Design of an Energy Management Program for the University of Washington

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The authors designed an energy management program for the University of Washington, a large northwestern university. The university, with more than 250 buildings and 50,000 inhabitants, spends more than $6 million on electricity annually. This paper describes the program design process and discusses the program status one year after its launching. The project is valuable as a model for other institutions because it establishes a long-term, comprehensive program for perpetuating energy savings and for incorporating energy efficiency into a wide range of university practices and procedures. Furthermore, a variety of innovative financing approaches were proposed, from use of ESCOs and state loan programs to a utility energy service charge.

The energy management program developed for the university includes five major strategies: retrofitting buildings; incorporating energy efficiency into new buildings and renovations; developing operations and maintenance procedures that support energy efficiency; promoting energy awareness among students, faculty, and staff; and tracking results. The authors identified over 8 megawatts of potential energy savings from retrofits alone.

The paper describes some of the key steps in developing this plan, including

- The situational analysis: an assessment of management structures, policies, and procedures that influence energy use
- The technical assessment of the conservation potential
- The founding of an energy management group and definition of its role within the facility management department
- The process for gaining support from various constituencies
- An agreement with the local electric utility and its wholesale supplier to provide a $5 million contribution.

INTRODUCTION

The University of Washington (University), is one of Seattle's biggest users of electrical energy, spending more than $6 million on electricity each year. Encompassing 700 acres, and with 13 million square feet of building space and 50,000 inhabitants, the campus resembles a small city. The University is the largest public institution in the Pacific Northwest and continues to grow. In fiscal year 1995–96 alone, over 2 million gross feet of building space will be added and several large-scale renovations will occur. Coupled with an increased use of energy-intensive research facilities, electricity use is expected to increase 10 percent by 2000. Based on expected rate increases, electricity costs could rise as much as 60 percent. In addition, the state legislature has consistently requested the University's biennial budget be cut, most recently by $12 million.

Historically, the University's interest in energy management has fluctuated. In reaction to the energy crisis in the 1970s, there was a spurt of conservation activity focusing on turning down thermostats, delamping lighting fixtures, and installing energy-saver fluorescent lamps. By the 1980s, however, energy conservation was a lower priority due to low energy prices and a concomitant reduced sense of urgency.

Starting in the late 1980s, motivated by Seattle City Light's demand-side management (DSM) programs and through the efforts of a few energy conservation enthusiasts on the University's staff, a small, unofficial energy management group had formed to manage energy conservation projects and obtain Seattle City Light rebates. The group resided within the Physical Plant Department of Facilities Services. By 1993, the Physical Plant Department had undertaken some lighting retrofits, installed direct digital control (DDC) systems in new buildings, and obtained rebates for incorporating energy-efficient design practices into new construction.

Meanwhile, Seattle City Light was developing a tailored agreement program focused on working directly with its largest customers to improve their energy efficiency. The prospect of increasing electricity costs motivated the Physical Plant Department, with funding from Seattle City Light, to hire consultants in 1993 to develop a long-term comprehensive electrical energy management plan for the University.[1]

Brown, Vence & Associates, teaming with O'Neill & Company and BRACO Resource Services, was selected to prepare the plan. In addition to University personnel, key participants included the Bonneville Power Administration, Seattle City Light, and the Washington State Energy Office.

This paper discusses the methodology used by the authors to develop an energy management plan for the University and the results of that effort. While the project had many unique characteristics, the strategic planning process described in this paper can be followed by any institution seeking to reduce its energy consumption.

METHODOLOGY

As consultants, the authors played two key roles in developing an energy management program: we facilitated the planning process and provided expertise needed to design a program and to quantify program costs and benefits. The planning process was a collaborative effort drawing on a number of interest groups: the University, Seattle City Light, Bonneville Power Administration, and the Washington State Energy Office. The process included six key steps: (1) defining goals, (2) assessing the existing situation, (3) developing strategies, (4) quantifying savings potential, (5) developing a management plan, and (6) developing a financing plan.

The cost of developing this plan was just over $200,000. About one-third of the cost was related to quantifying the savings potential at the University (step 4). The remainder of the cost involved the non-engineering tasks, such as developing a financing and management plan, which were equally critical to the success of the plan. The planning process also necessitated ongoing interaction and communication with the University staff and the other stakeholders, and the time devoted to this effort was another component of the cost of the plan.

Defining Goals

The first task in the planning process was to clarify the goals and scope of the plan. One challenge was that the plan had many stakeholders, each with its own set of needs:

- University Physical Plant Department: Our primary client, Physical Plant staff initiated and managed the development of the energy management plan and are responsible for its implementation. Its main goals were to lower University energy costs, to improve the operation and maintenance of campus facilities, and obtain the funding and institutional support it needed to achieve those objectives.

- Seattle City Light: The local utility company that funded the plan as part of its commercial conservation programs. Its main goal was to help the University in meeting its goals as well as achieving its own DSM goals.

- Bonneville Power Administration: The regional wholesale power distribution agency that historically provided a portion of funding for Seattle City Light's conservation programs. Its concerns were similar to Seattle City Light's.

- Washington State Energy Office: The state agency with responsibility for promoting and achieving energy savings in state facilities. Its main goal was to help the University become more energy efficient.

- University Community: The administration, faculty, and students whose support and cooperation would be needed for the plan to succeed.

Prior to hiring consultants, the University Physical Plant Department formed an advisory committee comprised of representatives of the groups named above. An early advisory committee meeting resulted in a list of over 100 objectives covering issues ranging from financial parameters, to utility program requirements, to state agency technical assistance, to regular training for facilities personnel. Assessing these objectives required the consultant team to sort and prioritize sometimes overlapping, sometimes disparate issues into a focused scope and set of goals. We identified four main goals that seemed to encompass the primary concerns of all parties:

- Reduce the University's operating costs

- Reduce the University's electrical demand and usage

- Improve the efficient operations and maintenance of University facilities

- Establish the financial and organizational means to sustain efficient campus operations.

Assessing the Existing Situation

After broad goals were established, the next step was assessing existing energy practices at the University, termed a situational analysis. Energy practices can be broadly defined as all activities that influence energy use, including undergraduates plugging in computers in the dormitories, graduate students running experiments late at night in laboratories, academic departments purchasing new research equipment, and the Physical Plant Department, installing and maintaining HVAC and lighting equipment.

Ideally, a situational analysis should address all the departments that make decisions on funding, selection, installation, and operation of energy-using equipment. Our situational analysis focused primarily on the activities within the control of Facilities Services because the resulting plan was to be implemented within that office. However, the final planning document included strategies for influencing activities in the broader University community.

The mission of Facilities Services is to ‘‘develop and maintain facilities that effectively serve the needs of the University's academic mission.’’ It is organized into four departments: finance and computer services, capital projects, plant engineering, and physical plant. The authors conducted confidential in-person interviews with 17 individuals associated with Facilities Services to gain an understanding of standard procedures for developing budget requests, receiving budget approvals, managing major remodeling and new construction projects, and paying utility bills. The interviews were treated as confidential so that the participants would not be inhibited in their comments.

These interviews revealed information of importance in developing an energy management plan. For example, we learned that electricity costs, as well as other utility costs, are estimated for each biennial budget cycle and incorporated into the overall two-year budget proposed to the state legislature. Therefore, Facilities Services can use money allocated for utility payments to invest in energy conservation if the payback occurs within the two-year budget cycle. As another example, we also learned that all new construction projects and major remodels must follow a Facilities Design Information (FDI) manual, which had recently been updated to require T-8 lamps and electronic ballasts.

We interviewed another 12 people within the Physical Plant Department to assess operations and maintenance procedures. The department is organized into four groups: campus operations, custodial services, maintenance and alterations, and transportation services. The interviews gave us an understanding of practices that affect energy efficiency, such as the preventive maintenance software system, group relamping procedures, and the computerized energy management system.

Due to the confidentiality of the interviews, the staff was open to discussing problems and suggesting ways to reduce energy use. For example, many interviewees believed that energy efficiency would be a higher priority for staff if upper management set clear direction and provided support and commitment. Other suggestions were more specific, such as identifying a need to repair leaking ductwork or recommending that standards be set for use of new electronic control technologies. Several people commented that greater coordination and cooperation among groups was needed to reduce energy use, such as cooperation between the shops that maintain refrigeration equipment and the shops that maintain controls.

From the interviews, we formed some overall impressions of preexisting energy practices. In the past few years, electrical energy management had relied heavily on the efforts of a few highly motivated staff who have made real strides toward lowering energy use. However, not all current practices were supportive of energy efficiency. While many different people were involved in the planning, building, and maintaining of campus facilities, there was no process for ensuring that energy efficiency is a consideration in their decision-making.

As is typical of many universities, the focus of the administration is on obtaining long-term resources including endowment funds, capital investments, and world-renowned professors. The absence of broader organizational and financial support for energy conservation had prevented realization of the full potential of electricity savings available at the University.

Developing Strategies

Based on the major goals expressed by the University and its advisory committee, and on our assessment of existing energy practices, we developed five strategies that would promote long-term energy management at the University (see Table 1). The strategies were responses to what we saw as the main opportunities for improving energy efficiency at the University, and potentially at any institution. In the final plan, we presented a detailed action plan for implementing each strategy, which consisted of initial tasks and ongoing tasks (see ‘‘Developing a Management Plan’’).

Table 1. *Energy Management Strategies*

Opportunities	Strategy
University has an older building stock with lighting and HVAC equipment that is less energy-efficient than currently available technologies.	Retrofit existing buildings
Over 2 million square feet of new construction is planned.	Incorporate energy efficiency into new buildings and major renovations
Behavior of students, faculty and staff has a large impact on energy use.	Promote energy awareness among students, faculty and staff
Operation and maintenance practices have a large impact on energy use and are not always consistent with efficiency goals.	Develop operations and maintenance procedures that support energy efficiency
Better information on energy use and energy savings will enhance energy management efforts.	Track and measure results

Quantifying Savings Potential

We decided that the technical assessment of conservation potential on the campus should focus primarily on the retrofit of existing buildings. Projecting savings from future design practices, operations and maintenance (O&M) practices, and occupant behavior changes offered theoretical challenges and would result in debatable assessments, so we did not estimate the potential for savings in these areas. The technical potential we identified, based upon retrofit savings only, is a conservative estimate of the overall potential for campus energy savings.

The University campus has over 250 buildings, including dormitories, offices, research facilities, parking garages, a hospital, athletic facilities, and libraries. The range of building types combined with limited time and budget drove consideration of a number of approaches to assessing the savings potential on the campus. We determined that campuswide energy consumption data were not available in an easily accessible form. The common practice of conducting in-depth energy audits followed by comprehensive analysis and computer modeling of a significant number of buildings was not an option because of the time and budget that would be required. We decided the most workable approach was to identify energy conservation measures (ECMs) applicable to a wide range of building types, following by site surveys of buildings that represented each of the building types found on campus.

The first step in our analysis was to develop a list of ECMs that had a high probability of being cost-effective, were applicable to a large number of buildings, and could be analyzed without detailed data on every building. This list was developed with considerable input from Facilities Services staff and was revised over the course of the study. Initially we did not use firm economic criteria for inclusion of ECMs (e.g., payback under five years) because the ultimate economic benefit to the University was dependent upon a number of factors, one of which was the level of contributions obtained from utility DSM programs, that we would clarify during the study. We tailored our analysis to the University using an approach focused on the application of proven technologies.

After developing an initial list of ECMs, we collected data to analyze the potential energy savings and costs associated with them. We developed cost estimates by estimating the basic project cost, including labor, materials, design and sales tax, and then adding typical cost multipliers used at the University. Our calculations included different factors for projects that could be installed in-house than for those that would be installed by an outside contractor. The 10 ECMs we evaluated included the following:

- Install T-8 lamps/electronic ballasts (40 percent of the estimated potential)
- Retrofit and/or replace incandescent fixtures
- Convert constant volume heating/cooling to variable-air-volume
- Install variable-frequency drives on cooling tower fans
- Convert inlet guide vanes to variable-frequency drives
- Install occupancy sensors
- Install DDC system
- Retrofit three-way valves to two-way on the chilled water loop
- Install LED exit signs
- Replace standard motors with high-efficiency motors.

The next step in our assessment was to categorize campus buildings into general types and conduct site surveys of representative buildings within those types. The categories we selected include classrooms and offices, research and science, libraries, hospital, residences, food services, athletic facilities, warehouses and garages, and special (e.g., museum). To meet the objectives of the technical assessment task of the energy management plan we conducted extensive interviews with University staff in the Physical Plant Department, Capital Projects Office, and other groups involved in the physical operations of the campus (see ''Assessing the Existing Situation''). A major objective of the interviews was to locate sources of information that would assist us in developing a technical assessment of the campus potential. As a result of those interviews we were able to access a number of sources prior to conducting the site surveys. One example is the building data from the Capital Projects Budget Office from which we obtained the total square footage of classrooms, thus facilitating our analysis of the potential for installing occupancy sensors.

Our next step was to develop a calculation method for estimating energy savings and costs for each ECM. For almost every ECM, it was necessary to extrapolate from representative cases from our site surveys to assess the potential campuswide application of that ECM. For example, to evaluate the conversion from constant volume to variable-air-volume HVAC systems, we analyzed the ECM in three representative buildings, two with air conditioning and one without, and extrapolated the results to other similar buildings. The central chilled water system was the primary exception to this extrapolation method. In every case our extrapolation methodology intentionally incorporated conservative assumptions to maintain our commitment to realistic estimates. We developed a rough energy balance, a breakdown of energy use by end-use, to verify that our estimates of energy savings in lighting and HVAC were reasonable when compared to the energy use of those systems. We did not estimate the energy use of systems such as office equipment and refrigeration as they were not a focus in our assessment.

We concluded that if all of these measures were implemented, the University could reduce its annual energy consumption by about 61 million kWh, representing 27 percent of current electricity consumption, at a cost savings of roughly $2 million per year. To capture the entire energy-efficiency potential outlined in our engineering analysis, we estimated a capital investment of over $14 million.

Developing a Management Plan

To capture the potential energy savings at the University, an organization with sufficient staffing was needed for project development, project management, and related activities such as monitoring, energy accounting, and updating new construction guidelines. Necessarily, the financing plan, described below, incorporated these management costs.

The energy management plan was drafted based on the five main strategies described earlier. For each of these strategies, we developed an action plan consisting of a series of tasks, both initial and ongoing. For each task, we then estimated the level of staffing required (see Table 2). In total, the plan identified a need for six full-time equivalent staff (FTEs). The plan recommended establishing an Energy Management Program, including an administrator (one FTE), project managers (two FTE), a design manager/new technology specialist (one FTE), an energy specialist (one FTE) and a program/design assistant (one FTE). This organizational structure was developed with considerable input from the client, based on its standard job classifications and management approach.

Developing a Financing Plan

As described above, we were able to quantify savings potential of about $2 million per year for an investment of $14 million, providing a seven-year payback if all measures were implemented. However, the spending authority of Facilities Services was limited to investments with a payback of under two years, so that the project cost could be recovered through reduced utility costs in the same biannual budget cycle. The development of a financing plan was therefore the next required step in the planning process, and we evaluated alternative financing mechanisms including utility assistance, university financing, state loans, and energy service companies.

Utility Assistance. Since the late 1980s, utilities in the Pacific Northwest have provided rebates and customized incentives to customers for the installation of energy-efficient measures as part of the Bonneville Power Administration's DSM programs. During the development of the energy management plan, however, Bonneville Power Administration began rethinking its financial commitment to conservation due to deregulation of the utility industry. Incentive funds passed along to local utilities began dwindling, and the threat of elimination of financial support for DSM loomed throughout the Pacific Northwest.

In considering how to approach Seattle City Light for assistance, we looked beyond typical funding mechanisms, such as straight rebate programs. For example, we examined such options as a payment per kWh saved, a one-time upfront payment for lifetime energy savings, and an energy service charge. An energy service charge is essentially a loan that appears on the customer's bill. The bill is a combination of

Table 2. Energy Management Program Strategies and Staffing

Task	FTE
Strategy 1: Retrofit Existing Buildings	
Develop a Computerized Database for ECMs	0.24
Develop and Implement Retrofit Projects	3.97
Establish One or More Showcase Projects Each Year	0.11
Submit Rebate Applications Periodically	0.12
Develop Design Concepts for Expanded Energy Management System	0.17
Obtain Financing for Phase II Projects	0.24
Strategy 2: Incorporate Energy Efficiency Into New Buildings and Major Renovations	
Attend Building Committee Meetings	0.12
Update FDI Manual	0.24
Maintain a Resource Library on New Technologies	0.02
Develop Standards for Purchasing Technologies	0.05
Obtain SCL Funding for Design Improvements	0.30
Strategy 3: Develop O&M Procedures that Support Energy Efficiency	
Coordinate Training on Energy-Efficient Practices	0.02
Review Physical Plant Preventive Maintenance Program	0.08
Give Shops Maintenance Guidelines on ECMs	0.04
Strategy 4: Promote Energy Awareness Among Students, Faculty and Staff*	
Educate the Campus Community	
Gain Feedback from the University Community on Retrofitting	
Acknowledge Campus Supporters of Energy Conservation	
Promote Interest in Research Related to Energy Efficiency	
Strategy 5: Track and Measure Results	
Develop a Computer Database for Tracking Energy Use	0.10
Develop Protocols for Measuring Savings	0.06
Measure Savings for Each ECM Implemented	**
Track Savings for New Construction Projects	0.05
Add Electronic Metering Capabilities	0.05
Evaluate Progress Annually	0.06
Grand Total (all strategies)	**6.04**

*** The University intends to incorporate the energy awareness tasks into other tasks.**
**** The measurement task is included in the FTE estimate for the ‘‘Develop and Implement Retrofit Projects’’ task.**

the monthly loan repayment amount and the new electricity charges structured so as to not exceed the customer's current electricity bill. The customer is billed for the conservation measures, cost of the audit, and an interest charge. The customer sees a positive cash flow over time.

University Funding. In addition to utility financing, we investigated obtaining an internal loan from the University. The University's 10-percent internal rate of return, however, is high by most standards due to an extensive investment portfolio. Therefore, this mechanism was not as attractive as some others.

State Financing. Another option was financing through the state. A lease-purchase option program allows short- to moderate-term investments, averaging five to seven years. The program had been used for the installation of conservation measures by other public institutions and was seen as a viable alternative. This option would require the approval of the Washington State Energy Office. If approved, the state would finance the loan amounts through Certificates of Participation.

Energy Services Companies. Finally, we considered contracting with an energy service company (ESCO). ESCOs offer both funding and installation support, providing a benefit to many public agencies with limited capital expenditure funds. Agreements can be structured in many different ways: straight leases, split-shared savings, positive cash flow for the customer, guaranteed savings, etc. Bonneville Power Administration's competitive bid mechanism was already in place, with contracts signed and firms interested in securing resources. ESCOs with these contracts had approached the University as a possible host site.

Pro Forma Analysis. Extensive pro forma spreadsheets were developed, outlining savings and costs under various financing scenarios. It was decided to prepare the economic analyses from the perspective of the University (rather than the utility), and yet provide sufficient information for the utility to prepare its own cost-effectiveness analysis.

Savings included both energy and demand, O&M, and other known benefits. Costs included materials/labor, overhead, the Energy Management Program, any relevant debt service, O&M, and other costs or impacts. We calculated present values using the University's discount rate of 10 percent, and assumed that it would take four years to implement the first $8 million of projects.

We evaluated each of the above financing options, including slight variations thereof, based on cash flow, net present value, internal rate of return, and simple payback. As we progressed, several of the alternatives became less viable in terms of feasibility while others became more viable. In addition, a number of alternatives, while viewed as attractive by the University, were seen as less suitable by Seattle City Light. As mentioned earlier, we were striving to satisfy all parties involved.

Based on our analysis, we recommended the University pursue the options of utility financing and ESCO support. Although the utility was always willing to contribute some level of financing to the project, the projected amount available varied throughout the planning process due to the constantly changing environment supporting DSM. As negotiations became more serious, discussions determined that a $5 million contribution from Seattle City Light was indeed viable. Table 3 shows the first five years of the pro forma analysis used to show cash flows under the scenario with a $5 million contribution from Seattle City Light. To supplement this contribution, we urged the University to seek an agreement with a local ESCO. The coupling of these two preferred financing options potentially allows the University to install all cost-effective ECMs.

The financial analysis was very sensitive to assumptions about the pace at which energy conservation measures could be implemented. The internal rate of return increases if the projects are implemented sooner rather than later. However, there are structural/institutional limits on how fast the University can mobilize its forces, so it is important to be realistic about how quickly retrofit work can be accomplished. Implementing $8 million worth of projects in four years is an aggressive, yet achievable schedule, assuming the energy management program continues to have adequate staffing and institutional support.

RESULTS

The planning process described above had three main results: the formal establishment of an Energy Management Program, a planning document outlining strategies and tasks to be implemented through the program, and an agreement with Seattle City Light to provide $5 million in funding to the University for the satisfactory installation of energy-efficient measures.

Utility Agreement

Despite the climate of uncertainty about DSM in which this planning process took place, Seattle City Light was able to commit significant funding to the University. Several factors made the University an attractive host site for limited DSM dollars. First, it was one of the largest customers in the system and had identified a large savings potential. Second, the University had demonstrated its commitment to energy management by past participation in Seattle City Light incentive programs and by establishing an organization to implement DSM projects. Third, electrical demand savings at the University would relieve stress on local distribution capacity. Fourth, through its support, Seattle City Light was contributing to the economic viability of an important Seattle institution.

The tailored agreement with Seattle City Light was structured to provide the University with flexibility in selecting and implementing projects while ensuring that the utility would only contribute to projects that met its cost-effectiveness criteria. Under the agreement, Seattle City Light will reimburse a maximum of $5 million for costs incurred in the satisfactory installation of conservation measures.

The agreement, signed in September 1994, made $2.5 million available immediately; another $2.5 million was committed in 1995. The incentive level under the agreement is $0.135 for each kWh saved in one year for all measures. After all comprehensive measures have been installed and approved by Seattle City Light, the total overall incentive amount may not exceed 62.2 percent of the total installed

Table 3. Financial Analysis of Phase I ECMs (First Five of Fifteen Years)

	Year 1 1994–1995	Year 2 1995–1996	Year 3 1996–1997	Year 4 1997–1998	Year 5 1998–1999
Estimated Savings					
Energy (kWh)	7,568,000	20,812,000	32,164,000	37,840,000	37,840,000
Demand (kW)	1,000	2,000	3,000	4,000	4,000
Savings ($)	$367,000	$1,010,000	$1,560,000	$1,836,000	$1,836,000
Estimated Costs					
Construction	$1,608,000	$2,814,000	$2,412,000	$1,206,000	$0
Management	$400,000	$390,000	$390,000	$390,000	$157,000
Other costs/impacts	$231,000	$351,000	$311,000	$191,000	$70,000
Total cost	$2,239,000	$3,555,000	$3,113,000	$1,787,000	$227,000
Financial Analysis					
Project cash flow	($1,872,000)	($2,546,000)	($1,553,000)	$49,000	$1,609,000
Utility contribution	$1,022,000	$1,788,000	$1,533,000	$766,000	$0
Net University cash flow	($850,000)	($758,000)	($20,000)	$815,000	$1,609,000
University contribution	$1,239,000	$1,805,000	$1,613,000	$1,036,000	$227,000
Net present value (Over fifteen years)	$6,819,000				
IRR (Over fifteen years)	46%				

cost of all combined ECMs. The agreement states that the University shall implement the measures identified in the technical assessment or measures that achieve the same level of savings, thus providing some flexibility in developing projects. For each conservation project, the University needs to submit energy savings calculations, specifications, manufacturer's product sheets, and cost estimates to Seattle City Light for approval. The purchase and installation of conservation measures must be completed by June 15, 1998.

To take advantage of funding available from the utility, the University divided ECMs into Phase I projects, Phase II projects, and any remaining projects. Phase I projects are those covered by the Seattle City Light agreement. Phase I is expected to encompass an $8 million investment in installation of a portion of the first eight measures of the ECM list presented earlier. Phase II projects are to be implemented through ESCOs or other financing methods, to be determined later by the Energy Management Program staff.

The University's financial contribution was estimated to be about $3.2 million for ECMs and another $400,000 (averaged) per year for the first four years for staffing the Energy Management Program plus costs of monitoring equipment. After all measures are installed (by 1998), the annual energy savings are estimated to be $1.55 million per year; additional O&M savings of $290,000 per year were anticipated, largely due to the removal of incandescent lamps. The plan assumed the University's contribution could be paid for either with internal University funds and/or out of its utility budget.

The Program One Year Later

As of November 1995, the University had completed the development of ECMs with a total project cost of $1.8 million under its tailored Seattle City Light agreement, concentrating on energy-efficient lighting projects.[2] These projects will save a projected 8 million kWh of electricity per year. Seattle City Light's contribution to these projects is $1 million, and some of the projects were funded in part by piggybacking on other budgeted capital projects.

Currently, the Energy Management Program has five full-time staff, a contract project manager, and a part-time student who focuses on computer input. The full-time staff include a program administrator, a project manager, a design manager, a lead lighting project developer, and a monitoring and verification specialist. Two staff from the University maintenance shops have been trained in conducting lighting surveys.

In 1996, the Energy Management Program will continue identifying and implementing energy-efficient lighting projects and will focus more on HVAC projects. The implementation of HVAC projects has been slower than planned, and it is anticipated that outside technical assistance may be needed to develop these projects in the next three years. In addition, discussions are underway with ESCOs to begin implementation of Phase II projects.

Developing and implementing building retrofits eligible for Seattle City Light funding are the main focus of the Energy Management Program activities to date. Some progress has been made regarding the other four strategies in the plan, as described below.

New Buildings and Renovations. The University continues to obtain Seattle City Light assistance and funding for new construction design improvements. As yet, there is no formal participation of Energy Management Program staff on building committees; however, the staff are recognized as a resource by the committees.

O&M Procedures. While some of the specific tasks related to improving O&M have not yet been undertaken, the O&M shops have been participating in the implementation of lighting retrofits and therefore are becoming more aware of, and integrated with, the Energy Management Program.

Energy Awareness. Some energy awareness activities are underway, particularly as related to lighting retrofits. For example, a few days before lighting crews are scheduled to begin work, they circulate a notice on doorknobs that explains the advantages of the new lighting system and describes the University's Energy Management Program. This has helped raise awareness and acceptance of the lighting changes.

Measurement and Verification. The Energy Management Program has invested in a computerized energy accounting system, which will be installed this year. The system will be used to forecast baseline energy use and track program impacts. Verification of savings using before-and-after measurements has been completed for about one-third of the retrofit projects.

CONCLUSIONS

The main successes of the planning process undertaken at the University include:

- Identifying $2 million in cost-effective energy savings by proposing energy efficient technologies
- Establishing an Energy Management Program to pursue energy-saving activities
- Bringing together state and federal entities, utilities, and several University departments to agree on a plan
- Negotiating a tailored agreement with Seattle City Light to contribute $5 million toward ECMs.

Several factors contributed to these successes:

- The early effort of the Physical Plant department in generating interest of the local utility, University, and state.
- The consulting team, working with an advisory committee of representatives from these stakeholders, was able to achieve an implementation plan that addressed the concerns of many constituencies.
- The plan addressed not only the technical energy conservation potential at the University, but also provided a structure for achieving those savings by outlining both a management plan and a financing plan that met the requirements of the University.

We learned several lessons that should be considered by energy planners for other institutions:

- Developing a plan that addresses concerns of many internal and external constituencies and that addresses financing and management issues requires a level of effort well beyond the more straightforward task of assessing potential energy savings.
- Beginning with an examination of current energy practices and procedures was helpful in developing technical, organizational and financial strategies.
- Early buy-in by an institution's budget office will make it easier to structure financing arrangements.
- A financing plan for ECMs must use realistic assumptions about the pace at which projects can be implemented at a large public institution, and timelines for implementation of ECMs should be conservative.

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ENDNOTES

1. Because of the funding source, the emphasis of the plan was on measures that save electrical energy. However, some of the measures identified impact natural gas usage as well, and those effects were considered in the analysis.

2. These are projects that have been completed or have been identified and are in process.