

Heating and Air Conditioning

Schools consume most of their heating energy when the building is empty. During occupied times the heat from the lighting, equipment, and students is enough to keep the building warm. In the summer these same heat sources, along with the sun, cause schools to consume most of their cooling energy during the daytime hours.

- There are many recommendations concerning thermostat settings. The most practical approach is to get the teachers and office personnel to find a comfortable temperature, set the thermostat and forget it. At night in the winter, the temperature should be set to 58°. Because of Kentucky's humid environment, the night time temperature in the summer should only be set 3° higher than the daytime temperature.
- In buildings heated electrically, either with a central boiler or room heat pumps, stagger the times at which different parts of the building are brought up to occupied temperature in the morning. This strategy will prevent a large demand charge on the electric bill.
- Make sure heating and cooling vents are open and not blocked by furniture or other objects.
- Don't heat and cool the great outdoors. Close exterior doors and windows when heating or air conditioning is on.
- Windows that are never opened and are not needed to be opened for safety reasons should be screwed shut and caulked to prevent air leakage. Awning-type windows are particularly bad about leaking air.
- If possible, close outdoor air intake vents when the school is unoccupied. Fresh air is only needed

when students are present. At night the fresh air can account for up to half of the heating needs of the building.

- Inspect all ductwork and insure that it is connected tightly. Seams and connections should be sealed with a mastic specifically made for HVAC ducts.
- Refrigerant levels should be verified, and heat transfer fins cleaned in air conditioners and heat pumps on a regular basis. Low refrigerant levels and dirty fins will reduce equipment efficiency and increase utility costs. These conditions can also increase maintenance costs and shorten equipment life.
- Clean and/or replace filters monthly when school is in session.

Lighting

Lighting retrofits are the surest way of saving energy. For example, if an old 4-foot, 4-lamp fluorescent fixture is retrofit or replaced with appropriate lamps and ballast, its energy use can be reduced by 46% with no reduction in light output.

- Teachers and administrators should turn off the lights when they leave a room.
- Lights in the cafeteria and the gymnasium should only be on when they are needed. They should not automatically be turned on first thing in the morning.
- Install occupancy sensors in closets and rarely used spaces.

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- Use energy-efficient lighting. Replace incandescent bulbs with compact fluorescent lamps. Replace fluorescent T-12 bulbs with more efficient T-8 bulbs. Replace high bay metal halide gymnasium fixtures with high bay fluorescent fixtures.

Fluorescent Lighting Myths

1) Leaving fluorescent lights on is cheaper than turning them off for brief periods of time.

Actually turning off lights saves energy, extends overall lamp life, and reduces maintenance. Turning off a 4-foot lamp for just ½ hour per day will save enough energy over the life of the tube to pay for the tube.

2) Lights shouldn't be turned off because it shortens lamp life. This is true fluorescent lamps will run more hours if run continuously, but they will last more years if they are turned off when not needed.

- Replace the two 20 watt incandescent bulbs in exit lights with 3 to 7 watt LED retrofit kits. Not only is there a savings in energy but the LED lights last up to 25 years making for a sharp reduction in maintenance costs.

Kitchen

In all-electric schools, the peak electrical load in the building probably occurs early in the morning when the building is reheated for classes. If it is not all-electric then it is quite possible that the kitchen will drive the peak electrical load. This will be from any electric cooking equipment in the kitchen as well as the booster heater for the dishwasher.

- If using electric cooking equipment, stagger the turn on times so the school does not have an unusually high electrical load during kitchen start-up.
- Minimize the use of range tops, griddles and broilers. Opt instead whenever possible to use ovens, steamers, and fryers.

- Keep heat reflectors clean and polished.
- Periodically recalibrate the broiler thermostats.
- Clean and check the burners regularly.
- Eliminate the use of booster heaters on dishwashing equipment by using an approved chemical rinse.

Building Envelope

The condition of the building envelope drives the need for heat. Anything that leaks air - windows, doors, open vents, etc. - greatly increases the heating load. The air conditioning load is primarily driven by the heat from the students and the lights. But it is also driven by heat absorbed by the roof and sunlight coming in through the windows.

Besides those measures listed under HVAC, the following measures should be considered.

- Use effective window treatments (blinds, shades, etc.), storm windows over regular single pane windows, or various types of solar screening or reflective films on the outside of the windows to cut energy costs. This is particularly important on southern and western exposures.
- Make sure that weather-stripping, sweeps, and caulking around and under exterior doors and windows is in good repair and that the doors seal properly when closed. Individually air leaks may seem small, but the leaks throughout a building can easily equal leaving a window open 24 hours per day, seven days per week.
- Consider the use of reflective roofing materials or coatings to reduce air conditioning costs. Coatings recommended by The Department of Energy can reduce the school's air conditioning load by 10% to 20%.

http://www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products

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- Heating in high bay areas, such as gymnasiums, can be improved by installing fans or air handling units at the ceiling to force heated air down to floor level.

Other

There are many other sources of energy consumption in a school. Some are large such as water heating while individually others can be small. For example a single computer is certainly a small electrical load but a 100 computers is a significant load. Controlling the small loads may seem like nickel and diming the reduction in energy use, and it is, but effective programs of turning this equipment off or putting it into its sleep mode can produce significant savings.

- If the school has a circulating hot water system, then over half of the school's water heating energy is consumed when the building is empty. This energy is used to replace the heat lost through the pipes. Place a time clock on the circulation motor and turn off the pump when the building is unoccupied.
- Buy Energy Star rated photocopiers and fax machines. These models use half the energy of regular machines.
- Copiers and laser printers have a heating element that sets the toner when a page is printed. Make sure the energy saving features of these machines are set properly. They should all be turned off at night and during weekends.
- If a copier is rarely used or only used at certain times, then turn it off when not in use. Better yet, see if it can be eliminated.
- Make sure that the energy saving features on computers are set properly. They should go into sleep mode when they are not used for a period of time.

Screen savers do not reduce energy use. To achieve this, the monitor has to be shut off, either through the energy saving features of the computer or with the switch.

- Turn computers, monitors, printers and other computer equipment off at night and on weekends. One way to make this easy to do is to plug machines and peripherals into power strips with a built in switch. Then one flick of a switch turns off all the equipment in the system.
- Time clocks should be placed on vending machines that sell non perishable products, e.g. soda, candy, etc. so they only run when students are in the building.
- If possible remove the lights from any vending machines where the lights are not needed to display the product. The product and machine supplier may not like this; however, the school is paying the electric bill, not them.

The lights in a typical beverage vending machine consume 150 watts of energy. Over the period of a year the lights in one vending machine cost the school about \$130 to operate.

Require that any vending machines be Energy Star certified. These machines will use half the energy of non-certified machines.

- Minimize the number of classroom refrigerators. Placing one refrigerator in an easily accessible location can easily accommodate the needs of six classrooms.