



# The LED lighting revolution

A win for climate, economy, and society



# The Presenting Today:

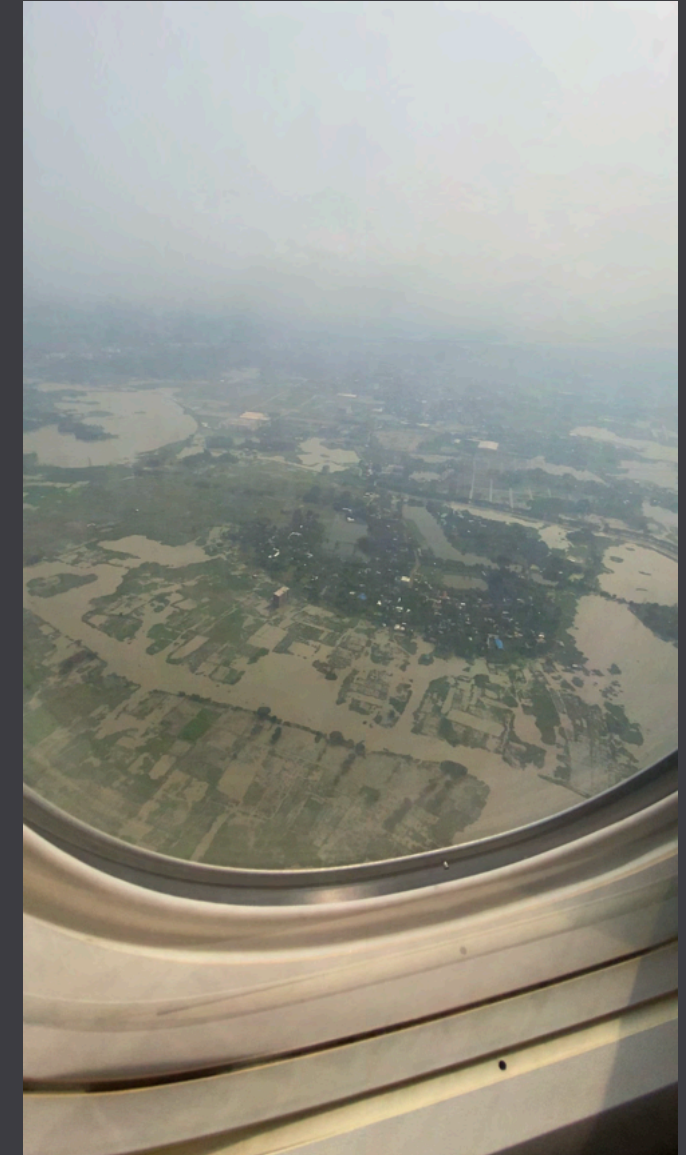


**VINAY KRIS MEHTA**

**11+ Year Lighting Industry  
Journey Man**

11+ years of sales, marketing & operational experience in the lighting industry with Signify (formerly Philips Lighting), the leading global supplier of lighting.

World Traveler, Loving Husband & Dedicated Philadelphia Sports Fan (Though, Generally Nice Person)



# The challenges

## Our world is changing

- **Population growth** and urbanization are increasing demand for artificial lighting
- **Resource challenges** and the fight against climate change increase the need for energy efficient lighting
- **Rapidly emerging digitization** is increasing the need for further integrations and connected lighting

**35% increase  
in light points from  
2006 to 2030**

Due to population growth, urbanization, and the rise of the middle class, the total number of light points throughout the world is projected to grow by **35%** between **2006 and 2030**.

# LED lighting:

## A major energy-saving opportunity

The lighting share of global electricity consumption fell from **19% in 2006** to **13% in 2018**, and is projected to decline to **8% by 2030** following the adoption of state-of-the-art lighting solutions.

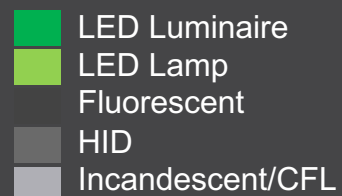
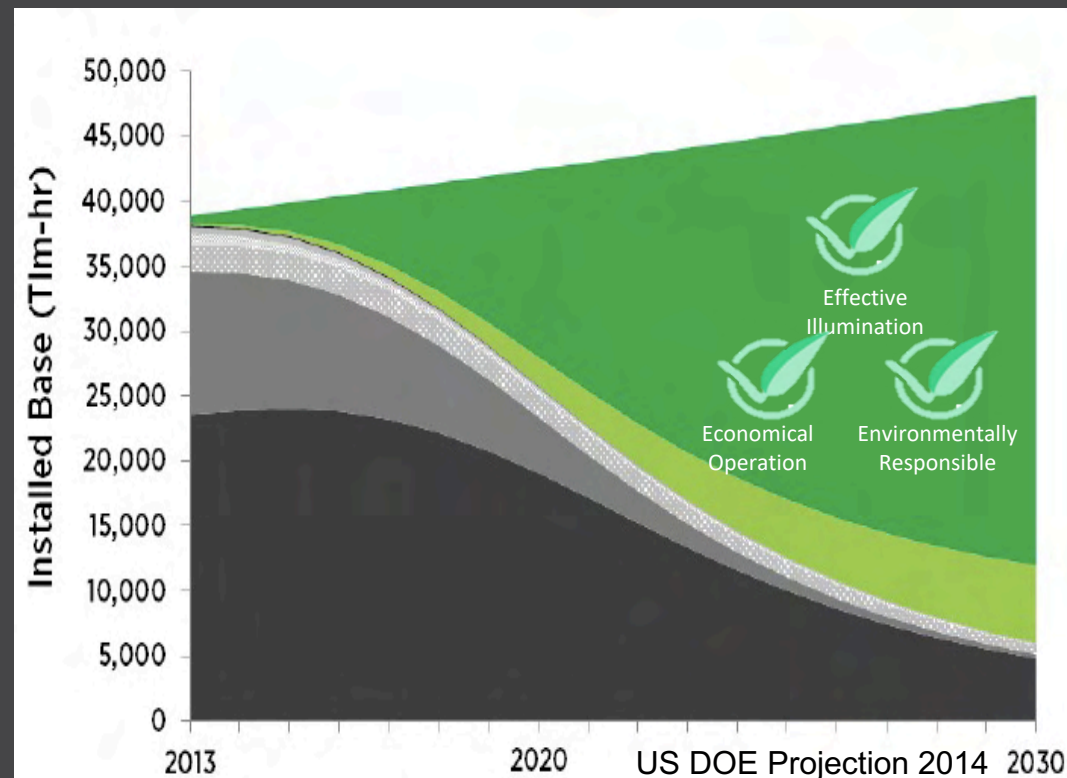
A decrease of  
**1400 million**  
tons of carbon  
emissions  
per year

Energy savings of  
**€ 272 billion**  
compared to  
“business as usual”  
per year

Savings of  
**1250**  
power plants’  
output compared  
to “business  
as usual”

# Why LED?

## Benefits of LED Lighting



- ✓ Energy efficient
- ✓ Long life
- ✓ Cold environments
- ✓ Small size
- ✓ Easily controlled
- ✓ Instant on
- ✓ No mercury
- ✓ No UV or IR (virtually)



# Signify is globally recognized as a leader in sustainability



Carbon Neutral in 2020

**No. 1**

Conventional Lamps  
LED  
Connected Lighting

**\$7.3bn**

Sales  
~ 75% Professional

**>64M**

Connected light points

**4.8%**

of total sales invested in R&D  
2X our nearest competitor



**100+**

University partnerships

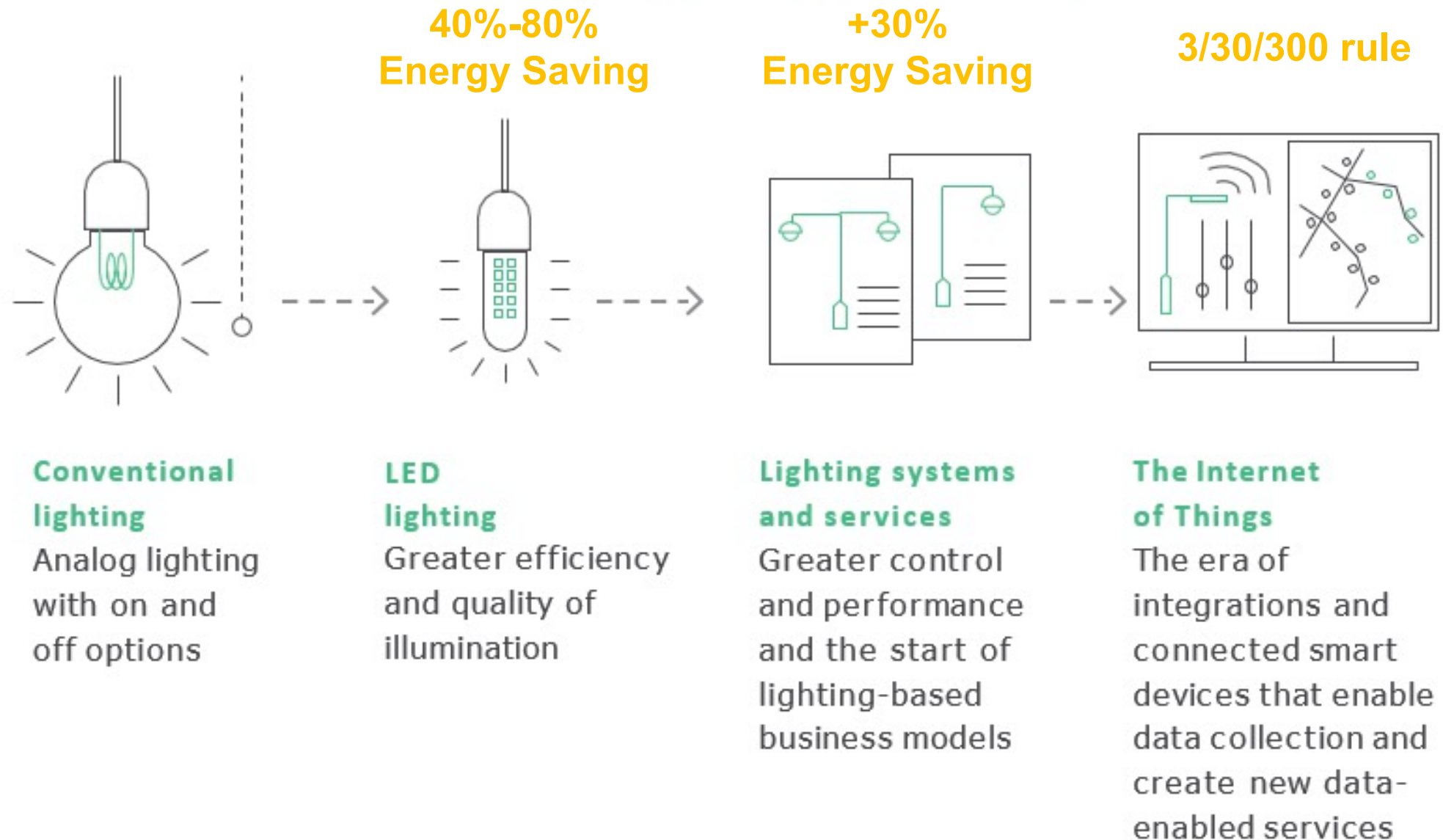
# Going beyond illumination

We are leading the ongoing development of connected lighting systems and services. By leveraging the Internet of Things, we are transforming buildings, urban places, and homes. We increase energy efficiency and manage working environments in a more environmentally friendly way.

We make cities safer and more responsive. We offer rich lighting experiences that make people feel safe, comfortable, focused, energized, and entertained. That's how we take light beyond illumination, and help improve the way the world works and people live.

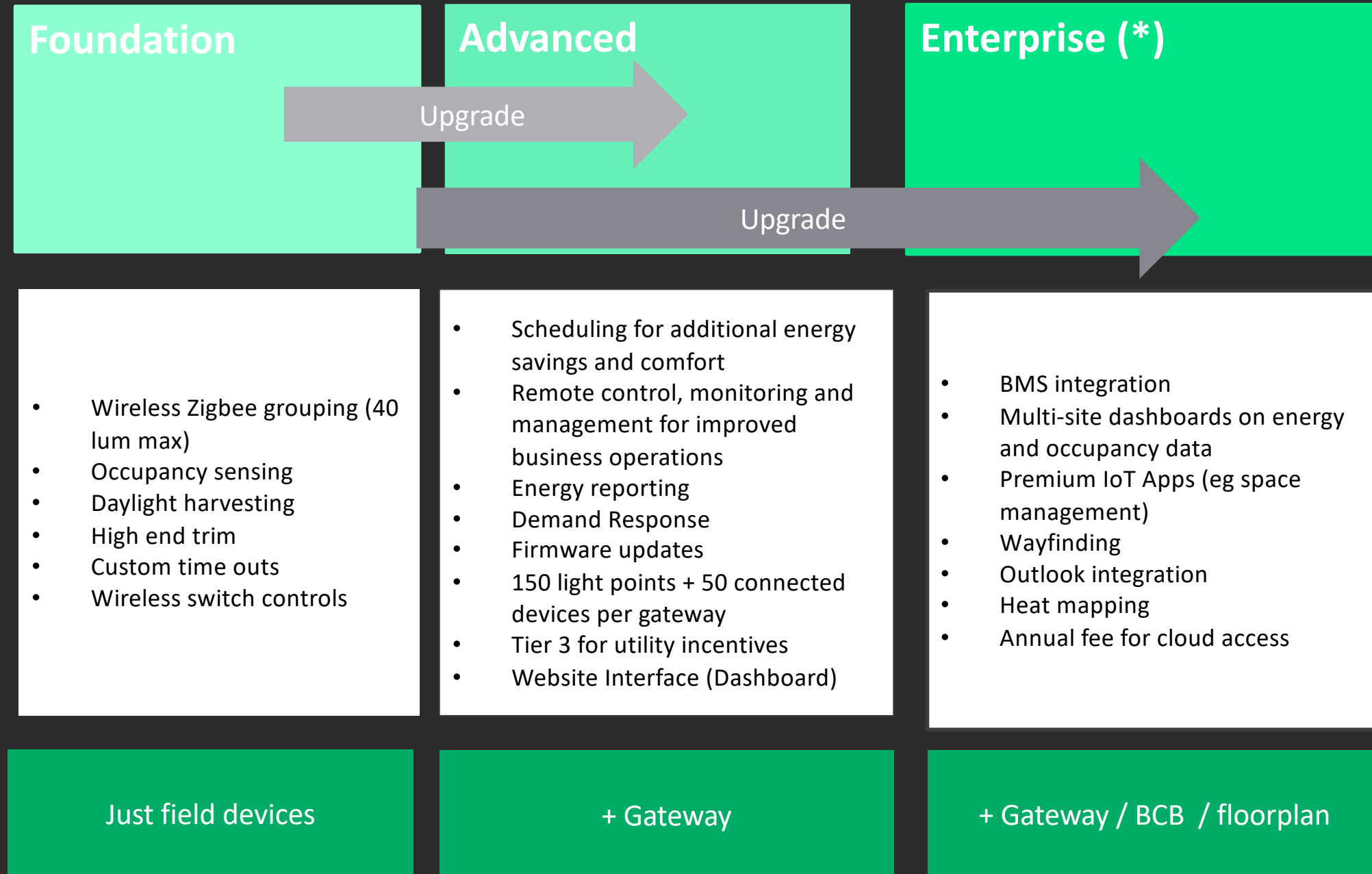
# From analog to digital...

## The evolution of the lighting industry

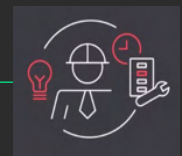




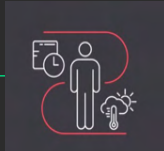
# A scalable wireless lighting platform to meet your needs today and “scale up” for the future.



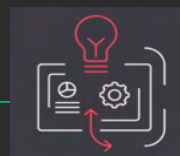
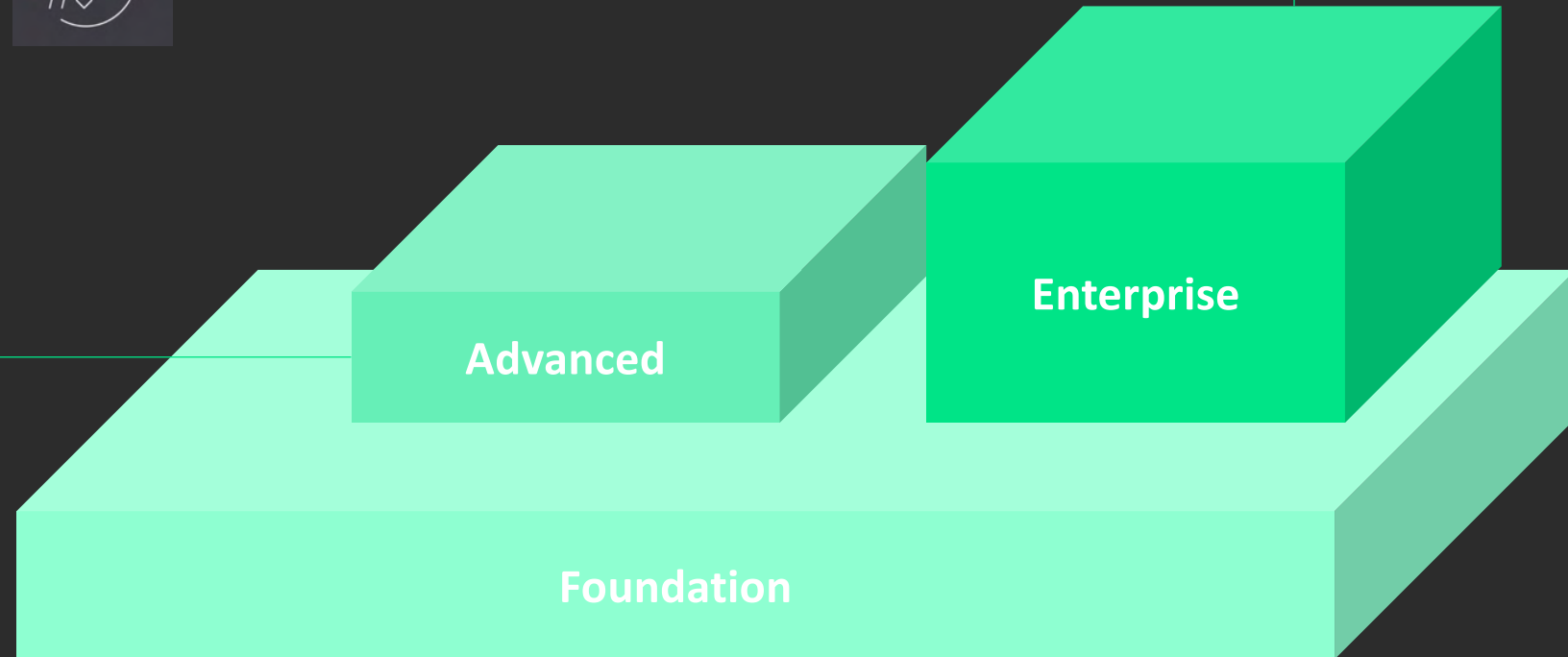
# 3/30/300 Rule



Adding cloud connectivity for energy reporting and remote management



Unlock value beyond illumination through data-enabled applications and APIs

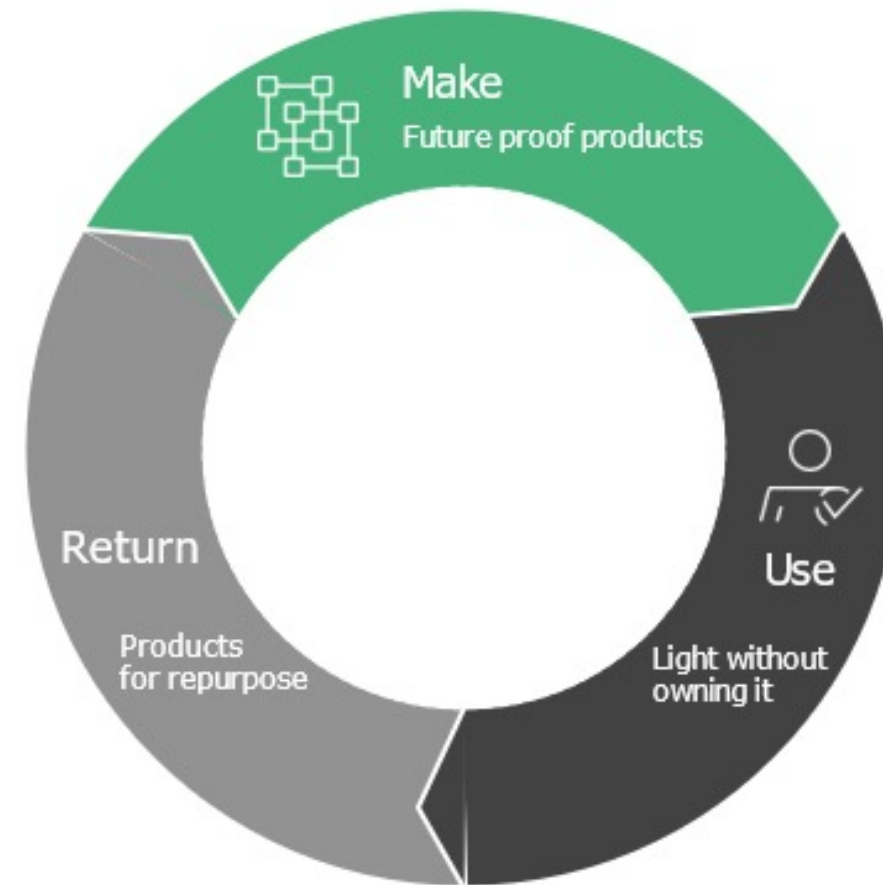


A solid basis of cost effective, code compliant energy saving lighting

	Foundation	Advanced	Enterprise
Productivity / employee wellbeing and safety	-	-	+
Building efficiency	-	+	++
Energy saving	+	++	+++

# Circular economy rapidly emerging

For a sustainable world, the transition from a linear to a circular economy is essential. A circular economy aims to decouple economic growth from the use of natural resources by using resources more effectively.



# 3-D Printed Luminaires – Circular Economy

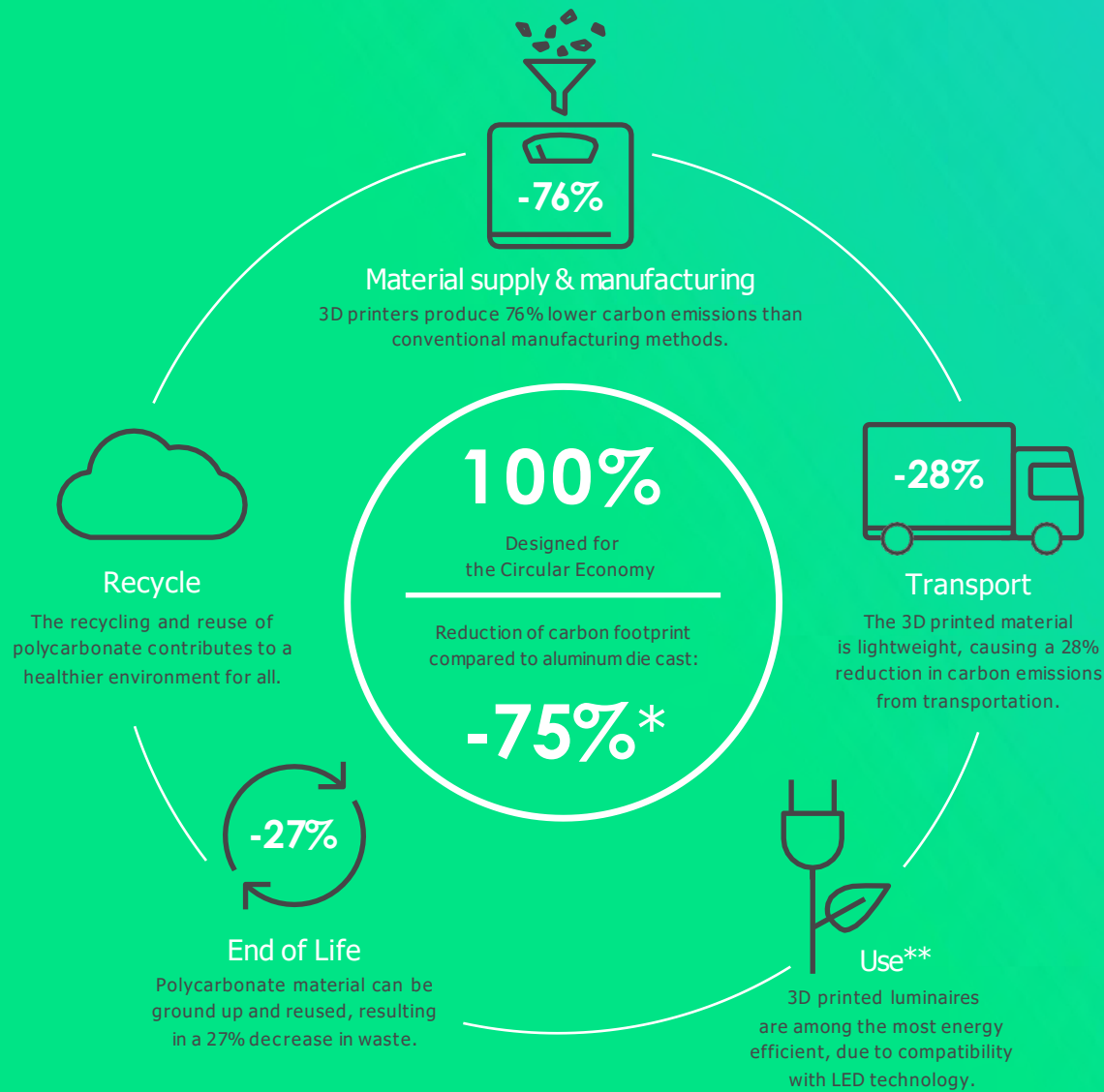
“ We are the first lighting manufacturer to produce 3D printed luminaires on an industrial scale, reinforcing our position at the forefront of lighting and sustainable innovation.”

Olivia Qiu,  
Chief Innovation Officer at Signify



# Sustainability at the core

We produce our 3D Printed Luminaires in a way that minimizes waste and accelerates the Circular Economy. We use a 100% recyclable polycarbonate material, allowing our luminaires to be shredded and reused to print more luminaires.

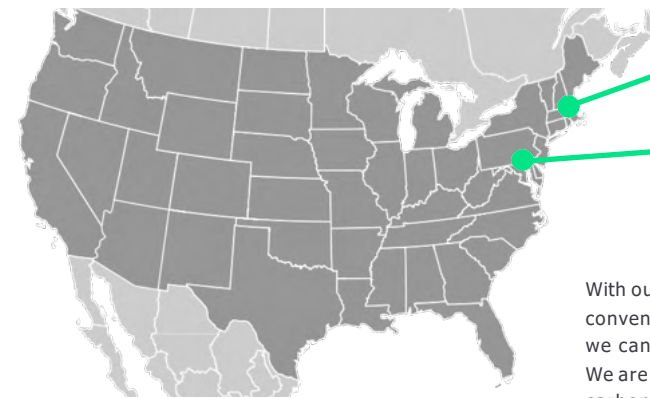


\*75% reduction of carbon emissions from 3D printing, only compared to traditional downlights made from aluminum die cast. Only includes material supply, manufacturing and transport phases.

\*\* The use phase, though having the highest impact during the life cycle, is excluded as it is the same between the 2 compared products.

Data based on comparison of a traditionally manufactured downlight using a die casted housing with a 3D printed downlight in polycarbonate. Data for other products will vary.

## American made & shipped



**3D Printing Operations**  
Burlington, MA

**3D Printing Factory**  
Littlestown, PA

With our 3D Printing Factory and Operations facility located conveniently along the East Coast of the United States, we can domestically produce and deliver your luminaires. We are effectively cutting out overseas shipping to reduce carbon emissions and accelerate your delivery time, among the fastest for customized products.

As of the date of this document, our 3D Printed Luminaires meet the domestic preference requirements of the **Buy American Act of 1933 (BAA)**. Prior to ordering a product, you should confirm the product's current compliance. Please [click here](#) to view a current list of BAA-compliant products.

Pictured: Littlestown, PA facility



# Call to Action

Let's work together to:

- Identify Lighting Retrofit Opportunities
- Determine Energy Savings and Value-Added Solutions
- Reduce your carbon footprint

**Ask about rebates & incentives**

# The Lighting Ecosystem – Let's get a jump start

## End User



- Owner
- Facilities Manager
- Energy Manager
- Sustainability Manager

## Engineer/ Architect



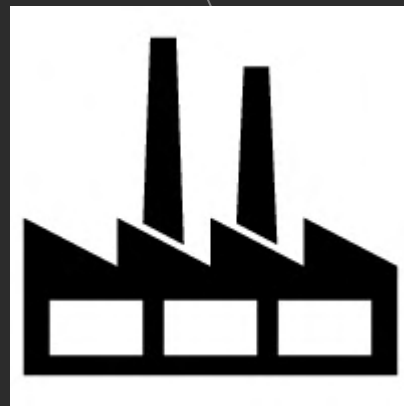
- Verify/ Produce drawings for new builds
- Confirm Code Compliance
- Consult on Design & Solutions

## ESCO/ Contractor



- Audit Facilities
- Design Solutions
- Procure Materials
- Install Products

- Manufacturer lighting product
- Stock product in bulk based on forecasted demand
- Provide technical product support
- Sell to Distributors



## Manufacturer



## Distributor

- Stock Products for customers
- Buy from all manufacturers
- Provide logistics support
- Sell to Contractors

# Top Energy Savers: Lighting

Contractor Perspective



*for the global good*



# DANIEL HANCOCK OWNER-SUPERGREEN SOLUTIONS

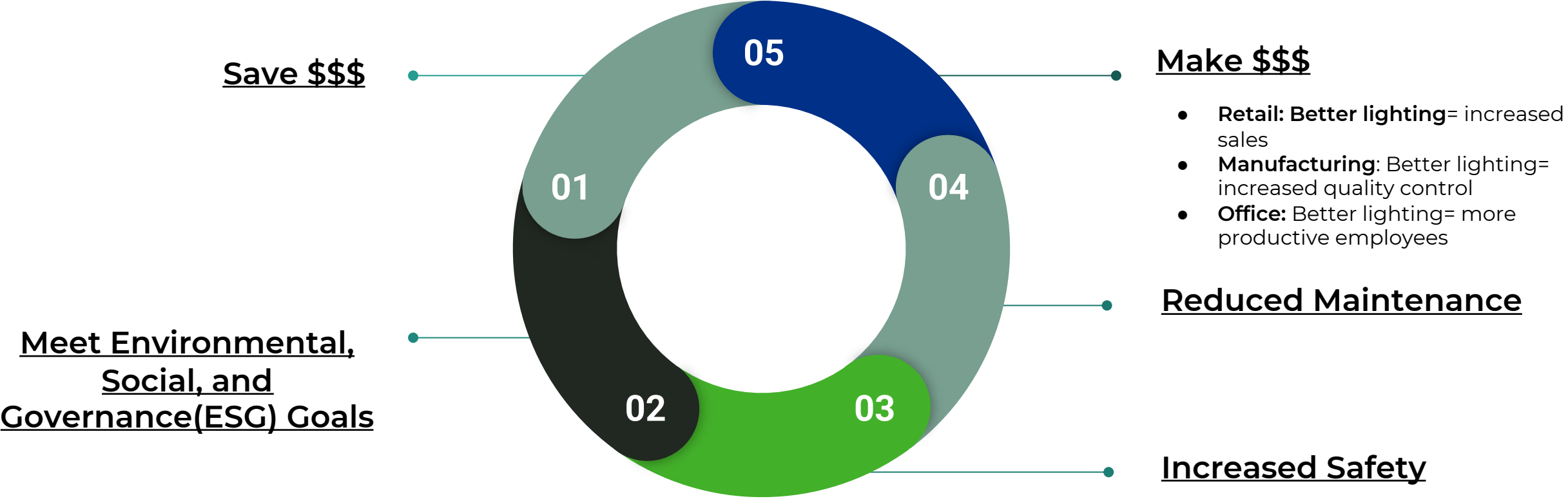
Licensed engineer (Clemson graduate... Go Tigers!) and general contractor. Provide turn-key LED lighting solutions from initial consultation and audit through installation. Some notable clients include Clemson University, City of Charleston, Mercedes Benz, Bosch, US Marine Corps, multiple school districts, and Habitat for Humanity. Approximately 150 full LED lighting retrofits/upgrades completed.

## Focus Areas in Addition to LED Lighting:

- EV Chargers
- Solar (Commercial & Residential)
- Indoor Air Quality
- Energy Management Systems



# Most common reasons our customers are upgrading to LED



# Up and coming reasons for upgrading lighting technology/controls

- **Adaptive lighting**  
Match circadian rhythm = more productivity
- **Covid**  
UV lighting integrated to disinfect air and surfaces
- **3/30/300 Rule**

The 3-30-300 rule states that for every square foot of space, a company will spend an average of \$3 on utilities, \$30 for rent and \$300 on payroll each year.

In the past LED upgrades could only help companies save on the \$3 utilities savings. Now IOT and Smart Lighting can have much larger impacts on both the \$30/rent and \$300/payroll. Examples:

Rent savings – Company thinks they need additional square footage. Uses data to determine that conference rooms are vacant 70% of time even though they are showing as booked on calendars. Turned out that recurring meetings were not being deleted. After correcting problem, company found that not only did they not need to expand, but they had an entire floor they could lease out.

Payroll savings – Study found that nurses spend up to 1 hour per shift searching for equipment. Smart Lighting has the capability to integrate Real-Time Location Services (RTLS) into the overhead lighting. Equipment can be “Tagged” and location displayed in real time on phone or tablet. Geo-fences can be set up so that real-time alerts are sounded when equipment or patients leave virtual boundaries.

# Contractor's Role in LED Upgrade Process

1

Consultation – Contractor is often 1st and main Point of Contact for customer.  
(Could also be Energy Service Company (ESCO) as part of An energy savings performance contract (ESPC), Manufacturer's Lighting Rep, Or Lighting Distributor) Help Customer: Define Project Goals, Understand needs, What are your lighting pain points?, Budget / ROI expectations, discuss financing options

2

Audit the Facility  
Surveying the existing lighting infrastructure: counting lights/types, measuring light levels / energy consumption)

3

Gather information: Hours of operation, Current utility rates

4

Design the solution  
Based on customer needs and available lighting product solutions (Any manufacturer) Photometrics based on Illuminating Engineering Society (IES) recommended lighting levels for task

5

Present Energy Saving Proposal (Review ROI/Budget/Product specs, discuss project timeline with customer)

# Contractor's Role in LED Upgrade Process

6

Customer Sign Accepted Proposal

7

Apply for Rebate Incentives (maximize/confirm rebate incentives)

8

Project Implementation (50% deposit (typical), order materials, install, commissioning (if controls are included), recycle old materials)

9

Final Site walk/Project completion sign-off (Confirm light levels and full functionality)

10

CUSTOMER ENJOYS ENERGY SAVINGS, REDUCED MAINTENANCE and IMPROVED LIGHTING!!!

SC Manufacturing Facility - >5,000 Fixtures

# Case Study 1: Industrial Client

- 01 \$1,158,314 Net Investment
- 02 2.79 Year Payback!
- 03 \$414,674 Annual Savings

**Investment Analysis**

---

**Total Investment**  
This price is based on a material / labor lighting upgrade which includes all products, removal and disposal of old technology, and installation of new lighting system. Taxes not included.

Total Investment	\$1,191,435
Taxes	\$66,879
Estimated Rebates	\$100,000
<b>Net Investment</b>	<b>\$1,158,314</b>

Savings Type	Annual Savings	Cumulative Payback
Energy Savings (\$)	\$305,807	3.79
Maintenance Avoidance (\$)	\$30,745	3.44
HVAC Energy Savings (\$)	\$78,122	2.79
<b>Total Operating Savings</b>	<b>\$414,674</b>	<b>2.79</b>

Weighted Product Life	23.34
Total Lifecycle Savings	\$9,678,286
Net Project Return	\$8,519,972

**Utility Rebates / Incentives**  
The rebates and incentives indicated below are based on utility rebates for lighting upgrades. Applications for these incentives must be filed by the utility customer and funds will not be available until approved by the utility. In some cases, pre-visit must be conducted by the utility prior to initiating any lighting projects.

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**Operating Cost Savings**  
Operational savings includes electricity savings, HVAC savings and maintenance avoidance. The energy savings is based on manufacturer's published amperage and wattages with operating hours and kWh cost being provided by the client. Maintenance avoidance is based on industry standard failure rates of lamps and ballasts and competitive replacement cost and repair labor rates. The HVAC savings is calculated using the fraction of year cooling is used, the load being removed by mechanical cooling and the cooling system's coefficient of performance. The actual savings derived by your firm may be higher or lower depending on hours of operation, kWh rates, system efficiencies and geographic location in the U.S.



# Case Study 2: Warehouse

01	\$89,518 Net Investment
02	1.92 Year Payback!
03	\$46,740 Annual Savings

## SC Warehouse - High Bay Lighting

### PROJECT SUMMARY



	Existing	After Retrofit
Number of Fixtures	280	280
Lighting System Energy Consumption	611,667 kWh	158,206 kWh

### ANNUAL SAVING SUMMARY

(Energy Rate \$0.0950 /kWh)

Energy Reduction	Energy Savings	Maintenance Savings	Carbon Savings
<b>453,461 kWh REDUCED</b>	<b>\$43,078 SAVED</b>	<b>\$3,661 SAVED</b>	<b>320,058 kgCO2e GASES REDUCED</b>

### FINANCIAL SUMMARY

(10 Year Analysis Period)

Project Cost	\$88,347
Tax	\$4,171
Less Rebates and Incentives	\$(3,000)
<b>Net Project Cost</b>	<b>\$89,518</b>

<b>PAYBACK 1.92</b>	<b>ROI 52.21%</b>	<b>NPV \$263,852</b>	<b>IRR 66.19%</b>

### COST OF WAITING

Postpone for one month	\$3,895
Postpone for six months	\$23,370
Postpone for one year	\$46,740

# Case Study 3: Industrial Client

01	\$124,861 Net Investment
02	2.58 Year Payback!
03	\$55,665 Annual Savings

## Charleston, SC Hotel PROJECT SUMMARY



	Existing	After Retrofit
Number of Fixtures	1,419	1,419
Lighting System Energy Consumption	593,163 kWh	175,332 kWh

## ANNUAL SAVING SUMMARY

(Energy Rate \$0.1000 /kWh)

Energy Reduction



**417,831 kWh**  
REDUCED

Energy Savings



**\$50,166**  
SAVED

Maintenance Savings



**\$5,500**  
SAVED

Carbon Savings



**294,910 kgCO2e**  
GASES REDUCED

## FINANCIAL SUMMARY

(10 Year Analysis Period)

Project Cost	\$135,369
Tax	\$7,792
Less Rebates and Incentives	\$(18,300)
<b>Net Project Cost</b>	<b>\$124,861</b>



**PAYBACK**  
**2.58**



**ROI**  
**44.58%**



**NPV**  
**\$288,922**



**IRR**  
**47.85%**

## COST OF WAITING

Postpone for one month	\$4,639
Postpone for six months	\$27,833
Postpone for one year	\$55,665



for the global good



# Case Study 4: Steel Industry Client



## SC Steel Industry Client PROJECT SUMMARY



	Existing	After Retrofit
Number of Fixtures	428	428
Lighting System Energy Consumption	574,725 kWh	123,463 kWh

## ANNUAL SAVING SUMMARY

(Energy Rate \$0.1200 /kWh)

Energy Reduction	Energy Savings	Maintenance Savings	Carbon Savings
451,262 kWh REDUCED	\$65,014 SAVED	\$2,944 SAVED	318,506 kgCO <sub>2</sub> e GASES REDUCED

## FINANCIAL SUMMARY

(10 Year Analysis Period)

Project Cost	\$192,611
Tax	\$12,486
Less Rebates and Incentives	\$(42,774)
<b>Net Project Cost</b>	<b>\$162,323</b>

PAYBACK 2.83	ROI 41.87%	NPV \$344,140	IRR 44.78%

## COST OF WAITING

Postpone for one month	\$5,663
Postpone for six months	\$33,980
Postpone for one year	\$67,959

# Before/After Photos



# Before/After Photos



# Before/After Photos



# Before/After Photos



# Before/After Photos



# Before/After Photos



# Before/After Photos





# Before/After Photos



# Before/After Photos



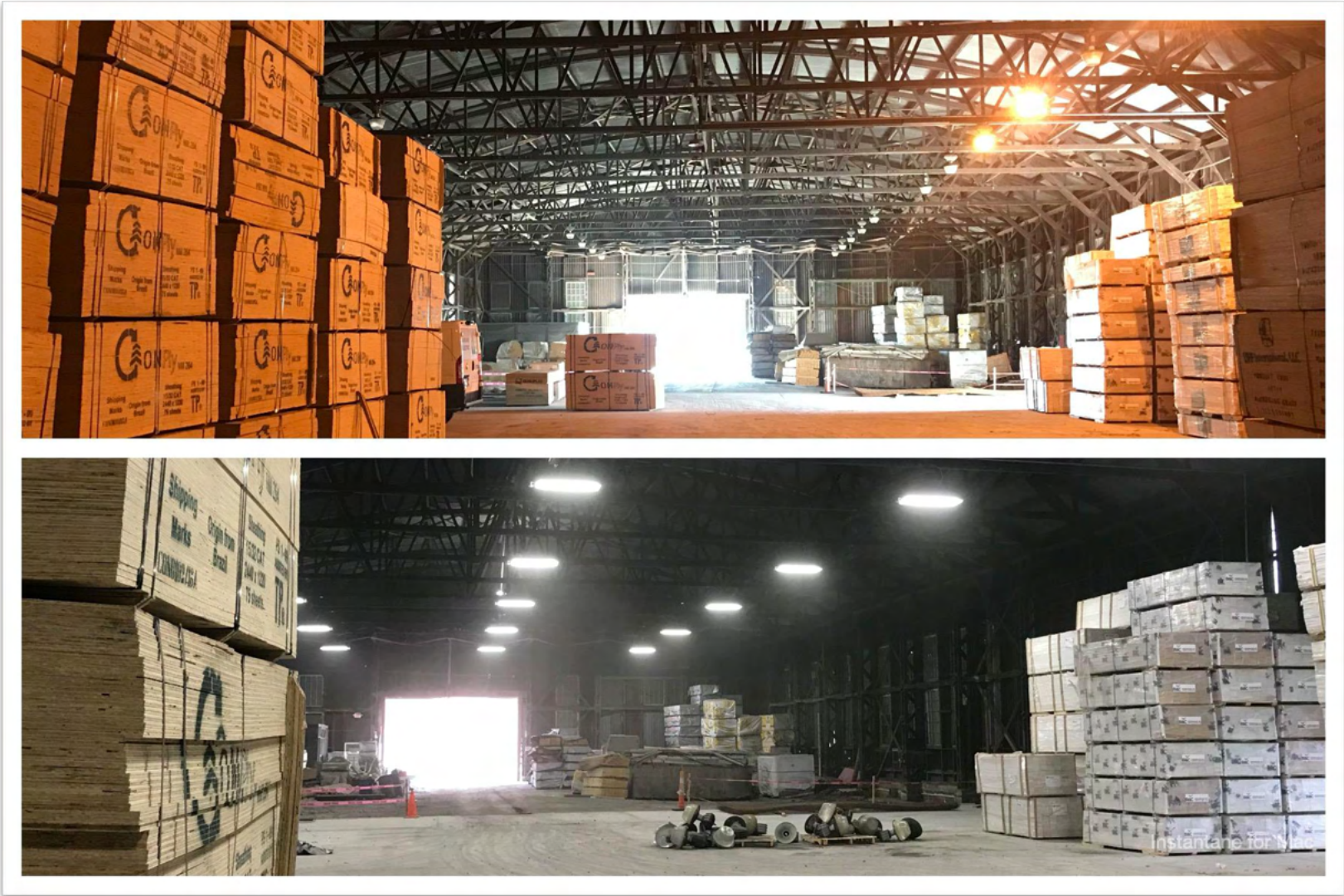
# Before/After Photos



# Before/After Photos



# Before/After Photos



# Before/After Photos



# Before/After Photos

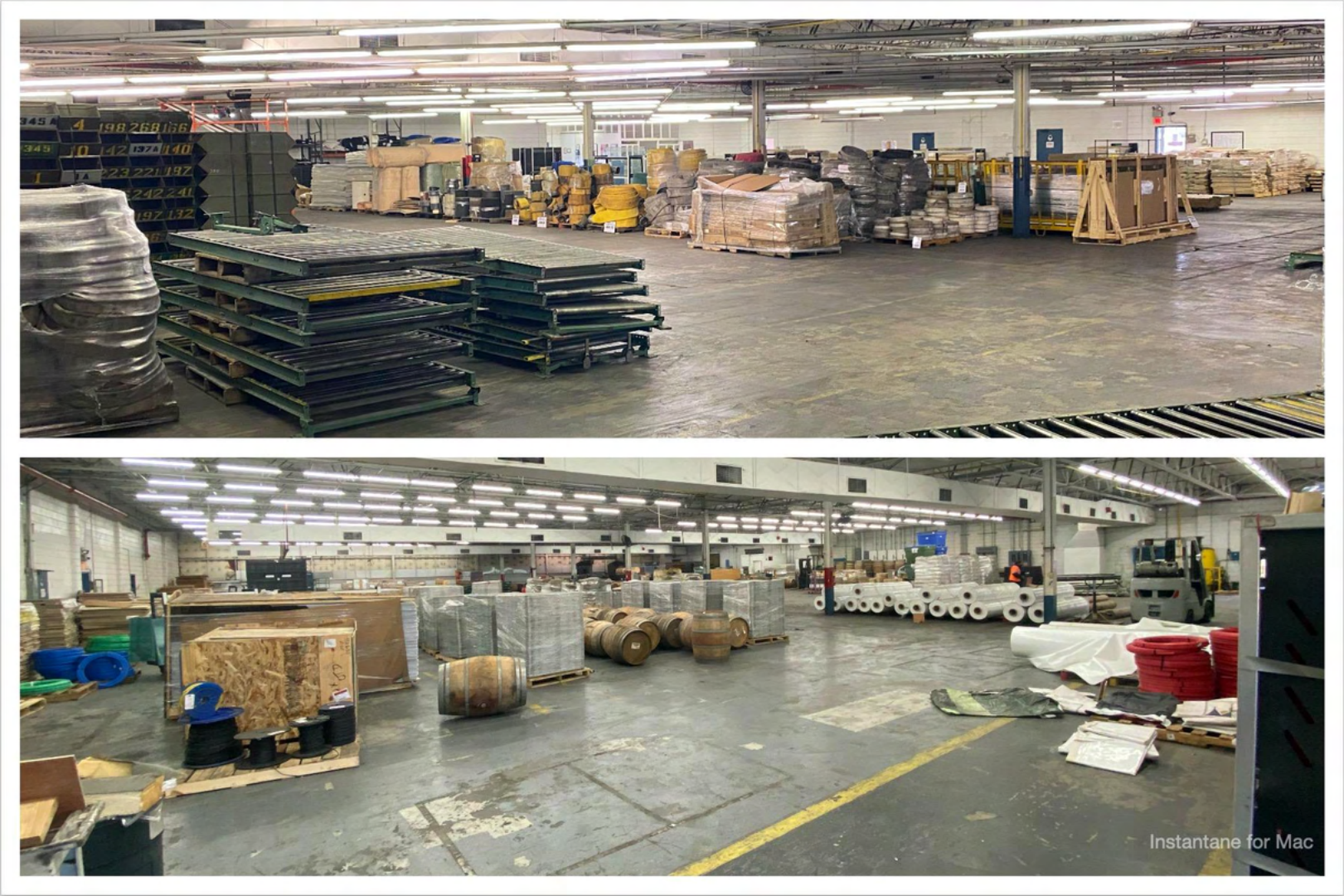


# Before/After Photos





# Before/After Photos



# Contact Information

Daniel Hancock  
Owner

[dhancock@supergreensolutions.com](mailto:dhancock@supergreensolutions.com)

Visit our website:

[charlestonsc.supergreensolutions.com](http://charlestonsc.supergreensolutions.com)

843-790-4365



# Watt Family Innovation Center - Lighting

2<sup>nd</sup> Dec 2021

# Director of CEVAC Operations and Development

## Tim Howard



Watt Facility Solutions Manager, GGP

(864-650-0323)  
timh@clemson.edu

# Agenda

- Building Introduction
- Lighting
- Clemson Energy Visualization & Analytics Center (CEVAC)
- Example of savings
- Q/A

# The Watt Family Innovation Center



Built: 2016  
GSF: 76,387  
Floors: 5  
Rooms: 143

Media Lists:  
209 ft long  
24 ft high

Over 49,000 LEDs,  
4" apart



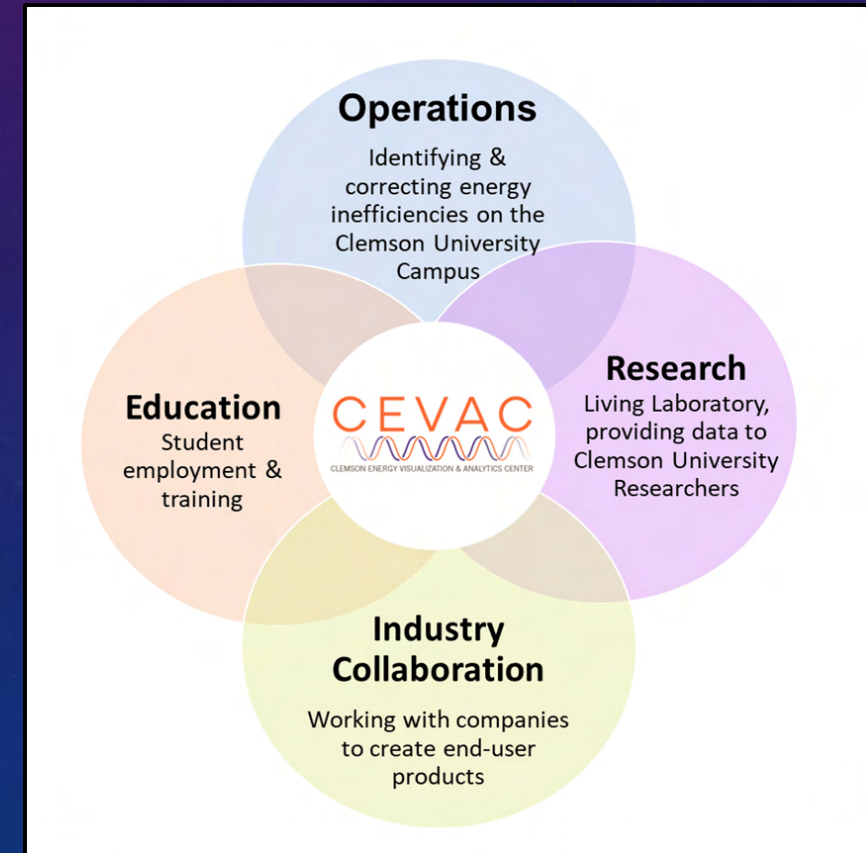
Brand Center / Main Atrium



Room 106

Over 975 light fixtures  
Majority are powered over POE/POE+  
Each light has it's own IP address

Clemson Energy Visualization & Analytics Center (CEVAC) is a state-of-the-art operations center that supports student educational opportunities, interdisciplinary research, and improved facilities operations to help realize the Clemson Sustainability Action plan. CEVAC believes that empowering students to work in a team on complex issues enhances their educational experience and will help lead Clemson to a carbon neutral campus.

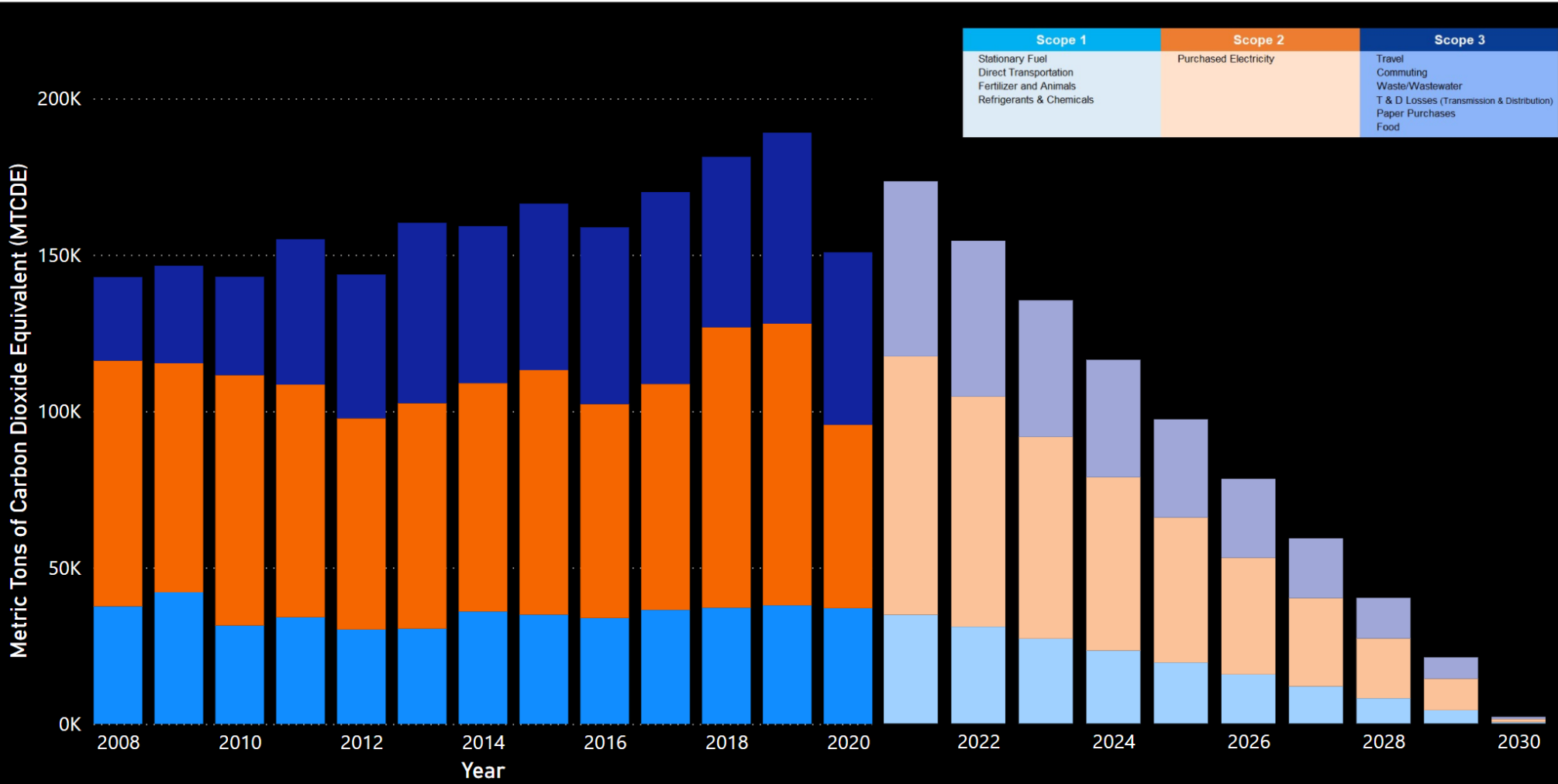






# Campus Carbon Footprint

Report v1.13



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# Campus Overview

Report v1.75

- Metric
- Chilled Water
  - Electricity
  - Natural Gas
  - Steam
  - ...

- Campus
- Anderson
  - Charleston
  - Clemson

- Category
- Academics
  - Athletics
  - Living

- SubCategory
- Administration
  - Arena
  - Classrooms
  - High Rise
  - Historic
  - Holmes-McCabe
  - Labs
  - ShoeBoxes
  - Student Center
  - The Quad
  - Wet Labs

Carbon Footprint

## Campus Utilities - Past Month



Building	Change
Hunter Hall	377675
Poole Agricultural Center	248542
Jordan Hall	221231
Redfern	198894
Life Science	190415
Littlejohn Coliseum	184341
Robert Muldrow Cooper Library	173791
Fluor Daniel	166111
Sirrine Hall	152609
Jervey	143230
Hendrix Student Center	130842
Watt Family Innovation Center	122163
McAdams Hall	114663
Holmes Hall	112701
Lehotsky Hall	94796
Manning Hall	89479
Lowry Hall	89117
Rhodes	87749
Tillman Hall	84914
Lee III Hall	79781
Earle Hall	77961
Edwards Hall	71610
Mickel Hall (Stadium Suites)	71542
Riggs Hall	61920
Olin Hall	57061
Barre Hall	52969
Martin Hall	52617
Strom Thurmond Institute	51891
Fike Recreation Facility	51526
McCabe Hall	50681
Sikes Hall	49298
Long Hall	47153
Freeman Hall	42882
Hardin Hall	41645
Norris Hall	35664
Harris - Packaging Science	33184

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# Watt Family Innovation Center

Report V2.207

**Built**  
2016

**GSF**  
76,387

**Floors**  
5

**Rooms**  
143

Outdoor Temp [°F]

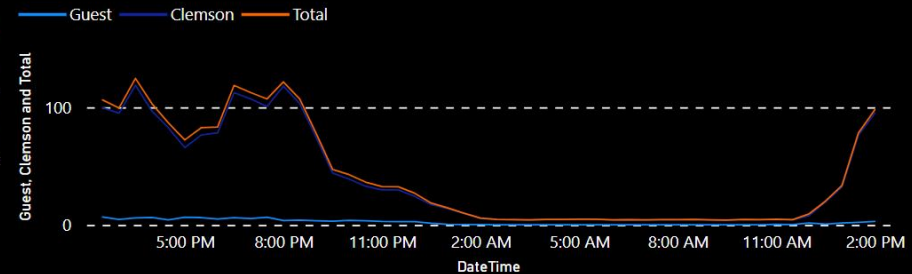


10/29/2021 10:00:01 AM

Building Occupancy: Guest, Clemson, and Total by DateTime

Floors

- 1st Floor
- 2nd Floor
- 3rd Floor
- 4th Floor
- Basement

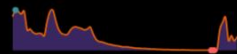


2088 people visited the building yesterday

(Blank)

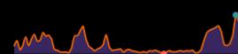
Max [ppm]

RM 208 / CO2



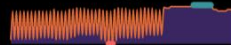
Max [%]

AHU-01 / DA Humidity



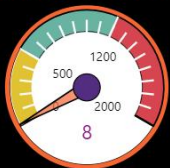
Max [°F]

RM 401U1 / Temp



Min [ppm]

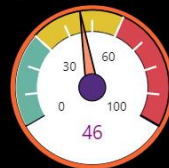
AHU-02 Return Air CO2



10/29/2021 9:45:00 AM

Min [%]

RM L110U / Humidity



10/29/2021 9:45:00 AM

Min [°F]

RM 304 / Temp



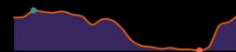
10/29/2021 9:45:00 AM

Utility Ranking - September 2021

Chilled Water	Power	Steam	Water
26 out of 63	12 out of 56	32 out of 52	49 out of 77

Weighted

Power [kW]



10/29/2021 9:45:00 AM

Observations

Metric	Total	Daily	Points
CO2	8,041,168	3,072	32
Electricity	2,546,247	1,724	19
Humidity	4,287,217	2,167	23
Output	8,994,583	2,658	31
Temperature	67,885,021	12,626	306
WAP	162,070	0	48
<b>Total</b>	<b>91,916,306</b>	<b>22,247</b>	<b>459</b>

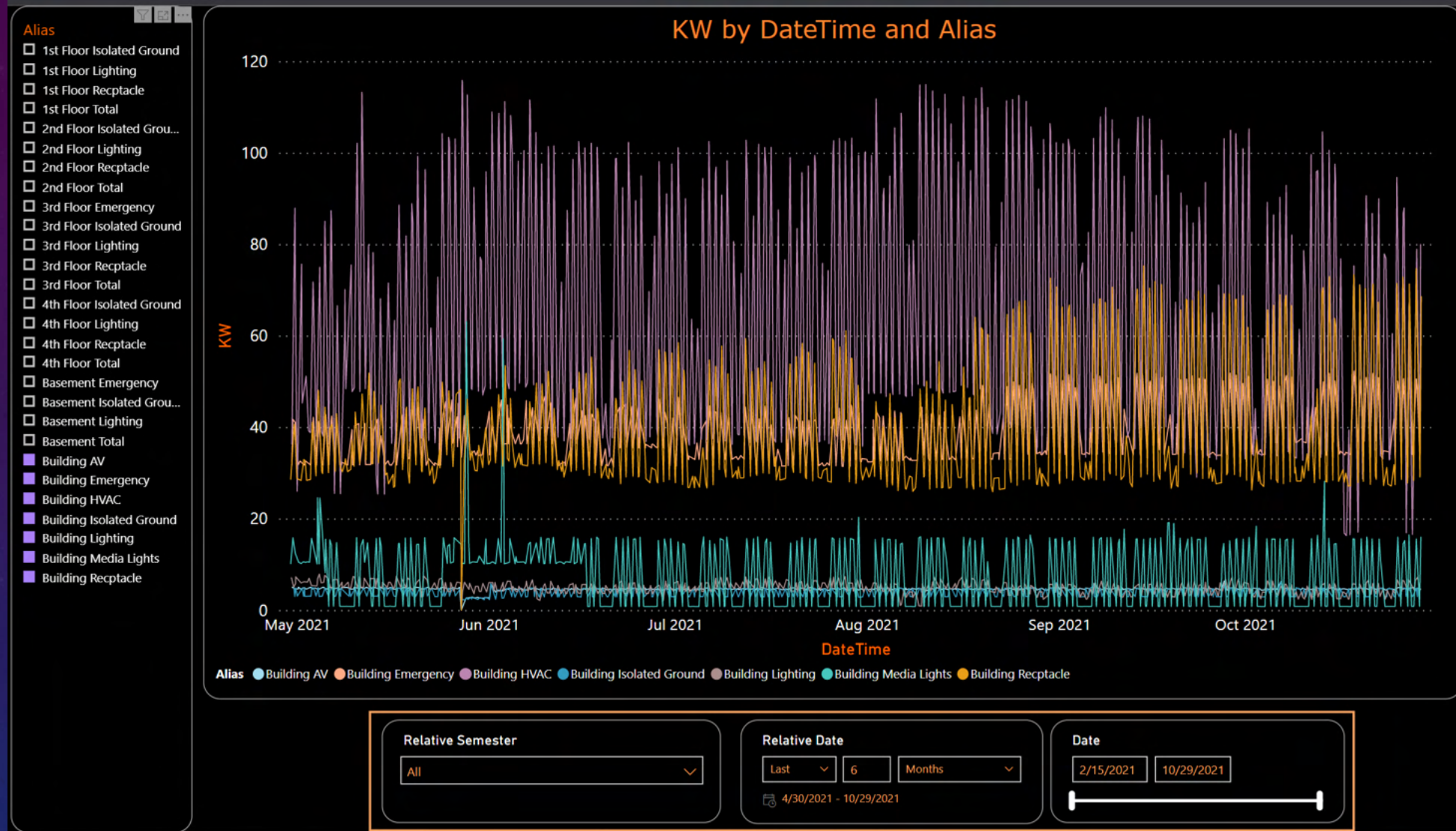
Tickets

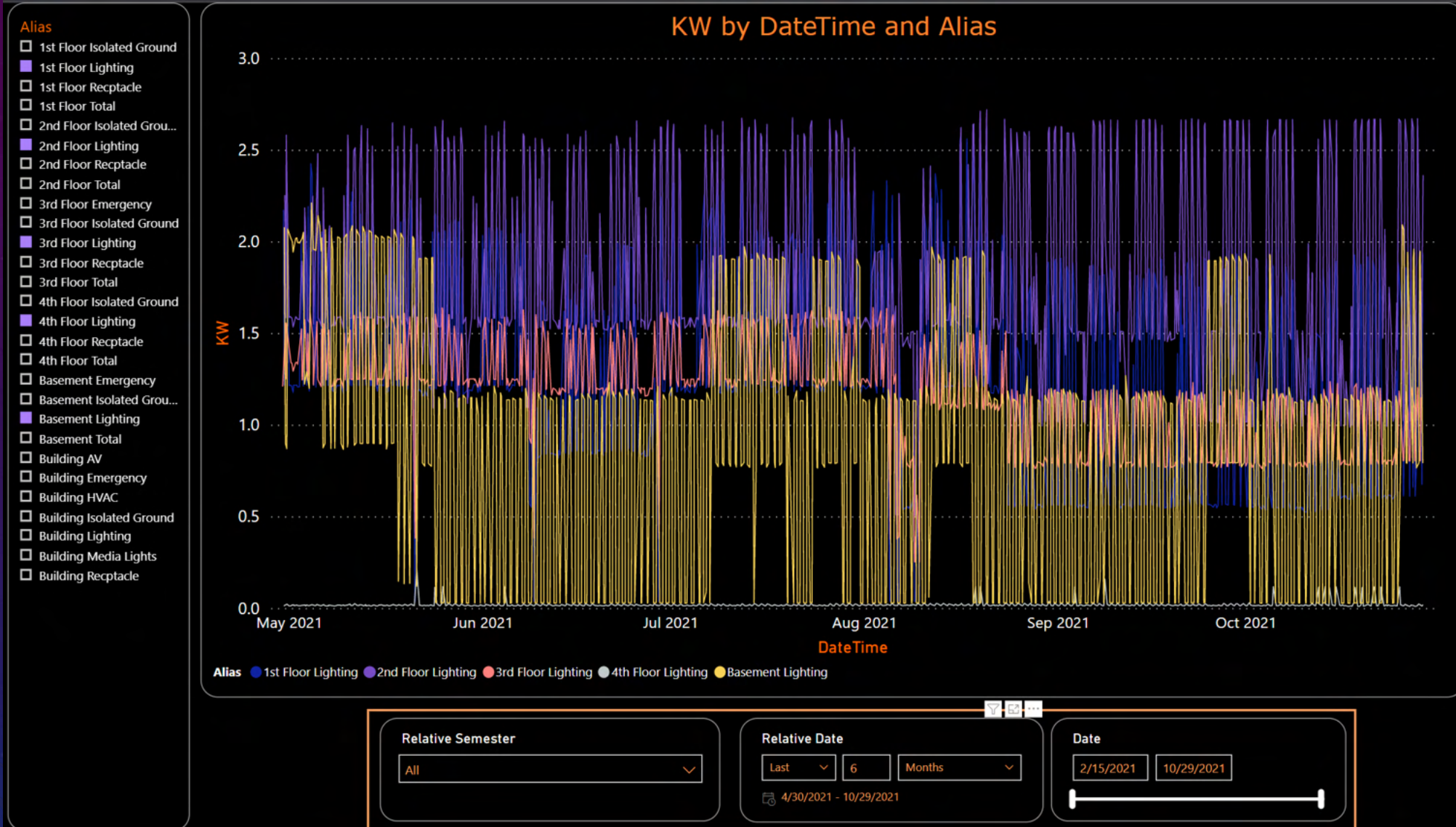
Status	Count
Assigned	435
New	3
On Hold	4
Phase Canceled	11
Phase Closed	1702
Released	74
Work Complete	331
Working	6

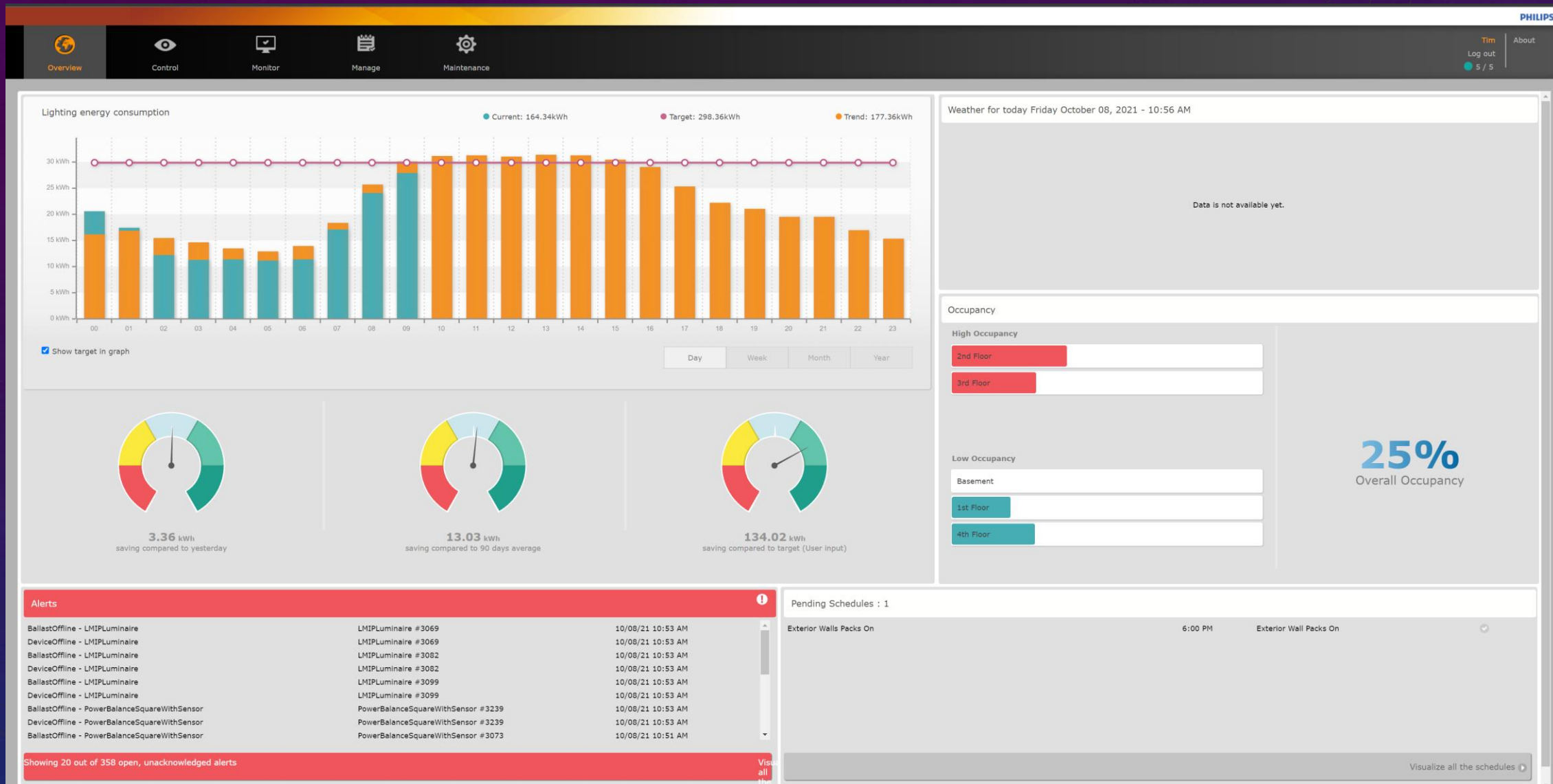
Permits

Status	Count
Approved	3
Complete	6

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**PHILIPS**

Tim | About  
Log out  
5 / 5

Overview | **Control** | Monitor | Manage | Maintenance

Site Map View | Panels View

1st Floor - 106 - Collaborative Learning Room # 1

106 - Collaborative Learning Room # 1

Luminaires in group : 29

Lighting Presets

Automatic M... | Medium

Low | Off

Tech High | Tech Low

Preset 7 | Preset 8

Smart Timer... | Unoccupied

Switch off W...

Dimming

106 - Collabor-Channel 1-3

106 - Collabor-Channel 1-27

Sensors Timeout

00:10:00

Set Timeout

Overview
Control
Monitor
Manage
Maintenance

PHILIPS  
Tim  
Log out  
5 / 5

Energy

Occupancy

Alerts

Make a report

Report Format

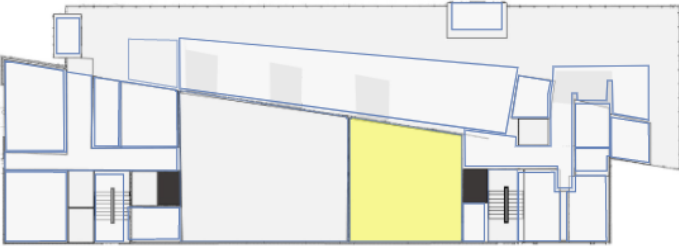
PDF
  CSV

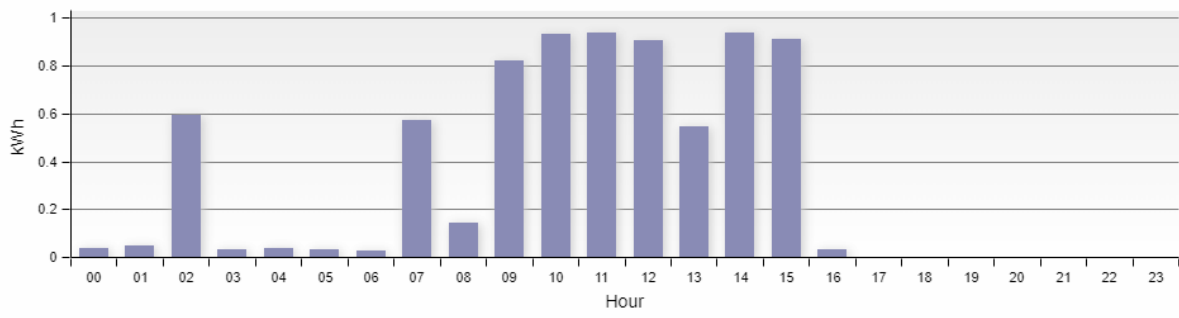
Clemson Watt Innovation C...

1st Floor

- 100 D/C/B/A - Media Loun...
- 100C - Media Lounge
- 100D - Media Lounge
- 100E Tech Concierge
- 100L - Lobby
- 100S1 - Stair
- 100S2 - Stair
- 100V1 - Vestibule
- 100V2 - Vestibule
- 100V3 - Vestibule
- 101 - Cafe and Bathroom ...
- 102 - Consultation
- 103 - Warming Kitchen
- 104M1 - Mens Rest Room
- 104W1 - Womans Rest Ro...
- 105 - Janitor
- 106 - Collaborative Learni...
- 106A - Storage
- 108 - 200 Seat Auditorium
- 108A - Storage
- 110 - 3D Project Demo Lab
- 112 - Workshop / Rapid Pr...
- 112 - Workshop / Rapid Pr...
- 113 - Comand Control Roo...
- 113B - Data Center

1st Floor - 106 - Collaborative Learning Room # 1





Day
 Hour  3 Hours
Oct. 2021

Hour Line : 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Reset

<


Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	
26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18


>


Compare

One  Two

Location  Time

  
 Env.

  
 Energy

  
 Financ.

**1 - 106 - Collabor...**

36.91%

36.91%

36.91%



