ENSP 400 Capstone

LED Lighting: Carbon Footprint Reduction and Energy Cost Savings at Prince George's County Parks and Recreational Facilities

Final Presentation

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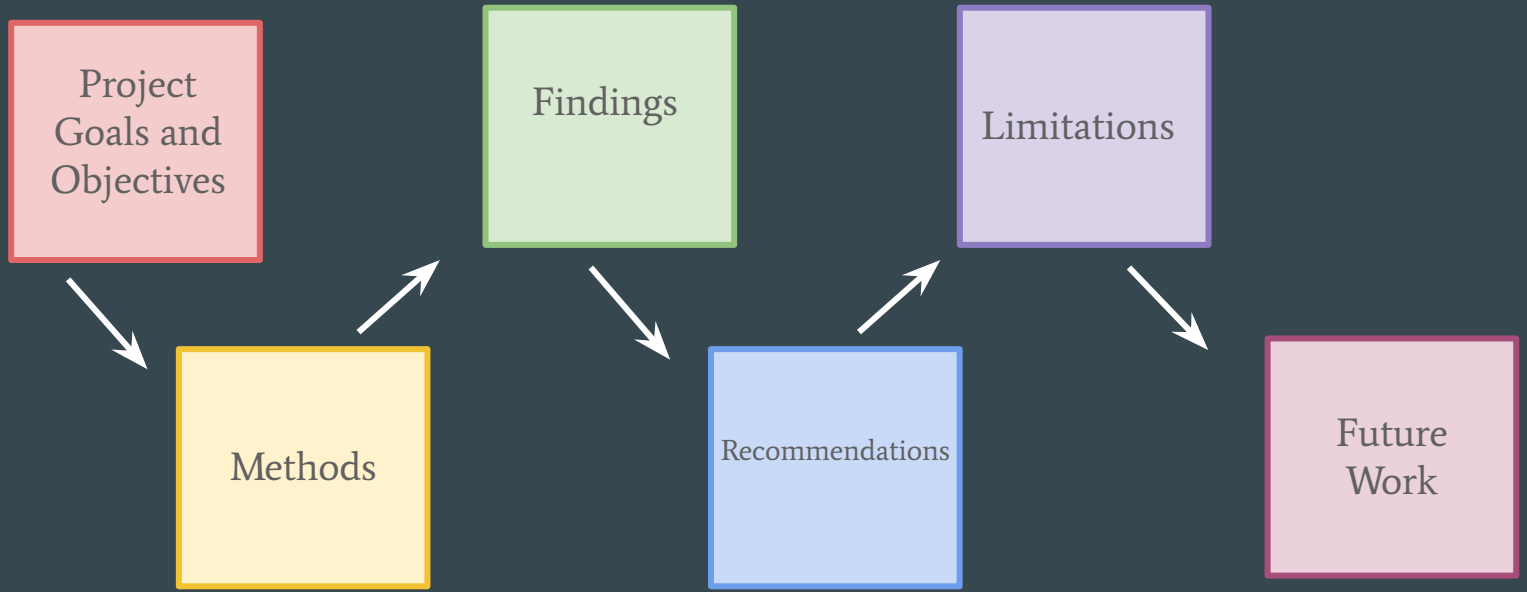
Agenda


Project Goals and Objectives
Methods
Findings
Recommendations
Limitations
Future Work

Goals and Objectives

- Goal: To account for, and subsequently minimize, the carbon production associated with operation of a facility
- Determine and verify carbon reduction, energy efficiency, and cost savings across 4 facilities
- Apply those findings to measure the assumed carbon reduction and cost saving for a facility that has not undergone a LED retrofit

Objective 1

- To identify 4 facilities with the informational needs to accurately assess the facility electrical energy usage and impact retrofitting:
  - Seat Pleasant Community Center (retrofitted: 18,200 sq. ft.)
  - Vansville Neighborhood Recreation Center (retrofitted: 4,100 sq. ft)
  - Huntington Community Center (not retrofitted: 20,000 sq. ft.)
  - Palmer Park Community Center (not retrofitted, 32,000 sq. ft.)
- Once we started calculations, we cut the aviation museum
  - Analyzing energy usage per square foot per day
  - To compare energy use across retrofit vs non-retrofit we want to have similar energy uses

Objective 2

- Original: Identify realized and potential cost-savings for switching to LED lights. Where data is available, include cost-savings for additional energy-saving technologies (motion sensors, automatic lights, etc.)
- Updated: Examine the projected and actual energy savings that took place at three facilities in response to the conversion to LED lighting, and the addition of light control sensors

Objective 3

- Determine realized and potential carbon footprint reduction that results when switching to LED lights, including the carbon reduction from additional energy-saving devices such as motion sensors or timers
- Carry out a life cycle analysis and evaluate literature in order to obtain data from which the carbon footprint reduction can extrapolated for the facilities being studied

Methods

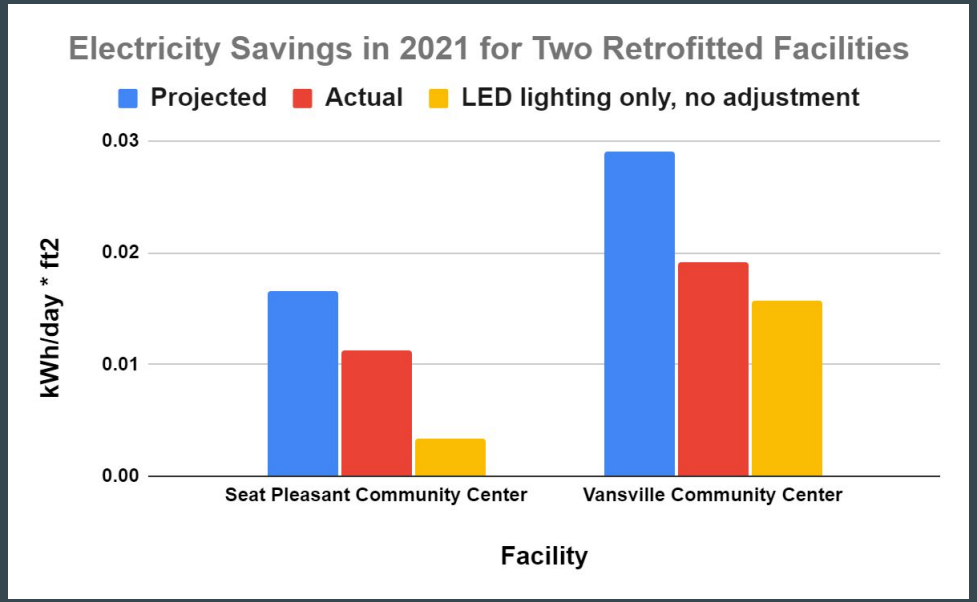
- Research of peer-reviewed literature on life cycle analysis
- Requests for data from client's points of contact via phone and email
- Analysis of electric bills, consultant reports, contractor documents, and manufacturer information

Methods

- Energy bills from June, July, Aug of 2019 and 2021
- Projected: taken from consulting documents plus the average difference for the two non-retrofit sites
  - Per-facility: calculated change from switching to LED appliances
  - Average difference for non-retrofit represents expected change due to factors other than LED
- Actual: change in kWh/sq. ft/day from energy bills
  - Calculated from the utility bills for the three months
- LED lights only:
  - Calculated from the consultants itemized listing of the wattage of all lights present within the facility
- Everything calculated in kWh/sq. ft./day
  - To account for differences in the size of the facilities, slight differences in the billing periods between the facilities, and the years being considered in the analysis

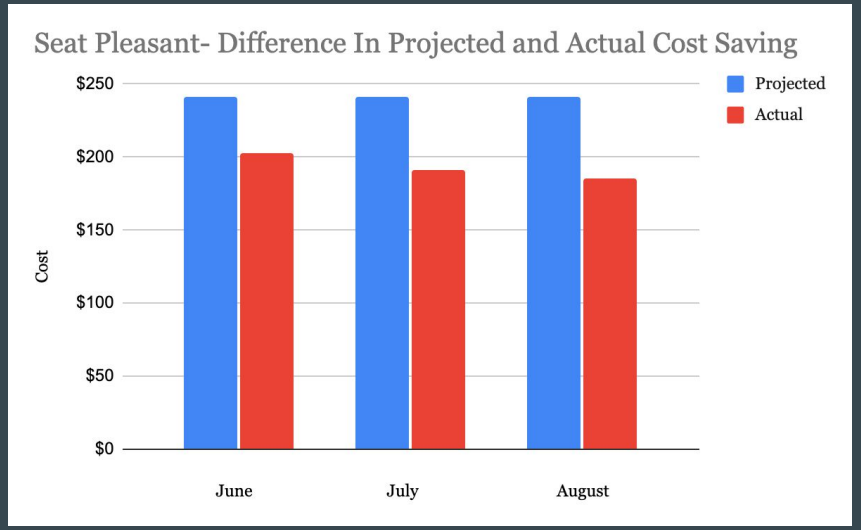
Findings: Objective 2 - Energy and Cost Savings

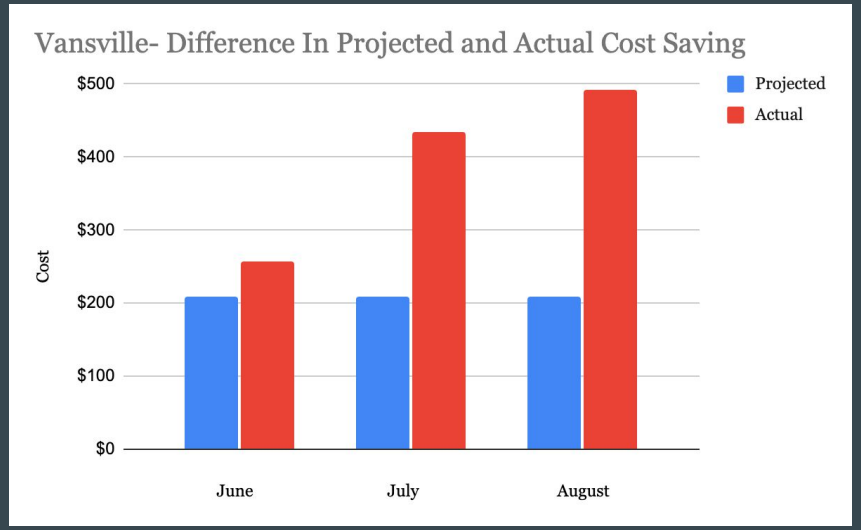
- The data shows that the difference in electricity bills from 2019 to 2021 was larger for the retrofitted facilities in all months.
- Since the study only examined two retrofitted facilities, it is hard to determine what would be expected for the average community center.
- Both retrofitted facilities observed electricity savings but less than predicted by the consulting team.
- Some of the reduction in electricity usage can likely be attributed to changes in occupancy due to the COVID-19 pandemic.



Findings: Objective 2 - Energy and Cost Savings

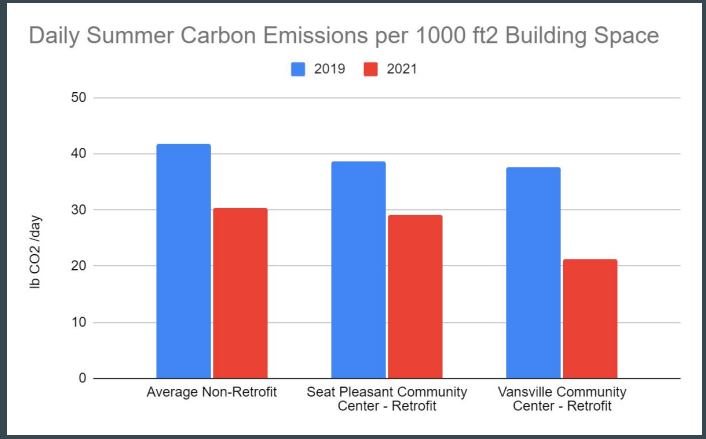
- The findings of cost savings for the facilities that retrofitted to LED lights varied
- The reason can be due to the impacts of Covid-19 varied between facilities and saw the effects differently

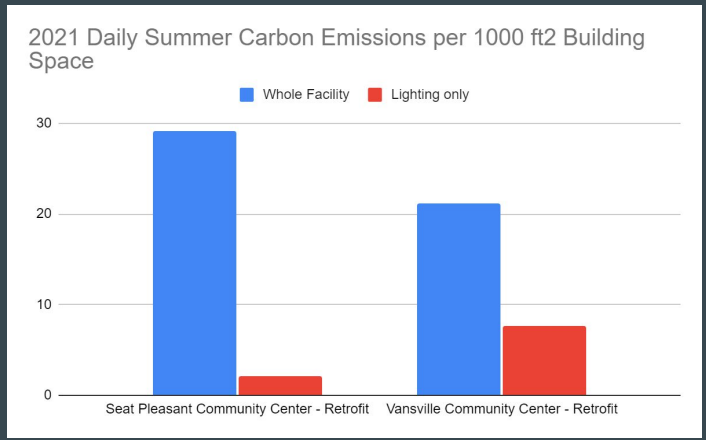




Findings: Objective 3 - Carbon Savings and LCA

- Carbon footprint reduction from retrofitting is greatest in facilities where lighting already made up a larger portion of total electricity usage (and therefore the total resulting carbon emissions)
- All facilities studied (retrofitted and non-retrofitted) had a reduction in their carbon emissions in Summer 2021 when compared to Summer 2019
- Out of all the facilities studied, Vansville Community Center experienced the greatest carbon emissions reduction after being retrofitted
- Although Seat Pleasant Community Center was also retrofitted, it did not experience a reduction in carbon emissions that was greater than that of non-retrofitted facilities, but it also had a much smaller amount of total electricity usage that came from lighting





Findings: Objective 3 - Carbon Savings and Literature Review

- Manufacturing phase sees LEDs as most impactful
  - Impacts are of less significance when considering use phase
  - LEDs see at least “41% less global warming impact because of less CO2 emissions”
- LEDs with higher luminous efficacy have highest degree of energy/carbon savings
  - The addition of dimming technology can cut energy consumption by an additional 10%
  - Benefits maximized with sensors
- Overall, data on production and disposal stages is not as extensive
  - Data on use stage is extensive for most every lighting product

Recommendations

- Prince George's County Department of Parks and Recreation make a complete switch to LED lights along with other energy saving devices in all facilities under their administrative jurisdiction
  - Motion sensors
  - Automatic lights
- Going forward all newly constructed facilities be fitted with LED lights and energy saving devices from the beginning
  - Saves money on energy bill and maintenance bill
  - Has a greater impact on reduced carbon footprint

Limitations of Results/Findings

- Inconclusive data on multiple stages of LED lifecycle
  - Creates uncertainty during the decision making process
- Study only examined two retrofitted facilities
  - Small sample size can skew the data
- Compares only three months from two years as opposed to the entire year
  - 2019, 2021
  - Jun, Jul, Aug
- Data shows the amount of saving for cost, energy, and maintenance is linked to the proportion of electricity used for lighting in each facility
  - More electricity dedicated to lighting is grounds for more savings

Future Work

- Same analysis but with more facilities
  - Two facilities is not enough to get a complete picture
    - Vansville saw less of a reduction in energy usage compared to Seat Pleasant
    - Facilities have different policies
- Same analysis in a year or two
  - COVID-19 still had impacts on occupancy
  - Different community centers had different policies
    - Ex. Palmer Park: fewer summer camps, closed earlier, etc.
- Interview employees at the four facilities
  - Want to know what we knew for Palmer

Questions?

Photo Credit: Catherine Madsen (Photographer) and the PALS Program at Palmer Park Community Center