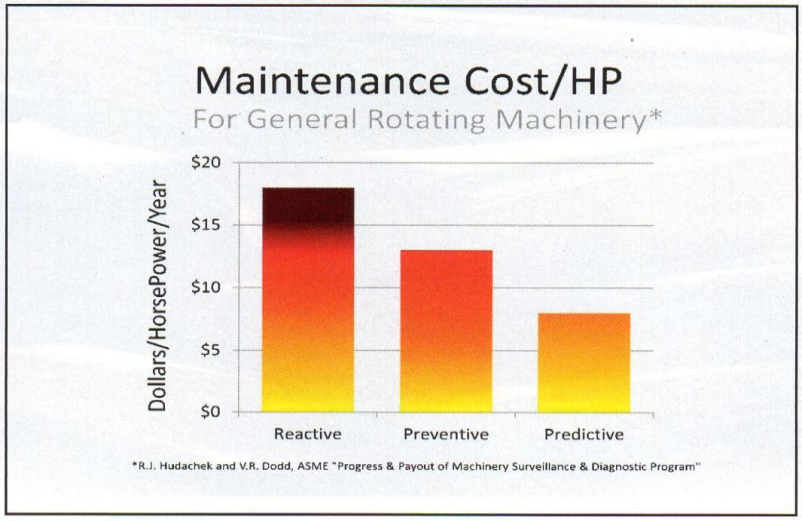
Conserving Energy & Saving Money While Improving IEQ

Energy costs are one of the largest expenses of operating a building. Using less energy in buildings sends savings directly to the bottom line. So why do so many organizations avoid energy audits—performed either internally or by an outside professional audit team? Usually it is because they do not want to spend money on what they speculate the recommendations in the audit might cost; therefore, there is no reason to spend money on an audit in the first place. Does this sound familiar?

To use a medical analogy, a building and its various systems are like a body. The "skin" is the building envelope, the HVAC systems are the "heart and lungs," and the duct work is the circulatory or distribution system. If the skin of the building is good, but the heart, lungs and distribution system are in poor shape, the energy used by the building—and the O & M costs—will be higher. At the same time, the indoor environmental quality (IEQ) typically will suffer.



Using the methods in this article, you can make significant reductions in energy use and save considerable money in the process.

Whether the building is a school or a medical facility, HVAC performance can be improved without spending a lot of money. Often it has more to do with how the building is operated than the HVAC system itself. Most low-cost and no-cost energy saving steps fall into four primary categories of operations and preventive or predictive maintenance:

- Equipment Scheduling
- Sensor Error
- Heating or Cooling When You Should Not Be
- Managing Outside Air

Equipment Scheduling

When was the last time you checked your building automation system (BAS)? HVAC equipment often operates during hours it is supposed to be off, even though the BAS says it is off, because most BAS systems do not have feedback loops.

Making sure the BAS is operating properly should not take an extraordinary amount of time, except perhaps the first time, and can save an extraordinary amount of money. Also, check the operation of the building room by room. You may find areas that do not require certain HVAC systems to be running during normal operating hours. Given the often changing use of space that happens in schools and hospitals, this room-by-room evaluation should be scheduled at least annually or even quarterly.

Another often overlooked but easily implemented energy saving technique is to use power strips to turn off plug loads, sometimes called parasitic loads. The EPA estimates that devices plugged into electrical receptacles, such as chargers, task lamps, computers, copiers, coffee machines, etc., are 10-15% of the electrical load in a commercial building, and soon will be 15-20% of that load.

Take the following steps to help reduce these energy costs:

- Put plug loads on a power strip at each work station.
- Educate employees and others to turn off toggle switches when they leave at night.
- Alternatively, use power strips that automatically shut off after a period of time where there has been no load.
- Educate employees to save work on their computers when they leave their desks.
- Make sure any new purchases are Energy Star® rated.

Sensor Error

How many times have you heard "I'm too hot," or "I'm too

cold?" Sometimes these complaints are based on the numbers on a thermostat rather than how the person really feels. Thermostats may read incorrectly either because they need to be calibrated, they are placed incorrectly, or there is something blocking them.

For example, is the thermostat placed just above a microwave oven or a coffee maker? Or is it closed in by shelving and boxes? Being cognizant of where thermostats are placed and recalibrating them on a regular basis is another low-to-no-cost fix to conserve energy and save money.

Problems with enthalpy (humidity) sensors, sometimes used in air-side economizers in rooftop units and other air handling equipment, can also lead to energy waste. While newer designs maintain sensitivity for longer periods, older ones need to be checked and recalibrated at least once a year; otherwise, they might bring in excess outside air when the outdoor humidity in cool weather is higher than that in the return air. This causes the chiller—or the compressors in a rooftop unit—to work harder than they would otherwise.

Heating or Cooling When You Should Not Be

Do you really want to both heat and cool your building at the same time? Unfortunately, this often happens, and it may be happening in your building right now. Engineers typically design oversized HVAC systems. This helps the system compensate when something is not operating properly (this does not refer to reheat in hospitals). For example:

- If the issue is overcooling in cold weather, the larger heating system has the added capacity to put additional heat into the space.
- If the problem is overheating in warm weather, the cooling system can deliver more cooling.

Basically, if the airside economizer is bringing in too much outside air, the oversized heating/cooling system will usually have enough extra capacity to overcome the problem. The problem can be difficult to find when no one complains and people feel comfortable, but it is a costly way to maintain temperature.

Fortunately, there are two ways to address the issue: sub-metering and/or regular analysis. If the building is not sub-metered, and there are no funds to install sub-meters, then conduct a monthly, or preferably weekly, analysis of the systems. With a building automation system (BAS) in place, this can—and should—be done on a daily basis.

Look for trends outside of what is normal. For instance, you will know there is a problem if a large water-cooled chiller is gradually using more energy than it has in the past. Here are some of the many possible reasons this scenario might occur:

- An additional load has been added, or the weather has warmed.
- The condenser tubes have contaminant in them, decreasing their heat transfer capability.
- The cooling tower is not operating properly.
- The chilled water sensor is not operating properly or requires

recalibration.

- Some of the two- or three-way valves have problems that need to be addressed, e.g., they are not closing (or opening) properly.

In a new building or a major retrofit, especially one applying for LEED® certification, we recommend installing sub-meters for lighting, plug loads and HVAC systems, at the minimum, as well as for water usage. Suppose there is a large spike in summer electric use that raises the demand rate for the rest of the year. Sub-metering will indicate what might have caused it so it can be addressed.

While this is not a no-cost solution, it is worth considering. Prices for sub-metering have come down recently, especially with wireless, and installing them may be relatively low-cost compared with dollars spent on wasted energy. We refer to this as cost-avoidance. Check with your local utility companies as many offer incentives for sub-metering.

Managing Outside Air

To maintain good indoor air quality you have to bring in the proper amount of outside air. Extensive experience with ASHRAE Level II energy audits has shown us that most buildings bring in too much outside air. And most of them have no energy recovery. In some cases, this is out of compliance with current energy codes and/or ASHRAE Ventilation Standard 62.1.

Checking return and outside air dampers on air handling equipment to make sure they are operating properly does not take a lot of time, and can bring large dollar savings.

Educating building occupants is a critical part of any successful energy program. We always recommend getting buy-in before the program begins, as well as consulting with employees and others throughout the process. Without that education and buy-in, most energy reduction programs will fail.

Saving energy in a facility is not always about spending money on the most "energy efficient" equipment. It is about making sure existing equipment is operating as well as it can, and about well-informed facility staff members that know what is going on in the building. An older, less efficient HVAC system that is properly maintained and operated can often perform better than a newer, more efficient system that is poorly operated.

Sometimes facility managers have only enough money and time for reactive maintenance. Yet everyone in the field knows this is not the proper—and certainly not the best—way to approach the issue. What is more, reactive maintenance, seemingly the least expensive route, actually increases maintenance costs.

Making that argument to top management can help justify funds for preventive or predictive maintenance. Using the methods in this article, you can make significant reductions in energy use and save considerable money in the process—without spending considerable money to accomplish it.

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