Recipe for an Effective Campus Energy Conservation Program
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The importance and urgency of energy conservation has never been more apparent. Conservation is an effective way to reduce acid rain and air pollution. It is fundamental to mitigating global warming. Recent events in the Middle East remind us of the critical role conservation can play in lessening our nation's dependence on energy imports. Energy conservation has many environmental and social benefits. Of course, it is also a great way to save money.

An energy conservation program will find fertile soil anywhere the cost of energy is perceived as a problem. Large energy bills and a general consensus that future energy costs will rise have made most colleges and universities interested in energy conservation.

Annual energy costs for the State University of New York at Buffalo (UB) currently run nearly $15 million. While energy prices have been fairly constant the last few years, our energy conservation program, Conserve UB, was launched in 1982 after a decade of escalating energy prices. Coal, gas, and electric prices rose by 400 percent from 1972 to 1982. This inflation generated considerable support for energy conservation as a "cost avoidance" strategy.

More recently, interest in conservation has been reinvigorated by a State budget policy which appears to deliberately underfund State University utilities. Although contradicted by other State budgetary policies which discourage conservation, this policy has kept conservation an issue. Continually facing significant energy-dollar shortfalls keeps energy conservation off the back burner.

Our Conserve UB program is by no means perfect, but it is reducing our utility bills by an estimated $3 million a year. While trying to develop a comprehensive energy program, we've learned some lessons from both our successes and failures. What follows are 21 steps to a successful campus energy conservation program.

1. **SECURE TOP-LEVEL SUPPORT**

An energy conservation campaign can begin in the "grassroots," but an effective, long-lasting program to reduce energy waste needs top-level support. Once it is apparent that a university president and his or her administration support a conservation program, things begin to happen that otherwise would not. Doors open that would otherwise be closed. Resources are provided that would otherwise be withheld. Competition with other institutional priorities is resolved in favor of conservation. And feathers are less likely to be ruffled when the chain of command is bypassed to permit the kind of communication (and occasional prodding and badgering) necessary for an effective conservation effort.

There is no point in trying to save energy by shutting off building fans and air conditioning on weekends, only to have the whole effort scuttled the first time Professor Jones calls and complains to the college president. It is essential that the president and others in authority stand behind the program.
Our Conserve UB program got off to a good start because the energy officer was hired directly by a vice president, our school's top business officer. This sent a clear signal of top-level interest and support. Occasional public involvement by UB's president, coupled with steadfast support from our vice president's office and Physical Facilities division, have provided Conserve UB with some measure of status and influence, both essential ingredients for a successful program.

2. DEVELOP EFFECTIVE LEADERSHIP

An effective conservation program needs effective leadership. Program leadership can take different forms -- individual and group. Let's begin with the person who directs the program, the campus energy officer.

The campus energy officer need not be an engineer, though he or she must be able to talk to engineers and understand and critique their work. Engineering skills are just part of the energy officer's bag of tricks. To get anything done the energy officer needs good communication skills and must be politically astute enough to maneuver projects through the bureaucratic maze: Promoting conservation in an institutional setting requires the will to swim against the current since waste, like entropy, is the natural course of things. A desire to "tilt at windmills" helps as does a thick skin since the conservation program will be blamed for almost everything that goes wrong anywhere on campus.

Needless to say, the position of the energy officer within the organizational structure is critical. Minimally, he or she needs access to top-level university leadership and must be able to challenge decisions on all levels that lead to energy inefficiency and waste.

But an energy officer cannot do the job alone. There needs to be a support network. The conservation campaign should be a team effort.

At UB, a Conserve UB committee was established in 1983 to work with the energy officer. This committee is comprised of faculty, students, and staff from a variety of positions within the University, all of whom are conservation enthusiasts. The primary functions of the committee are to develop energy awareness programs, push stalled conservation projects, and lend moral support to the energy officer. In addition to the Conserve UB committee, our conservation effort has benefitted greatly from in-house physical plant department conservation committees whose members are tradespeople and technicians who know our energy-using equipment and systems firsthand. Many excellent projects have been developed by these committees.

One limitation of both types of committees described above is their inability to set overall energy policy. An executive energy policy committee was, therefore, established at UB two years ago to fill this void. This policy committee has high-level participation from both the business and academic sides of the University.
From its inception, it has provided additional leadership for our program and generally has been committed to making hard decisions to save energy and reduce utility expenditures.

3. **REMEMBER: NO PAIN, NO GAIN**

One of the first things our executive energy policy committee did was to take a serious look at our heating and cooling season temperature policies. Typically, we had been heating to 72 F and cooling to 74 F. In light of fiscal constraints, this committee instead adopted a 68 F heating policy and a 76-80 F cooling policy. We also took a hard line on fan run times and summer reheating, the practice of running duct heaters during the cooling season to warm and dry the air-conditioned air. Evening and weekend fan operation was minimized. We reaffirmed our policy to keep most reheats off.

As a result of adopting these policies, there were some complaints and some discomfort. But fallout was not as extensive as feared, and projected savings of about $600,000 did materialize. Once these policies were felt on campus, members of the University community realized that our conservation program was serious. To have an effective program, one way or another that message must be communicated.

Having said this, let me add that care should be taken not to cause too much discomfort. Although causing a little discomfort in some circumstances may be a good thing, it does not follow that making people miserable is even better. After a point, the level of discomfort will seem unreasonable, and support for conservation measures will be lost. So discretion is advised.

Some energy analysts have argued that we should always talk about "improving efficiency" and never "promoting conservation" -- because the latter implies sacrifice and discomfort. But I do not subscribe to that school. Evoking some sacrifice and discomfort is not necessarily bad -- especially if the starting point is one of excess (which is usually the case).

4. **ESTABLISH A HIGH-PROFILE ENERGY-AWARENESS CAMPAIGN AND SEIZE THE MORAL HIGH GROUND**

While energy awareness came naturally in the 1970s, a concern for energy was not central to most people's thinking throughout the 1980s. Leadership on the national level has been absent, and the price of gasoline at the pump dropped. The good news is that environmental awareness is increasing again. People, especially college students, are more willing to think about the energy they use, how much of it is being wasted, and how it can be conserved and used more efficiently.
In developing an awareness program, it is important to identify key constituencies and target them appropriately. An approach that is effective with the maintenance department may not be with the housing office. What works with faculty may leave students cold. In any case, you have to be imaginative and persistent. There is no single right way to help people become more energy conscious, and the job is never done.

A campus energy-awareness program should have a logo. As people begin to think positively about the program, this logo becomes a positive symbol, part of the program's good image. Moreover, the logo can be widely distributed. At UB, in addition to having our Conserve UB logo on the literature we distribute, the logo appears on light-switch stickers in every office and classroom. It's also on payroll envelopes accompanied by the slogan "Help Us Keep the Cost of Education Down"

We've utilized a number of successful energy-awareness techniques at UB. For example, we've installed signs in the vestibules of campus buildings that tell building occupants the annual energy costs of their buildings. Most people find the size of these numbers shocking; it certainly gets them thinking about energy. We've also sponsored educational lectures and symposia on campus, most recently a 90-minute panel discussion on the "Energy Crisis" which was broadcast live on the University's public radio station. Fostering a general interest in conservation -- including conservation at home -- can only help campus efforts.

If you have a good thing, don't keep it a secret! Maintaining a high profile and publicizing a college energy conservation program to the wider community have numerous benefits. In addition to serving that community by setting a good example, off-campus visibility helps secure and reinforce campus support. College and university administrators, as well as students and faculty, are much more likely to show support for a program that is widely recognized and makes their school look good.

Conserve UB has been successful in making itself known in Western New York. Over the years, we've developed strong media ties and on two occasions have arranged for the filming of short documentaries about our program which were aired on the local public broadcasting station. Additionally, we've carried on a continuing dialogue with two State legislators, both of whom are committed to energy and environmental issues. These legislators have championed our cause on a number of occasions. Recently, they expressed interest in working with us to develop State legislation that will provide increased incentives to State agencies to save energy.

Energy conservation does more than save money. Its numerous environmental and social benefits should be publicized by a campus energy-awareness program. Energy conservation protects the environment by decreasing air pollution, reducing the likelihood of oil spills, and protecting wilderness areas from the damaging impacts of energy exploration and production. Curtailing the burning of fossil fuels
is a big part of the solution to the acid rain and global warming problems. Energy conservation also eliminates the need for new power plants, conserves non-renewable resources for future generations, promotes world peace, and is a fundamental component of the future sustainable society. Many people will identify with an energy conservation program when it is placed in this broader context.

5. MOTIVATE WITH INTEGRITY

At home, we reap what we sow. If we waste energy, we pay for it. This connection to the consequences of our behavior provides some motivation for conservation. In a college setting -- and in any institutional or corporate setting where someone else pays the energy bills -- there's a tendency to regard energy as a free commodity and take it for granted. Motivating people to save energy (or at least to accept conservation measures) may be difficult.

It is sometimes thought that this situation could be remedied at a college by separately metering and billing each academic and business department. However, this "solution" is impractical. The cost of metering and billing would be high. It is also unfair because departments rarely design their own buildings or operate their own heating, ventilating, and air-conditioning (HVAC) equipment.

How do you motivate people to conserve energy? Should energy-saving contests be held? Should prizes be awarded for conservation achievements? This "circus" approach has a down side. It may succeed only in reducing conservation to a sideshow.

In the end, the best way to motivate individuals may be to avoid the issue of material incentives and disincentives entirely. By alerting people to the numerous environmental and social benefits of energy conservation, we can stimulate support for a campus energy program. This approach reinforces the moral integrity of the program and demonstrates intellectual respect for the members of the campus community.

6. MAKE SURE MAINTENANCE IS ON-BOARD

While there are many campus groups whose support is important for the success of a campus energy conservation program, maintenance is one of the most critical. Key maintenance staff such as HVAC technicians and energy management computer operators are on the energy front lines. But other maintenance staff can be helpful as well. All maintenance, including cleaning staff, can serve as the eyes and ears of the program. Energy-conscious maintenance employees are not only in a position to complete conservation projects and save energy in the course of their daily activities, but their intimate knowledge of the facilities enables them to identify conservation projects that may have been previously overlooked.
The commitment of maintenance is important for another reason. An energy program puts maintenance in the spotlight or on trial. If we expect the rest of the campus to pitch in and assist the conservation effort, they will be watching maintenance closely to make sure it is doing its part. Thus, it is imperative that maintenance demonstrate in word and deed its full commitment to the program.

7. BE FAIR, CONSISTENT, AND RESPONSIVE

There's a natural tendency to cater to those at the top. Ranking officials need not even ask for special treatment; they are accorded it naturally. But this tendency needs to be resisted. A campus energy program will not be supported by the campus community if it is unfair, i.e., if it asks rank and file faculty, students, and staff to make sacrifices while not requiring the same of upper-level administrators.

Inadvertent inconsistencies can also spell doom for a campus conservation program. How can a conservation program be taken seriously if it announces a 68 F winter heating policy while many campus buildings remain chronically overheated? Here again, the special role of maintenance is clear.

However, some inconsistencies are inevitable and even desirable. For example, some special-purpose spaces need not be heated or air conditioned to the same level as offices, classrooms, and labs. These opportunities for energy savings should be exploited with appropriate explanation. Also, in areas where summer humidity control is required, different temperature setpoints are appropriate. We generally try to keep these areas cool (e.g., 68-70 F) to minimize reheating and thus save energy. Again, it helps if the reason for this kind of inconsistency is explained to members of the campus community.

When complaints come in about overheating or overcooling, it is essential that these be dealt with promptly. The same is true of suggestions for energy improvements. The credibility of a college energy conservation program depends on its unflagging commitment to equity and its interest in responding to complaints and suggestions. When failings, inadequacies, or imperfections are pointed out, defensiveness has no place.

8. ENCOURAGE AND NURTURE CREATIVE STAFF

Large organizations tend to stifle people. The inevitable and frustrating battles with red tape, ever-present salary inequities, and all the daily petty (and not-so-petty) insults and injustices of the workplace wear people down. An effective energy program has to do battle with these forces of negativism in order to benefit from the good will of the campus community and the creativity of key staffers.
Creative people need room. They need to be able to step outside narrow job descriptions and have the latitude to imagine new ways to provide energy services. They need to have their ideas taken seriously even if at first glance they seem a little wild. And they need to see their ideas become completed projects. Moreover, resources need to be made available for training and other professional growth and development experiences. In summary, an effective conservation program must create an environment where creative staff members can not only survive but also thrive.

While we've had mixed success at UB in nurturing and lending support to creative staff, we clearly have been the beneficiary of the work of these exceptional people. For example, consider the innovation of a member of our HVAC controls shop. This technician had noticed that lights, equipment, and body heat caused some of our North Campus buildings to overheat even in cold weather. He also noticed that other buildings -- notably lab buildings with large ventilation requirements -- needed heat even when outside air temperatures were just marginally cold. But how to move the heat from one set of buildings to the other? Realizing that running large insulated ducts across campus was impractical, this perceptive soul determined that the means of moving heat between these sets of buildings was already there -- the chilled-water loop! This underground pipe loop, containing a million gallons of water, is an integral part of the campus air-conditioning system. It connects all the fan systems in all our North Campus buildings.

By allowing chilled-water coils in the fan systems of both sets of buildings to operate through mid-December (at which time freeze-ups become a problem), we now remove heat from the warmer-running buildings and transfer it via the chilled-water loop to preheat coils in our lab buildings. After an expenditure of less than $1,000 on control modifications, this new system was put into operation and has saved us in excess of $80,000 a year each of the past few winters. We are now considering the addition of some glycol loops to protect against freeze-ups and permit us to operate this cycle all winter long, more than doubling its savings potential.

9. **EMPLOY LOW-TECH SOLUTIONS**

High technology may grab the headlines, but significant progress in reducing energy consumption can be achieved through a strategy focusing on "low" technologies. Low tech is easy to understand, easy to install, and has advantages in terms of equipment reliability and repairability.

When it comes to saving energy, the simple act of turning something off is usually a step in the right direction. Low-tech methods of accomplishing this task abound. In a number of our buildings we found lighting that could only be controlled from breaker panels. Installing ordinary light switches has made it possible for these lights to be turned off 50-75 percent of the time. Other simple devices that lend
themselves to turning off indoor and outdoor lights include photocells, time clocks, and personnel sensors. My favorite way of turning off lights is to do it permanently by delamping. We found we could delamp -- i.e., disconnect -- 50 percent of the corridor lights in most of our campus buildings and still have adequate illumination levels. Disconnecting lamps and ballasts was easier and cheaper than installing current limiters or modifying fixtures to reduce lighting and wattage.

Any piece of equipment that is running for long hours should be studied to determine if it can be turned off at least sometimes. In one building we had good luck simply turning off fume hoods that were not in use. This involved doing a survey of fume hoods and negotiating with faculty. Once we knew which hoods were not really being used, we developed a simple decommissioning procedure which involved capping hood ductwork and turning off or slowing down the exhaust fans to which these hoods were connected. This low-tech approach netted us $122,000 a year in savings in one building alone.

But you cannot turn everything off. What low-tech methods exist for operating energy-consuming equipment more efficiently? Effective low-tech lighting improvements often involve relamping. We've replaced hundreds of incandescent fixtures with fluorescent fixtures, often reducing wattage by 80 or 90 percent. We've also had good luck using the new 9- and 13-watt compact fluorescent lights as well as high-pressure sodium lights in outdoor applications.

Don't overlook simple low-tech ways of improving heating and cooling efficiency. Caulking, weatherstripping, and insulating not only work at home; they are effective on an institutional level too. Soffits were poorly sealed in one of our North Campus dormitories until large amounts of caulk were applied. In another building we found two unsealed 2' x 100' gaps inside other soffits. These gaps were discovered when carpenters were replacing ceiling tiles in this building and found that the ceiling space was the same temperature as outside! A low-tech solution -- sheetrock and rigid board insulation -- solved the problem nicely.

Hot-water systems also readily lend themselves to low-tech energy savings. Consider energy-saving showerheads. We estimate that 200 of these inexpensive devices are saving us $28,000 a year in seven of our dorms. We found that a nonaerating, low-flow showerhead gave the best shower while substantially reducing hot-water use.

10. **GO FOR THE GOLD**

In every facility there are at least a few major sources of energy waste and high energy costs. An effective energy program should establish long-term goals that address these sources of waste.
At UB we have at least three major sources of energy waste and cost: (1) buildings with constant-volume fume hood systems which collectively exhaust nearly 600,000 cubic feet a minute (cfm) of conditioned air 24 hours a day, year round; (2) electrically heated buildings on our North Campus, which cost us approximately $3 million more per year to heat than they would if heated by natural gas; and (3) our aging MacKay Power Plant, a 65-70 percent efficient coal burner that produces steam heat for our South Campus. Eliminating these sources of energy waste are our energy conservation prizes. While working on other projects, we've kept our eyes on these larger opportunities.

Six years ago, we began studying our three most energy-intensive lab buildings which together have 280 fume hoods. We had difficulty identifying appropriate funding sources and developing an energy saving design consistent with the requirements of safety, reliability, and installation with an absolute minimum disruption to ongoing research. After much deliberation and numerous setbacks, we finally settled on what we think is the best plan for these buildings. Once implemented, we expect this project to save $1 million a year in energy costs. This savings figure is, of course, the same amount of money we "lost" each year the project was delayed. Thus, it is important that projects capable of producing large savings be assigned a top priority and that continuing efforts be made to expedite them.

Perhaps it goes without saying that planning, persistence, and patience are required on big projects. In 1986 we began studying the feasibility of converting some of our buildings with electric-resistance heating systems to natural gas. While a few minor gas conversions have been completed since then, it has taken us four full years to get two larger projects into the design stage. Soon we hope to be heating our law school and field house with hot water produced by gas-fired boilers, saving an estimated $100,000 and $150,000 per year, respectively. Payback on the law school project is only 1.0 year (for reasons I will discuss later) while the field house is about 5.5 years.

Concerning the MacKay Plant, ideally we'd like to see it replaced by a gas-fired cogeneration facility that would both generate electricity and produce steam for campus heating. Such a facility would be fuel-efficient and environmentally clean. But no firm decision has been made yet.

11. **BE CAUTIOUS BUT TRY NEW PRODUCTS**

There are a lot of new products on the market that promise to increase energy savings. But not all of them work well or work at all. It is important to be open-minded about new products and technologies without being gullible or overly optimistic. The trick is to objectively evaluate new products before using them.
Can vendors be trusted to provide an objective evaluation of their products? Some can but others cannot.

Regrettably, utility companies and government agencies are reluctant to test and publish brand-name evaluations of products. Generic information is available but not especially helpful to someone who has to make a decision about purchasing a specific product. What is needed is a nationally recognized test lab that provides a Consumer Reports-type service to large institutional energy users.

In the absence of such a service, we have had to test a variety of products ourselves. Over the years, we've tested the performance of fume hood control systems, reflective window film, energy-efficient showerheads, compact fluorescent lights, fluorescent wattage reducers, electronic ballasts, computerized hot-water temperature controllers and boiler water treatment devices. Some of these tests were time-consuming but all of them yielded data helpful in making purchasing decisions. Although most of our product testing is done in-house by physical plant department staff, occasionally we receive outside assistance. For example, we conducted the fume hood control systems test in cooperation with the consultant we hired to complete the design work on the fume hood project described in the previous section.

Engineering consultants can play a key role in evaluating new products and technologies. However, one of the pitfalls in relying on them is the inherent conservatism of many firms. Playing it safe can serve the interests of client and consultant. But it can also hurt because some new products and technologies are worth using. A consultant may reject a new, more efficient boiler type, arguing that its track record is unknown and that it may not last 20 or 30 years like a traditional cast-iron sectional boiler. Well, that's true, but it's also not reasonable to wait 20 years before trying it out!

12. OBTAIN EXPERT TECHNICAL SERVICES

Few colleges and universities can do all of their engineering in-house. Outside consulting is needed, sometimes to expedite projects and sometimes to permit them to occur in the first place. At UB, our engineering office is perpetually backlogged, and only top-priority projects stand a chance of competing with "rehabs" and emerging from that shop in a reasonable amount of time. Hence we often look outside.

What do we look for in an outside firm? First and foremost, we look for an engineering firm that specializes in energy conservation. For projects involving new technology, we look for a firm that knows the technology and has completed projects similar to what we are contemplating.
Engineering consultants best serve their college and university clients if they are familiar with the administrative requirements of funding agencies and have the administrative skills to see a project through to completion. This involves knowing what funding agencies are looking for and being able to provide that information honestly and efficiently.

Concerning Technical Assistance (TA) studies, it is important that consultants be familiar with their client's needs and expectations. Usually, a school is looking for a list and ranking of all possible conservation projects for a given campus building. On occasion, a TA is needed for use as a "ticket" for Institutional Conservation Program (ICP) funding of an Energy Conservation Measure (ECM) that has been already identified. Rarely is a lengthy description of existing equipment desired or helpful -- though this is what some consultants seem to specialize in.

13. SECURE SUFFICIENT FUNDING FOR PROJECTS

While some energy savings can be achieved at little or no cost through operating and maintenance (O & M) measures, most conservation projects cost money to implement. Fortunately, these first costs often are recovered quickly through energy savings. But even projects with great rates of return can go begging because funding is not available.

Funding is what turns good ideas into completed projects and real energy savings. Moreover, the possibility of obtaining funding for projects is what gets people thinking about conservation projects in the first place. When funding is not there, good ideas disappear and the program withers. One can measure an institution's commitment to conservation by looking at the amount of money it spends on it. If conservation is not funded, one can be fairly certain that the program is not a priority.

In recent years, tight budgets have put the squeeze on conservation funding at UB and forced us to become more innovative. We have begun funding one-year payback projects (yes, we still have a few) from our utility accounts. But other financing mechanisms need to be identified for good projects with paybacks of more than one year. With less money available, it is not surprising that we are doing less.

New York State is currently in the throes of a financial crisis that probably will propel State agencies toward shared savings and third-party financing. A recent executive order by Governor Mario Cuomo calls for New York State facilities to reduce energy use by 20 percent by the year 2000. It will take money -- a lot of it-- to save all that energy. The executive order, while high-minded, will be impractical until private money is allowed to come to the rescue. There are some hopeful signs that government leaders recognize this and are taking action to permit it to occur.
14. **OVERCOME BUDGETARY DISINCENTIVES**

A special budgetary problem exists when one campus budget is expected to cover the costs of conservation projects while another budget on that campus benefits from the savings. This "split incentive" situation partly explains why it can be difficult to obtain funding even for projects that are obviously beneficial to the whole institution and pay back quickly. Often, split-incentive conflicts can be resolved only by going high up the organizational chart and winning over an authority who is responsible for both budgets.

This problem does not just exist at the campus level. In New York it's a statewide problem instigated by State budgetary practices. Currently, administrators at many State facilities are reluctant to invest much in conservation because they know they won't be able to keep any of the savings. Worse, they fear conservation will result in further cuts in their (already inadequate) utility budgets once energy savings are noticed by the State's Division of Budget (DOB). While taking back savings may make sense to the Division of Budget, it is resented by individual agencies. Moreover, it discourages energy conservation and thus promotes energy wastefulness.

Another irony results from State budgetary practice. Up until a few years ago, SUNY utility allocations were more than adequate to cover annual energy costs, and it was common practice to return a portion of the year-end surplus to campuses with good conservation records in order to further their conservation efforts. This incentive/funding program disappeared when the DOB began reducing SUNY's utility budget in order to promote energy conservation.

It has been argued by some energy analysts that energy conservation is inevitable because it makes such excellent economic sense. It would seem that these analysts are unfamiliar with the ways of large bureaucracies.

15. **TURN VENDOR COMPETITION TO YOUR ADVANTAGE**

Until we had energy-management computer systems purchased from two companies, we had trouble getting responsive service and reasonable charges from the company that had the original monopoly. A good conservation program pits competing vendors against one another. The competition need not be cutthroat to be effective.

UB is currently the beneficiary of friendly competition between our local gas and electric utility companies. About five years ago, our gas utility (National Fuel Gas) began assisting us in assessing the feasibility of gas-heating conversions of the electrically heated buildings on our North Campus. They financed a number of free studies which (not surprisingly) demonstrated and quantified the benefits of gas heating. These studies helped us proceed with some gas-conversion projects.
Until then, our electric utility (Niagara Mohawk Power Corporation) had taken our $10 million electric bill for granted. But when they heard about our interest in gas conversion, their attitude changed and they became much more service oriented.

We now receive free engineering services from both utility companies -- one helping us save money by switching to gas heat (where cost-effective) and the other helping us save money by using electricity more efficiently (in part so we won't want to switch to gas). Either way we win. While this friendly competition has put us in an enviable position, bureaucratic and funding constraints have made us slow to take advantage of the help offered by either utility company.

16. MAKE USE OF UTILITY REBATE AND DEMAND-SIDE MANAGEMENT PROGRAMS

Fifteen years ago, it would have seemed far-fetched to suppose that an electric utility -- a company in the business of selling electricity -- would be interested in reducing their sales by promoting energy conservation. However, in the intervening years, the cost of new electrical generating plants has skyrocketed. Building new plants, especially costly nuclear power plants, has financially damaged more than one utility. Thus, when faced with a growing demand for electricity, an increasing number of utilities have chosen or been forced to look at their demand-side management options -- i.e., conservation.

One way for a utility company to promote energy conservation is through a rebate program. These programs can be especially useful to energy users because they provide needed funding for energy conservation projects and reduce the payback of these projects significantly.

This year our electric utility, Niagara Mohawk, began offering rebates. At present, this incentive program offers rebates on lighting improvements such as energy-efficient fluorescent tubes, compact fluorescent lamp fixtures, electronic ballasts, fluorescent wattage reducers and high-pressure sodium light conversion kits. We are presently considering the purchase of a significant number of compact fluorescent lights and electronic ballasts. The rebates will cut our PL lamp cost in half and cover the full materials cost on the ballasts.

Another type of demand-side management involves private companies that contract with electric utilities to reduce the latter's power-generating requirements by implementing conservation measures that permanently reduce electrical load. Since saving energy is much cheaper than generating it, contracts of this type can benefit local utilities while providing large profit margins to these energy service companies. In turn, these companies can offer colleges and universities excellent deals. They may even undertake substantial energy projects at no cost at all to the school.
17. **PIGGYBACK CONSERVATION ON REPAIR PROJECTS**

Opportunities for energy conservation abound at most colleges and universities. Potential projects lurk everywhere. A good energy program makes energy conservation an issue at all times. When a piece of equipment fails and is in need of repair or replacement, energy conservation should be a consideration.

Early in our Conserve UB program we discovered that it made sense to replace burned-out electric motors with new motors of an energy-efficient design rather than having the old motors rewound (as was past practice). The additional cost of the new motors was more than made up for by the energy savings these motors produced. Repairing building roofs presents another opportunity for energy savings. A modest additional cost will produce a substantially more efficient roof. Energy savings will easily pay the cost difference.

Our law school gas-conversion project demonstrates the benefits of piggybacking projects on a large scale. The existing electric boilers in this facility are in need of replacement. Instead of replacing them with new electric boilers, we plan to take this opportunity to convert the heating system to natural gas. Matching up projects in this manner has the effect of reducing conservation costs and shortening the payback (to 1.0 year in this case).

This same approach may help us justify converting the MacKay Power Plant to cogeneration. The Plant is old and a number of boilers will have to be replaced soon. This is a capital cost that the University will have to bear. When assessing the economics of cogeneration, these boiler replacement costs can be subtracted -as avoided costs -- from the total cost of converting to cogeneration.

18. **AVOID THE FAST-PAYBACK TRAP**

It makes sense to start with quick-payback projects. These projects are impressive, and it is easy to get hooked on them. But as time goes on, one- and two-year payback projects get harder and harder to find. This is no reason for a conservation program to close up shop. Projects that pay back in three, four, five, or more years are good projects. Money invested in these projects is still returned at an attractive rate. Only by undertaking these projects (along with the quick-payback ones) can a facility move toward becoming a truly efficient one.

There is no magic line dividing good and bad projects. There is no right or wrong payback threshold below which a project should be done and above which it should not. Many variables play a part including the availability of funds at any given moment.

Most buildings on a college or university campus are likely to remain standing and operational for many years -- perhaps 50 years or more. Thus, even projects that may pay back in ten or more years, e.g., window replacements, make sense and
should be considered. Moreover, while economics may drive most decision-making, it is important to remember that energy conservation is not simply a matter of saving or making money. It is also a matter of moral responsibility.

19. DESIGN RIGHT IN THE FIRST PLACE

Today's energy costs are significant, and future major price escalations are inevitable as fossil fuels become more scarce. In this context, energy conservation should be fundamental to building design and construction.

When designing a new building, it is false economy to overlook or omit energy-saving measures in an attempt to keep costs down. An inefficient building can waste natural and economic resources year in and year out for its entire lifetime. Although retrofits can make a conservation program look great, it would be better to have buildings designed right in the first place. In most cases total costs would be much less and overall savings much greater.

Responsibility for SUNY building construction belongs to the State University Construction Fund. For years this agency operated more or less autonomously and did not show much interest in campus input. First cost was the Fund's prime consideration, not life cycle. The campuses were responsible for operating the buildings, and they sometimes got stuck with excessive operating costs.

In the last few years, there have been some positive changes. A large fine arts complex is currently under construction on our North Campus. This will be the first new building on that campus that will be heated by natural gas. Despite the economic and environmental advantages of gas heating, all previous designs for our North Campus called for electric-resistance heat, a design decision apparently based on an economic analysis done in the late sixties. It seems as though electric heat became part of the Construction Fund's master plan, and master plans die hard.

The next building slated for construction on our North Campus is our natural sciences and math complex, a facility currently in the last stages of engineering design. The design process for this facility has been much different than that used in earlier building designs. There has been ample campus input and significant sensitivity to the energy issue. Regrettably, this building still will be energy intensive due to its large number of fume hoods. However, its fume hood systems were designed with efficiency in mind, and the entire structure will be heated by natural gas.

Colleges and universities have a responsibility to look at the big picture and design for the future. Engineers and architects have a similar responsibility and should act accordingly even if their clients are not thinking about long-term savings.
20. DOCUMENT SAVINGS AND ACCOMPLISHMENTS

In the public and private sectors alike, a program that makes a demand on an organization usually must justify itself. Justification is especially important when dollars are tight and other priorities threaten to displace the institution's loyalty to the program. It is much easier to justify a campus energy program and to maintain administrative support if full documentation on the program is available.

At UB, we keep an extensive log of projects completed on both our North and South Campuses. Our records show more than 200 completed projects for the North Campus and 120 projects for the South Campus. This energy log has proved invaluable in justifying our program to upper-level management here at the University and to our Albany-based colleagues at SUNY Central and the State Division of Budget. Our project logs form a databank which often comes in handy, e.g., in preparation of educational materials about Conserve UB for campus distribution or when preparing for lectures or presentations to students, faculty, or staff audiences.

In addition to recording and documenting energy conservation projects, it is important to keep careful energy statistics which document the energy consumption history of individual buildings and the campus as a whole. Having this kind of data has enabled us to generate statistics that many have found impressive. For example, since 1983 our North Campus energy consumption has dropped 5 percent despite the construction of six new campus buildings with a total area of 775,000 gross square feet (a 20 percent increase in the size of the campus). One could say that in achieving a 25 percent campus energy savings we've supplied all six buildings with free energy!

21. NEVER REST; NEVER BE SATISFIED

In many respects, our Conserve UB program has accomplished a lot. But we also have a long way to go. Opportunities for new conservation projects continually present themselves. These should be exploited in our pursuit of a truly energy-efficient campus.

There is a danger in becoming self-satisfied. Once a program begins resting on its laurels, the law of entropy takes over. Not only does support for the program erode, but conservation measures previously undertaken have a way of getting undone. Thus begins the awful slide back toward increasing waste and inefficiency.

Energy conservation needs to be institutionalized without being taken for granted. It should be viewed as an ongoing practice, not only a way of life but a love of life. Our planet and our future demand it.
APPENDIX:
A UNIVERSITY PERSPECTIVE ON THE GREENHOUSE EFFECT

As part of Conserve UB's educational activities, UB biophysics professor Fred Snell and energy officer Walter Simpson prepared a report documenting SUNY Buffalo's annual contribution to global warming and the greenhouse effect. By analyzing UB energy use patterns, they determined the University's annual emission of carbon dioxide, the most significant greenhouse gas.

They calculated that each year the University is responsible for CO$_2$ emissions totaling 313,900 tons. Dividing this number by 30,000 students, faculty and staff, they arrived at a figure of 10.5 tons of CO$_2$ per person per year.

Campus electrical use accounts for 221,900 tons (71 %) of their annual carbon dioxide emissions. The North Campus is electric-intensive, relying heavily on electric resistance heating. And the South Campus is becoming increasingly electric-intensive as more and more buildings become centrally air conditioned. The purchased electricity is primarily generated at a coal-fired power plant which operated at approximately 33 percent efficiency. Coal is a carbon-rich fuel and contributes disproportionately to global warming.

The South Campus is heated by steam generated at the University's MacKay boiler plant. This plant burns coal directly and is responsible for releasing 31,900 tons of CO$_2$ per year or about ten percent of total emissions.

Commuters burn an estimated 5,900,000 gallons of gasoline each year traveling to and from the campuses. This produces approximately 51,000 tons of carbon dioxide annually (16 percent of our total). The remaining fraction of emissions is accounted for by campus vehicles and buses.

How much photosynthetic activity would be required to offset SUNY Buffalo's 313,900 tons of emissions? Assuming a young growth forest can "fix" nearly two tons of carbon per acre per year, 42,900 acres or 68 square miles of young growth woodlands would be required.