

Managing Energy Costs in Correctional Facilities

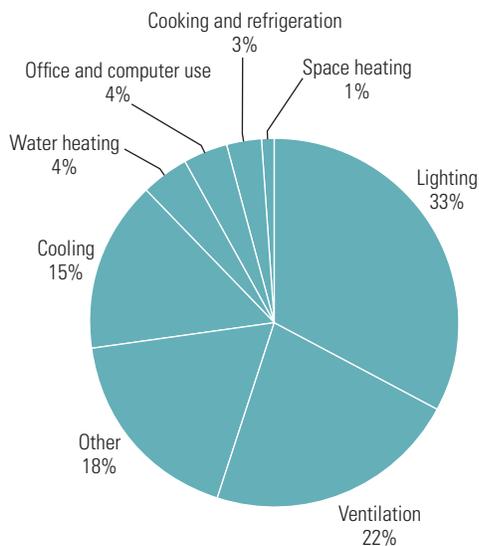
Correctional facilities are energy-intensive areas that can greatly benefit from energy-saving strategies. Facilities managers at organizations ranging from the California Correctional Institution to the Michigan Department of Corrections can attest that “locking in” energy savings can save funds, increase inmate and staff comfort, and, if desired, help your facility attain a greener image. The energy-saving measures described below can yield substantial energy savings with quick payback periods.

How Correctional Facilities Use Energy

Most electricity consumption in correctional facilities generally goes toward lighting, ventilation, and cooling (**Figure 1**), whereas most natural gas use goes toward space heating.

Figure 1: Electricity use in correctional facilities

According to data from the 2003 Commercial Buildings Energy Consumption Survey, lighting, ventilation, and cooling account for the majority of electricity use in jails, reformatories, and penitentiaries.



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Because these facilities must fulfill a variety of needs, there are a wide range of opportunities for efficiency improvements.

Ways to Save Energy

Many correctional facilities can realize substantial savings quickly and easily by making basic changes to existing equipment and investing in comprehensive upgrades.

Lighting

Improving the efficiency of your lighting systems, which can account for over one-third of your electricity use, can be straightforward and inexpensive, and is an easy way to save energy.

Reduce light levels. Security and safety is of the utmost importance, but if possible, dim hallway lighting by 30 percent during daytime hours to reduce demand charges and energy consumption. You may be able to identify fixtures that can be “delamped”—that is, extra lamps can be removed from overlit areas. Additionally, by painting areas like cells and dayrooms white, you can lighten these spaces and realize energy savings by reducing the number of lights.

Update fluorescent lamps and ballasts. High-performance T8 systems (also referred to as super T8s) can improve lighting performance by 70 to 81 percent compared to T12 systems, and 23 to 31 percent when compared with conventional T8 systems.

Install occupancy sensors. Areas that are not consistently occupied—such as storage rooms, conference rooms, back offices, and hallways—are ideal places for occupancy sensors. They can save 30 to 75 percent in lighting-energy consumption and typically yield simple payback periods of one to three years.

Optimize cell lighting. If possible, use a single two-lamp fluorescent fixture in sleeping rooms to meet minimum illuminance requirements.

HVAC

Heating, cooling, and ventilation systems use large amounts of energy in correctional facilities and offer substantial potential for energy reductions.

Check the economizer. Many air-conditioning systems use a dampered vent called an economizer that draws in cool outside air when it is available to reduce the need for mechanically cooled air. If not regularly checked, the linkage on the damper 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 check, clean, calibrate, and lubricate your economizer about once a year, and repair it if necessary.

Sequence chillers. Operators often run too many chillers for a given load. Because every chiller has a range of loading conditions wherein it operates most efficiently, set up your control system to turn chillers off so as to keep the remaining ones operating in their most efficient zone—typically, above the 30 to 50 percent load mark.

Use variable-frequency drives (VFDs). VFDs can be added to pumps and fans in HVAC systems, saving energy by allowing motors to adjust their output to fluctuating heating and ventilation needs. Further savings are possible by using energy-recovery equipment, demand-controlled ventilation, and efficient fan motors.

Add boiler controls. A new control system measures real-time heat load using a flow meter and temperature sensors in conjunction with an advanced software algorithm, to enable the boiler to deliver only enough heat to match the load. By reducing short-cycling losses, this control strategy can reduce boiler energy consumption by as much as 45 percent. At the moment, the only company selling this type of control system is Thermodynamic Process Control Inc.

Replace boilers. Newer boilers feature a variety of efficiency improvements that can justify replacement of older boilers before failure. Improvements include condensing heat exchange, sealed combustion, electric ignition, and fan-assisted combustion. Smaller boilers are more efficient than large ones, and grouping multiple smaller boilers not only allows staged operation of each unit at its highest efficiency point; it also provides backup. If a larger boiler is not ready to be retired, a smaller boiler can be added to serve the base heating load, reserving the larger boiler for additional heating as needed. When replacing a boiler, be sure to analyze the entire boiler system (including the distribution network) in order to maximize overall boiler system efficiency.

Apply reflective roof coatings. In warm climates, consider white or some other highly reflective color when a roof needs recoating or repainting. This change can minimize the amount of heat the building absorbs and can often reduce peak cooling demand by 15 to 20 percent in addition to reducing your overall cooling load, making it possible to downsize the cooling system as well.

Commissioning

Commissioning is a process in which engineers check and tune up building systems to ensure that they are operating appropriately and efficiently. A 2009 study by Lawrence Berkeley National Laboratory indicates that commissioning existing buildings yields average energy reductions of 16 percent. In addition to providing energy savings, commissioning often increases comfort for occupants. The majority of problems identified tend to concern HVAC systems, particularly air-distribution systems. If your building was previously commissioned, consider investing in recommissioning every three to five years.

Other Equipment

In addition to lighting and HVAC systems, correctional facilities often have a number of sources of energy consumption



that can be minimized, including office, laundry, and kitchen equipment. Talk with your utility to find out effective ways to reduce these sources of energy waste.

The Bottom Line

All of the measures discussed above represent good investments. Not only will they save you money and pay for themselves quickly, but they can also help your correctional facility establish a greener image as well.

Resources

Energy Efficiency Design Guide for California Detention Facilities, www.cdcr.ca.gov/CSA/FSO/Docs/2001-04-17_400-01-010_Detention_Facility_Energy_Design.PDF.

This guidebook includes information on a variety of energy-saving strategies for detention facilities. Topics include improvements to the building envelope, lighting systems, and mechanical systems as well as maintenance and commissioning.

