

## Green Lighting for College of the Redwoods' Life Science Building

By: James Adams

One day, while enduring a long lecture in Environmental Science, I began to daydream. Students who wanted to share stories were constantly interrupting the professor so I had plenty of time. I didn't find the class boring and I truly enjoyed the lectures. However, I will admit that I did not have much patience for the stories that others wanted to share in an attempt to support the professor's point. Inevitably, my daydreaming began.

My gaze moved to the ceiling. I admired the architecture of this old building. The beautiful wood walls gave particular warmth to the room and the architecture made the large space feel cozy. Further divulging the building's age were the recessed light canisters that contained incandescent floodlights. I started counting the old lights: 1...3...8...27 in all. Over half the bulbs were burnt out which made me think: "What did this place look like back in the day?" I imagined how warm it must have felt when all these lights were on and how brilliant the walls must have looked. Now, the lecture room is very dim. The Professor instructs from the shadows, which are darkest at the front of the room. You can still see him just fine but the room certainly lacks proper classroom lighting. With over half of the canister bulbs burned out, and only two fluorescent runners over head, the room feels more like a cave than a classroom. It was at this point, in my daydream, that I realized the irony of this lighting situation.

I was sitting in an environmental science class, listening to a lecture on natural resource preservation and management, while the most inefficient form of lighting illuminated the classroom; irony at its best. I am the first one to notice this? If not, why haven't the light bulbs been changed? More and more questions started flooding my mind as I focused back on the lecture for a moment. I shortly realized the stories were continuing: Back to the daydream. Aside from the irony of the situation, I began to ask the important question: How much money would the college save if they switched over to LED lights (the most efficient)?

When class was over, I waited outside for my professor, Jeff Hogue, so I could harass him about his lecture; we had become pals over the semester. I told him how I found it ironic that he was giving a lecture promoting Natural Resource Preservation while the most inefficient lights burn over our heads. As he lowered his head in disgust he said, "I know...it's horrible." I knew that he didn't make the decisions as to what light bulbs went into the classrooms but I had to point out the irony. This is a college, a place where students get imprinted and informed. We were all taught to lead by example when we were kids so: How can a college teach an Environmental Science class, promote Green Energy, express the importance of natural preservation, and tell students to go out into the world and be good to nature when the building that the Environmental Professor teaches in has lighting that is the most wasteful? This is like hearing an anti-violence speech from someone wearing a UFC shirt; it just doesn't make much sense. After a short talk with my Professor, I decided to do a little research into the situation and find out what it would take, how much it would cost, and how much it would save the college to change the lecture room over to LED lighting.

Adding more irony to the story, an LED light manufacturer is only ten minutes away from College of the Redwoods. CCrane Company in Fortuna, California, makes LED floodlight replacement bulbs. After meeting with Ralph Guest (CCrane VP), I learned just how big a difference LEDs could make on CR's power bill for just that one lecture room. Mr. Guest was kind enough to run all of my preliminary data into one of their programs. The program takes care of all the mathematics involved in

calculating wattage differences and power consumptions. The preliminary figures that came out of the program were shocking.

Unfortunately, I was unable to retrieve the exact power ratings of the bulbs currently in use in the lecture room. With school in mid-fall session, and the maintenance crew battling heating issues on campus, Professor Hogue and I were unable to get anyone to retrieve one of the highly elevated light bulbs for us to analyze. Given our struggle to acquire precise data, the wattage listings in this report are low approximations: i.e. we guessed a low wattage that the existing bulbs may be. Odds are, given the appearance of the existing bulbs, they are most likely 75 watt bulbs, however there is a high probability they are rated between 75-150 watts.

Here is the evaluation of the existing lights:

College of the Redwoods

Life Science Building:

Lighting Evaluation (Pictures Attached):

Main Lecture Room: Average Run Time = 12 Hours/day/5 days/week

23, Par 30 Recessed Light Canisters- incandescent bulbs

4, Par 38 Recessed Light Canisters- incandescent bulbs

**Note:** Although different in size, for this evaluation we will assume they have the same power rating. We are assuming 27, 75watt bulbs.

Outside Perimeter: Average Runtime = 12 Hours/night/7 days/week

15, Covered Socket Light Fixtures- Old CFLs installed

Please review the attached comparison charts where you will find data on the existing lighting system, a cost analysis comparison chart, and coal and natural gas savings charts.

The figures listed on the attached charts show how changing over just one room and the building's under-eave lighting, to high quality LED lighting, can make a big difference. By replacing the existing light bulbs in the life science lecture room and the outside eave lighting, CR would save an estimated total of: \$14,882.30 in electricity and 72,929.39 pounds of coal (or 207,999.9 cubic feet of Natural Gas) from being consumed over the life of the LED bulbs. Although this report merely focuses on changing the lights of one lecture room, one can only imagine what savings might be witnessed from changing whole departments over to LED lighting.

After taking a quick stroll through CR's library, the newest building on campus which was built in 2002, I could spot many inefficient lighting systems: over 40 incandescent lamps with two incandescent bulbs each, over 20 incandescent flood lights at the entrance (more floodlights illuminate other areas), and many outdated CFLs in various regions. I am sure that with a little more time and access, I could find many more inefficient areas in the library. This research project focuses on the Life Science lecture room but I would gladly extend my research to other areas on campus.

Although there are no affordable industrial LED light solutions currently on the market, there is a large abundance of smaller lighting needs solutions. For instance, there are many LED options for replacing lamp bulbs, floodlights, and accent lighting, which are widely used on the CR campus. On a large scale, upgrading these lights to efficient LED components can be very beneficial. As seen in this

report, just one college lecture room can hemorrhage thousands of dollars in powering the lights alone.

In the midst of a global power crisis, and ever growing threat from global warming, we look to our educational institutions for guidance and wisdom. It is the responsibility of our educational institutions to set the standards for the rest of the population to follow. In this instance, CR has an opportunity to take a step in the right direction, no matter how small it may be, and set an example for the rest of us. Upgrading the lights in one room can make a difference financially, environmentally, and ethically. Perhaps, the next environmental science students will have adequate, green, and efficient lighting illuminating their notepads while they take notes on environmental preservation.

The estimated figures listed on the attached data sheets clearly show the financial and environmental benefits of upgrading to LED lighting. Furthermore, CR would be making a positive statement to its students and the community; it is time for change. Upgrading the Life Science lecture room is a great opportunity for College of the Redwoods and a step towards a greener, more efficient campus.

Thank you for your time and consideration.

Best Regards,

James Adams

College of the Redwoods Student

References:

Natural Gas Facts and Usage Data



[http://www.epa.gov/climatechange/emissions/ind\\_assumptions.html](http://www.epa.gov/climatechange/emissions/ind_assumptions.html)

Coal Facts and Usage Data

<http://www.coaleducation.org/>

Jeff Hogue, College of the Redwoods, Environmental Science Professor



Ralph Guest, Ccrane Company, Vice President

CR Life Science Lecture Room Ceiling Lights	 Replacement bulb	 Existing bulb
<b>Compare</b>	<b>PowerVivid BR30</b>	<b>R30 Incandescent 75W</b>
<b>Rated Hours of Life **</b>	35000	2000
<b>Hour Per day use</b>	12	12
<b>Cost per Bulb</b>	\$36.95	\$5.99
<b>Bulb Operating Wattage</b> (dimmed bulbs have lower wattage typically)	10.4	75
<b>Years of life</b> (based on hours per day use and rated hours of life)	11.2	0.6
<b>Number of Bulbs to be replaced</b>	27	27
<b>Bulb Cost</b> (Per Replacement bulb rated hours run time)	\$997.65	\$3,623.95
<b>Cost per kWh*</b>	\$0.12	\$0.12
<b>Electricity Cost</b> (based on Replacement bulb rated hours of life)	\$1,177.46	\$8,491.39
<b>Total Cost</b> (Electricity + Bulbs + labor Per Rated Hours of Replacement bulb)	\$2,175.11	\$14,131.34
<b>Total Estimated Savings</b> (using the Replacement bulb)	\$11,956.20	
<b>Hazardous Materials</b>	No	No
<b>Annual Electricity Cost</b> (based on cost per kWh)		
4 hours/day 7 days a week	\$49.06	\$353.81
12 hours/day 7 days a week	\$147.18	\$1,061.42
24 hours/day 7 days a week	\$294.37	\$2,122.85
<b>Service Required</b> (number of each bulb needed per year based on Rated Hours of Life)	0	54
<b>Total Cost to Service Bulbs</b>	\$90.00	\$2,016.00
<b>Labor Cost per hour to Service Bulbs</b>	\$20.00	\$20.00
<b>Maintenance time to replace one light bulb</b> (in minutes)	10	10
<b>Lumens per Watt</b> (light output per watt)	51.92	9.33
<b>Brightness (lumens)</b>	540	700

These figures do not include time to purchase and disposal cost.

\* cents per kWh is based on National Average as released by the Energy Information Administration.  
kWh cost will vary from area to area.

\*\* Based on an average of name brand manufactures rated life in hours and usage per day.

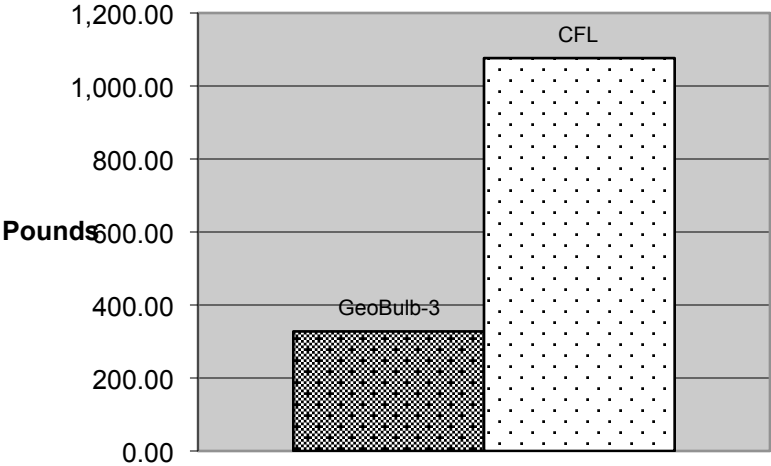
CR Life Sciences Lecture Room Ceiling Lights	 Replacement bulb	 Existing bulb
Compare	GeoBulb-3	CFL
<b>Bulb Operating Wattage</b>	7	23
<b>Rated Hours of Life **</b>	50000	8000
<b>Hours Per Day in Use</b>	12	12
<b>Days Per Week in Use</b>	5	5
<b>Hours Per Year in Use per bulb</b>	3120	3120
<b>Years of Life</b> (based on Hours Per Day Use and Rated Hours of Life per bulb)	16	2.6
<b>Number of Bulbs to be replaced</b>	15	15
<b>Cost Per Bulb</b>	\$49.95	\$5.99
<b>Total Bulb Cost</b> (Per Replacement bulb Rated Hours of Life)	\$749.25	\$1,437.60
<b>Electricity Cost per kWh*</b>	\$0.12	\$0.12
<b>Total Electricity Cost</b> (based on Replacement bulb Rated Hours of Life)	\$628.96	\$2,066.72
<b>Total Cost</b> (Electricity + Bulbs + labor Per Rated Hours of Life of the Replacement bulb)	\$1,378.21	\$4,304.32
<b>Total Estimated Savings</b> (using the Replacement bulb)	\$2,926.10	
<b>Hazardous Materials</b>	No	No
<b>Annual Electricity Cost</b> (based on cost per kWh*)		
4 hours/Days Per Week in Use	\$13.10	\$43.06
12 hours/Days Per Week in Use	\$39.31	\$129.17
24 hours/Days Per Week in Use	\$78.62	\$258.34
<b>Service Required</b> (number of each bulb needed per year based Replacement bulb Rated Hours of Life)	0	15
<b>Total Cost to Service Bulbs</b> (based on Rated Hours of Life of the Replacement bulb)	\$50.00	\$800.00
<b>Labor Cost per hour to Service Bulbs</b>	\$20.00	\$20.00
<b>Maintenance time to replace one light bulb</b> (in minutes)	10	10
<b>Lumens per Watt</b> (light output per watt)	74.29	35.87
<b>Lumens (brightness)</b>	520	825

These figures do not include time to purchase and disposal cost.

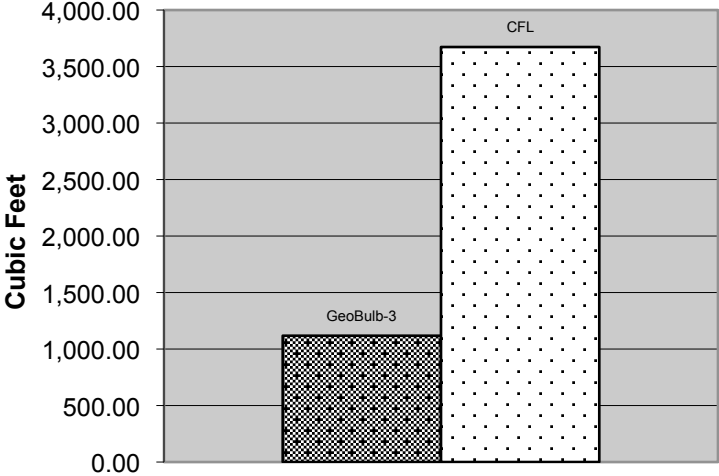
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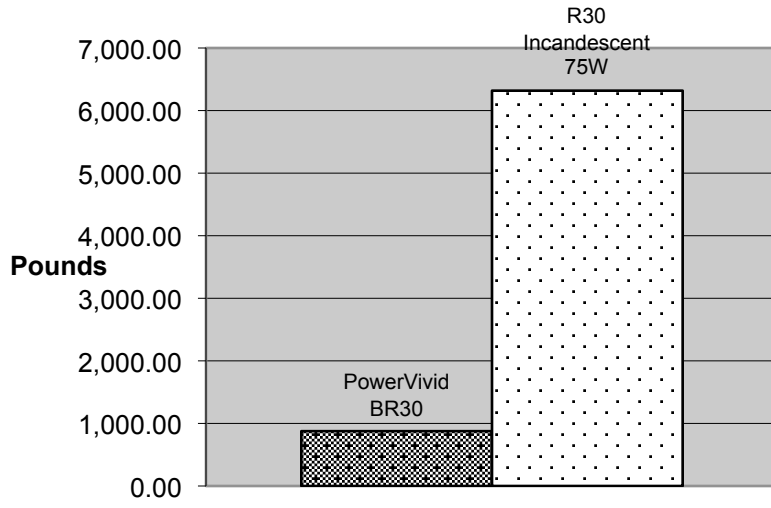
**Annual Coal Usage per Bulb Type**



**Annual Natural Gas Usage per Bulb Type**



**Annual Coal Usage per Bulb Type**



**Annual Natural Gas Usage per Bulb Type**

