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Benefits and Opportunities of Building Systems Integration

Innovations in the building automation market can help facility executives optimize the performance of their facilities

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Executive Summary:
The building automation market is growing steadily. One key reason is advances in technology that enable a greater degree of integration. Today, integration is an increasingly practical way for facility executives to achieve a range of benefits, from increased comfort to greater energy efficiency and improved staff productivity. In addition, government efforts around energy efficiency are also driving integration strategies. But properly leveraging all of the data generated by building systems integration requires the skilled attention of facility executives.

This white paper discusses some of the capabilities available with building systems integration, and how facility executives can best leverage these to make their buildings more intelligent, comfortable, and efficient.

Topics addressed include:

- Technological innovation in building control systems
- Benefits of building systems integration
- Application of integration strategies in existing buildings
- Energy efficiency and sustainability benefits of system integration

building OPERATING management

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Systems integration has long been held up as an important way to improve building performance. But in the past, integration in practice was often limited in scope, and therefore limited in benefits. Today, enabled in part by advances in technology, a greater degree of integration is an increasingly practical way for facility executives to achieve a range of benefits, from increased comfort to greater energy efficiency to improved staff productivity. And integration is shaping up to be an even more powerful force in the future, as subsystems and even components become smarter and the benefits of linking them become greater.

To maximize the benefits of integration, facility executives should be aware of both the potential and the challenges inherent in integration. Today, automation systems, metering systems, sensors, and smart devices all can be integrated to send tremendous amounts of data to the building automation system. But using and accessing this data is difficult because it is stored in different formats with inconsistent naming conventions and limited data descriptors.

"Big data is a flashy concept," says Craig Cherry, program director of Oklahoma Facilities Energy Conservation Program. "Facilities executives have reams of data." The bigger question is not what data are available, but how to access precisely the two or three essential pieces of data necessary from the gigabytes available.

Fortunately, advances in technology, such as control centers and analytics, provide new options for facilities executives to turn mountains of data into useful information. Given all the choices available today, facilities executives may find many benefits from upgrading and integrating existing systems.

Gains in Technology Multiply Integration Options

One reason for the growth in systems integration is that manufacturers have made great strides in the past decade, so that today's options for building automation are nearly endless. Gone are the days when manufacturers provided only basic information, and then only on proprietary platforms. Today's major manufacturers can provide hundreds of pieces of information across a broad range of standard and open protocols. Such advances make integration more powerful and easier to achieve for both new construction and existing buildings.

"There are a multitude of different options in the marketplace today," says Rawlson O'Neil King, communications director of the Continental Automated Buildings Association (CABA). "They may use proprietary or open protocols and standards. But they are based on the idea that the building may have a mixture of systems and subsystems that can still talk and interoperate together, through an underlying platform."

Using platforms, middleware, or smart workstations, building systems and subsystems can be linked together so that seemingly disparate functions such as fire and life safety, energy efficiency, proactive maintenance, and even work order production can occur using the same automation system.

Platforms such as Siemens' Desigo CC control center, for example, use analytics and graphics to help in decision making for issues or events using data from building automation, HVAC, lighting, fire and life safety, power and energy, and even Internet Protocol (IP) cameras. The interface is personalized, so that each user can access data he or she needs without having to wade through data extraneous to their task. The platform also interfaces with the organization's IT infrastructure.

Interoperability is essential to that functionality. The platform supports about 70 standard and proprietary protocols. Using BACnet, Desigo CC integrates HVAC, lighting, and fire and life safety. OPC and Modbus allow integration of process control and metering systems, while SNMP integrates IT equipment. ONVIF also allows video surveillance cameras to be integrated in the one workstation.

Similarities Between Building Systems Enable Integration

Even though today's building systems generate vast amounts of data, commonalities in their functions allow building automation systems and integration interfaces to present data in understandable and actionable packages of information, with ever more refined and powerful functionality available with each software iteration.

Benefits of Integration

System integration offers five key benefits for facilities executives, says David Wilts, associate principal of Arup, an engineering and design firm:

1. Improve the human experience in the built environment.
2. Improve productivity of occupants and operations staff.
3. Maximize space utilization and efficiency.
4. Reduce energy use.
5. Empower sustainability and stewardship goals.

There are other benefits to be had with integration. For example, integrated building systems can improve life safety outcomes in the event of an emergency by automating response items such as illuminating the escape route and releasing doors along the route, while at the same time focusing surveillance cameras on the risk area to give first responders better and faster intelligence on the emergency.

As well, integrated systems can help bridge the information gap between facility executives and facility occupants, with systems able to report data on how occupants actually use the space. This can help facility executives better optimize systems to the needs of the occupants. It can also provide crucial insight into where better education and communication for and with occupants would help achieve facility operational goals, such as meeting enterprise carbon emission reduction mandates.

Those benefits help explain why the total building automation and controls market is expected to grow at a compounded annual rate of more than 9 percent through 2020, according to MarketsandMarkets. That growth promises new, higher expectations for the functionality of building controls among building occupants and top executives alike.

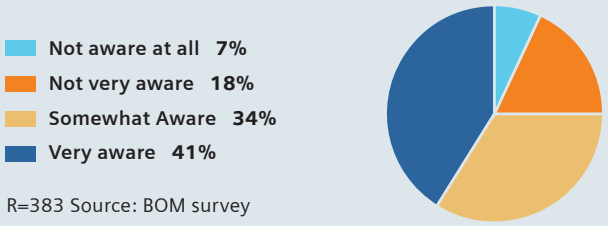
In a 2012 *Building Operating Management* survey of facilities executives, 41 percent of respondents reported that top managers in their organizations were very aware of the general condition of the building management systems/controls, with a total of 75 percent indicating that top executives were at least somewhat aware. As integrated systems and advanced technologies become more common, that high level of awareness could make it easier to justify investments in integration and systems upgrades or replacements.

Integration Offers Gains for Existing Buildings

Although optimizing building control systems is a growing trend, CABA statistics indicate that only 15 to 20 percent of existing systems are fully integrated. "We are still a long way before wide adaptation," maintains King.

Most Senior Executives Aware of the Condition of BAS

In general, how aware is top management of the condition of the building management system/controls of your buildings?



R=383 Source: BOM survey

One reason is that certain building systems — notably HVAC — have a long building lifetime. Often, HVAC systems have a 20- or 30-year lifetime before they are replaced. Nevertheless, when renovating a building system or subsystem, looking at ways to optimize building controls often can yield dramatic energy savings and provide better comfort conditions.

For example, The Tower Companies recently renovated The Millennium Office Building in Washington D.C. with HVAC controls, LED lighting, and a real-time energy management program, resulting in a 20 percent reduction in energy use and savings of $200,000 annually. Tower Companies' experience shows that integration to optimize the building controls systems can produce improvements in the organization's bottom line.

New technologies, like migration tools that bring legacy systems up to new standards and wireless technologies that eliminate the need to run new cabling through finished space, also make it easier than in the past to retrofit existing buildings for integration and upgrade projects.

In addition, as the Internet of Things becomes more compatible with exchanging information, integration offers facility executives additional ways to optimize energy and operational efficiency in existing facilities.

For example, Seattle's Office of Economic Development is working to develop energy efficiency citywide. A 2 million-square-foot smart building pilot for downtown Seattle includes a mix of building types, including the Seattle Municipal Tower, Sheraton Hotel, Boeing, and the University of Washington School of Medicine's research facility. The city is funding the project through a grant from the U.S. Department of Energy to invest in next-generation energy efficiency technologies.

Employing a new analytics layer on the cloud provides a single data repository for all building systems, giving facilities executives participating in the pilot the ability to analyze data and optimize building performance. In the cloud solution, data from a myriad of building systems is collected. Then data analytics provide a prescriptive approach on how to tune building management systems to improve energy efficiency.

Mining information so that controls operate efficiently and effectively has become the responsibility of facilities executives. The data can assist the BAS with current operations and allow real-time troubleshooting using the equipment's diagnostic functions. Real-time and historical data that the BAS obtains from the equipment can verify operational efficiency and also assist in predictive maintenance practices. "A good interface between a major piece of equipment and the building automation system can allow the data from the equipment to be used directly by the BAS," observes Cherry, of the Oklahoma Facilities Energy Conservation Program.

19%

In a survey of over 270 facility managers, 19 percent reported to *Building Operating Management* that their building management system or controls are "on their last legs or close to it." Replacing existing systems, even when still functional, with the latest generation of building management systems and interfaces allows facility managers to reap the most benefit in vastly evolved systems capabilities.

Facilities executives also have the option of using analytic software on the building management system to identify faults in other building systems such as HVAC, notes Jim Sinopoli, managing principal at Smart Buildings, LLC. "The software helps determine how each building system runs optimally and then creates rules to achieve that."

As systems integration and applications of new automation technology become more common, it is worthwhile for facilities executives to keep an eye out for opportunities in existing buildings. For example: Most facilities executives know that at any specific time, there's a possibility that only 40 percent of the people actually scheduled to occupy building space are actually there. Today, occupancy metrics can be developed by tracking employee smart phone locations, according to Sinopoli. The metrics can be used to adjust lighting and HVAC in occupied areas.

Integration Offers Energy, Sustainability Advantages

Facility executives seeking to improve the energy efficiency or sustainability of their existing facilities are taking a close look at integration and controls upgrades to achieve gains. Consider the Spring 2014 progress report of the Department of Energy's Better Buildings Challenge, a public-private partnership program in which leading organizations commit to improve the energy intensity of their building portfolios by at least 20 percent over 10 years and share their strategies and results with the market.

According to the Spring 2014 progress report, nearly 200 organizations have taken the challenge, representing more than 3 billion square feet of building space across diverse public and private sectors. Many of them have done so by optimizing building control technologies.

The energy and sustainability benefits can be substantial, experts say. "Integration between building systems allows us to make a building as efficient as possible, based on how it's occupied and used," says David Powell, associate principal of Arup.

There are plenty of strategies for saving energy. "For instance, after-hours access into a commercial office building is a practical application," explains Sinopoli. When a weekend worker scans his or her access card, he says, the access control/security system can identify which office the worker is going to. HVAC and lighting can then be activated while the area is temporarily occupied.

Powell cites an example involving the integration of meeting room booking systems with lighting and temperature controls. "When the room is unoccupied, the lights can be left off and the temperature in that location can be set back," Powell explains. "Then, 15 minutes before a meeting is scheduled, the temperature can be adjusted, and five minutes before the meeting, the lights can be turned on.

Facilities are increasingly reaping the energy benefits of integration. The University of California, Irvine (UC Irvine) reduced its energy intensity in the past few years by 23 percent. It did so by optimizing building controls. UC Irvine's Smart Labs Program implementation model, covering 7 million square feet of research laboratory space, uses an integrated approach to energy management with controls and sensors. A showcase project at the Natural Sciences II building at the university alone has annual energy savings of $180,000.

Technology Helps Address Integration Intricacies

Facilities management staff today need new skill sets to leverage advances in building controls technologies, as well as take advantage of increased data analytics and fault detection systems provided by integrated building controls systems. "We're dealing with some sophisticated building controls, and you have to have people who know how to manage that technology," CABA's King says.

Building systems controls manufacturers are addressing this issue by making the interfaces for their solutions ever more intelligent, intuitive, and customizable for the end user. For example, even though a system like Siemens' Desigo CC might integrate a whole host of functions at a facility, when the security guard logs in to the interface, he or she would only see the data that pertains to his or her specific duties. In addition, manufacturers are making systems more intelligent and self-sufficient out of the box, with self-discovery of system components and self-commissioning capabilities increasingly common.

To fully capitalize on the potential of technological innovations, facility executives need to educate themselves on the capabilities of their building systems. Today, it's not uncommon to see facilities executives fail to take full advantage of their integrated systems. Some missed opportunities Arup's Wilts often sees are the following:

- When building management systems alarms are triggered, the building automation system can send emails to facility executives, building engineers, and even office managers.
- Occupancy sensor status from the lighting control system often can be leveraged when sequencing mechanical equipment operations.
- Optimized building controls can allow metering data to set baseline performance measures, permitting building operators to chart actual improvements in energy reduction over time. Firms can also incentivize building engineers and facility executives with bonuses for reductions, observes Wilts.

Great Future for Building Systems Integration

We now live in a world where the expected standard of excellence for a building is one that is smart and adaptable. Through open, robust, and increasingly easy-to-use building automation systems and integration interfaces, achieving such a facility is within the realm of the possible, not tomorrow, but today. Both for facility executives who have been unable to pursue greater systems integration in their buildings, or for early-adopters who haven't upgraded in a while, the capabilities available with modern integration systems are well worth a closer look.

NICK MERRICK / HEDRICH BLESSING 2008

At the University of California, Irvine, the Smart Labs Program implementation model covers 7 million square feet of research laboratory space. It uses an integrated approach to energy management with controls and sensors to reduce energy use in already energy-efficient laboratory buildings by as much as 60 percent. As an example, the Natural Sciences II building at the university was 20 percent more efficient than California's energy code when completed in 2005. After a Smart Labs retrofit in 2011, the building realized an additional 50 percent reduction in building systems energy use.

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