

LED Lightbulb Replacement Challenge: A Pledge for a Brighter Future

Team Lumen-ate

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Introduction

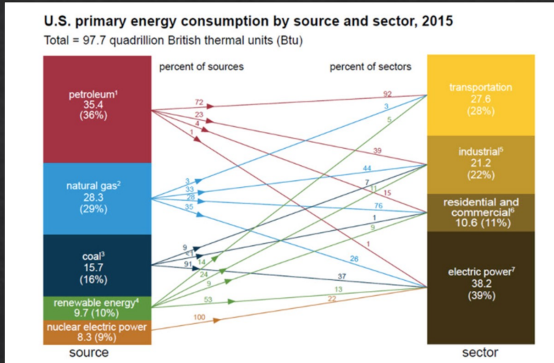


Figure 1: U.S. Primary Energy Consumption by Source and Sector, 2015. EIA.gov

Around 30% of our carbon footprint is due to electricity usage and from that, 17% is from lighting. By switching to more efficient lightbulbs we can reduce our electricity consumption and pounds of carbon emitted.

The Problem

Carbon Emissions

The 2015 electricity consumption for the average Georgia household was 13,464 kWh per year, which equates to over 15,500 lbs of CO₂.

Electricity Costs

The average Georgia customer pays over \$1,550 in electricity bills annually. EIA (1)

Our Solution

Our objective was to reach out to family and friends to help households to increase energy efficiency and save utility costs by switching to LED bulbs. Households would purchase their own LED bulbs of choice.

Calculations

For Georgia Stakeholders

$$(W_i - W_f) \times lifetime(h) \times \frac{1 kW}{1000 W} \times \frac{1.1516 lb CO_2(3)}{kWh} \times number\ of\ bulbs = lbs\ CO_2\ saved$$

$$(W_i - W_f) \times lifetime(h) \times \frac{1 kW}{1000 W} \times \frac{\$0.1086(2)}{kWh} \times number\ of\ bulbs = dollars\ saved$$

For South Carolina Stakeholders

$$(W_i - W_f) \times lifetime(h) \times \frac{1 kW}{1000 W} \times \frac{0.8668 lb CO_2(3)}{kWh} \times number\ of\ bulbs = lbs\ CO_2\ saved$$

$$(W_i - W_f) \times lifetime(h) \times \frac{1 kW}{1000 W} \times \frac{\$0.1214(2)}{kWh} \times number\ of\ bulbs = dollars\ saved$$

*the numbers for pounds of CO₂/kWh are carbon equivalents of greenhouse emissions.
Carbon equivalents: EPA (3)
Prices: EIA (2)

Georgia vs. South Carolina: Diversity of Energy Portfolios

In 2015, South Carolina executed an initiative to switch from coal power to natural gas. Their energy production is now more efficient than Georgia, causing the amount of carbon emissions per kilowatt hour to be less in South Carolina. However, the price of electricity in South Carolina is slightly more expensive, most likely because of the price of their cleaner energy production. (5)

Results

Number of bulbs replaced: 292
Participants saved anywhere from \$425.00 to \$6,660.00

Total Carbon Savings
214,872.8992 lbs

Largest Cost Savings
\$6,660.00

Breakdown of participant with the highest cost savings

214,872.8992 lbs CO₂ is equivalent to...



Driving around the Earth 9.5 times!!

EPA (4)

If every American household switched to just 1 LED, enough carbon would be saved to...

Drive around the earth 5 million times!!

EPA (4)

References

- "2015 Average Monthly Bill- Residential." (n.d.). n. pag. EIA, 2015. Web. 18 Apr. 2017. <https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf>.
- "Average Price of Electricity to Ultimate Customers by End-Use Sector," EIA - Electricity Data. EIA, 24 Mar. 2017. Web. 18 Apr. 2017. <https://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a>.
- "EGrid2014 Summary Tables." EPA, 3 Jan. 2017. Web. 18 Apr. 2017. <https://www.epa.gov/sites/production/files/2015-10/documents/egrid2012_summarytables_0.pdf>.
- "Greenhouse Gas Equivalencies Calculator." EPA. Environmental Protection Agency, May 2016. Web. 18 Apr. 2017. <<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>>.
- Bartelme, Tony. "A little less gas in the greenhouse: S.C. industries reduced CO2 emissions in 2015." 9 January 2017. Web. 19 April. <http://www.postandcourier.com/news/a-little-less-gas-in-the-greenhouse-s-c-industries/article_294777e8-bc8f-11e6-8b3e-17d13f323815.html>

*EIA (2)

Incandescent	LED
Life Span 1,250 hours	Life Span 15,000 hours
Price of one bulb \$1.50	Price of one bulb \$3.00
Wattage 60 W	Wattage 9 W
Price of Electricity/h (10.86¢/kWh*) \$0.006516/h	Price of Electricity/h (10.86¢/kWh*) \$0.0009774/h
Electricity cost over 15,000 hours \$997.74	Electricity cost over 15,000 hours \$14.66
Bulbs needed for 15,000 hours of use 12 bulbs	Bulbs needed for 15,000 hours of use 1 bulb
Total Costs (15,000 hours of use) \$115.74	Total Costs (15,000 hours of use) \$17.66



Quantity (number of bulbs)	Wattage	Lifetime of bulb (years or hours)	Carbon (pounds)	Cost Saved (dollars)
36	3.8 W (replaced 40W)	15,000 hours (SC)	16,983.3024	\$2373.13
65	3.8 W (replaced 40W)	15,000 hours (SC)	30,664.2960	\$4284.81

Proof of Purchases

