

Managing Energy Costs in Grocery Stores

A typical 40,000-square-foot (ft²) grocery store in the U.S. can spend nearly \$230,000 annually on energy. Although energy represents only about 1 percent of total grocery store costs, it is approximately equal to a typical grocery's profit margin. Therefore, a 10 percent reduction in energy costs can mean a 10 percent increase in profits!

How Grocery Stores Use Energy

In a typical grocery, refrigeration and lighting represent about 80 percent of total electricity use, and space heating consumes 68 percent of natural gas use (**Figure 1**), making these systems the best targets for energy savings. On average, a grocery store in the U.S. uses 51 kilowatt-hours (kWh) of electricity and 41 cubic feet per ft² of natural gas annually. (Data are calculated based on a 2003 U.S. Energy Information Administration survey of commercial buildings.) The average annual cost per square foot for supermarkets in the U.S. is approximately \$5.31 for electricity and \$0.38 for natural gas, based on average national commercial rates.

For a customized benchmark of your facility, use the Energy Star National Energy Performance Rating system via Portfolio Manager software, which will rate the energy efficiency of your store on a scale of 1 to 100 (www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager).

Quick Fixes

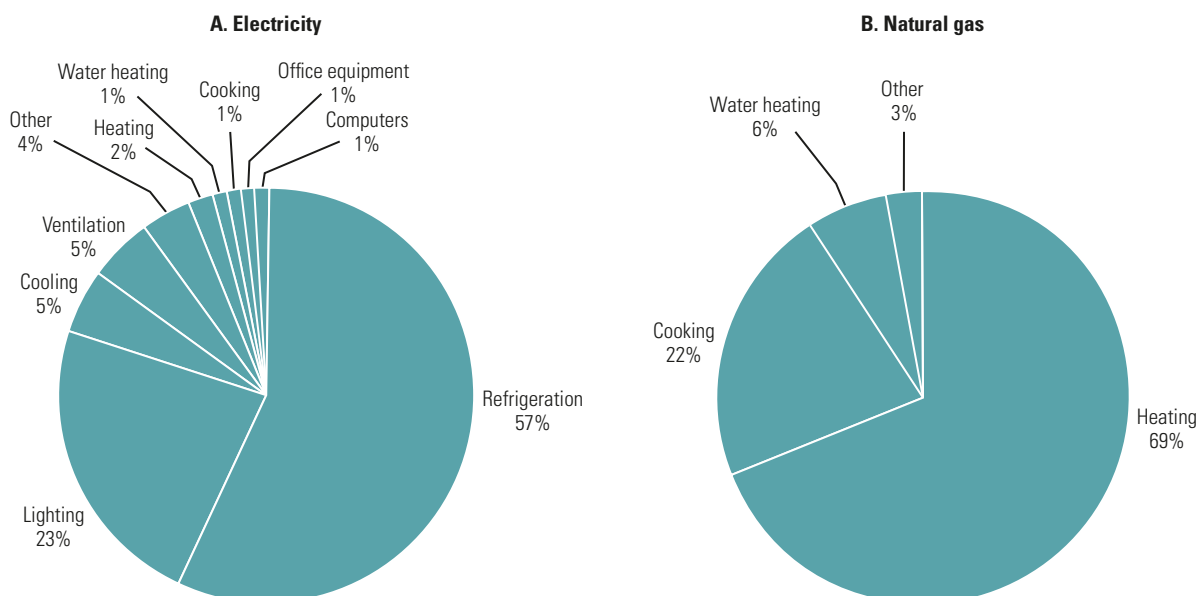
Many grocery stores can benefit from low- or no-cost energy expenditure reductions.

Turning Things Off

It's the simplest of ideas: Remember that every 1,000 kWh you save by turning things off equals \$100 off your utility bill. (This assumes average electricity costs of \$0.10/kWh.)

Plugged-in devices. Computers, cash registers, deli scales, and deli cooking equipment should be shut off when not in use. "Smart" power strips with built-in occupancy sensors are available to shut off plugged-in devices when no users are present.

FIGURE 1: Average grocery store energy consumption by end use in the U.S.
Data from the U.S. Energy Information Administration show that refrigeration and lighting comprise 80 percent of electricity use (A) and space heating dominates natural gas use with 68 percent (B).



Note: Sum may not add up to 100% due to rounding.

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Lights. Turn off lights when they're not in use. Occupancy sensors can help, but a less expensive alternative is to train staff to ensure that switches are off when the lights aren't needed. Stores open all night may want to install dual-level switching for overhead lights, allowing alternate fixtures to be turned off during low-traffic hours.

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.

Special-use rooms. Make sure that HVAC settings in warehouses, stockrooms, offices, and other special-use rooms are at minimum settings.

Cleaning and Maintenance

For proper performance of existing equipment, it is important to ensure that these measures are performed on a regular schedule.

Check the economizer. Many air-conditioning systems use a dampered vent called an economizer to draw in cool outside air when it is available to reduce the need for mechanically cooled air. The linkage on the damper, if not regularly checked, can seize up or break. An economizer stuck in the fully open position can add as much as 50 percent to a building's annual heating costs by allowing cold air in during cooler months. Have a licensed technician calibrate the controls; check, clean, and lubricate your economizer's linkage about once a year; and make repairs if necessary.

Check air-conditioning temperatures. With a thermometer, check the temperature of the return air going to your air conditioner. Then check the temperature of the air coming out of the register nearest the air-conditioning unit. If the temperature difference is less than 14° Fahrenheit (F) or more than 22°F, have a licensed technician inspect your air-conditioning unit. Also, ask your service technician to annually check the calibration of temperature and humidity sensors.

Change air filters. Change air filters every month—more often if you're located next to a highway or construction site where the air is much dirtier.

Inspect and replace gaskets On a quarterly basis, inspect the gaskets on all refrigerated-case doors and rooftop air-conditioning units. If any door seals are broken or compromised, replace them. For the air conditioner, make sure that the panels are fully attached with all screws in place and that gaskets are intact so no chilled air leaks out of the cabinet. Such leaks can cost more than \$100 per year in wasted energy for each rooftop unit.

Clean condenser coils. Condenser coils should be brushed or vacuumed quarterly to remove debris, natural or otherwise, that has collected there. Thoroughly wash the HVAC cooling coils at the beginning and end of the cooling season. Refrigeration coils should be cleaned every six months.

Maintain appropriate refrigeration settings. Energy is wasted if temperature settings in refrigerated systems drift too low. The most commonly used settings for freezers are between -14° and -8°F. For refrigerators, they are between 35° and 38°F.

Longer-Term Solutions

Although the actions described in this section require more extensive implementation and investment, they can dramatically increase the efficiency of your grocery. Ask your local utility's representative for more information about initiating such projects.

Optimize Refrigeration

Refrigeration-system optimization can reduce refrigeration energy use by 24 percent relative to standard practice. These measures yield the largest savings.

Floating head pressure. Taking advantage of lower ambient temperatures to reduce refrigerant temperatures is a form of "free" cooling. One approach is to allow the pressure of the vapor coming out of the compressor (the "head pressure") to float—that is, to drop with reduced ambient temperatures. This requires an expansion valve capable of operating at lower



pressures and flow rates, and such valves are now commercially available. In addition, refrigerant pressures must be kept high enough to avoid “flashing,” which is the unwanted vaporization of refrigerant. One study found annual savings of 75,000 to 150,000 kWh, or up to \$15,500 per year, through the implementation of a floating head pressure control system.

Anti-sweat heater controls. Many refrigerated display cases have a device called an anti-sweat heater, which heats the door to prevent condensation when it is opened. Anti-sweat heater controls monitor the temperature or humidity of the store and run the heater only when there is a risk of condensation. By decreasing the operational time of the heaters, not only do the heaters themselves use less energy, but the amount of heat they add to the refrigerated case is also decreased. One grocery store with 143 display-case doors estimated that it saved 265,000 kWh per year by installing the controls (for a typical grocery store, this is equivalent to saving more than \$27,000).

Evaporative condensers. Most condensers in grocery stores are air-cooled, but it is technically possible to use evaporative condensers, in which water is sprayed over the condensing coils, instead. Evaporative condensers are more energy efficient, but they do have a notable disadvantage: They require a water supply, which often means increased maintenance due to freezing, clogging, and mineral buildup. Evaporative condensers may be cost-effective in drier climates, but the added maintenance may make them unattractive in other climates.

Display-case shields. One simple fix can produce a surprising amount of savings for open refrigerated cases. Aluminum display-case shields, also known as night covers, can reduce the daily refrigeration load from the display case by 8 percent when applied overnight. Products are kept colder when the shields are in place and remain colder for several hours after the shields are removed. Similar products made of different materials are also available.

Heat recovery. Many groceries use heat-recovery systems to capture waste heat from refrigeration systems to make hot

water for use in the store. The hot water can be used for kitchen cleanup areas or bathroom sinks, or it can be run through a heat exchanger for space heating in cold weather. Hannaford Bros. Co. stores in the Northeast use heat reclamation to displace fossil fuels for space and water heating.

Smart defrost controllers. When installed in walk-in freezers, a smart defrost controller monitors several variables and optimizes the number of daily defrost cycles. Adding these kits can save hundreds of dollars a year, depending on the size of the freezer.

LED refrigerated-case lighting. Light-emitting diodes (LEDs) have become increasingly attractive options for use in refrigerated display cases for several reasons. When Walmart replaced the conventional fluorescent T8 lamps with LED fixtures tied to occupancy sensors in 500 stores, energy consumption by the refrigerated-case lighting dropped by about 70 percent and the lights were only on about 60 percent of the time. Not only do LEDs require less energy for lighting, but the fixtures can also be installed to dissipate heat outside the case, resulting in reduced refrigeration energy needs. In all, for every watt in reduced lighting energy consumption, there is an additional 0.48-watt savings from reduced refrigeration demands.

Consider Desiccant Dehumidification

In humid climates, much of the air-conditioning energy is used to remove moisture from air. Desiccant dehumidification can be a cost-effective solution for removing this moisture because it uses natural gas instead of electricity. If you choose desiccant dehumidification, air-conditioning equipment can sometimes be sized smaller because it is only used to cool dry air.

Kitchen Appliances

Kitchen energy use is becoming an increasingly significant portion of grocery store energy use. There are a number of technologies and practices any commercial kitchen can pursue to curtail these growing energy costs. Some of the more cutting-edge technologies commercial kitchens can employ to reduce energy consumption include:

- Connectionless steamers
- Rapid-cook ovens
- Variable-speed kitchen ventilation hoods
- Advanced fryers

Upgrade to Efficient Lighting

Because electric lights in supermarkets remain on for extended periods, substantial savings can be found by making improvements to lighting systems. Many supermarket owners have already upgraded their lighting systems at least once. However, auditors continue to find new and overlooked lighting opportunities in supermarkets.

For storewide ambient lighting, efficient linear fluorescent systems—either T5 lamps or high-performance T8 lamps—can reduce lighting energy consumption by 35 percent or more compared with T12 lighting. In high-bay areas and big-box stores with ceiling heights greater than 15 feet, high-performance T8 and high-output T5 lamps are the most efficient approaches. However, some grocery store owners prefer the look of semispherical metal halide fixtures. In those cases, ceramic metal halide fixtures with electronic ballasts are a good choice because they combine high efficiency with superior color quality.

For exterior signage, high-efficiency fluorescent systems are the most efficient choice for internally illuminated box signs. In other applications, such as channel letter signs, accent lighting, architectural lighting, and neon-style signs, LEDs are significantly more efficient than traditional incandescent or neon sources. And because LEDs have a far longer lifetime than these competing technologies, the long-term maintenance and replacement costs are also lower.

LED exit signs are now a mature technology that can offer significant savings. Exit signs are easy to retrofit, and many retailers sell white LED light strips that simply screw into the incandescent interface in an exit sign. These kits cost on the order of \$20 and can generally reach payback in two years. To achieve even better performance, the entire fixture can be replaced at an installed cost ranging from \$30 to \$250,

depending on the style of sign. Energy Star estimates the average replacement cost per sign to be about \$40. Incandescent exit signs typically use about 40 watts; replacement LED signs use about 3 watts. So, for a sign that operates 24 hours a day, replacing a conventional sign with an LED model would save approximately \$35 per light annually.

Use Smart Lighting Design in Parking Lots

For parking and outdoor applications, high-intensity fluorescent (HIF) lighting is often a more efficient choice than high-intensity discharge (HID) lighting. HIF fixtures can provide more-even illumination with fewer fixtures than HID lights. To maintain their light output, HIF lamps should be enclosed when used outdoors in cold climates.

Recently, LEDs have emerged as an even more efficient option than high-intensity lighting. However, because of the high initial price, many stores might find that LEDs do not yet offer suitable returns. Future price reductions and Energy Star standards will likely spur more widespread adoption of LEDs for this application.

Resources

Energy Star for Grocery and Convenience Stores, www.energystar.gov/index.cfm?c=grocery.sb_grocery. Energy Star is the preeminent consumer information source for energy-efficient appliances. The program also provides resources for supermarket and convenience store owners, including case studies.

U.S. Environmental Protection Agency (EPA) Building Upgrades Manual for Supermarkets and Grocery Stores, www.energystar.gov/ia/business/EPA_BUM_CH11_Supermarkets.pdf. The EPA's Building Upgrades Manual provides owners and operators with a resource for energy conservation and efficiency information.

Natural Resources Canada: 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 any supermarket can undertake.

