

# Carbon Reduction Challenge 2017 "Carbongate"



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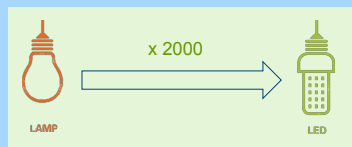
# Georgia Tech



## 3 The Solution

Since a large number of bulbs are required, the marginal savings from switching fluorescent bulbs to LED will multiply and significantly reduce the energy costs. The project must also generate a return on investment within 1 year for approval.

- 1 fixture has 20 bulbs
- 1 row has 10 fixtures
- 10 rows in the plant
- 2000 bulbs total



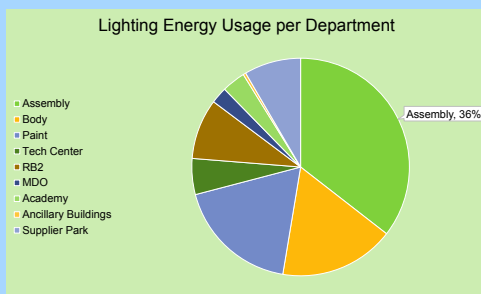
## 1 Overview

For my Carbon Reduction Challenge, I worked with the Plant Infrastructure team at Volkswagen Chattanooga Operations. I found that a major percentage of energy costs at the plant come from lighting, and more specifically, the lighting in the assembly plant. This summer I worked with Nick Tuders to develop a business proposal to change fluorescent bulbs to LED, thus saving the plant money while also reducing carbon emissions.

## 2 The Problem

VW uses about 12 million kWh per year in Lighting

- The assembly plant uses the most out of all the departments (almost 4.5 million kWh per year)



Rows of lights (2000 bulbs) are the largest sources of lighting in the assembly shop. They are used to highlight vehicle defects and are required to always be on when work is being performed (12 hours per day, 7 days a week, 52 weeks per year).

## 4 Data and Calculations

The calculations used for the business proposal were cost savings, carbon reduction, and return on investment. There are the important variables used in those calculations:

Variable	Value
Fluorescent Bulb Power	150 W per bulb
LED Bulb Power	75 W per bulb
Electricity Cost	\$0.068 per kWh
Carbon Emissions	0.000703 metric tons Carbon per kWh electricity
Installation Cost	\$1500 per month equipment, \$0.10 per bulb disposal
LED Bulb Cost	\$10 per bulb
Labor Cost	Negligible (< 5% operating cost)
Heating Cost	Negligible (< 5% operating cost)

### Calculation for Cost Savings

- Fluorescent bulbs operating cost  

$$- 2000 \text{ bulbs} \times \frac{150 \text{ W}}{\text{bulb}} \times \frac{1 \text{ kW}}{1000 \text{ W}} \times \frac{12 \text{ hours}}{\text{day}} \times \frac{7 \text{ days}}{\text{week}} \times \frac{52 \text{ weeks}}{\text{year}} = \frac{1,310,400 \text{ kWh}}{\text{year}}$$

$$- \frac{1,310,400 \text{ kWh}}{\text{year}} \times \frac{\$0.068}{\text{kWh}} = \frac{\$89,126.40}{\text{year}}$$
- LED bulbs operating cost  

$$- 2000 \text{ bulbs} \times \frac{75 \text{ W}}{\text{bulb}} \times \frac{1 \text{ kW}}{1000 \text{ W}} \times \frac{12 \text{ hours}}{\text{day}} \times \frac{7 \text{ days}}{\text{week}} \times \frac{52 \text{ weeks}}{\text{year}} = \frac{655,200 \text{ kWh}}{\text{year}}$$

$$- \frac{655,200 \text{ kWh}}{\text{year}} \times \frac{\$0.068}{\text{kWh}} = \frac{\$44,553.60}{\text{year}}$$
- Savings = **\$44,553.60 per year**

### Calculation for Carbon Emissions

- Fluorescent bulbs emission  

$$- \frac{1,310,400 \text{ kWh}}{\text{year}} \times \frac{0.000703 \text{ metric tons CO}_2}{\text{kWh}} = \frac{921.2 \text{ metric tons CO}_2}{\text{year}}$$
- LED bulbs emission  

$$- \frac{655,200 \text{ kWh}}{\text{year}} \times \frac{0.000703 \text{ metric tons CO}_2}{\text{kWh}} = \frac{460.6 \text{ metric tons CO}_2}{\text{year}}$$
- Savings = **460.6 metric tons CO<sub>2</sub> per year**

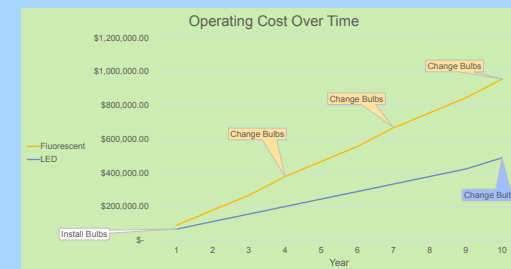
## 5 Results

ROI within **6 months**

**\$22,853** saved within the first year

Annual Assembly lighting usage reduced by **4%**

	1 Year	5 Years	10 Years
Carbon Reductions	460.6 tons	2,303 tons	4,606 tons
Energy Savings	655,200 kWh	3,276,000 kWh	6,552,000 kWh



**\$467,236** saved over 10 years

## 6 Conclusions

**\$467,236** can buy you...

23



400



**4,606** tons of carbon is about...

4500



2300

