Energy Efficiency/Pollution Prevention Intern Programs Provide Low-Cost Alternatives for Implementing Energy Efficiency Projects

David A. Carter, Kansas State University Pollution Prevention Institute

ABSTRACT

Time and money are two obstacles that often prevent companies from implementing energy efficiency projects. To mitigate these concerns, the Kansas State University (K-State) Pollution Prevention Institute (PPI) began an intern program that places engineering students at commercial facilities, to conduct focused research on well-defined energy efficiency projects for 10 weeks. Throughout the three-year history of the program, interns have identified potential savings of more than 217.5 million gallons of water; 6,776 tons of waste; 6.8 million kWh of electricity; and approximately $4 million in operating or disposal costs.

Grants pay a portion of the interns' salaries, making the program even more cost-effective for participating companies. PPI staff provide energy efficiency training, technical resources, oversight, and project review to ensure the interns' data provide a solid foundation for project recommendations. PPI also provides light meters, data loggers, and an ultrasonic leak detector so the participating company doesn't have to purchase its own equipment for research.

Success of this program is evident from energy and cost savings, as well as the number of companies that return for additional interns. In the second year, two companies returned to the program. Five of seven companies were repeat participants in the third year, and three of six companies are repeating participants for the 2009 program. Three companies have applied for interns in three of the four years the program has been offered. One three-year participant has identified annual savings of approximately one million kWh of electricity and two million gallons of water.

Introduction

In lean economic times, companies often become more fiscally conservative, especially small- to medium-sized companies without large cash reserves. They tend to reduce investing in high-capital projects and look for simpler projects with shorter payback periods. Even in good times, smaller companies typically implement fewer pollution prevention projects than larger companies. A study conducted for the Iowa Department of Natural Resources (DNR) indicates the majority of the businesses that made no changes had less than 50 employees; and the smaller the business, the less likely it was to have made pollution prevention changes (Hill 2000, 11). It is no different for energy efficiency projects, despite long-term cost savings associated with reduced fuel, electricity, and water consumption. In spite of the reluctance of companies to invest in energy efficiency, we in the energy field can drive companies in this direction by helping them leverage additional resources.

As any energy manager can tell you, many obstacles prevent implementation of energy efficiency projects. In the Iowa DNR study, "cost in terms of staff time needed to research availability and performance of innovative technologies" was one of the perceived economic barriers to implementing pollution prevention technologies and projects (Hill 2000, 13). Researching projects and obtaining appropriate data require vast amounts of time, and there are

often distractions – phone calls, reports, meetings – to pull the energy manager's attention away from potential energy-savings opportunities. If the energy manager is conducting the research in house, there are generally three options: the energy manager can do the research himself, he can utilize his staff (if he has any), or he can utilize staff from another department. If either of the first two options is used, existing work tasks have to be readjusted to allow time for the research, or the research is simply added on as an additional task. The same would apply in the case of utilizing staff from another department, except, in this case, the employee may not be familiar with the parameters required for the research, resulting in more oversight of the employee to ensure the appropriate data are obtained.

Funding is a factor when the energy manager has to hire outside consultants to research the project and make recommendations for energy efficiency. Obviously, consulting fees add to the overall cost of a project. Moreover, consultants are frequently used for specific projects, rather than helping a business determine a number of potentially available projects. Also, in many cases, the company would be paying the consultant to conduct fairly mundane tasks, such as counting light fixtures or taking flow measurements.

To help businesses leverage additional resources for implementing energy efficiency and other pollution prevention projects, the Kansas State University (K-State) Pollution Prevention Institute (PPI) began an intern program that places engineering students at commercial facilities to conduct focused research on well-defined energy efficiency projects for 10 weeks. With this program, there is no need for a company to hire a full-time employee or contractor to research the project. The intern works on the project without the distractions commonly encountered by company employees. Also, the intern's salary is considerably less than that of a consultant or professional engineer. Since the intern's salary is partially funded through a grant program, the financial investment is even less of a burden for the company. With the intern conducting all of the research on the project, on-site engineers and environmental managers can spend their valuable time conducting normal operations. In addition to obtaining the data required to determine if a project is technically feasible, the intern also calculates the simple payback period and return on investment, allowing companies to implement easier projects first, while putting higher capital projects on a budget to implement in a more robust economic period. Finally, the intern will also notify the company of any grants available for implementing energy efficiency projects and will assist in completing applications for these grants as well as environmental awards that may be appropriate after implementation of the projects.

Kansas State University Energy Efficiency/Pollution Prevention Intern Program

K-State PPI began its intern program in 2006 with a pollution prevention grant from the U.S. Environmental Protection Agency. During the first year, funding was available for only four interns. In subsequent years, K-State PPI increased the company's share of the interns' salaries so the program could accommodate more interns. The value of the program is evidenced by the number of repeat companies participating, despite the increase in the company's cost share. In the second year, two companies returned to the program. Five of seven companies were repeat participants in the third year, and three of six companies returned in the fourth year. Three companies have applied for interns in three of the four years. The evolution of the program is depicted graphically in Table 1.

Table 1. Evolution of the K-State PPI Intern Program

	2006	2007	2008	2009
Number of Interns	4	7	7	6
Colleges Involved	KSU	KSU, ESU	KSU, KU, SWC	KSU, KU
Intern Pay	$13	$14	$14	$16
Company Match	$3	$7	$10	$12
Number of Repeat Companies	N/A	2	5	3

Although the company share of the interns' salaries has increased each year, K-State PPI continues to provide a significant portion of the costs associated with the program. K-State PPI conducts all recruiting activities for both intern and business applicants, reviews applications and selects intern applicants for interviews, conducts interviews, selects interns and negotiates positions, and completes required paperwork for the interns to become K-State employees. Prior to hosting the interns at their respective companies, PPI staff members provide week-long training on energy efficiency and pollution prevention topics, including an overview of relevant regulations; HVAC, motors, lighting, and boiler systems; water conservation; engineering economics; and solid and hazardous waste. Obviously, the training is tailored to provide fundamental knowledge in topics pertaining to the interns' projects. In addition to technical subjects, interns receive training in other areas such as technical writing and effective interviewing techniques. During the internships, PPI staff members assist interns with technical questions and direct them toward appropriate research areas. When the interns have completed a draft report of their project calculations and recommendations, PPI staff members, as well as K-State and other university engineers, review their reports for technical accuracy and completeness. K-State PPI also hosts an on-campus session where the interns present their projects and findings to representatives of the EPA, Kansas Department of Health and Environment, K-State College of Engineering, and their host companies.

To further reduce costs for participating companies, K-State PPI has invested in equipment the interns can use while researching their projects. PPI has an Ultraprobe 9000 ultrasonic leak detector; a four-in-one combination air flow meter (anemometer, hygrometer, light meter, and thermometer); a conductivity meter; an infrared, non-contact thermometer; a data-logging light meter; and a watt meter. Interns use this equipment at no charge to the participating company, so the company receives credible energy data without having to rent or lease their own equipment. Three PPI interns have used the ultrasonic leak detector for compressed air audits at their host companies. To purchase this detector on its own, a company would have to invest approximately $3,500.

Environmental Results

Results ultimately prove the success of the program. In the first three years of the program, participating companies have implemented 48 of the 73 recommendations made through the program, for an implementation rate of 66%. An additional seven projects are currently in the implementation process, which will bring the total implementation rate to 75%. These implemented projects have resulted in savings of 6.8 million kWh of electricity, 217.5 million gallons of water, 6,776 tons of waste, and almost $4 million in operating or disposal costs. Over the three-year period of its participation in the program, one company alone has realized annual savings of approximately one million kWh of electricity and two million gallons

of water. All of these reductions were attained through a combined company investment of approximately $63,000 (excluding capital costs required to implement projects). These figures include only the direct savings. A study published by the Nebraska Partners in Pollution Prevention (P3) Program reports that clients in the study realized indirect savings of similar magnitude to their direct savings, regardless of the scale or type of assistance (Youngblood, Dvorak & Hawkey 2007). As indicated above, these indirect savings included time saved from the research or technical assistance provided by the interns. Total savings identified through the three-year history of the program are shown in Table 2.

Table 2. Environmental Results of the K-State PPI Energy Efficiency/Pollution Prevention Intern Program

Pollution Prevention Impacts	2006	2007	2008	Total
Water Conservation	N/A	30.4 million gallons	187.1 million gallons	217.5 million gallons
Waste Reduction	1,025 tons	5,344 tons	407 tons	6,776 tons
Energy Conservation	2,129,524 kWh	1,603,000 kWh	3,076,600 kWh	6,809,124 kWh
Operating/Disposal Savings	$0.38-0.46 million	$1.2 million	$2.3 million	$3.88-3.96 million

As mentioned previously, during lean economic times, companies can be reluctant to initiate energy efficiency projects requiring large capital investments. Fortunately, as the following examples show, many energy efficiency projects do not require large investments. In fact, some projects are relatively simple and are revealed because the interns look at a facility's processes with fresh eyes.

Example 1. In the second year of the intern program, Company A, a brake-manufacturing company, requested an intern to help with water conservation, specifically for an on-site wastewater treatment process. Company A's chemical finishing department, which included a resin impregnation and chrome finishing line, used more than 1,793,405 gallons of water per year. Several options for water-usage reduction had been researched, including different options for treatment and reuse (ion exchange, reverse osmosis, and evaporation) and conductivity controls for source reduction. Although their project specified water conservation during the on-site wastewater process, our intern noticed a more significant water-savings opportunity.

The chrome finishing line was not presented as part of the intern's project. However, during the intern's orientation, she noticed the chrome rinse tank was supplied with a continuous supply of clean water. Company A did this in order to ensure the conductivity in the rinse tank did not rise to the point where it degraded the quality of the products. On her own initiative , with no input from the company, the intern recommended installing a conductivity meter with a sensitive setpoint to ensure adequate water quality. At a cost of less than $700, excluding installation, the intern's suggestion enabled Company A to save 600,000 gallons of water per year at a total cost savings (including procurement, treatment, and disposal) of approximately $14,600 per year.

At the time, Company A's investment in the intern program was only approximately $3,300. The example cited above was only one of three projects conducted by the intern for the summer. Total savings identified for the intern's projects included 1.8 million gallons of water, 24,500 kWh (for a relamping project), and approximately $45,800 in annual savings. As a result of the intern program, Company A has reduced their water consumption from 300 units (one unit equals 478 gallons) per month to only 130 units per month, and they are on the city's lowest tier for water consumption (Willis 2009). Due to its reduced water consumption, Company A was able to apply for an EPA Water Efficiency Award.

Example 2. In the third year of our program, one of our companies had been reluctant to participate again because it had participated previously and did not think there were any additional savings to be found. On the first day of the intern's orientation, the company's environmental manager was showing her an electric air dryer used to dry parts before further processing. After he finished explaining the process to her, she asked why the dryer was running when there were no parts inside it to dry. Since he did not know, she researched the process and found the line workers turned the dryer on first thing in the morning and turned it off 10 hours later when it was time to leave. The intern suggested putting the dryer on a timer and reduced the "drying" time from 10 hours each day to only one hour each day. At a cost of less than $50 (the cost of the switch and a short length of electrical conduit), the intern's suggestion saved more than 60,000 kWh per year, for an annual savings of $5,000.

Company B's investment in the intern program was approximately $4,800, so on the first day alone, the intern had already returned the company's investment in the program. Furthermore, as in Example 1, the intern worked on multiple projects during the summer. Total savings for her five projects included 444,000 gallons of water; 342,715 kWh of electricity (for a relamping project, heater insulation, and the hot-air dryer); and approximately $29,224 in annual savings.

Example 3. Company C joined our program in its second year. This food manufacturing company wanted an intern to assist them in meeting corporate water-reduction goals. Through its utility bills, the company knew how much water was entering the plant, and it knew how much water was leaving the plant. What it didn't know was how much water was being used in each of its processing lines in between. Our intern conducted flow measurements at every nozzle on every flow line and discovered the company was using too much water for most of its food manufacturing processes. He recommended purchasing and installing flow-restriction orifices. In the process, he saved the company more than 22,820,000 million gallons of water, resulting in an annual savings of $114,784. Company C's investment in the intern program was only approximately $3,300. Conversation with the company engineer reveals the company paid less than $500 for 20-30 of the flow-restriction orifices (Robinson 2009).

Other Intern Programs

The K-State PPI Intern Program is not the only game in town – it is only one of many such programs offered throughout the United States. In the Midwest alone, there are intern programs in each of the four states in EPA Region 7 (Iowa, Kansas, Nebraska, and Missouri). Although these programs are similar, differences exist in many aspects of the programs, including the company's cost share. In Iowa, for example, first-time companies are not required to pay any portion of the intern's salary; returning companies are required to pay $4,000 (DNR 2009). Companies participating in the Nebraska P3 program pay $3,300 for a full-time intern

(UNL 2009), and companies participating in the Missouri intern program pay 100% of the intern's minimum $6,600 salary (MOEAC 2009). The Minnesota Technical Assistance Program student intern program requires companies to pay a cost share of $2,500 (MnTAP 2009). The New Hampshire Pollution Prevention Partnership also coordinates an internship program, at a company cost of $6,000 (NHP2P 2009). The New York State Department of Environmental Conservation began an internship program in 2008 and requests a voluntary company contribution of $1,200 (Cruden 2009).

Regardless of the cost share, all of these intern programs produce similar benefits and result in sometimes extraordinary energy savings. The Iowa intern program reports environmental and cost savings of one billion gallons of water; 108,947 tons of solid waste; 942,332 tons of special waste; more than 221.5 million kWh and 2.29 million therms of electricity; and more than $54 million in operating and disposal costs (DNR 2009). The Nebraska intern program indicates environmental and cost savings of more than 10,100 tons of solid waste; 431 tons of hazardous waste; 5,794,000 kWh of electricity; 11.8 million gallons of water; and $978,142 in operating and disposal costs (UNL 2009). In its first year, the Missouri intern program reports environmental and cost savings of 84 tons of waste; 14,100 MMBTU of natural gas; 797,000 kWh of electricity; and $260,000 in operating and disposal costs (MOEAC 2009). Since 2003, the Minnesota intern program has identified environmental and cost savings of 43,138,845 kWh of electricity; 4,985,489 therms; and $4,309,236 in operating costs (Larson 2009). Finally, also in its first year, the New York intern program reports environmental savings of 22 million gallons of water and annual cost savings of one million dollars for one company alone (Cruden 2009).

Conclusion

It is certainly understandable for companies to be even more fiscally responsible in troubled times. This increased fiscal responsibility, however, should not lead companies to overlook plausible energy-saving opportunities within their facilities. Additional resources are available that allow companies to achieve significant energy reductions without necessarily outlaying large sums of capital. With their proven track record and cost-sharing opportunities, intern programs provide a low-cost alternative to implementing energy efficiency projects. The interns focus only on their assigned projects, leaving on-site environmental managers free to deal with the myriad other task that consume their time. Any company interested in leveraging available funding resources for implementation of energy efficiency projects that reduce operating costs should contact its small business assistance program, state regulatory agency, or EPA regional office to determine availability of pollution prevention intern programs within a particular geographical location.

Acknowledgements

The K-State PPI would like to thank U.S. EPA Region 7 for its continued support of the K-State PPI Energy Efficiency/Pollution Prevention Program. PPI would also like to thank all intern program coordinators in Iowa, Missouri, and Nebraska for their technical support and guidance. The K-State program has benefited greatly from your advice. PPI also thanks the host companies for their desire to become more energy efficient and for sponsoring interns to help them become so. PPI is grateful for the incredible interns we have hired. Through their

intelligence, creativity, hard work, and diligent research, they have helped create a program whose results are worth relaying to others for replication. Finally, PPI would like to thank the K-State Engineering Extension staff, and especially Joyce McDiffett, for consistent efforts to make the intern program run smoothly for both the interns and the program specialists.

References

Cruden, Erica (New York State Department of Environmental Conservation). 2009. Personal Communication. March 18.

[DNR] Iowa Department of Natural Resources (DNR) Waste Management. 2009. Pollution Prevention Intern Program. http://www.iowadnr.gov/waste/p2/intern.html.

Hill Simonton Bell, L.C., and the Iowa Department of Natural Resources. 2000. Regulated Community's Perceptions on Pollution Prevention. http://www.p2pays.org/reg/15/14840.pdf.

Larson, Krysta (Minnesota Technical Assistance Program). 2009. Personal communication. March 18.

[MnTAP] Minnesota Technical Assistance Program, University of Minnesota. 2009. Student Intern Program. http://www.mntap.umn.edu/intern/index.htm.

[MOEAC] Missouri Environmental Assistance Center (MOEAC). 2009. "News: Summer Intern Program Helps Firms Cut Costs by Reducing Environmental Impact." http://www.missouribusiness.net.eac/news/internships_summer09.asp.

[UNL] University of Nebraska-Lincoln (UNL). 2009. Partners in Pollution Prevention. http://www.p3.unl.edu/.

[NHP2P] New Hampshire Pollution Prevention Partnership (NHP2P), University of New Hampshire. 2009. P2 Internship Program. http://www.unh.edu/p2/nhppp/p2intprgm.html.

Robinson, Jim (Company C). 2009. Personal communication. March 18.

Willis, Dan (Company A). 2009. Personal communication. March 17.

Youngblood, Doug J., Dvorak, Bruce I., and Hawkey, Stacey A. 2007. "Indirect Benefits of P2 Technical Assistance Estimated Using Fuzzy Set Theory." Journal of Cleaner Production 16 (2008): 771-779.