

Promoting Energy Awareness in Two Federal Workplaces

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ABSTRACT

This project's goal is to promote energy saving behaviors among employees at federal work places and to find approaches that can be effective in other work places. The Wisconsin state energy office launched this project and identified the federal partners: a laboratory and a hospital. The next step was working with internal stakeholder teams to achieve buy-in for the project and to understand the technological and social dimensions of energy use that were unique to each facility. Program delivery was customized based on their feedback. Surprisingly, the teams resisted traditional awareness approaches such as friendly competition between departments, lotteries, individual prizes, and pledges. Instead, stakeholders preferred approaches that did not spotlight one worker over coworkers, and minimized friction between departments, such as rewards to the entire organization. The next step was performing engineering "operational" audits, to determine where the best savings opportunities were, and to establish a baseline. Based on the audits, behaviors targeted for change pertained to office equipment (including use of monitor power management), lighting, fume hoods, thermostats, blinds, and air conditioning. An educational campaign was launched and technical assistance was offered to operations and maintenance staff. The project was expanded to include pilots of energy-saving hardware that relate to occupant behavior. Project results are being transferred to several other State and local government facilities.

Introduction

This project was started at the suggestion of a federal agency energy manager in the region. It began with the assumption that a federal workplace could achieve significant energy savings by promoting energy awareness and changing workers' energy use habits. The goal was to create a model for similar projects in public and private workplaces. The project was designed to adapt to specific conditions and opportunities in the participating buildings. Implementers planned to include both technical assistance to operations and maintenance staff, and general educational outreach to all employees.

Education to promote energy awareness at work is an approach with great promise. Almost every commercial operation can benefit from such a project. A building with state-of-the-art energy hardware can achieve additional savings with an educational campaign. On the other hand, a business that cannot get management approval for energy hardware upgrades can still make progress toward savings with a low-cost education campaign. In both types of facilities, an education campaign can create a culture of energy saving and cultivate internal

energy champions that will influence the organization's willingness to invest in energy efficiency over the long term.

With this vision, several federal facilities were recruited for the project. Two physically adjacent facilities in Madison, Wisconsin, were chosen – the U.S. Forest Service's Forest Products Lab (FPL) and the William S. Middleton Memorial VA Medical Center (VAM). Work in the facilities began in the summer and fall of 2001, and will continue through the fall of 2002. This paper will discuss the start-up phase of the project and preliminary results.

Context for Project

Many efforts targeting building users have proved that energy savings are possible through purely educational approaches (Egan 2001; Green & Skumatz 2000). Efforts targeting home energy use reduction seem most common (e.g., Brandon & Lewis 1999), but workplace efforts have also proved effective (Siero et al. 1996; Staats, van Leeuwen & Wit 2000). Workplace energy conservation campaigns may be more challenging than residential campaigns because employees receive no direct financial benefit, and may have less control over their energy use at work than they do at home.

Government agencies are particularly important partners for energy conservation, because of the sheer size of the sector, its public service role, and its need to demonstrate responsiveness to fiscal and energy crises. California's state facilities are reported to have achieved over twenty percent energy savings from rapidly implemented programs in summer 2001, which included education (CEC 2002). Goals for federal government energy conservation were set forth in June 1999 in Executive Order 13123. The U.S. DOE supports energy savings initiatives in federal agencies through the "You Have the Power" education and publicity campaign (e.g. see DOE 2000).

Studying these efforts suggested some of the educational strategies used in this project. Implementers realized that achieving actual behavior change was more difficult than increasing awareness or understanding, or changing attitudes (Costanzo et al. 1986). In order to compensate for the shortcomings of any one type of strategy, implementers planned to take an eclectic approach, while tailoring the information to the audience as much as was practical. Implementers also expected to eliminate strategies that proved impractical or ineffective, and to add other strategies that were suggested during the project. Proven strategies such as pledges (Katzev & Wang 1994) and "comparative feedback" or competition (Siero et al. 1996) fell victim to this selection process early, because of building stakeholder input. Since workplaces are animated by a community social dynamic, previous community-based efforts also provided ideas on how to proceed (Weenig 1993).

While energy education was directed toward all employees, more intensive educational or technical assistance efforts were directed to maintenance staff.

Background on Participating Buildings

Finding facilities suitable for participation in this project was surprisingly time-consuming. Three major factors made VAM and FPL promising host facilities for this project. The most important factor was the interest of the chief facility engineers responsible

for energy efficiency. The second was that initial facility walk-throughs indicated potential to save significant amounts of energy by changing employee behavior, e.g., the presence of several hundred computers that were not consistently shut off at night. Lastly, the two facilities included markedly different space use types, organizational cultures and functions that allowed testing of a variety of approaches. VAM is an 850-employee three-shift facility of 600,000 square feet with only 80 patient beds. The majority of the space is research labs, clinics, and administrative areas. This hospital uses an unexpectedly large amount of space for administrative work due to its function as an administrative services hub for eight other VA hospitals in the Midwest region. The complex also includes a child-care center and a laundry. FPL is a 275-employee facility of 430,000 square feet. FPL includes a 1930s-era main building and several 1960's-vintage laboratory buildings. One-third of FPL's floor area is labs and the remainder is office space. Both facilities are adjacent to the University of Wisconsin.

Creating a Plan

As outsiders, project implementers realized it was important to understand and meet the needs of the people they were working with. The first step was to develop a project plan in coordination with an internal stakeholder group assembled by the lead building manager in each facility. These two teams provided useful insights. For example, FPL stakeholders rejected certain proposed activities as "changing the work environment," which would trigger objections by the union representing two-thirds FPL staff, the non-scientists. Also, both FPL and VAM teams suggested avoiding enforcement mechanisms such as "mock tickets" for leaving computers on, which were perceived as too negative and intrusive. They disliked inter-departmental competitions, which were seen as undermining management's teamwork message. Furthermore, both FPL and VAM teams advised that rewards should be made available to all employees and not on a merit basis. Some proposed program elements, such as an energy cartoon caption contest, were perceived as frivolous and distracting from the goal of saving energy. The FPL team, with a workforce of many scientists, indicated that their coworkers were motivated by no-nonsense factual information on saving energy and the prospect of larger research budgets as a result. Both teams were interested in using the existing U.S. DOE Federal Energy Management Program slogan "You Have the Power."

In tandem with these stakeholder meetings, project implementers established a "before" picture of energy use in the buildings, by interviewing building managers and doing baseline "operational" audits. These audits focused on identifying opportunities for improving employee interaction with energy-using equipment. The results of the audit are included in Table 1. Using the audit information, project implementers identified the most important actions employees could take to save energy. These actions included:

- Turning off lights and computer monitors when leaving the office for extended periods of time.
- Shutting off computers at night.
- Activating power management on office equipment.
- Setting thermostats back during the winter and up in the summer before leaving work for the day.

At FPL, these actions were estimated to have a savings potential of \$30,000 per year, or enough energy to prevent 350 tons of carbon dioxide emissions a year. At VAM, these actions were estimated to save \$50,000 per year and 690 tons of carbon dioxide emissions per year. The campaign would focus on encouraging more employees to take these actions consistently at work.

Launch Event

The first major outreach efforts to FPL and VAM employees were one-day drop-in launch events in mid-November to introduce the campaign. Refreshments were provided to promote a social, informal atmosphere. At each launch event, campaign promoters distributed brochures outlining the actions employees were being asked to undertake, and quantifying the expected energy savings if employees did take these actions at each facility.

A campaign booth demonstrated efficient actions, using wattmeters to display the potential impact of monitor power management. Before and during the launch event, employees were asked to fill out a survey to determine energy conservation habits and knowledge. Upon completing the survey, occupants were entered into a raffle to win a compact fluorescent torchiere lamp.

In addition to the campaign booth, which focused on daily habits occupants could adopt to save energy at work, the following organizations also had booths at the fair:

- Wisconsin Energy Conservation Corporation, which runs the residential portion of the state Public Benefits program (Focus on Energy), displayed materials about their programs.
- Madison Gas and Electric, the local utility, displayed residential energy savings information and staffed a popular booth covering opportunities to save energy at home. A variety of compact fluorescent bulbs were displayed on a light bar. Attendees could turn the bulbs on and off, watching the wattmeter reflect the change in energy consumption.
- Madison Ride Share program promoted commuting via carpools, vanpools, mass transit, bicycling, or walking.
- Sustain Dane, a grassroots county environmental organization, promoted sustainable living in the Madison area.

Results of the Launch and Survey

Employees were enthusiastic about the campaign. There was outstanding attendance at the event, as measured by the number of brochures given away. At FPL, 147 employees (over 50% of staff) attended the launch event and 123 employees filled out surveys. At VAM, 234 employees (about 30%) attended the launch event and 204 filled out the survey. The all-day format of the event probably inhibited attendance by the second- and third-shift VAM workers. Project implementers did not measure self-selection. On the survey, employees also submitted numerous energy saving ideas of their own. The results of the operational audits and the self-reporting surveys are shown in Table 1 below.

Table 1. Results of Audits and Self Reporting Surveys

Percentage of Employees That:	VAH Audit	VAH Survey Self Reporting	FPL Audit	FPL Survey Self Reporting
Computers and Monitors				
Shut off computer at night	20%	34%	83%	80%
Shut off computer monitors when you leave the office for extended periods of time during the day		20%		13%
Activate monitor power management	2%	22%	22%	45%
Think screensavers save energy		30%		23%
Think turning off your computer shortens computer life		10%		8%
Think turning off your monitor shortens monitor life		8%		12%
Think turning off computers and monitors leads to power surges that use more energy		15%		12%
Lights				
Shut off lights when you leave the office for extended periods of time during the day	47%	41%	22%	35%
Shut off lights when leaving meeting rooms		43%		63%
Think shutting off lights leads to more energy use due to power surges		13%		3%
Set back their office thermostats at night	0%		0%	
Leave fume hood on 24 hours a day			89%	

Some differences in behavior and knowledge were apparent between VAM and FPL. Shutting computers off at night was standard practice at FPL but limited at VAM, partly due to its 24-hour operations. FPL staff tended to understand power surges better and turn off their lights when leaving meeting room more often.

The high percentage of employees who reported activating monitor power management suggests that employees do not understand what monitor power management is. Project implementers discovered that 98 percent of VAM computers were not capable of monitor power management because they use Windows NT 4.0. Even EPA's Monitor Power Management software tools cannot overcome this feature of Windows NT 4.0. In spite of this, 22 percent of VAM survey respondents indicated that they had enabled monitor power management. While more FPL staff had machines capable of using monitor power management, FPL employees also reported more use of monitor power management than was found in audits. One source of confusion was a software conflict at FPL that required power management to be re-set after each boot-up in order to stay activated.

Ongoing Activities

After the launch event, the campaign continued outreach to the employees. Subsequently, various barriers stymied outreach efforts for three months. Implementers overcame these barriers and launched a monthly energy newsletter for employees (paper at FPL, electronic supplemented with paper at VAM). Also, a weekly energy tip was e-mailed to employees. Posters and displays with facility-specific energy information were also installed. Information provided included survey results and profiles of energy champions in

each facility. Initial efforts to launch a "one up, two down" campaign for elevator use was abandoned after further checking established that energy savings would be negligible.

An ongoing activity is daytime audits. Initially conceived as an evaluation activity, these audits were instead recast as "walk around" education. Both FPL and VAM staff were trained to conduct lunch-time operational audits, to see if lights and monitors were left on over lunch. However, there were problems gathering complete and statistically valid data. Furthermore, management expressed reluctance to allow outsiders intrude in employee workspace during office hours, and concern about the appearance of excessive surveillance of employee behavior. On the other hand, facility staff was too overworked to handle the audits themselves. A solution was to pair an implementer with facility staff as auditors, to reward good behavior with "thank you" messages and trinkets (calculators and penlights). Auditors also make an effort to talk with neighboring coworkers during their rounds, to answer energy questions, and to generally create a presence and energy awareness "buzz." This approach may reach employees who do not attend any of the events.

A challenge implementers continue to face is the issue of reducing energy use by computers. Surprisingly, implementers encountered major barriers to using the EPA Monitor Power Management tools and recommendations. Software and operating system incompatibilities were described above. In particular, EPA's Monitor Power Management tools are not applicable to computers running Windows NT. As an alternative, implementers encouraged computer users to turn the monitor off manually when going to lunch or meetings. Additionally, a hardware alternative (Monitor Miser) will be piloted. Even in cases where computer operating systems do not thwart monitor power management, implementers have encountered facility manager and IT manager reluctance or lack of motivation to offer the EPA's EZSave and EZWizard software to employees. EZWizard would be particularly useful at the FPL, since it can be implemented as part of the boot-up script, to get around the existing software conflict that requires re-activation every day. Implementers have also stressed the value of turning computers off at night. Several VAM employees believed that this practice would not allow them to access their network after re-booting. This problem appears to be a myth, or simply uncommon. Implementers are investigating, and plan to further emphasize computer use "best practices" in each facility once they resolve some of these problems.

The project had a notable success during Earth Week. Two local retailers were brought in to hold a one-day lunchtime sale of compact fluorescent light bulbs (CFLs) in each facility. A small display demonstrated how CFLs and incandescents made an electric meter spin at different speeds. The sales proved much more popular than expected. FPL employees bought 800 bulbs, half of them as "rain checks" (pay now, deliver later) because the retailer ran out of stock. VAM employees, patients, and building users bought 1800 bulbs over the lunch period. Although promotional prices offered (about \$2 per bulb after instant rebate) were the same as periodic in-store promotions in the area, the high volume of sales achieved in a short period surprised the retailers. Unlike in-store promotions, advertising for these sales was low cost, consisting of e-mails to the employees and posters around the facility. The VAM facility manager announced the sale in key management meetings, an example of the management support the sales enjoyed. Possibly holding the sale at work, with the implicit blessing of management, drew attention and credibility to the sale. Focusing on one product may also have allowed employee/consumers to consider the product more

fully than when shopping in a hardware store. The unintentional understaffing of the sales resulted in long lines that did inhibit sales. On the other hand, the crowds attracted passersby and provided an opportunity for employees waiting in line to discuss their experience with CFLs with their coworkers.

Rebate information will allow implementers to determine how many individual purchasers participated in each sale. Furthermore, similar sales planned in the region in other federal, local government, and private workplaces, will likely provide insight into whether the success of this sale was evidence that FPL and VAM employees were responding to this energy awareness project in their facilities, or whether the sale works just as well with an unprepared employee base. These sales indicated that workplace events can be effective ways to promote residential energy efficiency. Furthermore, implementers speculate that involving employees directly in saving energy, even at home, will produce new energy awareness and behavior at work.

Implementers are transferring the project's successful activities such as the CFL sale to other facilities, particularly government facilities, as a direct result of the state energy office's experience with this project.

Targeted Training

In the future, the campaign will provide targeted training. A lunchtime seminar for all interested employees is scheduled to cover optimal lighting strategies. Topics will include direct vs. indirect light, glare, color temperature and visual acuity, daylighting and thermal gain, task lighting, optimal use of dual switching, and placement of fluorescent recessed fixtures. Maintenance and operations staff believed that this training will help their staff and employees at large identify savings opportunities, and initiate or accept energy-saving lighting changes in their work environment.

Other training sessions will focus on specific groups of employees with a potentially disproportionate effect on energy savings. It was determined that changes in fume hood use would not now reduce energy consumption, so a fume hood workshop has been postponed until a planned equipment upgrade takes place. Other training workshops for operations and maintenance staff, housekeeping employees, and laundry workers are being considered.

Hardware Pilots

Although the main focus of this campaign is educational, campaign promoters decided that selected hardware upgrades would complement the education already being offered. Initial operational audits indicated promising opportunities to boost energy savings with hardware while retaining the behavioral focus of the project. Adding hardware will also address a problem perceived during the audits. Contrary to the slogan, many building users did not "have the power" to control energy-using equipment. For example, many workstations lacked task lights as alternative to overhead lights. Project implementers decided that only hardware with a high degree of human interaction would be considered. Currently, such energy conservation opportunities are frequently overlooked because the savings associated with them are uncertain. Establishing the savings potential of these hardware items fit in well with the other efforts already underway with this project. Project

implementers decided to install some hardware on a pilot basis, in order to study user satisfaction and establish energy savings. These hardware pilots also fit well with the campaign's focus on low-cost energy saving measures. As a complement to these pilots, campaign promoters will work with facility staff to specify ENERGY STAR products for purchase whenever possible in the future.

The first pilot includes twenty Berkeley lamps installed in VAM offices.¹ Metering will verify the energy savings achieved by providing this additional task lighting option to employees. Another pilot consisted of equipping FPL soda machines with Vending Miser, a device to reduce energy use in response to occupancy. Metering showed a 33% reduction in energy use from the 3300 kWh/year baseline. Demonstrations of these other small hardware options are being considered: (1) occupancy sensors in common areas, and (2) occupancy-controlled power strips for task lights, computer monitors, fans, etc. These devices are warranted where education proves difficult, or to provide certainty where savings potential is high.

Technical Assistance and Facilitation

The campaign has provided engineering technical assistance and facilitation assistance to operations and maintenance staff. In these roles, project implementers were able to respond directly to the requests of the facility managers themselves for assistance. Project implementers believe that this will expedite energy upgrades in the facility over the two to five year time frame. Technical assistance is primarily focused on establishing better estimates for savings available from changing out certain pieces of equipment. More certain estimates are invaluable for "selling" hardware upgrades to internal management in most organizations. Implementers assisted facility staff to identify potential for energy savings from motor replacement. For example, a motor on a 40 horsepower air handler was determined to be running at only 25% load. These findings will influence future motor replacement decisions at the FPL. Project implementers also identified outside technical assistance resources to study the energy performance of a UV coil-cleaning device for air handlers at the VAM. This study will document the maintenance and energy changes resulting from this device. With this information, the hospital intends to decide whether to install more such devices. Project implementers have also identified resources to assist with a study of the single-pass city water-cooling system at the FPL. This study will estimate the benefits of retrofitting, in terms of energy and water savings.

The FPL had preliminary plans to upgrade fume hood equipment for safety reasons. Given further information on energy saving opportunities that came to light during this project, the FPL is considering expanding this retrofit into a more comprehensive project, which would require financing. Additional measures include lighting, VSD's, and controls. The VAM also has an interest in pursuing a multi-measure equipment retrofit. Implementers are assisting both facilities to identify possible financing sources. Implementers have approached the local utility to inquire into the possibility of doing a utility energy service contract. While the VAM had discussed this with the local utility in the past, progress faltered when press reports surfaced that the VAM might close. The threat of closure was

¹ See <http://eetd.lbl.gov/BTP/LSR/projects/table/table.html>.

ended several months ago. Implementers played a role in re-starting negotiations with the utility.

Performance Measures and Persistence

It was quickly established that determining energy savings by comparing "before" and "after" utility bills was not practical. Implementers will compare two years of baseline utility data with utility data gathered during the project. However, implementers do not expect to see energy use reductions clearly on the utility bill. One reason is that a single meter serves most of each facility. Furthermore, targeted behaviors identified at the beginning of the project are estimated to save less than ten percent of the total energy use in each facility. Instead, the plan is to estimate energy savings through equipment spot measurement and post-project operational audits. Post surveys will measure the change in energy awareness and self-reported change in behavior.

Several changes sought in this project are expected to persist after the project ends. For example, if monitor power management is implemented on a wide scale at the FPL, it will persist because users will not have to take any further action to keep it implemented. The lighting seminar will increase understanding of FPL's dual switching, which may impact persistence. However, many other behavior changes, such as thermostat and task lighting habits, will still have to be reinforced in the future to retain the savings. Establishment of a thermostat policy in this project will make future reinforcement easier, because there will be a new explicit standard for employee energy "best practices." Technical assistance to maintenance staff will have more persistence, because it will lead to major hardware upgrades, such as motor replacement. The low turnover of employees at these facilities will also improve persistence.

Conclusions and Lessons Learned

- **Identifying suitable buildings for participation was time consuming and challenging.** Several federal building managers who were approached did not want to endure the hassle of a project like this, even though services offered were free. In a few cases, buildings offered little potential to save by changing occupants' habits. For example, at one military facility, employees demonstrated exceptional behavior already. Another had few computers, and thus could not save energy by changing employees' interaction with them. Choosing facilities that were nearby optimized use of resources, because it allowed for frequent contact between the project implementer and the building manager. Several facilities approached were too small. Choosing larger facilities allowed outside implementers to capitalize on the initial investment of developing a relationship with the facility manager.
- **The building managers' time and enthusiasm were very important contributors to project success.** Conversely, the biggest barrier to success was the building managers' limited time and attention. Short staffing often did not allow even enthusiastic building managers to prioritize this project sufficiently to implement many of the activities planned.

- **Obtaining stakeholder input was important.** Without this, implementers would have offended employees with inappropriate approaches, particularly during the project introduction.
- **Employees' showed a relatively high level of interest in saving energy.** This indicates fertile ground for educational campaigns such as this one. Adding small hardware options such as task lights gave meaning to the slogan "You Have the Power" and did stimulate new energy saving actions on the part of employees.
- **Project implementers need to plan in advance to measure self-selection bias and spillover with home behavior.** For example, participants in the various events might have different attitudes than non-participants. If this had been measured initially, it would clarify whether the project was equally effective for employees with different initial energy-related attitudes. Also, measurement could have established whether there was spillover between home and work energy behavior, and in which direction(s).
- **Through a work place project, it may be easier to influence employees' energy use at home rather than at work.** The surprisingly high participation in the lunch time CFL sale showed that employees will respond to opportunities employers offer to take energy-saving actions for home.
- **A paper newsletter was needed to supplement electronic communication.** The program planned to feed-in to existing communication channels, such as internal e-mail newsletters and intranet sites. This was slowed by difficulties getting the time and attention of gatekeepers who control official communications. Starting a customized newsletter covering energy issues for the facility was an alternative to keep the energy saving message in front of employees. Electronic media were overrated, because in practice getting access to e-mail and intranet sites was difficult for outsiders like project implementers. Also, VAM welcomed paper supplements to their e-newsletter, since a substantial share of their employees had an inferior e-mail system that would not display the color graphic e-newsletter. It is likely that access to electronic media was not uniform among all employees in both work places.
- **Synergies arose from combining education with energy management assistance.** An ongoing presence is allowing implementers to identify new opportunities, to correct problems with previous solutions, and to pursue repeated and varying approaches to tough problems. Problems and solutions that would have been missed in an audit became clear through this process.
- **This type of educational campaign may be an effective energy saving approach over a timeframe of several years.** While creating immediate savings by altering workers' daily energy use habits has been difficult, this project will likely produce significant energy savings in the next few years. For example, repeated efforts have been required to understand and address barriers to using monitor power management. Targeted hardware was determined to be the answer in some cases, and education in other cases. Similarly, efforts to alter purchasing plans for small equipment (for example, lamps and patient TVs in the hospital) shows great promise for saving over subsequent years. Technical assistance and facilitation will produce the most savings by expediting large hardware changeouts, though this will not happen in the first year. Time spent promoting energy awareness in the facilities was

important to truly understand the interaction of staff with energy using equipment, and to identify the best savings approaches.

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