THE HIGH PERFORMANCE PORTFOLIO:

NIGHT WALKS

Take a walk through your building at night to discover energy wasters

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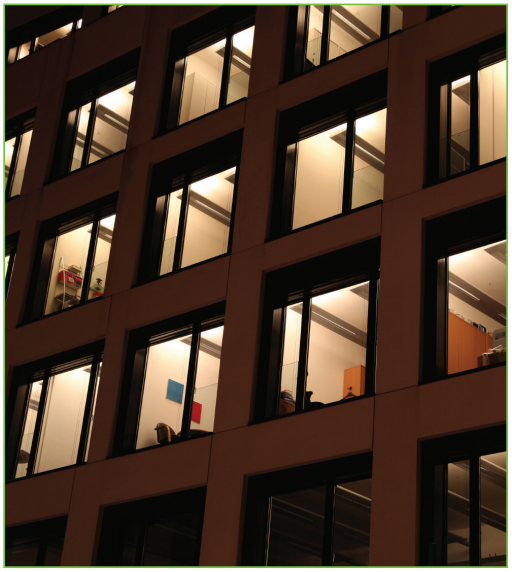
SUMMARY

Property management teams tend to focus on operations when the building is occupied and experiencing normal conditions. After all, that's when staff members are most likely to be on site, and when they're likely to be getting tenant feedback on comfort issues. But for the majority of the year – likely between 5,000 and 6,200 out of 8,760 hours – buildings are unoccupied. How do building systems truly operate during this time? Periodic "night walks" are the key to finding out. They can reveal a myriad of operational issues that could be costing energy, money, time, and tenant comfort. Quite often, these issues are easily addressed, providing the opportunity for immediate energy efficiency and building performance improvements.



IN DEPTH

NIGHT WALKS: WHY, WHO, WHEN, AND HOW

Building engineers and property managers spend a good deal of time in reactive mode, chasing problems and finding solutions as fast as possible so that they can move on to the next of their many demanding tasks. Rarely do they have the opportunity to slow down long enough to see the big picture – only what they came in to fix. A typical workday probably begins when the building systems are already operating, and ends when they're *still* operating. Staying after-hours is not in the cards unless there is a special situation, such as a system shutdown for tenant improvements. Even then, staff members are focused on the task at hand. They have a personal life to get home to, after all, and may or may not be getting paid for the extra work.

Because of all this, many engineers and property managers mistakenly assume the EMS is doing what they want it to after-hours, or what they believe it's programmed to do. This

The Night Walkers' Toolbox

- Flashlight with good batteries
- Camera for documenting findings
- Temperature sensor and/or portable data logger that includes temperature and humidity sensors
- Small toolkit for accessing filters, mixing boxes, etc.
- Hand-held radios or cell phones
- Warm clothes in case extended time is spent on the roof
- If possible, an infrared camera

is often not the case. For example, in some instances a single thermostat set-point adjustment can force the entire HVAC system into occupied mode after-hours, maintaining a comfortable space temperature in an unoccupied space. When several people have access to the thermostats or EMS time schedules to make these types of changes, it's easy for building operators to lose control - and that's when energy bills start going up.

There are lots of potential reasons for abnormal spikes or increases in energy use; some are justified, but many are not. Being able to pinpoint which is the case at a given building often requires a special visit - a "night walk."

This can be done efficiently and effectively by the on-site building engineer and another member of the engineering or property management team. After-hours walks shouldn't be performed solo, as there may be safety concerns. Further, a second set of eyes may be helpful to review what is found and talk over why it is happening. In a large building with a correspondingly large team, several members of the engineering team might participate in the first couple of walks, and then pairs of them can be assigned to perform future walks on a rotating basis. Property managers often find value in attending one or more night walks along with engineering staff members, gaining additional insight into building systems and operations.

The walk should begin when the building has gone into unoccupied mode. This could be on a weeknight at midnight, or on a Sunday afternoon – or both. Many senior engineers recommend walking through the building at night and on a weekend day at least monthly. At an absolute minimum, schedule night walks at least once a quarter. A specific visit may be required if the building experiences pressurization or HVAC operation issues during normal daily activities. At least an hour should be dedicated to each night walk, but this varies greatly depending on the specifics of the building; a large building might require a total of about 15 minutes per floor.

The Night Walkers' Roadmap

The walk should encompass the entire building, but key spaces to visit include:

- Mechanical rooms
- Areas near the top of the building, including the top of stairwells and the roof
- The main lobby and elevator lobbies
- A typical tenant space in each HVAC zone

WHAT TO LOOK FOR – AND LISTEN, AND FEEL, AND SMELL

Start in the engineering office and mechanical rooms, reviewing the EMS programming to determine if all HVAC equipment and lighting is off as scheduled. If any equipment is found to be operating unintentionally, determine if it is following the correct sequence – sometimes equipment gets placed in manual mode or is overridden for a temporary purpose and is not returned to normal operating mode afterward.

Next, review the HVAC system temperatures at the air handling units, looking for temperatures that don't make sense. For example, the supply air temperature could be well above or below the building "rest" temperature. This could be due to an operating compressor or leaking/failed dampers.

Make a note to inspect any abnormally-operating equipment when proceeding to the next step: the walk-through. While progressing throughout the building, use a number of different senses to identify possible issues.

Real-life example:

An engineer identified that two AHUs were not shutting down at night, remaining on for more than 100 unnecessary hours per week. By better controlling the operation of these units, the property is saving an estimated $15,000 per year.

Feel For...

Air movement. If HVAC components are continuing to operate during unoccupied hours, you may notice air movement in the building. This could be caused by overridden EMS programming, a failed sensor, or a number of other factors, but is easy to correct – and once corrected, it has the ability to greatly reduce energy costs.

Air movement could also indicate envelope leakage, which is easier to detect when the systems are offline and the building is unoccupied. Start in the lobby. Look and feel for airflow and follow the air. Since hot air rises, the air will normally exit the building at the top: through exhaust fans operating excessively, leaking dampers, failed damper actuators leaving the dampers wide open, dampers that are completely missing, open stairwell or roof doors, envelope panel joints, and elevator machine room ventilation systems. Use a piece of paper to check for airflow at exhaust grilles or envelope joints.

In some cases there will be backdraft dampers or other isolation dampers installed on ventilation systems to prevent the movement of air when the ventilation fans are off. If these are not properly installed or operating, stack effect can force them wide open as if they were not there. ("Stack effect" is defined as air movement into and out of buildings due to pressure differences between the outdoor and indoor air; these pressure differences are caused by differences in temperature between outdoor and indoor air. Greater temperature differences and building heights lead to a larger potential for stack effect.) HVAC fans can actually spin due to air losses from stack effect, making them look as though they were on.

Hot or cold temperatures, humidity, or static shock. These conditions can be felt on the face or feet or by placing hands on building and equipment surfaces. They could indicate areas that are over-conditioned when in occupied mode, where the HVAC is continuing to operate during unoccupied hours, or where ventilation systems are not maintaining proper humidity levels (static shock can indicate low humidity or excessive ventilation rates). Pay attention to shock when touching light switches, door handles, and metal surfaces.

Acoustic or physical vibrations. This could indicate the operation of rotating HVAC components such as fans, VAV boxes, or pumps; it may also mean that there's a damper failure somewhere in the building. Again, correcting these issues can have a dramatic positive impact on energy efficiency.

Hot electrical and mechanical systems. Focus on both plug loads (coffee pots, space heaters, copiers, halogen desk and task lights, toasters, microwave ovens, etc.) and mechanical equipment. With regards to plug loads, pay particular attention to spaces beneath desks, perimeter offices, and areas where tenants

Real-life example:

Upon entering a building, it was immediately evident that the lobby was under negative pressure. In the elevator machine room at the roof, the ventilation fan was running in order to cool the room, pulling building air up through the elevator shafts and exhausting it through the roof. The local thermostat was set at 63 degrees, so the 5,000 CFM fan in the elevator machine room was forced to operate continually in an attempt to cool the room above the main building's 72 degree set point. This drained the building of heat and caused the negative pressurization issues. The engineer adjusted the machine room thermostat to a more typical 80 degree setting, resolving the issue and reducing energy waste.

sometimes work extended hours without overtime HVAC operation sufficiently cooling the space.

When walking through mechanical support areas, feel for heat coming from motors in particular. This might indicate that the motor has failed, or that it is operating where the dampers or valves are closed, thus overheating.

Look For...

Brightly lit areas. There might be failed light sensors, controls, or switches; or building occupants, janitors, or security staff might have forgotten to turn the lights off before leaving. The building might also have an excessive amount of emergency lighting, well beyond code requirements.

Check the entire property for unnecessary lighting usage, including common areas, tenant spaces, building support areas, exterior lighting, roof access lights, indoor and outdoor signage, loading docks, parking garages, and parking lots. If issues are found and corrected, the building will see immediate, substantial reductions in energy consumption.

Extremely dark areas. Conversely, look for abnormally dark areas, which could indicate burnt-out lamps, insufficient emergency lighting or exit signs, or failed breakers and fuses.

Visible condensation. Check beneath and around refrigeration and air conditioning systems for condensation, which could be a sign of poor air flow; introduction of hot, humid outdoor air into the building; failed or missing insulation on pipes or ducts; or failed insulated window panels.

Accumulations of dust or dirt on building surfaces. Look on the ceiling near recessed lighting, HVAC supply air diffusers, and penetrations from pipes, ducts, or conduits; also check around door frames, window frames, mullions, elevator door openings, and light switches. This could result from inadequate air filtration, air that is bypassing filters, or failed or leaking seals at penetrations. Dirt, scale, or standing water along windows or exterior walls could indicate failed window seals or damaged curtain wall components.

Blocked air diffusers. Check air diffusers in the ceiling and walls, looking for indications that someone has blocked the airflow – maybe they've closed the vent, taped paper over it, or slid a filing cabinet in front of it. This is a common issue with building occupants who are too hot or too cold or who can feel the draft from the vents. According to ENERGY STAR, blocked vents cause HVAC systems to use 25 percent more energy to distribute air. Talk with tenants to address their comfort concerns, and find a solution that doesn't involve blocking vents.

Water spots, stains, or standing water. Check ceiling tiles, walls, and carpets; the top of furniture and counters; in restrooms; along intersections of walls and floors; near windows, structural columns, exterior walls, and doors; and beneath roof setbacks. There could be leaks or overflows in mechanical, restroom, or janitorial areas on the floor above, or general leaks from pipes, faucets, drains, roofs, curtain wall, exterior doors, or condensate pans.

Listen For...

Airflow, rattling, humming, and other mechanical noises. Listen for the sound of operating equipment that should not be on, indicated by the sound airflow through ducts, rattling noises above the ceiling or behind closed doors, or humming noises. If equipment is operating when it shouldn't be, check whether the equipment is being controlled in automatic or manual mode; chances are that someone has overridden the control and placed it in manual operation.

Besides operating HVAC equipment, airflow noises could also be a sign of failed dampers, window seals, or door seals. Humming noises could point to failed or failing ballasts. These sounds can come from linear fluorescent tubes, CFLs, and other fluorescent lamps.

High-pitched radio static. The building might be experiencing high-pressure air leaks in ducts and pneumatic devices, or tenants may have left intercoms, music, or other electronic systems turned on.

Real-life example:

Some tenants were complaining of mechanical noises and vibration. The engineer visited the building after-hours to identify its source, and learned that it came from the domestic water pumps. He arranged to install VFDs on the pumps, which paid for themselves in energy cost savings in addition to eliminating tenant complaints about the noise and vibration.

Running or dripping water. Listen for this not only in restrooms and kitchens, but throughout the building and its exterior landscaping. These noises could lead to plumbing leaks, unnecessary domestic water pump operation, or sprinkler system issues.

Smell For...

Food, trash, or chemical odors. The obvious cause is poor housekeeping practices or janitorial performance, but the presence of odors in areas from which they don't originate might also indicate previously-unidentified pollutant pathways or HVAC systems operating incorrectly.

Moldy odors. A number of issues could be the cause of moldy odors, including water leaks, HVAC systems that are not adequately ventilating or dehumidifying spaces, and overwatered plants.

Odors of mold, decaying plants, or mulch. Besides poor housekeeping or landscaping practices, indoor plant odors could also indicate that the outside air system is not fully isolated. When HVAC systems are shut down and the building is not positively pressurized, outdoor odors are being introduced into the building.

Overheated mechanical/electrical systems. Pay attention to the unique odor, of overheated mechanical or electrical equipment (see *Hot electrical and mechanical systems,* above).

THE BOTTOM LINE

- Most building engineers and property managers focus on operations in the occupied mode. But walking the building at night, when occupants have left and HVAC systems are supposed to be shut down, can provide valuable insight into operational issues that may be causing the building to use more energy and water than necessary.
- Often, these issues are easily addressed, leading to immediate improvements to efficiency, comfort, and performance.
- Night walks can be performed by on-site staff with a very basic set of tools and a general roadmap of what to review.
- Operational and equipment issues can be detected by heightening awareness of sights, sounds, smells, and sensations throughout the building.

ADDITIONAL RESOURCES

Night walk videos

http://www.betterbricks.com/operations

Symptom Diagnosis Tools

http://www.betterbricks.com/building-operations/tools/symptom-diagnosis-tool-0

Top 5 Operational Improvements

http://www.betterbricks.com/operations

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