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Evaluate Setback of Temperature and Airflow Settings at Night

All ECM content was independently developed and reviewed to be vendor, product and service provider-neutral.

Description

Evaluate and, if appropriate, implement night and weekend setbacks for ventilation rates and supply air temperature (SAT) setpoints in areas that are occupied less than 24 hours a day.

Project Talking Points

Programming cooling, heating and ventilation to ramp up only when spaces are occupied will increase energy efficiency and extend the life of heating, ventilation and air conditioning (HVAC) equipment. Often, implementing unoccupied modes can have paybacks of less than one year.

Triple Bottom Line Benefits

- **Cost benefits**: Setback during unoccupied hours can result in significant energy savings, reducing utility costs. See case studies for specific examples.
- **Environmental benefits**: Reducing energy consumption reduces carbon emissions associated with energy production. (See the Benefits Calculator.)
- **Social benefits**: Depending on the improvements made, thermal comfort and controllability may be improved, which enhances patient and staff experience. Money saved by reducing energy consumption can be applied towards the mission of the hospital, increasing patient and employee satisfaction.

Purchasing Considerations

Prioritize life-cycle costs of controls upgrades, such as unoccupied modes, rather than first cost. These upgrades will often be a small fraction of the project cost and will have very short paybacks. Include checks of unoccupied modes in the building controls' preventative maintenance program.

How-To

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1. Determine who is on the team. This can include the facilities manager, building engineer, mechanical, electrical and plumbing (MEP) engineer, building automation system (BAS) manager and hospital staff.

2. Review the facility occupancy schedule to identify which areas are not occupied on nights and weekends.
    - Note administrative and outpatient areas, as these are often ideal candidates for unoccupied reductions.

3. Conduct an occupancy survey in these areas to establish a preliminary occupancy schedule, including details regarding occupancy level, daily hours of operation and seasonal fluctuations in occupancy.
    - Coordinate these steps with energy conservation measure: Reevaluate HVAC equipment scheduling.
    - Discuss and meet with building occupants. Building use and occupancy may differ from the noted hours of operation. It's important to set expectations with building occupants.

4. Review historical data from the BAS to identify whether or not HVAC systems are cycling down at night and over the weekend. At a minimum, monitor trends for the following criteria: duct static pressure, supply fan speed, outdoor air temperature, outdoor air damper position signal and discharge-air temperature.

5. Perform a walk-through of the setback areas. If occupancy sensors have been installed, note which systems they control (i.e., lighting, ventilation, air temperature) and whether they are linked to the BAS.
    - Off-hour operations such as building cleaning should not necessarily trigger the HVAC building to go to occupied mode. Consider a "walkthrough mode" that prevents the HVAC system from going to occupied mode because of transient operations.

6. Consider supply air temperature reset (see energy conservation measure Set thermostats to balance efficiency and comfort) to save energy while also maintaining thermal comfort. Supply air temperature can be reset higher during certain times of year, which provides energy savings while also providing the same or better thermal comfort. This is especially cost effective in facilities with electric reheat as it will "match" the building load, rather than overcooling then heating to the appropriate temperature.

7. Check for existing occupancy sensors and their functionality.
    - If existing occupancy sensors can be configured to include control of air supply temperature and ventilation rate, configure the BAS to trigger automatic setbacks when the zone is unoccupied.
    - If occupancy sensors are not present or cannot be reconfigured, use programmable thermostats or configure occupancy schedules for non-24/7 spaces via the BAS. Configure the system to turn off the lights, set back the air temperature to a seasonal baseline (as outlined in energy conservation measure Set thermostats to balance efficiency and comfort) and reduce air supply ventilation to the minimum allowed by code during unoccupied hours. Allow for adequate pre-occupancy warm up and cool down periods especially in any critical spaces where temperature setpoints need to be achieved rapidly.

8. Ensure the system can be overridden by building occupants if a space is activated during off-hours.
    - A common example is an off-hours executive board meeting. Make sure the system can be activated if the building is in use.

9. Monitor space use, including the number of overrides, on an ongoing basis to verify that the setback occupancy schedule reflects actual building use. Track the number of overrides to ensure the setbacks are effective.

10. Incorporate a regular assessment of the setback controls in the facility's commissioning (see Energy Conservation Measure – Retrocommission HVAC Controls) and preventive maintenance programs (see performance improvement measure Practice preventive maintenance of major HVAC equipment).

Case Studies

- **Seven Oaks General Hospital, Winnipeg, Manitoba, Canada**
    - Occupancy schedules for the Daycare, Geriatrics and SkyView Terrace were developed as part of the hospital's RCx program.
    - The hospital achieved an annual savings of $1,995, and the project had an immediate payback.

- **Providence St. Peters Hospital, Olympia, WA**
    - Installed dual occupancy sensors (infrared and ultrasonic) in OR rooms, which are unoccupied 47% of the time.
    - Set high sensitivity and three-minute delay before the motion detector is activated (to avoid false positives).
    - Project cost: $3,300.
    - Less than one-year for ROI.

Resources

- If you have an ROI tool, calculator or similar resources to share, please contact us.
- American Society for Health Care Engineering (ASHE): Reducing Operational Costs through Energy Efficiency
- American Society of Heating, Refrigerating and Air-Conditioning Engineering (ASHRAE)
    - Guideline 14 for Measurement of Energy and Demand Savings
    - Standard 170: *Ventilation of Health Care Facilities*
- California Commissioning Collaborative: California Commissioning Guide: Existing Buildings
- Federal Energy Management Program: Operations & Maintenance Best Practices Guide: Release 3.0, Chapter 9: O&M Ideas for Major Equipment Types
- LEED for Existing Buildings: Operations and Maintenance
    - Energy and Atmosphere Prerequisite 1: Energy Efficiency Best Management Practices, Planning, Documentation and Opportunity Assessment
        - Document the current sequence of operations, develop a building operating plan, develop a systems narrative, create a preventive maintenance plan and conduct an energy audit that meets the requirements of the ASHRAE Level I walk-through assessment.
    - Energy and Atmosphere Prerequisite 2: Minimum Energy Performance
        - Establish the minimum level of operating energy efficiency performance by achieving an energy performance rating of at least 69 using the EPA's ENERGY STAR® Portfolio Manager tool; or, demonstrate energy efficiency at least 19% better than average

following the LEED Reference Guide for Green Building Operations and Maintenance; or use the alternative method described in the LEED Reference Guide for Green Building Operations and Maintenance AND have energy meters that measure energy use.

- Energy & Atmosphere Credit 1: Optimize Energy Efficiency Performance
  - Achieve increasing levels of operating energy performance relative to typical buildings of similar type utilizing any of the methods described in Energy and Atmosphere Prerequisite 2.
- Energy and Atmosphere Credit 2.1: Existing Building Commissioning, Investigation and Analysis
  - Develop an understanding of the building's operation through a commissioning process or an ASHRAE Level II Energy Audit.
- Energy and Atmosphere Credit 2.1: Existing Building Commissioning, Implementation
  - Implement minor improvements, provide training for management staff, demonstrate financial costs and benefits and update the building operating plan as necessary to reflect changes.
- Energy and Atmosphere Credit 3.1: Performance Measurement, BAS
  - Utilize a computer-based BAS that monitors and controls major building systems.
- Energy and Atmosphere Credit 5: Measurement and Verification
  - Develop a measurement and verification plan by incorporating the Calibrated Simulation method; or the Energy Conservation Measure Isolation as specified in the International Performance Measurement and Verification Protocol Volume III.
- Indoor Environmental Quality Credit 2.3: Thermal Comfort Monitoring
  - Have in place a system for continuous tracking and optimization of systems that regulate indoor comfort and conditions in occupied spaces.

- LEED for Healthcare: New Construction and Major Renovations
  - Energy and Atmosphere Prerequisite 1: Fundamental Commissioning of BAS
    - Designate a commissioning authority to commission the heating, ventilating, air condition systems and associated controls.
  - Energy and Atmosphere Prerequisite 2: Minimum Energy Efficiency Performance
    - Establish the minimum level of energy efficiency for the proposed building and systems by a whole building energy simulation; or a prescriptive compliance path utilizing the ASHRAE Advanced

Energy Design Guide (AEDG) for Small Hospitals and Health Care Facilities; or a prescriptive compliance path complying with ASHRAE Standard 90.1.

  - Energy and Atmosphere Credit 1: Optimize Energy Efficiency Performance
    - Achieve increasing levels of energy performance beyond the prerequisite standard to reduce energy usage.
  - Energy & Atmosphere Credit 3: Enhanced Commissioning
  - Energy & Atmosphere Credit 5: Measurement and Verification
    - Develop a measurement and verification plan by incorporating the Calibrated Simulation method; or the Energy Conservation Measure Isolation as specified in the International Performance Measurement & Verification Protocol Volume III.
  - Indoor Environmental Quality Credit 6.2: Controllability of Systems, Thermal Comfort
  - Indoor Environmental Quality Credit 7: Thermal Comfort, Design and Verification
- Pacific Northwest National Laboratory: Building Re-Tuning Training Guide: Occupancy Scheduling: Night and Weekend Temperature Set back and Supply Fan Cycling during Unoccupied Hours
- U.S. Department of Energy:
  - Energy Smart Hospitals: Retrofitting Existing Facilities
  - Hospitals Realize Fast Paybacks from Retrofits and O&M Solutions
  - Hospitals Save Energy and Money by Optimizing HVAC Performance
- U.S. Environmental Protection Agency (EPA), ENERGY STAR®

Regulations, Codes and Standards, Policies

- ASHE:
  - Health Facility Commissioning Guidelines
  - Health Facility Commissioning Handbook
- ASHRAE:
  - Standard 170: *Ventilation of Health Care Facilities*
  - Standard 62.1: *Ventilation for Acceptable Indoor Air Quality*
  - Standard 55: Thermal Environmental Conditions for Human Occupancy

ECM Synergies

- Establish baseline for current energy consumption.
- Retro-commission HVAC controls.

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- Install variable frequency drives on pumps and motors.
- Practice preventive maintenance of major HVAC equipment.
- Set thermostats to balance efficiency and comfort.
- Reevaluate HVAC equipment scheduling.

ECM Descriptors

Energy

Level: Beginner

Category List:
- Commissioning
- Contracted services
- Controls
- HVAC

ECM Attributes:
- Optimize operations
- Repair or optimize existing systems
- System upgrades

Improvement Type:
- Commission/retro-commission
- Retrofit/renovations
- New buildings
- Operations and Maintenance (O&M)

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Department:
- Engineering/facilities management