

RCM Factsheet

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Looking for Lighting Opportunities

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Lighting is often referred to as the “low hanging fruit” when it comes to energy saving opportunities in buildings. While energy-efficient lighting is common in new construction, many older buildings still use inefficient lighting. This results in higher-than-necessary energy consumption and poor lighting quality.

The purpose of lighting is to enable us to see well, a task originally handled by daylight through windows, and later virtually taken over by artificial lighting. Ongoing studies are examining the many ways lighting affects occupants – from mood, to health and productivity, good lighting improves it all. Energy consumption is getting more attention these days, but it is extremely important to provide excellent light first, and then figure out how to do it efficiently. Otherwise, features of the lighting system may be sabotaged by unhappy occupants.

Lighting has come a long way from the bare bulb and designs that simply provide a prescribed level of light (measured in foot-candles) at a target area such as desktops. Controls have also moved beyond a simple on/off wall switch that operates a large area of a building. And the conventional wisdom that said it is more cost effective to leave fluorescent lights on – rather than turn them off when spaces are unoccupied – is no longer useful.

If your facility has not kept pace with the new practices and technologies, you have the potential to make changes that can result in substantial energy savings.

Behavioral and Low-Cost Changes

The first thing to do when considering energy efficiency is to find out what you have, when it's on, and make sure it is off when not needed. Ask facility managers, school officials, and janitorial staff if a lighting audit or survey has been done in the past. Your electric utility may also have information in this area. If nothing has been done, at least a basic survey should be conducted to determine what technologies are used, how much they are used, and whether spaces are adequately lighted. If your local utility does not provide this service, you can do a basic survey yourself or with some help.

The first level of information gathering can be interviews with occupants and facility staff.

To go further a light meter is necessary. From code officials or publications obtain the recommended lighting levels set by codes (energy, building, and health and safety) for each type of space (office, restroom, hallway, classroom, gym, etc.). Note how each space relates to the recommended level – does it meet the recommendation, or is it over lit or under lit? Calculating the energy consumption of your lighting system will give you a starting point for making improvements. While codes rely on foot-candle measurements on the work surface, good lighting must also address color, contrast, distribution, glare and more.

If there is a real possibility that changes would be made, an ESCO (Energy Service Company) may be willing to provide a fairly detailed audit. If the audit shows good opportunities, the ESCO can finance the project and receive their payment through shared savings over a period of time.

A campaign to turn off lights that are not being used is a good first step for energy efficiency. The more time a light is on, the more important it is that the light is energy-efficient. Make sure that energy intensive lights that are used infrequently (athletic fields, stage lights) and those out of sight (e.g. storerooms) are controlled to be off when not needed. Required lighting such as exit lights that operate all the time should be



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replaced or upgraded if they are not currently using either compact fluorescent or LED technology. This can represent a large amount of energy if old, two-lamp incandescent fixtures are still operating, to say nothing of labor for the frequent lamp replacements they require.

Interviews with occupants can inform you about how lighting affects their comfort and work. It also lets you know how things are operated such as whether window shades are frequently adjusted or always left in one position (and whether the mechanism is working and easy to operate); whether lights are turned off when the last person leaves the room; if glare or heat gain from windows is a problem; if glare from lamps is a problem, and more. A conscientious person may be able to save more energy daily than automated controls, but automated controls are more reliable over time. Go by the building on several late

evenings to see what is still lit. The simplest and cheapest control may be the timed switch, but there is a wide range of more sophisticated controls to choose from.

Stay aware of any space use changes or remodels in the plans and try to incorporate better lighting whenever possible. The colors and reflectivity of ceilings, walls and floors have a large effect on lighting distribution so, if a change is already being considered, be sure it will improve light distribution. When spaces are used for activities other than what they were designed for, lighting often is poorly suited for the new use. One example is computer labs that need much less light than other classrooms, and where there may be opportunities to reduce lighting.

Group re-lamping – the practice of replacing lamps and cleaning the fixtures at 70 percent of lamp life – can improve light levels (dirt may reduce light levels by 20 percent) and reduce labor costs. Proper recycling is easier if all the lamps are handled at once rather than stored until a sufficient quantity is ready to recycle.

Measures That Cost Money

Changing the lighting system technology has a substantial cost, but can result in much better and more efficient light. Compared to the old standard T-12 fluorescents with their "cool white" color, T-8 fluorescent systems save

energy and improve lighting with no flicker or noise and improved color appearance. Compact fluorescent lamps can replace incandescent lamps in many applications, although special models are required for dimmers, wet locations, and for fixtures with occupancy sensors.

Two terms you may hear when discussing lighting are CRI (color rendering index, a scale of 1-100 with 100 being best) and CCT (correlated color temperature, a scale of Kelvin temperature; higher numbers are "cooler"). Typical residential lighting is incandescent with a 2700K but fluorescent lamps are now available to match. From 3000K to 3500K is usually considered neutral and 4000K and above is cool. "Daylight" lamps tend to be 5000K and up with a number of marketing terms, including "full-spectrum" ascribed to them. Learn much more about these on the EnergyIdeas or Lighting Design Lab websites (see below). Basically they refer to how things appear under those light sources, but if lamps of different numbers are visible simultaneously they will also appear to be of different color. A common situation with old T-12 lamps was to put one "cool white" next to a "warm white" for better appearances of objects and people illuminated by them. This was of marginal help for what was being lit, and looks ugly in a fixture. It is important to match both CRI and CCT within a space. Dimmers can also impact the quality of color with incandescent sources becoming "warmer" (more yellow) as power is reduced.



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With proper equipment and design, occupancy sensors can turn lights off, on and off, or dim in response to daylight.

High intensity discharge lights may be upgraded or, in many cases, replaced with fluorescent technology for better color and energy performance as well as instant on-off operation.

Daylight has been shown to improve student performance and if you can utilize it more, energy savings may be realized. Designing a system to take advantage of daylight is a process best handled by professionals who can account for heating and cooling impacts as well as light distribution and quality. Combined with dimming ballasts, compatible lamps, and good controls,

daylight can replace all or some of the artificial light much of the day.

Free Resources

The combination of appropriate technologies and efficient operation of the lighting system can save energy and improve the indoor environment. There are many free resources about this complex topic and some are listed here.

EnergyIdeas Clearinghouse has energy efficiency information online at www.EnergyIdeas.org, and technical assistance available by phone (800-872-3568) or email for eligible clients in the Pacific Northwest.

The Lighting Design Lab (800-354-3864) has lighting specialists who can consult with you at no charge. The website has many short, easy-to-understand articles on technology and applications. See the list of titles at:
<http://lightingdesignlab.com/articles/toc.htm>

You can also download publications such as *T-12 to T-8 Retrofit* at:
<http://lightingdesignlab.com/downloads/index.html>
The publication *High Performance T-8s* at
http://lightingdesignlab.com/ldnews/2004_spring_ldl_high_perf.pdf is a good introduction to current technology and possible savings.

EnergyStar's Building Upgrade Manual has a good section on lighting. www.energystar.gov/ia/business/BUM.pdf

The Federal Energy Management Program (FEMP) offers free promotional items for Earth Day and Energy Awareness Month (October) and a CD for making your own promotional items using their graphics.
www.eere.energy.gov/femp/services/yhttp/

School Operations and Maintenance: Best Practices for Controlling Energy Costs. This 130-page U.S. Department of Energy publication offers not only strategies for maintaining facilities, but also opportunities for reducing energy costs and increasing energy efficiency at existing schools.
www.ase.org/uploaded_files/greenschools/School%20Energy%20Guidebook_9-04.pdf

Fundamentals of Lighting Control. This publication was produced by Watt Stopper and the U.S. Department of Energy's Rebuild America.
www.wattstopper.com/getdoc/1.pdf

Classroom Lighting knowhow, Design Lights Consortium
www.designlights.org/downloads/classroom_guide.pdf

Office Lighting knowhow, Design Lights Consortium
www.designlights.org/downloads/office_guide.pdf

Federal Lighting Guide: A Resource for Federal Lighting Improvement Projects, FEMP. This publication contains links to resources for training, software and more.
www1.eere.energy.gov/femp/pdfs/fed_light_gde.pdf



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More information

For more information, see the WSU Resource Conservation Management web page at
www.energy.wsu.edu/projects/remrcm.cfm.

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