

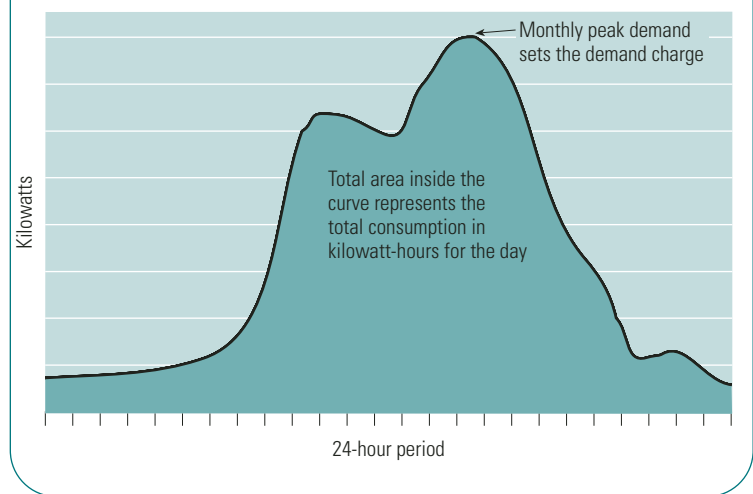
Managing Energy Costs in Grocery Stores

Grocery stores in the U.S. spend an average of \$3.95 on electricity and 24 cents on natural gas per square foot annually. In a typical grocery, refrigeration and lighting represent between 44 and 77 percent of total use depending on climate, making these systems the best targets for energy savings (see illustration, next page).

Although energy only represents about 1 percent of total grocery store costs, it is about equal to a typical grocery's profit margin. Therefore, a 10 percent reduction in energy costs can mean a 10 percent increase in profits!

To better manage your building's energy costs, it helps to understand how you are charged for those costs. Most utilities charge commercial buildings for their natural gas based on the amount of energy delivered. Electricity, on the other hand, can be charged based on two measures—consumption and demand (**Figure 1**). The consumption component of the bill is based on how much electricity in kilowatt-hours (kWh) the building consumes during a month. The demand component is the peak demand in kilowatts (kW) occurring within the month—or, for some utilities, during the previous 12 months. Demand charges can range from a few dollars per kilowatt-month to upwards of \$20 per kilowatt-month. Peak demand can be a considerable percentage of your bill, so care should be taken to reduce it whenever possible. As you read the following energy cost management recommendations, keep in mind how each one will affect both your consumption and demand.

Figure 1: Diagram of a hypothetical daily load shape



Quick Fixes

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

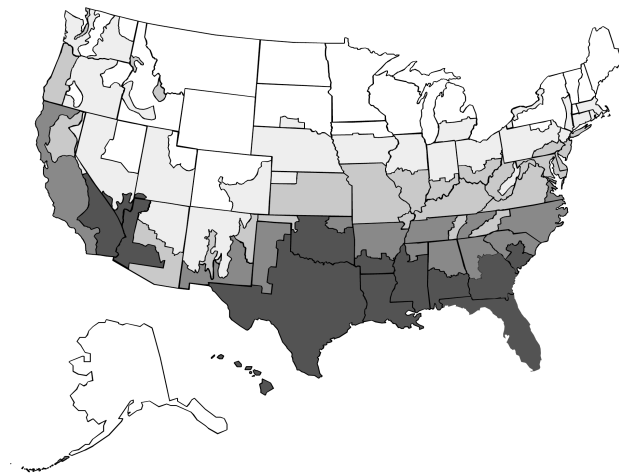
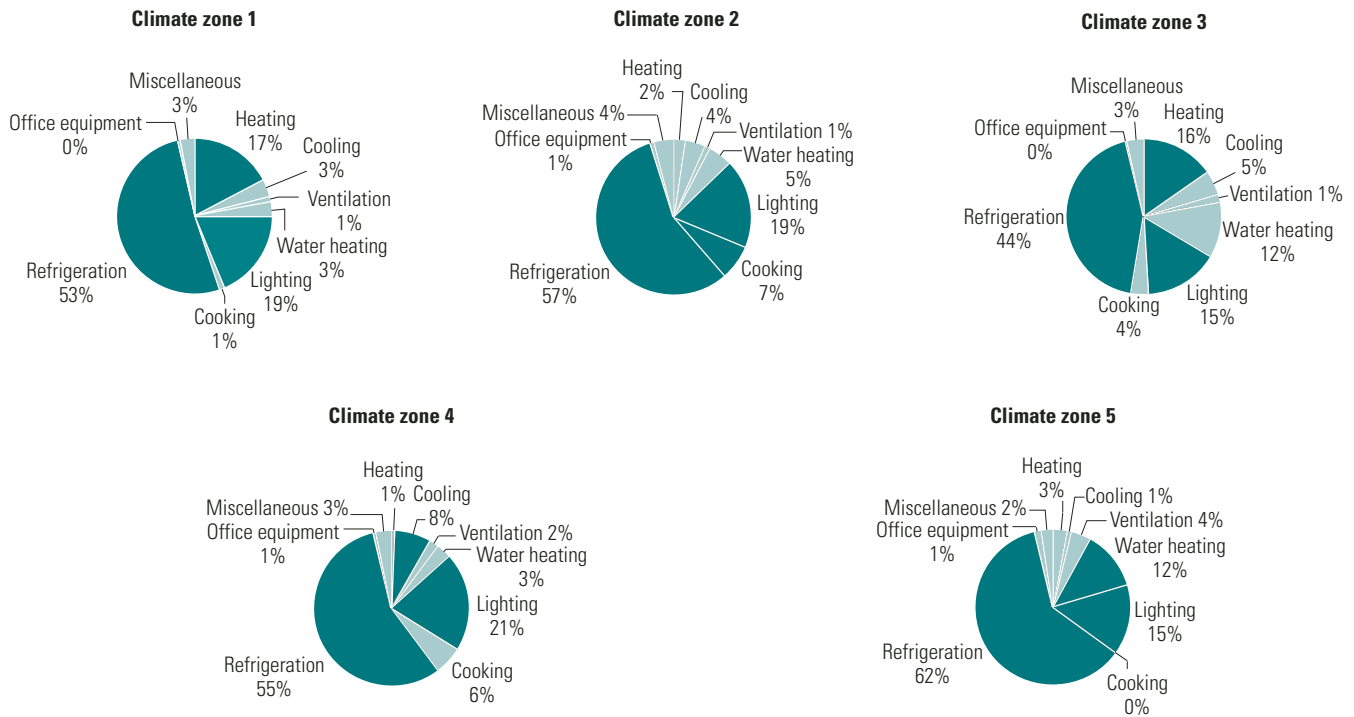
Turning Things Off

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 10 cents/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.

Lights. Turn off lights when they're not in use. Occupancy sensors can help; a less expensive alternative is to train staff to ensure that switches are off when the lights aren't needed. Stores

Energy consumption by end use in supermarkets for five U.S. climate zones



Climate zones

-  Zone 1 is less than 2,000 CDD and greater than 7,000 HDD.
-  Zone 2 is less than 2,000 CDD and 5,500–7,000 HDD.
-  Zone 3 is less than 2,000 CDD and 4,000–5,499 HDD.
-  Zone 4 is less than 2,000 CDD and less than 4,000 HDD.
-  Zone 5 is 2,000 CDD or more and less than 4,000 HDD.

Note: CDD = cooling degree day; HDD = heating degree day

Source: U.S. Energy Information Administration

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 warming 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

Check 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 energy bill by allowing in hot air during the air-conditioning season and cold air during the heating season. 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 degrees Fahrenheit (°F) or more than 22°F, have a licensed technician inspect your air-conditioning unit.

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

Check cabinet panels. On a quarterly basis, make sure that the panels to your rooftop air-conditioning unit 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 \$100 per year per rooftop unit in wasted energy.

Clean condenser coils. Check condenser coils quarterly for debris, natural or otherwise, that has collected there. At the beginning and end of the cooling season, thoroughly wash the coils.

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

Longer-Term Solutions

Although the actions described in this section require more extensive implementation, 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 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. In one field test, operating a system with floating head pressure reduced annual electricity costs by 4.9 percent relative to operating with fixed head pressure.

Ambient and mechanical subcooling. Reducing the temperature of the liquid refrigerant below its condensation temperature is called subcooling. This can be done either by using ambient air or water to remove heat from the liquid refrigerant (ambient subcooling) or by using an additional refrigeration system (mechanical subcooling). Colder refrigerant means more cooling per pound of refrigerant delivered to the display case or shorter compressor run-times, because less refrigerant is needed. This in turn can decrease energy use. Ambient subcooling is often more cost-effective than mechanical subcooling, as it requires less equipment.

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.

Install display case shields. Aluminum display case shields can reduce refrigeration load from the display case by 8 percent when applied overnight and 40 percent when applied over a 24-hour holiday, relative to the load present without the shield! Products are kept colder when the shields are attached and remain colder for several hours after the shields are removed.

Consider Desiccant Dehumidification

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

Upgrade to More Efficient Lighting

Lighting is critical to creating ambiance and making merchandise attractive to shoppers. High-quality lighting design can reduce energy bills and drive sales. 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 and new lenses and reducing the number of lamps can double the savings. Occupancy sensors or timers can add further savings in storerooms and other staff-only areas. Paybacks of one to three years are common.

Change display case lighting to T8 lamps and electronic ballasts and, if possible, move display case lighting outside of the case. Changing to T8

lamps can reduce display case energy consumption by 13 percent.

Supermarkets with high ceilings might want to consider using T5 lamps and 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 typically found in high-ceiling stores.

Use smart lighting design in parking lots. Most parking lots are designed with far more lighting than the Illuminating Engineering Society of North America's *Lighting Handbook* (2000) recommends—that is, an average of 1 foot-candle or less for most applications. 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, consider low-wattage metal halide lamps in fixtures that direct the light downward, rather than high-pressure sodium lamps. Even with a lower wattage, a grocery 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.

Consider Reflective Roof Coating

If the 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 peak cooling demand by 15 to 20 percent. For a list of suitable reflective roof coating products, check out the Environmental Protection Agency's Web site at <http://yosemite1.epa.gov/estar/consumers.nsf/content/roofbus.htm>.

The Bottom Line

All of the conservation measures discussed here represent good investments. Most will not only save money but also enhance both the aesthetics of your store and the amount of merchandise it sells.

