The Brains Of The OPERATION

From underfloor air performance to water meters measuring the condensate recycled for cooling towers, the BAS monitors and adjusts nearly every component of HSBC's North American Headquarters outside Chicago.

BY JULIE DENARDIS, LEED® AP

BAS have drastically altered the way designers and endusers interact with and relate to their facilities, especially in high-performance buildings. By reviving yesterday's autonomous equipment into today's living, integrated MEP systems, the BAS has given birth to a new generation of facilities that demand, and more accurately, deliver sustainability. HSBC's new North American headquarters is one of them.

Located in Chicago's suburban Mettawa, IL, the 575,000-sq-ft facility features six floors of office space, including a mission critical data center, all connected to the building's central nervous system. Its BAS measures, monitors, and stores performance data from its MEP and lighting systems. Since the LEED® Gold facility opened its doors in February 2008, its BAS has provided the facilities team with easy access to all equipment information, the tools to continually tweak setpoints, and the opportunity to drive sustainability to its highest peak.

Combined with an effective building envelope and efficient MEP equipment, the BAS at HSBC's North American HQ will track an annual energy savings of 45.1% over the ASHRAE 90.1-1999 Standard. Here's how.

MECHANICAL SYSTEM

HSBC's BAS was designed to function as a permanent monitoring system for the HVAC system, providing performance feedback verifying that minimum ventilation requirements are constantly being met. This was achieved through the use of CO_2 sensors, airflow measuring stations connected to outdoor air dampers, and an underfloor air distribution system (UFAD), all of which transmit usage information to the BAS.

Deployed in the building's 90 conference, training, and assembly rooms, the CO_2 sensors communicate to the BAS through a zoned terminal unit. Terminal units are enabled and disabled through the room's lighting occupancy sensor and are able to react locally to IAQ demands inherent in these densely occupied spaces, promoting both occupancy-based and demand control ventilation (DCV).

For example, when CO_2 levels are considered too high, the local terminal unit will respond, overriding the temperature sensor within the room to deliver additional air from the building's main air handling system. If the alarm condition is not satisfied, or when two or more CO_2 sensors are in alarm, additional outdoor air from the building's main air-handling system will be introduced to satisfy the IAQ needs.

Additionally, each individual terminal unit is monitored by the BAS, whose interface reveals the zone temperature, zone CO_2 level, the primary and secondary air quantities and what mode the fan is in. Similarly, the BAS uses airflow measuring stations at outdoor air dampers to continuously measure and report the amount of fresh air being brought into the HVAC system.

Each component of the building's UFAD was designed to communicate with the BAS, as well. Air column fans are provided in the interior of the building to maintain the underfloor air plenum pressure. The VFDs on the air column fans operate at a fixed underfloor static pressure that is adjustable through the BAS. The air column will vary underfloor temperature between 65°F and 69°, based on the return air temperature for each unit. The BAS manages this return air temperature setpoint schedule and allows a reset to be easily modified for a single unit or for all 60 units located throughout the building, with just a few keystrokes at the computer.

There is always a difference between how a building is designed and how it operates based on actual load. For this reason, HSBC's BAS was created to automatically respond to real-time conditions through the combination of automatic indoor and outdoor temperature reset schedules for the building's air and water systems along with user-adjustable setpoints for each of the systems' controls.

FIGURE 1. The unique shape of the HSBC North American HQ building outside Chicago takes advantage of natural daylight inside the space.

FIGURE 2. A BAS, installed to monitor energy consumption, provides real-time and trending data to track and compare energy use over time.

Establishing adjustable setpoints prior to day one allows the building's facility managers to operate out of "design day," or worst-case scenario conditions, and to instead play with setpoints to enhance real-time efficiency.

ELECTRICAL/LIGHTING SYSTEM

In order to calculate energy use of both the building's HVAC and lighting systems, power distribution was designed such that lighting and HVAC loads are circuited to separate, metered power panels that communicate energy usage to the BAS. These "smart" panels allow the building's facilities team to easily track and compare the energy usage of each system over time. When energy use inconstancies are discovered, the real-time and trending data provides the first clue as to which system the inconstancy can be attributed to. The solution to any problem can more easily be determined when the problematic systems can be readily identified.

While its power consumption is measured at the BAS, the building's lighting system is operated and controlled through Lutron's EcoSystem™ with Quantam™ software, an independent lighting control system. Although the EcoSystem does not communicate to HSBC's BAS for server security reasons, a user-adjustable time schedule at the BAS enables and disables the lighting power distribution panels to ensure it is not left on outside of normal business hours.

PLUMBING SYSTEM

The building also reduces its overall water use by 67.7% over comparable buildings by employing low-flow urinals, showers and faucets, dual-flush toilets, and through rainwater collection. Rainwater gathered from the 90,729-sq-ft roof is stored in two underground tanks, each capable of holding 15,000 gal of rainwater, for reuse in the toilet and urinal flushing. In addition to reducing non process water usage, HVAC-related process water is also reduced by recycling

▶Building Elements Reduce Energy Expenditure

Earning LEED® Gold was the result of a combination of sustainable efforts for HSBC's North American HQ. One of the most unique is the Warema™ (*www.warema.com*) automated blind system employed throughout the building to maximize its orientation which helps provide daylighting to approximately 40% of its open office area. The blind's top automated convex-shaped section, with its reflective interior coating, allows natural light to penetrate farther into the occupied space while the lower portion of the blinds, located at the elevation of perimeter workstations, can be controlled manually by the employee.

The combination automated/manual control feature allows natural light to replace artificial light without causing a glare on employee workstations. While this system can easily be integrated into the BAS, it was determined by the project team that the benefit of such interoperability would not justify the cost of integrating hundreds of fractional motors from the shades and solar sensors from the roof.

Instead, the daylighting system reacts to internal light levels within the space and the lighting system responds by reducing artificial light when possible. The BAS and the daylighting system don't necessarily need to know how or why that additional light is making it into the space. Instead, the most important piece of information pertains to the energy consumption and any reduction provided from the combination of these measures that is being measured by the BAS through the "smart" power distribution panels.

While interoperability between multiple building systems is often advantageous, it is important to differentiate between when and with which systems connectivity makes sense and where it may add additional cost without adding significant additional benefit. For every system in the building, the question that must be asked is: "What will this integration bring to the table?"

cooling coil condensate back into the condenser water system. Recycling the condensate reduces the water required to make up cooling tower evaporation and bleed off by approximately 400,000 gal/yr.

In order to validate these efforts, water meters were placed at the building's incoming service to transmit water usage quantities to the BAS. Water savings are calculated by combining pump runtime information from the pump controller through the BAS and pump flow rates to estimate the amount of water used from the rainwater system. The information readily available through the BAS can allow for a reasonably accurate calculation of savings without substantially increasing control points or meters.

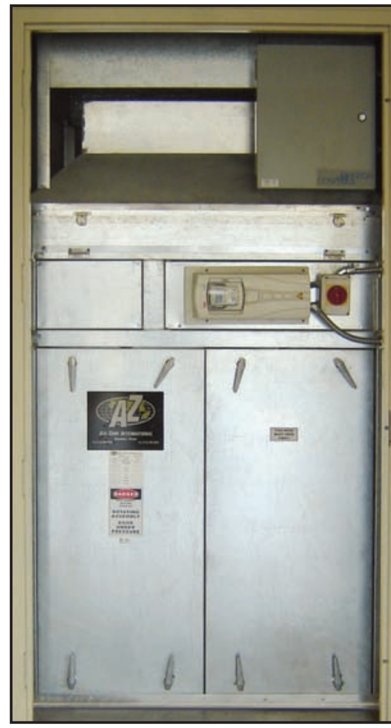

FIGURE 3. Air column fans are installed inside the building to maintain the underfloor air plenum pressure.

LIVING SUSTAINABILITY

The HSBC North American HQ works to meet corporate conservation goals by measuring and recording energy and water usage information at its BAS. This information can easily be trended to compare usage rates between days, months, years, or with periods of similar ambient conditions. It can also be compared to design energy modeling information to determine if the energy conservation measures accounted for in the building design are showing real savings in the building's actual operation. The BAS provides the proof that the building that was designed green is actually performing green.

The HSBC project took the BAS beyond the traditional role of simply measuring and monitoring the building's temperature control and ventilation systems. Building on successful BAS connections, the next step for intelligent buildings is to fully integrate all energy manageable resources from daylighting and rainwater to power and natural gas usage into a fully intelligent building information system (BIS). A BIS that can integrate and closely respond to and schedule all building needs and changes, from "hoteling," conference room scheduling, electronic directional signs, audio visual equipment, shading devices, and daylighting to eventually even interacting with occupants. The future of any building's living, breathing BAS will be determined by the extent of systems integration they assume over time, taking a central nervous system and growing it into a more inclusive building brain center. **GIB**

DeNardis is a senior associate with Environmental Systems Design in Chicago.