ridership was involved in the CES/Way project or other Conserve UB efforts; instead, utility incentives allowed for deeper, more comprehensive savings through an ESCO contract that would have otherwise been likely characterized by "cream skimming" and less comprehensive retrofits.

MEASURE LIFETIME

The energy efficiency initiatives at the University of Buffalo have included a wide range of behavioral and technical measures, encompassing everything from turning off lights and computers, to lighting retrofits, to installing a glycol heat recovery loop. CES/Way's contract committed it to savings with a persistence of at least 15 years. Thus The Results Center has assigned this value for the broad range of technical and non-technical measures installed, confident that any attrition of measures will be more than recouped thanks to the increased awareness and appreciation for energy that the overall program has stimulated.

PROJECTED SAVINGS

The DEA projected savings of 42,334 MWh annually for all of the identified measures. With the elimination of a sizable portion of the gas conversions, the total electric savings dropped to 35,568 MWh. However, the cancellation of fuel switching projects has initiated Phase II of the project. While Phase II is still in the preliminary stages and the additional measures have not been confirmed, CES/Way engineers are projecting to capture all of the lost savings from the cancellation of fuel switching projects. Future goals for the program include a lighting retrofit for the South Campus and a reinvigoration of conservation awareness to elicit improved energy use practices from the campus population.[R#10]

CES/WAY PROJECT ECM SAVINGS	ELECTRIC SAVINGS (kWh)	SUMMER DEMAND SAVINGS (kW)	WINTER DEMAND SAVINGS (kW)
<i>Cooke-Hoch heat recovery</i>	1,919,201	0	1,455
<i>Lighting - Academic</i>	8,569,307	1,749	1,358
<i>Lighting - Residential</i>	1,940,346	252	222
<i>Lighting - Exterior</i>	851,929	0	0
<i>Motors - Academic</i>	371,113	54	49
<i>Motors - Residential</i>	23,016	5	5
<i>Alumni Arena heat recovery</i>	459,359	-8	143
<i>Cooke-Hoch reconnect fan RF-1</i>	159,025	0	35
<i>Variable Speed Pumping</i>	302,480	-3	8
<i>EMCs - Academic</i>	4,132,786	350	350
<i>EMCs - Residential</i>	1,017,162	125	125
<i>Lockwood Library VAV</i>	434,024	-48	-48
<i>VSDs on constant volume AHUs</i>	1,227,682	95	173
<i>VSDs on CV, PP</i>	1,883,635	117	268
<i>VSDs on VAV AHUs</i>	1,320,461	69	165
<i>Gas conversion</i>	10,956,186	602	4,031
Total	35,567,712	3,359	8,339

Additional Program Benefits

AVOIDED EMISSIONS

The Detailed Engineering Analysis conducted for the CES/Way project estimated an annual emissions reduction of 31,709 tons CO₂, 70 tons SO₂, and 107 tons NO_x. To put these values in a relative perspective, a UB faculty member calculated that without energy efficiency UB's annual CO₂ output would be approximately 250,000 tons and that it would take 54 square miles of trees to remove an equivalent amount of the greenhouse gas. Based on this estimate, the emission reduction achieved by the CES/Way project would reduce the amount of trees needed by approximately seven square miles. Put another way, the electrical savings alone resulted in a 13% reduction in atmospheric emissions.

ADDITIONAL ECONOMIC BENEFITS

Maintenance savings: In addition to the direct budget savings realized by lower energy bills, UB enjoys the economic benefit of efficiency improvements through reduced maintenance. New motors and lamps and improvements to air handling systems lead to a decrease in material and labor costs associated with avoided maintenance. This not only saves in materials costs, but frees up man-hours for other maintenance tasks for which there is always a severe backlog. Following the edict that "an ounce of prevention is worth a pound of cure," improved maintenance on campus facilities can lead to further avoided costs over time.

ADDITIONAL ENVIRONMENTAL BENEFITS

In addition to the avoided emissions achieved through energy efficiency, Conserve UB has made a number of contributions toward protecting the environment. For example, water conservation was achieved by retrofitting dormitories with high performance (low-flow) showerheads. Further water conservation efforts are anticipated through Phase II of the CES/Way project. UB also remained environmentally conscious during its relamping projects by recycling removed materials. In fact, the lighting retrofits installed as part of the CES/Way project resulted in the recycling of over 55,000 ballasts. [R#13]

Environmental literacy: Because of the university venue for the range of efficiency initiatives, UB's energy efficiency projects have been effectively coupled with education – the primary mission of UB. Publicizing and promoting the Conserve UB projects has given campus occupants a better understanding of how energy influences their lives and their world. While not quantifiable, environmental awareness has clearly been a benefit of Conserve UB.

Local community benefit: In addition to the broad societal benefits that energy efficiency provides – such as increased national security due to less dependence on imported oil – Conserve UB's focus on efficiency awareness has extended into the surrounding community on more than one occasion, creating a local multiplier effect of sorts. The popular recognition of UB's accomplishments has helped to promote energy savings practices within Western New York by capitalizing on "good old hometown pride." Additionally, UB has sparked some projects which may serve the general public, such as piloting a rideshare program with the local transit authority. If successful, the program will be expanded to the entire region.

Improved IAQ and comfort: The campus-wide retrofit has also resulting in improved indoor air quality and improved occupancy comfort. Retrofits provide better indoor lighting and temperature control. Although difficult to measure, all of these benefits result in improved productivity,... and in the case of a university, a better and more healthful learning environment.

THE ENVIRONMENTAL BENEFIT STATEMENT

The Environmental Benefit Statement is intended to provide approximations of avoided air emissions for the electricity savings from a particular program when applied to another region or service territory. To transfer UB's program success to your own situation, first determine the representative marginal power plant for your situation by perusing the left hand column of the table. What type of generation will be avoided if you enjoy UB's level of success with a similar program in your region or service territory? Once you have determined the proxy power plant based on fuel type, heat rate (the efficiency of the power plant), and sulfur content in the fuel, move to the right across the row selected to find approximations of avoided emissions should you achieve UB's results. Note that the coefficients in each cell of the table contain a 10% credit for transmission and distribution losses avoided through energy efficiency.

* **TSP = Total Suspended Particulates**
NSPS = New Source Performance Standards
BACT = Best Available Control Technology

ENVIRONMENTAL BENEFIT STATEMENT

➔ **Avoided emissions based on 335,560,000 kWh saved 1973-1996**

<i>Marginal Power Plant</i>	<i>Heat Rate BTU/kWh</i>	<i>% Sulfur in Fuel</i>	<i>CO2 (lbs)</i>	<i>SO2 (lbs)</i>	<i>NOx (lbs)</i>	<i>TSP* (lbs)</i>
Coal						
Uncontrolled Emissions						
A	9,400	2.50%	723,467,000	17,164,000	3,470,000	347,000
B	10,000	1.20%	771,452,000	6,644,000	2,241,000	1,661,000
Controlled Emissions						
A	9,400	2.50%	723,467,000	1,716,000	3,470,000	28,000
B	10,000	1.20%	771,452,000	664,000	2,241,000	111,000
C	10,000		771,452,000	4,429,000	2,215,000	111,000
Atmospheric Fluidized Bed Combustion						
A	10,000	1.10%	771,452,000	2,030,000	1,107,000	554,000
B	9,400	2.50%	723,467,000	1,716,000	1,388,000	104,000
Integrated Gasification Combined Cycle						
A	10,000	0.45%	771,452,000	1,366,000	221,000	554,000
B	9,010		693,938,000	495,000	166,000	33,000
Gas						
Steam						
A	10,400		420,792,000	0	960,000	0
B	9,224		365,425,000	0	2,289,000	108,000
Combined Cycle						
1. Existing	9,000		365,425,000	0	1,403,000	0
2. NSPS*	9,000		365,425,000	0	664,000	0
3. BACT*	9,000		365,425,000	0	92,000	0
Oil						
Steam--#6 Oil						
A	9,840	2.00%	609,041,000	9,228,000	1,089,000	1,034,000
B	10,400	2.20%	645,953,000	9,154,000	1,369,000	664,000
C	10,400	1.00%	645,953,000	1,307,000	1,100,000	347,000
D	10,400	0.50%	645,953,000	3,839,000	1,369,000	211,000
Combustion Turbine						
#2 Diesel	13,600	0.30%	808,364,000	1,609,000	2,499,000	137,000
Refuse Derived Fuel						
Conventional	15,000	0.20%	959,702,000	2,473,000	3,256,000	723,000

Cost of the Program

COSTS SAVINGS OVERVIEW	ANNUAL ENERGY COSTS SAVINGS Nominal	CUMULATIVE ENERGY COSTS SAVINGS Nominal	ANNUAL ENERGY COSTS SAVINGS Levelized	CUMULATIVE ENERGY COSTS SAVINGS Levelized
1973-81	\$1,721,165	\$1,721,165	\$2,474,766	\$2,474,766
1982	\$81,210	\$1,802,375	\$109,991	\$2,584,758
1983	\$2,160,885	\$3,963,260	\$2,835,619	\$5,420,377
1984	\$608,700	\$4,571,960	\$765,708	\$6,186,085
1985	\$73,950	\$4,645,910	\$89,826	\$6,275,911
1986	\$286,340	\$4,932,250	\$341,466	\$6,617,377
1987	\$132,880	\$5,065,130	\$152,882	\$6,770,259
1988	\$105,650	\$5,170,780	\$116,724	\$6,886,983
1989	\$512,880	\$5,683,660	\$540,592	\$7,427,575
1990	\$132,200	\$5,815,860	\$132,200	\$7,559,775
1991	\$348,350	\$6,164,210	\$333,691	\$7,893,466
1992	\$200,970	\$6,365,180	\$186,718	\$8,080,184
1993-96	\$2,703,191	\$9,068,371	\$2,373,922	\$10,454,106
Total	\$9,068,371	\$64,970,111	\$10,454,106	\$84,631,620

DATA ALERT: All tables reflect projected data for Phase I of the CES/Way project only. Note that Phase I measures will be complete by mid-1996.

The three distinct phases of the comprehensive campus retrofit at UB have been funded with different sources of capital. Initially, basic measures were paid by the University out of its O&M budgets. The Conserve UB program has benefitted from a number of financial sources described below which were not carefully tracked. Finally, the CES/Way work was supported by utility incentives and paid through energy and dollar savings from the measures installed through a form of performance-based contract.

COST SAVINGS

Estimated costs savings based on engineering estimates are presented in the accompanying chart. Prior to the founding of Conserve UB, University Facilities and Maintenance staff achieved \$1,721,165 in annual energy costs savings. By 1992, Conserve UB resulted in total annual savings of \$4,644,015

based on measures installed between 1982 and 1992. With the \$2,703,191 expected from the CES/Way project (1993-96), total annual savings will reach \$9,068,371 for a cumulative budget savings of \$64,970,111. If Phase II of the project meets the original DEA estimates, then the CES/Way project will garner a total annual costs savings of \$3,200,414. This would raise UB's total savings to \$9,565,596 annually and \$65,467,336 cumulatively. [R#13,14,15]

FINANCING CONSERVE UB

When Conserve UB was launched in 1982 it was initially supported by UB's operating budget. The savings that Conserve UB produced in the University's energy budget was either re-allocated to other budgetary needs or reabsorbed by the SUNY Central office ("SUNY Central") in Albany. The unspent funds for the collective SUNY campuses were redistributed by SUNY Central at year-end to various campuses based on their projects and financial performance. Sometimes, Conserve UB would benefit nicely from this arrangement; at other times the result was a classic "split incentive" between the landlord (who pays the bills) and the tenant, in this case the university, that made big efforts to cut the bills as far as

possible. Without sufficient ownership of the savings they achieved, Simpson and his colleagues had little incentive to continue to “do the right thing.”

At the SUNY Central office the energy budget for each campus was adjusted each year based on the average consumption of the three previous years. This meant that the energy savings achieved by Conserve UB led to a reduction of UB’s energy budget. SUNY central had essentially ratcheted down UB’s energy budget and “siphoned off” the savings that UB had produced, creating a shortage of in-house funds available for future activities. (SUNY Central’s position was that the

campus was able to enjoy the benefits of its efficiency activities until the next time the budget was adjusted.) [R#1,18]

By the late 1980s money for additional program activities was getting harder and harder to come by. Concurrently, tighter times and budget cuts were hitting the state university system. UB’s utility budget was pushed down so low that the campus actually accumulated an energy bill budget deficit of over \$1 million despite its exemplary energy efficiency works. [R#1]

This caused UB to seek other financial resources. Federal funding, such as ICP grants were tapped occasionally. But the

CES/WAY PROJECT ECM COSTS	GROSS INSTALLATION COST	ANNUAL COST SAVINGS	NMPC INCENTIVE	NET PAYBACK
<i>Cooke-Hoch heat recovery</i>	\$1,487,946	\$189,959	\$1,757,722	-1.42
<i>Lighting - Academic</i>	\$4,645,030	\$733,870	\$1,640,812	4.09
<i>Lighting - Residential</i>	\$574,990	\$152,821	\$267,851	2.01
<i>Lighting - Exterior</i>	\$409,956	\$54,078	\$28,475	7.05
<i>Motors - Academic</i>	\$152,462	\$29,194	\$58,913	3.20
<i>Motors - Residential</i>	\$14,699	\$1,973	\$5,535	4.64
<i>Alumni Arena heat recovery</i>	\$122,031	\$37,047	\$172,739	-1.37
<i>Cooke-Hoch reconnect fan RF-1</i>	\$11,515	\$12,125	\$0	0.95
<i>Variable Speed Pumping</i>	\$99,998	\$20,428	\$3,760	4.71
<i>EMCs - Academic</i>	\$1,999,530	\$283,475	\$0	7.05
<i>EMCs - Residential</i>	\$308,436	\$73,916	\$0	4.17
<i>Lockwood Library VAV</i>	\$203,035	\$29,934	\$9,685	6.46
<i>VSDs on constant volume AHUs</i>	\$606,353	\$97,357	\$36,540	5.85
<i>VSDs on CV, PP</i>	\$535,355	\$149,134	\$323,353	1.42
<i>VSDs on VAV AHUs</i>	\$564,457	\$100,788	\$42,445	5.18
<i>Gas conversion</i>	\$1,974,596	\$737,092	\$0	2.68
<i>Lamp/ballast recycling</i>	\$184,468	\$0	\$0	NA
<i>Detailed audit</i>	\$627,325	\$0	\$0	NA
<i>Non-measure costs *</i>	\$1,613,321	NA	NA	NA
Total	\$14,522,182	\$2,703,191	\$4,347,830	3.76

Bold indicates NMPC equipment rebates

** Includes construction bond, finance fees to lessor, and construction interest*

Cost of the Program (continued)

COST OF SAVED ENERGY (¢/kWh) Levelized	3%	4%	5%	6%	7%	8%	9%
Total project costs	3.00	3.22	3.45	3.69	3.94	4.19	4.45
University costs	2.44	2.62	2.80	3.00	3.20	3.40	3.61
Utility costs	1.66	1.78	1.91	2.04	2.17	2.31	2.45

lengthy processing involved in such grants made them impractical. SUNY Central also played its part by acquiring special State funds for energy efficiency projects while they were available. These funds later dried up after turnover in the Division of Budget. With no room left in UB's own budget, Conserve UB was restricted from any capital improvements, leaving only operational modifications to be implemented on the campus. This caused the University to consider other options.

The tremendous financial opportunity presented by CES/Way certainly got UB's attention. The next step was to get the blessing of SUNY Central since UB would need to retain its bill savings to pay off any debt incurred by implementing efficiency measures. In the end, and after considerable negotiations, SUNY Central agreed to cover the debt by allowing the resultant savings to stay in UB's budget.

MEASURES COSTS

Total construction cost for the project was originally projected to be \$17,397,753. With the cancellation of several of the identified gas conversions, estimated project costs for Phase I totaled \$14,522,182. However, the unexpended portion of the project will be used fully for Phase II since the total construction amount has already been secured through a loan. In addition to the cost of the measures themselves, UB incurred costs relating to construction bond and interest and finance fees to the lessor, increasing the total project cost to \$19,011,075. [R#13]

Installation costs, estimated savings, and NMPC incentives for efficiency measures installed as part of the CES/Way project are listed in the chart on page 19. Indoor lighting accounts for the largest expenditure of the project with \$5,220,020 for all campus facilities. Correspondingly, indoor lighting retrofits also created the greatest annual savings, totaling \$886,691 for both academic and residential buildings.[R#13]

Given its contribution to curtailing peak energy use, the heat recovery loop installed at Cooke-Hochstetter was awarded the

largest portion of NMPC's Power Partners incentive with \$1,757,722. Additional equipment rebates were issued for exterior lighting, variable speed pumps, and variable speed drives.

COST EFFECTIVENESS

Net payback for each of the measures installed in the CES/Way project reflects the contribution made by NMPC. Collectively and in line with the parameters established by Niagara Mohawk, the CES/Way project had a net payback of 3.76 years for Phase I of the project and is expected to have a net payback of 4 years with the inclusion of Phase II measures.

The cost of saved energy for the total construction cost of Phase I of the CES/Way project was 3.45¢/kWh at a 5% real discount rate. From UB's perspective, which benefits from the NMPC incentive but also must pay additional costs related to financing the project, the net project cost for Phase I was \$11,787,674. Thus UB's associated cost of saved energy to date is 2.80¢/kWh. NMPC's contribution of \$4,347,830 in incentives did not include awards for gas conversions and energy management control systems and thus only contributed to 19,303 MWh of the project's total projected savings. Based on these figures, NMPC's cost of saved energy would be 1.91¢/kWh. However, it could be argued that these additional measures would not have occurred without the participation on Niagara Mohawk and that the additional savings are the result of free drivership. In this case the cost of saved energy would be 1.03¢/kWh.

If the implementation of Phase II fulfills the DEA's original savings projection of 42,334 MWh, the cost of saved energy will remain at 3.45¢/kWh for the whole project. For UB however, which will receive no additional utility incentives, the cost of saved energy will rise slightly to 2.93¢/kWh. Although NMPC will provide no incentives for Phase II measures, NMPC has effectively leveraged savings from Phase I and II at a cost of saved energy of 0.87¢/kWh.

Enormous efficiency gains can be made on college campuses: First and foremost, UB serves as proof that major efficiency gains can be extracted from college campuses. Thanks to its two-decade long commitment to energy efficiency, the University will realize \$9 million in annual utility bill savings and has achieved a total savings of \$65 million to date. Much of this was bootstrapped thanks to the commitment of the University administration and the dedication of staff, students, and faculty alike. A major portion of this was achieved through a unique partnership with UB's utility and an energy service company. In fact, UB's \$13 million investment in the CES/Way project – paid entirely through savings – is projected to leverage \$50 million worth of energy savings over its 15 years of guaranteed persistence.

A key feature of the Conserve UB program has been its interface with environmental education, a major program feature of university efficiency initiatives: While not necessary to leverage major levels of savings, universities have tremendous opportunities to link physical plant upgrades with education. Students thirsty to learn can be galvanized to put practice into action, to have hands-on experiences with efficiency. This link is a major synergy that campus efficiency efforts provide. And when the students graduate and move on, they take their awareness – and perhaps even an ethic that has been cultivated on campus – with them, creating attractive multipliers of the program's effect.

A host of financing mechanisms can leverage tremendous savings which can be applied to a college or university's primary mission: The UB experience with energy efficiency illustrates the range of financing opportunities that universities have to leverage cost-effective savings. Tune-ups can be paid for out of operations and maintenance budgets, capital budgets can be tapped for major efforts, utility funds can be used, state and federal sources of capital have been important, and working in partnership with energy service companies provides an appealing means of building on fundamental measures and drawing the technical and financial resources of the ESCO to implement significant capital retrofits.

Keeping energy dollar savings in UB's budget was essential for financing a major capital retrofit: Eventually, as UB was able to lower its energy bill from Conserve UB's accomplishments, it found its energy budget was also being lowered. The central office for SUNY recalculated the energy budget for each campus every year based on the prior three years' usage. In doing so, SUNY Central was usurping UB's hard-earned savings. When coupled with tightened op-

erating budgets in the mid- and late-eighties, the practice of ratcheting down the energy budget contributed to a deficit in UB's energy budget despite its success in improving efficiency. This situation sent a message to UB's administration that reducing energy bills was unrewarded by SUNY's head office, leaving them "gun-shy" about further conservation efforts.

Fortunately, the CES/Way proposal brought forth such attractive financial opportunities that all parties recognized the need to resolve this matter. While the project would provide \$4.3 million in capital, and could produce nearly \$50 million savings over a 15-year period, it would require a \$13 million capital investment. In order to secure and repay the necessary loans required to leverage the investment, UB needed to be able to keep the savings it would receive through the CES/Way project. In the end, SUNY Central agreed that in order to implement a project of this magnitude, UB must be able to keep the savings on its energy bill. This reinvestment mechanism was critical to the University's success with efficiency and was perhaps one of the key triumphs for UB. For any institution that is part of a larger entity – for instance a state university system, a school district, or a national retailer – establishing a budgetary mechanism which allows individual facilities to keep and benefit from the savings they achieve is a necessary precursor to efficiency.

In addition to the overarching lessons learned through UB's two decade long commitment to increasing efficiency on campus, Walter Simpson has developed a list of pragmatic lessons:

Garnering top-level support for efficiency initiatives is vital: Walter Simpson recognizes that his effectiveness was clearly a function of the top-level support that he enjoyed, beginning when he was hired by the University's vice president. Through this sponsorship there was a clear message of executive interest and approval for efficiency initiatives. Without it, Simpson's actions could have been easily contested and stopped. Securing an alliance with top officials, including Associate Vice President Ron Nayler and his predecessor Dean Fredericks, ensures both the ideological and financial support needed to see projects through.

Energy officers must not only be technically competent but must have strong leadership and organizing skills: Simpson strongly believes that a campus energy manager – and perhaps the same is true for an effective energy manager in any number of venues – needs more than just

Lessons Learned (continued)

engineering skills. He or she also needs organizational and educational skills to reach out and create a team effort. The formation of groups and subcommittees to direct specific campaigns, such as the BCC, the Policy Committee, the Physical Plant Department Committee, the Intersession Curtailment Committee, the CES/Way Facilities Team, helps to concentrate efforts for identified goals. These groups were facilitated by the Energy Officer; they were catalyzed by his drive and enthusiasm, key and admittedly “soft” program attributes that were essential to UB’s success.

Developing a successful energy conservation program requires knowing the key constituencies and targeting them appropriately: It is important that the conservation message be delivered to and accepted by all segments of campus life including administration, faculty, students, and maintenance staff. Each of their roles and contributions in a successful program are important but quite different. Thus efficiency measures must be tailored and introduced to various constituents with a high degree of sensitivity to their needs to effectively solicit their participation. Administration officials must be fully aware of the financial benefits of efficiency; faculty and students must be shown the environmental benefits and how their role is really integral to the overall program; maintenance staff must be enlisted as key players on the front lines of an energy program. Only with the cooperation of the entire campus community will the program be completely successful.

Encouraging creativity and input from the maintenance staff and the entire campus population results in good ideas and empowers program participants: Simpson reports that some of Conserve UB’s greatest accomplishments were the product of innovative ideas brought forth by staff. Rather than solely relying on external expertise, Simpson found tremendous merit in listening and being receptive to ideas and observations made by Facilities staff and colleagues. Being responsive to all creative ideas not only opens up communication to bring new perspectives and solutions to the table, but also empowers anyone wanting to participate. With 80 buildings and eight million square feet of building space, Simpson strongly believes that, “The program needs all the help it can get in identifying waste, or potential savings. There is strength in numbers.”

Using a comprehensive approach to efficiency enables measures with longer paybacks: A fundamental goal of Simpson’s was that Conserve UB accomplish more than cream-skimming, that deeper levels of savings are extracted using comprehensive retrofits. While it was tempting

to install the quickest-payback lighting measures, this would not result in deep levels of savings and instead would create “lost opportunities” for further energy savings. These considerations were shared by CES/Way whose NMPC contract specified that a complete, comprehensive approach be taken, using the savings from the short payback measures to leverage funds for the longer payback measures, and guaranteeing a savings persistence of 15 years. Bundling low- and high-cost measures is essential for tapping the levels of savings possible on campus and must be a key selection ingredient when a college or university chooses an energy service company.

Promoting efficiency at the time of repair and capital improvements makes sense: While UB has undergone numerous retrofit projects dedicated to energy efficiency, college campuses and institutions of all kinds undergo regular maintenance and repair projects that afford highly cost-effective opportunities for energy efficiency as well. Keeping efficiency in the forefront on campus assures that the numerous opportunities for efficiency at the time of equipment replacement and upgrades are not missed, that they support efficiency rather than contribute to the attrition of measures previously installed.

Energy efficiency retrofits supported by policies which institutionalize efficiency help produce major savings and create lasting change: Setting policies regarding temperature settings, facilities usage, and procurement of supplies, such as buying recycled paper, has been an effective way of putting good theory into practice at UB. With the support of programs like the BCC and the designation of procedures regarding building use, compliance with policies is consistent and assured.

Effective campus efficiency can have rippling effect into the surrounding community: A campus energy or conservation program doesn’t need to stop at the university’s property line. Letting the community know about what is being done on campus not only promotes conservation in surrounding homes and offices, but also lends support to campus efforts. The accomplishments of Conserve UB are well known throughout western New York. Not only are citizens learning about energy conservation as a result, but they are taking pride in Conserve UB, which has helped to further promote the program on campus.

Given its size and the confines of working within the SUNY system, implementing the CES/Way project in more phases may have sped up the project: CES/Way’s Project Manager Bob Kennedy noted that implementing a

campus-wide retrofit of this magnitude was quite cumbersome. He believes that this was also a function of working within the bureaucracy of a major state institution. SUNY's infrastructure, and the case is likely true in most other states, was not "well oiled" for dealing with the size and type of project implemented at UB. Kennedy suggests that in future projects some form of segmentation may ease the administrative burden and thus facilitate implementation.

The CES/Way project served to catalyze major capital retrofits at the expense of other elements of the Conserve UB program: Simpson reports that the enormity of the CES/Way project necessarily usurped the time of Conserve UB officials and related parties. While the contributions the project made to UB's energy efficiency were certainly worth the distraction, it meant sacrificing some of the awareness efforts that stand at the core of Conserve UB. Walter Simpson recognizes that there is now a need to reinvigorate these elements of the program and to again place greater emphasis on the educational and behavioral components in the coming years.

Documenting savings is essential for proving the efficacy of retrofits and for garnering support for future initiatives: While easy to fall between the cracks, carefully documenting program savings is essential for a number of reasons. Beyond this, forming and motivating task forces and student groups to perform conservation activities requires "fueling." Giving participants a sense of impact by documenting successes in saving energy, recycling, reducing paper use, etc. is a powerful motivator. Similarly, tracking the costs and savings will help to justify efforts and investments to chief executives as they have for Conserve UB.

Campus energy managers bring their unique styles to their work, leaving unique imprints on campus efficiency initiatives: Finally, an energy manager can certainly affect a campus program through his or her own philosophy of energy use. One of the defining traits of the SUNY experience with efficiency has been that it has been driven by Walter Simpson's zeal and dedication to wise resource use. Working within the confines of a state university system, with its necessary bureaucracy, Simpson has been able to promote change and make the entire campus community aware of the key interface between energy and the environment. And for those who discount the import of these program results, Simpson can proudly point to nearly \$65 million of savings delivered for a fraction of the cost.

Many energy managers base their work solely on technical efficiency, working with advanced technologies to promote efficiency. Walter Simpson, on the other hand, does not shy away from suggesting that the heat or the fan needs to be turned down or off. Nor does he believe that "conservation" is a dirty word because it may imply some sacrifice. Instead he claims that in many cases what is being "sacrificed" by conservation is an overextension of comfort. Simpson cautions, however, that while a little sacrifice is good, too much is bad. Once a conservation measure is truly causing discomfort then it becomes detrimental both to the productivity of building occupants and the support of the conservation program. Through this orientation Simpson has been able to tap the synergies between technological efficiency and conservation driven by behavioral change.

Transferability

Given their size and energy intensity, universities tend to be good candidates for energy efficiency. As with other large institutions, university and college campuses are essentially micro-cities housing hundreds if not thousands or tens of thousands of residents which provide a range of workplaces and learning environments for a highly active population. Fundamentally, universities and colleges are conducive to global thinking and responsible action. Thus institutions of higher learning around the world are assuming the important role of environmental stewards, recognizing that their facilities are ideal teaching laboratories for proper energy and resource management, demonstrating that it is possible to stem wasted energy and costs that can be better applied to education.

While the State University of New York at Buffalo is certainly a standout among college campus efficiency programs, and is an especially potent example of a university working within a state university system and bureaucracy, it is certainly not alone in its achievements. Many different approaches and financing mechanisms have been used with varying results. Some university efficiency initiatives have resided solely within facilities departments; others have been integrated into the learning process influencing curriculum and fostering hands-on activities for students while bolstering awareness of responsible resource use for the entire university community.

While many universities have had marked success with energy efficiency, energy is but one of a number of key resource issues being addressed on campuses. In fact as UB and other campuses have demonstrated, there is a synergy in tackling them concurrently. In addition to addressing campus energy use, campus initiatives can encompass wise water use, recycling and solid waste management, healthful food services, responsible purchasing practices, transportation patterns, land-use planning, and the powerful interface with curricular interests.

FOCUSING ON ENERGY EFFICIENCY

Most if not all colleges and universities have addressed their energy consumption in one way or another in the past 20 years. As the UB case study suggests, the menu of retrofit options is extensive. Efficiency opportunities range from promoting simple behavioral changes, such as turning off unnecessary lights and computers, to no- and low-cost measures such as delamping, installing occupancy sensors, etc., to highly sophisticated measures involving extensive engineering, analysis, construction and project management, and capital-intensive retrofits financed through a number of sources.

Despite a wide variety of academic pursuits and strengths, colleges and universities are fairly homogeneous in terms of energy use. "Ecodemia: Campus Environmental Stewardship at the Turn of the 21st Century," authored by Julian Keniry of the National Wildlife Federation presents a number of exciting efficiency efforts made by many campuses and identifies the five broad least-cost opportunities for improving energy efficiency on campus: lighting, insulation, ventilation, office equipment, and heating and cooling. Of these, Keniry reports that lighting has been pursued most often. These efforts can be as simple as no-cost, no-tech actions like delamping. (UB, for example, delamped up to 50% of its corridor lighting.) The Rochester Institute of Technology (RIT) conducted its own lighting retrofit, installing motion sensors, switching to LED exit signs, and replacing incandescent lights. Other universities including Harvard, Tufts, and the University of Georgia have participated in the EPA's Green Lights Program to address their lighting energy use. [R#3,25]

Just as UB has tapped a number of funding sources over the years, financing college and university retrofits can take a number of forms. Low-cost measures can bootstrap savings that can be redirected into more and more sophisticated measures. Some universities have effectively tapped both their operating and capital budgets to finance efficiency internally. Others have gone to outside sources of funding. Institutional Conservation Program matching grants through the U.S. Department of Energy have funded several efforts at UB and the Rochester Institute of Technology, for example. State funds have also been used. Many universities have worked in partnership with their local utilities not only drawing rebates but also taking advantage of their utilities' technical expertise. Now performance contracting in partnership with energy service companies appears to be the most important financial model for campus efficiency. Not only can the ESCO secure financing if necessary, but it will guarantee savings, providing a promising risk-free option for retrofits.

UB may have set a precedent with the size and comprehensive nature of its ESCO-managed project, but similarly sized pursuits are already underway. CES/Way has completed an \$18.7 million power plant project at Louisiana State as well as a \$10 million retrofit project at SUNY Cortland. (SUNY is also currently working with the state's New York Power Authority to improve efficiency on other campuses.) At Columbia University, teaming up with EUA Cogenex has resulted in \$2.8 million dollar annual bill savings,... all with no money down. Through its performance-based contract, Columbia has kept its energy bills flat for the past five years. Like UB, Columbia hired

an Energy Conservation Manager and contracted an ESCO to achieve these savings. Like the UB financial approach, the Columbia retrofit involved hybrid financing using a number of capital sources,... a situation critical to the financially challenged private university. These and other projects reinforce the fundamental point that campus efficiency can result in dramatic savings, often with no money down at all. [R#10,27]

The dollar savings associated with improved campus energy management has taken on new dimensions in light of today's increasingly competitive utility environment. While performance contracting may fill any shortfall in incentives from local utilities' decline in DSM, other cost savings opportunities are coming to light. Lindsay Audin, Columbia University's Energy Conservation Manager, notes that Columbia has invested in a lobbyist to promote its interests vis-a-vis industry restructuring in New York, not entirely unlike the path taken by many large industrial customers. (Many universities have cost effectively addressed their natural gas procurement strategies and are preparing to do so for their future electricity supplies.) Just as the installation of a compact fluorescent lamp has a payback, Audin suggests that this kind of policy work does too. Similarly, a number of years ago Audin hired a consultant to review the university's utility bills. The consultant found major savings – with paybacks measured in weeks – and was able to significantly cut utility bills,... another means of promoting the economic efficiency of energy use on campus. The risk, of course, is that lower rates will retard further efficiency investments, and that economic efficiency will replace institutions' desire for improving their energy efficiency. [R#1,27]

CAMPUS “GREENING” ACTIVITIES

Energy efficiency is but one facet in a “green” wave that is sweeping over college campuses. Evidence of a green momentum on campuses is pervasive. A Campus Earth Summit hosted by Yale University in 1994 was attended by over 450 faculty, student, and administrative delegates who represented campuses from 22 countries and all 50 states. The Heinz Family Foundation sponsored the event and its ensuing book, “Blueprint for a Green Campus.” [R#3,20]

The Talloires Declaration which promotes university leadership for global environmental management and sustainable development is another example of campus awareness at a global level. The proclamation has over 200 campus signatories from 40 countries worldwide, all of whom are members of the Association of University Leaders for a Sustainable Future. The Declaration includes curricular development and peda-

gogy, promotion of ecological research, instituting environmental policies and practices, and formulating partnerships. [R#24]

There are a number of other related relevant networks. For instance, Campus Ecology (formerly known as Cool It!) is an initiative of the National Wildlife Federation. Established to celebrate Earth Day 1990, the Campus Ecology program assists college and university students, faculty, and staff in learning about environmental issues and how to improve sustainability on campus. Over its six-year history it has participated in some 1,200 projects, working with fully one-third of the country's campuses, providing workshops, information, visits, newsletters, career counseling, organization and one-on-one consulting. [R#25]

ESSENTIAL ELEMENTS FOR GREEN CAMPUSES

In addition to the tips embedded in this Profile, there are many resources for campus efficiency, each of which underscore the essential elements for campus environmental stewardship. Clearly there is the need to cultivate and nurture top-level administrative support even when the financing is done off-balance sheet. A second ingredient relates to the participation of all campus segments. Tying facilities personnel actions with student, faculty, and staff awareness and action leads to a powerful synergy. Leadership is another key feature; the value of a “champion” cannot be overemphasized.

Documenting energy savings is another factor that adds to the resilience of a campus-wide retrofit, proving a project's efficacy especially in situations where efficiency projects have competed for scarce dollars. Institutionalizing environmental practices with policies is another means of assuring the longevity of a program's effect. Finally, linking physical retrofits on campus with an academic component seems to be the ultimate melding of program impacts, adding a major dimension to the import of the learning experience and affect of a campus retrofit.

TIEING PHYSICAL RETROFITS TO ENVIRONMENTAL LITERACY

Perhaps colleges' and universities' most attractive interface with energy efficiency is to transform what has been considered a maintenance and facilities function into a campus-wide initiative. Using efficiency as a tool to teach “eco-literacy” fulfills two functions at the same time. Just as the campus is retrofit, students learn the value of energy efficiency and the importance of global sustainability. This opportunity also exists

Transferability(continued)

for other academic institutions such as elementary, middle, and high schools and is thoroughly explored in The Results Center Special Report, "School Efficiency Programs: Retrofitting Today's Schools and Educating Tomorrow's Energy Consumers."

Walter Simpson taught UB students to conduct environmental audits. George Washington University launched its "green university," an interdisciplinary approach which incorporates greening of campus facilities in the curriculum. Tufts established the Tufts Environmental Literacy Institute which provides training for educators on environmental issues and suggestions for bringing environmental perspectives to their classrooms. These and other means of tie physical retrofits that provide short-term savings with longer term awareness raising initiatives that will create long-term benefits, epitomize the exciting opportunities for campus efficiency.

SELECT PUBLICATIONS

"Ecodemia: Campus Environmental Stewardship at the Turn of the 21st Century," Julian Keniry, National Wildlife Federation. To order this book for \$14.95, call (800) 432-6564.

"Blueprint for a Green Campus: The Campus Earth Summit Initiatives for Higher Education," Heinz Family Foundation. To order for \$10, call (202) 234-5992.

"The Campus and Environmental Responsibility," David Eagan and David Orr, New Directions in Higher Education series, #77, Spring 1992, Jossey-Bass Publishers, 350 Sansome St., San Francisco, CA 94104.

Select articles by Walter Simpson: "Environmental Stewardship and the Green Campus," Facilities Manager, January 1996; "Recharging Campus Energy Efficiency," Facilities Manager, Winter 1994; "Recipe for an Effective Campus Energy Conservation Program," A Report for the APPA: The Association of Higher Education Facilities Officers, February 1992. For copies of any of these articles, call (703) 684-1446.

"UB Guide to Green Computing: How Your Choices Can Make a Difference," Conserve UB. To order this booklet for \$2, please call (716) 645-3636.

"Success at Zero Net Cost: Columbia University's Achievements in Energy Efficiency," Lindsay Audin and Bill Howe, E Source. For more information, please call (303) 440-8500. Select Organizations

SELECT ORGANIZATIONS

National Wildlife Federation, Campus Ecology: A national network that provides literature, workshops, and support for campus programs. For more information call, (202) 797-5435.

U.S. Environmental Protection Agency, Green Lights Program: Information and assistance in conducting lighting retrofits on campus is available from the EPA. For more information call (202) 775-6650. EPA's Energy Star Computer program is also a good resource for improving office energy efficiency. The program's hotline is, (202) 233-9114.

The Association of Higher Education Facilities Officers (formerly the Association of Physical Plant Administrators and still known as "APPA"): This trade association publishes Facilities Manager and provides member services such as seminars. For more information call, (703) 684-1446.

SELECT CAMPUS NETWORKS

Brown University's "Brown is Green" network is a comprehensive conservation program and provides an information network called "Greenschools" on the internet. For more information contact Kurt Teichert at Brown University, Box 1941, Providence RI 02912, (401) 863-7837 or by e-mail: <http://www.envstudies.brown.edu/environ>. For a Greenschools list subscription contact listserv@brownvm.brown.edu: subscribe GRNSCH-L "your name"

Tufts University conducts the Tufts Environmental Literacy Institute and houses the office for the Association of University Leaders for a Sustainable Future (ULSF). Contact Tom Kelly, Director at Tufts University, 474 Boston Ave., Medford, MA 02155, (617) 627-3486.

The University of Wisconsin at Madison has been in the forefront of green campus efforts. For more information contact Daniel Einstein, Environmental Management, Rm. 120 WARF Bldg., 610 Walnut St., Madison, WI 53705 (608) 263-3417, and/or David Eagan at Institute for Environmental Studies, 70 Science Hall, Madison, WI 53705, (608) 263-2985, e-mail: djeagan@students.wisc.edu.

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