White Paper

Simplified BAS Solutions for Small to Medium Buildings

By Melissa Schumann, product manager, system controls, Trane

While building automation systems have been available for many years, research suggests that the benefits of a building automation system (BAS) may not be fully realized or understood, especially in regard to smaller and medium-sized commercial buildings.

A 2012 study conducted by the Pacific Northwest National Laboratory on behalf of the U.S. Department of Energy states that while a BAS is the preferred way to implement many energy-efficiency and demand-responsive strategies in buildings because they allow for automatic programming strategies, the penetration rate of these systems into small commercial buildings is low because they are perceived as expensive and because building owners are not fully aware of the benefits.

There are a range of options available for controlling the heating, ventilation and air conditioning (HVAC) in smaller and medium-sized commercial buildings. The options include programmable thermostats, Web-enabled thermostats and simplified BAS technology, and each have features that make them suited to certain applications.

However, automation is becoming a more viable option to consider for a range of applications, including small- to medium-sized buildings, to help optimize building performance and efficiency. New options in BAS technology make it easier to manage all types and sizes of buildings more intelligently and efficiently, resulting in a high-performance facility. This makes the detail and sophisticated control of a BAS a cost-effective and easy-to-use solution for smaller commercial buildings, including commercial properties, hospitality and retail applications.

BAS considerations

Building automation can provide many benefits, including improved facility performance and efficiency, easier day-to-day operation and control of building systems, and optimized occupant comfort, but few buildings utilize automation technology. According to the Commercial Building Energy Consumption Survey (CBECS), only about 10 percent of buildings in the United States use a BAS or central controls to manage building systems. The requirements of conventional wired building automation systems often restrict the financial feasibility for some smaller commercial applications.

Buildings that do use a BAS are typically large (greater than 100,000 square feet), but more than 90 percent of buildings in the United States are either small-sized (less than 5,000 square feet) or medium-sized (between 5,000 and 50,000 square feet).

The 2012 study conducted by the Pacific Northwest National Laboratory concludes that a significant portion of the energy consumed in buildings is wasted because of the lack of controls or the inability to use an existing BAS properly. Much of the waste occurs because of the inability to manage and control buildings efficiently, according to the study.

This same report concluded that development of cost-effective BAS options for small- and medium-sized buildings will make these buildings more energy efficient. The report indicated that such systems should provide the ability to monitor and control major end-uses (such as HVAC, exhaust fans, lighting) from anywhere in a coordinated way (via Web, smartphones or computers).

New BAS options, in addition to evolving technology such as wireless technology, mean building automation is being used differently than in the past, providing the detail and sophisticated control of automation in a simplified and cost-effective solution. This makes a simplified BAS technology a more feasible solution for small- and medium-sized commercial buildings.

Options for small- and medium-sized commercial buildings

The three general categories of technologies available to control HVAC equipment in small- and medium-sized commercial buildings are programmable thermostats, Web-enabled thermostats and simplified BAS solutions. Each of the technologies offer characteristics that should be evaluated when considering a solution for smaller commercial buildings.

Programmable thermostats are easy to install and offer low hardware costs. However, conventional thermostats are individual units that cannot be integrated with other devices or building systems. And while the units are programmable, when there is a need to change scheduling or make changes to the system for better building management, each unit must be manually adjusted. Programmable thermostats also do not provide the ability to connect to equipment data or energy-saving features.

Web-enabled thermostats can offer interoperability, but are often largely focused on residential automation proprietary protocols rather than commercial building open, standard protocols. This can limit the ability to integrate it with other HVAC systems, or other types of systems found in commercial buildings. The technology in Web-enabled thermostats is similar to programmable thermostats, in that each schedule for each piece of equipment must be adjusted individually, with up to a seven-day schedule offered. Some Web-enabled thermostats offer energy saving features, such as limited setpoint range or optimal start function.

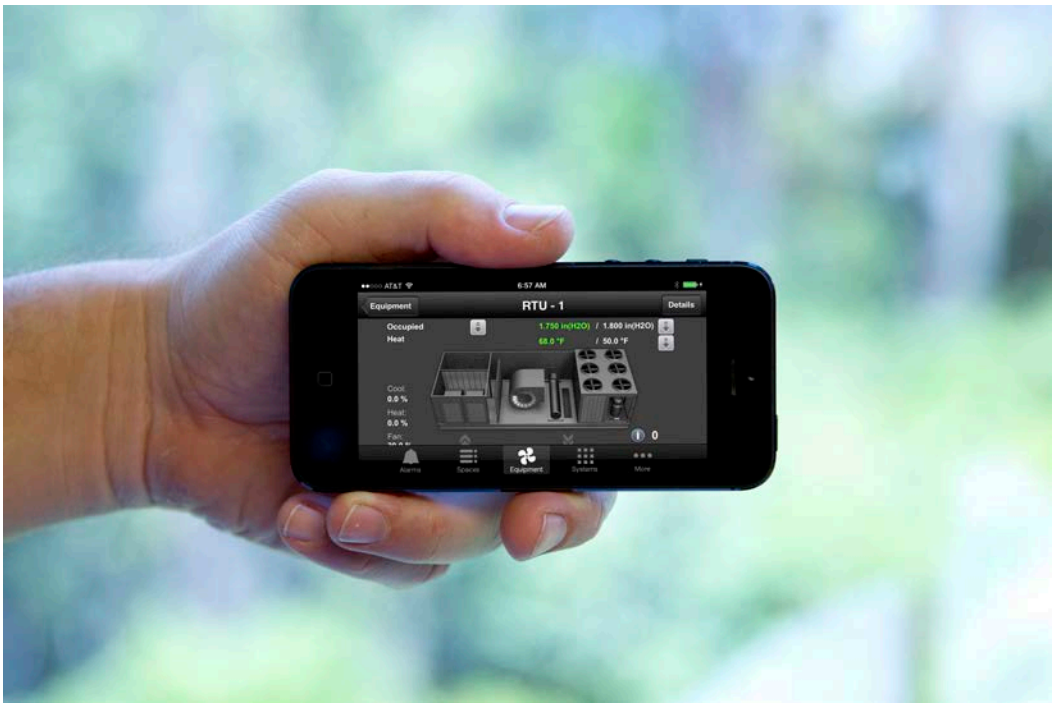
Simplified BAS solutions available on the market are built on platforms that support traditional open standards for commercial applications. This makes integration easier, so multiple building systems such as HVAC, lighting and security can be managed and adjusted via one single interface through the BAS. These systems can offer a range of functionality and control, including customizable alarm notifications, 365-day scheduling, area control, and optimal start and stop feature. Available BAS technology also enables the utilization of energy management solutions, providing features such as real-time monitoring of all energy-related data gathered in a building, energy analytics and automated fault detection. This provides a link to additional intelligent services that make it easier to monitor data and gain insights into building performance and usage to help drive efficiency-improvement efforts.

Benefits for efficiency and performance

The ability to gain centralized control of multiple systems and zones in a building is a key benefit of a BAS. Systems and equipment that with some other solutions must be controlled individually, often from various locations or rooms, can be controlled and monitored from one centralized dashboard with a BAS. This can save time and make operating a building easier and more efficient, while also providing the capabilities to optimize building equipment and systems.

Automation can provide the ability to easily see what's happening in a building — from information about equipment, to alarm information, to energy use. Varying resources show that 60 to 70 percent of energy consumption in a commercial building is due to HVAC and lighting. Solutions that provide an easy-to-use, single point of control for these systems make it easier to optimize energy efficiency while balancing the energy consumption of a building with the comfort and control of the space.

Available BAS solutions also allow remote access to these building control capabilities. Web-enabled capabilities provides access to building systems from virtually anywhere using a tablet or smartphone, resulting in more responsive building control.



BAS options will perform real-time monitoring of equipment data, to provide visibility into what's happening in the building so issues can be addressed in a timely manner. Alarms can be monitored and/or sent to servicing contractors, and problems can fixed before occupants become uncomfortable or in some cases even realize there was a problem. Through a BAS, a building also can be connected to cloud-based technology for monitoring and analysis. Combining the data provided by the BAS with energy analytics and services that a BAS enables the ability to use can reveal previously hidden operational anomalies and provide insight into potential energy conservation measures.

The 2012 Pacific Northwest National Laboratory study included a case study of a 20,500-square-foot commercial office building that was retrofitted with a BAS in 2010. Before the controls where upgraded, the

building had 11 rooftop units controlled by programmable thermostats with limited remote hardwire temperature sensor averaging; no holiday scheduling or optimal start sequencing; no networking capabilities; and no remote diagnostic, alarming or trending capabilities, according to the study. The BAS upgrade included new programmable thermostats on all rooftop units that communicated with a BAS; a wireless temperature sensor monitoring network; a communications network was established to share common data points like outside air temperature, occupancy and holiday scheduling and data analysis of the different rooftop units' performance; and a whole building electrical meter was installed and integrated with the BAS for data collection.

Using the electricity interval data from the building, the study compared energy use between the pre- and post-upgrade periods. The models showed energy savings to be approximately 22 percent after the BAS upgrade, with a four-year simple payback. The study also noted a dramatic decline in comfort-related occupant complaints after the upgrades were completed.

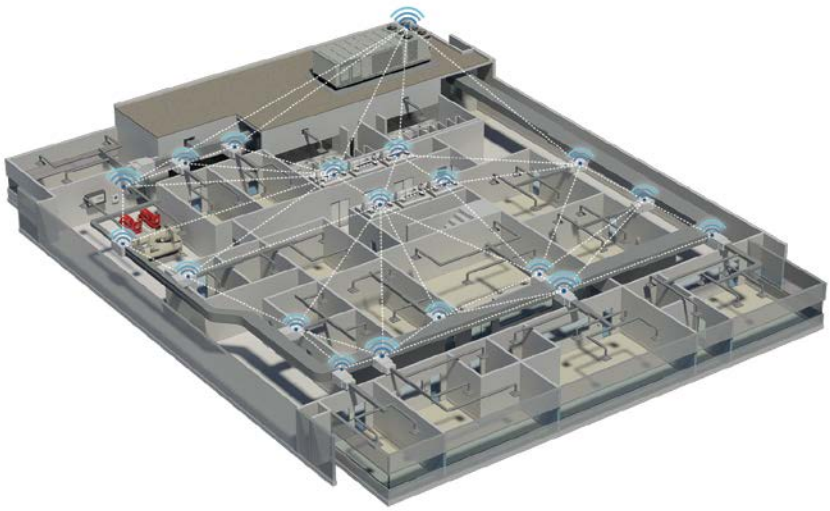
Wireless technology benefits

For small- and medium-sized commercial properties considering a BAS, the option of utilizing wireless communication technology helps make automation cost-effective and feasible. A wireless solution puts building automation — and the improved building performance and energy saving strategies automation can bring — within financial reach of more customers.

Choosing a BAS with wireless technology can reduce the complexity, time and cost of installation, since wireless controls eliminate the need to pull or run wires in the building for humidity and temperature sensing, equipment and system communications, remote access and service tools. In existing buildings wireless results in less disruption to the facility and its occupants and can help avoid disturbing the structure and potentially hazardous materials, for decreased cleanup costs and risk involved with installation.

These factors make wireless a cost-effective, less complex solution that puts a more sophisticated level of building control within reach.

Wireless technology also can offer easier problem solving, life-cycle savings and future flexibility, providing the ability to easily add or move devices as building needs change. These features can enhance the benefits a simplified BAS can provide in small- and medium-sized commercial buildings.



Summary

There are various technologies available to control HVAC equipment in small- and medium-sized buildings. While programmable thermostats often offer lower first cost, simplified BAS options can help improve building performance and provide efficiencies in the long term. They do this by enabling easy and cost-effective integration of future technology or services to help manage and sustain efficient building performance.

Available BAS options that utilize wireless technology are cost-effective and offer ease of use, making them a viable solution for small- and medium-sized buildings. Unified control of building systems is feasible in these applications, making day-to-day operation and management of building systems easier and offering improved building performance and system efficiency.

About the Author

Melissa Schumann joined Trane in 2011 and currently works as the Tracer Concierge product manager within the Controls division in St. Paul, Minnesota. She has worked on projects that include development of the Tracer BAS Operator Suite mobile app and technician tools. Prior to joining Trane, Melissa was a product manager of instrumentation products in the industrial automation industry. She also worked as an analyst in the energy industry, where she worked on development and construction of a combined cycle power plant and as an agent for a municipal power agency. Melissa graduated from the University of Minnesota with a bachelor's degree in mechanical engineering and earned her master's degree in business administration at the University of Minnesota's Carlson School of Management in 2012.