



Energy Efficiency Recommendations for Commercial Buildings

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After performing energy assessments on millions of square feet of building space in New Mexico, Local Energy has a good idea of some of the efficiency improvements that will benefit you even before we visit your facility. In this document, we have assembled our most commonly recommended building upgrades to help you begin taking a critical look at energy usage at your facility.

Our experience shows that a strategic approach to improving energy efficiency includes three basic components: **Operations and Maintenance (O&M)**, to make sure that your facility is performing in the way it was designed, **Occupant Awareness**, ensuring that occupants are well informed on the things they can do to reduce energy waste, and **Facility Upgrades**, which involve retrofitting the lighting, mechanical, and envelope of your facility for improved energy performance. Although here we are mainly focused on facility upgrades, we recommend that you develop a comprehensive plan to address the operational, maintenance, and awareness components as well.

Occupant awareness is one of the most important and inexpensive ways to reduce energy waste. When lights, computers, air conditioners and other items are routinely left turned on when not needed, the energy waste and the resultant utility costs can be enormous. And since leaving a light bulb lit for one day necessitates burning nearly two pounds of coal to generate the electricity, the environmental impact of energy waste further highlights the need for effective awareness programs.

Before implementing energy efficiency upgrades, you should consider whether you are a candidate for an energy-savings performance contract. Performance contracting shifts the burden of determining the best ways to save energy from you to the performance contractor, and gives the contractor an incentive to save you the most money possible. Typically, the contractor guarantees a cost-savings to you, and then installs the best available technology to minimize energy costs. Upgrades may include improved lighting, higher efficiency boilers and chillers, automated building control systems, cogeneration systems, solar heating systems, or any other measures that are cost effective. A performance contract reduces your energy costs immediately, and they can often be structured to eliminate capital investment on your part.

Suggested Building Envelope Upgrades:

- 1. Improve insulation in walls and ceilings.** The effective R-value of installed insulation is generally much less than its rated value, especially if it has been installed improperly. Any insulation that is not touching the surface it is intended to insulate is compromised nearly to the point of being useless. Many areas are difficult to insulate properly with batts, and a superior result is generally obtained with blown cellulose insulation. Payback periods for insulation upgrades are often very short, especially in electrically heated buildings.
- 2. Seal the windows and doors.** Infiltration of outside air can account for more than half of a building's heating load. Windows can be sealed with a high quality clear plastic such as Flex-O-Pane. Add weather-stripping and sweeps to doors to minimize leakage.
- 3. Reduce the cooling load from black rubber roofs.** Installing a reflective roof typically reduces roof-related cooling loads by 75 percent compared to a black roof, resulting in significant energy and dollar savings. If your roof is still in good shape it may not be cost effective to replace it, but

you may instead want to add a light-colored rock ballast or coat the roof with a reflective paint such as Hypalon. Check your roof warranty before proceeding.

4. **Tint the south and west-facing windows.** Excessive solar gain through south and west-facing windows increases cooling costs. There are several methods to reduce direct solar gain, including adding exterior shade cloth, interior window blinds, or installing a tinted film with a high thermal reflectance.

Suggested Lighting Upgrades:

1. **Replace all T-12/magnetic lighting with T-8/electronic.** The newer T-8 lamps with electronic ballasts provide better light and consume 40 percent less energy. Even greater savings are possible in areas where fixtures can be upgraded to higher performance models that use fewer lamps. T-8 lamps also reduce the building cooling load. Although all lamps should be upgraded, start with the fixtures that have the highest duty cycle in order to get the fastest payback.
2. **Replace incandescent lamps with compact fluorescent.** Compact fluorescent (CF) lamps provide comparable light levels using about one-third of the energy, and can now be applied in nearly all incandescent lamp applications. Installing CF lamps also reduces maintenance costs, since they last about 10 times longer than incandescent. To maximize savings, replace bulbs in high usage areas first.
3. **Add occupancy sensors in intermittent use areas.** Installing sensors to automatically shut off lights in meeting rooms, rest rooms, and other intermittent use areas reduces both lighting and cooling expenses and generally provides good return on investment.
4. **Retrofit incandescent exit signs with LED lights.** LED retrofit kits can be installed in the existing fixtures, and they reduce energy consumption by 95 percent. They are generally brighter than incandescent, and with an 80-year life expectancy they virtually eliminate maintenance.
5. **Add a photocell to outdoor lighting controls.** Adding a photocell ensures that your outdoor lights never operate unnecessarily in daylight.
6. **Consider installing master relay switches in hotel guest rooms.** A master relay to turn off all the room lights and the air conditioner reminds guests to conserve energy when they leave the room. In some hotels, the room key must remain inserted in master relay, such that all loads are powered off whenever the guest removes their key to leave the room.

Suggested HVAC & Controls Upgrades:

1. **Repair or install automatic fresh-air damper systems.** The daily temperature swings in New Mexico make continuous modulation of outside air a necessity. Optimal operation of a fresh-air damper can only be accomplished with automation. Simply propping the dampers open makes the chillers work harder than needed on hot afternoons, while holding them closed prevents using cool night air to condition the building.
2. **Test and balance the building ventilation system.** This will make the indoor temperature of the building more uniform, which improves building comfort and allows the HVAC system to work at peak efficiency. Annual savings are often many times the cost of this repair.
3. **Install setback thermostats.** Your HVAC system should maintain your building at a comfortable temperature during operating hours, but when unoccupied, the building should “coast” until just prior to the next occupied period. Setback thermostats are remarkably inexpensive now, and they reduce unnecessary wear and tear on heating and cooling equipment.
4. **Program the HVAC temperature-scheduling system.** Unnecessarily heating and cooling unoccupied spaces is inefficient and costly. Large intermittently-used areas such as ballrooms and meeting rooms yield particularly large savings with temperature schedulers.
5. **Install plate-and-frame heat exchangers on chillers.** Whenever the outdoor temperature is 10°F below the chilled water return temperature, “free cooling” is available via a plate-and-frame heat exchanger. They can generally be retrofitted to existing equipment, and since chillers often represent the largest electrical load in the building, they provide significant savings.

6. **Ventilate overheated equipment rooms.** Installing a fresh-air intake duct and active exhaust ventilation in overheated equipment rooms reduces the load on the building's cooling system. The reduced temperature also extends the life of the motors that run your fans and pumps.
7. **Consider installing heat-recovery systems on exhaust ventilators.** The proximity of the exhaust and intake air determines whether this is practical, and getting an estimate will help you determine the cost effectiveness.
8. **Insulate evaporative coolers in the off season.** A thin sheet of metal is often all that prevents heated air from escaping through an evaporative cooler during the winter. Check that the damper doesn't leak, and add insulation if possible to reduce conductive heat losses. It also helps to install an outdoor cover over the cooler for the winter.
9. **Check duct insulation.** Insulation is critical on ducts that are installed in unconditioned spaces.

Suggested Boiler and Chiller Upgrades:

1. **Add economizers to boilers.** Using the waste heat from the exhaust stack to preheat combustion air or return water can improve boiler efficiency and reduce fuel consumption. The recent increases in fuel costs have greatly improved the return on investment for economizer projects.
2. **Install digital temperature controllers on boilers.** As the weather gets warmer, boilers can operate at lower temperatures for improved efficiency. Digital controllers such as those available from *Tekmar* keep the boiler's supply water temperature as low as possible while still satisfying heating requirements, thereby maximizing the boiler's efficiency.
3. **Insulate steam lines, hot water lines, and water tanks.** Pipe insulation reduces heating costs and cooling loads at the same time, and pump motors will last longer in a cooler utility room. Insulation investments generally pay for themselves very quickly.
4. **Repair leaks in steam systems.** Steam leaks are expensive in that they greatly reduce the efficiency of the boiler system. They also reduce your boiler capacity, since the boiler must constantly heat makeup water. These repairs generally pay off very quickly.

Suggested Hot Water System Upgrades:

1. **Reduce heat losses from hot water tanks.** Insulate all pipes that are hot to the touch, and add a blanket over older tanks. Also check that cold water inlets have heat traps. Finally, reduce the temperature to the minimum setting that still provides sufficient hot water at peak usage times. If hard water is a problem, you should drain a quart of water from the tank every three months to remove sediment.
2. **Install timers on hot-water circulation pumps.** Circulation pumps should turn off automatically whenever a building is not in use. Use a seven-day timer if you need a different schedule on the weekend. A timer extends pump life in addition to saving energy.
3. **Install timers on electric water heaters.** Timers should be set to turn the tank off immediately after the last use of the evening and restart it shortly before the first use in the morning. Use seven-day timers if you need a different schedule on the weekend.
4. **Reduce hot-water consumption with sink aerators and low-flow showerheads.** Reducing hot water consumption can yield savings in several ways. Water and sewer charges are lessened, and the cost of heating the water is reduced. Pumping energy is also saved, although you may not realize this benefit directly. Even repairing a dripping hot-water faucet can provide savings.
5. **Consider installing a solar hot-water heating system.** New Mexico is one of the most cost effective places to utilize solar thermal energy. A solar heat exchanger can be added to your existing hot water tank, or for even greater savings you can add a preheat tank. Either way you will greatly reduce your hot water fuel consumption.
6. **Investigate capturing the waste heat from the water drain pipes.** The bulk of the energy used to heat domestic water goes right down the drain, and heat-recovery systems can capture and reuse that energy. Check the temperature of drain pipes during peak shower usage periods, and also note their proximity to cold water supply lines – installation may be a simple matter of adding some coils and a pump.

Other Suggested Upgrades:

1. **Install timers on water coolers.** Water coolers should turn off automatically when the building closes to save energy and extend compressor life. This can be accomplished with a simple appliance timer.
2. **Install controllers on vending machines.** Vending machines should turn off automatically when not being used. This saves energy and also extends compressor life. “Smart” controllers can turn these machines on and off based on usage, temperature, and occupancy. Removing the lamps from vending machines further reduces energy consumption by reducing the load on the cooling compressor.
3. **Improve the efficiency of walk-in refrigerators.** Door switches should turn refrigerator lights off when they are not being used. Dial-timers or occupancy sensors may also be effective. Door seals and closers should be repaired to ensure a tight seal, and plastic sectional curtains should be installed to reduce infiltration losses while the door is open.
4. **Consider correcting the power factor of your facility.** Although the monthly charge from your utility is small, correcting your power factor improves efficiency and helps motors run cooler and last longer. The reduction in heat generation also reduces your air-conditioning load.
5. **Consider installing high efficiency motor controllers on escalators and walkways.** Motors with widely varying loads (such as escalator motors) run more efficiently with controllers that can trim motor current under reduced loads. Power-factor correction and harmonic filtering can also provide savings in some applications. Information is available at www.performancecontrol.com

Suggested Swimming Pool Upgrades:

1. **Install a cover on your outdoor pool.** About 95 percent of the energy loss from an outdoor pool occurs at the water's surface. Covering a pool at night significantly reduces these losses, and savings of 50-70 percent are possible. Manual pool covers can pay for themselves in about one year, whereas automatic covers typically have 5-year payback.
2. **Install covers on indoor pools.** About 70 percent of energy losses from indoor pools are due to evaporation. Covering a pool when it is not in use significantly reduces these losses, and also reduces the amount of room dehumidification needed. The higher temperature of a spa increases the savings from adding a cover, and payback times of less than one year are possible.
3. **Reduce the pumping energy.** Circulation pumps often supply several times the required daily flow through the filter system. In such cases, you can save energy without reducing water quality by downsizing the pumps. Check whether your system flow was reduced by partially closing a butterfly valve downstream from the pump. Pumping against a partially closed valve is wasteful, and reducing the pump size is far more efficient. Replacing plumbing elbows with sweeps may allow you to downsize the pumps even further. There are many additional ways to reduce swimming pool costs at <http://www.eere.energy.gov/>
4. **Install a solar hot-water system on the swimming pool.** Swimming pool heating is one of the most cost effective uses of solar energy. The low-temperature delivery of heat means that the solar collector runs at a high thermal efficiency. Recent increases in natural gas prices have greatly improved the return on investment for solar pool heating systems, and getting a quote from a qualified vendor will help you determine the cost effectiveness of your application.