

BUILDING SERVICES I No. 3

Uproot costly inefficiencies in building systems

Performance issues that building operators cannot see are costly and damaging to equipment.



Be ahead of emerging issues

If your building is humming and your occupants are happy, what could be wrong? Even at such times, complex building systems may have undetected issues that erode performance, increase costs, and overburden your staff resources. You can eliminate such faults and waste with a maintenance program that uses data to address the following three issues.





Multiple minor faults that collectively undermine system performance are difficult to diagnose.

Cadmus Group, Commissioning Long Term-Monitoring and Tracking—2016 Square Footage Update, https://neea.org/resources/commissioning-longterm-monitoring-and-tracking-2016-square-footage-update.

1. Detect and correct operational drift

When building systems have catastrophic failures – a sewer backup, a cooling tower disabled, an air-handling unit (AHU) inoperative – the cause is usually easy to recognize. Less easily diagnosed are multiple minor faults that collectively undermine system performance. Over time, the resulting operational drift – largely unseen – can be as costly to building owners as catastrophic failures.

Although full building commissioning can detect such faults, its value erodes over time as building systems grow older and a facility undergoes inevitable changes in operations and occupancy. Moreover, many new buildings are not fully commissioned before occupancy, and recommissioning of existing buildings is very rare. A survey of commissioning agents by the Northwest Energy Efficiency Alliance reported that while 71% of new buildings are commissioned during construction, only 1.2% of existing buildings are recommissioned.

Researchers of the University of Oregon noted that ongoing monitoring will prevent the building from drifting back to its underperforming state. The consequences of performance drift typically include higher energy costs, shorter equipment life, and greater replacement costs. Occupant dissatisfaction is also likely greater, with more complaints about indoor temperatures and equipment noise, both of which are known to reduce occupants' productivity.

To study the impact of performance drift, researchers at the University of Oregon identified a 60,000-square-foot campus building that had unusually high utility consumption for unknown reasons. For a detailed assessment of the issue, the researchers collected data points from the building management system (BMS). The data included fan runtimes and speeds, duct static pressures, system temperatures, etc.

Data analytics revealed a number of faults, including damper control, software programming no longer performing as intended, and sensor problems (failed, uncalibrated, or installed in incorrect locations). After addressing the faults and implementing continuous monitoring, the researchers found a 66% decrease in the building's electrical usage and 60% decrease in steam.

Paul Ward et al, Developing a Process for Continuous Commissioning, https://ieeexplore.ieee.org/abstract/ document/8591688

After recommissioning, electric usage plunges 66%

University of Oregon researchers found that continuous recommissioning of systems in a campus building delivered a 66% decrease in electrical consumption and 60% in steam. The graph shows the difference in fan running times during the pre- and post- commissioning periods. Without continuous systems monitoring, the building would likely drift back to its previous condition. Source: Northwest Energy Efficiency Alliance



In addition, the building manager reported higher occupant comfort and fewer complaints about indoor temperature and equipment noise. The researchers noted that ongoing monitoring will prevent the building from drifting back to its underperforming state. (See graph above depicting the building's drift.)

In this case, the focus is on electricity usage. Similar issues can be detected with fire and security disciplines, for example. Siemens addresses these needs not only in a campus environment but also in a wide range of verticals like healthcare, life sciences, and industrial manufacturing.

2. Use automated monitoring to leverage staff resources and expertise

In-person preventive maintenance based on schedules or runtimes is a familiar element of traditional Building Services. The tasks are time-consuming for personnel, and as a result, are done at comparatively long intervals (if time permits). In-between such checks, equipment may fail and system performance may drift for months or even longer without operators' awareness.

Automated preventative maintenance performs many tasks more frequently than technicians can get to during a visit. For example, automated remote monitoring of an AHU might verify a function daily, while a technician would be available to do the same task only annually.

For more on the most cost-effective mix of Building Services or various building system equipment, see **How to use data** for outcome-based maintenance.

But frequency is not the only benefit. The automated program has greater intelligence because it works from rules rather than laborious visual checking, recording, logging and documenting. For example, instead of a visual check of a filter, the automated rule detects changes in differential pressure over time. Instead of checking the correct operation of a device like a damper, the automated program detects anomalies – like a temperature rise or fall across a coil when a specific valve is closed – providing insight into potential problems.

With automated rules in place, preventive maintenance functions like a proactive sentry who is always on alert.

Automated rules for an AHU

The diagram illustrates various checks and fault detection routines that can be done remotely on a daily basis using data from an AHU. By contrast, it would take a technician hours to accomplish the same checks just one time on one AHU.



3. Proactively and automatically solve issues that undermine performance

Your BMS has the ability to maintain setpoints for indoor comfort when equipment faults would otherwise threaten it. However, in compensating for faults, the BMS can undermine efficiency in ways that the building operator cannot recognize.



Data analytics ensures higher occupant comfort and fewer complaints about indoor temperature and equipment noise.

The automated program has greater intelligence because it works from rules rather than laborious visual checking, recording, logging and documenting.

For example, if an outside air damper begins to leak, the BMS is designed to compensate, possibly by automatically adjusting cooling coil actuators to maintain the setpoint for supply air temperature. The root problem – the leaking damper – may not be flagged because the system is maintaining indoor comfort and avoiding occupant complaints. The damper fault may be detected during the annual, in-person inspection, but in the meantime, energy is being lost.

Automated monitoring detects deviations from optimal operation, putting the building manager in front of the failure curve.

Find out more: www.usa.siemens.com/buildingservices

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