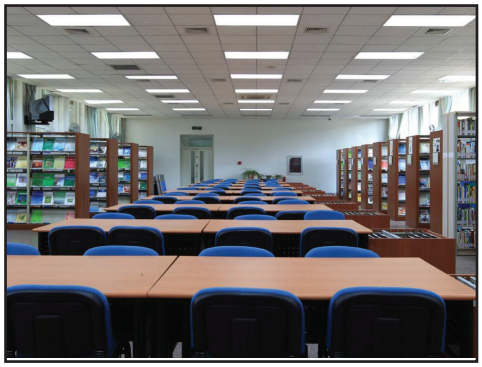
SEDAC ENERGY SMART TIPS

Libraries



Libraries model sustainability by providing shared and reusable resources to people throughout the community. Many libraries in Illinois are extending their sustainability efforts by implementing energy efficiency measures with the help of the Smart Energy Design Assistance Center (SEDAC).

SEDAC has analyzed the energy usage of many public libraries in Illinois and identified ways to reduce energy consumption, averaging $33,000 in annual energy cost savings for each facility, a savings of about 30%.

This Smart Tip highlights SEDAC's most commonly recommended energy cost reduction measures for libraries, including some no-cost or low-cost items like turning off computer monitors, controlling temperatures, and replacing outdated lighting fixtures.

We also examine some energy questions unique to libraries, such as whether energy-intensive humidification systems are necessary.

Energy efficiency projects will benefit patrons and demonstrate your library's commitment to sustainability. Energy efficiency projects can improve the comfort and usability of a building by offering better lighting and consistent temperatures for patrons.

Adoption of sustainable energy practices is a proven method of controlling costs, allowing libraries to spend money on other important services and materials. Cutting a building's energy use by 30% yields the same benefits as a 5% increase in net operating income. Lowered energy use at your library also provides stability in the face of budget uncertainties and energy price fluctuations.

Average annual energy cost savings for Illinois libraries: **$33,000**

SEDAC staff can perform energy assessments at your library and help you find financial incentives to lower the cost of energy efficiency projects. Apply for personalized help at sedac.org.

Additional resources on designing energy efficient libraries, sustainable practices, and energy efficient products can be found on the last page of this document.

The Smart Energy Design Assistance Center performs energy assessments on various building types. Each building type has different energy requirements. SEDAC's Energy Smart Tips help building operators identify energy cost reduction measures.

SEDAC'S STEPS FOR ENERGY SUCCESS

1. **GET INSPIRED.** Saving energy leads to environmental and economic benefits. Check out SEDAC **case studies** to see how Illinois facilities are saving energy.
2. **GET BUY-IN.** Implementing energy efficiency requires staff time, financial investment, and facility modifications. Commitment from management and buy-in throughout the organization are critical for enduring success.
3. **CONSULT WITH AN EXPERT.** Contact SEDAC for quick advice, in-depth technical analysis, and referrals to other organizations and programs.
4. **BENCHMARK.** Work with SEDAC to understand how much energy your building uses, compared to other similar buildings in similar climates.
5. **GET AN ENERGY ASSESSMENT.** Walk through your facility, inspecting areas and equipment to identify problems. A SEDAC energy assessment can provide a list of solutions to make your building more efficient.
6. **PRIORITIZE SOLUTIONS.** Start by implementing the solutions that will achieve high energy savings at low cost and that will have the greatest long-term impact. SEDAC can provide comprehensive economic analysis, identify incentives, and offer implementation assistance.
7. **EVALUATE PROGRESS.** Gather energy data to determine if actions taken have led to energy savings. SEDAC can provide historic bill analysis.
8. **SCHEDULE REGULAR MAINTENANCE.** Create and follow a maintenance schedule for HVAC systems, lighting and envelope. See SEDAC's Operations and Maintenance and Energy Tune-up **Tech Notes** for more information.
9. **STAY CURRENT.** Learn about the latest energy-saving solutions by attending SEDAC workshops and webinars and accessing SEDAC's **online resources**.

KEY LIGHTING RECOMMENDATIONS

T12 to T8/T5 or LEDs

More efficient LEDs, T8 or T5 linear fluorescent lighting and electronic ballasts are available to replace outdated T12 linear fluorescent lamps and magnetic ballasts. These lamps will consume 10% to 50% less energy than T12 lamps, while providing comparable light output. Electronic ballasts are more efficient than magnetic ballasts in converting input power to lamp power, resulting in increased system efficiency. Based on the savings and economics of this strategy, retrofitting T12 lamps is recommended for immediate implementation.

HID to T8/T5 or LEDs

In large open areas, replace high intensity discharge (HID) lamps with high-bay linear fluorescent fixtures or LED lamps. HID fixtures include: metal halide, mercury vapor, and high pressure sodium lamps.

HIDs have long start-up times and lose a significant percentage of light output after only three years of use. In contrast, fluorescent fixtures and LEDs have minimal loss of light output, and provide as much as 50% reduction in energy consumption. Payback periods average less than seven years.

CONSULT AN EXPERT

SEDAC recommends consulting a lighting expert to ensure appropriate lighting levels and compatability of new lamps with existing systems.

INCANDESCENT LAMPS to LED

Replace incandescent lamps with LED lamps. According to **energy.gov**, 2700-3600K is the recommended color temperature for most indoor lighting. [1]

LIGHTING CONTROLS

Occupancy and vacancy sensors are inexpensive lighting controls that can dramatically reduce energy consumption. Research estimates that energy savings from lighting controls are 25% for private offices, 30% for classrooms, and 40% for stairs and hallways.

Occupancy sensors detect whether a space is occupied, then turn lights on or off automatically. Occupancy sensors with dual modes of detection (ultrasonic and passive infrared) are best for restrooms so that accidental turn-off is minimized.

Vacancy sensors, which provide manual-on/auto-off settings, can be even more effective energy savers. Vacancy sensors allow people to turn lights on whenever they are needed, and prevent unintended movements from turning on lights when they are not needed. SEDAC recommends installing vacancy sensors in most offices, classrooms, conference rooms or break rooms. When programming lighting controls, SEDAC recommends a 15-minute delay before automatically turning off the lights.

1 www.energy.gov/energysaver/articles/lighting-principles-and-terms

ENERGY COST REDUCTION MEASURES FOR LIBRARIES

HUMIDIFICATION SYSTEMS

Have a rare book collection in your library? Humidification systems are generally only needed in spaces that house delicate collections.[2] Most library materials are subjected to conditions outside the library's controlled environment when the items are checked out by patrons. Accordingly, the trend is to place less emphasis on temperature and humidity controls.

SEDAC has observed that libraries without electric and gas steam humidification systems use significantly less energy than libraries with those systems, yet these libraries generally do not experience any problems with their collections. We recommend that libraries still using building-wide humidification consider decommissioning those systems. If humidification is deemed necessary, review the sequence of operation to ensure the system is running optimally, switch to a passive non-steam system, or just use a simple room humidifier.

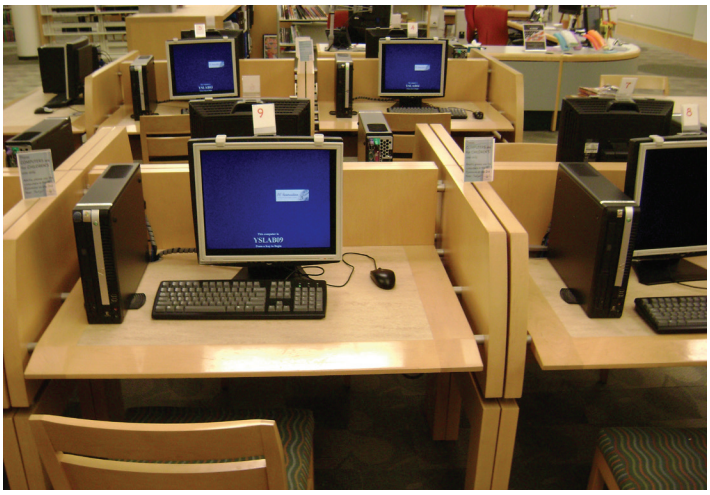
DEMAND CONTROL VENTILATION

Ventilation is the process of bringing in outside air to provide building occupants with fresh air. Ventilation air must be heated or cooled, an energy-intensive process. Generally, ventilation systems operate continuously at peak occupancy levels, but continuous ventilation is wasteful when the building is empty.

Demand control ventilation (DCV) can save energy by eliminating the heating and cooling of excess air when the building is unoccupied. One method of implementing DCV is by using CO_2 sensors to estimate occupancy. Through measuring the level of CO_2 in the building, DCV regulates the amount of outdoor air brought into the building. The reduced air volume saves energy by decreasing the fan usage as well as the need for heating and cooling. SEDAC has found that buildings with DCV systems have lower energy consumption levels. Installation costs typically range from $1,200 - $2,000 per zone.

VENDING OCCUPANCY CONTROLS

SEDAC highly recommends installing controls to decrease unnecessary vending machine run-time. Vending occupancy controllers manage power consumption by monitoring both occupancy levels in the space around the vending machine and ambient temperature changes. They maintain cool product temperatures and reduce heat-generating lighting. They also regulate compressor cycles to run only when needed. When replacing old vending machines, consider ENERGY STAR® products, which are 50% more efficient than standard models.[4]



COMPUTER POWER MANAGEMENT

Computer power management is a simple measure that can be easily implemented in most libraries. SEDAC suggests enabling sleep or hibernation of both the monitor and central processing unit (CPU) when not in use. Making use of existing energy management options (features already built into a computer's operating system) can result in considerable energy savings.

According to ENERGY STAR, libraries can save up to $50 per computer annually by implementing power management strategies. SEDAC recommends setting computers to enter sleep or hibernate after 20 minutes of inactivity; monitors should enter sleep mode after 5 to 20 minutes of inactivity. Contrary to popular belief, screensavers do not save energy. When funds allow, CRT monitors should be replaced with LCD monitors.[5]

BOILER UPGRADES

Facilities with an older boiler should consider upgrading to a condensing boiler that has an efficiency of over 90%. Condensing boilers recover energy that would otherwise be discharged to the atmosphere through the flue.

If an upgrade is not feasible, boiler tune-ups maximize efficiency by optimizing the combustion air/fuel ratio. For natural gas-fired boilers, common targets are 10% excess air or 2% excess oxygen. A rule-of-thumb is that boiler efficiency increases by 1% for each 15% reduction in excess air or 40°F reduction in flue gas temperature. Tuning boilers at least once per year will help maintain system efficiency and reduce natural gas consumption.

SETBACKS

SEDAC suggests installing programmable digital thermostats and using setbacks for periods when buildings have little-to-no occupancy. Thermostats in spaces that are open to each other should all be programmed with the same schedule and set points. This configuration prevents the mechanical systems from working harder than necessary.

Set the thermostat to 70°F in the winter and 76°F in the summer for occupied conditions. When unoccupied, recommended setbacks are 62°F in the winter and 84°F in the summer. According to the U.S. Department of Energy, thermal setback changes generally save about 1% per year per degree of setback for an eight hour period.[6]

[6] www.energy.gov/energysaver/articles/thermostats

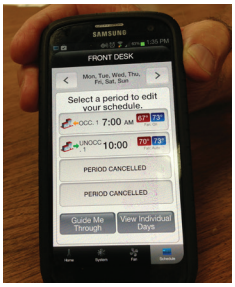
CASE STUDY: NORMAL PUBLIC LIBRARY

NORMAL ATTAINS 33% ENERGY SAVINGS WITH NEW HVAC SYSTEM

Normal, IL— A SEDAC team provided a detailed energy assessment of the Normal Public Library and identified numerous opportunities for energy savings. The team also reviewed assorted upgrade bids, met with city officials and contractors to review options, and identified incentive opportunities. A custom energy efficiency incentive from DCEO covered over 26% of the capital costs. Currently, NPL is enjoying energy savings and making plans to implement other energy saving measures.

Some of the benefits? The ability to check and adjust thermostats from a smart phone makes life a little easier for Library Director Brian Chase and his building operators. The upgraded heating and cooling system in the library's east wing is producing numerous benefits, including improved comfort conditions, significantly lower utility bills, and more readily serviceable equipment.

The 40-year-old multi-zone air handling unit was inefficient, finicky, and did not allow for a variation of space temperatures throughout the library. Its first-generation Building Automation System (BAS) was cumbersome and required a controls specialist for maintenance. The multiple new high-efficiency split systems make use of best control practices, including multiple-speed fans, economizers for free cooling, night setbacks, and adjusted ventilation rates based on occupancy patterns.



TOP 10 SEDAC TIPS FOR LIBRARIES

1. Upgrade lighting & establish controls
2. Evaluate humidification needs
3. Program thermostat setbacks
4. Use computer power management
5. Install vending occupancy controllers
6. Implement demand control ventilation (DCV)
7. Upgrade to high-efficiency HVAC
8. Perform HVAC tune-up
9. Develop an energy management plan
10. Install variable frequency drives (VFDs)

ENERGY SMART RESOURCES FOR LIBRARIES

Sustainable Practices
This Whole Building Design Guide publication addresses space needs & emerging issues in libraries:
http://www.wbdg.org/design/public_library.php

Energy Saving Opportunities for Library Collections
The Image Permanence Institute's study on sustainable methods for preserving library collections:
http://www.ipisustainability.org/

ENERGY STAR® Resources for Buildings and Plants
https://www.energystar.gov/buildings

WHO WE ARE

SEDAC, The Smart Energy Design Assistance Center assists buildings and communities in achieving energy efficiency, saving money, and becoming more sustainable. SEDAC also conducts energy and sustainability research.

SEDAC is a public-private partnership between the University of Illinois at Urbana Champaign and 360 Energy Group.

HOW TO REACH US

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SEDAC SERVICES

- Quick Advice
- Benchmarking
- Energy Assessments
- Energy Incentive Guidance
- Implementation Assistance
- New Construction Design Assistance
- Retro.commissioning
- HVAC Optimization
- Information Center
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