

Identifying Energy Waste with the Walk-Through Audit



Consulting engineers may provide several types of auditing services for small and midsize businesses depending on a client's budget and time. One type, commonly known as a standard or desktop audit, involves developing an energy consumption baseline and using simplified tools to evaluate the economic benefits of specific measures. Another type, the detailed audit, is the most expensive and time-consuming but produces the most accurate results and recommendations. One can spend days, weeks, or even months measuring the performance of specific end uses and calibrating building energy simulations to accurately predict the outcome of replacing or re-commissioning existing equipment. However, before building owners and facility managers spend big bucks on a detailed audit, they can have a consultant perform a walk-through audit. Although it is likely that a consultant will have more expertise, anyone with a keen eye can perform a walk-through that can lead to significant energy cost savings.

The Walk-Through Energy Audit

A walk-through audit is a stroll through your facility with the intention of identifying low- or no-cost operating and maintenance measures that will improve building performance without sacrificing comfort or indoor air quality. One secondary goal is to identify a list of potential capital improvements that require further investigation. Although a walk-through is generally a one-time event, performing one every 6 to 12 months will allow a facility manager to gauge the effectiveness of previous measures while keeping an eye out for new sources of energy waste.

Figure 1 : When not in use, turn off the juice

A sticker on a light switch is a friendly reminder to building occupants to turn off lights when a room is unoccupied.



Courtesy: University of Colorado at Boulder Environmental Center

When Not in Use, Turn off the Juice

Lighting. The following issues should be considered regarding lighting energy use.

- *Are lights on during unoccupied periods?* Often, lights are left on during the day for no functional or aesthetic reason, or at night because cleaning crews illuminate an entire building even when working only in a particular section. Each 32-watt fluorescent tube that's left on all night consumes about \$6 worth of electricity in a year's time. Turning off 500 lamps at night could save a company \$3,000 annually. An energy management system or a series of occupancy sensors could do the job automatically, but employee education, often as simple as a sticker next to a light switch (see **Figure 1**), can be an effective means of motivating staff to turn off the lights at the end of the day.

- *Is the lighting in any particular area too bright?* Delamping is a low-cost option for fixing overlit areas, saving energy, and improving occupant comfort.

Office Equipment. Are computers, printers, or copiers left on overnight or through the holidays? Contrary to popular belief, starting a computer does not consume more electricity than leaving it on all night, and turning it off and on once per day does not create significant extra wear and tear on the system. Computers can be set up to automatically switch to sleep mode when not in use for a short period of time, for example, 30 minutes to an hour. Turning off a computer each night and on weekends, instead of leaving it in sleep mode, can save \$15 per year per computer. For 500 computers in an office building, the annual savings would be \$7,500.

HVAC Equipment. The following issues regarding cooling and heating should be considered.

- *Is the building's air-handling unit providing conditioned air during unoccupied times?* Many buildings' energy management systems are set to provide conditioned air 24/7/365, even when the building is closed or only a few people are inside. Next time you work a very late night or holiday when few people occupy the building, check to see if you sense air emerging from the supply vents. If so, the air-handling unit is on, most likely when it doesn't need to be. Air-handling systems need to operate on a schedule that closely mimics the normal occupancy schedule. Changing an air-handling unit's operating schedule from 24/7/365 to 6:00 a.m. to 8:00 p.m. on weekdays will reduce the fan energy use by approximately 40 percent for a constant-volume system, in addition to heating and cooling energy savings. Be sure to alert occupants to any changes in the schedule—if many occupants are working on a particular weekend or holiday, they may need to request that a particular air-handling unit be on. Building operators lacking

control over air-handling unit schedules should look into setting back heating and cooling temperature setpoints during unoccupied periods.

- *Are portable space heaters commonplace?* Consuming up to 1.5 kilowatts (kW) apiece, portable electric space heaters can add a significant amount to a utility bill, especially if the facility pays for electricity demand. If these devices are common in conditioned areas, it could mean that a change in temperature setpoint is needed or that problems may exist that limit warm air flow within the room. Limited airflow to the space could be the result of several problems, such as stuck air dampers, dirty air filters, or significant duct leakage.

Efficiency Is Key

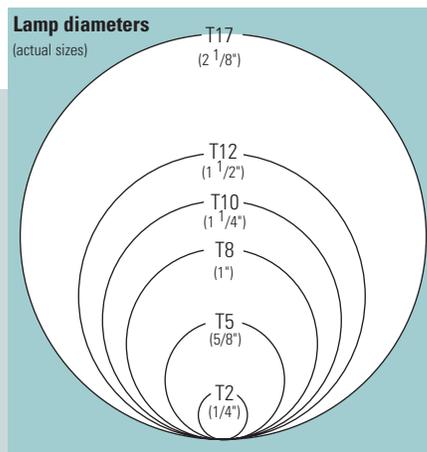
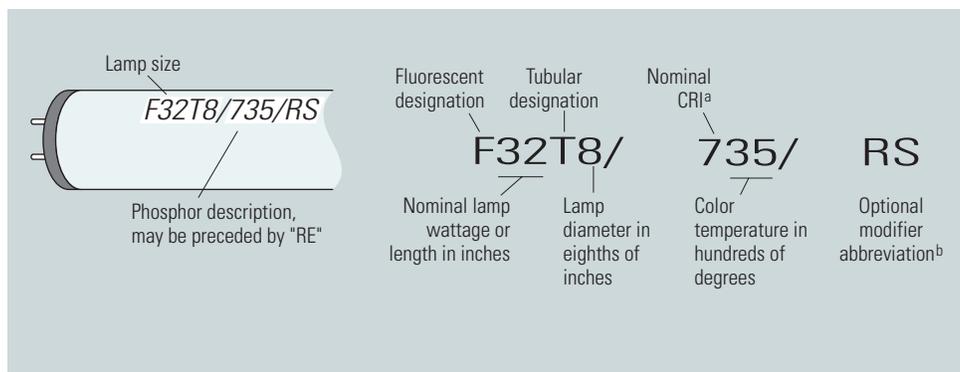
Energy Star. It is unlikely that replacing useful existing office equipment with a more-efficient product will be cost-effective (except lighting; see the next paragraph), but throughout the walk-through, keep an eye out for equipment that is due to be replaced or badly needs replacing. Energy Star, the U.S. Environmental Protection Agency's program that promotes energy efficiency, provides simple-to-use calculators that can help you make purchasing decisions on anything from commercial fryers to packaged rooftop units. Energy Star-qualified products consume 10 to 65 percent less energy than other products on the market.

Lighting. Lighting accounts for about 7 percent of industrial electricity use and 39 percent of commercial electricity use. Known as the mother lode for energy efficiency, lighting retrofits represent a significant opportunity to cost-effectively reduce utility bills and improve lighting quality. What type of lighting do you use? (See **Figure 2**, next page.) If you know the lighting in your building hasn't been changed in the past 5 to 10 years, then it may be wise to contact a local lighting consultant and ask about a retrofit.

Figure 2: What kind of fluorescent lamps do you use?

Identifying the lamps in use will help you make retrofit decisions.

The first number in a lamp's designation usually—but not always—indicates the nominal wattage for rapid-start lamps and the nominal tube diameter for instant-start lamps.



Notes: a. Nominal color rendering index (CRI) range (7 = 70–79, 8 = 80–89, 9 = 90–99).
b. For example, RS = rapid start, ES = energy saving, and HO = high output.

Source: E SOURCE

Exit signs are also a significant retrofit opportunity because they often operate 24/7. Typical incandescent signs may use 30 to 40 watts, whereas light-emitting diode (LED) signs, the most commonly used alternative, may use only 5 watts. Several other alternatives include electroluminescent signs, which use even less electricity than LED signs, or photoluminescent signs, which use no power at all. The low difference in wattage between one technology and another may not generate substantial electricity savings for a small building with just one or two exit signs, but savings become noticeable in a large facility with several hundred exit signs. To cut down on retrofit costs, exit-sign LED retrofit kits are also available.

Equipment interactions. Many energy-consuming devices in buildings interact with other building systems. For example, using energy-efficient equipment such as lights, pumps, motors, or computers in a conditioned space will reduce the cooling load and therefore the cooling energy consumption for that space. These measures will have the opposite effect on heating, though the effect is generally not as significant.

Gaps, Cracks, and Leaks

Gaps and cracks in the exterior shell of a building are a major concern for low-rise and cold-storage facilities. For example, it is common for air leakage and indoor equipment to represent 50 percent of the cooling load for a refrigerated warehouse or distribution center. Throughout the walk-through, pay close attention to drafty or broken windows and gaps around frames, doors, and loading docks. Most air leaks around doors and windows can be sealed with weather stripping, available at any local hardware store. For truck docks, several manufacturers produce specialty products for preventing air leakage around dock doors and levelers. In addition, listen for leaks around compressed-air systems. Even well-maintained plants lose about 10 percent of compressed air to leaks, and many more lose 20 to 40 percent.

High Flow to Low Flow

Check to see whether shower heads and sink faucets have low-flow fixtures. These fixtures are meant to supply water at the same level of performance as high-flow fixtures, but with significantly lower flow rates,

Lighting Electricity Savings

The following calculation estimates energy savings from a lighting retrofit in kilowatt-hours (kWh). What is the energy savings from replacing the lamps in 100 luminaires, each with three 40-watt T12 lamps with magnetic ballasts (144 watts total per luminaire), with 32-watt T8 lamps with electronic ballasts (89 watts total per luminaire)? The lights are on 10 hours per day, 5 days per week, and 52 weeks per year.

$$\text{kWh} = N_L \times WR \times N_H$$

Where N_L is the number of lamps, WR is the wattage rating per lamp, and N_H is the number of hours the lamps are on.

$$\text{Energy savings} = 100 \text{ luminaires} \times (144 \text{ watts/luminaire} - 89 \text{ watts/luminaire}) \times 10 \text{ hours/day} \times 5 \text{ days/week} \times 52 \text{ weeks/year} \times 0.001 \text{ kilowatts/watt}$$

Energy savings = 14,300 kWh per year.

creating water utility and hot water heating savings. Low-flow fixtures typically have a label displaying the flow rate and are generally 2 to 2.5 gallons per minute (gpm) for showers or 0.5 to 2.2 gpm for restroom and kitchen faucets. One simple retrofit option for restroom faucets is an aerator: a small screw-on device that controls the flow of water and mixes it with air to increase spray velocity and reduce splash. Check with your local water utility to see if it offers discounted retrofit kits or other incentives.

Prioritize and Save

The walk-through audit is a simple task that can reap large benefits for your facility. Once a list of findings is in hand, prioritize the measures by importance or potential energy savings and then go down your list and implement each measure. Try out a number of the free audit tools available online (see the “For More

Information” section) or hire a qualified energy consultant if your facility requires further technical investigation.

For More Information

Natural Resources Canada’s Energy Efficiency and Planning Guide provides a thorough look at the auditing process: http://oee.nrcan.gc.ca/publications/infosource/pub/cipec/Managementguide_E.pdf.

The U.S. Department of Energy maintains a database of over 300 energy analysis tools, many of which are free, at www.eere.energy.gov/buildings/tools_directory.

Energy Star’s Financial Value Calculator helps determine the financial impact of energy-efficient retrofits: www.energystar.gov/ia/business/financial_value_calculator.xls.

