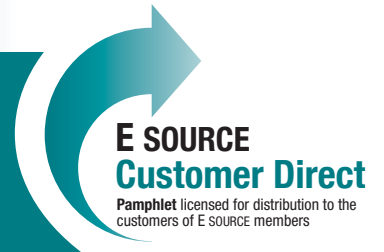


Managing Energy Costs in Convenience Stores

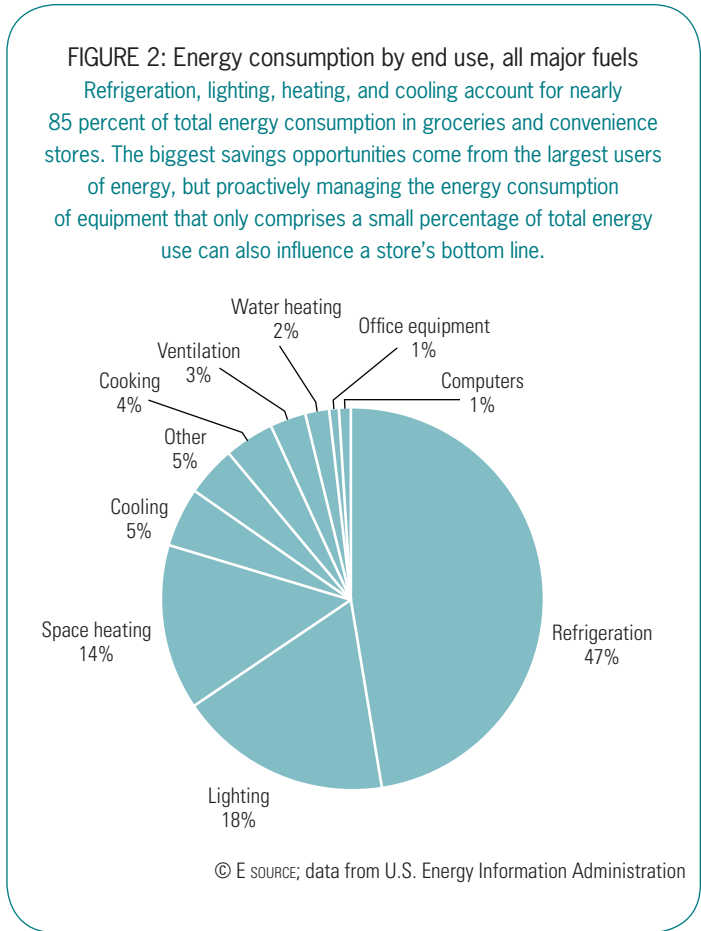
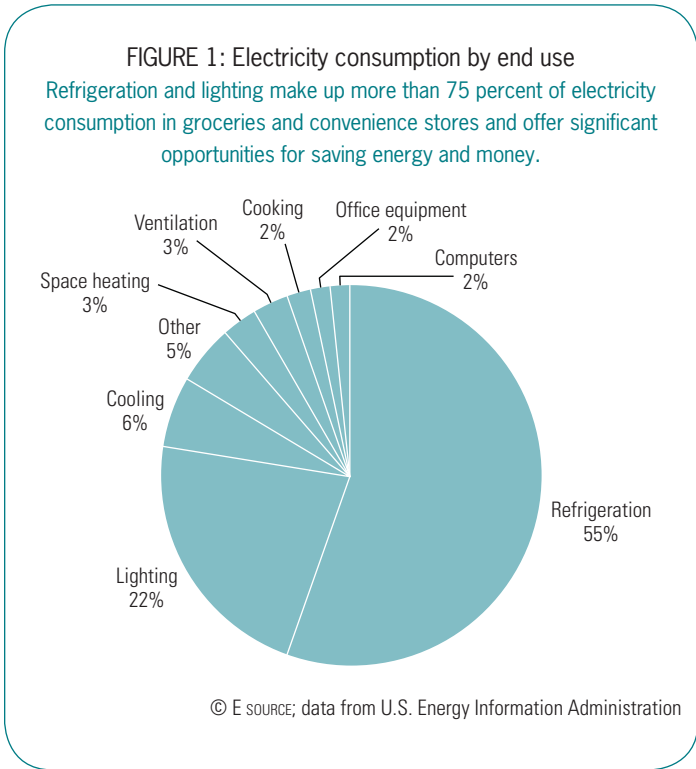


A typical convenience store in the U.S. uses an average of 52.5 kilowatt-hours (kWh) of electricity per square foot and 38.2 cubic feet of natural gas per square foot per year. However, energy intensity can be greatly amplified by a variety of factors, including the quantity and types of hot food you're selling, the amount of refrigerated space in the store, and the levels of interior and exterior lighting (for example, if your store also has a gas station with a lighted canopy). Factoring in these elements means that your monthly electricity usage may be anywhere from 15,000 kWh/month to 50,000 kWh/month. Although there are many differences among convenience stores, there are many similarities in how they use energy.

In general, refrigeration and lighting collectively account for more than 75 percent of total electricity use in an average grocery or convenience store (**Figure 1**). Looking at energy

consumption across all types of fuels (including electricity, natural gas, and heating oil) provides a more complete picture about where energy is being used and where it can be cost-effectively managed to reduce waste and decrease costs (**Figure 2**).

Although energy expenditures represent a relatively small fraction of a convenience store's total operational costs, improving efficiency and reducing energy costs can increase its profits by as much as 10 percent. We found a variety of measures—ranging from those that promise a quick payback to longer-term investment options—that can help you better manage your store's energy costs and save you money.



Quick fixes

Convenience stores can benefit from many easy, low- or no-cost fixes that can add up to significant energy savings—assuming average electricity costs of 10 cents/kWh, every 1,000 kWh you save equals \$100 off your utility bill.

Refrigeration

Check temperature settings in refrigerators and freezers.

Temperatures that drift below recommended levels can be wasting energy and costing you money. The most commonly used settings are between -14° and -8° Fahrenheit (F) for freezers and between 35° and 38° F for refrigerators.

Check refrigerated cases for air leakage. Inspect and replace worn seals and gaskets on refrigerator and freezer doors. Ensure that doors are closed or install automatic door closers to prevent heat from entering the refrigerator or freezer and increasing the energy required to cool units. Add strip curtains to doors of walk-in coolers.

Check the refrigerant charge. Incorrect refrigerant charge can reduce equipment efficiency by 5 to 20 percent and raise the risk of early component failure. Have a licensed technician check the refrigerant charge annually.

Clean evaporator coils. The buildup of dirt and ice on evaporator coils slows down the rate of heat transfer and causes the refrigeration system to use more energy to maintain the same temperature.

Lighting

Replace incandescent lightbulbs with screw-in CFLs.

Replace incandescent lightbulbs that are on for longer than two hours per day with compact fluorescent lamps (CFLs), which are three times more energy efficient than incandescent bulbs and can last up to 10 times longer. If the existing bulbs are on dimming circuits, consider the use of cold-cathode fluorescent lamps.

Install occupancy sensors. Wall-mounted occupancy sensors that replace an existing wall switch cost between

\$30 and \$90 uninstalled. Occupancy sensors can save 30 to 75 percent in energy consumption when used in back offices, storage rooms, or restrooms. A less expensive alternative is to train staff to turn lights off when not in use.

Use LEDs for exit and other signage. Retrofitting incandescent exit signs (which use around 40 watts) with light-emitting diode (LED) signs (which use about 3 watts) is easy. Many retailers sell white LED light strips that screw into the incandescent interface in an exit sign. These strips cost \$20 or less for a two-“bulb” set, and payback is generally about two years. Replacing an incandescent exit sign with a whole new LED unit can save even more energy. An LED sign can cost from \$30 to \$250, and payback ranges from three months to four years. LEDs are also an efficient alternative to neon lighting for exterior and department signage.

Consider dual-level switching. Convenience stores that are open all night may want to install dual-level switching for overhead lights, allowing some fixtures to be turned off at night or during low-traffic hours. Studies have shown that people prefer lower light levels at night.

Heating and Cooling

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

Adjust thermostat settings. Raise air-conditioning setpoints by 2° F and lower heating setpoints by 2° F. 7-Eleven implemented this change and estimates that the company will save more than \$5 million across its 6,300 chain stores in the U.S. Maintain minimum heating and cooling temperature settings in stockrooms and offices.

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. An economizer that is stuck



open can let in too much outside air and ones that are stuck closed will not provide the benefit of free cooling. 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°F or more than 22°F, have a licensed technician inspect your air-conditioning unit.

Check cabinet panels. On a quarterly basis, make sure that the panels to your rooftop air-conditioning unit are fully attached, that all of their screws are in place, and that the gaskets are intact so no chilled air leaks out of the cabinet. Such leaks can cost \$100/year, per rooftop unit in wasted energy.

Clean condenser coils. Dirty coils can hamper heat transfer. Check coils quarterly for debris that can accumulate, and wash coils at the beginning and end of the cooling season.

Miscellaneous

Reduce energy from plug loads. Using power strips for plugged-in devices can help eliminate phantom loads—the energy an electronic device consumes when switched off or into a low-power mode. “Smart” power strips with built-in occupancy sensors shut off devices such as coffee makers when not in use. Enable built-in power-saving settings on computers so they switch to a low-power operating state after a specified period of inactivity, and turn them off when not in use.

Longer-Term Solutions

Although the following recommendations require more extensive implementation, they can dramatically increase the efficiency of your convenience store. For

example, improving the efficiency of refrigeration systems can reduce energy use by 24 percent relative to standard practice. Ask your local utility representative about initiating these projects and find out what incentives are available for installed efficiency measures.

Refrigeration

Floating head pressure. This approach reduces the work of the compressor by allowing the pressure of the vapor coming out of it (the “head pressure”) to float—that is, to drop with reduced ambient temperatures. An expansion valve capable of operating at lower pressures and flow rates is required, and refrigerant pressures must be kept high enough to avoid “flashing”—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.

Evaporative condensers. Most condensers are air-cooled, but it is also possible to use evaporative condensers, which are cooled by water spraying over the condensing coils. Evaporative condensers are more energy efficient than air-cooled condensers, but they require a water supply and added maintenance due to possible freezing, clogging, and mineral buildup. Evaporative condensers are probably most cost-effective in drier climates.

Display-case shields. Aluminum display-case shields can reduce refrigeration load from the display case by 8 percent when applied overnight or when the store is closed. Products are kept colder when the shields are attached and remain colder for several hours after the shields are removed.

Evaporator-fan motors. Electronically commutated motors use about one-third the energy of the typical evaporator-fan motors in walk-in coolers. Drop-in replacement designs have made this retrofit relatively simple for a technician to perform. This upgrade can pay off within one year, depending on electricity rates.

Also consider equipping walk-in coolers with advanced controls that slow or turn off evaporator fans when the cooler's compressors aren't running.

Anti-sweat heaters. Anti-sweat heater controls monitor the humidity levels in a store and automatically adjust the operation of refrigerated door heaters to keep the glass condensation-free. They are relatively easy to install and promise significant savings and quick payback.

"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 controllers can save hundreds of dollars a year, depending on the size of the freezer.

Lighting

Replace T12 lighting with T8. Investing in lighting upgrades is one of the best ways to improve the customer experience, boost sales, and reduce energy bills. If your store uses T12 fluorescent lamps or older T8 lamps, replacing them with high-performance T8 lamps and electronic ballasts can reduce your lighting energy consumption by 30 percent or more while providing better light quality.

Update lighting in refrigerated display cases. LEDs offer several advantages over the fluorescent lamps that are typically used for refrigerated-display-case lighting. LEDs perform well in cold temperatures and allow light to be directed just where it is needed inside the case. The waste heat from LEDs can be moved outside the case, resulting in reduced refrigeration energy needs. All of that adds up to a 40 to 70 percent reduction in energy

use from lighting in display cases and roughly 20 percent in refrigeration energy use.

Consider relamping the building's exterior. Use light levels recommended by the Illuminating Engineering Society of North America and fixtures that minimize light pollution. Consider lower-wattage metal halide lamps rather than high-pressure sodium lamps. The former is less efficient than the latter in conventional terms, but it puts out more light in the blue part of the spectrum, which is easier to see under low-light conditions. LEDs are also an option; however, the cost and quality can vary widely so a trial installation is recommended. It will be easier to identify good products when the Energy Star program starts rating LED fixtures for parking lot applications.

Other Solutions

Install an energy-management system. Energy-management systems can be used to control temperature, humidity, lighting, and refrigeration. By automatically controlling setpoints and turning off equipment at night, these systems enable equipment to function more efficiently and effectively. Web-based control systems are becoming increasingly available and affordable for small retail applications.

Consider reflective roof coating. If your store's roof needs recoating or painting, using a highly reflective color or coating material will minimize the amount of heat that the building absorbs and can reduce peak demand and cooling energy use by 15 to 20 percent.

