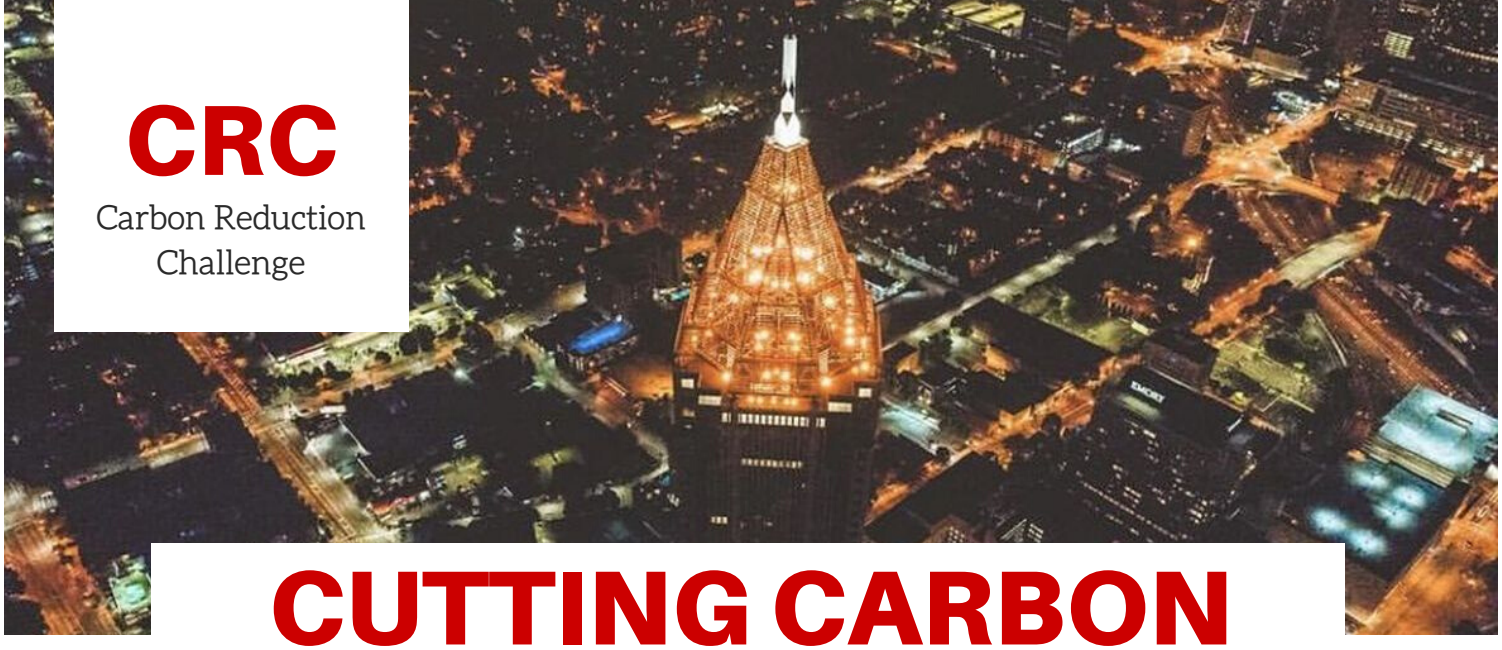

CRC
Carbon Reduction Challenge

CUTTING CARBON AND COSTS

BANK OF AMERICA PLAZA, ATLANTA

Reduce the carbon footprint of the “pinnacle of the Atlanta skyline”

LED Conversion

Change the High Pressure Sodium Lights to LED lights.
LED lights are cheaper, require less frequent maintenance, have a longer lifetime, and produce the same luminosity as HPS lights to keep Atlanta bright.

Run Tme Reduction

Reduce the 10 hour nightly run time to 8 hours.
Lights can be shut off during lowest traffic hours (2-4am)then reactivated during morning rush traffic by using a timer or manually turning them on/off.

Fiscal Savings

$3,900 saved annually while reducing carbon emissions by 70,000 lbs per year.
The current HPS bulbs can be replaced with LED at the end of their lifetime, and the initial investment in LED bulbs is less than HPS bulb costs.

GaTech Carbon Reduction Challenge

Developing projects that reduce carbon dioxide emissions and encourage sustainable business practices

Kanisha Ahmed, Alli Brightwell, Shine Lee, Anastacia Wood; 912-245-4635; anastaciawood@gatech.edu

Introduction

The Bank of America Plaza is a notable highlight of the Atlanta skyline with its iconic peak visible across the entire city. As its building manager, Shorenstein Properties has demonstrated a commitment to increased energy efficiency in recent years through various energy conservation projects. Despite these initiatives, there has been little to no effort to acquire more energy efficient outdoor lighting. Currently, there is a significant amount of carbon emissions produced solely by the 50 high pressure sodium (HPS) floodlights at the top of the building. This introduces the potential for eliminating 1.1 million pounds of carbon over the next 16 years and substantially increasing savings.

This proposal consists of two plans for carbon reduction. The first plan details a simple effort to decrease the outdoor HPS floodlights' runtime by two hours, requiring no costs. The second plan recommends replacing the 50 HPS floodlights with LED lights, which involves upfront costs. However, by implementing both plans, the plaza could save up to 70,000 pounds of carbon emission per year, drastically minimizing its carbon footprint and making the tallest building in Georgia an exemplary model for the advancement of key sustainability goals.

Background and Motivation

The Carbon Reduction Challenge (CRC), engaging both Georgia Tech students and local businesses as stakeholders, aims to significantly cut carbon emissions and boost savings for the respective stakeholder. Visible from the Georgia Tech campus, the Bank of America Plaza, otherwise known as the Pencil building, is a striking and significant feature for students and for the City of Atlanta. This CRC project advances student entrepreneurship and innovation, as well as opportunities to collaborate with the Bank of America Plaza; it is an innovative effort to promote greater energy efficiency within Atlanta's tallest and most recognizable building. Fundamentally, this project envisions significant reductions in carbon emissions that benefit the city of Atlanta as a whole, and fosters a partnership between Georgia Tech students and the Atlanta community.

Cost and Carbon Calculations/Savings

Plan 1: 2-Hour Reduction in runtime of HPS Lights (daily)

HPS Lights: running 10 Hours a Day	HPS Lights: running 8 Hours a Day
75,540 lbs of carbon emitted each year ● 48,500 kWh per year[1] ● $4,690 per year to run[2]	63,836 lbs of carbon emitted each year ● 40,900 kWh per year[3] $3,950 per year to run[4]
Total Annual Savings: ● Carbon savings[5]: 75,540 - 63,836 = **11,704 lbs CO2** ● Dollar savings: 4,690 - 3,950 = **$740**	

This plan proposes a daily 2-hour reduction in runtime for the HPS lights on top of the Bank of America Plaza. There is no cost to implement this plan unless the building requires a new timing system to run the lights. A timing system would have an initial cost of around $1,270 and has a payback period of 1.7 years[6]. This is a high-end estimate for timers, and because of the easy installation process, the stakeholder would likely not have to hire a specialist to install the timer and connect the lights. The annual savings would be $740 and 11,700 lbs of carbon emissions.

Plan 2: Convert Lightbulbs from *400 watt HPS* to *IL 450 120 watt LED lights*

Chart 1: Comparison of total costs (S) for 50 LED and 50 HPS lights*	
Initial LED Implementation Costs *(Chart 1A)*	**LED Light Costs - recurring at the end of lifespan *(Chart 1B)***
$16,940 total, one-time cost ● $7,500: *fixture installation cost* (may not be required) ● $9,440: LED *bulb cost* for 50 bulbs	$12,000 total cost *every 16 years*** ● $9,440: LED replacement *bulb cost* ● $2,500: *maintenance cost*
HPS Costs - recurring *(Chart 1C)*	
$30,000 total cost *every 16 years** (2 replacements based on an 8 year maximum lifespan)* ● $25,500: HPS *bulb cost* for 100 bulbs ($12,750 for 50 HPS bulbs x 2) ● $5,000: Total *maintenance cost* over 16 years** ($2,500 one-time maintenance x 2)	

[1] kWh calculated from https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator
[2] kWh prices retrieved from https://www.psc.state.ga.us/calc/electric/GPcalc.asp
[3] kWh calculated from https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator
[4] kWh prices retrieved from https://www.psc.state.ga.us/calc/electric/GPcalc.asp
[5] http://lightemittingdesigns.com/calculator/carbon-calc
[6] https://www.grainger.com

** 50 bulbs is the minimum estimate of bulbs at the top of the building; this estimate came from a conversation we had with a maintenance employee.*
*** 16 years is the average lifespan of an LED bulb (twice that of HPS bulbs); calculations reflect costs/savings throughout a 16-year period.*

This plan involves three main expense categories:

- The ***bulb cost*** is the total cost to replace 50 bulbs (HPS or LED). Additional bulbs would increase initial costs, as well as carbon savings.
- The ***maintenance cost*** is the estimated service cost, based on local prices and the type of lights, for bulb replacements at the end of their lifetime.
- The ***fixture installation cost*** only applies to LED lights if the current HPS light fixtures are incompatible with the recommended LED light bulbs.

Explanation of Chart 1: Comparison of total costs (S) for LED and HPS lights

LED Average Lifespan
8-hr vs. 10-hr running time

On average, LED bulbs would only need to be replaced once in a 16 year period because they have a lifetime of ~50,000 hours. If the lights run 8 hours a day, 365 days a year, this is a 17 year lifetime. If the lights run 10 hours a day, 365 days a year, this is a 13.5 year lifetime.

According to the professional recommendations and values given by an LED vendor[7], we were able to calculate all initial implementation costs. The *bulb cost* of 50, IL 450 120 watt LED bulbs is $9,440. Combining the *bulb cost* with an estimated $7,500 *fixture installation cost* results in a total initial implementation cost of about $16,940 (Chart 1A). Every 16 years, there is an additional $12,000 cost that includes the LED *maintenance cost and* replacement *bulb cost* (Chart 1B).

HPS Average Lifespan
8-hr vs. 10-hr running time

HPS bulbs, on average, have a lifetime of ~24,000 hours. If they run 8 hours a day, 365 days a year, they must be replaced every 8 years at a maximum. If the bulbs run 10 hours a day they must be replaced every 6.5 years.

We also projected the recurring costs of maintaining the current HPS lighting array (Chart 1C) in order to calculate the estimated savings after LED conversion. HPS lights require more frequent replacement than LEDs (for one LED bulb replacement every 16 years, HPS bulbs undergo two replacements). The replacement HPS *bulb cost* and *maintenance cost* totals to about $30,000 in fees every 16 years.

[7] www.myledlightingguide.com

Plan 2 Total Cost and Carbon Savings

Potential Cost Savings ($) after Implementation
Average Annual Savings = $2,750 + ($30,000-$12,000)/16 = ~$3,900* **(Projected Savings in a 16-year period =** $3900 * 16 = $62,400) ● $30,000 is the cost of maintaining HPS lights for 16 years (*bulb* and *maintenance cost*) ● $12,000 is the cost of maintaining LED lights for 16 years (*bulb* and *maintenance cost*) ● $2,750: energy savings per year *Considers energy saving, bulb savings, and maintenance savings
Total Carbon Savings after Implementation
● 55,600 lbs of carbon annually[8] ● 889,600 lbs of carbon over a 16 year period

The upfront LED light installation cost is more costly than maintaining the HPS bulbs for this year alone. However, the payback period upon implementing Plan 2 is roughly 4 years and 4 months. Thereafter, the annual savings are $3,900. The savings include $2,750 in energy savings (based on Georgia Power's tiered billing system) and additional savings from fewer maintenance fees. Converting to LED lights reduces the twice-every-16-years HPS light maintenance and bulb fee to a single maintenance and bulb fee within that same time.

Benefits and Challenges

The calculations presented above demonstrate that the benefits of implementing this energy-savings plan outweigh the costs. Both Plan 1 and Plan 2 result in similar benefits, but they also face common obstacles to implementation.

The most significant benefit in carrying out both plans is the reduction of carbon emissions. This move towards a more sustainable business model is excellent for marketing to potential customers and new building tenants. Furthermore, the tenants within the Bank of America Plaza benefit from this project as well. In demonstrating their support for this project and for sustainability efforts, tenants will improve their reputations and attract potential employees and customers, resulting in increased profit in the long-term.

The most apparent obstacle to moving forward with both plans is the ongoing pandemic that has placed serious strains on the Bank of America Plaza and its tenants. In general, businesses prioritize maintaining job security for their employees and keeping their companies open. Therefore, sustainability projects are not an absolute necessity at this time. However, the right energy efficiency projects and sustainability efforts may improve cost-efficiency and attract customers and new employees in the long-term.

[8] Carbon calculations from: http://lightemittingdesigns.com/calculator/carbon-calc

Plan 1 requires little to no implementation costs, and strategically shutting off the lights at a time with minimal traffic will not affect the building's reputation for its iconic lighting. However, the current lighting schedule is ambiguous; rather than operating only at night, the lights atop the building are visible during late morning hours when there is heavy fog. This may indicate that the lights operate based on a light sensor rather than on a consistent schedule. Clear communication with the stakeholder regarding the lighting schedule is essential to determine if an updated time schedule is necessary. If the lights operate on a timed setting, manually reducing the runtime is simple and free to implement, and the results are immediate. But, if the lights currently operate on a light sensor, additional hundreds of dollars for replacing the system with a consistent timed schedule will accrue[9].

The largest drawback to implementation for Plan 2 is the upfront cost of LED bulbs and of installation. A potential solution to this issue is a phased-in plan. This allows the company to purchase new LED lights on a quarterly or annual schedule; these LED lights would replace the current HPS lights as they burn out. Another uncertainty to address is whether the fixtures atop the building are compatible with the new LED lights. The compatibility of the fixtures and lights will save thousands of dollars for the stakeholder.

Current status and Next steps

So far, we have had an initial phone call with one of the building's employees regarding details about the lights at the top of the building. Our carbon and cost calculations use an estimate of the number of lights that we received during this call. Our proposal also suggests the most cost-effective LED lighting product out of numerous options. In addition to our initial contact with the building and our preliminary calculations, we have developed a one-pager for our stakeholder. This report presents our proposal and cost-benefit analysis of implementation in a simplified and concise format.

Moving forward, we will engage in discussion with the building manager to determine an exact number and model of the HPS lights currently in use. This will allow for more precise calculations on the potential costs and savings that will enhance our cost-benefit analysis. It is also crucial to discuss the desired LED specifications and a budget range with the stakeholder. Following this discussion, we will select a variety of LED light brands and models that best fit the desired specifications and budget. For each LED option, we will include an estimated projection of the upfront labor and bulb costs, as well as the carbon and cost savings. Then, we will present the various options to the stakeholder and help them to select the most appropriate LED model.

[9] https://www.grainger.com

Conclusion

The Carbon Reduction Plan introduces an innovative and simple way to reduce carbon emissions while delivering significant cost savings. This project consists of two parts: Plan 1 proposes reducing the hours of operation of the current HPS lights at the top of the building by two hours, and Plan 2 suggests replacing the HPS lights with more energy and cost efficient LED lights. With minimal effort, Plan 1 will save around 11,700lbs of CO2 and $740 annually. Despite initial labor, timer, and LED bulb costs, Plan 2 will save an estimated 889,600lbs of CO2 and $62,400 within 16 years or throughout the lifespan of the LED bulbs.

This proposal benefits the stakeholder, the City of Atlanta, and Georgia Tech students. Shorenstein Properties, the building owner and manager of Bank of America Plaza, has demonstrated a commitment to achieving greater energy efficiency through a variety of energy-saving initiatives. This potential project will propel the company forward as a leader in energy efficiency, boost the City of Atlanta's environmental reputation, and provide entrepreneurship and innovation opportunities to Georgia Tech students.

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