Benefits of Compact Fluorescent Lights in Residence Life Housing at Arkansas State University: Students Take Action

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Abstract

The technology of electricity production has liberated man from darkness (i.e. usage of the candles, and the lanterns), but some repercussions accompany this technology. According to the Department of Energy, US spends about one-quarter of our electricity budget on lighting, or more than $37 billion annually. The incandescent bulbs have been shown to contribute to these high costs. Even though incandescent light bulbs are less expensive to purchase, they are much more expensive to operate. Emissions of gases (e.g. CO_2, and oxides of NO_x) during electricity production has contributed to global warming, a situation which requires immediate attention in order to halt the trend. To bring down the production of Green House Gases (GHG), one must calculate his/her emission footprint and take action. Institutions of higher learning consume large amounts of electricity in both their halls of residence and offices. As concerned students we evaluated the type of bulbs used in the students' halls of residence with the intention of comparing them in terms of their energy efficiency. Our research indicated a significant difference between the incandescent bulbs and the compact fluorescent bulbs with the latter being more efficient in electricity consumption. From our findings, total replacement of incandescent bulbs with CFLs in the residence halls will save the university about $28,641 annually in the best case scenario of 3 hours. Results from our research project led us to conclude that it was a worthy venture, both in terms of environmental sustainability and cost effectiveness. The results also indicated lessening of carbon dioxide emission by approximately thirteen million pounds and a payback period of less than one and half years. With increasing stress on our environment due to greater populations and resource consumption we have an even greater responsibility to future generations to be good stewards. Arkansas State University has an opportunity to save on financial inputs and also cut back on the gases effects released into our environment.

Introduction

The global population increase has put pressure on the earth's available meager resources thus leading to overexploitation and pollution. Among these resources are water, coal and others. Water and coal are majorly used in the production of electricity. Also water is a vital commodity in any living thing. Because of its importance and multifaceted use, there is need to reduce its wastage. Increased concern over global climate change, acid rain, respiratory ailments, and smog have raised concerns about emissions of carbon dioxide, sulfur dioxide, nitrogen oxides, mercury, and particulate matter from the burning of fossil fuels during electricity production and industrial use. There are also other concerns about the environmental impacts associated with traditional electricity generation fuel sources, such as the impacts of mining, drilling, processing, transporting, and disposing of fuels. According to the U.S. Energy Information Administration's estimate, of the total 15TW energy consumption in 2004 worldwide, 86 percent was supplied by fossil fuels.

Using the energy saving appliances and bulbs can contribute to the reduction of the aforementioned environmental problems. The reduction is dependent on individual and corporate decisions. Institutions of higher learning do utilize a lot of electricity in running their daily activities. Halls of residence, offices and security lighting systems rank highly as the sectors which consume a lot of electricity in institutions of higher learning. In order to reduce the inflated bills and being concerned of other environmental impacts, there is need for institutions and individuals consumers to install energy saving bulbs which will cut down the consumption of electricity. This will also help in easing the pressure on coal consumption hence reducing greenhouse gases emission to the environment.

According to the Department of Energy, U.S. spends about one-quarter of its electricity budget on lighting, or more than $37 billion annually. This cost can be brought down if intuitions and individuals embrace the usage of energy saving bulbs like Compact Fluorescent Lights (CFLs). However, embracing this change has an attached cost in terms of the higher prices per CFL bulb but in the long run, the energy saving

bulbs are pocket and environmental friendly. On the other hand traditional incandescent light bulbs are less expensive to purchase, but they are much more expensive to operate since they consume a lot of energy thus reflected on the inflated energy bills and their longevity is short in comparison to CFLs.

Inflated bills due to consumption of large amounts of electricity need to be considered for reduction, this will only be through replacing the incandescent bulbs with the CFLs. The benefits of changing from incandescent lighting to fluorescent lighting are multifaceted. Economically the CFLs Last approximately 10 times longer hence reducing the cost of replacement, they use 75% less energy, produce 90% less heat and deliver more light per watt. Environmentally, they are more sound (i.e. by installing one energy efficient CFL one can reduce 1,000 pounds of CO_2 emission). Finally, in terms of perception, CFLs convey a positive message to the growing number of environmentally concerned students and communities within and without institutions of higher learning. The objectives of this study were threefold; 1) to find out how much the current lighting system in costing ASU in terms of labor and electricity bills, 2) to find out how much the new system of lighting will cost ASU in terms of labor and electricity bills, 3) to compare the various amounts of carbon dioxide emitted in each system.

Methodology

Residence halls were identified where the incandescent bulbs were in use and the numbers of bulbs in all these halls were got from the residence life office in the university. The cost of the total incandescent bulbs was calculated based on the then current price of the incandescent bulbs (i.e. $0.50). Labor for periodical replacement these bulbs once they blow out was factored in, this was done by selecting one house in the Indian Village were replacements were done. During this exercise, the amount of time spent by a university worker in replacing one bulb was noted by timing the amount of time we spent unscrewing out the bulb and then screwing it back assuming one was doing a replacement. The time spent was multiplied by the number of fixtures in the residence halls to give the amount of time it was to take if one was to do a whole replacement of the

incandescent bulbs. The total hours were then multiplied by the minimum wage per hour (i.e. $ 6). The energy cost was based at $0.39 per KWh consumed. This was done on a single year, since CFLs can last approximately ten times than the incandescent bulbs, all the costs from both the incandescent and the CFLs were based on the ten year period. Also a hypothetical scenario of 3 hours was used as the minimum amount of time each bulb was on each day in the halls of residence where students do their private studies and other activities which requires the lights to be on. The calculations were done using a software program developed by General Electric Company (GE). The amount of KWh consumed by either bulb type was calculated. Since about 1.5 lbs of CO_2 are emitted in every one KWh generated and consumed, we multiplied the amount of pounds (1.5lbs) by the total KWh consumed per year in each case (table 3).

Results

The results presented here are based on the best case scenario of lights being on each day (3 hrs) and the worst case scenario (6 hrs).

Table 1: Summary of the Savings in the Best Case Scenario (3 Hrs/day of bulb on)

Hall Name	Fixtures	Current System	New System (CFLs)	Savings	Duration of recovery
Arkansas Hall	440	$1,127	$282	$846	19 months
Indian Houses	432	$1,107	$277	$830	19 months
Indian Flats	3,011	$7,715	$1,929	$5,786	19 months
Kay's Hall	910	$2,332	$583	$1,749	19 months
North park Quads	5,460	**$13,990**	**$3,498**	**$10,493**	19 months
Collegiate Park	3,900	$9,993	$2,498	$7,495	19 months
University Hall	378	$969	$242	$726	19 months
Total Fixtures	**14,531**	**$38,187**	**$9,547**	**$28,641**	**19 months**

Table 2: Summary of the Savings in the Worst Case Scenario (6 Hrs/day of bulb on)

Hall Name	Fixtures	Current System	New System (CFLs)	Savings	Duration of recovery
Arkansas Hall	440	$2,313	$578	$1,735	19 months
Indian Houses	432	$2,271	$568	$1,703	19 months
Indian Flats	3,011	$15,826	$3,956	$11,870	19 months
Kay's Hall	910	$4,783	$1,196	$3,587	19 months
North park Quads	5,460	**$28,698**	**$7,174**	**$21,524**	19 months
Collegiate Park	3,900	$20,498	$5,125	$15,373	19 months
University Hall	378	$1,987	$497	$1,490	19 months
Total Fixtures	**14,531**	**$76,375**	**$19,094**	**$57,281**	**19 months**

Table 3: The amount of carbon dioxide emitted in using either of the two types of bulbs

Type of bulb	Total kWh/yr	Total CO_2 Emissions/yr
Incandescent Bulbs	**954,687 kWh**	**1,432,031 pounds**
Compact Fluorescent Bulbs	**238,672 kWh**	**358,008 pounds**

Conclusions

Economic savings totaled to about $28,641 (best case scenario) annually with a change from incandescent to CFLs. In the interest of getting a return on an investment our calculations did show a return to the investment in less than a year and a half (19 months). A change from incandescent bulbs to CFLs on ASU campus could reduce 1,074,023 pounds or ~ 487 Tons of CO_2 from being emitted into the atmosphere per year. The option will save about thirteen million pounds of carbon emission in a decade on top of the reduced electricity bills. With increasing stress on our environment due to greater populations and consumption of meager resources we have an even greater responsibility to conserve them for our future generations. The findings did indicate that if students spend a lot of time reading or doing other business, then the amount of electricity consumed doubled as indicated in table 2 which is the worst case scenario.

Plan of action for ASU

For maximum savings we proposed the purchase all 14, 531 CFLs in order to replace all the incandescent bulbs so as to lower the labor costs and leap the benefits of reduced electricity bills.

Alternately we recommended for the purchase 3,900 CFLs to replace the incandescent bulbs in Collegiate Park complex which had similar fixtures and keep track on labor costs, electricity consumption and compare past and present electricity bills.

Finally, in many instances it costs money to do things that are environmentally friendly.

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