Improving Energy Efficiency in Houses of Worship

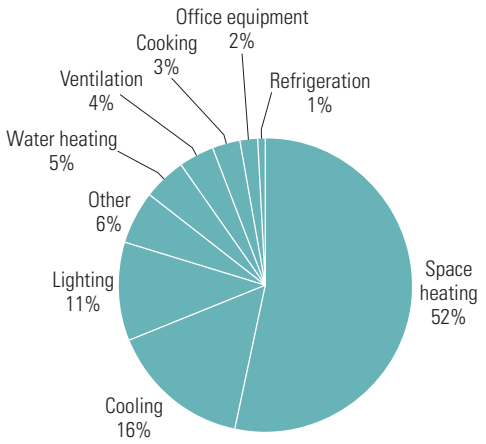
Energy-efficiency measures in churches, synagogues, mosques, and temples can both increase the comfort of the staff and congregants and save scarce funds.

According to the Interfaith Coalition on Energy, energy costs can be as little as 5 percent or as much as 50 percent of a congregation's budget. About half of those costs go to space heating, and more than a quarter are spent on lighting and cooling the building (**Figure 1**). These are not fixed costs—they can be reduced and controlled with mindful attention to daily habits, regular equipment maintenance, and prudent investments in upgrades.

Congregational facilities are typically occupied much less often than other commercial buildings. Consequently, meaures that reduce energy consumption during unoccupied hours (such as timers for lighting and setback thermostats) are likely to be quite cost-effective.

Figure 1: End-use energy consumption data

Space heating accounts for more than half of the energy consumption of congregational facilities in the U.S. Cooling and lighting are also important contributors to congregations' energy loads.



Source: E SOURCE, data from U.S. Energy Information Administration

Congregational facilities also tend to be older and less likely to have energy-efficient equipment. According to the 2003 Commercial Buildings Energy Consumption Survey by the U.S. Energy Information Administration, the median age of congregational buildings was 43.5 years, compared with 28.5 years for office buildings. Furthermore, 60 percent of U.S. congregational buildings had not seen any renovation since 1980. Because of a high turnover rate of staff and volunteers, building improvements may be underreported; however, there are several opportunities for efficiency upgrades that make sense for most congregational facilities.

Quick Fixes

The following measures can be implemented easily at little or no cost.

Turn off the lights. Simply turn off lights when they are not in use. Occupancy sensors can be cost-effective, but a less-expensive alternative would be to post reminders to ensure that switches are off when the lights are not needed and to train custodial staff to switch off lights. Timers may be useful in daylit lobbies, entries, and vestibules to ensure that lights are off during daylight hours.

Replace incandescent bulbs with compact fluorescent lamps (CFLs). CFLs can save between two-thirds and three-quarters of the energy consumed by the incandescent bulbs they replace. Energy savings usually repay the cost of the CFLs within one year.

Control plug loads. Plug loads such as microwaves, computers, and televisions can draw power even when the appliance is turned off. Staff should simply unplug these appliances when they've finished using them. Computers should be set to go into sleep-mode when they're not in use, and be turned off at the end of the workday. One option is to use "smart" power strips that automatically turn off plug loads when they're not

in use. One type of smart power strip, designed for computers, has a master outlet for the computer: When the computer is turned off, all other equipment plugged into the power strip is also turned off.

Delamp vending machines. You can disconnect the ballasts for vending-machine lights. These lights not only cost money to run but also heat the refrigerated compartment. Turning off a vending-machine light saves about $100 a year.

Set back HVAC temperature. Programmable thermostats set the heating or cooling to minimum levels when the building or room is not occupied. These are the same types of controls that households use to automatically set back the temperature if no one is home during the day. To help ensure continued savings, post clear operating instructions for members, volunteers, and staff so that the normal thermostat schedule is not erased if someone needs to adjust the heat or cooling for a special event.

Turn down water heaters. Where possible, turn down water heaters on low-occupancy days.

Seal gaps. Use caulk and weather stripping to seal gaps around windows, doors, chimneys, and other structural elements. If possible, use caulk or expanding foam to seal the gap between the top of the foundation and the wall that sits on top of it.

Prevent waste in water use and water heating. Insulate hot water pipes by wrapping the first 3 to 6 feet of hot water supply with pipe insulation. Fix leaky faucets, showerheads, pipes, and toilets.

Monitor and measure. Use a plug-in power monitor to meter electricity usage in appliances and office equipment before and after turning them down and off in order to demonstrate and encourage savings. Visit the building in the early-morning hours to note temperatures, lights, and sounds; then take measures to reduce unnecessary overnight energy usage. Monitor energy usage by reading meters morning and night or by using a data logger to record measurements of temperature, relative humidity, light intensity, and amperage.

Cover windows. On plain-glass windows, use window treatments such as drapes and shades; on walls of south-facing windows, use awnings or window film to block solar heat gain in the summer and reduce the air-conditioning load.

Practice good maintenance habits for heating, ventilation, and air-conditioning systems. These measures can boost HVAC efficiency and may be performed in-house or by an outside contractor.

- Check that the difference between the temperature of the air coming out of the register nearest the air-conditioning unit and the return air is not lower than 14° Fahrenheit (F) or higher than 22°F.
- Check to see whether airflow to the HVAC unit may be restricted. In some cases, return grilles may be covered, or dampers may be closed by mistake.
- Change filters monthly—more often if your building is located next to a highway or construction site where the air is dirtier.
- Wash condenser coils thoroughly at the beginning and end of the cooling season.
- Ensure that the panels for rooftop air-conditioning units are fully attached with all screws in place, and verify that gaskets are intact. Leaking air can waste $100 per rooftop unit per year (check panels quarterly).
- Shut off registers in unused rooms.
- Many air-conditioning systems use an economizer to draw in cool outside air to reduce the need for mechanically cooled air. Have a licensed technician check, adjust, clean, and lubricate economizers each year. A malfunctioning economizer can increase annual HVAC costs by 50 percent.

Conduct an energy audit. Energy audits help building managers identify and prioritize cost-effective improvements to buildings, equipment, and appliances. Utilities and contractors provide these audits for a modest fee, or sometimes for free. Other organizations that provide free assistance to faith-based organizations wanting to analyze and reduce their energy use are:

- Energy Star for Small Business and Congregations, www.energystar.gov/index.cfm?c=small_business.sb_congregations
- The Regeneration Project's Interfaith Power & Light Campaign, www.theregenerationproject.org

Longer-Term Solutions

When planning a capital campaign for your facility, or if your existing equipment needs replacement, consider these investment options for long-term energy—and dollar—savings.

Recommissioning. Recommissioning is a process in which engineers check and tune up existing building systems to ensure efficient operation. Continuously monitoring a building's energy systems can lead to reductions of 10 to 15 percent in annual energy bills. Recommissioning usually costs between 5 and 40 cents per square foot.

Fluorescent lamps. Congregations can improve lighting efficiency and quality by replacing T12 fluorescent lamps with modern T8 lamps and electronic ballasts. Adding specular reflectors, new lenses, and occupancy sensors or timers can double the savings. Paybacks of one to three years are common.

Light-emitting diodes (LEDs). LEDs can be an efficient choice for both exit signs and holiday lighting. The payback for replacing an existing incandescent sign will often be less than three years—even less when maintenance cost savings are included. LED holiday lights use far less energy, last many times longer than other light sources, and are more durable.

Daylighting. Good daylighting systems can reduce the need for electric light while avoiding glare and overheating. Light shelves will shade and prevent glare in the bottom six feet of a floor and reflect daylight up onto the ceiling, which indirectly illuminates a room.

Occupancy sensors. Occupancy sensors that turn off lights when no one is around are ideal for bathrooms, utility closets, and other less-used spaces. Select sensors that turn lights off when no one is present rather than ones that turn lights on when they sense occupancy.

Parking-lot lighting design. Most parking lots are designed with far more lighting than is necessary. Consider using lower-wattage metal halide lamps or large CFLs instead of higher-wattage high-pressure sodium lamps in fixtures that direct the light downward. Even with a lower wattage, a congregation could safely use fewer lamps if this choice is made. Timers should also be used on all outdoor lighting.

High-efficiency HVAC units. A highly efficient packaged air-conditioning and heating unit can reduce cooling energy consumption by 10 percent or more over a standard-efficiency commercial packaged unit. Equipment that has multiple levels of capacity (compressor stages) and good part-load efficiency is well-suited for congregational buildings with variable occupancy. Ask a contractor about energy-efficient systems appropriate for your climate. For example, in warm, dry areas, evaporative coolers typically use less than 25 percent of the energy of other air-conditioning systems.

Demand-controlled ventilation (DCV). For spaces that have large swings in occupancy, congregations can save energy by decreasing the outdoor ventilation air supplied by the HVAC system during low-occupancy hours. A DCV system senses carbon dioxide (CO_2) levels in the return airstream; using that level as an indicator of occupancy, the system decreases the amount of outdoor air supplied to the space when CO_2 levels are low. DCV systems are particularly applicable to

variable-occupancy areas such as worship spaces, meeting rooms, and cafeterias.

Economizers. Ask a contractor about the cost-effectiveness of retrofitting existing HVAC equipment with an economizer.

Windows. In cold climates, it may be cost-effective to replace old, single-pane windows with more-energy-efficient (low-emissivity) windows. For stained-glass windows, protective glazing such as laminated glass or polycarbonate will decrease drafts—but note that without proper ventilation and proper glazing, such treatments may cause damage to the stained glass.

Cool roofs. Cool roofs are made with materials that are white or another highly reflective color and will minimize the amount of heat the building absorbs. This change can often reduce peak cooling demand by 15 to 20 percent.

Landscaping. Deciduous trees, planted on the west- and south-facing sides of buildings, will shade windows, reducing solar gain and therefore air-conditioning needs during the summer months.