

How to Implement a Comprehensive Building Operations Technology

The commercial real estate (CRE) industry is busy adopting technology to streamline services, meet rising tenant expectations, and maintain profitability in an increasingly competitive marketplace. As a result, the departments involved with building operations are evaluating technologies that analyze building system data to reduce operating expenses and facilitate a better tenant experience.

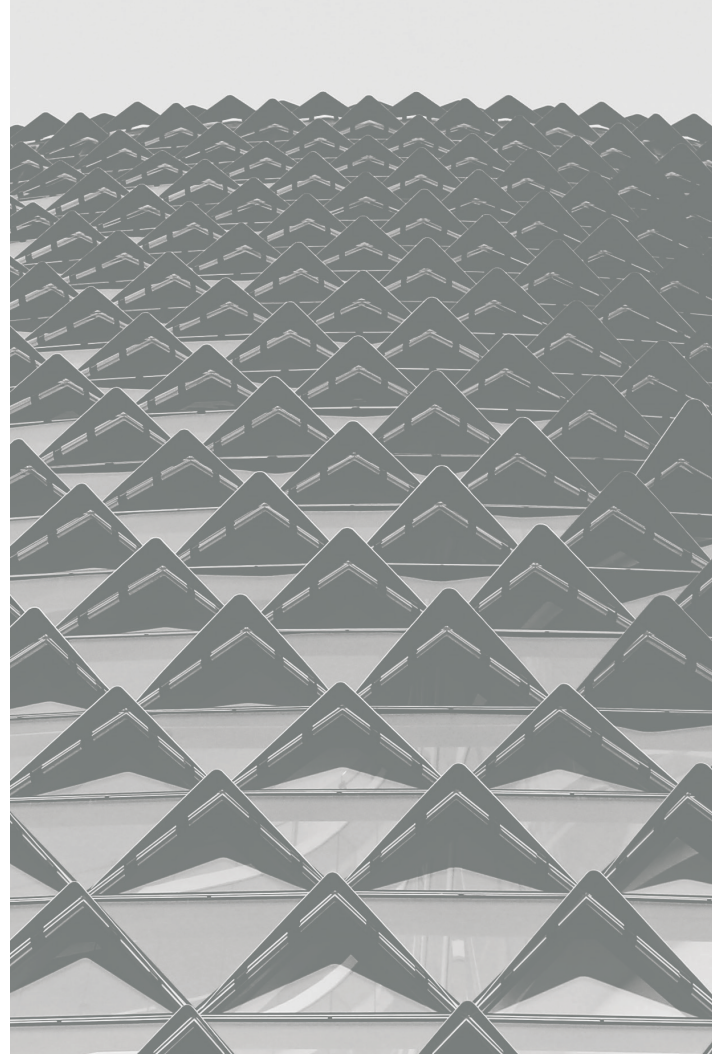
This technology category comes in a variety of shapes and sizes, and does not yet have an established naming convention. In addition, there are overlapping capabilities with familiar technologies such as building management systems (BMS), energy management systems (EMS), and computerized maintenance management systems (CMMS).

To provide clarity, this paper will define this new technology category as an operations performance system (OPS). On a high level, an OPS is different in that it is designed to use data and analytics to improve building operations comprehensively, instead of solving a specific problem.

To differentiate an OPS from a BMS, it's important to note that an OPS does not control any equipment in a building. Instead, an OPS independently collects, visualizes, and analyzes building systems data to continuously optimize how a building functions. An OPS may use data pulled from the BMS, but maintains an independent data collection method to minimize costs, increase scalability across buildings, and ensure data collection beyond systems controlled by the BMS.

An OPS is different than an EMS in that it has a wider scope, and fundamentally different focus. Where an EMS is solely focused on reducing energy costs and reporting on sustainability, an OPS treats these goals as only one aspect of operational performance. In practice, there are many overlapping strategies: equipment scheduling optimization, peak demand reductions, real-time reporting & visualizations, etc. While these are essential to the goals of an OPS, optimizing maintenance activities, and ensuring tenant comfort are equally important.

Another important distinction is the relative affordability and simplicity of implementing an OPS. Because there are no expensive controls, the cost to install an OPS is generally an

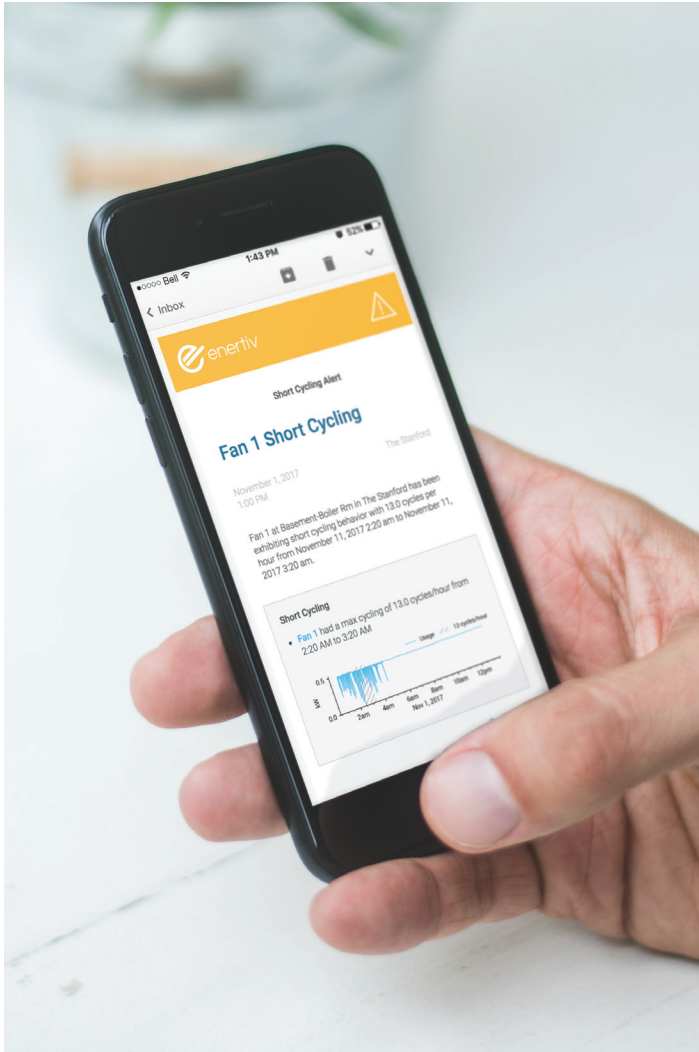


order of magnitude lower than that of a BMS. On the other hand, while the cost to install an OPS may be marginally higher than an EMS, the broader scope often means deeper savings, a shorter payback period, and a greater contribution to an improved NOI.

This paper will cover the implementation of an OPS, provide examples of how an OPS can have a significant impact shortly after installation, and demonstrate the ongoing advantages to a more holistic approach to improving building operations.

Key Takeaway

An Operations Performance System (OPS) combines many of the capabilities of building automation, energy, and maintenance systems.



Rapid Installation, Robust Data

Despite enormous strides in the capabilities of IoT sensors (as will be discussed in the next section), the best place to start for an OPS implementation is energy consumption. However, unlike an EMS, which is often designed to utilize energy data from the master meter and the largest loads, a much higher level of granularity is required for an OPS.

For example, the proper functioning of smaller systems can have a profound effect on the operations of a building, even if the system does not consume large amounts of energy. A case in point is that while an exhaust fan may not consume much electricity, and would likely not be tracked by an EMS, an exhaust fan malfunction has adverse effects on indoor air quality experienced by occupants. To ensure tenant comfort in addition to energy consumption, an OPS generally collects between 200 and 500 pieces of equipment continuously as data streams in a building, covering both small and large loads.

Tracking the energy consumption of every piece of equipment is useful for two reasons. First, maintenance notifications can be sent immediately when there is a change to normal operating conditions of a piece of equipment. Second, by pulling energy consumption data multiple times per second, the nature of changes to the equipment's energy profile can be mapped to specific problems. In the exhaust fan example, a broken motor has a very different profile than a fan belt slip. This differentiation saves maintenance teams time investigating the problem and leads to quicker resolutions.

To collect this level of granularity, a special type of advanced metering technology is necessary. Surprisingly to many owners and operators, many of the objections to installing additional infrastructure have already been addressed. The meters themselves have no moving parts, are powered directly from the electrical panel, and do not require any rewiring or additional infrastructure to function. Furthermore, there is no power shutdown required for installation, so the building can operate normally throughout the installation process.

Unlike a BMS, an important function of OPS meters is the ability to continuously upload data to the cloud for analysis and to be used in visualizations. Fortunately, because there are no controls, there are much lower security implications for this data transfer (though data is still encrypted and sent securely). Instead of relying on the building's internal Wi-Fi or ethernet network, installations usually include a dedicated cellular gateway to eliminate the need for IT departments to spend time verifying the system.

The result of these efficiencies is that the eight to twelve meters required for large office or multifamily buildings can usually be installed and online in one or two days.

Key Takeaway

An OPS is built on data from sensors which collect between 200 to 500 equipment data streams per building.

Including the Internet of Things

While providing the backbone for an OPS, equipment-level energy consumption tracking is usually supplemented with additional data streams to maximize the effectiveness of the system. Other utility types, namely gas and water, can cost as much or more than electricity. Real-time tracking of these other utility resources can bring significant reductions to operating expenses.

For example, in many utility jurisdictions, water is billed on a quarterly basis instead of monthly. This means that catching water leaks and surprise escalations is particularly valuable. In addition, programs like [Con Edison's Interruptible Gas Program](#), promise lower gas rates if fuel types are switched when prompted. To ensure compliance, significant fines are levied if a property does not switch fuel types in a timely manner. Tracking gas use continuously enables notifications to be sent when gas has not been switched to help avoid fines. Though neither of these examples fall neatly into the purview of an EMS, an OPS is designed to help building operators avoid all unnecessary costs with operating a building.

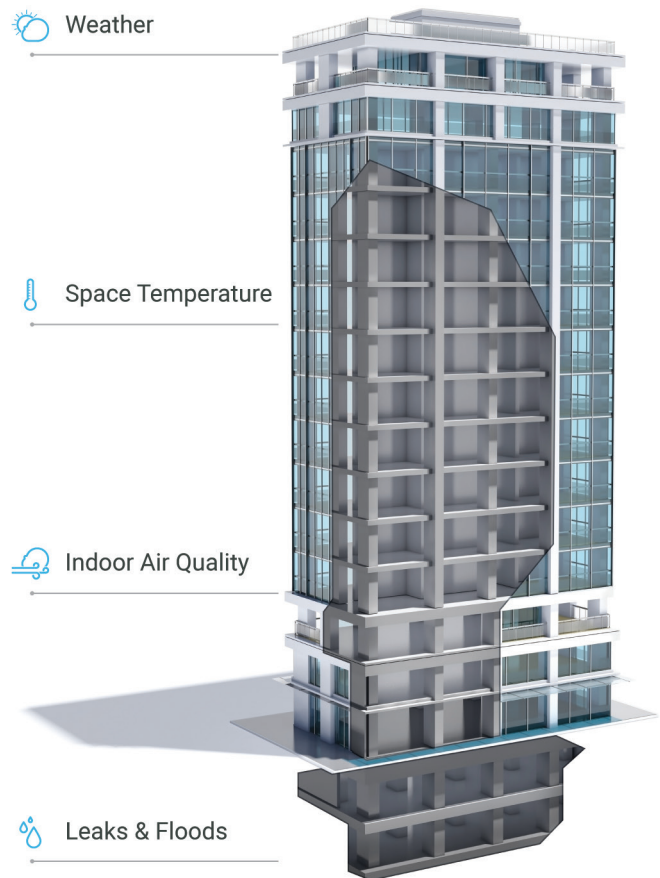
Another area of building operations that does not fall under the responsibilities of an EMS is real-time indoor environmental conditions and tenant comfort. Tracking these conditions requires a new suite of technologies—sensors enabled by the Internet of Things (IoT).

The primary difference between IoT sensors and those utilized by a BMS is the “internet” aspect (as opposed to a BMS “intranet”). Like advanced energy meters, IoT sensors can upload data continuously to the cloud instead of being restricted to the building’s intranet. Also, because these sensors are not installed for the explicit purpose of systems control and automation, a much wider range of data streams can be utilized with the IoT.

These data streams are covered in much more detail in another Enertiv white paper: [Measuring the Impact of IoT on Real Estate Operations](#). For the purposes of this paper, the important aspect to note is the different types of conditions that IoT sensors can monitor, and how these relate to building operations. Sensors can be deployed to track moisture, branch waterflow, local weather, indoor air quality, space temperature, occupancy, lighting intensity, and more.

While this data may not be used to directly reduce operating expenses, these factors have profound effects on the health and comfort of building occupants. For example, IoT sensors can monitor the parts per million (ppm) of CO₂ in a building. This is important because [studies have shown](#) that elevated levels of CO₂, in the range between 1,000ppm and 2,500ppm, lead to a decreased cognitive abilities and an increase in headaches and absenteeism. Tenant health and comfort receive a large share of attention from building operators, and for good reason. As more businesses become aware of these effects on productivity, owners and operators will be pressured to provide strategies to ensure healthy conditions. This trend is already taking shape, the CBRE Global Market View found that peak performing buildings have a 4% higher occupancy rate on average.

To add to the benefits of the IoT, the costs for such sensors



have [plummeted in recent years](#). In 2004, the average cost of an IoT sensor was \$1.30, in 2020 the average cost is expected to be just \$0.38. In addition, Low-Power Wide-Area Network (LoRaWAN) protocols have enabled IoT sensors to transmit data across much further distances than previously possible. In practice, this means that hundreds of IoT sensors placed throughout a building, from the basement to the roof, can transmit data to the cloud through one wirelessly gateway. Without such a network, it would take a handful of gateways placed strategically near the sensors. Instead, IoT sensors can be rolled out more quickly, cost-effectively, and easily.

Key Takeaway

The average cost of IoT sensors have dropped 70% from 2004 prices.

Finishing Implementation

With data streaming continuously to the cloud around equipment performance, utility consumption, and environmental conditions, the next critical step is system provisioning. For an OPS implementation, this process involves “tracing” each of the data streams to their exact source, location within a building, and grouping. While this may seem insignificant, it is an appropriate example of the difference between an EMS and an OPS.

When performing energy analytics, the exact source or location of a piece of equipment is not necessarily pertinent. However, if the real-time data is being used to generate targeted fault detection and diagnostics, this “meta data” about the equipment is essential. Building operators and on-site staff need to be able to pinpoint issues that may affect tenant comfort or profitability. The appropriate labeling of systems by physical location and equipment type enables operators to respond quickly and efficiently.

The detail and accuracy of existing building documentation can speed up or slow down this process, but the average time is around one week after installation. Once this is complete, data will be accessible in a software platform that visualizes the analytics and reporting in real time.

Key Takeaway

One of the major benefits of deploying a standalone sensor infrastructure is that “provisioning,” or the process of labeling data streams, is much easier than integrating vendor-specific BMS’s.

Machine Learning and Human Touch

Building management systems have been around for decades and building engineers are familiar with the technology. But the data and software of an OPS is new to the industry. Therefore, onboarding and ongoing support remain important components of an effective OPS solution. Also, while a BMS is designed for a very specific user, an OPS provides tools for a range of stakeholders in building operations.

While an owner is most interested in the high-level costs across a portfolio, building operators and engineers need to be able to dive into power factor, system configuration, and the fault detection notifications that have been sent to maintenance staff. At the other end of the organization, fault detection notifications help managers and maintenance staff stay on the same page with equipment issues.

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However, even the most capable building operators will need ongoing assistance to uncover all the waste in a building’s operations. An OPS installation is usually accompanied by two important support systems: human and machine. As mentioned earlier, highly-granular building operations data is new for most operators and engineers. Even if an operator understands how a building functions intuitively, access to data specialists can speed up how quickly a project begins to see results. An OPS is usually coupled with dedicated staff to guide the process of building optimization.

Still, there are limits to human capabilities when it comes to analyzing very large data sets. For this reason, machine learning algorithms are integrated into operations performance systems to help identify trends and make predictions about future performance. These predictive abilities improve over time as more data flows into the system, and input from operators “train” the algorithms. However, because a pump in an office building will behave differently than a pump in an industrial plant, it helps if an OPS is designed for a real estate vertical. To leverage machine learning properly, it’s important to track the same types of equipment under the same use cases.

Machine learning can be used to infer schedules around operating hours, forecast costs, generate predictive maintenance notifications, normalize data for weather conditions, identify complex relationships between disparate systems, and more.

Generating Ongoing Value

The lowest hanging fruit for reducing operating expenses, which is typically addressed equally by OPS, EMS, and BMS optimization solutions, is building system schedules. Equipment that is running when it could be off represents waste that can translate to an average 10% savings if addressed. For example, by simply identifying that lighting systems are on and/or HVAC equipment is running while the building is unoccupied can save tens of thousands of dollars per year.

However, there is a reason this type of optimization is called “low hanging fruit.” While the impacts can be significant, this strategy is relatively straightforward. To deliver ongoing value to commercial properties, a system needs to continuously optimize building operations. Energy consumption is only part of the equation; in industrial real estate, it was

found that 18–30% of every dollar spent on maintenance is wasted. While there is no hard data for sectors such as office or multifamily, this ratio is likely even higher, as maintenance is a highly critical component to industrial applications and thus carries more consistent attention by staff. Inefficient maintenance practices also translate to a suboptimal experience for tenants due to equipment breaking down or functioning in a non-optimal capacity and resulting in things like broken down elevators or a more humid-than-desired environment.

To continuously optimize all aspects of building operations, a system needs to be able to track the performance of every piece of equipment and conditions of every tenant space in a building around the clock. When this is done, any deviations from peak performance can be immediately identified and corrected.

Thanks to machine learning, these deviations can now sometimes be identified predictively. For example, a malfunction in an elevator's brakes may cause them to be activated constantly. While the elevator may still operate close to normal, significant wear is occurring to the system. Eventually, the elevator will fail and trigger an emergency shutdown. An OPS can identify the anomaly in the elevator's performance and trigger an alert. By notifying operators before full failure occurs, damage to the system can be avoided, and tenants can be spared the ordeal of an elevator emergency.

Though elevators can be major energy consumers, these systems are often not tracked by EMS because there are few energy optimizations tactics available. Occupants use elevators while they are in the building, and the system naturally lays dormant when not in use. Likewise, because elevators are user-operated, there are typically no BMS controls, so solutions that mine BMS data to provide insights will be blind to these issues.

Predictive fault detection is a new way of thinking about maintenance. While a CMMS is great for tracking preventative maintenance schedules, the likelihood of a routine check uncovering an issue with elevator brakes is extremely low. An OPS will not be able to replace preventative maintenance out of the box, but it can be a powerful supplement. Over time, as the OPS aggregates data from building systems, operators will be able to transition to conditions-based maintenance, where activities are based on the performance of equipment, rather than arbitrary schedules.

Not all building operations issues can be identified from equipment profiles. Other issues can be best detected by IoT sensors. For example, critical equipment such as electric panels, HVAC systems, boilers, and electric furnaces are in

the basement. Flooding can severely damage these equipment and the basement interior if not properly handled. In addition, severe flooding can cause long lasting problems such as mold and other air quality issues. In this example, a targeted notification based on recognition that sump pumps are running non-stop (say, in the middle of the night after a storm) can enable operators to save equipment and electric systems before severe damage occurs.

By definition, there are diminishing returns to a system that only optimizes schedules and configurations. That is not to say that this step is not important, almost all buildings have potential to save considerable amounts of money from poorly optimized systems. However, in an ideal world, scheduling waste is identified in the first 30 days after an installation. The ongoing value is ensuring that the equipment continues to operate at peak performance and that tenant comfort is maximized.

Key Takeaway

Unlike energy optimizations, which are one-time value events, streamlining maintenance and repair not only has direct cost savings, it frees up operator time to work on higher value-add activities.

Conclusion

Enertiv is the first company to provide a true Operations Performance System for office and multifamily real estate portfolios.

Our focus is to provide ongoing value to clients by making buildings easier to operate, healthier to occupy, and more profitable to own.

[Schedule a demo](#) today to see it in action!