Texas A&M University

A detailed account of how one university is improving its energy efficiency and campus environment through effective management and performance contracting

TEXAS A&M UNIVERSITY

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One of the largest universities in the United States, Texas A&M University is well-known as the home of the Aggies, the first public institution of higher education in Texas, and one of the top American research institutions. While energy management and water conservation on campus might not be top of mind when people think of Texas A&M, the proactive approach taken by professionals in the institution's Utilities & Energy Management Department, referred to as UEM, is certainly noteworthy.

The university's main campus, located in College Station, has grown significantly in recent years and now serves 50,000 students, including 9,000 graduate students. During this growth, utilities and energy management professionals at Texas A&M have provided leadership and expertise to more efficiently use energy and water resources at the campus' 750 buildings which are spread over 5,200 acres. "It's not that we woke up one day and decided to get in the energy conservation business; we've been working on it for quite some time," says Les Williams, Associate Director for UEM. In line with the university's utilities and energy management goals, Texas A&M has recently initiated a two-phase performance contract with the Building Technologies Division of Siemens Industry, Inc. This new contract, which provides funding for building improvements that increase energy efficiency, is the latest stage in a long-term partnership between the two organizations.

Proactive Utilities and Energy Management

On-Campus Power Generation

Since 1893, Texas A&M has been generating a significant portion of its own electricity. Outside markets are used to supply the balance of what isn't produced on campus. "We're not just a net consumer of electricity, we're also a producer," says Williams. A $73.25 million combined heat and power (CHP) upgrade is currently underway and slated for completion by the end of 2011. The CHP project will:

- Replace older equipment with more efficient, reliable generation equipment
- Increase capacity to serve a growing campus
- Improve power generation efficiency an additional 20 percent
- Decrease greenhouse gas emissions associated with energy consumption by 30 percent

Building Automation

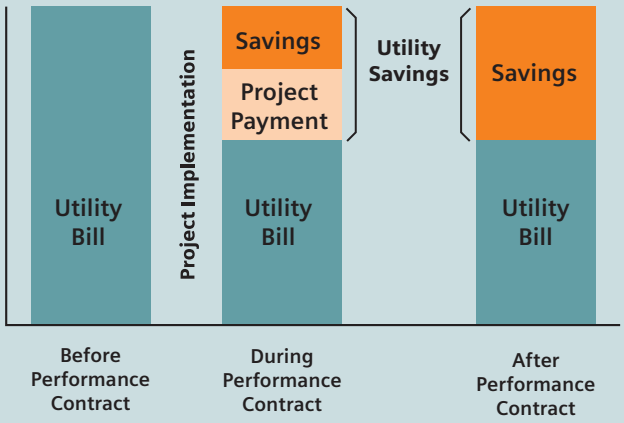
In order to manage such an expansive campus, UEM relies on an extensive building automation system (BAS) that includes energy management and controls capabilities. In fact, Texas A&M has one of the largest building automation systems in the world with nearly 200,000 monitoring and control points in over 200 buildings. The campus BAS monitors and controls close to 14 million gross square feet.

Performance Contracting Defined

Performance contracting is a means of financing a multi-faceted capital improvement project. An energy services company (ESCO) identifies facility improvement measures (FIMs) that will reduce water, sewage, electricity, steam, natural gas, etc. and guarantees the predicted savings. The ESCO provides single-source accountability, acting as project manager, executing the work and/or hiring local contractors.

The contractee gets a loan to pay for the improvements. The cost of the project is divided by the guaranteed annual savings to determine the length of the contract. Project payment is based on the guaranteed annual savings. Once the project is implemented, the savings resulting from increased efficiencies are used to make loan payments to the capital leasing company. If the actual savings are in excess of the guaranteed savings, the contractee keeps the amount above the guarantee. If they are lower, the ESCO must pay the contractee the difference. Beyond the term of the contract, the contractee receives the entire energy savings.

How Performance Contracting Works



Metering
The university started installing a new generation of revenue-quality meters in 2002 and by 2009 the goal of becoming a fully metered campus, for all buildings larger than 5,000 GSF, was realized. Today, Texas A&M operates 1,500 revenue-quality utility meters in over 500 buildings, allowing accurate billing and verification of energy efficiency improvements. The meters measure consumption of electricity, chilled water, heating hot water, domestic cold water, domestic hot water, and steam. "We have a large database of information allowing us to track the performance of buildings based upon a number of different baselines," says Williams. The meter data is used to:

- Troubleshoot problems in the buildings and measure energy efficiency
- Generate monthly customer statements to raise awareness among campus customers
- Demonstrate the results of conservation and efficiency improvement initiatives
- Produce accurate cost estimates for budgeting purposes
- Allow for accurate billing and cost recovery

Building Retro-commissioning
For more than a decade, UEM has managed an extensive building retro-commissioning program on campus in partnership with the Energy Systems Laboratory (ESL). The purpose of the program is to optimize mechanical and electrical system performance within campus buildings, especially the HVAC systems that control environment and consume significant energy. "At times we have up to four teams performing retro-commissioning with a goal of completing a million square feet annually," says Williams.

Engaging the Campus Community
By both raising awareness and reaching out to the campus community, the university takes its conservation efforts beyond ensuring efficient operation to also positively influence behavior. If students, faculty and staff want to know how much energy and water are consumed by campus facilities, they need look no further than the Texas A&M UEM website where there is a link to utility consumption profiles. If customers or stakeholders notice wasteful practices, a hotline is provided where issues can be reported.

In 2009, the university launched a grassroots energy stewardship initiative, called the Energy Stewardship Program (ESP), with a goal of reducing energy consumption in existing campus facilities by at least 15 percent. "We have individual energy stewards assigned to 40 buildings (or about 7 million square feet) who work with occupants to raise overall awareness and support for energy conservation and sustainability," explains Williams.

This overall strategy has paid off. Jim Riley is the director for UEM and since his arrival at Texas A&M in 2002, the UEM Team has led the effort to reduce total campus energy consumption by almost 25 percent. Over the same time the campus square footage increased by 18 percent. "Texas A&M has been very successful with our energy management program. While serving a growing campus, energy consumption has been reduced by 35 percent in eight years on a per square foot basis," explains Riley.

Since 2002, overall utility plant operating efficiency has improved by 40 percent and Texas A&M's energy efficiency initiatives have yielded $106 million in avoided costs. The result of ongoing water conservation efforts is equally impressive, with total campus water consumption reduced by 33 percent since 2000. "Our UEM Team is proud to be able to report these kinds of results as we continue to identify and implement new ways to improve service levels and efficiency," says Riley.

Partnering with Siemens

As the university began launching various utilities and energy management initiatives over time, it became important to partner with vendors that could supply both expertise and superior building systems and equipment. Texas A&M has repeatedly turned to Siemens.

The university began installing Siemens BAS in its buildings in 1983. Just five years later, in 1988, the university began standardizing on the Siemens APOGEE® Building Automation System for all campus buildings. "Texas A&M has a longstanding relationship with Siemens for the BAS and has sole-sourced with Siemens for the automation systems in all new buildings and all retrofits performed to precise direct digital control standards," says Riley. Over the past 25 years, the APOGEE system has grown in size to monitor and control close to 200 campus facilities.

In addition to the BAS, Texas A&M has standardized on Siemens fire monitoring system for the last 10 years. They also use Siemens security system to monitor and control access to the utility plants on campus. Riley states, "We have a lot of confidence in Siemens, and they have done a good overall job at Texas A&M. The 'guaranteed pricing' package that Siemens has offered, together with quality service, has made it attractive for Texas A&M to continue an ongoing partnership with a sole-source arrangement."

The Performance Contract

After performing commissioning and energy audits with support from ESL in 30 high profile buildings, UEM identified opportunities for system retrofits and operational improvements in a number of the campus facilities. These initiatives were identified to improve services and energy efficiency, resulting in significant energy savings. The question was how to fund them.

Through the American Recovery and Reinvestment Act (ARRA) of 2009, stimulus dollars were designated to the state for disbursement to state agencies with qualifying energy conservation projects through a performance contract. "The university applied for and was successfully granted two low-interest loans from the Texas State Energy Conservation Office (SECO)," says Riley. The low-interest loans are at two percent – the first for $10 million and the second loan for an additional $5.1 million.

The timing couldn't have been better. "Through our partnership with ESL and our ongoing retro-commissioning program, UEM had identified a list of things that needed to be completed and were looking for the capital to fund them. So, when this opportunity presented itself, it was a perfect fit," says Williams. The ARRA funding with a performance contract will allow the university to get all of the projects underway promptly and benefit sooner from the efficiency improvements.

Texas A&M issued its request for qualifications (RFQ) in January 2010 and began its search for an energy services company (ESCO) to complete the work under the required performance contract. From the submittals, three companies were interviewed and after thorough review, Siemens was chosen as Texas A&M's ESCO partner.

While it was an open competition for the contract, the university's positive experience and long history with both the professionals and products at Siemens were considered when it came time to make a decision.

"We looked at a number of opportunities with different vendors and felt that Siemens best met our requirements. We called around and talked to other folks, and concluded that people really liked the work that Siemens did. People really appreciated the follow-through and attention to detail, and that really resonated with us," says Williams.

With Siemens chosen, the assessment phase began. The company's engineers performed energy audits of their own and calculated exact consumption reduction amounts. A list of projects to be performed under the 10-year contract was firmed up and the guaranteed savings were finalized. "The simple payback has to be less than the 10-year loan repayment period so the savings from the energy projects will cover repayment of the debt service," explains Riley.

The total contract amount is $15.1 million, with $10 million of the work being performed as Phase I and the remainder completed under Phase II. "There are 24 buildings slated for upgrades or retrofits in these two upcoming performance contracts; 17 in Phase I and another seven in Phase II," says Riley.

In September, the projects were presented to the Texas A&M Board of Regents for final approval. Design began the following month with both Phases I and II slated for completion by December 2011. "All construction has to be completed before the end of 2011, which is a commitment that the university and Siemens have made to SECO as a condition of getting the loan," explains Riley. The projects will be fast-tracked to meet an aggressive 12-month construction schedule.

Reducing energy consumption isn't the only goal for the projects. "The net result is that Texas A&M will have buildings that are better able to meet the requirements of the occupants," says Williams. Building occupants and the budget will both benefit, and so will the environment. "The project is one more step in a direction of improving customer service, reducing our carbon footprint, and being as sustainable a campus as possible," adds Riley.

The Projects

Siemens has guaranteed $1.1 million annual energy and operational savings over the contract's 10-year term for Phase I projects, a description of which follows.

BAS Building Optimization
Optimization of the building automation system will impact 1.6 million square feet, improve energy efficiency and enable better control of the HVAC equipment in certain buildings. Occupancy sensors, either existing or to be installed, will be tied into the terminal equipment controllers (TECs) in specific buildings, minimizing or shutting down air flow during unoccupied periods. Building reset and setback schedules, including the following, will be implemented:

- When the occupancy sensors indicate that a non-lab area (e.g. an office, classroom or conference room) is unoccupied, the room temperature setpoint will be reset to 65°F. in heating mode and 80°F. in cooling mode during the daytime; the minimum airflow for VAV boxes will also be reset to zero percent.
- In lab areas served by 100-percent outside air units, the ventilation setpoint will be reset to four ACH (air changes per hour) when the system is in 'night' mode and the occupancy sensor indicates the room is unoccupied.
- In zones that were previously pneumatically controlled with a single setpoint, heating/cooling and day/night temperature setback will be implemented.

Projects such as these that prevent HVAC equipment from operating unnecessarily will result in significant savings at Texas A&M. Other improvements include connecting exhaust fans into the BAS to schedule them off at night and optimizing discharge air temperature and static pressure reset programming in order to minimize unnecessary reheating and fan power.

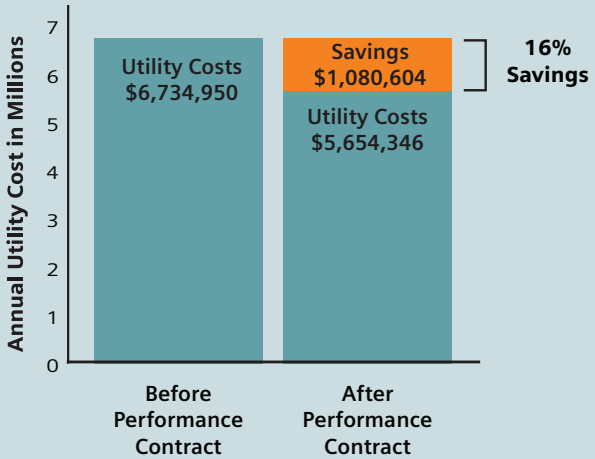
Installing variable frequency drives (VFDs) will optimize space conditions and provide additional savings. On constant-speed air-handling unit fans, the VFDs will reduce fan motor energy use and improve dehumidification capability. Installing VFDs on constant-speed pumps and airflow equipment, together with programed differential pressure setpoint schedules, will also minimize energy consumption.

Control systems at air-handling unit and zone levels will be converted from pneumatic to DDC. Heat recovery systems that had previously been out of service will be re-commissioned.

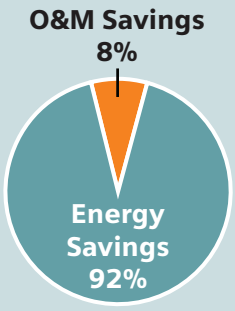
Occupancy Sensors
Occupancy sensors will be installed in offices, classrooms and common areas to reduce energy consumption and eliminate the wasteful practice of conditioning and lighting spaces when not occupied. "Texas A&M is going to get greater room control by tying lighting occupancy sensors into not just the lighting, but the variable air volume boxes in the buildings," explains Jacob Richardson, Account Executive, Siemens Industry, Inc., Building Technologies Division, Houston.

Lighting Retrofits
Replacing older inefficient lamps will reduce energy consumption dramatically. T-12 lamps with magnetic ballasts will be replaced by T-8 lamps and electronic ballasts, 28W lamps will be substituted for 4-foot 32W fluorescent lamps, and 400W metal halide fixtures will be retrofitted with 3-lamp T-5 fixtures. Texas A&M's 700,000 square foot library will directly benefit from updated lighting technologies.

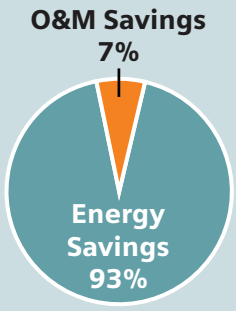
Texas A&M Annual Utility Cost Savings



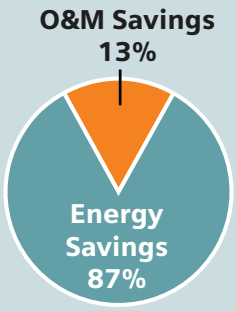
Annual Savings by Project Component



Building Automation
$744,047 Annual Savings



Building Lighting Retrofits
$183,842 Annual Savings



Parking Garage Lighting Retrofits
$198,210 Annual Savings

Lighting projects aren't relegated exclusively to building interiors. In campus parking garages, where lights remain on 24/7/365, new lamps and fixtures will provide energy efficient lighting without compromising safety. Highly efficient induction fixtures will replace slow start-up high pressure sodium (HPS) fixtures. Stairwell and area lighting will be retrofitted with LED shoeboxes and T-8 compact fluorescents. Lighting quality and color rendition will also be upgraded with the efficiency improvements.

Phase II of the performance contract will see additional BAS optimization and lighting upgrades completed on campus. These improvements will impact seven buildings, including a 700,000 square foot library, and deliver an additional $575,000 in annual savings for Texas A&M.

Measurement & Verification

During construction, as a stipulation of the ARRA funding, quarterly reports must be submitted to the State Energy Conservation Office. For four years after construction is completed, every annual reconciliation report, which shows actual vs. guaranteed savings, submitted by Siemens to Texas A&M, will be reviewed by an independent third-party identified by the state. "There will be a measurement and verification phase after the project is completed," says Williams. "A vendor is going to be selected from SECO to make sure that the projects actually deliver what is expected." For extra assurance, Texas A&M will use its own resources to verify project results. "We will use our partnership with ESL to monitor these facilities and make sure that we get the performance that we expect," he adds.

Project Challenges

The performance contract and upgrades to be completed present some steep challenges, all of which validated why Siemens was the best ESCO partner for Texas A&M.

While $15.1 million is a substantial amount of money, the list of projects Texas A&M identified, together with other opportunities Siemens identified, could have left the project short of funding; however, Siemens was able to deliver much of the equipment at a discount allowing more work scope to be completed. Because the university has standardized on Siemens' control systems, Texas A&M can take advantage of preferred customer pricing for all BAS upgrades. And because Siemens owns Danvers, MA-based OSRAM SYLVANIA, high quality, cost-effective solutions can be delivered for the lighting retrofit projects. "It kept costs down so Texas A&M could get more bang for their buck," says Richardson.

As a condition of the ARRA funding, all materials have to comply with 'Buy American' provisions. A smaller ESCO with limited resources may have struggled with the work required to meet this requirement. Siemens, however, is happy to support American-based companies and meet the Buy American requirement. The company's procurement team made sure that both large and small equipment conformed to ARRA requirements.

The stimulus funding brought an extra level of complexity to the performance contract by adding requirements, including completion by December 2011, which shortened the construction cycle and accelerated the timeline. Siemens enlisted many internal resources, including energy engineers, controls technicians, and support from other Siemens operating companies. "We have the necessary resources to meet the required timeline," states Richardson. "We brought out a team of two engineers and had them dedicated full-time, along with a full-time project manager." The energy solutions team made this project a top priority and Siemens gave Texas A&M the promise that whatever resources were necessary to complete the projects on time would be applied.

"When you work with a company like Siemens on a performance contract, you get a certain level of guaranteed support that raises your level of confidence. You get a combination of things: a competent provider, a low-interest loan, and guaranteed payback," says Williams.

Jim Riley
Director,
Utilities and Energy Management,
Texas A&M University

Les Williams
Associate Director,
Utilities and Energy Management,
Texas A&M University

The Texas A&M Team

Jim Riley has been Director for Utilities & Energy Management at Texas A&M University since 2002. He earned a Marine Engineering degree from Texas A&M in 1979 and has worked since then in the field of utilities, energy, and industrial plant management, including over 16 years managing utilities and facilities in higher education and several years as owner/manager of a contracting company. Jim is a Certified Energy Manager (CEM) and has been acknowledged by the Association of Energy Engineers for outstanding accomplishment in the field of energy management.

Les Williams has more than 20 years experience in the utilities and facilities business and has held many management positions including Director for Project Management and Chief Operating Officer. Les earned a Bachelor's in Mechanical Engineering from Texas A&M University, an MBA from Baylor University and is a Certified Energy Manager.

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