

# **REDUCING ENERGY COSTS: HOW ONE UNIVERSITY REALIZED DRASTIC SAVINGS THROUGH AN INNOVATIVE CONTROL SYSTEM**

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## **The Perfect Technology Storm**

Today's building owners and managers have an increasing responsibility to address energy efficiency within their organizations. Energy costs continue to rise at a rate unimaginable just a few years ago. According to a survey conducted by the International Facility Management Association, utility costs have increased 19 percent since 2006.<sup>1</sup>

At the same time, companies face growing, external pressures to set high standards of environmental and social performance. These three responsibilities – fiscal, environmental and social – are often called the “triple bottom line” of sustainability. And while many organizations struggle to define what that “sustainability mandate” means to them, the journey often begins with coordinated, energy-efficient facility design and management strategies.

Fortunately, in recent years, the technology, standards and expertise required to maximize facility efficiency have matured. Previously distinct systems within buildings are converging on standard platforms, applications and infrastructures. And the synergy created by that convergence is translating into lower construction costs along with increased efficiencies in operations and energy usage.

It is a rare, compelling set of circumstances. Advancements in the development of technology, standardization and expertise are combining to unleash opportunities like never before for Facility and IT Managers to improve building and business performance. It is The Perfect Technology Storm.

## **A History of Disconnection**

Whether the pressure to address energy consumption is economic, social or environmental, virtually all organizations are paying more attention to energy efficiency than they did just one year ago. Energy efficiency is now a mainstream mandate.

Facility Managers, and to a lesser but growing extent IT Managers, are among those under pressure to identify strategies to improve energy efficiency. Yet the successful implementation of those initiatives will hinge on removing the long-standing barriers between Facilities and IT. It may not be easy.

The Facility Management and IT disciplines, along with their respective technologies, have evolved in silos. The skills of Facility Managers and technical staff are an accumulation of what they have learned over the years, and the limited set of solutions that have historically been available to them. IT Managers, on the other hand, not only grew up with technology, they are routinely trained in new developments, and have established methods for documenting and implementing technology best practices.

Facility and IT Managers have traditionally installed and managed separate networks for their building and business systems, each measuring success against a distinct set of criteria. While there has been, to some extent, a convergence of those systems in recent years over a common IT network infrastructure, the promise of efficiency has not been fully realized because there remains confusion and skepticism.

Facilities Managers ask, “Will I have to abdicate responsibility for the reliability and quality of my systems to an organization that has other priorities? Can I depend on IT for critical applications like fire alarms? Will all the special IT “rules” constrain how I remotely access my system? Can I train my staff with all the new things they need to understand?”

IT Managers ask, “Is the building automation system application consistent with IT network technologies, including firewalls and VPNs? Does it comply with our policies for user authentication and authorization? Does it introduce vulnerabilities to computer viruses?”

And both disciplines question their traditional roles in an integrated environment. Who manages the procurement process? Who holds ultimate responsibility for the network? Who controls head count when efficiencies are gained?

The result is often a paralyzing continuation of time and money wasted by providing separate, uncoordinated networks and software that doesn't leverage common standards.

### **Today's Compelling Combination of Circumstances**

The tide is turning. Historical challenges are being outweighed by pressure within organizations to create economic advantages by improving efficiencies, cutting energy costs and demonstrating social and environmental responsibility.

By desire or by necessity, then, Facility and IT Managers are partnering more closely than ever to approach building and business improvements holistically. At the core of that partnership is the acceptance of Internet Protocol (or IP)-based control as the foundation for an integrated Building Automation System (BAS) / IT environment.

The trend is evidenced in the following forecast that identifies 2009 as year in which sales of integrated building control systems that are IP-based outweigh those that are not.<sup>2</sup>

It is a trend made possible because the technology, standards and expertise are well in place to deliver against the promise of true integration. A rare combination of circumstances that, unlike any time in recent history, has created an undeniable opportunity for Facility and IT Managers to take full advantage of the convergence.

### **The Standardization of Technology**

Within the past decade, technology standardization has evolved in two phases, first within the building automation system industry itself, and more recently, as IT protocols were applied.

In the late 1990's and early 2000's, most BAS vendors reinvented their systems to use standard protocols that were developed for the controls industry, such as BACnet and LonTalk.

This allowed building control systems from multiple vendors for HVAC, lighting, electrical distribution and life safety to be integrated into a common facility management system.

While total interoperability was not always insured, the direction and promise were well established. Owners could install building networks and field bus solutions that would support standards based expansion in the future. But it did not enable an IT application to read real-time or historical control system values.

Until now. Communications based on Internet Protocols (IP-based) have evolved as open and standardized making the transfer and sharing of information from one data point to another not only possible, but seamless – even beyond the building systems themselves.

Building-related data – including energy, security and life safety system information – is easily accessible through a standard Web browser instead of being trapped in a building management system's

workstation. Real-time energy consumption data is now widely available to management outside the facility department.

Today, for example, an organization may use its energy consumption database to estimate next month's energy bill, merge this information from financial database into enterprise databases so that other departments can more accurately forecast their budgets, and print a report that identifies the resultant enterprise expenditures. Or, environmental alarm data can be merged with production data to find correlations between employee comfort and productivity.

IP-based control and monitoring, whether in a wired or wireless environment, is the new expressway to expanded enterprise applications. We have begun to see this with Web Services, where device's data is served to other devices that order the data.

Building code, for example, requires that a minimum amount of outside air per occupant is brought into a building. Common control system design is to use a fixed minimum of air based on "design" occupancy, or ventilation is adjusted based on a proxy for occupancy levels, such as CO2 measurement. But significant energy savings could be realized if the outside air was based, instead, on actual occupancy.

In the case of buildings like auditoriums, theaters, or convention centers, the actual occupancy might come from the advanced and walk-up ticket sales system. The HVAC systems can know in advance what the anticipated occupancy is, and proactively adjust control strategies accordingly, with additional fine tuning added as actual real-time attendance information becomes available. Web services are the common language that allows the attendance to be fed from the ticket sales system to the building control system, keeping everyone comfortable at the lowest possible ventilation cost.

### **The Development of Expertise**

The proliferation of technology, and the increasing convergence of building systems with IT and business systems, is changing both the expectations for successful facility management, and the face of facility management, as well.

Recruits to the industry are more technically savvy than their predecessors, which is already helping to bridge the gap between Facility and IT departments. For all facility professionals, keeping pace with new, diverse technologies and methods to operate and maintain building systems will require a broader knowledge base. They must get additional training, rethink the status quo and must borrow best practices from the IT professional who has had these opportunities all along.

For Facility Managers, this involves fully understanding the IT infrastructure and cooperating with those who implement the network for the enterprise. It is also important to recognize what motivates the IT department in teaming with the facility staff so that both disciplines work together harmoniously and efficiently.

In the meantime, best practices are already emerging that assign a single point of responsibility to building network infrastructure, both wired and wireless. In this approach, that person, the Technology Contractor, is identified upfront and brings an enterprise-wide perspective to managing the planning, design, installation, integration, commissioning and service of building systems. Technology Contracting can save time, reduce risk, and decrease construction and operating costs.

### **The Sustainability Mandate**

Today, companies are expected to earn a profit as well as to set high standards of environmental and social performance – what is often called the "triple bottom line" of sustainability.

For Facility and IT Managers, the sustainability challenge is to design, build and operate buildings in the most efficient, economical and environmentally responsible, "green" way possible. Energy efficiency is at

the heart of that challenge. And it's a challenge that must be addressed. According to a recent survey of corporate executives, nearly 40 percent say they expect legislation mandating energy efficiency to be passed by the year 2010.<sup>3</sup>

An organization's success in recruiting the next generation of employees will likely be affected by its sustainability efforts as well. That same survey noted that nearly a third of organizations say that "green buildings" will be important in attracting and retaining future employees.

### **Facility and IT Benefits**

Clearly, the time is right to blend an organization's building systems and information technology architecture into a seamless entity, to share resources and realize the benefits of the convergence.

### **Less Duplication Leads to Greater Efficiency**

In an integrated environment, building automation systems are less expensive to install because they can use the existing IT infrastructure. High performance can be achieved more economically because a single high-speed network avoids the redundancy that is required with a separate BAS infrastructure. In addition, with fewer wires, bridges, routers and repeaters throughout a building, there is less opportunity for component failure and downtime.

### **Reduced Operating Expenses**

More than 75 percent of a building's total lifecycle costs are consumed after design and installation – in the "maintain and operate" phase. With that in mind, IP-based control and monitoring is a prudent bottom-line decision because it can accommodate both current and future technologies. IT Managers are already accustomed to the concept that network technologies are constantly evolving, and budget for upgrades on a regular basis. Facility

Managers must often live with a dedicated network for many years after it is first installed, unable to justify upgrading their network to take advantage of the new technologies. In a shared network, the facility system benefits from the ongoing IT network improvements.

### **Increased Energy Efficiency**

It would be unreasonable to claim that an IP-based system saves more energy simply because both BAS and IT information is flowing over a common data highway. However, it is possible to claim credit for making facility improvement measures easier to undertake. The simpler the improvement plan, the more likely it is to be implemented. And once implemented, studies suggest that a retro-commissioning program for HVAC equipment and controls can save from 10 to 30 percent of applicable energy costs.<sup>4</sup>

### **Seamless Accommodation of System Additions and Modifications**

In a converged network environment, Facility and IT Managers can leverage the existing wired or wireless building network to extend building control capabilities across the entire network infrastructure, without increased installation costs and with the assurance that future technologies can be incorporated seamlessly.

As an example, energy utilities are beginning to provide real-time pricing tariff schedules, with the real-time data provided from the utility to their customers over IT data networks. If the facility management system is already integrated to this same network, it can be adopted to take advantage of this additional information to refine its energy cost saving strategies.

### **Improved Enterprise-wide Planning, Coordination and Budgeting**

As described previously, the Technology Contractor brings a coordinated, enterprise-wide perspective on leveraging technology. He also has the authority and technical expertise to make decisions and influence how the information technology network – as well as comfort, communications, life safety, asset tracking, and business applications – will be chosen, installed and operated.

The building is seen not a collection of systems, but a functioning whole. Enterprise organizations see network integration as a means to maintain a competitive edge, improve productivity and facilitate organizational collaboration.

## **The Case for Convergence**

### **Ave Maria University, Florida**

Ave Maria University, located in southwest Florida, is the first new Catholic university built in more than 40 years and is among the most technologically advanced educational institutions in the world. By employing industry best practices, Ave Maria successfully converged 23 systems from information technology to facility operations on a single IP-network.

Bryan Mehaffey, vice president of technology systems and engineering, had unique vision for Ave Maria's technology division. He sought to incorporate IT operations and facility operations into one group – and to combine the university's IT infrastructure, fire, security, HVAC and building control systems on a common platform. To Mehaffey, converging these technologies made sense from both a construction and ongoing operations standpoint.

The convergence of the building management system and the IT network, via IP-based control, has cost advantages in terms of installation and maintenance. A single cabling infrastructure is obviously easier and cheaper to install than multiple proprietary networks for different building-related functions. Service costs would also be higher to maintain these different wiring systems.

Ave Maria opened its doors to students in August of 2007. At the time, Mehaffey estimated the university had already saved \$1.5 million in construction costs.

Future costs savings are estimated to be:

- \$600,000 dollars saved in annual utility costs
- \$350,000 dollars saved in annual staffing

“We manage the entire campus operations – facility systems and IT systems – with just seven full-time employees, which is pretty lean when you consider the alternative of as many as 24 people to manage those same entities,” says Mehaffey. “The fact that we are operating more efficiently means that we are able to apply more resources to educating students, which is really what we are all about as a university,” adds Chief Financial Officer Paul Roney.

At Ave Maria University, Mehaffey had the vision and led the charge to combine the new university's IT and building systems groups – to take full advantage of their convergence.

For other organizations, however, the path to increased efficiency and building performance is not always as clear. That's where the emerging discipline of Technology Contracting comes in.

Technology Contracting, as mentioned previously, is a coordinated, enterprise-wide approach to managing the installation and integration of complex building systems. It involves assigning a single point of responsibility, a Technology Contractor, to provide expertise and perspective on technology, and who is granted the authority to make decisions about how the network and building systems will be chosen, installed and operated.

The concept of Technology Contracting is not new. But the industry is now ready to embrace the Technology Contractor for large, complex projects because the return on investment is documentable. Take, for example, the City of Aurora, Colorado.

## **City of Aurora, Colorado**

Once a small town on the plains, Aurora has grown to become the third largest city in Colorado and is today a business leader in key growth industries such as biotechnology, aerospace and high technology.

Even though the city has enjoyed significant growth, its infrastructure did not grow proportionally. The city sought to increase operational efficiency across its 100 facilities by replacing outdated systems, maximizing energy efficiency and improving occupancy comfort.

A new municipal center was designed in 2002 which consolidated 28 municipal departments that had been scattered throughout the city. "Construction of the Aurora Municipal Center, the City's largest building, gave us the opportunity to adopt baseline standard systems that could be retrofitted into our existing buildings, and in future developments," says Russ Grant, manager of the Facilities Management Division.

Because the city needed to move into the new facility quickly, a Technology Contractor was commissioned to lead a coordinated effort. The Technology Contractor worked closely with the mechanical, electrical and security engineers and the general contractor, to develop specifications for the project that were customized around Aurora's desire for fully integrated systems.

All of the major building systems and equipment at the Aurora Municipal Center were integrated. A common Web-based user interface accommodates the addition of existing and new buildings.

The Technology Contractor, notes Grant, "...took direction from our general contractor, but held themselves accountable by following up to ensure that what was actually installed is what was contracted for. Although efforts were made to avoid up-front costs, (the Technology Contractor) maintained a focus on long-term operations, as well, which will minimize costs down the road," adds Grant.

The Technology Contractor established baselines against which the performance of key systems can be measured. The result? Against those measures, annual operational savings of \$15,000 have been achieved at the Aurora Municipal Center since it was first occupied.

## **Conclusion**

For building managers and owners, the challenge today is to design, build and operate buildings in the most efficient, economical and environmentally responsible way possible. Fortunately, the technology, standards and expertise required to overcome those challenges have matured.

Networks converged via IP-based control and monitoring are gaining acceptance. And the holistic approach to building technology, embodied by the Technology Contractor, provides a greater ability to create efficiencies.

It is a rare, compelling set of circumstances. Advancements in the development of technology, standardization and expertise are combining to unleash opportunities like never before for Facility and IT Managers to improve building and business performance. It is The Perfect Technology Storm.

## **Resources**

<sup>1</sup> International Facility Management Association survey released June, 2008

<sup>2</sup> ibexcellence, IT Convergence & Building Systems, September 2006

<sup>3</sup> Johnson Controls Energy Efficient Indicator Survey released April, 2008

<sup>4</sup> US Department of Energy's Federal Energy Management Improvement Program (FEMP), January 2008