Published on *Business Energy Advisor* (https://tva.bizenergyadvisor.com)

Whole-Building Energy Evaluation and Management Strategies

Taking a whole-building approach to energy efficiency is essential for realizing lasting savings in commercial buildings. Not only can this process help to ensure that any individual efficiency measures yield the expected energy savings, but it can also help energy managers to identify potential actions that they may have otherwise been unaware of and to prioritize the implementation of these measures. Use the strategies in this checklist to plan and track your progress in evaluating energy consumption and implementing energy management strategies. It is also worth checking with your local utility for incentives that could help with your efforts. Some utilities now offer incentives for measures that haven't been widely covered before, such as for existing building commissioning and the installation of building automation systems.

Operations

BENCHMARKING

Develop a plan.

Energy-use benchmarking is a process that either compares the energy use of a building or group of buildings with other similar structures or looks at how energy use varies from a baseline. It is a critical step in any whole-building energy evaluation and management project because it informs organizations about how and where they use energy and what factors drive their energy use.

The first step in developing a benchmarking plan is to set a goal for the project. This will help to determine what type of benchmark will be most useful. For example, if the goal is to improve performance over time, the benchmark might be the baseline energy consumption of a building or portfolio of buildings. Alternatively, a project with an external focus may seek to benchmark a facility relative to a measure of the best in class.

Second, define the scope of the benchmarking effort. It may cover whole buildings, a portfolio of buildings, or the entire organization. Its focus may be internal to the company or it may be

external, comparing performance to that of competitors or peers. And the time frame could be annual, monthly, weekly, or even continuously, depending on the goals. The defined goals and scope make it possible to identify a specific benchmark to use (**Table 1**).

TABLE 1: Common benchmarks

The type of benchmark chosen by a company depends on its goals. The most commonly used benchmarks are listed here.

Benchmark type	Description
Best in class	The performance level of the top performers sets the bar when comparing similar buildings.
Performance goal	A specific performance level can be established as a target against which progress can be measured.
Baseline	An initial performance baseline of the building that is established before any commissioning or other measures are taken can be used to track improvements over time.
Above average	Percentages above an average can be used to establish a benchmark.
Commissioned performance level	The performance level of a commissioned building can be used as a benchmark.
National ratings	National performance ratings, such as those established by Energy Star, can be used as performance targets for specific buildings.

© E Source

The U.S. Environmental Protection Agency (EPA), through the Energy Star program, has developed a set of benchmarks that can be used to assess energy performance for many commercial building types, such as the average energy-use intensity for grocery stores and hospitals, for example. The EPA has also developed a building rating system. Both the benchmarks and the rating system can be accessed through a free online tool, Portfolio Manager , which allows users to set up private accounts to track building portfolios, set baselines, share information, and document the results of their efforts to improve energy performance. Note that some limitations of the early versions of Portfolio Manager have been overcome through the addition of new features over the last several years. If the EPA doesn't provide a rating for a specific building type, energy managers can develop their own using technical guidance from the Energy Star *Guidelines for Energy Management*.

Third, determine the type of data that need to be collected. This will typically be set by the type of benchmark selected. For example, to use Portfolio Manager, it is necessary to collect data on specific building characteristics such as operating hours, floor area, and utility bill data. Examples of common data types include energy usage and costs, key physical building attributes, climate, how the space is used (for example, occupancy data), production, and financial data (such as value of shipments).

Lastly, identify and engage partners needed to complete the benchmarking. This could include internal departments or organizations that own the data needed for benchmarking, or external industry or sector partners. An effective partnership requires that the partners

understand the objectives, expected outcomes, and schedule of the project, and know their role and the costs and benefits of their participation. Some participants may feel threatened by energy management efforts, fearing results that may reflect poorly on them. Therefore, it's important to engage partners at the beginning of the process, be open and clear about the purpose of the project, and focus on how it can improve competitiveness and profitability.

Implement the plan.

After a plan has been developed, the next step is to collect data, evaluate benchmark metrics, and apply the results. A variety of software options, both free and for purchase, exist to collect and track data. Portfolio Manager is one widely used free online tool that enables users to track multiple energy and water meters. Other packages include Metrix, Advantage IQ, Energy CAP, EnTERPRIZE.EM, EEM Suite Bill Analyst, EnerCop, and Utility Manager. Different packages may vary significantly in regards to the options offered, and can range from fairly simplistic comparisons of performance between sites to more sophisticated features such as weather normalization and regression analysis. Another option is to build a spreadsheet as a quick check to prioritize further in-depth analysis (though this generally does not provide the degree of functionality that benchmarking software would). If possible, look for software options that import electronic billing data directly from your utility; this will help to minimize data entry errors.

Once data have been collected, specific benchmarks can be computed for the building or across a set of buildings. Software options like Portfolio Manager can allow users to benchmark facilities relative to past performance, view percent improvement, determine energy performance ratings, and convert energy consumption into units of carbon dioxide equivalents (CO_2e) for assessing greenhouse gas emissions or dollars to more directly assess cost data. This information can help to identify sites where on-site audits, tune-ups, and retrofits may be effective, to prioritize investment opportunities, and also to remind local managers about energy-efficient behaviors. Additionally, top-performing buildings can be identified in order to uncover successful management and operational practices that can be applied to lower-performing facilities. Sometimes it may make sense to set new efficiency goals based on the initial benchmarking results (such goals could include improving the efficiency of the poorest-performing buildings or reducing overall energy consumption by a set amount, for example).

Benchmarking data can also be used to foster internal or external recognition, which can generate support for an organization's energy management plan and encourage further efforts. External opportunities for recognition are available through a variety of associations, and participants can receive a number of benefits, including free advertisements and custom

reports detailing the energy performance of their buildings. The EPA also offers recognition—individual buildings that perform in the top quartile are eligible for the Energy Star label, and organizations that partner with Energy Star and achieve a 10 percent energy reduction across their portfolio can become Energy Star Leaders .

Benchmarking can be repeated over time to encourage continuous improvement and track progress in working toward a goal. It can also reveal whether a goal was achieved and how much money was saved.

COMPLETE AN AUDIT

See where your opportunities for efficiency are.

Audits come in varying degrees of detail, but all are aimed at finding options for improving efficiency based on real-world information. Although hiring a consultant is likely the best option for more in-depth auditing, a good first step is to do a walk-through audit. This type of audit involves walking around a facility to identify low- or no-cost operating and maintenance measures that will reduce energy consumption while maintaining or improving comfort and indoor air quality as well as identifying potential capital investments that may prompt further investigation later. Performing a walk-through audit every 6 to 12 months can help a facility manager to indirectly monitor the general performance of various systems, gauge the effectiveness of previous measures, and identify opportunities for additional improvements. For example, if a facility manager notices that a newly installed occupancy sensor isn't turning the lights off, corrective action can be taken to ensure that it performs as originally intended.

When performing a walk-through audit, it's generally a good idea to look at the most energy-intensive areas, such as lighting and HVAC equipment, and also other equipment, such as motors, compressors, refrigeration, and cooking equipment, as well as the overall building shell. Plug loads are also worth reviewing—they may not consume much energy individually, but they can quickly add up to a sizeable amount. A particularly effective strategy for realizing energy savings is simply to look for times when energy is being used even though an area is unoccupied. Another approach is to look for areas of the building that are drafty and may be leaking conditioned air. Easy and low-cost upgrades may also be found, like replacing T12 fluorescent lamps with T8s, incandescent exit signs with light-emitting diode (LED) exit signs, or aging equipment with an Energy Star–labeled alternative.

EXISTING BUILDING COMMISSIONING

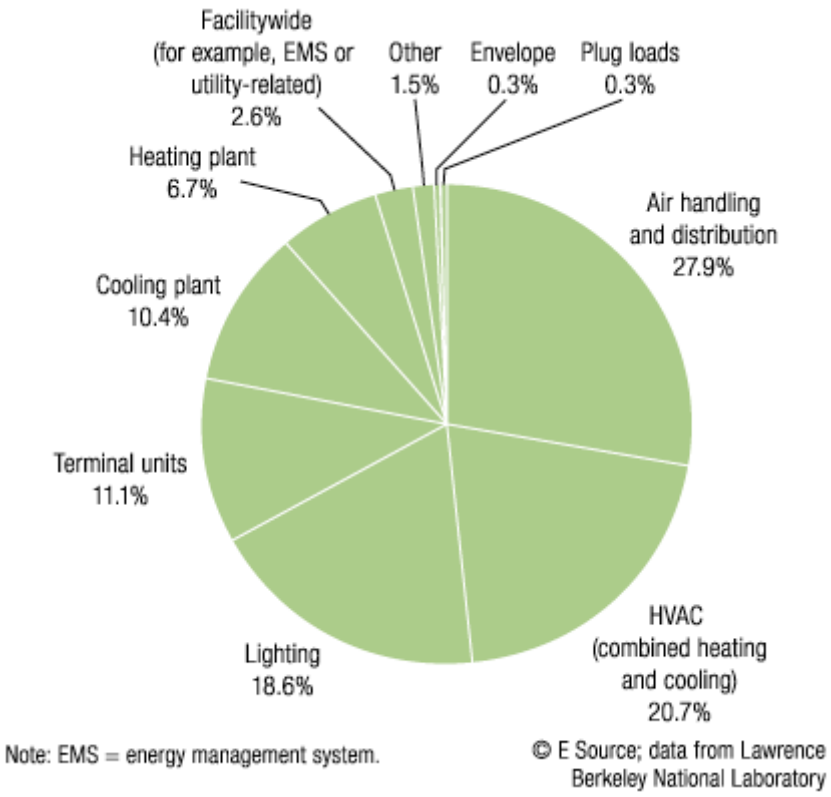
Make sure your building systems are working properly.

Making what you already have work the way it's supposed to is one of the most cost-effective means of improving energy efficiency in commercial buildings. Existing building commissioning is a process that systematically investigates the operation and maintenance of building systems and "tunes" them to work as an integrated whole to suit current needs. Through the use of documentation and process reviews, building inspections and systems testing, commissioning can identify and correct deficiencies that may be difficult or impossible to address with an audit. When this process is applied to existing buildings that have not been commissioned before, it's termed "retrocommissioning," as opposed to "recommissioning," which typically is used for buildings that have been commissioned before and need to be re-tuned.

Retro- and recommissioning yield average whole-building energy savings of 16 percent and a simple payback of 1.1 years, according to data from a 2009 study by Lawrence Berkeley National Laboratory (LBNL). In addition to energy savings, commissioning also yields a number of non-energy benefits, including improved thermal comfort, extended equipment lifetimes, improved indoor air quality, and increased occupant productivity and in-house staff competency. In many cases, LBNL estimates that the non-energy benefits actually exceed the energy savings. **Figure 1** illustrates the problems typically identified through commissioning.

FIGURE 1: Building system deficiencies

According to a 2009 Lawrence Berkeley National Laboratory study, 77 percent of problems identified through existing building commissioning were related to the HVAC system in some fashion (for projects where deficiencies were characterized).



To get started on a retro- or recommissioning project, the first step is to select a building or group of buildings that will likely yield significant energy savings (this may be determined by unusually high energy use, persistent failure of equipment or controls, or frequent comfort complaints), select a commissioning provider, and define the scope of the project. Additionally, it's a good idea to assemble a team of people that can work on the project through to its completion.

Next, gather together all of the documents that will be used by the commissioning team for the comprehensive operations review and complete regular maintenance tasks before the commissioning starts. When the project is underway, having your team assist with monitoring and testing efforts will help to lower the project cost and provide hands-on training for the building staff so that they can maintain the implemented measures. Lastly, after the project is complete, make sure to track implemented measures to ensure that the benefits last. It's a best practice to consider investing in recommissioning every three to five years, especially if energy consumption increases or if there are comfort complaints.

Retrofits

SUBMETERING

Get more accurate information.

For many facilities, information on the amount of electricity used in a given period is only available from one source—the utility's electrical meter. Because of this, adding meters to otherwise unmonitored electrical systems, a process known as submetering, can be a great way to improve energy management and promote efficiency through increased awareness of energy use and accountability.

Electrical submetering systems vary widely in design and application. For instance, they may be used to provide data on loads above a certain size (for example, 50 kilowatts or larger) within a building, or to monitor the energy consumption of a whole campus of buildings. In office buildings and commercial spaces, submetering may make the most economic sense for tenant metering and bill allocations. For manufacturing and industrial sites, shared resources (such as chilled water and compressed air) are likely candidates for submetering, although motor, lighting, or process loads can also be significant depending on the application.

Note that electronic meters that use current sensors (as opposed to electromechanical meters) take up little space and do not require you to shut off the power during installation, greatly simplifying implementation.

BUILDING AUTOMATION SYSTEMS

Make your equipment work for you.

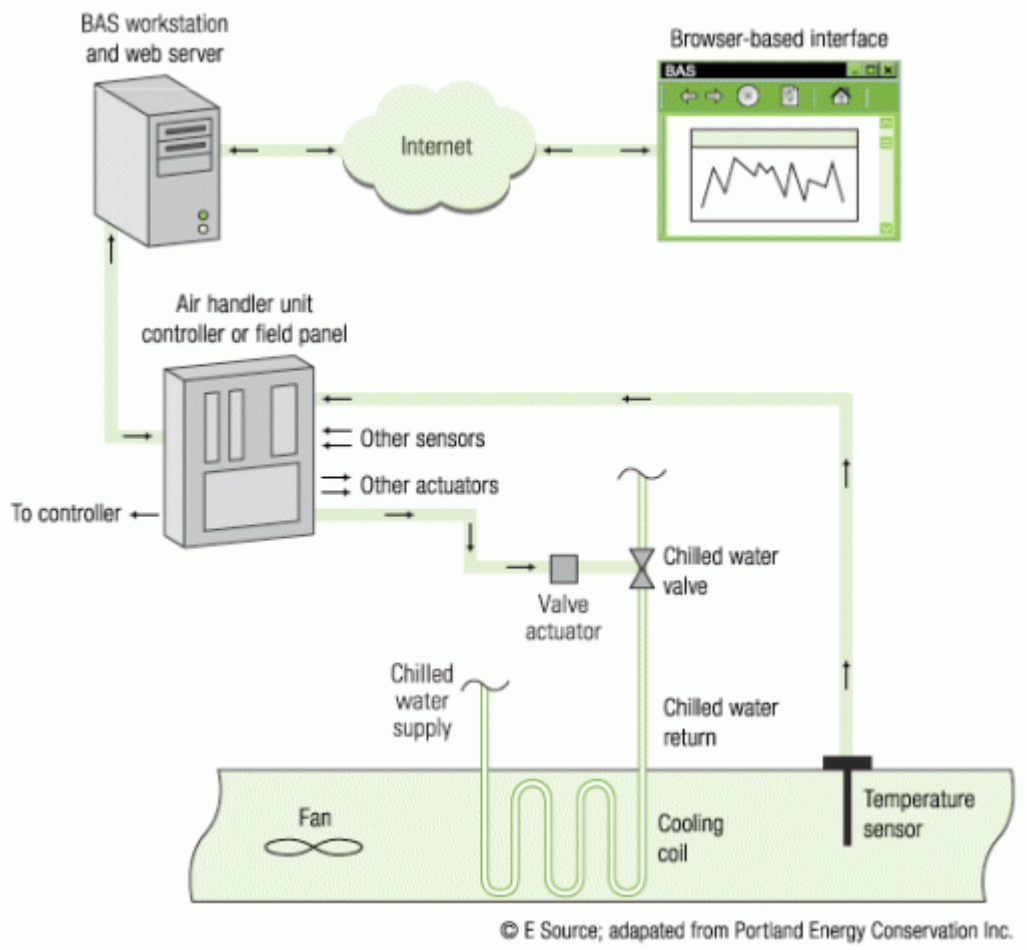
Building automation systems (BASs, also variously called energy management systems, energy management and control systems, central control and monitoring systems, and facilities management systems) can reduce overall building operating costs by automatically controlling building equipment so that it operates more efficiently and effectively. The types of equipment controlled generally include HVAC systems, lighting, security, and fire safety systems.

The BAS itself consists of a network of sensors, controllers, and actuators that are managed through a software package (**Figure 2**). Sensors measure environmental conditions such as temperature, pressure, on/off status, and electrical current and send that information to microprocessor controllers. The controllers process the sensor inputs and generate output signals that are passed along to other devices or equipment. Most current BASs are web-based, allowing a user to access and view the system through an online portal, and some newer systems use wireless networking to coordinate the various system parts. By running equipment only when necessary and changing the level of performance based on demand, BASs can typically save 5 to 15 percent of total building energy consumption, and in retrofit

installations, savings can be as high as 30 percent.

FIGURE 2: Linking building automation systems to building systems

With a building automation system (BAS), building systems can be connected through sensors, controllers, actuators, and software. An operator interfaces with the system via a central BAS workstation, which can be connected to other BAS workstations via the Internet or through remote access.



All content copyright © 1986-2017 E Source Companies LLC. All rights reserved.

Source URL: https://tva.bizenergyadvisor.com/members/CEMC-OMCK-7/OM_Checklist/Whole_Building