Managing Energy Costs in Retail Buildings

A typical 50,000-square-foot (ft^2) retail building in the U.S. spends around $90,000 each year on energy costs. Energy-saving measures thus can boost the bottom line for a retail business or free up funds for other uses, such as investment in store improvements. Furthermore, an energy-efficient building can result in improved customer comfort and better lighting, leading to increased sales as well as a "green" image.

How Retail Buildings Use Energy

In a typical retail building, lighting and heating alone represent nearly 70 percent of total energy use, making those systems the best targets for energy savings. Other sources of energy consumption include cooling, ventilation, and refrigeration (**Figure 1**).

On average, retail buildings use 14.3 kilowatt-hours (kWh) of electricity and 30.9 cubic feet of natural gas per ft^2 each year, with resulting costs of $1.47/$ft^2$ and $0.29/$ft^2$, respectively (assuming average 2009 commercial energy prices of $0.10 per kWh and $0.93 per hundred cubic feet).

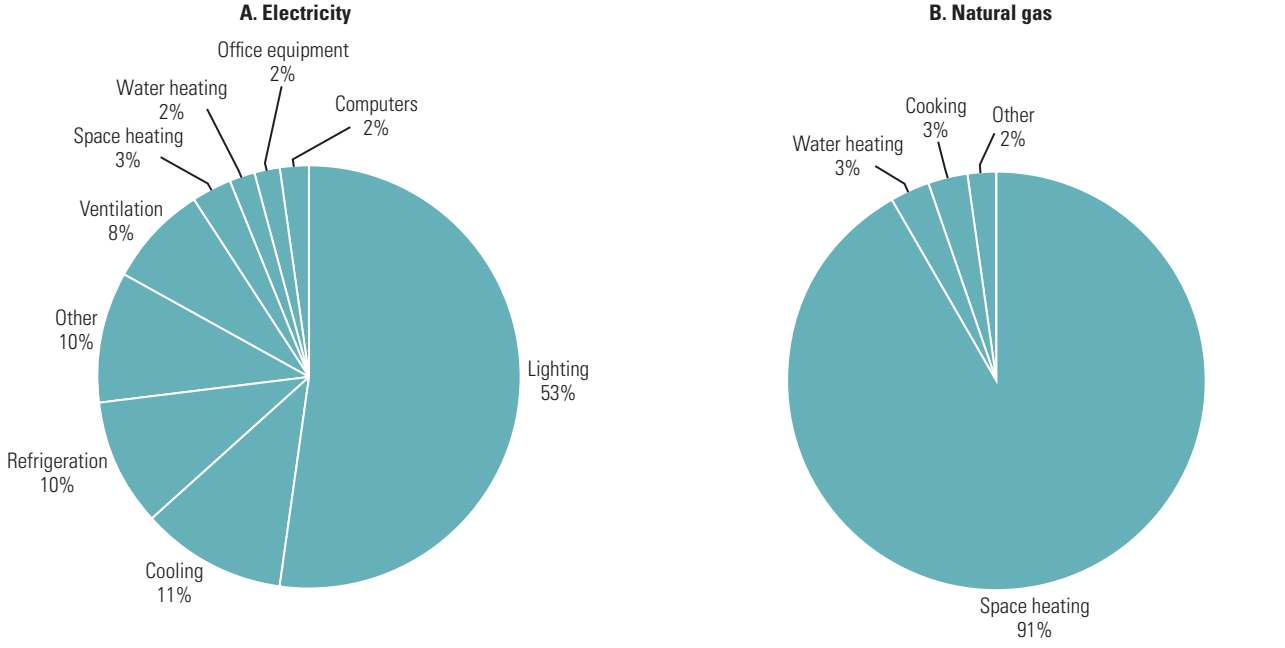
To get a customized benchmark rating of your facility's energy use, you can use the Energy Star Portfolio Manager software. This free software allows you to monitor multiple meters, track a facility's energy use over time, and compare energy consumption with other, similar facilities. Portfolio Manager is available at **www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager**.

Quick Fixes

Many stores can benefit from quick low-cost/no-cost energy-saving solutions, such as turning things off, turning things down, and keeping up with cleaning and maintenance.

FIGURE 1: Energy consumption in U.S. retail buildings by end use

Data from the U.S. Energy Information Administration show that lighting, cooling, and ventilation account for 72 percent of electricity use (A) and space heating dominates natural gas use at 91 percent (B).



Note: Sum may not total 100 percent due to rounding.

Turning Things Off

Turning equipment off might seem too simple to make a significant difference, but it's important to remember that every 1,000 kWh that you save by turning things off takes $100 off your utility bill annually (assuming electricity costs of $0.10/kWh).

Lighting. Turn lights off when they are not in use. When properly installed, occupancy sensors and timers can help to achieve this. A no-cost option is to simply train staff to include turning off lights as part of store closing procedures. (You can also identify the location of light switches on a posted notice.)

Electronic displays. Many stores have electronic displays that are left on even when the store is closed. Consider shutting off the displays at the end of the day either manually or with simple timers.

Turning Things Down

Some equipment cannot be turned off entirely, but turning it down to minimum levels where possible can save energy.

HVAC temperature setbacks. During closed hours, turn temperature settings down in heating seasons and up in cooling seasons. You can automate these settings with programmable thermostats.

Peripheral spaces and back rooms. Make sure that HVAC settings in stockrooms, offices, and other peripheral spaces are at minimum settings.

Cleaning and Maintenance

Making sure that your HVAC system is regularly cleaned and serviced can help to prevent costly heating and cooling bills.

Check the economizer. Many air-conditioning systems use a dampered vent called an economizer that draws in cool outside air to reduce the need for mechanically cooled air. If not regularly checked, the linkage on the damper can seize up or break. An economizer that is stuck in the fully open position can add as much as 50 percent to a building's annual energy bill by allowing hot air in during the air-conditioning season and cold air in during the heating season. Have a licensed technician check, clean, and lubricate your economizer about once a year, and repair it if necessary. If the economizer is still operating, have the technician clean and lubricate the linkage and calibrate the controls.

Check air-conditioning temperatures. With a thermometer, check the temperature of the return air going to your air conditioner and then check the temperature of the air coming out of the register that is nearest the air-conditioning unit. If the temperature difference is less than 14 degrees or more than 22 degrees, have a licensed technician inspect your air-conditioning unit.

Change the filters. Dirty filters can restrict airflow, making your HVAC system work harder to heat or cool your facility. Filters should be changed monthly—and more often if you are located next to a highway, construction site, or other site where the air is dirtier than usual.

Check the cabinet panels. On a quarterly schedule, make sure the panels to your rooftop air-conditioning unit are fully attached, with all screws in place and all gaskets intact so that no air leaks out of the cabinet. Chilled air leaking out can cost nearly $100 per rooftop unit per year in wasted energy.

Clean the condenser coils. Condenser coils are vital to the operation of air-conditioning units. Check the condenser coils quarterly for either man-made or natural debris that can collect in them. At the beginning and end of the cooling season, thoroughly wash the coils.

Check the airflow. Hold your hand up to the registers to ensure that there is adequate airflow. If there is little airflow, or dirt and dust are found in the register, have a technician inspect your unit and ductwork.

Longer-Term Solutions

Longer-term solutions should also be considered. Although the actions covered in this section require more extensive implementation, they can dramatically increase the efficiency of your facility without compromising the shopping environment. Ask your utility for more information about initiating such projects.

Commissioning

Commissioning is a process in which engineers systematically check and tune up building systems to ensure that they are operating appropriately and efficiently. Studies have shown that commissioning a building's energy systems can lead to reductions of around 16 percent in annual energy bills. For the typical 50,000-ft^2 retail building, that equates to more than $14,000 in savings per year. In addition to energy savings, commissioning often increases comfort for occupants. The majority of problems identified tend to concern HVAC systems, particularly air-distribution systems. Problems with low-voltage electrical systems such as lighting, alarm, and building management systems are also frequently uncovered. If your building was previously commissioned, consider investing in recommissioning every three to five years.

Lighting Measures

Lighting is critical, both in creating ambiance and in making merchandise attractive to shoppers. High-quality lighting can reduce energy bills and drive higher sales.

Display lighting. Proper display lighting is critical for boosting retail sales and preventing merchandise returns. Quartz halogen lamps are commonly used for accenting merchandise because they provide a bright, focused column of light. Unfortunately, these lamps are energy-intensive. Efficient alternatives to consider for accenting merchandise are compact fluorescent or metal halide track or spot lights. Have a lighting consultant review your lighting layout to ensure that it provides the appropriate light levels, quality of light, color rendering, color uniformity, and energy performance.

Fluorescent lamps. If your facility uses T12 fluorescent lamps, relamping with modern T8 lamps and electronic ballasts can reduce your lighting energy consumption by 35 percent. Adding specular reflectors, new lenses, and occupancy sensors or timers can double the savings and yield short payback periods.

Big-box retail stores with high ceilings can switch to a system that features T5 lamps complemented by indirect fixtures to boost both lighting quality and efficiency. T5 lamps are far more energy efficient and offer better light quality than the high-intensity discharge lights that are typically found in stores with high ceilings.

Daylighting. Using natural daylight in retail stores can save energy and potentially improve sales as well. A 2003 study, "Daylight and Retail Sales," sponsored by the California Energy Commission, found that stores employing significant daylighting had sales increases of up to 6 percent over non-daylit stores. The study also found that employees were more satisfied with daylighting, perceiving more lighting uniformity even when testing showed that the lighting was actually less uniform overall. To put it simply, people respond positively to environments that are enhanced with natural lighting.

Smart lighting design in parking lots. In its "Lighting Handbook," the Illuminating Engineering Society of North America recommends that parking lots be lit at an average of one footcandle or less of light, but most parking lots are designed with far more lighting than that. Using lower-wattage bulbs can actually increase the safety of your lot: An overlit lot can be dangerous to drivers if their eyes cannot adjust quickly enough in the transition from highly lit to dark areas. When designing lighting for a new parking lot, instead of high-pressure sodium lamps, consider using low-wattage metal halide lamps in fixtures that direct the light downward. Even with a lower wattage, a retail store could safely use fewer lamps if this choice is made. Metal halide is less efficient than high-pressure sodium in conventional terms, but it puts out more light in the blue part of the spectrum, which turns out to be easier for our eyes to see under low-light conditions.

Demand-Controlled Ventilation

When only a few people are in a store, energy can be saved by decreasing the amount of ventilation supplied by the HVAC system. A demand-controlled ventilation (DCV) system senses the level of carbon dioxide in the return airstream and uses it as an indicator of occupancy. DCV can save energy during peak cooling periods when many shoppers are at work and occupancy is low. In retail sales applications, DCV works best when a dedicated HVAC system serves the sales floor.

Vending Machines

Use occupancy sensors to power down vending machines when the area is unoccupied or consider upgrading to Energy Star–certified machines. Both of these measures can reduce energy use by up to 50 percent, resulting in annual savings of more than $150.

Reflective Building Roof Coating

If a roof needs recoating or painting, consider white or some other highly reflective color to minimize the amount of heat the building absorbs. This change can often reduce your peak cooling demand by 15 to 20 percent, in addition to reducing your overall cooling load. To get an idea of how much you can save, check out the Energy Star Roofing Calculator: www.roofcalc.com/RoofCalcBuildingInput.aspx. Energy Star also provides a list of suitable reflective roof coating products: www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products.

LED Exit Signs

Light-emitting diode (LED) exit signs are well established in the marketplace and can offer significant savings. Although recent federal legislation mandates that all new exit signs must be energy efficient, there are still many buildings with inefficient signs. Exit signs are easy to retrofit, and many retailers sell white LED light strips that simply screw into the incandescent interface. To achieve even better performance, the entire fixture can be replaced. Old incandescent exit signs typically use around 40 watts; replacement LED signs use about 3 watts. In addition to energy savings, less maintenance is required—LEDs can last more than 10 years without lamp replacement, compared to less than 1 year for an incandescent sign. Overall, this means that an LED exit sign that is on for 24 hours a day can reach payback within 6 months and save about $100 per year.

The Bottom Line

The conservation measures we've outlined represent good investments. Not only will they save you money, but they can also enhance the aesthetics of your store and increase the amount of merchandise you sell.

Resources

Energy Star for Retail, www.energystar.gov/index.cfm?c=retail.bus_retail. Energy Star for Retail provides case studies, technical guidelines, and energy benchmarking tools to assist businesses with their energy-saving goals.

Natural Resources Canada, "Energy Efficiency in Buildings: Saving Energy Dollars in Stores, Supermarkets and Malls," http://oee.rncan.gc.ca/publications/commercial/m144-23-2003e.cfm?attr=16. This publication of the Canadian government is a comprehensive guide to energy-efficiency measures that retail stores can undertake.

New Buildings Institute, "Advanced Lighting Guidelines," www.advancedbuildings.net/ALGOnline.htm. This free guide aims to be the definitive resource for lighting design and provides advice for a number of different retail building types.

U.S. Department of Energy (DOE), "Energy Cost Calculators for Energy-Efficient Products," www1.eere.energy.gov/femp/technologies/eep_eccalculators.html. The DOE's Energy Efficiency and Renewable Energy web site provides a number of calculators that estimate savings resulting from the installation of energy-efficient products.