PROFILE

HMT Shoots & Scores

Syracuse University Upgrade

By Susan Casey

HOME OF THE NCAA DIVISION I football and basketball Orangemen and the country's fifth-largest indoor stadium, Syracuse University's Carrier Dome has been a pressing concern for school officials for several years.

The concern comes with good reason. The 51,000-seat dome, built in 1980, needed a electrical overhaul.

"We did experience a loss of one of the two feeders serving the dome," said Kevin Noble, manager of engineering, Office of Design and Construction, Syracuse University (SU). "It occurred at a noncritical time, and it did not affect any of the games, but we did need to operate without a backup feeder. Our emergency generator was not large enough to provide all the lighting needed for a televised event."

The Carrier Dome project

The stadium has its own direct electric connections to the local utility company, Niagara Mohawk, a subsidiary of National Grid USA, Westborough, Mass. It also had the original switchgear requiring manual transfer to the backup feeder when the utility lost power on its main feeder.

HMT Inc., Cicero, N.Y., the contractor that had been upgrading the university's electrical distribution system for several years, was called in on the project to eliminate the need for manual transfer.

"The existing service to the dome required a significant amount of time to transfer to the alternative source in the case of a power failure," said Richard Maybury, vice president, HMT.

HMT's proposal was to replace existing obsolete switchgear with main-tie-main circuit breakers, while minimizing the required outage time. Since 2000, HMT had worked on an upgrade of SU's energy metering system—an experience that was helpful in implementing the Carrier Dome project.

"We could better anticipate what the voltages would be that the automatic transfer system would have to sense and react to," said John Pertgen, HMT project engineer.

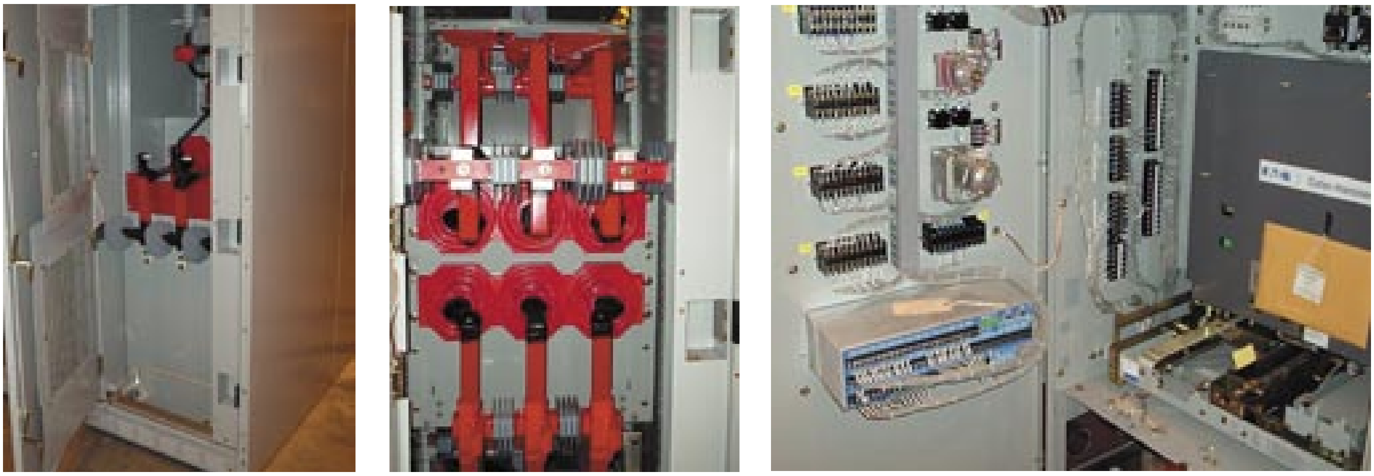
Selecting utility-grade equipment was a requirement of Niagara Mohawk. Equipment had to provide an automated-transfer process, so selection required careful consideration.

"It also became a question of availability and fit," said Noble. "New switchgear with additional features had to fit into the old footprint. We investigated multiple manufacturers."

HMT selected the Cutler-Hammer MEB switchgear by the Eaton Corp. and submitted a budget. The metal-enclosed assembly of single high-draw-out VCP-W vacuum circuit breakers was an advanced technology that fit into the space nicely.

HMT did not simply install the off-the-shelf product.

"We did a lot of application engineering on the switchgear designed by the factory since it wasn't totally compliant with



Carrier Dome switchgear: (left) Cable-entrance section; (center) custom-designed bus transition section; and (right) protective relay and control section

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the university's requirements," said Maybury. "The switchgear normally wouldn't have fit in the available space but we were able to install it on the existing pad and intercept all the existing cables with a minimum of down time and interruption to the facility. We ended up being able to refine the design enough to get the new output box to land almost exactly in the same position as the old output box."

HMT visited the factory during construction to take detailed measurements and give input on some of the construction features.

"We were able to have them rework it to interface with the existing conduits and comply with Niagara Mohawk requirements," said Pertgen.

HMT also used multifunction protective relays from a different vendor, Schweitzer Engineering Laboratories. HMT's in-house engineer, Peter Thiemann, designed an automatic throw-over scheme to detect a voltage failure on either circuit and make the appropriate transfer between two sources with a minimum downtime.

The relays gather all the electrical parameters required by the transfer scheme, and they are programmed with the actual logic required to accomplish the transfer.

HMT also needed to address concerns for the university and the local utility company.

"We receive our power from the utility at a number of different places," said Noble. "On our two sections of the campus, utilizing two different voltages, we operate a fairly extensive medium-voltage electrical distribution system. The utility has a well-defined set of specs for switchgear in general. We had to perform a coordination study to ensure that the overcurrent protective relay was compatible on the university's side with overcurrent protective devices and on the side of the local utility with its feeders for the Carrier Dome."

Because SU shares a hillside with three other major facilities, they also share feeders that serve the Carrier Dome and its neighbors. As a result, HMT had to de-energize feeders one at a time in order to install the switch gear.

As part of the operation, the other facilities lost one of its primary power feeders for one to two days. They had to switch their electrical load to the alternate feeder while HMT did their work. Careful coordination allowed the switch to operate smoothly. For the Carrier Dome, the downtime during the project was only four hours, most of which was time HMT spent testing the equipment.

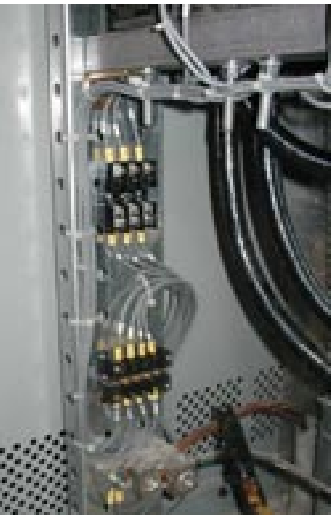
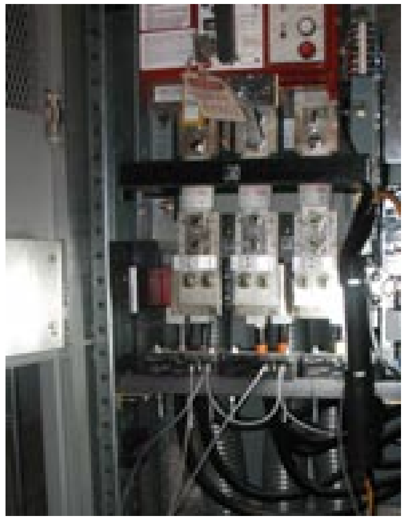
"HMT was responsible for everything from conceptual design, to execution, to being one of the primary liaisons with the utility in this design-build project," said Noble.

The project was completed in August 2004.

The university conserves energy

The Carrier Dome project wasn't all that occupied HMT's professional attention. In the early 1990s, the university—with 18,000 students and staff members in 11 schools and colleges with high-tech labs and specialized computer applications—established an Energy Conservation Program to help control energy consumption without adversely affecting the university's work environment.

In 2000, HMT began implementing an upgrade of the electrical metering system, a process that continues as new buildings are constructed and others are renovated. The upgrade has been partially funded by a grant from the New York State Energy Research and Development Authority (NYSERDA) and was motivated by the New York Public Service Commission's (PSC) plan in 1996 to deregulate the electric industry.

Metering accuracy current transformers and shorting terminal blocks retrofitted into existing switchgear at the Tennity Ice Skating Pavilion on the Syracuse University campus.

The university's Department of Energy and Computing Management, in conjunction with the Office of Design and Construction, initiated the upgrade of manually read electromechanical submeters installed on campus between the 1960s and the 1980s to networked metering devices.

"Our metering project was done to monitor our energy consumption, which enables us to be more proficient in negotiating good contracts for the purchase of that energy since we know exactly what the university uses when and it helps us to get the best deal," said Noble.

According to Nathan Prior, the department's energy conservation manager, the driving force behind the project was the lack of historical interval data for campus substations.

"The only historical data that we possessed regarding electricity usage and demand was provided by our local utility. While this information was useful prior to deregulation, it was incomplete for our purposes," said Prior. "We did not possess any data regarding power-quality issues, such as sags and swells on our substations, which could negatively impact our computing and research centers."

HMT installed a campuswide network of intelligent ION meters and Enterprise Energy Management (EEM) software technology from Power Measurement with test switches and socket mounts that can be easily interchanged in the field.

It was a two-phase project. The first phase was installation of the meters and adjustments so that they could be read properly. The second phase was making the software interface properly with the university's existing Andover Energy Management System. ION 8500 socket-mount revenue meters were installed at six electrical substations to monitor power-quality data as well as kilowatt use and demand.

A separate project involving the submetering of major buildings involved installation of ION 8400 and ION 8300 meters at selected campus buildings including the Goldstein Student Center and the Tennity Ice Skating Pavilion. All installation and interface with the campus' Andover Controls' system was done with the assistance of a power measurement field application engineer, who verified the system for proper operation and final commissioning. The project took three months due to the difficulty of scheduling needed outages on the active campus.

"The university chose the ION system because it is an excellent metering system that interfaces with the Ethernet," said Maybury.

A high-speed Ethernet link connects all meters to a central ION Enterprise workstation that continually gathers and analyzes data, including usage and power quality data.

The system allows the university to avert disruption by monitoring potentially disruptive sags and swells, harmonics and other conditions. Real-time status is monitored for each area allowing for direct notification of alarm conditions. Since the meters also account for energy use at the building level, the root contributors of electrical demand can be determined.

"Through the interface with the Energy Management System," said Prior, "we can respond immediately when the New York State Independent System Operator (NYISO) calls for an emergency reduction of electrical load. By changing a few parameters, we can automatically start the curtailment process."

That happened the day after the Aug. 14, 2003, blackout. Because SU is a member of the Emergency Demand Reduction Program (EDRP), the NYISO asked the university to reduce its load while other areas were brought back onto the grid.

"We were automatically able to do this without inconveniencing our students or staff by curtailing nonessential loads and adjusting building airflow. Without this system, the process would have had to be accomplished manually and would have been considerably more time-consuming and disruptive to campus," said Prior.

Since the system allows the university to predict energy consumption, SU can take advantage of daytime energy-price fluctuations by reducing energy needs during peak periods by adjusting air flow in some buildings and shedding nonessential loads during peak periods. The university can also avert emergency situations. Power to one building on campus was being interrupted on Monday mornings at 2 a.m.

"We found that the whole building would go down and that the emergency generator would kick in," said Prior.

Investigation revealed that the problem was caused by an unscheduled but programmed exercise of the generator.

"Our system allowed us to quickly identify and fix the problem," said Prior.

As the university renovates old buildings and constructs new ones, HMT is continuing to install ION meters that monitor a building's energy usage and operation. **EC**

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