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Going Green? Start in the Kitchen
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Green design (also referred to as sustainable design, eco-design, or design for environment) is the catch-all term for a growing trend in the fields of architecture, landscape architecture, engineering, industrial design, and interior design. Green can be a pale mint or a dark forest and many shades in between: It is possible to make significant, beneficial changes to existing systems without having to start over.

Green design is often viewed as a necessary tool for achieving sustainability, meaning a process that can be maintained indefinitely at a certain productive level, even in the face of diminished resources. The essential aim is to create places, products, and services that reduce the use of nonrenewable resources, minimize environmental impact, and relate people with the natural environment. In this article, we will explore some ways to reduce your institution's environmental impact where it is most intense: the kitchen.

Building greener kitchens, both in design and choice of materials, is one of the most significant ways that we can affect our future. Kitchens are energy intensive, and much of the concern boils down to the use of energy, which directly influences environmental quality because of the inherent pollution of greenhouse gases and other emissions.

Many environmentally beneficial green efforts can be accomplished at no cost; in fact, some could potentially result in a profit. Other efforts or programs have various degrees of expense, ranging from minor expenditures or investments to a major redesign of the entire operation. Built from scratch, green kitchens tend to cost 20% to 30% more than nongreen kitchens, but that initial expense can be recouped by making intelligent choices. In the real world, green is the color of money.1

Profitable Solutions

● **Find a buyer for waste grease.** Biofuels are booming. Look for a buyer who will come to your operation and empty the grease trap, a job considered undesirable by most employees.

● **Use natural lighting** whenever possible to reduce energy use and create a more pleasant ambience. According to the U.S. Green Building Council, designs that take advantage of sunlight can reduce energy use for lighting by at least 50% while also creating a more pleasant atmosphere. Studies show that in workplaces lit mostly by natural light, worker productivity and absenteeism improved 15%.2

Letting in lots of sunlight also creates a good environment for plants, which clean the air by absorbing pollutants and carbon dioxide through their leaves. Consider growing herbs for fresh, ready-made seasoning.

● **Find a buyer for recyclable products**. Sell soda cans and food containers to a metal recycling facility, cardboard boxes to a paper recycler, and glass containers to a glass recycler. Remember that the cans usually need to be rinsed before being placed in recycling containers. Other buyers want the bottoms and tops removed and the soda cans flattened.

Economical Adaptations

● **Set up a recycling area** to facilitate the process and get people into the routine. Preassembled recycling centers and in-cabinet retrofit kits are available to take the mess out of managing your recyclables. These modified cabinets can accommodate any kitchen style and cabinet size and are available in a full range of cabinet materials.

● **Use biodegradable disposables** and attempt to reduce the use of disposables such as paper and foam plates and cups and paper towels to the lowest possible level. Most quantity kitchens already wash some permanent ware and laundry, so a few more pieces being washed will increase costs only slightly and result in considerable savings in the cost of disposables. Use natural, ecologically friendly detergent or liquid soap to wash your dishes and laundry.

● **Turn off lights** in any room that is not in use. An easy method is to install motion and occupancy detectors that turn the lights on when someone enters the room and off when no motion is detected. They are fairly inexpensive and can be mounted in standard switch boxes. Because they limit the time that the lights are on, they can reduce energy use by up to 90%.

Occupancy sensors can also be used in rooms that are used for short periods of time, such as hallways, public powder rooms, employee lounges, workrooms, and closets. Programmable controls allow fixtures to perform as task, safety, or mood lighting.

● **Use fluorescent lights in all fixtures.** Replacing incandescent bulbs with compact fluorescent light (CFL) bulbs will have a higher initial cost, but they need to be replaced less often and use a fraction of the power.1 A 60-watt incandescent bulb can be replaced with an 11- to 15-watt CFL bulb. Although CFL bulbs cost more than regular light bulbs, they last six to 10 times longer, and each one saves $25 to $30 over its lifetime. To maximize their benefit, use CFL bulbs in high-use areas. Follow safety guidelines in disposal due to mercury content.

Avoid through-the-ceiling recessed cans, unless they use fluorescent bulbs and are airtight, to keep air from escaping around the can. Even fully sealed, they can create indoor air quality problems if the airspace around the cans is unconditioned. This may be true even for the so-called airtight cans, where their assembly fails to seal with the surrounding drywall.

● **Use lighter colored paints** on the walls and ceiling to enhance electric lighting. Good lighting lessens eyestrain and fatigue. Light in the kitchen should range from 15 foot-candles on the floor to 35 foot-candles on equipment and 35 to 50 foot-candles on work surfaces.

Light-colored, smooth ceilings and walls reflect light better than dark or porous surfaces. Changing a ceiling or wall surface from a dark color to a lighter one may improve the light in the room. Avoid having walls that are too smooth because glare from a shiny surface can be tiring.

● **Install high-quality, dimmable electrical ballasts.** They will not only save energy but also prevent flickering.

● **Investigate light-emitting diode (LED) lighting.** LED lighting is new to the market and promises long life and extremely efficient operation, but it is not widely available and can be pricey.3 LED technology uses 90% less electricity than incandescent bulbs. Because of LED's long life and additional up-front cost, it is suggested for difficult-to-service indoor and outdoor applications and heavily used indoor areas. LED lighting can also be used in a variety of creative lighting layouts because of their size—roughly that of small Christmas lights.

● **Use glass or ceramic baking pans** to help conserve energy. They warm up faster and retain heat longer than metal pans, so you can lower the oven temperature by 25°. Foods will cook just as quickly as they would in the original recipe. (However, cake baking is better in metal.)

● **Use a high-efficiency ceiling fan.** A ceiling fan boosts natural ventilation by helping to move air through the space, and it uses less energy and is quieter than an exhaust fan.4

● **Practice energy-efficient cooking.** Preheating ovens is almost prehistoric. Many newer ovens come to temperature so rapidly that they make preheating nearly obsolete—except perhaps for soufflés and other delicate dishes. When roasting or baking, put the food in right away and then turn the oven off five or 10 minutes early and let dishes finish cooking in the residual heat. The same concept is true for anything cooked on an electric stovetop.5

Investments With Good Return

● **Select a durable faucet.** Use a solid brass base material and a ceramic disk valve. There are hundreds of styles and dozens of finishes, though tough and fashionable chrome reigns. Repair water leaks immediately.

● **Use faucet aerators** that maintain good water pressure by adding air to the water stream. They reduce the water usage from 2.2 to 1.5 gallons per minute. If a shower is provided for employees, be certain that low-flow showerheads are installed in the employee lounges. These showerheads are equipped with small water restrictor discs that achieve a rate of 2.5 gallons per minute. One new showerhead uses a frugal 1.6 gallons per minute and is designed so that the water droplets are larger, holding on to heat and offering the feel of a 2.5-gallons per minute shower.

● **Install hands-free faucets** with either knee or foot pedal controls. These have a quicker response time, saving water by letting you easily control water use.

● **Replace plumbing fixtures** that were installed before 1992. Older fixtures are water hogs, and many low-flow products function as well as their traditional counterparts.4

● **Install a tankless water heater.** Also known as demand, instantaneous, or in-line water heaters, these save energy in sinks that are a long distance from the water heater or in employee lounges or preparation areas that seldom require hot water. Tankless hot water heaters, which do not have a holding tank, heat water as needed at the desired temperature. The heating process begins when you turn on a hot water tap. Cold water travels through a pipe into the unit and either a gas burner or an electric element heats the water up quickly. Each model has a flow rate, which is measured in gallons per minute. They use less water and 10% to 20% less energy.

● **Install dual-flush toilets** in employee lounges and public restrooms. The concept is simple: a full 1.6 gallons per flush for solids and a reduced-volume flush (usually 0.8 to 1.1 gallons per flush) for liquids only. These fixtures entered the U.S. market in 1998 with only a few products but are very popular with water conservation specialists. If dual-flush toilets are not yet available in your area, replace the old 3.5-gallons per flush models with new 1.6-gallons per flush toilets. Replacement is preferable to converting old toilets with those that are retrofit at the factory.

Another new feature is designed for hand washing only: The toilet tank's lid is replaced with a minisink, which is connected to the toilet's intake hose. Every time the commode is flushed, water comes out of the faucet and then drains into the tank.

● **Install air admittance valves**—pressure-activated, one-way mechanical valves that are put in plumbing drain lines—rather than through-the-roof pipe venting. They operate with the discharge of wastewater just like conventional plumbing vents and are durable. By eliminating piping and flashing at the roof penetration, there is a net savings after the initial investment.

Electricity and Electronics

● **Install a solar photovoltaic system** on the roof and sell the power to the local power company or use it to heat water. Check with your local power company to see how these arrangements can be made in your area. In sunny areas, it is possible to actually make money by selling electricity to the electric company.

● **Purchase Energy Star electronics**—the rating means that they have passed an energy efficiency test—when replacing cooking and refrigeration equipment. To earn Energy Star qualification, products must meet strict criteria for energy efficiency set by the Environmental Protection Agency and the Department of Energy. The Web site www.energystar.gov offers lists of Energy Star-qualified products such as dishwashers, refrigerators, lighting fixtures, and ceiling fans and a database of builders (developers who can help find and install Energy Star equipment).

● **Investigate induction cooking**, which uses electricity to produce a magnetic field that reacts with the ferric content in stainless steel, cast iron, and enameled steel cookware, exciting the molecules and producing heat. The cookware (and therefore the food) gets hot, but the stovetop doesn't. Less heat is wasted and the food heats faster, saving time and energy. Induction cooking is about 90% energy efficient compared with gas and electric radiant, which are 50% to 60% efficient. Induction cooking is relatively new to quantity cooking and is currently more expensive.

Windows, Doors, and Skylights

● **Install energy-efficient windows, doors, and skylights** to reduce electric consumption. Well-designed windows and skylights can lighten the feel of a dining room and save on lighting, but you need the right kind. Significant savings can be achieved by replacing single-pane windows with products made with low–energy-emitting glass, with solar shading that increases the room's comfort, protects items from sun damage, and reduces condensation on windows.

To find energy-efficient windows and skylights, look for products with Energy Star stickers and evaluate the National Fenestration Rating Council (NFRC) ratings. The NFRC measures the following key properties: U-factor, solar heat gain coefficient (SHGC), air leakage (AL), and visible light transmittance (VT).

U-factor indicates the rate of heat loss for the entire window. (It's the opposite of R-value, which indicates the insulating value of the window.) The lower the U-factor, the more energy efficient it is. Along with the SHGC, this is the most important number to watch.

SHGC measures how much of the solar radiation that hits the window will enter the home. It is expressed as a number between 0 (0%) and 1 (100%). The lower the SHGC, the more radiation the window blocks.

AL measures the cubic feet of air infiltrating 1 square foot of the window area. The lower the number, the less air can get in. Casement, awning, and fixed windows tend to be tighter than sliding, single-hung, and double-hung windows.

VT indicates how much visible light passes through the window, expressed as a number between 0 and 1. The higher the number, the more light is transmitted.

Windows, doors, and skylights can qualify for the Energy Star program based on U-factor and the SHGC. The requirements vary by climate. In the northern part of the country (Alaska, plus contiguous states from the Canadian border to the southern border of Nebraska), windows must have a U-factor less than or equal to 0.35 and skylights must have a U-factor less than or equal to 0.65. They can have any SHGC. In the southern zone (Hawaii, Florida, and the southern tips of Texas, Louisiana, Mississippi, Alabama, and Georgia), windows must have a U-factor of 0.65 or less and an SHGC of 0.4 or less. The SHGC is the same for skylights, but the U-factor can go up to 0.75.

Factors that affect a window's energy efficiency include the glazing, coatings, gas fills, spacers, and the material used for the frame.

Glazing is the glass or plastic panes themselves. A double-glazed window is the same as a double-pane window. Windows can be single, double, triple, or quadruple glazed; the more panes or glazing layers, the more energy efficient they will be. Usually double glazed is the preferred style.

Coatings also help reduce solar heat gain. Low-emittance (low-E) coatings or films are thin layers of metal or metallic oxide applied to the window pane. The tinted glass is nearly invisible, lowers the U-factor, and helps reduce heat loss. Low-E coatings differ by SHGC and can go on multiple panes. The right combination depends on your climate.

Gas fills (such as argon and krypton gas) between the multiple panes provide better insulation and lower the U-factor. They are nontoxic.

Spacers keep the layers of glass the right distance apart from each other. In the past, they were made from aluminum, whose conductivity can lead to heat loss and condensation. Now, manufacturers offer warm edge spacers made from less conductive materials such as stainless steel, silicone foam, fiberglass, and vinyl.

Frames made of fiberglass and insulated vinyl are the most efficient choices, but standard vinyl, wood, vinyl-clad wood, and wood composite frames are all acceptable. Aluminum frames, especially those without a thermal break, are the least efficient option and better suited to warmer climates.

Reducing Indoor Pollution

Volatile organic compounds (VOCs) are used in a variety of products to improve performance and durability. VOCs diminish air quality and may be detrimental to the health of those working in the area. All of these products can release organic compounds when being used and, to some degree, when they are stored: adhesives; cleaning supplies; degreasing compounds; pesticides; paints; office equipment such as copiers and printers, correction fluids, and carbonless copy paper; graphics and craft materials such as glues and adhesives; aerosol sprays; cleansers and disinfectants; moth repellents; air fresheners; permanent markers; photographic solutions; and protective finishes.

The EPA Total Exposure Assessment Methodology (TEAM) studies found levels of about one dozen common organic pollutants to be two to five times higher inside homes than outside, regardless of whether the homes were located in rural or highly industrial areas. Additional TEAM studies indicate that when people are using products containing organic chemicals, they can expose themselves and others to very high pollutant levels, and elevated concentrations can persist in the air long after the activity is completed.6

● **Use low-VOC products.** Today, low- and no-VOC paints are available almost anywhere. They release no or minimal VOC pollutants and are virtually odor free. This improves indoor air quality, making it safer, particularly for people with chemical sensitivity. Also, latex paints use water as their solvent and carrier, allowing for easier cleanup and generally lower toxicity. Today, latex paints are equal or better in quality and durability than conventional oil-based formulas.7

To reduce exposure, increase ventilation when using products that emit VOCs. Meet or exceed any label precautions. Do not store opened containers of unused paints or any of the products listed previously. Never mix cleaning products unless directed on the label.

● **Use mold-resistant gypsum or cement board.** Mold growth requires moisture and a food source. To improve moisture resistance, some gypsum board manufacturers have developed products with paperless coatings and gypsum cores. To reduce the risk of mold, some manufacturers chemically treat the paper on both sides of the gypsum board while others eliminate the paper and replace it with a gypsum-cellulose combination. Mold-resistant wall panels help maintain good indoor air quality while reducing the probability of costly replacement or remediation.

Tough Choices

Some trade-offs are inevitable. Most large operations will find stainless steel counters and cabinets a better choice because of sanitation, longevity, and durability considerations, even though they are not considered green. Mining and refining steel uses a great deal of energy and pollutes the environment, but stainless steel contains a significant amount of recycled steel and doesn't off-gas (release undissolved ozonated vapor or volatile chemicals). Sometimes, you have to compromise, as there is no benefit to "making the good the enemy of the perfect."

Many green products are great for home use but will not stand up to the wear and tear of a quantity foodservice (eg, bamboo, eucalyptus, or cork flooring manufactured from rapidly renewing forests). Commercial porcelain tile or stained concrete can provide a beautiful, affordable, and durable floor. Stained concrete uses nontoxic, natural pigments rather than surface-applied stains.

Other recycled materials may be added into the concrete mixture. Many types of indigenous stone are available and can come from salvage and remnants. They can also be made of quartz composite known as engineered stone. They must be well sealed to prevent staining.

Cabinets made of agricultural fiber panels such as wheatboard and strawboard or laminates and thermofoil cabinets can seal in VOCs contained in substrates. Countertops and backsplashes can be made from materials that are durable and water resistant.

When a major redesign is planned or an entirely new operation is on the drawing board, the opportunity to integrate green principles, products, and practices is ideal. With so many

factors to consider, a green consultant will help your team meet priorities, address concerns, and incorporate innovative solutions and incorporate team member feedback to produce an integrated design. By making decisions early in the process, there will be an opportunity to consider all of the elements, as well as the time to run energy models and to hold employee educational sessions. This not only ensures that building elements and systems are designed, installed, and calibrated to operate as intended, but it also minimizes the need for costly change orders and communicates to employees how to best operate and maintain the equipment.

One practice that retards the industry's efforts at greening the kitchen is the failure by those who specify and procure kitchen equipment to do an adequate life-cycle analysis. When "first cost" alone serves as the primary basis for a purchasing decision, rather than the total cost of ownership, the benefits of higher performance, energy-efficient equipment are not considered. You're stuck with energy waste and higher operating cost. This is called "split incentives." What might be attractive to the purchasing agent from a capital cost perspective is not beneficial to the operator, and it stalls the evolution of the green kitchen.

To help the industry get over this speed bump on the green highway, the foodservice engineering community needs to launch an education campaign that equals the work being done on the cultivation side.8

Leadership in Energy and Environmental Design is a certification program developed by the U.S. Green Building Council, a nonprofit coalition of leaders from the building industry working to promote buildings that are environmentally responsible, profitable, and healthy. The program contains a set of guidelines and a rating system that builders and operators must pass to formally present themselves as "green" buildings or kitchens. It is a quantitative metric indicating how environmentally friendly the building is.9

— Lynne N. Robertson, PhD, RD, LD, created and delivered continuing education workshops on foodservice topics from 1966 until her retirement in the mid-1990s. Since then, she has provided consulting services to hospitals, restaurants, state health departments, nursing homes, colleges, and foodservice vendors and written numerous books, booklets, continuing education courses, and training aids on foodservice-related topics.

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