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Photo 1: Xerox was able to increase efficiency and interoperability, as well as reduce costs, at its Webster, N.Y., campus by implementing a BACnet-based system. The campus includes research, engineering and manufacturing areas, cafeterias, offices, and conference rooms.

BACnet® at Xerox Campus

By Nancy L. Robbers

Xerox's Joseph C. Wilson Center for Technology in Webster, N.Y. houses some of the company's global research, engineering, manufacturing, and distribution operations. The campus encompasses nearly 5 million ft² (465 000 m²) in 42 buildings and houses approximately 5,000 employees. The Wilson Center is one of Xerox's biggest sources of energy consumption.

Xerox needed to upgrade the Wilson Center to make it more efficient in terms of the labor required to maintain the building controls, provide comfort for building occupants, and to comply with the company's greenhouse gas initiative.

When Xerox began its upgrade in 2005, its annual energy expenditure was roughly \$24 million, and it was projected to be \$26 million by 2008, so the company also sought a better way to monitor its energy consumption.

The Xerox campus hosted multiple independent control systems that operated several different components in building systems that were not centrally visible. The independence of these systems made troubleshooting and system analysis difficult for the campus staff. The idea of Ronald Lapointe, manager of engineering and project operations for Xerox in Monroe County, N.Y., was to create a building enterprise control system that would seamlessly integrate all these components and provide access and visibility to the operations group anywhere on campus.

About the Author

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Xerox had four objectives for its new building controls system:

- It had to leverage the existing technology;
- It had to be based on an open communications protocol that could integrate old and new equipment;
- It had to be scalable across the enterprise; and
- It had to safely integrate with Xerox's existing IT security systems.

Challenges

"From the start we knew this project was going to be a challenge from many perspectives," Lapointe said. "We had limited capital budgets and knew we would have to leverage a lot of the existing technology while understanding that a lot of it would have to be replaced. We were searching for just the right technology to drive this project forward." Onsite installers had additional challenges: a 21-month timeline, minimal downtime, and no disruption of day-to-day operations.

Xerox sought help from an energy consultant that was involved in the business of control systems but had no allegiances to particular products or technologies. The company selected VSEnergy, an energy control and integration firm headquartered in Washington, Pa. VSEnergy undertook a needs assessment for Xerox to prepare for an open system integration request for proposal (RFP) and to facilitate the installation of the pilot project.

"One of the major challenges we faced on the project was the lack of documentation of the existing systems," said Mark Sankey, vice president of VSEnergy. "We needed to plot the entire system architecture, control system sequences, and data, which would be required to put an engineered project out to bid."

"The problems associated with this site were both geographic and physical," Sankey said. "The buildings were all disconnected. Some were connected by virtual LANs, some were connected by a private energy network. So, in addition to making all the controls systems talk to each other, there needed to be network engineering to actually get the buildings connected."

At the end of its assessment, VSEnergy recommended the use of BACnet-based integration. Following evaluation of all the proposed packages, the project panel selected a native BACnet system.

"The BACnet architecture on this project was specified to be native BACnet, which means BACnet on the Ethernet IP network as well as on the local level, the MS/TP network," Sankey said.

BACnet has a manageable networking and addressing scheme and would be compatible with Xerox's extensive IT security requirements.

"Xerox is obviously a technology-based company and is very careful about what kind of data is transported on its own network and who has access to the network," said Sankey. "So it was our responsibility to engineer a schematic that granted secure access to energy management system users but denied them access to any other portion of the Xerox global intranet through their operator workstations."

Solution

Xerox first installed BACnet-based global controllers in each building on the campus, establishing network communications that were visible at the front end. When necessary, Xerox replaced various unitary controllers that could not be readily networked with global controllers. Because of the modular nature of the global controllers, the company can easily install new ones when it needs to expand the system.

Xerox also installed two BACnet hardware devices—Web ports—that use the building automation system's software to give the building staff access to their BACnet-based equipment using a Web browser. The Web ports show real-time data from the BACnet network and enable the staff to securely view all the building data over the Xerox LAN and make modifications to devices. Using the Web ports instead of a client/

server configuration eliminates the need to change computers when software or graphics change.

Various access levels for employees were set up. Some staffers were given a low access level, meaning they can only look at graphics, but cannot make changes. Higher access levels include the ability to make changes to setpoints and schedules as appropriate. This limits changes to the people who understand the ramifications of the change and helps prevent equipment from being left on manual operation, which increases operating costs.

Integration

While Xerox replaced many devices, it integrated a great deal of existing equipment as well. To date, the BACnet BAS controls more than 27,000 points across the Xerox campus.

The decision to integrate rather than replace equipment saved Xerox a significant amount of money on first costs.

The installation included replacing all temperature and calibration devices as required of transducers. Commissioning



Photo 2: BACnet Web ports use the BAS software to display equipment and real-time data via a Web browser.

the system included calibration checks with NIST-traceable devices, a review of loop tuning, alarms, and interlocks, as well as trend verification.

Results

As Xerox brought its buildings and systems online, energy conservation opportunities were discovered, based on data being collected. The single largest project was the demand control ventilation project, which instead of bringing in fixed minimum percentages of outside air, allowed the reduction of outside air ventilation as long as the carbon dioxide levels within the facility were monitored. As Xerox collected data, it became clear that it could establish new demand control strategies with a setpoint of 25% to 50% outside air and few to no occupants, significantly reducing the required outside air and enabling the campus staff to calculate energy conservation and cost reduction opportunities.

The original purpose of installing the DDC was to integrate the existing control systems without any enhancements. Based upon the energy cost reduction forecast and building modeling, Xerox management moved forward with the implementation and expansion of the DDC system into the demand control ventilation project. The result of that project was payback in less than two years.

Xerox also identified a compressor project in a campus building as another opportunity to reap the benefits of integration. During the engineering phase, Xerox installed three new 500 hp (370 kW) air compressors in the building. A communications package was added to the compressors, as well as supplemental metering for compressed air production monitoring. At the completion of the project, all of the operating data from the compressors—including real-time operating efficiency, real-time output, real-time compressed air production, storage and consumption—could be monitored and trended on a continuous basis through the BACnet BAS. This enables Xerox to determine if there are compressor performance problems or impending failures, as well as meter the amount of compressed air usage for the high-pressure and low-pressure process consumption.

By integrating different equipment into one BACnet-based system and centralizing building operations, Xerox now has unprecedented control over its entire campus. The programming now in place—demand control ventilation, occupied/unoccupied, load shedding and optimum start—has enabled Xerox to supply heating and cooling only when occupied areas require it, and to cycle down its operations when areas are unoccupied or unused. So far, the system has resulted in substantial energy and cost savings. ●

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