COOL IT DOWN

Russ College Students Help Ohio University Cut Costs

During the dog days of summer, when temperatures, humidity, and sometimes tensions soar, Ohio University faculty, staff, and students crave air conditioning like many of us. But with rising energy costs, cranking up this costly commodity adds to the University's ever-increasing energy bills—the electric portion of which is estimated at more than $5.6 million for this fiscal year.

Recently, however, Russ College students helped the University save at least $30,000 a year.

As part of his capstone senior design project, advised by Professor of Electrical Engineering Brian Manhire; Chris Pierce, B.S.E.E. '05; along with fellow students Brian Mollenshot, B.S.E.E. '05; Kyle Robenstine, B.S.E.E. '05; and Aaron Swope, B.S.E.E. '05, analyzed how the University uses power and ways in which it can conserve energy—to ultimately save money on energy costs.

Like other large consumers of electric energy, Ohio University's electric bill depends on its power factor. This, roughly speaking, reflects how efficiently electric power is utilized. Under some relatively low power-factor circumstances, electric energy can be consumed more economically if the power factor is raised to a higher value.

"It's a classic cost-benefit problem in electric power engineering," Manhire said.

After surveying the University's power meters, the team determined how much money the University could save by raising its power factor. "Facilities Management does as much as they can to get people to use less power," Pierce said. "But in the end, you can't force people to change the way they use power."

The team's work led to the purchase of a new electrical capacitor for the University physical plant's "OU-1" substation, which provides electric power to half of the Athens campus.

The team collaborated with David Mace, an electrical project engineer with Facilities Management, who served as the project manager. Mace was thrilled when he learned of the team's project. After all, he'd been asking the University to fund a project like this for the past five years. "It was the perfect opportunity," he said.

Before the students and Manhire began exploring the idea of the project, they didn't know Dave and so were unaware of his interest in correcting Ohio University's power factor. "Once we began working with him and found out we had mutual interests," Manhire said, "I think this really motivated the students to become even more energetic—pun intended—about the project."

That collective energy produced electrifying results. The new capacitor bank corrected the power factor. The power factor affects KVA (kilo volt-amps), and Ohio University is billed on its peak KVA demand. When the capacitor bank's switch was flipped on March 28, 2006, the meter reading on which the University is billed instantly decreased by 370 KVA. This enabled the University to maintain a lower peak demand in June 2006 than in June 2005. What does all that mean? Because of increasing energy costs, the new capacitor will save the University at least an estimated $29,217 this year—meaning the project will pay for itself in 18 months.

"It's hard to grasp what the total savings will be, because it's compounded savings," Mace said. "The savings will continue to be recognized forever."

In addition, by using in-house university shop support, including electricians, masons, equipment operators, plumbers, welders and metal workers, the 1,340 KVA, 12,470 volt, three-phase capacitor came in under budget by more than $2,500.

The project was also designed with room for expansion to meet future needs of the University's growth. The capacitor's cabinet has room for another capacitor. This would contribute to future savings because of a reduced need for construction and labor.

Real World, Real Results

The four students are now graduates and have benefited professionally from their experience with the senior capstone course. Pierce now works in the power industry at a transmission and distribution design company in St. Louis. He cites the capstone project as a big aid in landing his job. "It was good to have some experience with helping to spur Ohio University to install the capacitor bank and save some money," he said.

Angie Bukley, associate dean for research and graduate studies, who co-directs the course sequence, said she is often contacted by students who tell her they use their experiences from the course in their professional lives. "Experiences in this class are useful across the board," she said.

Bukley calls this project unique because it had an impact outside the classroom. "It was about something more than just a grade," she said. "It was something that actually showed a benefit to the community."

Manhire agrees: "The students clearly saw they were able to bring their studies to bear on a real technical problem that was important to the University's economic well being," he said. "We were all highly motivated to apply ourselves toward this end. The project had the potential to be more than an academic exercise, and in the end, to our great pleasure, the project's outcomes were beneficial to Ohio University."

The fact that Manhire recommended this specific project was no luck of the draw. "I knew the students would remember studying the concepts two years earlier—and that they would likely be interested in applying what they had learned at an elementary level in the classroom to a more sophisticated real-world situation," he said.

According to Pierce, the capacitor bank project also served as a model for future students in the electrical engineering senior design program, and he'd like to see more similar opportunities.

Capstone Course Timeline

The capstone senior design course is a yearlong effort to provide between 10 and 12 teams of students with realistic, applied engineering experiences.

QTR: Fall	Winter	Spring
Lectures and exercises culminate in a proposal and preliminary design, which outline students' first idea of what they are going to design and how they are going to design it.	Teams work with faculty to complete a final design for a critical design review.	Teams present final reports and, in cases such as the capacitor bank project, implement their project with their customers.

Luckily for him, the course directors have plenty of projects in mind. Bukley said some of her goals with the capstone course are to reach outside the college and to bring in more real-world experiences like this one. Other capstone projects have aided in various science investigations and in laboratory instruments for the College of Health and Human Services' physical therapy group. An upcoming project involves collaboration with the College of Fine Arts on a robotic sculpture and software application.

This sort of teamwork is also an important aspect of the course. "In the real world, it's not an individual thing." Bukley said. "Everybody works in teams now—mostly interdisciplinary teams."

Bukley also said students learn about systems engineering, which is not something they would typically learn in other classes. "Systems engineering is how we do things in the real world," she said. "Students learn about developing requirements, development specifications, project goals and schedules, how to do cost estimation, and other concepts that you really don't get in another class."

Waste Not Want Not

When Russ College students traveled to the annual Waste Management and Environmental Research Consortium's Environmental Design Contest at New Mexico State University in Las Cruces, NM, they learn about more than just engineering—they learn some of life's tough lessons.

The goal of the design contest is to answer real-world environmental problems by developing fully operational bench-scale solutions to be presented to judges who are also environmental professionals. Teams composed of students from all majors, but mainly from chemical, environmental, and civil engineering, are required to write a paper, give an oral presentation, present a poster, and demonstrate their solution. This past year's team designed an electrostatic precipitator that removes particulates from exhaust gases from stationary diesel generators.

But there is more to the contest than the design project, according to Dan Gulino, associate professor of chemical engineering and a faculty advisor to last year's team along with Darin Ridgway, associate professor and undergraduate chair of chemical engineering. "They gain an introduction to the realities of life," Gulino said.

The judges in the competition, Gulino explained, are not as lenient as professors tend to be. "In school, the professors, even when critiquing, always have the students' best interests at heart and are trying to help them learn," he said. "The judges out there don't necessarily care about you. If you go out there and say something wrong, they're not going to tell you that you did."

The lack of feedback lends itself to real-world experience. "When you don't get a job, you don't get an evaluation sheet back telling you things you did wrong in the interview," Gulino said.

Students are challenged to adjust. "It's frustrating," said senior chemical engineering major Jeff Gardner, who was part of this year's team. "But in the long run, it's helpful. The real world isn't necessarily a friendly place."

Gulino agrees. "If you're trying to sell a product and you go to visit a potential client and you do a bad job," he said. "They're going to say 'Don't call us, we'll call you.'"

Not that the contest is a grueling competition that gives students a complex. In fact, they gain other, less harsh, lessons that aid them in the real world. The colloquium hosts a job fair every year, and some students have received jobs and job offers. A few years ago, a group from Ohio University actually discussed their wastewater treatment plan with officials from a city in Colorado.

In the eight years Russ College students have been involved in the contest, they have brought home a total of $11,500. And although this year's team didn'tt bring home any awards, they did bring home something much more valuable—a sneak peek at the real world.