University of Miami upgrades medical campus energy systems

Since opening a state-of-the-art central plant at its Miller School of Medicine, UM has prescribed ongoing efficiency and resiliency improvements.

Marcelo Bezos, CEM, Director, Utilities and Engineering, University of Miami Miller School of Medicine

Courtesy Moss and Associates.

The Miller School's 15th Street Parking Garage and chiller plant.

Editor's note: *In February 2011, the University of Miami Miller School of Medicine graciously hosted IDEA's 24th Annual Campus Energy Conference, Workshop and Trade Show. Next month, the school will again welcome our delegates to Miami for IDEA's 30th Annual Campus Energy Conference, Workshop and Trade Show. We are pleased that Marcelo Bezos, director of utilities and engineering, was able to provide the following update.*

The University of Miami (UM) Leonard M. Miller School of Medicine is among the most comprehensive medical centers in the U.S., known for its consistently top-ranked Bascom Palmer Eye Institute and highly regarded practice specialties of ear, nose and throat; kidney disorders; and neurology and neurosurgery. In 2009, the Miller School opened its new state-of-the-art central cooling plant – one of the most significant capital investments made by the university to date.

The Miller School was committed to expand its facilities in an ecologically sound manner, in keeping with UM's Green U sustainability initiative. The new 49,000-sq-ft plant represented a significant step in improving campus energy efficiency. Currently providing 11,700 tons of cooling capacity, it is the second-largest chilled-water plant in South Florida. Uniquely, the chiller plant is located on the ground floor of a 10-story, 1,400-space parking garage that has been hardened to withstand a Category 5 hurricane.

Since the new plant commenced operation, the Miller School has not stopped its pursuit of ever-greater energy efficiency and resiliency. In recent years, it has increased the plant's emergency power supply and installed a backup water well system. In addition, projects are now in the works to both integrate those wells with the chiller plant's nonchemical water treatment system and to install variable-speed drives on condenser water supply pumps.

THE SWITCH TO CENTRALIZED CAMPUS COOLING

Prior to 2009, the Miller School's 3.2 million sq ft of health care, research and administrative space had been cooled by local chilled-water plants serving individual buildings. Initially the new campus cooling system delivered 6,700 tons of chilled water to 2 million sq ft of space in eight buildings. Among those was the 188,000-sq-ft Biomedical Research Building – then the newest of the medical school's Leadership in Energy and Environmental Design-certified buildings (profiled in "Customer Closeup," First Quarter 2011 *District Energy*). (A new central steam plant, which replaced individual in-building steam systems, was installed in this new Biomedical Research Building at the same time as the chilled-water plant construction project.)

Today 16 buildings totaling 2.4 million sq ft are connected to the Miller School campus cooling system, supplied with chilled water produced by three 3,900-ton chillers. Five of those buildings – three hospitals, the Biomedical Research Building and a second research facility – plus the chiller plant are backed up by 14 MW

The power room at the Miller School central plant is equipped with its original three 2.8 MW generators and two 2.8 MW units added in 2010, for a total 14 MW of emergency backup power supply.

The filtration system circulation pumps.

This aqueous chlorine dioxide generator system is coupled with the campus cooling system's pulsed-power water treatment process to ensure the necessary environmental standards are met so that blowdown can be discharged to the filtration pond.

Cooling tower blowdown is discharged to this filtration pond, instead of the sewer, part of an environmentally friendly process that will essentially recycle aquifer water back to its source.

of emergency power generation capacity installed at the plant.

EMERGENCY POWER EXPANSION

At the end of 2010, UM added three 2.8 MW generators to its original two 2.8 MW units for the combined 14 MW of emergency power capacity at the central plant. The goal was to provide 100 percent power redundancy to all four hospitals on campus in the event of a prolonged outage due to hurricanes or other catastrophic events.

The three hospitals currently backed up by emergency power – the Bascom Palmer Eye Institute, Sylvester Comprehensive Cancer Center and University of Miami Hospital & Clinics – will be joined by the 800,000-sq-ft University of Miami Hospital in FY 2017-2018. That facility will also be connected to chilled-water service in the same time frame. The 560-bed hospital is the region's first university-owned, multispecialty acute care hospital and the flagship facility of the UHealth – University of Miami Health System.

EMERGENCY WELL INSTALLATION

Early in 2016, UM embarked on a project designed to further harden the medical campus utility infrastructure. It installed a system of emergency makeup water wells capable of pumping 100-plus gpm of water from the Biscayne Aquifer in the event that municipal water or water pressure is compromised during a major storm. The well system also could double as a source of nonpotable water for flushing or cleanup at the plant and other campus buildings in the event municipal water isn't available. The quality of the water is such that it can also be used on a permanent basis for condenser water makeup. The offset in savings is calculated to cover the additional infrastructure costs in a matter of two to three years.

INTEGRATION OF WELL AND WATER TREATMENT SYSTEMS

By February 2017, UM expects to have this new water well supply integrated with its existing cooling tower water treatment system, creating an environmentally friendly process that will recycle aquifer water back to its source. The treatment system, part of the original

central energy plant build, utilizes pulsed electric fields for control of mineral scaling, microbial growth and corrosion in the cooling towers. This has been combined with an aqueous chlorine dioxide generator to ensure full treatment of biocontaminants in the condenser water supply that is subjected to South Florida's warm, moist weather. This system allows UM to safely blow down concentrate to a filtration pond instead of the sewer, saving the Miller School more than $82,000 in sewer charges in one year.

By adjusting the cycles of concentration, UM is confident that it will be able to replace its average daily blowdown volume of 23,000 gal per day of municipal water use with water drawn from the new well system. The water will be discharged to the filtration pond and then to a storm drain field – essentially recycling back to the Biscayne Aquifer. This water could be further used for irrigation downstream or other gray water use. The integration of UM's well and water treatment systems will reduce municipal water use by 8.3 million gal per year, for an annual water bill savings of $74,000.

VSDS ON CONDENSER WATER SUPPLY PUMPS

Another upcoming energy efficiency improvement at the Miller School is the installation of variable-speed drives on the cooling system's condenser water supply pumps. Three of five pumps will be equipped with VSDs in January 2017.

For those systems designed around an N+1 configuration, having an extra pump sitting idle can offer a great opportunity for power reduction. The affinity pump and fan laws for turbomachinery dictate that power will decrease proportionally to the cube of the speed reduction. Using a parallel pump configuration and that extra pump, it is possible to decrease power loads by 87.5 percent at a 50 percent speed reduction. The Miller School's current plant delivers close to 48 million ton-hr per year and will see annual energy savings of 1.54 million kWh when the VSDs are installed. Averaged over the year, the use of VSDs on the current load profile (8,000 tons on peak) is calculated to render close to $100,000 in annual power bill savings and shave off close to .083 kW/ton from the peak plant kilowatt-per-ton load profile, or a .03 kW/ton reduction on average over the course of the year.

MEDICAL EDUCATION BOOM

The Miller School at UM is among South Florida's medical schools that are currently experiencing burgeoning growth and investment, as the region anticipates becoming a major health care hub. Last year, the university received a $50 million donation to build a new high-tech medical school complex and another $25 million for the university's Interdisciplinary Stem Cell Institute.

Plans call for the campus energy system to expand too. A 5,600-ton chiller will be added at the plant in FY 2017-2018, bringing total installed cooling capacity to 17,300 tons – in preparation for connecting the University of Miami Hospital to the chilled-water system. Steam system capacity will similarly be boosted within two years by more than 9,000 lb/hr to 32,085 lb/hr to add service to this facility.

As the Miller School continues to grow in size and reputation, its campus utilities will keep pace and remain committed to delivering efficient, resilient district energy services.

***Marcelo Bezos, CEM**, is director of utilities and engineering at the University of Miami Miller School of Medicine. He currently oversees the annual utility use budget of over $15 million in addition to wearing a controls and systems engineering hat for the Miller School and its satellites. He has worked for the university in this capacity for the past 24 years. Bezos holds a bachelor's degree in mechanical engineering from New Jersey Institute of Technology and is a certified energy manager. He develops enhanced thermal water projects outside the university via Thermolentics, a private company he cofounded in 2013. He may be contacted at mbezos@med.miami.edu.*

System snapshot: University of Miami Miller School of Medicine

	Steam system	Chilled-water system
Startup year	2009	2009
Number of buildings served	9	16
Total square footage served	1.25 million sq ft	2.4 million sq ft
Central plant capacity	22,700 lb/hr	11,700 tons
Number of boilers/chillers	2 boilers	3 chillers
Fuel types	Natural gas	Electricity
Distribution network length	1,250 lineal ft	5,500 lineal ft
Piping type	Steel (Schedule 800) welded	Ductile iron supply water mains, high-density polyethylene DS9 pressure rating branch circuits
Piping diameter range	2 to 12 inches	4 to 36 inches chilled water, 42 inches condensate
System pressures	105 psig	85 psig
System temperatures	341 F	40.5 F supply/51 F return
System water volume	NA	500,000 gal

UM Miller School of Medicine.