How smart buildings can deliver long-term asset sustainability

Many of today's building managers and owners are looking to smart buildings to improve how they use, manage, and monitor their assets, while also reducing their energy costs and carbon footprints. From the electric grid to the global environment, smart buildings are more sustainable, more efficient, and can help lower costs. But to do all this, organizations must be able to take advantage of enterprise asset management (EAM) tools, as well as business collaboration and integration tools. This paper will explain how EAM-based facilities management technologies can help facilities managers in industries as diverse as commercial real estate, government, healthcare, industrial manufacturing, and retail to take advantage of strategies such as global asset sustainability (GAS) and overall equipment effectiveness (OEE) to make their buildings smarter.

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What is a smart building?

The National Institute of Building Sciences defines a smart (or intelligent) building as one that can "provide advanced functionality through a computerized, intelligent network of electronic devices designed to monitor and control the mechanical, electrical, lighting and other systems in a building." A smart building uses advanced technology to enable the "integration, automation, and optimization of any building system in support of facilities management and the building's operation and performance."[1]

The purpose of making a building "smart" is to provide greater efficiency for building owners and managers—while continuing to provide tenants with consistent safety and comfort. To accomplish this goal, building managers need to implement technologies that can monitor a building's assets to detect inefficient performance, diagnose or automatically correct problems, and alert building management of issues that cannot be corrected.

As energy costs rise, smart building technologies become even more crucial. Organizations that can better manage the energy needs of their buildings can not only reduce energy costs, but also create buildings that are more environmentally friendly and sustainable over the long term. For example, New York City's Empire State Building once consumed as much energy in a single day as 40,000 single homes.[2] Since undergoing a retrofitting project in 2009 to make it more "smart," the Empire State Building has seen energy reduction savings of as much as $7.5 million in only a three-year time period.[3]

This paper will explore the essential components required to make a building or facility "smart," while also explaining the benefits of smart buildings in relation to asset sustainability, as well as some common terms and concepts.

Smart building technologies

can help organizations reduce energy costs—and create buildings that are more environmentally friendly and sustainable over the long term as energy costs rise.

Achieve significant energy savings

Organizations with major plants, facilities, and equipment assets are facing a stark reality: Energy consumption is eroding their profit margins. Energy costs, environmental concerns, competitive pressures, and global complexity will not reverse course over the long haul. In 2014, in fact, 41% of the total US energy consumption was from residential and commercial buildings, according to the US Energy Information Administration (EIA).[4]

Buildings of all types, from public or commercial and industrial spaces to offices and multi-unit residential buildings, can achieve significant energy savings with smart building technologies. One effective strategy is to use an enterprise asset management (EAM) system with integration tools to connect the building management system, building assets, and submeters together. An EAM system with built-in business collaboration can deliver real-time insights into the maintenance of equipment and appliances, as well as plumbing, electrical, and HVAC systems, while also connecting all of a building's stakeholders to a real-time, single source of shared data. And, this EAM system can be used to monitor and control the building's energy usage to meet sustainability initiatives to reduce CO_2 emissions and keep utility costs low.

When an EAM-based facilities management system is used as a single data repository for building data, not only do building owners and managers gain greater insights into ways to reduce waste, but this system also provides a smart foundation for creating a more sustainable future for their building and assets.

How smart buildings connect to the smart grid

Without smart buildings, there is no smart grid. The smart grid is a modernized electrical grid that uses communications technology to gather data and act on energy management needs. The US electrical grid, which was constructed throughout the 20th century, includes more than 9,000 generating plants and around 300,000 miles of transmission lines—but 7% of the power generated by this electrical grid is lost in transmission and distribution.[5]

The smart grid has been modernized to meet 21st-century demands. With the smart grid, energy can be created from solar, wind, geothermal, and other renewable energy sources, as well as from power plants. When this energy is distributed, its commercial and residential end-users can use smart meters, EAM systems, submeters, and other technologies to make the distribution and use of energy more efficient—and less wasteful.

When connected to the smart grid, a smart building can collect information about its energy usage. Then, building managers can act on information about their technology and energy suppliers to automate and improve the efficiency, reliability, costs, and sustainability of their energy usage and distribution.

Measure asset health and performance

Energy costs comprise an increasingly large portion of a organization's operating and maintenance budget. To counter this trend, organizations are forced to reallocate budgets away from strategic initiatives to cover escalating energy costs. For many organizations, these costs can be in the hundreds of millions or more, and it is the assets—from equipment on the shop floor to HVAC units in facilities—that consume the most energy. To further compound this challenge, conventional facilities management systems ignore this major expense.

Eliminate energy waste with global asset sustainability

From motors to pumps to heating coils, equipment assets are made of many moving parts. These equipment assets can generate waste if all of their components are not running efficiently. Many organizations, however, measure their assets in terms of their ability to meet operating needs—not on how efficiently each component part of a piece of equipment is working. These organizations need to adopt a new strategy.

To make the best use of technology in a smart building, many organizations are now focusing on four major areas of waste as they review the asset performance in their buildings: availability, performance, quality, and energy consumption. This new approach is called global asset sustainability (GAS). GAS provides the visibility and control that organizations need to eliminate the wasteful energy practices that can result from the day-to-day operation of all of the assets in their buildings and facilities.

Together these elements constitute the foundation of GAS:

- **Availability** is critical for the asset to serve the organization as intended. Maximizing uptime is a primary goal for maintenance, facilities, and asset managers. If production and facility assets are not available, the organization is hobbled in its ability to generate revenue and effectively serve tenants, patients, and constituents.
- **Performance** reflects how well the piece of equipment is behaving or how fast it is operating compared to the theoretical specifications for its operation. When organizations make capital investments, decisions rest on this performance rating. To meet financial goals in both cost and revenue terms, assets must perform as close as possible to that rating.

- **Quality**—how good the output of an asset is—can have a material impact on an organization's margin and ability to execute its mission, whether it is having a retail store at the optimal temperature to drive consumer buying, keeping humidity at a level where machinery and people can work effectively, or ensuring production equipment consistently puts out product at or above specification.
- **Energy consumption** is increasingly costly, and has become an integral element of asset performance. An asset's energy consumption may change over time, based on the conditions of operation and maintenance, eating into margins if it is inefficient. For example, a single 100-horsepower motor running continuously at 95% efficiency over a five-year period will cost an organization close to $350,000 in energy (10¢/kwh). If the same motor consumes just 5% more energy due to suboptimal operation (e.g., energy waste), it will cost almost $17,500 more to operate. By monitoring energy usage, organizations can gain a view of the asset's true operating costs and alert the maintenance and operations departments when excess energy consumption occurs so that waste and its associated costs can be minimized.

Combined, the measurement of these four foundational elements creates the GAS index, which can be used to measure the overall ability of an organization and its building assets to generate revenue, serve tenants well, and keep costs low.

Gauge an asset's performance with the GAS index

The GAS index consists of the measurement of the four major components described in the previous section: availability, performance, quality, and energy consumption. The first three factors are part of overall equipment effectiveness (OEE), while the fourth (energy) is the largest cost driver for operating assets in most organizations. An EAM-based facilities management system can help an organization combine the OEE metric—which factors in the availability, performance, and quality of an asset—with the GAS index to create a complete picture of an asset's performance.

Take, for example, an organization that operates across 50 facilities. A conventional facilities management system may indicate that the chiller component of an HVAC system is operating within acceptable limits, when in actuality the chiller at each facility is consuming $5,000 more in energy than was expected. In this example, GAS could save the organization an additional $250,000 per year in HVAC energy costs on top of traditional EAM system savings.

By incorporating energy consumption into an asset management practice via GAS, organizations can gain the required visibility and control into unnecessary energy usage, while also finding answers to eliminate waste. This approach and resulting savings can be applied to any energy-consuming assets, such as the motors that drive production equipment.

An EAM-based facilities management system can help to deliver these insights, but to do so it must become a system of record, or a consistent single repository, for asset management information throughout the lifecycle of the asset. The EAM system can then play a role as assets are purchased, commissioned, operated, maintained, and even retired. EAM-based facilities management systems offer proven benefits in boosting efficiency through improving equipment capacity, productivity, and operating costs. They also can help increase the productivity of maintenance labor, and can lower maintenance, repair, and operating inventory levels and costs.

Review an asset's energy consumption with EAM tools

Relatively mature organizations already use EAM-based facilities management systems to help keep their equipment operating at peak efficiency. The EAM software helps ensure that systems and pieces of equipment that run production and facilities experience minimal downtime, maximum lifespan, and effective operation. In essence, an EAM-based facilities management system helps align asset infrastructure with business requirements.

What follows are some technologies and practices that organizations can use to review the asset performance in their buildings.

Use submeters in discrete multi-tenant spaces to gather data

Rather than measure a building's energy usage as a whole, the information a building or facility collects can get very granular. This is where submeters come into play. A submetering system collects energy consumption data for electric, water, and gas metering devices. Submeters can be placed in each discrete unit in a multi-tenant building to measure individual apartments, office suites, storefronts, and more.

According to Greentech Media, "submetering discrete building power systems—HVAC, lights, plug loads, common spaces, security and emergency evacuation systems, etc.—can also help a facilities manager optimize each, whether it's predicting which equipment is about to fail and replacing it, or running it when electricity is cheap and shutting down when it's about to skyrocket in price."[6]

With the data gained from submeters, building owners and managers can determine if certain occupants are greater power hogs than others, and incentivize their tenants to control their energy use. In addition, a submeter is a flexible, easily configurable utility that can extract data from building management or EAM system databases on a recurring, automated basis.

Allocate equipment assets based on their Energy Star ratings

One way to determine a building's efficiency and plot a course of action to make improvements is to measure its Energy Star rating. Developed by the Environmental Protection Agency (EPA) and the Department of Energy (DOE), the Energy Star rating is a US-based standard for measuring the energy efficiency of computers, servers, HVAC systems, lighting, and other appliances.

Just as new and used automobiles have a fuel efficiency rating, typically stated in miles per gallon, a property can also earn a rating based on energy efficiency when compared to properties of the same or similar type. The Energy Star rating is a standardized value (1–100) given to a property based on factors such as energy consumption, property use, occupancy, and weather. A rating of 75 indicates that at the time of the rating, the property was in the top 25th percentile of similar properties across the country. The Empire State Building, for example, had an Energy Star rating of 90 in 2013, after its retrofit process.[7]

When data is collected about actual energy usage in a building management or EAM system, this data can be shared with the EPA to determine an Energy Star rating. The EPA provides a suite of web services to enable the exchange of data to manage building characteristics, operational information, and energy data; and to retrieve key performance metrics, such as the Energy Star rating.

Adapt better business practices for degree days

Another strategy for getting the most out of a building's assets is to change business practices for certain assets—HVAC systems, for example—based on seasonal variations. This practice is known as "degree days," where the hotter the day, the harder the equipment will run—hence, a higher bill and a larger CO_2 footprint. Degree days are an average of outside air temperature used to calculate how much energy is needed to heat or cool a building.

There are two types of degree days:

- **Heating degree days (HDD)** are used comparatively to measure the relative severity of a winter, or how much energy is required to heat a building. Heating degree days are used to "relate each day's temperatures to the demand for fuel to heat buildings."[8]
- **Cooling degree days (CDD)** are used comparatively to measure the relative severity of a summer, or how much energy is required to cool a building using an air conditioner.

EAM-based tools

for facilities management can help organizations align their asset infrastructure with their business requirements.

Degree day averages can be created by an EAM system with temperature data sourced from the National Climatic Data Center, the climate data steward of the National Oceanic and Atmospheric Administration (NOAA); and World Weather Online (WWO). By monitoring this data and using it to inform how assets are used, organizations can reduce their CO_2 footprint as well as avoid unnecessary wear and tear on their building's HVAC systems.

In addition, because degree days are an average of regional temperatures, they can be used to determine the best locations to headquarter buildings or facilities that have specific uses. For example, data centers, which need to be kept cool, are best located in regions that have the lowest number of cooling degree days. Adapting business practices to allow for a mobile workforce can also help control energy costs in office buildings during times of the year when there are the highest number of cooling or heating degree days in a particular region.

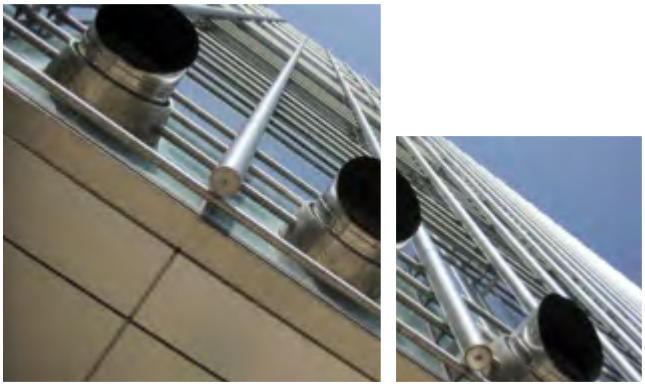
Cut down on energy waste through effective space planning

To make an investment in smart building and asset management technologies that truly delivers, organizations must also take a close look at how their buildings and other facilities are being used. For as much energy as buildings consume, as much as 50% of office space goes unused most of the time, reports the corporate real estate associate CoreNet Global.[9]

With efficient space planning, building managers and owners can account for degree days, allocate their energy resources via submeter data, and ensure proper asset utilization. Effective space planning can be accomplished with the use of smart building technologies such as building information modeling (BIM) tools.

The National BIM Standard (NBIMS) has defined BIM tools as a digital representation of physical and functional characteristics of a facility.[10] BIM tools can help establish asset sustainability and facility baselines, forecast facility operational costs, and access initial layout designs for space management. Not only can BIM be used to create 3D models and visualization aids, but these models can also integrate graphical and non-graphical information.

For decisions and collaboration of different stakeholders at different phases of the lifecycle, BIM can be used to create a shared knowledge resource for information about the facility. A facilities management system should enable organizations to access the BIM equipment data, data sheets, specifications, warranties, and linked documents and drawings to efficiently plan their building and facility spaces. This way wasted space does not result in wasted energy or assets.



Deliver long-term sustainability

Energy is expensive. With the right materials and information, a building can be run in a more efficient manner, while also delivering long-term energy and asset sustainability. Over time, organizations that use smart building technologies can save more on costs; create a more productive building environment for their tenants, patients, or citizens; and continue to gain actionable insights into their building management needs.

For a smart building to succeed, its facilities management system should be able to establish sustainable energy policies and programs, monitor and measure energy performance to determine the causes of energy waste and expense in a timely manner, and enact the activities and programs to correct these issues. This system, with integrated energy and environmental management, should provide end-to-end control over how a building's energy is used, while also providing the ability to continually monitor asset health and behavior, analyze data to detect key trends and anomalies, forecast performance issues, make decisions, and drive action.

With EAM-based facilities management technologies, organizations can collect, monitor, and act on the data their buildings produce. This information can help organizations to realize incredible gains in energy and cost savings, while also adding extra life to their buildings and assets.

Learn more about Infor CloudSuite Facilities Management.

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