Energy Conservation and Optimization Measures
at
Michigan State University

Group 1 *(Low-cost, typically implemented through existing control logic or simple control devices)*

- Scheduling –Equipment is enabled only when necessary. Scheduling has been a primary responsibility of Central Control since 1974. Mechanical & electronic time clocks are replaced by Central Control connection when possible.
- Scheduling –Conditioning of unoccupied spaces is minimized. Where possible, room level controls are placed in a night mode or reduced flow operation when not occupied.
- Scheduling – Lighting is reduced or turned off in unoccupied spaces. Occupancy sensors are utilized to automatically turn lights off when occupancy is not detected.
- Economizer/Outside Air –Optimized to maximize the use of free cooling (damper and set-point control). By using outside air, use of mechanical cooling can be minimized when the conditions allow.
- Economizer/Outside Air – Controlled to prevent over ventilation. Excess outside intake requires additional heating and cooling. Outside intake settings are measured during the commissioning process to ensure they are appropriate for the design.
- Economizer/Outside Air – Measured and alarmed to ensure proper operation. Mixed air temperatures are alarmed and the Central Control staff responds when operational tolerances are exceeded.
- Controls – Optimized to prevent simultaneous heating and cooling. Valve control is staged to minimize the possibility of control sequences competing.
- Controls – Thermostats are calibrated to ensure proper operation during the commissioning process.
- Controls – Building Efficiency Services reviews system operation to detect "hunting" and makes adjustments to correct problems with control loops and adaptive control (loop tuning, parameter review, optimization)
- Set-point Changes – Seasonal guidelines encourage occupants to set room control to 70 in the winter and 75 in the summer.
- Set-point Changes – Static pressure reset is employed on ventilation systems where appropriate. This can be done with simple reset strategies or more complicated reset through system modeling and optimization (VAV Plus).
- Set-point Changes – Static pressure reset on variable fluid flow systems are used where appropriate. Seasonal adjustment can be employed where load vary with outside conditions.
- Set-point Changes – VAV box minimum flow set-points are reviewed and verified during the commissioning process.
- Set-point Changes – Nighttime thermostat setback is used where appropriate to reduce heating of unoccupied areas.
- Reset Schedules – Heating water supply temperature is reset based on outside temperatures to match thermal requirements of a building.
- Reset Schedules – Where appropriate, chilled water supply temperature is reset to optimize energy use.
- Reset Schedules – Where appropriate, supply air temperature is reset to meet the thermal requirements of the space.
- Efficiency/Load Reduction – Space occupancy sensors are used to reduce air flow to unoccupied spaces.
- Efficiency/Load Reduction – In new design and where possible in renovation the use of natural lighting replaces or reduces the need for artificial lighting. (e.g. Wharton Center addition, Plant & Soil Science addition, Physical Plant office space renovation)
- Ventilation Quantity – Laboratory ventilation rates are adjusted to meet recognized safety standards and minimize total energy demands. Ventilation quantity modifications to existing buildings require careful review of the scientific activities occurring in a given building and are coordinated with Office of Radiation, Chemical, and Biological Safety staff. A general approach is taken to maximize energy savings while first preserving occupant safety in the laboratory environment. Systems are also put in place to measure potential contaminants and allow reduced ventilation when operating within safe ranges. With this in mind, it is anticipated that the minimum possible ventilation rate (ACH) for many laboratory spaces will be 8-10 ACH in an occupied mode and 4-6 ACH in an unoccupied mode.

Group 2 (Often paybacks of three to five years)

- Variable flow systems are designed with variable frequency drives on fan and pump motors. Existing systems which are variable flow with other control mechanisms are converted to use variable frequency drives.
- Lighting systems are retrofit (lamps and ballasts) and replaced (lamps, ballasts, and fixtures) for energy efficiency and the best life-cycle cost.
- Lighting strategies use a task oriented approach and minimize areas which require a high general illumination level.
- Lighting controls (time clock, occupancy, and day lighting) are employed to reduce lighting when not required.
- Fume hoods are replaced during renovations to improve safety and lower total cost of operation.
- Occupancy Sensors are used to reduce fume hood flow through face velocity setback while maintaining safe operation during active use.
- Laboratory minimum ventilation rates are designed or re-evaluated based on chemical usage to minimize the number with high air-flow requirements. Many labs do not need high air changes per hour and frequently can be reduced significantly (from 10 ACH to 6 ACH).
- Demand control ventilation, through the use of CO_2 sensors, allows reduced room air flow and lower use of outside air that need to be heated or cooled to meet thermal requirements.
- Steam Trap Management utilizing yearly audits and repair of failed steam traps ensures that thermal energy is not wasted. A failed steam trap will allow steam to enter the condensate system before the heat is fully extracted (and condensed) for use in the heating or cooling of the building. This also leads to elevated condensate return temperatures to the power plant and increases the amount of wasted energy through thermal losses in the system piping.

Group 3 (Longer payback or higher cost projects often done in concert with a capital project)

- Buildings and systems are connected to the Building Automation System and pneumatic controls are converted to Direct Digital Control. DDC brings added control precision resulting in energy savings and allows for oversight and adjustment from a central location.
- Major plant equipment (chillers, boilers, cooling towers) is replaced to improve efficiency and maintainability.
- Old motors are replaced with higher efficiency models.
- Fan systems are replaced to use newer technology, improve efficiency, and improve reliability (e.g. fan-wall system)
- Fume hood exhaust systems are converted from individual (one fan per fume hood) to a plenum system for operational efficiency and safety by providing a level of redundancy.
- Window replacement reduces energy use and improves occupant comfort.
- Roof replacement allows for added insulation or alternative roofing, such as “green roof” construction, which results in lower thermal losses.