

Reliably and Efficiently Serving the World's Largest Medical Center

TECO's Central Utility Plant Master Plan at Texas Medical Center

To meet the energy needs of the rapidly expanding Texas Medical Center in Houston, the world's largest medical center, Thermal Energy Corp. (TECO) began developing a central utility plant master plan in 2005.

TECO retained Burns & McDonnell to validate the master plan's economics and constructability. Burns & McDonnell went a step further, recommending energy-efficient, cost-saving improvements for the district energy center.

As a result of this guidance and the firm's experience in comprehensive planning, design and construction services, TECO engaged Burns & McDonnell to develop and execute an implementation plan. Burns & McDonnell is providing phase-one engineering, procurement and construction management for a 45-MW, on-site combined heat and power (CHP) system; a 32,000-ton chilled water plant with planned capacity up to 80,000 tons; a 9 million-gallon, stratified chilled water tank; electrical substation

upgrades; and an expanded operations support facility and control room. This initial phase is expected to be completed in 2011.

"Burns & McDonnell has been an integral part of this entire process," Steve Swinson, CEO and president of TECO, says. "The only way TECO could do this project is to have design (and) construction under one roof. We recognized that we needed to identify a firm that could come in and do the design, that could do construction administration, could do the procurement in between, and Burns & McDonnell brought that expertise in all of those (areas). There's no question that there's an efficiency in everything — from time, dollars, effort — when you have one point of contact."

Challenges

Located in the urban core of Houston's Interstate 610 loop, with Brays Bayou bordering on the south and busy roadways

to the immediate north, east and west, TECO's district energy plant at Texas Medical Center faces site restrictions that require careful planning during construction of the expansion. The confined location presents challenges in finding staging areas for construction materials and equipment, space to safely perform lifts and room for up to 400 subcontractor personnel. Due to placement near densely populated areas, permitting for unique chemicals, such as aqueous ammonia, on the site requires coordination among city inspectors, the hazmat team and the fire department.

Compounding the site restraints is the team's work within an existing, operating thermal utility plant that serves the Texas Medical Center. It's essential that utilities for these facilities with ongoing surgeries and critical research are not disrupted. "For us, reliability is the most important thing we do," Swinson says of TECO. "Failure is not an option for us." While the design-build approach significantly



Due to energy-efficient combined heat and power technology, expansion of TECO's district energy plant at the Texas Medical Center will double operating efficiency, significantly reduce greenhouse gas emissions, and improve security, reliability and emergency operation capacity — saving nearly \$200 million in utility costs over 15 years.

enhances the team's ability to complete the project on time, it requires quick reactions when plans change, since design and scope are not yet final when construction begins. Also, overall project timing amid the worst recession since the Great Depression could have jeopardized financing.

"This is a very complicated project not just from a technical perspective, but (also) from the tightness of the site," Swinson says. "Burns & McDonnell has done an outstanding job."

Solutions

To accommodate the site's space restrictions, Burns & McDonnell created an intricate construction management plan to build the project from west to east, working around Brays Bayou and ongoing traffic. The firm is precisely planning material procurement and delivery to occur in the exact sequence needed to maintain the schedule and avoid on-site storage. Burns & McDonnell is also arranging nearby off-site storage for necessary equipment and materials, daily transportation of subcontractors to the site since no parking is available, and working shifts day and night so subcontractors have room to safely perform their jobs. Temporary installment of a tower crane allows for safe, light lifts such as movement of pallets and maximizes reach in a tight area.

With so many components, including commercial and industrial, carefully following every detail outlined in the schedule has been paramount. For example, traffic had to be shut down over a weekend to bring in an 800-ton crane to install four 8,000-ton chillers in the new east chiller building. Equipment delivery and construction of the surrounding structure had to be on time to avoid delays that would occur in obtaining another road closure approval.

Burns & McDonnell planned construction around utility services staying on continuously at the Texas Medical Center. For instance, when upgrading the electrical substation, the construction crew dug a tunnel to route piping and electrical power cables underground to avoid the infrastructure in place at the existing plant.

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Due to the changing nature of design-build construction, Burns & McDonnell reconciles bids awarded with final drawings throughout the project and reacts quickly when needed. "In spite of thorough planning, unanticipated circumstances can still occur such as adverse weather conditions or an unexpected equipment failure," says Steve Campbell, construction management lead for TECO's district energy plant and Burns & McDonnell principal and senior project manager. "You don't plan for the negative or the unknown, but when these happen, we need to be prepared to overcome them. A significant and substantial number of things have gone right on this project even though we've faced many challenges."

While the current economic state has adversely affected capital improvement projects for other organizations, the recession presented opportunities for TECO. When project planning began, inflation was at a record high, threatening the project financially. Now, material and equipment costs are down because of the recession, and with the help of Burns & McDonnell seeking competitive bids, TECO has realized more than \$30 million in equipment and subcontract savings on this project alone. In addition, Burns & McDonnell prepared a grant application that won TECO a \$10 million federal grant, one of nine American Recovery and Reinvestment Act grants from the U.S. Department of Energy for implementing energy-efficient CHP and district energy technology.

In a traditional central power delivery system, only a third of every Btu consumed is converted into electrical energy, with the rest lost up the stack. In a distributed power generation model, an on-site CHP system converts three-fourths of every Btu consumed as fuel into useful electric and thermal energy — a 46 percent efficiency improvement over a central utility plant fed from the grid.

Results

When the final phase is completed, TECO's district energy plant will provide 100 MW of on-site power generation, 80,000 tons of chilled water, 152,000 ton-hours of chilled water storage and 540,000 pounds-per-hour of steam to 75 percent of the 49 institutions' facilities at the Texas Medical Center. This on-site CHP system will double operating efficiency to 80 percent; reduce greenhouse gas emissions by almost 83,000 metric tons of carbon equivalent per year; and improve the security, reliability and emergency operation capacity of the utility infrastructure serving the world's largest medical center. Over the next 15 years, this CHP system could save TECO nearly \$200 million.

But these results stem from more than technical knowledge and relevant experience. "It's about relationships. It's about having a partner — someone you can trust," Swinson says. "I have recommended Burns & McDonnell for other projects and will continue to recommend them for future projects. Burns & McDonnell does an excellent job."

For more information, contact Ed Mardiat, 816-822-3344.



Watch a client testimonial from
TECO CEO and President Steve Swinson
at www.burnsmcd.com/chp.



System integration allows the control room operator at TECO's district energy plant to better manage plant systems that provide utilities to the Texas Medical Center.