



Cutting Costs With Energy Efficiency & Conservation

A Guide for Hotels

TABLE OF CONTENTS

<u>INTRODUCTION</u>	<u>3</u>
Saving Energy is Easy	<u>3</u>
 <u>PLANNING AN ENERGY PROGRAM</u>	 <u>4</u>
Planning an Energy Program: General Guidelines	<u>4</u>
Planning an Energy Program: Benchmarking	<u>5</u>
Planning an Energy Program: Energy Audits	<u>6</u>
Planning an Energy Program: Energy Teams	<u>7</u>
Planning an Energy Program: Energy Action Plan	<u>8</u>
Planning an Energy Program: Certification Programs	<u>9</u>
 <u>LIGHTING</u>	 <u>11</u>
Lighting: Guest Rooms	<u>11</u>
Lighting: Lobbies, Conference Rooms and other Common Areas	<u>13</u>
Lighting: Exterior Lighting	<u>14</u>
Lighting: Behind the Scenes	<u>14</u>
Lighting: Signage	<u>15</u>
 <u>CENTRAL HVAC SYSTEM</u>	 <u>15</u>
Central HVAC System: HVAC Efficiency	<u>16</u>
Central HVAC System: Central Cooling Systems	<u>16</u>
Central HVAC System: Air Delivery	<u>16</u>
Central HVAC System: System Management	<u>17</u>
 <u>BUILDING ENVELOPE</u>	 <u>17</u>
Building Envelope: Cool Roofs	<u>18</u>
 <u>RESTAURANTS</u>	 <u>19</u>
Restaurants: Cooking Equipment	<u>19</u>
Restaurants: Energy-Efficiency and Conservation	<u>20</u>
 <u>POOLS, SPAS, OFFICE EQUIPMENT AND MORE</u>	 <u>20</u>
 <u>WATER USE</u>	 <u>22</u>
 <u>DISTRIBUTED GENERATION</u>	 <u>23</u>
 <u>DEMAND RESPONSE</u>	 <u>24</u>

INTRODUCTION

Getting Started with Energy Savings

ENERGY STAR benchmarking compares annual kilowatt-hours (kWh) and British thermal As any hotel operator knows, keeping guests happy requires a high level of service and comfort. Traditionally this has also meant a high level of energy consumption - but it doesn't need to be that way.



Through energy efficiency and conservation measures, you can dramatically reduce energy use and utility bills - helping to limit greenhouse gas emissions, preserve the environment and protect California's energy security - all while improving the guest experience and your bottom line.

Hotels, especially full-service facilities, have a wide array of energy uses and a correspondingly wide array of savings possibilities. From lighting to cooling to cooking, you can easily save energy, money and the environment.

Saving Energy is Easy



This guide is designed to show facility managers many of the easiest and most cost-effective ways to reduce energy use and costs in hotel operations. With this knowledge, managers can either take simple steps or work with engineers and energy consultants to develop comprehensive plans.

By taking some of the steps outlined in this guide many facilities have been able to reduce their energy use by up to and over 20%, saving them tens - even hundreds - of thousands of dollars a year. These changes can also improve the guest experience through better aesthetics and a more comfortable indoor environment.

In California, the generation of electricity is a major source of the greenhouse gases responsible for global warming. By reducing electricity and natural gas consumption, California hotels can directly contribute to the fight against global warming. If every hotel took comprehensive energy efficiency actions, the effect would be the same as removing hundreds of thousands of cars from the road.

Whether you run a small bed and breakfast or a 1,000-room hotel and convention center, the basic steps toward lower energy use are the same:

- Conduct an energy audit to determine where and how your facility uses energy.
- Create an energy savings plan and enact changes to reduce use.
- Monitor and measure energy use to determine success.

The increased focus on energy and climate change in California makes this an ideal time to take action to save energy. The state has implemented a wide range of new laws and programs to improve building efficiency, promote alternative energy and cut greenhouse gas emissions. By taking steps to cut energy use at your facility, you will be helping California protect its energy grid from disruption and lower emissions of greenhouse gasses - both while ensuring that your facility meets current and future building code standards for efficiency. The state and local utilities are also offering a wide range of incentive programs to make saving energy even more beneficial to your business.

Marriott International

Through a wide array of 2006 programs, Marriott International has saved 4,700,000 kWh of electricity, 136,000 therms of natural gas and \$672,000. Programs include extensive evaluation and planning to ensure maximum energy efficiency, actions to cut CO₂ by 2% per room, promotion of a linen re-use program, a “group re-lamp” program to ensure maximum lighting efficiency, as well as peak-load reductions. Together, Marriott’s programs have cut CO₂ emissions by nearly 4 million pounds. Marriott International is a 5th Annual Flex Your Power Award winner.

PLANNING AN ENERGY PROGRAM

Planning an Energy Program: General Guidelines

Before taking any energy efficiency steps at your facility, devise a strategy that will guide your actions and yield the biggest benefits.

General Guidelines for creating an energy action plan:

- Conduct an energy audit to determine current and future energy needs based on current use and available improvements.
- Establish achievable goals for conservation in your hotel.
- Appoint an energy team or energy manager* to oversee your energy plan. You might use a task force to brainstorm specific conservation steps the hotel could take.
- Develop a draft. It is important to consider issues beyond energy when creating your energy plan to be sure that you are not creating problems in other arenas such as water use.

- Engage employees and solicit comments from anyone affected by the energy plan.
- Finalize your plan and create mechanisms for implementation and evaluation of results. Identify key players for implementation and evaluation, clearly defining roles and responsibilities and consequences for not staying on target. The plan will not help you if it sits on a shelf collecting dust.

*An energy manager is responsible for facilitating and coordinating the planning, procurement and utilization of energy resources at a property, facility or portfolio of properties. In some organizations, the energy manager is a full-time, dedicated position whose responsibilities might encompass a single building or a whole portfolio of properties. In others, energy management is just one part of the responsibilities of a facility or property manager. A background in engineering is common; increasingly, business and communication skills are also required. The energy manager carefully analyzes a company's potential for investment, articulates findings and recommendations to company decision makers, oversees implementation of efficiency and conservation measures and then tracks and quantifies results stemming from the energy management program. In doing so, successful energy managers depend on their relationships with co-workers, such as building staff, business managers and company executives, as well as external partners, such as vendors, contractors, energy service providers and the local utilities.

Your efficiency plan will be most successful if you have the full support of all employees. They will be responsible for many of the conservation steps in your plan. Make sure everyone understands the importance of efficiency to the business, the state and the environment.

Marriott International

Marriott International recently announced that more than 85 of its hotels will earn the ENERGY STAR label in 2007. Pat Maher, Senior Vice President, Engineering and Program Management for Marriott, says Marriott now has more than 200 properties with the ENERGY STAR label and it expects to increase that number by 33% in 2008.



Planning an Energy Program: Benchmarking

Without establishing a baseline for energy performance, facility managers have no way of knowing a building's potential for saving energy and money.

There are two primary ways to establish baseline data:

- Use an energy accounting system to analyze historical energy use, carefully taking

into account any changes in operations, extreme seasonal weather or other factors that might affect the energy use intensity or energy costs at a building or property.

- Model energy use in the building, also referred to as calibrated simulation. This involves the use of complex computer software to predict energy use in a building.

Often, energy efficiency and energy conservation measures are adopted to address discernible problems, such as uncomfortable indoor temperatures or wide fluctuations in utility bills. An energy accounting system that tracks the energy performance of a building and compares this to baseline data can help detect and confirm such problems, like malfunctioning cooling equipment that appears as a spike in energy demand of the heating, ventilating and air conditioning (HVAC) system.

In addition to analyzing energy performance against a baseline, owners and managers can use benchmarking to compare a building with properties of similar characteristics, such as climate, size, operations and age.



Planning an Energy Program: Energy Audits

An energy audit first identifies how energy is used in your hotel, and then recommends ways to improve energy efficiency and reduce energy costs. In practice, there is wide variance among the different levels of energy audits available. Or, as Albert Thumann writes in the Handbook of Energy Audits, “There is a direct relationship to the cost of the audit (amount of data collected and analyzed) and the number of energy conservation opportunities to be found.”

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) identifies three levels of energy audits:

- Walk-through Assessment: energy bills are analyzed and, possibly, a brief visual survey of the hotel is conducted. The subsequent report identifies no-cost and low-cost opportunities. This is the least costly of the three levels.
- Energy Survey and Analysis: a more detailed analysis is conducted, including a breakdown of how energy is used within the hotel. Recommendations consider an owner’s operations and maintenance, constraints, and economic criteria. Potential capital-intensive opportunities are identified in the final report for further research and analysis. This is the typical level of audit.
- Detailed Analysis of Capital-Intensive Modifications (Investment-grade Audit): this analysis focuses on capital-intensive opportunities and provides a higher

degree of monitoring, data collection and engineering analysis. The report includes detailed cost and savings information with a high level of confidence sufficient for major capital investment decisions, and may include a reasonable timeline for implementation of each recommendation.



Remember that certain problems only occur during a particular time or season. Time energy audits accordingly. For example, if you decide to upgrade cooling equipment that underperforms in warm weather, be sure to schedule the energy audit during summer months so that engineers can test it under the appropriate conditions.

Your local utility is a great resource for diagnostic tools, metering equipment and expert help in conducting an audit. Visit www.flexyourpower.org for more information.

A Financial Value Calculator presents energy investment opportunities in terms of key financial metrics. A Cash Flow Opportunity Calculator helps decision-makers decide how much equipment can be purchased from the anticipated savings. The Portfolio Manager is an interactive energy management tool that allows hotels to track and assess energy and water consumption across an entire portfolio of buildings.

The Doubletree Hotel Sacramento

When the Doubletree Sacramento set out to control energy costs in its 680,000-square-ft. hotel and convention center, it turned to a high-tech energy-management system (EMS). This system allows hotel management to monitor energy use in real time and to identify energy use spikes and irregularities. Through this system, enhanced automation and reduced lighting loads the hotel was able to cut electricity use by 11% in the first year. The analysis provided by the EMS has led to the discovery of costly problems. The EMS, for example, revealed that contract night janitors were inadvertently turning on the kitchen's ovens for 3 hours each night.

Planning an Energy Program: Energy Teams

The next step is to bring together the knowledge needed to develop and execute the energy action plan. An energy team's makeup could range from a single staff member at a small hotel taking on energy as one of many duties, all the way up to a team of full-time, dedicated energy specialists overseeing dozens of properties.



Consider goals and objectives when deciding whom to include among staff. For example, if air quality concerns are high among the priorities, then recruit staff familiar with the existing heating, ventilation and air conditioning (HVAC) system. Leverage the expertise of individual team members to make the most effective use of time and money.

External partners are another source of expertise and capabilities. Local utilities, for example, offer a range of services and programs that are often free of charge or tied to rebates. Similarly, third-parties, like architecture and engineering firms and building contractors, might be able to provide specialized services that in-house staff do not have the time or capacity to perform.

Leading by Example: Marriott International

Marriott has taken great effort to integrate all of their employees into their energy management strategy and to give them ownership over improving efficiency. Energy management is an important component of Marriott's intensive management training, and is often a topic at daily staff "stand-up meetings." Many properties even reward employees who identify and resolve energy related maintenance issues.

Planning an Energy Program: Energy Action Plan

The energy action plan will be a roadmap for continuous improvement, providing concrete steps for moving forward.

Typically an energy action plan is created after an energy audit has identified areas of potential improvement. Most energy audits include recommendations about the benefits and timing of potential energy projects; these will need to be evaluated by company decision makers to determine which projects fit internal investment criteria. The energy team can then assign specific tasks to its members, both in-house and outside consultants.



Regular meetings of the energy team help to assess progress and keep focus on action items. Depending on the scope of the energy program and the size of the property, creating incremental performance targets to ensure adequate progress may make the most sense.

Hilton, Starwood and Hyatt

Hilton, Starwood and Hyatt brand properties are also represented among the list of 247 hotels with the ENERGY STAR label. Jeff Hanulec, Director of Engineering at the Westin Copley Place Hotel in Boston, has led five hotels through the benchmarking process and he is currently leading an effort to make his hotel more energy efficient.

Planning an Energy Program: Certification Programs

Energy efficiency and conservation are major components of any green building program. Certification programs and green building guidelines are based on the collective experience of industry professionals - architects, designers, developers, academics, product manufacturers, utility representatives, facility managers and government regulators.



Hotels participating in ENERGY STAR make a commitment to allocate staff and funding to achieve continuous improvement. This includes appointing an energy director, establishing an energy team and instituting an energy policy. Gathering and tracking data is an important next step and includes the documenting of all energy uses. ENERGY STAR hotels establish a baseline for improvement and the metrics used to measure that improvement.

There are currently 247 ENERGY STAR labeled hotels listed on the U.S. Environmental Protection Agency's ENERGY STAR for Hospitality website. Almost 3,000 U.S. hotels have participated in this free government program since it was launched in 2002. Most participating hotels are in the 200-room range, but any property 20-rooms and up can benefit.

EPA provides a national energy performance rating system for hotels. The rating system allows participants to compare their hotel's performance against similar facilities. By uploading energy and building information to the EPA website, hotels can determine their benchmark score on a scale of one to 100. Buildings that rank in the top quartile of participating buildings based on energy efficiency are eligible for the ENERGY STAR label. Even though thousands of hotels have participated in the ENERGY STAR for Hospitality program, most have not applied for the ENERGY STAR label. Brodsky says, however, that he is seeing organizations apply now more than ever before.



The Leadership in Energy and Environmental Design (LEED) Green Building Certification by the U.S. Green Building Council encourages global adoption of green building practices through the implementation of universally recognized criteria, including energy efficiency in buildings.

The LEED Certification for Existing Buildings helps building owners and operators measure operations, improvements and maintenance and addresses whole-building cleaning and maintenance issues, recycling programs, exterior maintenance programs and systems upgrades.

A report issued in 2003 commissioned by more than 40 California state agencies and the USGBC looked at buildings constructed in the 1990s. This report has been further updated by the USGBC, which reports that as of 2007 the premium cost for LEED-certified projects, if any, is only 1% to 2%, and declining as people gain more experience. Any premium in costs is usually recovered through rebates, incentives and long-term cost savings, which have often provided a hard economic “payback” in 12 to 24 months.

LEED-certified buildings, typically save:

- 30% to 50% in energy usage
- 35% in carbon emissions
- 40% in water emissions
- 70% in solid waste

According to the USGBC, with a 30% to 50% energy savings a limited service hotel would achieve savings equivalent to increasing average daily rate (ADR) by \$1.80 to \$3.00, and a full service hotel would have the equivalent benefit of increasing ADR by \$4.00 to \$6.75.

W Hotel and Residences in West Hollywood

Marty Collins, CEO of Gatehouse Capital and the owner of W hotels in the United States decided to go for LEED certification for his current development, the W Hotel and Residences in West Hollywood. Collins considers the cost of meeting LEED certification standards “negligible” (less than 1% of his project, if that). The hotel will offer hotel guests, workers and residential owners a healthier environment for living and working - with significantly lower costs for energy, water and waste.

“1” Hotel and Residences

In October of 2006, Barry Sternlicht of Starwood Capital launched “1” Hotel and Residences, emphasizing that it will be the first luxury, eco-friendly global hotel brand. The concept promises to combine green construction and operating principles with exceptional service and luxurious comfort. “1” will show that green principles can actually enhance a luxury hotel experience.

LIGHTING

Lighting upgrades represent one of the best opportunities for energy savings in the hotel industry. A large hotel can have tens of thousands of individual light bulbs and fluorescent fixtures and may use 30% of its total electricity on lighting. By making upgrades in guest rooms, common areas and behind-the-scenes areas, a hotel can see immediate, consistent savings with no impact on the overall guest experience. In fact, the reduced heat generation and better modern lighting systems may improve comfort for guests and employees alike.

Lighting upgrades can usually be done in-house as part of routine maintenance. A hotel might choose to upgrade lighting gradually as part of a maintenance schedule, or as an all-at-once re-lamp. When replacing fixtures in high ceilings or hard-to-reach places it is usually easiest to replace all fixtures at once.



In both guest rooms and common areas, consider how you might be able to improve day lighting. A single 3'x5' window in direct sun lets in more light than 100 60-watt bulbs. Natural light also provides the best color rendering of any light source.

ENERGY STAR Commitment

The two largest hotels that have earned the ENERGY STAR are the Sheraton Waikiki with 2,228 rooms and the Sheraton Boston Hotel and Towers with 1,215 rooms. The smallest hotels with a label are the 60-room Laurel Super 8 Motel in Laurel, Montana, and the 85-room Saybrook Point Inn and Spa in Old Saybrook, Connecticut.

Lighting: Guest Rooms



Each hotel guest room has as many opportunities to cut lighting costs as there are light bulbs in the room. Each traditional incandescent light bulb uses approximately five times as much energy as a new compact fluorescent light bulb (CFL). CFLs also last many times longer than incandescent bulbs, so by replacing all traditional bulbs with CFLs, a hotel can reduce maintenance and dramatically cut lighting costs.

Along with improving the efficiency of guest room lighting, hotels can take action to reduce the amount of electricity wasted lighting empty rooms. Key-activated lighting systems and motion sensors will minimize unnecessary lighting use.

Key-activated lighting systems operate by requiring the guest to place the room's key card in a slot just inside the door. With the key in place all room lights operate normally, when the guest departs the room and removes the key the lights will shut off automatically. With such a system the room lights will always be off when unoccupied, without inconveniencing the guest.

Motion sensor controlled lights are mainly employed in guest room bathrooms, where the lights are most often left on. The sensors replace a traditional light switch and will simply turn on when the room is occupied and switch off after a few minutes with no motion.

Effective conservation of lighting, and other energy, will benefit from guest involvement and education. Consider providing informational materials to guests that inform them of your energy conservation measures and their importance to California and the world. Provide a few simple tips to guests on ways they can help, such as turning off lights and HVAC when rooms are unoccupied. This information also provides hotels with an opportunity to spread their message of energy efficiency outside of the hotel.

Atman Hospitality Group Inc.

After a study found that 60% of travelers leave their environmentally-conscious behavior at home when they check into a hotel (e-Newswire, 8/08/07), one hotel company is using new technology to encourage guests to remember their energy-saving habits. Atman Hospitality Group Inc. has installed kiosks at its Gaia Napa Valley Hotel & Spa (e-Newswire, 11/15/06) that show guests the status of energy efficiency in the building. The GreenTouchscreen kiosks and software - a \$51,000 expense - display electricity and water use and carbon-dioxide emissions, as well as charts comparing the energy consumption at the Gaia Hotel to other hotels.

As it turns out, accountability results in behavioral changes. With guests aware of their energy use - in-room television sets display the guests' individual and collective power and water consumption - the Gaia Hotel has seen a 26%-drop in energy costs and a 45%-drop in water costs, a significant improvement for both the environment and the hotel group's bottom line.

The Doubletree Hotel Sacramento

In their efforts to control energy waste and lighting costs, the Doubletree Sacramento turned to a new motion sensor developed by Watt Stopper, Lawrence Berkeley National Laboratory and the Sacramento Municipal Utility District. These motion sensor LED-lit nightlights were installed in 100 bathrooms in the hotel and cut usage by over 50% in

those locations. These sensors ensure that bathroom lights are not left on inadvertently by sleeping or departing guests to reduce instances of bathroom lights being used as nightlights.

Lighting: Lobbies, Conference Rooms and other Common Areas

Large open areas such as conference rooms, lobbies, exercise rooms, ballrooms and other common areas can greatly benefit from improvements to lighting efficiency and control. Many of these areas are lit by either fluorescent, inefficient incandescent or halogen lighting. Older fluorescent fixtures are often T12 lamps, which are inefficient, often provide poor light and are prone to flickering and buzzing.



To dramatically improve efficiency, consider replacing these older fixtures with high-efficiency T8 and T5 fluorescents. These lamps will result in immediate cost savings and can improve ambiance. Be sure to replace older magnetic ballasts with modern digital or electric units.

When upgrading lighting systems in common areas, consider installing new control systems to manage lighting in large areas. Computerized lighting controls will allow hotel operators to provide the ideal level of lighting based on the time of day, event or situation. This will prevent unnecessarily high lighting levels or unneeded lighting. In common bathrooms and seldom-used rooms, consider motion sensors to limit the number of unneeded lights left on.

What is a “light”?

All lights have a lamp, commonly but incorrectly referred to as the “light bulb.” The fixture connects and positions this lamp to its energy source. In fluorescent and high intensity discharge (HID) fixtures, the energy supply is modulated through a ballast. Halogen and incandescent fixtures, on the other hand, connect directly to the energy supply. Taken together, the lamp, ballast, and fixture are called a “luminaire” - light is the product of a luminaire.

What’s the difference between fluorescent fixtures?

Fluorescent fixtures are named by the diameter of the lamp. For example, a T12 is a 1-1/2” lamp, a T8 is a 1” lamp, and a T5 is a 5/8” lamp. The trick is to divide the number by 8 to determine the diameter in inches. Besides lamp diameter, fluorescents are sometimes further categorized by their lumen output - standard or high output (HO).

Lighting: Exterior Lighting



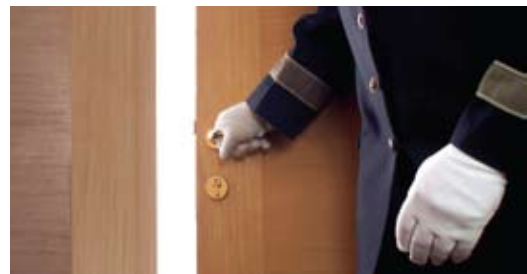
When upgrading exterior lighting, the first step is to replace inefficient lights. In general, hotel owners and managers will want to replace any incandescent lamps with compact fluorescent light bulbs (CFLs), and replace inefficient high-intensity discharge (HID) lamps with more efficient HIDs like low-pressure sodium (LPS) or high pressure sodium (HPS), depending on the color rendering needed. At the very least, mercury vapor HIDs should be replaced since these consume about three times the energy as the equivalent LPS lights.

Lighting controls play a large role in making outdoor lighting systems efficient and effective. Photosensors (also referred to as photocells) activate outdoor lighting as daylight diminishes. Hotels tend to be active throughout evening and nighttime hours, so parking lots, walkways, entryways and other areas need lighting during all dark hours. Motion sensors can activate lighting as needed for lesser-used outdoor areas, or during very low-traffic times. Seek the advice of a lighting professional who can help design, implement and test lighting levels in different outdoor areas to optimize the system to ensure safety compliance with lighting standards and building codes, as well as to provide the optimum guest experience.

Location and position are final considerations. Using lighting as a design element can have dramatic effects, but at 4 a.m., no one is around to impress. Consider adding timers and reducing the incidence of design lighting. All lighting, both essential and decorative, should be positioned so that direct and reflected light falls down, and not up into the atmosphere or across into a neighbor's space. This helps decrease the bothersome incidence of glare, light pollution and light trespass.

Lighting: Behind the Scenes

Most guests will never see the offices, laundry rooms, hallways and other staff areas of a hotel. Because these spaces don't affect the guest experience, they should be lit for maximum energy and worker efficiency. Be sure to upgrade incandescent bulbs to CFLs and upgrade T12 fluorescents to T8s or T5s.



In hallways and other behind-the-scenes areas you may not need all of the fixtures available, so consider de-lamping unneeded fixtures. In office spaces and other work

areas, you can reduce use of overhead lighting by installing task lighting. Task lighting directs light exactly where it's needed and can be effective with far fewer watts. LED task lighting is also now entering the market.

Motion sensors can also be very valuable in behind-the-scenes areas and can be installed in storerooms, bathrooms and other infrequently occupied spaces.

Leading by Example: Fairmont Sonoma Mission Inn & Spa

Through the leadership of Fairmont's hotel-based Green Teams, the Fairmont Sonoma Mission Inn & Spa recently completed an extensive lighting retrofit. The hotel has replaced 44,00 bulbs with energy efficient fluorescents. As a result the hotel has saved 203,000 kWh and \$61,000 annually. With a \$55,000 rebate covering most of the \$65,000 project cost, the hotel was able to realize a 2-month ROI.

Lighting: Signage

Commercial signage often operates 12 to 24 hours per day, consuming about 2% of the total electricity in the United States. A large hotel may have dozens or even hundreds of lit signs that are in use 24/7.



There are more than 100 million exit signs in use throughout the U.S. Typically lit by incandescent bulbs, these signs consume 30-35 billion kilowatt hours (kWh) hours of energy each year. Exit signs that have earned the ENERGY STAR operate on five watts or less per sign, compared to standard signs, which use as much as 40 watts per sign. When installed throughout a building, qualified exit signs can save hundreds or even thousands of dollars in energy and maintenance costs.

The lifetime savings of replacing 100 exit signs with LED models is approximately \$31,644 after repayment of initial costs. These savings can be even higher if the upgrade qualifies for rebates or incentives. High efficiency lighting in highway and other exterior signs will also cut power use in these constantly illuminated fixtures.

CENTRAL HVAC SYSTEM

No building system will have a greater impact on guest comfort than the HVAC system. Hotel guests will simply not tolerate a room that is too cold, too hot or too stuffy. Taking action to upgrade your HVAC system can have the dual impact of cutting energy costs and improving guest comfort.

Hotels employ many different types of HVAC systems - and often have several systems combined in the same facility. Rooftop HVAC units are regularly used in single-zone buildings or areas such as restaurants, conference rooms and other common areas. In small and mid-size hotels, terminal air conditioners are often employed in guest rooms to allow individual control over temperature. In larger facilities, fan coil units allow individual control of air blown over coils heated or cooled by the buildings central boiler or cooling unit.

In general, installing a central air conditioning system over individual room units is preferable. While a central system can be approximately two times more expensive to install, it saves a considerable amount of energy in the long run. Aside from increased efficiency, a central system will allow hotel operators to control the set points of the system and better monitor performance to ensure proper operation at all times.

Central HVAC System: HVAC Efficiency

Hotel operators can approach HVAC efficiency in a number of different ways. Eventually, you'll want to look at heating, cooling and the air delivery systems in your facilities.

Central HVAC System: Central Cooling Systems

Several central, water-cooled systems are available. Choosing the right system depends on your location, water costs and electricity costs. A qualified HVAC professional can help you determine how to get the most efficient system for your needs. Installing variable-frequency drives on chillers, pumps and cooling towers also improves cooling system efficiency. These drives ensure that cooling system power loads are tailored to your hotel's specific needs.



Central HVAC System: Air Delivery

Having the world's most efficient boiler won't do any good if half your hot or cold air is blowing away through leaky ducts or held up by clogged filters. Thoroughly examine ducts, filters, intakes and all other parts of the air circulation and delivery system. Your in-house maintenance team, or a qualified HVAC technician, can clean and seal this system for maximum performance. Make sure to clean or change filters on terminal units and undertake other recommended upkeep measures. After taking these steps, you will have a much better idea of how your HVAC system is performing and whether or not it is cost effective to upgrade your equipment.

Central HVAC System: System Management

The most efficient HVAC systems are ones that are used only when needed. Limit unnecessary heating and cooling costs with these simple steps:

- Instruct housekeeping staff to turn down or turn off heating or cooling when they finish cleaning a room.
- Plan properly for arriving guests so only those rooms are set for maximum comfort. Determine a “standby” setting for rooms that may be used by walk-in guests; it will only take a few minutes to bring them to a comfortable temperature.
- Limit the thermostat range available to guests. Guests should not be able to set rooms to below 60°F in the summer or above 80°F in the winter. This will prevent the accidental setting of extreme temperatures.

Marriott Mission Valley

This 350-room hotel took a number of steps to improve HVAC efficiency. Marriott’s hotel operators installed variable-frequency drives on their two chillers and on their cooling tower, saving 84,983 kWh per year. The hotel also installed a Hartman Loop, variable-frequency drives on pumps, demand-control ventilation and a retrofit of packaged HVAC units to a chilled water system. These additional upgrades save 629,707 kWh per year and have cut peak demand. San Diego Gas & Electric helped make these upgrades even more profitable with incentives totaling \$83,694.

Leading by Example: Motel 6

Motel 6

Motel 6 is participating in Cool Control Plus, Honeywell’s program to retrofit small hotels and motels in the Pacific Gas and Electric Company (PG&E) service territory. Honeywell offers participating hotels free installation of Telkonet SmartEnergy occupancy sensors and thermostats, which turn off air conditioning and heating equipment when guestrooms are vacant. Honeywell estimates that the upgrades will shave electricity consumption by 1,100 kilowatt-hours, and save up to \$140 in energy costs, per room each year. Honeywell will install the Telkonet SmartEnergy systems in 7,530 guestrooms at 66 Motel 6 properties in Northern and Central California. Motel 6 has already independently installed Telkonet SmartEnergy systems in nearly 50 of its California properties.

BUILDING ENVELOPE

The building envelope, also referred to as the building shell, consists of all partitions that separate outdoor air and temperature from indoor spaces: windows, doors, walls, roofs and foundation. The building envelope is critical for minimizing the buildup of humidity and uncomfortable drafts.

To keep conditioned air inside, check and repair any leaks in seals and insulation around building partitions and ductwork in the HVAC system.

MGM City Center in Las Vegas

To prevent outdoor air and temperature from infiltrating conditioned space, install high-efficiency doors and windows wherever possible. Doors can be a large source of hot or cool air loss in hotels. Make sure to seal door jambs and below doors, especially in hotels with outside access to rooms. Glazing or films for windows is another option, particularly for buildings in which window replacement is neither cost-effective nor practical. Glazing lowers the emissivity (i.e. radiation) of surfaces and reduces ultraviolet rays responsible for fading fabrics and furnishings.

Shade is the most cost-effective and simplest way to reduce solar radiation.

Architectural elements can be added that shade windows and doors - roof overhangs, light shelves and fins or slats, for example. Trees make great shade, too. Properly placed, trees lower air conditioning costs by shading buildings and lowering outdoor temperature through evapotranspiration. Trees also provide a significant community benefit by reducing stormwater runoff and trapping air pollutants like carbon dioxide. A study of San Diego County by American Forests, for example, found that the urban forest removes 4.3 million pounds of pollutants from local air each year - a benefit worth \$10.8 million annually. These trees sequester about 9,000 tons of greenhouse gases each year, storing a total of 1.2 million tons.

MGM Commits to Green Building

MGM, developer of the largest hotel project in the world (\$8 billion), City Center in Las Vegas, will make all of its new buildings green, retrofit existing buildings and operate all of them more sustainably.

Building Envelope: Cool Roofs



Cool roofs are roofs with special coatings or surfaces that reflect heat. While this seems simple in concept, the cooling benefits can be quite dramatic. Consider that dark surfaces in the sun are up to 70°F hotter than white ones - this means that when normal rooftop temperatures are peaking at 190°F during the hot summer months, cool roofs only reach about 120°F. The ability of your rooftop to reflect solar radiation and reduce surface temperatures is related to the effort your cooling equipment exerts to condition indoor spaces.

Besides lowering HVAC operating costs, cool roofs help others in the local community. In cities, building rooftops and paved surfaces collectively create urban heat islands.

Researchers at Lawrence Berkeley National Laboratory and the U.S. EPA have found that these heat islands raise outdoor temperatures 6°F to 8°F above surrounding areas, which can lead to a higher incidence of smog.

Cool roofs make sense when:

- A building has high air conditioning loads and/or is located in a hot, sunny climate.
- The roof has a large surface area as compared to the overall building size.
- Re-roofing or other roof maintenance is scheduled as part of routine operations and maintenance.
- Constructing a new building.
- Installation is part of a wider effort to reduce cooling loads; cool roofs and good insulation levels go hand in hand.

Cool roofs are most effective during the hottest part of the day and the hottest time of year, coinciding with peak energy demand. Having a cool roof allows for lower air conditioning settings, reduced energy costs and reduced strain on California's power grid - all without sacrificing guest or employee comfort.

Remember that a cool roof is only one surface, and that any rooftop retrofit should be part of a wider effort to improve insulation of the building envelope. Installing proper levels of insulation provides year round benefits by preventing heat gain in the summer and blocking cold air infiltration in the winter.

RESTAURANTS

Many larger hotels operate a restaurant or commercial kitchen, and a major resort facility can have numerous restaurants and commercial kitchens on site. Like any operator in the food service business, a hotel restaurant or kitchen has many opportunities to save energy and money.



Restaurants: Cooking Equipment

As in any kitchen, cooking equipment uses the lion's share of energy - energy you can save through efficiency and conservation. These potential energy savings translate into hundreds or thousands of dollars saved per year if your hotel restaurant upgrades older cooking equipment to ENERGY STAR qualified models.

Below are just a few of the examples of how much can be saved in your hotel kitchen. For more information, download Flex Your Power's guide to restaurant efficiency *Boosting Restaurant Profits With Energy Efficiency*.

- The EPA estimates that a new ENERGY STAR qualified commercial steamer can save 11,000 kWh (electric models) or 65Mbtu (gas models) per year over older inefficient equipment. This can mean a cost savings of \$600 to \$15,00 annually for a single steamer. ENERGY STAR qualified connectionless steam cookers also save water. They can cut water consumption by up to 90% and save approximately 170,000 gallons annually.
- ENERGY STAR qualified fryers offer significant savings while increasing production rates. The EPA estimates that ENERGY STAR qualified fryers can save approximately 1,000 kWh (electric models) or 36 Mbtu (gas models) annually. This adds up to savings of approximately \$130 to \$360 per year for each upgraded fryer.

Restaurants: Energy-Efficiency and Conservation

By practicing some simple energy-efficiency and conservation in the kitchen, you can cut energy bills without sacrificing cooking performance or spending a lot of money.

- Be sure to turn off standby cooking appliances when they are not in use. Hot food holding cabinets, heat lamps, steamers and broilers are often left on throughout the day.
- Conserve water, especially hot water, wherever possible. By adding aerators, low-flow spray valves and other water saving items you can reduce both water and energy bills. Adding insulation to hot water pipes and heaters will also cut costs and save energy.
- Clean refrigerator condenser coils at least every three months and defrost freezers frequently. Make sure to install strip curtains on walk-ins and check all seals regularly for air leaks. These easy steps can cut costs and energy use.

For a comprehensive guide to saving energy in your hotel restaurant please see Flex Your Power's guide [Boosting Restaurant Profits With Energy Efficiency](#).

POOLS, SPAS, OFFICE EQUIPMENT AND MORE

After a thorough energy audit, you may find that your hotel can save significantly on energy costs in these less obvious places. Seemingly small power uses can quickly add up and should not be overlooked during efficiency retrofits.



Pools and hot tubs consume a considerable amount of energy, especially outdoor pools heated in a cool climate. You can prevent constant heat loss to the surrounding air by installing a thermal pool and/or spa cover when facilities are not in use. Check the water temperature regularly to ensure that heaters are operating properly and to avoid over-heating your pool.

Consider replacing older, inefficient units and/or installing a solar pool heating system to reduce the amount of electricity used to heat water in cooler climates.

Laundry services in a hotel can use huge amounts of energy. With many loads of sheets and towels to be washed daily, you'll find numerous opportunities to increase efficiency in the laundry room. For smaller hotels that rely on traditional commercial machines, the best bet may be an upgrade to ENERGY STAR qualified washers and dryers. Energy-efficient washers reduce consumption by cutting water use and the corresponding energy to heat it, increasing water extraction in the spin cycle for quicker drying and improved efficiency of motors and pumps. Modern dryers can cut energy use by employing moisture sensors and increasing airflow to reduce the amount of heat needed.

In larger facilities, you'll find more opportunities to cut energy use and costs. While larger facilities can also benefit from modern high-efficiency machines, they have several other innovative options. Ozone laundry systems inject ozone into the cleaning process, allowing for a high-quality result with less hot water and less cleaning chemicals. In a large hotel these systems can pay for themselves in as little as two years.

Heat recovery systems are another way of reducing energy use in large hotel laundry operations. By utilizing an air-to-air heat exchanger in the dryers, these systems allow incoming air to be heated by the dryer exhaust. By capturing waste heat, these systems minimize the amount of energy needed to heat the dryers by up to 50%. Talk to your commercial laundry service provider about creative energy-saving options.

Vending machines consume energy through 24/7 lighting and refrigeration. Install controls that use infrared sensors to reduce the lighting of machines - and, thus, the energy consumption - of vending machines when nearby foot traffic is low. Modern vending machines also have improved insulation and higher efficiency cooling units to reduce energy costs. Since many machines are owned by vending companies, you may need to seek their help in making efficiency upgrades.

Saunas, exercise rooms and other infrequently used facilities can benefit from motion sensors to shut off lights, HVAC and equipment during periods of inactivity.

Remote-cooled ice machines improve efficiency because the heat generated can be discharged outside during summer months or captured and recycled by heat recovery systems in the colder months. Make sure the cooling units of ice machines are cleaned regularly to maintain optimal efficiency, or consider a self-cleaning model to reduce maintenance costs.

Office equipment is widespread in hotels large and small and represents yet another opportunity to cut energy use without diminishing the guest experience. Consider changing your computer monitors to flat-panel LCD units, which use as much as 90% less energy than traditional monitors. Make sure to enable the power management on all computers so they use less energy when idling. Many copiers, printers and other equipment can also be set to “sleep” when not in use. If your equipment does not have this feature, consider upgrading or simply turning off units that are not in use. When upgrading any office equipment, look for models that are ENERGY STAR qualified to ensure efficiency.

WATER USE

Every Californian understands the importance of water conservation. Now energy stakeholders are beginning to realize that water use has considerable consequences for energy, especially in Southern California, which receives its water supply through incredibly energy-intensive and expensive water projects. Pumping, treating, converging and heating water accounts for 20% of California’s total energy use. The State Water Project delivers 2.3 million acre-feet of water each year, consuming approximately 5 billion kilowatt-hours of energy each year. It is the largest single end-user of electricity in the state. Much of this energy is used to “lift” water 2000 feet over the Tehachapi Mountains - the highest such lift of any water system in the world. Pumping one acre-foot of water to Southern California requires roughly 3,000 kilowatt-hours of energy. Although the cost to end-users of water and sewage is small compared to other utility costs, saving water is the responsibility of all Californians.

Most water agencies in California offer free water use surveys (water audits) for commercial, industrial, and institutional customers. Like an energy audit, a water audit provides valuable information about a site’s water use, as well as options for reducing demand. Water audits focus on fixtures (flow rates and leaks), irrigation systems for landscapes and interior-scapes, and any water use associated with processes or operations.



A water audit generates a detailed report listing site-specific recommendations.

Save water at your hotel:

- Low flow toilets can save 4-6 gallons of water per flush.
- Low flow shower heads can reduce consumption by 50% or more.

- Installing aerators on faucets can save between 3 and 17 gallons per day, per faucet.
- Upgrading your landscaping with native plants, xeriscaping, drip irrigation and soil moisture sensors will dramatically cut water use.
- Upgrading laundry and kitchen equipment, such as steamers, will save thousands of gallons per year.

DISTRIBUTED GENERATION

Like any business, hotels have the opportunity to reduce energy use and energy costs by generating their own power. With recent technological advancements, the opportunities are continually increasing.



Hotels in locations with the proper natural conditions may be able to take advantage of solar power to meet some of their energy needs. Solar energy is an especially good choice for hotels in hot, sunny climates, such as Southern California and the Central Valley. In these areas, the hot sunny summer weather means that the peak periods for energy use often coincide with the peak conditions for producing solar power. A hotel solar system will save electricity during the most expensive times and will help protect the power grid by lowering the impact of high cooling loads. The large rooftop surfaces of suburban and rural hotel buildings provide ample space for a solar system, and systems can be easily tailored to meet specific needs.

Consider installing a system in conjunction with a cool roof and increased insulation. Increased rebates and incentives in California and other states make this the opportune time to consider solar power for your hotel. Hotels can also opt for a Power Purchasing Agreement, a less capital-intensive route to getting solar on your roof. Talk to your local solar installer about incentives, rebates and other financing options.

Cogeneration, or combined heat and power (CHP), is another good option for large hotel properties. A CHP system consists of an engine, turbine or fuel cell (prime mover) that generates on-site electricity, plus a heat recovery unit that captures waste heat from the generation process. In large hotels, CHP systems are usually connected to an absorption chiller that provides heating and cooling for the HVAC system. The absorption chiller - powered by thermal energy - replaces a traditional chiller powered by electricity. Cogeneration systems can also heat domestic water for use in the building.

Absorption chillers, although technically part of the HVAC system, are fueled by low-grade waste heat recovered from on-site electricity generation. Absorption chillers are available in capacities ranging from 100 to 1,500 tons and use environmentally benign refrigerants and absorbents instead of polluting chlorofluorocarbons. Although absorption chillers have a low coefficient of performance when compared to electrical chillers, they are extremely cost-effective and efficient when used with a cogeneration system, since very little electricity is used to power the chiller. Consider that the cost of cooling is about 22% of a building's total electrical expenses - the savings become clear. Leading by Example: Hilton Palm Springs

The Hilton Palm Springs

The Hilton Palm Springs has been an efficiency leader for years, employing an energy management system and undertaking many efficiency actions. The hotel further cut power use by installing solar water heaters for the 110,000-gallon swimming pool and installing two 140-kW cogeneration units with 50-ton absorption chillers to generate peak power. The chiller optimizer alone saves \$36,000 annually.

DEMAND RESPONSE

Demand response programs are a tool for cutting power use at “peak” times - times of greatest demand and highest risk for blackouts and other service disruptions, typically between noon and 7 p.m. Administered by local utilities or third-parties, these conservation programs notify participating businesses when to use less electricity to prevent shortages or high spot market prices. Some demand response programs provide financial incentives or other benefits to customers who agree to reduce peak consumption or shift electricity use to off-peak hours.



The California Independent System Operator (ISO) triggers demand response programs when operating reserves are expected to drop below 7%, meaning that blackouts are more likely to occur. Low operating reserves occur because of high peak demand, unplanned generation outages, transmission problems or adverse weather. If reserves drop, California ISO will notify program administrators, who then alert program participants.

The two basic types of demand response programs are reliability and pricing. Reliability programs are triggered the day of an electrical event to prevent or offset an impending emergency. Some are voluntary programs, meaning that a business does not face a penalty when unable to reduce its load. Other reliability programs are binding and

invoke penalties for non-action. However, these programs are designed so that penalties are wholly or partially offset by financial incentives, such as lower overall rates. Pricing programs are tied, in theory, to the spot market price of electricity. On critical days, pricing programs invoke higher rates for electricity used during peak hours. These higher rates are only put into effect for a maximum of 12 days a year.

Hotels interested in demand response programs should contact their local utilities to ask for no-obligation demand response audits. Similar to an energy audit, a demand response audit examines building equipment systems and operations to determine what opportunities exist for load curtailment. Your utility representative can then help you choose among the many programs available, matching your building's profile to the best-suited incentive packages. Hotels can also take advantage of the Flex Alert Network to reduce energy use at peak times.

Demand Response Tips for Hotel Operators

Hotel operators must be creative in finding ways to participate in demand response programs without affecting the experience of their guests. Hotels must capitalize on their ability to conserve power behind the scenes, while maintaining normal operations.

- Shut off unnecessary lights and equipment in offices, maintenance areas and other behind-the-scenes areas.
- Operate laundry services during off-peak times, such as the early morning.
- Schedule equipment - such as pool pumps - to run at off-peak times.
- Adjust cooling set points up where possible.
- Experiment with adjusting temperatures in areas such as lobbies and conference facilities to cut power and maintain comfort.
- Review building operations to develop demand response strategies and processes ahead of time.

Leading by Example: Wyndham Palm Springs Hotel

The Wyndham Palm Springs Hotel won a 5th annual Flex Your Power Award for its demand response programs. The resort completely redesigned its energy management policies to focus on conservation and demand response. The hotel operators accomplished extensive load shifting by rescheduling laundry and maintenance to off-peak times. They were also able to shed peak loads through HVAC management and continuous monitoring of unoccupied guest rooms, ensuring minimal waste of energy. These actions allowed the hotel to achieve a highest peak savings of 428 kW, or 44.9% of peak load. Overall, efficiency programs that saved 871,752 kWh per year.



Efficiency Partnership
2183 Union Street
San Francisco, CA 94123
(415) 771-7571 (P)
(415) 775-4159 (F)