
**THE BOTTOM LINE: A GUIDE TO ENERGY AND WATER EFFCIENCY FOR YOUR BUSINESS**

While some operating costs are difficult to control, by establishing a long-range conservation program for both energy and water used by your business, you can control utility costs.

This guide has been written for you who are involved with the day-to-day operations of a business - busy people who don't have time to read volumes on energy and water conservation, but who are interested in saving dollars.

You'll find tips to help you save energy and water—SAVING YOU MONEY—in the operation of your lighting, heating and cooling system, and even your water heater, without altering normal business operations or inconveniencing your customers. We hope that you will find this booklet informative and helpful.

For additional information and/or assistance in formulating a successful conservation program, please contact us at 800-GREEN LA (800)473-3652.

***Ef · fi · cien · cy****: The capacity to produce desired results with a minimum expenditure of energy, time and resources.*

# THE BOTTOM LINE: A GUIDE TO ENERGY AND WATER EFFCIENCY FOR YOUR BUSINESS

## LIGHTING

*Lighting has proven to be one of the largest energy expenses for business. Experience has shown that the lighting costs can be controlled with little, if any investment. Simply turning off unneeded lights is a good start. Choosing the right size and type of lamps, cleaning the fixtures and eliminating unnecessary lights can reduce your energy costs even further.*

*Most existing lighting systems have good and bad features. The best way to begin a lighting survey of your facilities is to determine what the good features are and what you can do to correct or eliminate the bad ones. In the survey, note the types and quantity of lighting in use, areas which are poorly lit or over lit, and where burned-out lamps need to be replaced. Before you conduct your survey, read the suggestions in this booklet and keep them in mind.*

Understanding Lighting

Understanding a few common lighting terms will help you read through this section and will aid in the selection and maintenance of the proper lighting for your business.

Lamp refers to any artificial light source, including incandescent, fluorescent, and high-intensity discharge (HID) lighting. This term is often used interchangeably with "bulb" or "tube".

A Lumen is a unit of light output from a lamp.

A Footcandle is a standard unit of measurement of illuminance. One foot-candle is equal to one lumen uniformly falling on an area of one square foot.

To produce light, lamps must use electricity and a WATT designates this unit of electrical use.

Lamp and fixture selection affect not only the performance of the visual task, but also the economics of the system, the building module, the electrical wiring system, and - because most lighting energy is converted to heat - the heating, ventilating, and air conditioning (HVAC) system.

For commercial and industrial applications, there are several lamp types

available; however, their basic characteristics vary substantially as shown on the next page.

A Variety of Lamps

At one extreme is the incandescent lamp, the least expensive to buy, but the most expensive to own, due to its low efficiency and short life. Its main benefits are low first-cost, ease of installation and good color rendition. At the other extreme is the low-pressure sodium lamp which is very efficient, but has poor color rendering characteristics which normally restricts its use to outdoor applications.

As most lamps age, their light output and efficiency decline, some at a much faster rate than others. Also, most lamps require a ballast to operate. The energy used by a lighting system depends on the lamps and ballasts. Some types of ballasts are far more efficient than others - electronic ballasts being the most efficient type. In addition, the amount of light distributed to where it is needed is far more important than total light output. Light distribution is mostly a function of the fixture. These and other factors must be considered in evaluating system efficiency, and in selecting the most efficient system suited for a given application.

While efficiency alone should not be your only consideration in the selection of lamp type, it is an important characteristic. In most cases, a more efficient light source can be substituted for a less efficient source with little if any loss in task visibility or color rendition.

*Incandescent Lamps:*

The incandescent lamp can be considered the basic light source, because it is the one in most common use. It also is the lamp category with the poorest efficiency (lowest lumens per watt ratings).

The popularity of the incandescent lamp is due to the simplicity with which it can be used and the low price of both the lamp and the fixture. Also, the lamp requires no special equipment, such as a ballast, to modify the characteristics of its power supply (electricity to the fixture).

The tungsten-halogen lamp, like the other incandescent lamps, uses a tungsten filament as the light source.

The halogens prevent lamp walls from darkening as quickly as those of the other incandescent lamps, so more light is available to the task or work surface. The purpose of the halogen is to reduce the rate of evaporation of the tungsten from the filament and thus permit higher temperatures with longer life. In other words, the light output of tungsten-

halogen lamps does not drop off as the light output of other incandescent lamps.

The efficiency of incandescent lamps increases as lamp wattage increases. This makes it possible to save on both energy and fixture costs whenever you can use one higher wattage lamp instead of two lower wattage lamps. For example, one 100-watt lamp produces more light (1,740 lumens) than two 60-watt lamps (860 lumens each for a total of 1,720 lumens).

The specific types of incandescent lamp used and the kind of fixture involved also make a difference. For example, a 75-watt ellipsoidal reflector lamp delivers more light in a stack-baffled downlight than a 150-watt flood R-40 lamp.

*Fluorescent Lamps:*

The fluorescent lamp is the second most common light source. It is found in homes, stores, offices and industrial plants. It is easily distinguished by its tubular design - circular, straight or bent in a "U" shape. In operation, an electric arc is drawn along the length of the tube. The ultraviolet light produced by the arc activates a phosphor coating on the inside wall of the tube, causing light to be produced.

Unlike the incandescent lamp, the fluorescent lamp requires a ballast to strike the electric arc in the tube initially and to maintain the proper voltage and current to the lamp to maintain that arc. Proper ballast section is important to optimum light output, lamp life, and overall efficiency.

Lamp sizes range from four watts to 215 watts. The reduced wattage fluorescent lamps, introduced in the last few years, use from 10-percent to 20-percent less wattage than conventional fluorescent lamps, depending on size.

For most applications, the cool white and warm white lamps provide acceptable color and energy-efficiency ratings. New types of fluorescent lamps can produce color that is similar to incandescent lamps' or daylight, but at some sacrifice of efficiency.

T-8 fluorescent lamps are now being used to replace the standard T-12. The T-8 lamp will fit in existing fixtures, but needs a ballast designed specifically for a T-8 lamp. By using T-8 lamps in combination with an electronic ballast, you can achieve a savings of up to 30% over the standard T-12 lamp and magnetic ballast.

Compact fluorescent lamps can be used in many situations to directly

replace incandescent lamps, and use only about one-quarter to one-third of the energy. Compact fluorescent lamps also last up to 10 times longer than incandescent lamps. There are numerous lamp/ballast configurations and dedicated fixtures available for compact fluorescent lamps.

Like the incandescent lamp, the fluorescent lamp can be dimmed. Several dimming technologies are available. Some provide full-range dimming; others permit limited dimming only, but require no modification of existing fixtures and ballasts.

Fluorescent lamp life is rated according to the number of operating hours per start; for example, 20,000 hours at three hours operation per start. The greater the number of hours operated per start, the greater the lamp life. Because fluorescent lamp life ratings have increased, the number of times you turn a lamp on or off has become less important. As a general rule, if a space is to be unoccupied for more than a few minutes, you should turn the lamps off.

*High-intensity Discharge (HID) Lamps:*

"High-intensity discharge" or "HID" is the term commonly used to designate four distinct types of lamps that actually have very little in common. The four types of lamps are mercury vapor, metal halide, high-pressure sodium, and low-pressure sodium. Each requires a few minutes (one to seven) to come up to full output. Also, if power to the lamp is lost or turned off, the arc tube must cool to a given temperature before the arc can be restruck and light produced. For metal halide lamps, up to fifteen minutes may be required.

On an individual basis, the luminaires and lamps used in HID lighting systems generally cost more than incandescent and fluorescent types. Because fewer lamps and fixtures generally are needed, however, the initial cost of an HID system may actually be less than those of others due both to reduced equipment requirements and the generally superior efficiencies of most HID lamps. In any case, the best way to determine which lighting system has the lowest cost is to make a complete life cycle or annual owning and operating cost study.

*Mercury Vapor Lamps:*

The mercury vapor lamp produces light when the electrical current passes through a small amount of mercury vapor. The lamp consists of two glass envelopes: an inner envelope in which the arc is struck, and an outer or protective envelope. The mercury vapor lamp, like the fluorescent lamp, requires a ballast designed for its specific use.

The color rendering qualities of the mercury vapor lamp are not as good as those of incandescent and fluorescent lamps. Mercury vapor lamps

have found greatest use in industrial applications and outdoor lighting, because of their cost and long life (16,000 to 24,000 hours).

Mercury vapor lamp sizes range from 40 to 1,000 watts.

*Metal Halide Lamps:*

The metal halide lamp is very similar in construction to the mercury vapor lamp. The major difference is that the metal halide lamp contains various metal halide additives in addition to mercury vapor.

The efficiency of metal halide lamps is 1.5 to 2 times that of mercury vapor lamps. Some of the newer metal halide lamps provide color similar to that of incandescent lamps; others emulate daylight.

Standard metal halide lamp sizes range from 175 to 1,650 watts. Compact metal halide lamps are available in a range from 32 to 250 watts. Ballasts designed specifically for metal halide lamps must be used.

*High-Pressure Sodium Lamps:*

The high-pressure sodium (HPS) lamp has the highest lamp efficiency of all lamps commonly used indoors. It produces light when electricity passes through a sodium vapor. This lamp also has two envelopes, the inner one being made of a polycrystalline alumina in which the light-producing arc is struck. The outer envelope is protective, and may either be clear or coated.

Because the sodium in the lamp is pressurized, the light produced is not the characteristic bright yellow associated with sodium, but rather a "golden white" light. Although the HPS lamp first found its principal use in street and outdoor lighting, it now is a readily accepted light source in industrial plants. It also is being used in many commercial and institutional applications as well.

HPS lamp sizes range from 35 to 1,000 watts. Ballasts designed specifically for high-pressure sodium lamps must be used.

*Low-Pressure Sodium Lamps:*

The low-pressure sodium (LPS) lamp is the most efficient of all, providing up to 183 lumens/watt. It is used where color is not important because it has a monochromatic light output. What this means essentially, is that reds, blues and other colors illuminated by an LPS light source all appear as tones of gray or yellow.

Low-pressure sodium lamps range in size from 18 watts to 180 watts.

Ballasts designed specifically for LPS lamps must be used. The primary use of the lamps is currently for street and highway lighting as well as outdoor area and security lighting. Indoor applications such as warehouses are practical where color rendition is not important.

## Lighting Requirements

How much lighting is needed in your building depends on the visual task. The Illuminating Engineering Society has provided us with the guidelines that are outlined below.

| TYPE OF ACTIVITY | FOOTCANDLES | REFERENCE WORK PLANE |
|---|---|---|
| *Public Spaces* | 2 -5 | General Lighting Throughout Spaces |
| *Simple Orientation* | 5 - 10 | |
| *Working Spaces; occasional visual tasks* | 10 - 20 | |
| *Visual Tasks; high contrast, or large size* | 20 - 50 | Illuminance on Task |
| *Visual Tasks; medium contrast, or small size* | 50 - 100 | |
| *Visual Tasks; low contrast, or very small size* | 100 - 200 | |

## Lamp Replacement

The efficiency (lumens per watt ratio) of all lamps drops off with use. In most cases, it is more economical for you to replace the lamp before burnout because you are not getting the amount of light that you are paying for. An important fact to remember: the cost of energy represents about 90-percent of the cost of light over the life of a lamp. You should develop a lighting maintenance program that indicates when lamps should be replaced and luminaires cleaned.

## Removing Lamps

A lamp is unnecessary ONLY if it can be removed without impairing the lighting system's ability to meet the illumination required for the application involved. This means that once lamps are removed, the lighting system still can provide the level of illumination needed, free of glare, shadows or other undesirable viewing conditions.

When removing fluorescent or high-intensity discharge lamps, also remove the ballast, or disconnect it in place. If it is left connected to the power source, it will continue to consume some energy even though it serves no purpose. When two-lamp fluorescent fixtures are mounted in a row and maintenance of a uniform system still is desired, remove lamps in alternate fixtures of the row (rather than removing one entire row) to help maintain quality lighting. Be sure to check the level of illumination once lamps are removed. It may be necessary to replace some of the remaining lamps with similar lamps having higher output. This

technique will take away little from your total energy savings, and will help ensure that the system continues to provide adequate lighting.

## Modify Existing Luminaires

There are several effective ways to modify luminaires. When the luminaires involved are outdated or damaged, the most effective "modification" is replacement. A modern luminaire that is easy to clean and uses high- efficiency lamps with good lumen maintenance characteristics very often will pay for itself in a short period of time.

If an existing luminaire is not providing enough light, and it cannot be made to provide enough even through replacement of lamps, look into the possibility of lowering the luminaire. It may be enough to provide the illumination level needed for the task. Naturally, also consider the use of a portable desk lamp, which may be enough to do the job without modifying the luminaire at all.

If the luminaire and work station are oriented so that the person performing the task must deal with veiling reflections, consider moving the luminaire, but not before you first consider the effect of moving the work station. When possible, try to orient workstations and luminaires so the light from the luminaire falls on the task from the side. Research has shown that light from a luminaire that is above and in front of a workstation tends to create veiling reflections.

In some cases, luminaire efficiency can be improved substantially by changing the lens. Discolored plastic lenses, for example, rob you of the light you are paying for. But even a lens that is in good condition may be inadequate for your needs. Look into changing luminaire lenses to one of the several different types now available that provides special light distribution patterns. For example, linear and radial batwing lenses, parabolic louvers and light polarizing materials may be able to provide better task visibility with the same or even reduced wattage. Competent technical advice is needed in this area before any decision is made to determine which specific kind of lens is best for a particular lighting system and work environment involved. Be especially careful of replacing a lens with one that is much heavier. The luminaire may not be designed to handle the extra weight.

## Lighting Controls

Several devices are available that can help you solve some of your lighting problems.

- Dimming devices allow you to adjust light levels and provide varying amounts of task lighting for special purposes. The efficiency of incandescent lighting drops when the lamps are dimmed. Fluorescent and HID dimming are available; however, special systems must be used with

the existing ballasts. When purchasing dimmers or dimming systems, only good quality equipment that is properly sized and protected should be considered.

- Occupancy sensors turn on lights automatically by using infrared, microwave, or ultrasonic technology that detect motion in a room. These sensors are available in either ceiling or wall-mounted versions.

- Photocell switches turn on lights automatically when natural lighting dims at dusk or on a cloudy day. However, such switches should be used with time controllers where lights are not needed throughout the night.

- Time controllers can automatically turn your lights on and off at preselected times. This allows you to control your lighting usage to meet the daily needs of your business.

- Intermittent timers allow for the efficient use of lighting for rooms not constantly in use, such as storage areas. These timers are available in different time durations. Some timers have a bypass position for those occasions when you need manual control of the lights.

## HEATING, VENTILATING AND COOLING

*Here are a number of simple, inexpensive ways to reduce the cost of heating, ventilating and cooling your place of business while still maintaining comfort for your employees and customers. Many of these suggestions can be put into use immediately.*

Operation

- Lower thermostat settings to 70°F in the winter, and raise them to 78°F in the summer.
- Since you can't always change the location of thermostats, avoid interference with their operation that might be caused by nearby fans, vents, and heat-producing appliances.
- Turn off lights when not needed. Their heat makes your cooling system work harder in the summer and is an expensive way to heat a room in the winter.
- During cold weather, open window draperies and blinds on sunny days to let the daylight in and warm rooms. At night, close the draperies to conserve heat. During the summer, close draperies during the day to keep heat out.
- Eliminate unnecessary heating or cooling when the building is unoccupied. Generally, the heating and cooling system should be turned off at night and over the weekends and holidays. Time clocks may be installed to activate the system just prior to occupancy.
- Encourage employees to dress warmly in winter and wear light clothing during the summer.
- Adjust duct registers to give the most efficient airflow and balanced air distribution within a room.
- Do not heat or cool unused office space, storage rooms, closets and other unoccupied spaces. Close duct registers in these areas.
- Keep warehouse areas closed off from office areas.
- Shipping and receiving doors should not be propped open while heating or cooling the area. In conditioned areas, air curtains or plastic strip curtains can help reduce the loss of heated or cooled air from doorways that need to be open for prolonged periods.
- Use outside fresh cold air for internal cooling whenever possible.

- When it is necessary to use your cooling system, close doors and windows. Otherwise, heat, humidity and dust can enter and put an extra strain on your cooling system and filter.

- If a boiler is used to supply space heating and hot water, turn it down or off during the summer months. Maintain hot water requirements by installing a separate water heater if you turn your boiler off during the summer.

- If you have a comfort conditioning system that simultaneously heats and cools space, adjust controls to minimize air mixing or change the system so there is no mixing of hot and cold air. Discuss system changes with your HVAC specialist.

- Air handling systems should supply only enough air to the conditioned space to maintain the appropriate ventilation and temperature. Care must be taken to adjust all supply and exhaust fans equally to maintain proper static pressure in the building. Improper fan speeds will waste energy.

Energy Saving Improvements That Can Save You Money

- Install tamper-proof thermostat controls to prevent employees from changing temperature settings.

- *Locking covers* are available which fit over just about any type of thermostat control to discourage tampering with the settings.

- *"Dead-band" zone thermostats* will not let your HVAC system heat or cool within a preset temperature range. That means that your heating and cooling settings must be at least the preset temperature range apart.

- *Remote bulb thermostats* have a sensing element that is mounted in the conditioned space, but the control mechanism is installed in an area out of the reach of those who might tamper with it.

- *Solid-state thermostats* contain a glass element that is set with a predetermined temperature setting. To change the setting, the glass element must be replaced.

- Install 24-hour or 7-day time clocks to avoid unnecessary use of your HVAC system.

- Investigate infrared heaters for areas with high bay ceilings where people are working in a large, open area.

- Investigate the use of adding a "precooler" device to roof mounted package air conditioners, which in hot dry areas can save as much as 10-20 percent on cooling costs by lowering the temperature of the air before it

enters the air conditioner unit (evaporative condensers and evaporative pre-cooler).

- In buildings with high ceilings, air at the ceiling may be warmer than the air at the floor. Investigate heat de-stratification devices, such as ceiling fans and "heat recuperators". These are best used in plants where the ceilings are twelve feet or more in height.

- Investigate the cost benefit of installing an economizer. This system consists of motorized dampers with temperature and humidity controls which allow you to use cooler outside air to cool your building.

- A simple, inexpensive way to reduce your cooling load is to prevent the sun's heat from entering through the windows.

- Many products on the market can help you accomplish this.

- Movable shutters to keep out the sun, outdoor awnings over windows and doors, and window roller blinds or other sunshades are excellent ways to block the sun.

- Outdoor solar control screens (louvered screens, fiberglass screens, reflective screening) block the sun while still allowing some light and view through the window.

- Effectiveness of various window treatments differs considerably; the more effective products generally cost more. (Low "E" coating)

- Reflective glass and window films reduce solar radiation.

- In any season, trapped air space is a good insulator, so double pane and storm windows can help save energy. So can tight fitting roll shades.

- When landscaping, plant deciduous trees which will shade the windows during hot summer months. The bare branches will let useful warmth through in the winter.

- If your business has an attic, a ventilation fan may reduce your cooling needs by removing trapped hot air. Cover or secure ventilation fans during the heating season. Make sure motor-driven attic fans are thermostatically controlled, or they will waste energy by operating continuously.

- In other parts of the country where winters are very cold, insulation has had a dramatic impact on heating needs. In Southern California our big energy expense is cooling, not heating. Insulation can lower your cooling bills. Especially if your building has less than R-11 insulation in the walls or R-19 insulation in the ceiling. Some older buildings don't have any

insulation. Consider insulation for these buildings, especially if applied to the roof or attic where most heat gain or loss occurs.

- If you're in the market for a cooling unit, first stop to consider whether you really need one. If you do decide that air conditioning is absolutely necessary, look for the most efficient models. They may cost slightly more, but the operating cost savings will usually offset the initial investment. To indicate efficiency in cooling units, the industry has set up performance ratings. These ratings are expressed as an Energy Efficiency Ratio (EER) or Seasonal Energy Efficiency Ratio (SEER). New models will have a metal plate or tag attached, giving performance rating as an EER or SEER number.

    - An SEER of 15 or more is excellent for central units.
    - An SEER of 12 to 15 is very good for central units.
    - An EER of 10 is good for room units.

Products having an EER or SEER less than these values will not give you as much for your energy dollar as those with the higher rating.

Maintenance

Proper maintenance of heating and cooling systems is a NECESSITY. Poor performance and system breakdowns are expensive, wasting energy and money.

Some systems are very complicated and their maintenance is best done by a professional who knows the intricacies of HVAC equipment. For simpler systems, however, check the manufacturer's literature of recommended maintenance procedures.

A rigid preventive maintenance program for controls (i.e., scheduled checks and necessary calibration, repair or replacement) is also essential and very cost-effective. Controls that are faulty or out of calibration can waste large amounts of energy.

Any HVAC maintenance program should include a semiannual inspection of your system's ductwork. Properly applied insulation prevents energy loss. The inspection should include the following:

- Any exposed forced air ductwork should be wrapped with at least one inch of insulation.

- Check the insulation wrapped around the outside of ducts for tears, gaps, or poor fit. Repair as needed.

- Inspect the flexible joints for holes or gaps that will let air escape. Patch leaks with duct tape.

The following checklist should be consulted regularly by you and your maintenance contractor.

Maintenance

*Monthly:*

- Inspect and clean air filters. Change them as needed.
- Clean fresh air intake screens.
- Check fan belts for frays, cracks, and nicks.
- Brush off air conditioner condenser coil.
- Check heat recovery devices.

*Quarterly*

- Lubricate rotating parts as required, such as bearings and shafts for fans and pumps.
- Clean heating/cooling coils.
- Check blower compartments for dirt, and vacuum if necessary.
- Check and repair or replace damaged insulation around ducts, pipes and vents.
- Check duct thermostats and remote sensing bulbs for accuracy, adjust if necessary.

*Semi-Annually*

- Check pulleys on all V-belts and fans for alignment and correct tension.
- Have entire cooling system checked before cooling season and have heating system checked before heating season.

*Annually*

- Check and repair all weather-stripping, caulking and glazing around windows, doors and HVAC casing.
- Check and tighten bolts and screws on cabinets, brackets and other heating, ventilating and air conditioning components.

- Remove all rust and repaint where necessary.

**Before doing any work on your heating and cooling system, turn it off!**

## WATER HEATERS

*Water heating systems provide hot water to faucets in one of two ways; water can be heated to the temperature at which it will be used at the faucet; or it can be heated to a higher temperature, stored, and mixed with cold water before it reaches the faucet.*

*You can save energy and money in the operation of your water heater by keeping two basic objectives in mind. First, reduce the amount of hot water you use. Second, reduce the temperature of the water to the lowest temperature appropriate for use.*

Operation

- Heat water only to the needed temperature.
- Water for rest rooms should be heated to a temperature comfortable for hand washing (approximately 105°). Hot water should not be mixed with cold water to achieve a comfortable temperature.
- Kitchens with automatic dishwashers must follow health code requirements of 180°F hot water.
- But you can save energy by reducing the water temperature down to 125°F, and installing a booster heater at the dishwasher's water inlet. The booster will raise the water temperature to 180?F only where it is needed.
- Rather than installing boosters for dishwashers, you may want to use a chemical rinse for sterilizing dishes. Health codes permit 125°F water with chemical rinses. However, the cost of purchasing or leasing the chemical rinse device may not make this a cost-effective measure.
- Many laundries can reduce their water temperatures to 125°F, EXCEPT commercial, institutional, and hospital laundries, which must adhere to health code standards of 165°F hot water rinses.
- Water heaters should be located as close as possible to the point of use.
- Never leave hot water running unnecessarily.
- You may find that reducing the temperature of the water does not provide enough hot water to meet all your needs. Experiment with the setting to find the lowest temperature provides you with enough hot water. By making this simple, no-cost adjustment, any savings achieved means saving you money.

- A simple way conserve energy in the operation of your water heater is to insulate the outside of the tank and pipes. By insulating the pipes with one inch or more of added insulation, heat loss and energy costs for heating water can be substantially reduced.

- Water heater blankets, sometimes called insulation "retrofit kits," are available at many building supply and hardware stores. The blankets are easy to install and are safe for use on electric and gas water heaters.

- Consider a solar water heating system. In this area, a substantial portion of hot water requirements may be met with solar energy.

- Install a spring-operated valve or infrared sensor on your rest room faucets to cut down on water use.

- Install a timer to turn off hot water circulation at night.

- Keeping your water heater free from deposits not only saves energy, but also prolongs the life of your equipment. Soft water treatment kits are available to attach to your equipment. Water treatment is important for businesses with large boilers or lots of water processing equipment.

Maintenance

- Good preventive maintenance can help you save energy dollars. Here are some simple steps:

- Drain and flush your water heater every 6 months. With normal use, water heaters accumulate solids that prevent the efficient transfer of heat to the water. These deposits can be removed by periodically flushing water and sediment from the unit. To do so, open the drain valve and drain water from the tank until it flows clear.

- Check the insulation on your water heater tank and hot water pipes; repair or replace it as needed.

- Check for leaks around your water heater.

- If a circulating pump is used, be sure to check the pump seals.

## FOOD PREPARATION AND STORAGE

*Almost half the total energy required by a typical food service establishment is used to prepare and store food. This section offers suggestions for conserving energy wherever food is stored and/or cooked, with special sections on dishwashers and refrigeration equipment.*

Cooking Equipment Operation

- Cook in the largest volume possible. Most food service establishments find they can cook some items more energy efficiently by cooking them partially or completely in advance. Food may also be cooked in volume and frozen until needed. However, the energy costs associated with cooking, freezing, thawing and reheating must be considered. In both cases, energy and nutrition factors will have to be balanced in order to determine the applicability of volume cooking.

- Cook at the lowest temperature that still gives satisfactory results. Slow cooking retards meat shrinkage, retains more nutrients and better preserves color in all foods. Even though lower temperatures result in longer cooking times, reduced energy losses from cooking equipment to the surrounding air yield overall savings.

- Preheat and reheat equipment no longer than manufacturer's instructions require.

- Heat only to the temperature required. Do not turn thermostats on "high" in an attempt to get equipment to heat up or food to cook faster.

- Break the habit of turning on all your equipment first thing every morning. Unless you plan to use a piece of equipment, leave it off until it's needed.

- Cook with a medium to low heat. Turn the heat down when cooking temperature is reached.

- Crowd thinning out? Turn off range or other equipment when no longer in use.

- Use flat-bottom utensils on solid-top ranges. Nearly any type of pot or pan can be used on open-top ranges.

- During slack periods, turn the heat on your griddle down. There's no point in keeping the griddle at peak when you're not busy.

- Turn the broiler heat low between broiling operations and off completely during slow periods.

- Operate just part of your multiple-burner broiler, unless the workload is heavy, to conserve energy.

- Plan baking and roasting so that foods requiring the same temperature can be done at the same time, and then load your oven to capacity.

- You waste energy by opening the doors on your oven unnecessarily to check on foods. Urge employees to depend on thermostats and timers instead.

- In modern, high-speed fryers, temperatures ranging from 325° to 335° are ideal for practically all types of fried foods. Too high a temperature makes fat break down and wastes energy.

- Use your fryer instead of the range top for frying, but don't turn on two fryers when one will do. Turn the thermostat down or off when fry kettle is not in use.

- Use warming tables wisely. They are not cooking appliances. Learn the recommended serving temperatures for different types of foods. You can waste energy and dry out foods with excessive heat.

Maintenance

- Keep your equipment clean and have it checked periodically - burners, pilots, thermostats and other controls. Well-maintained equipment works better, lasts longer and uses less fuel.

- Keep records of breakdowns, parts replacements, and regular maintenance checks on all equipment. Poorly functioning equipment and worn or dirty parts use energy inefficiently.

- When used properly, dishwashers are efficient and operate at a relatively low energy cost. The following steps assure that your dishwashing system uses as little energy as possible.

## DISHWASHING EQUIPMENT

*When used properly, dishwashers are efficient and operate at a relatively low energy cost. The following steps assure that your dishwashing system uses as little energy as possible.*

Operation

- Fill your dishwasher to capacity. The same amount of energy is used whether or not the racks are full. Be sure that the operator knows how to load racks fully and space tableware closely together on a conveyor system.

- If a power dryer is used, adjust it so that heated air is delivered just long enough to barely dry the dishes. Remember that drying will continue after the machine is shut off. Consult your maintenance manual for instructions on how to make the adjustments and then experiment to find the right setting.

- Use a wetting agent in the dishwasher to eliminate the need for power drying.

Energy Saving Improvements That Can Save You Money

- Provide an exhaust hood close to the dishwasher to carry wet air out of the kitchen before it burdens the heating, ventilating and air conditioning system. Try to have this blower activated automatically by the dishwasher cycle mechanism so that it operates only when required.

- Install a low-temperature dishwashing system that uses a sanitizing solution and 120°F water. Before selecting one particular low-temperature chemical dishwashing system, be certain that it meets health codes.

- Be sure that adequate water pressure is supplied to your dishwasher, and check to see whether a pressure-reducing valve is needed. Dishes will not rinse thoroughly if the pressure is low, and high water pressure wastes heated water.

- Install thermometers in the wash tap and in the hot rinse water line that feeds the dishwasher, so that the performance of the heating units can be checked. The temperature reading should be consistent with health codes.

- Investigate the possibility of different heat recovery methods. For example, waste-heat from ovens, etc., can sometimes be used to preheat water supplied to hot water heaters.

## REFRIGERATION EQUIPMENT

*The subject of refrigeration systems is quite complex. The installation and service guides of various manufacturers should be followed as closely as possible. This section is confined to broad recommendations which apply to commercial refrigeration, in general.*

Operation of Display Fixtures and Coolers (Freezers)

- Do not set controls (pressure and temperature) lower than necessary. Too often, a freezer may be operating at -30°F air temperature when -10°F or higher is all that is necessary.

- Keep products below clearly marked load lines. An overloaded display decreases product quality and increases energy use as much as 10-percent to 20-percent for each fixture.

- Use recommend night covers on low-temperature fixtures and keep these below low load lines. Compressor run time will be reduced, product temperatures will be lowered and energy can be saved. However, caution be exercised to avoid compressor damage and frost buildup on product caused by some night covers. Consult fixture manufacturer before using any night cover.

- Where possible, eliminate or reduce internal shelf lights to reduce energy use for refrigeration and lighting.

- Remove all incandescent bulbs over meat displays. Consider using fluorescents only.

- Do not permit refrigerated products to remain out of refrigeration and warm up. Display fixtures are designed to maintain product temperatures as they come from a storage cooler, not to bring their temperatures down. Unnecessary use of energy by fixtures will result when products are allowed to warm up in aisles or loading docks. Transfer products from storage coolers and trucks immediately.

- On multi-shelf fixtures, use manufacturer's recommended shelf position and shelf sizes to prevent increased refrigeration loads. Consider using plastic, slitted day covers on multi-shelf fixtures, subject to manufacturer's recommendations.

Compressor Condenser Units

- Select an air-cooled unit with an adequately sized condenser to keep condenser head pressure down during summer.

- Do not put units in confined areas or where the entering air may be affected by other units or dirty air, which will cause condenser head pressure to run abnormally high.

- In cool months, set controls to maintain the lowest head pressure at which the system can operate without short-cycling or impairing expansion valve and coil efficiency.

- If refrigeration load is decreased by any means (light reduction, case cleaning, etc.), check temperature and pressure control setting to avoid freezing of products or short-cycling of compressors.

Defrost Systems

- Carefully determine the number of defrosts and what period of time is needed for defrost in a 24-hour period. This will avoid unnecessary defrosts that are a waste of energy.

Maintenance

- Clean air- and water-cooled condensers regularly. Dirty condensers result in higher head pressures and increase energy use by six-percent to 10-percent for every 10°F higher condensing temperature.

- Keep air-cooled condensers clean. (Condenser looks like an automobile radiator.) A dirty condenser causes the compressor to work harder, which means it will consume more energy.

- Evaporative condensers (water-cooled) should receive water treatment. Without treatment, scale builds up on the tube bundles. It eventually insulates the heat transfer surfaces and more energy is used because the compressor is working harder.

## WATER CONSERVATION

*A variety of methods ranging from innovative water recycling techniques to simple common sense approaches can lead to substantial water use reduction.*

*The first step is to determine where your water is being used. List, rank (in terms of volume) and evaluate the various ways in which your water is used.*

Institute a Company-Wide Water Conservation Program

Remember to incorporate employee awareness into any water conservation program you develop.

When necessary, meter internal water flows. This type of metering allows monitoring in separate production and maintenance areas. Daily monitoring makes it possible to locate areas of potential savings in your water system and to measure the success of your water conservation efforts.

Regularly read your water meter to monitor your water usage. This is a key tool in any water conservation plan.

Building Equipment and Fixture Use

- Install flow reducers and low-flow faucet aerators on all plumbing fixtures.
- Install ultra-low-flush toilets.
- As appliances or fixtures wear out, replace them with water-saving models.
- Reduce the water used in toilet flushing either by adjusting the vacuum flush mechanism or installing toilet tank displacement devices (dams, bottles or bags).
- Minimize the water used in cooling equipment, such as air compressors, in accordance with the manufacturer's recommendations.
- Shut off sprayed coil units, except where humidity in critical areas cannot be maintained by other means or where the units are used to reduce chiller operation.
- Shut off the water supply to equipment and areas which are unoccupied. Also, discontinue water circulation pumping in unoccupied areas.
- Reduce the load on air conditioning units by shutting air conditioning off when and where it is not needed.

Building Maintenance

- Repair leaking faucets, showers, and continuously running toilets.
- Change window cleaning schedule from periodic to an on-call, as required, basis.
- Switch from wet or "steam" carpet cleaning methods to dry powder methods.
- Maintain insulation on hot water pipes.
- Avoid excessive boiler and air conditioner blowdown, monitor total dissolved solids levels, and blowdown only when needed.

Food Service Area Use

- Use ponded water whenever possible instead of allowing water to run continuously. For example, use ponded water for rinsing utensils and dishes, washing vegetables and thawing foods.
- Turn off the continuous flow used to clean the drain trays of the coffee/milk/soda beverage island. Clean the trays only as needed.
- Turn dishwashers off when dishes are not being processed. Wash full loads only. Replace spray heads to reduce water flow.
- Recycle rinse water from the dishwasher or recirculate it to the garbage disposer.
- Minimize the use of the ice machines and adjust them to dispense only the amount of ice needed.
- Use water from the steam tables in place of fresh water to wash down the cook's area.

Outdoor and Miscellaneous Use

- Repair leaks in the irrigation system as soon as they are detected.
- Use accurate timing methods to control the frequency and duration of watering.
- Investigate the advantages of installing drip irrigation systems for trees and shrubs.
- Watering should be done at night or in the early morning, when evaporation and wind are at a minimum, and only when needed.

- Limit landscaping additions and alterations. In the future, design for landscapes and turfs which require less water.

- Weeds compete for water and should be controlled by use of an appropriate registered herbicide or by hand removal.

- Fertilize in cool weather, using small doses of nutrient to build strong plants. Fertilizing in the summer months induces growth, which requires additional water and should be avoided.

- Mulch around plants to reduce evaporation and discourage weeds.

- Remove thatch and aerate turf to encourage the movement of water to the root area.

- Infrequent deep watering of grass conserves more water than frequent light watering.

- Avoid runoff and make sure sprinklers cover just the lawn or garden, not sidewalks, driveways or gutters.

- Eliminate the washing of walks, driveways and other paved areas.

- Autos, buses and trucks used by some companies can be washed less frequently and still maintain a pleasing appearance.

Process Applications

- Routing water from operations requiring high quality water to operations that could use a lower quality is called sequential use. Depending on the number of different water-using processes, a substantial amount of water could be conserved by applying this technique.

- Some industrial processes involve a series of rinse tanks to clean components as they proceed from one manufacturing stage to the next. Many operations use the highest quality water for the first rinse tank and the "dirtiest" water in the last tank. This system requires a large flow of water to insure that water quality in the last operation is adequate for rinsing the finished product. By reversing the flow direction in a "counter flow" system, the finished product receives the cleanest rinse water and a lower flow of water is needed.