Green Schools Best Practices: Lighting

Managing School Lighting to Realize Easily Achievable Energy Savings

In virtually any school, lighting is one area that is controlled primarily by the building occupants, meaning that teachers and students can have a great impact on how energy through lighting is used, and saved. Reducing the amount of energy that goes into lighting is a great project for the youngest and most advanced students.

Studies have shown that proper lighting strategies in schools including day lighting have a direct impact on academic performance. Lighting is an area with the greatest opportunity for cost avoidance as it accounts for between 25 and 50% of the total electricity consumed in educational facilities. Initiatives in this area are relatively safe, highly visible, offer significant savings and can initiate awareness much easier than most other activities. Facility personnel often welcome lighting conservation efforts because the result increases life expectancy of the equipment, reduces operational expenses and defers some of the daily tasks of custodians to others.

Student based activities can help to identify the need for EMS automation such as lighting controllers and occupancy sensors. Conservation strategies range from low-cost or no-cost to very expensive capital renovations. Any strategy should include the support of facility and operations personnel including custodians to maximize their effectiveness.

No-Cost Strategies

Turn them off

Many schools have achieved savings by starting a whole-school movement to turn unnecessary, unused lights off when they are not needed. By establishing a rotating "Energy Marshall" in each classroom or school-wide "Energy Patrol," students can take responsibility for making sure lights are off whenever the class leaves a room. Turning off the lights, both easy and cost effective, can become a fun challenge to students and faculty alike. Consider allowing students to write tickets to those who violate the lights-off rules and reward those who comply. Eventually turning off lights should become part of the school culture and become second nature. To get their creative juices flowing, students can design door hangers, or light switch stickers/fliers to remind occupants to shut lights off when they are not in use!

Turning off lights is especially important overnight, on weekends, and during extended breaks. While students may not be able to control after-school activities that require lighting, getting a custodian on the Green Schools team will help save energy after school as well. A "Friday Night Lights" club could be responsible for turning off all lights and auxiliary appliances before the weekend. Larger operations such as HVAC should be shut down during extended breaks, but the students can help with lights and electronics. Either way, good communication with custodial staff is important, as they are often the last ones in the building for the night and can help with savings efforts.

Only use what you need

Most modern classrooms give teachers the choice of using variable lighting of one, two, or even three strips of lights in the classroom. A good project for students is to use the **light meter** to

asses the amount of light at desk-level with varying numbers of lights on, and with daylighting alone. The Illuminating Engineering Society suggests 50-75 footcandles for classroom lighting levels. Once a measurement of the light output of the different light combinations is obtained, it is easy to use the minimum number of lights required.

If variable lighting controls are not an option, students may work with teachers and school custodians to suggest using half the lights in classroom ballasts, a practice called delamping. School custodians could opt to remove unnecessary lights based on the students' assessment of the classroom lighting requirements. Besides overhead fixtures, vending and soda machines may also be delamped, although you'll probably have to work with the vendors to get this done.

Use daylighting

Daylighting can and should be used with variable lighting controls. Studies have indicated that daylighting is good for children – often improved test scores and decreased incidence of behavior problems correlate with daylighting. Especially in computer labs, libraries, or reading labs, natural light can reduce glare and eye strain associated with harsher fluorescent lights. And, of course, light from the sun is free!

Something to consider with daylighting, however, is the time of year that you're using it. Solar heat gain from windows can actually be a positive in cool winter climates, potentially warming the room and reducing heating costs. However, blinds should be shut at night to keep cold out. On the other hand, allowing the sun into the classroom on hot spring or summer days may increase the air conditioning load. Conversely, blinds should be open at night in the summer to let cooler air in.

Clean

Dirty or dusty light fixtures can reduce the light output from your bulbs. Regular cleaning can improve light quality and obviate the need for all lights to be on. Cleaning ceilings and walls to be more reflective, or painting them white can also decrease need for more lighting.

Low-Cost Changes

Task lighting

Using task lighting is one of the cheapest and most effective ways to cut down on lighting. Teachers can use a small task lamp on their desk (using a 15 – 23 watt CFL bulb, of course!) before and after school when they are working alone in the classroom. Doing the same in libraries or computer labs where overhead fluorescent lights may cause glaring anyway will yield similar savings.

SAVINGS PER YEAR: **kWh = 221** **$ = 33.18**	
Desk lamp = 23 watts	Overhead lights = 576 watts (32 watts x 3 bulbs x 6 fixtures)
kWh/year = 9.2 (.023 kWh x 10 hrs/week x 40 weeks/year)	**kWh/year = 230.4** (.576 kWh x 10 hrs/week x 40 weeks/year)
Cost/year = $1.38 (9.2 kWh x $0.15/kwh)	**Cost/year = $34.56** (51.2 kWh x $0.15/kWh)

Switch bulbs from T-12 to T-8 or better

Schools with T-12 fluorescent lamps should convert to T-8 lamps or T-5 lamps with electronic ballasts as necessary for conserving power. The number after the letter T indicates how many 1/8th inch increments exist in the diameter of the lamp. A T-12 is therefore 1 ½ inches in diameter compared to a T-5 which is 5/8ths inches in diameter.

T-5 lamps use the least energy but are very bright and should only be used when the ceiling height is 12 feet or greater such as in cathedral type of ceilings or all purpose rooms, or gyms.

A wide T-12 lamp, skinnier and most common T-8, and most efficient T-5.

A lighting retrofit is a large undertaking and should be completed as part of a capital project so that building renovation project rather than a maintenance aid from the State can be maximized when possible.

SAVINGS PER YEAR FOR EACH BULB: **kWh = 12.8** **$ = 1.87**	
T-12 = 40 watts	T-8 = 32 watts
kWh/year = 64 (.04 kWh x 40 hrs/week x 40 weeks/year)	**kWh/year = 51.2** (.032 kWh x 40 hrs/week x 40 weeks/year)
Cost/year = $9.60 (64 kWh x $0.15/kwh)	**Cost/year = $7.73** (51.2 kWh x $0.15/kWh)

Sensors

Light sensors may carry a larger price tag, but can also be effective in areas of school that are used infrequently such as closets, locker rooms, and bathrooms. They are also effective in other areas of the school in reducing lighting, but behavior changes can do an equally good job and will reinforce the lights-out habit for students.

<u>Follow Up and Reporting</u>

Measuring energy savings in terms of kilowatt hours (kWh) and associated greenhouse gas (GHG) emissions reductions can be done easily and makes the most sense. Cost savings estimates can also be made with a little more effort. Here is a lighting guide to estimate how much energy your school currently uses, and what you could save by replacing bulbs or rendering some obsolete.

LIGHTING COSTS WORKSHEET

PART ONE

Name: _____ **Before Upgrade:** _____
Date: _____ **After Upgrade:** _____
Room: _____

	A *	B	C	D	E	F	G	H	I
TYPE	**Watts per fixture = lamp wattage + ballast wattage ***	**Estimated # hours used per month**	**Watt-hours used per month (A x B)**	**kWh used per month (C/1000)**	**Cost to run per month (D x cost per kWh)**	**Cost to run per year (E x 12)**	**Quantity: # of lights of this type & wattage**	**Total annual cost (F x G)**	**Total annual CO2 output (D x G x 12 x 1.36)****

Total: Add up values in column H to get total cost per year of all lighting……..
Total: Add up values in column I to get total cost per year of all lighting……

*If there is no ballast, or you are unsure, then just use lamp wattage.
**http://www.epa.gov/cleanenergy/powerprofiler.htm can show you the exact number of pounds of CO2 released from your local utility depending on the fuel mix that is used to generate electricity in your area. The national average is 1.36 lbs/kWh or 1363 lbs/MWh.

LIGHTING UPGRADE WORKSHEET

PART TWO

Name: _____ **Room:** _____

Date: _____

	A.	B.	C.	D.	E.	F.	G.	H.
TYPE	kWh used per month (D from Part 1)	Total Cost (E from Part 1)	Total CO2 output (I from Part 1)	# bulbs to be replaced or turned off	Projected Annual Energy Cost after upgrade ((A x 12) – total kWh saved by upgrades x electricity cost)	Projected CO2 output after upgrade (C – (kWh saved x 1.36))*	Cost Savings (B-E)	CO2 Savings (C-F)

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