

The Pennsylvania State University NECA Student Chapter



2015 Green Energy Challenge

Our Team



Nicholas Kolesar
Project Manager,
Energy Analyst



Haley Bendis
Lighting
Designer



Gabrielle Reese
Energy Systems
Engineer



Kevin Clement
Construction
Manager



Jiye Choi
Outreach
Coordinator



PennState

Client

Energy

Lighting

Microgrid

Construction

Outreach

Finding a Client: The Pennsylvania State University



24 Campuses 8th Largest Employer in PA



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Finding a Client: Henning Building



Primary Use: Research

Year Built: 1969

Gross Square Footage: 59,000

Site EUI: 363 kBtu/ft²

Projected Renovations: 2020



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Project Goals

Safety

Economic Feasibility

Business Development

Student Education



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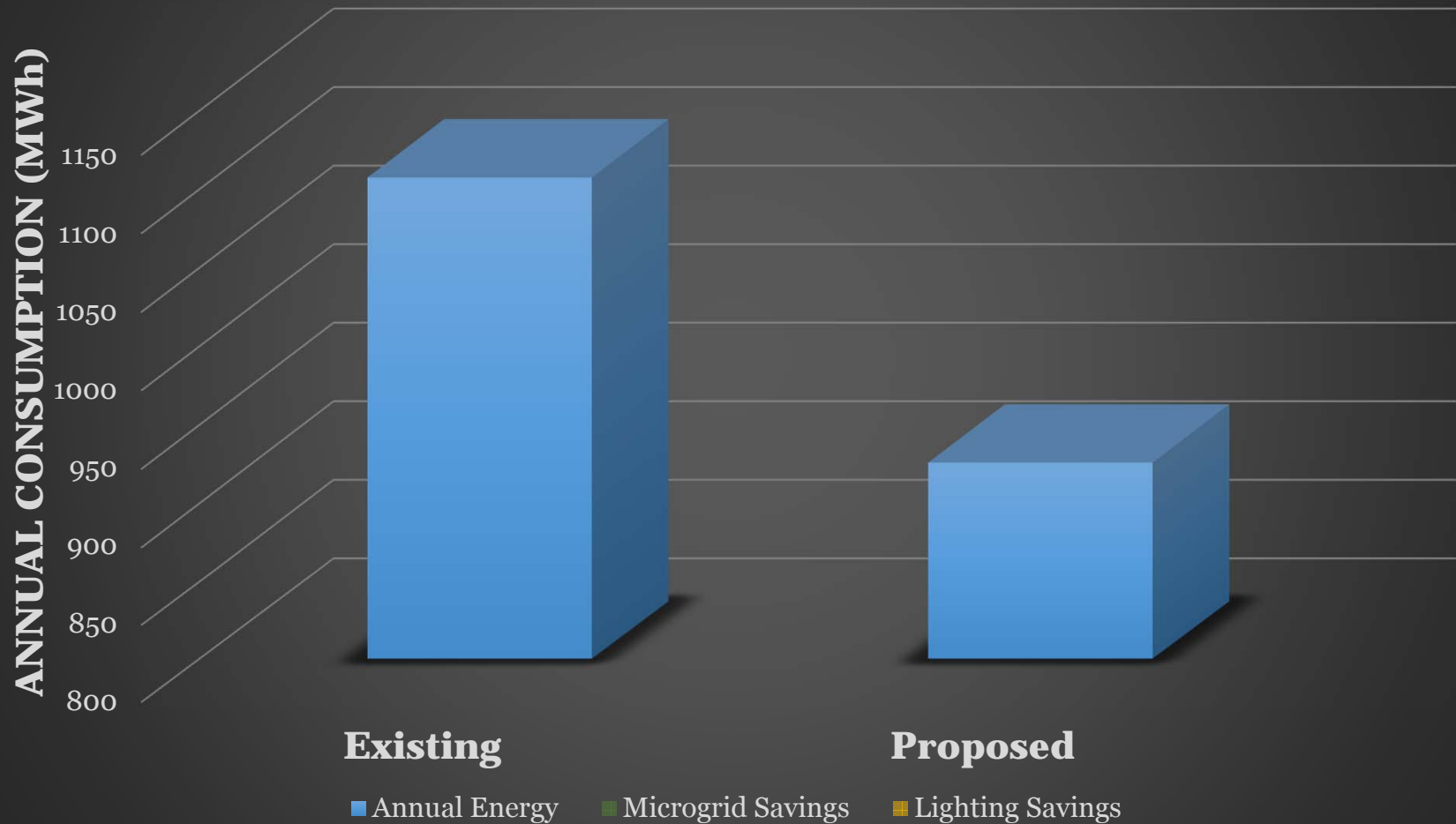
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Henning's Electricity Usage



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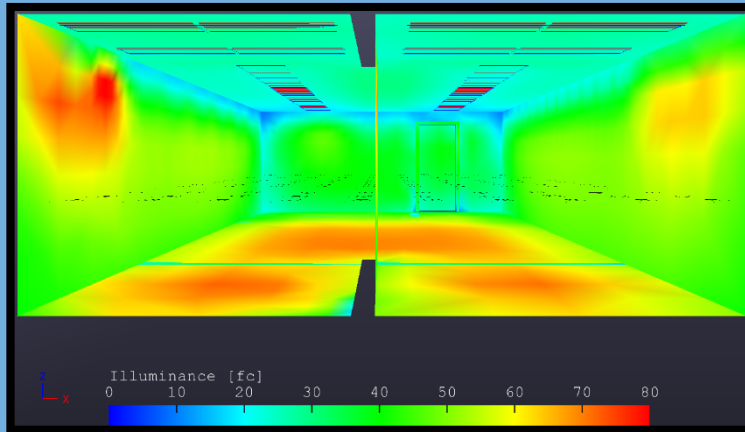
Lighting

Microgrid

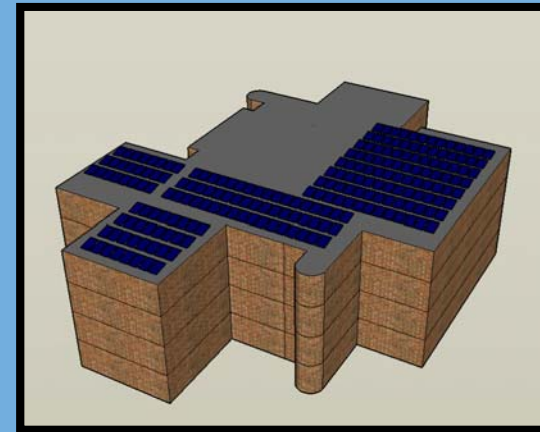
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Project Scope



**LED Lighting Retrofit with
Vacancy Sensors**



Microgrid with Solar PV Array

Lighting



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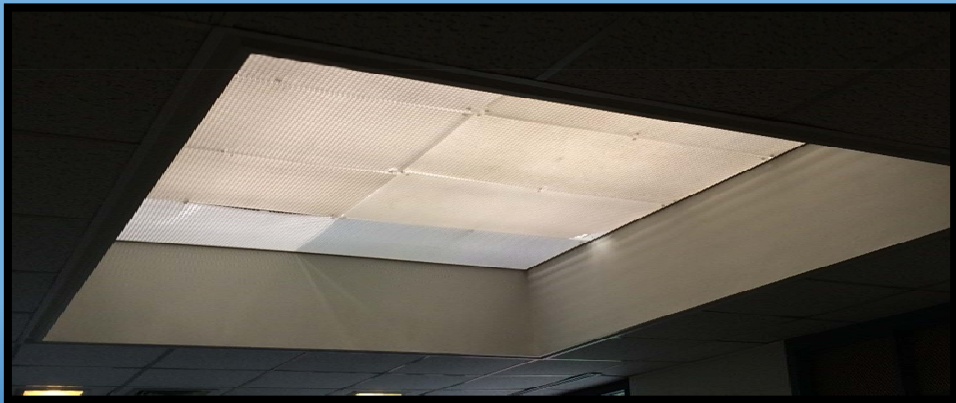
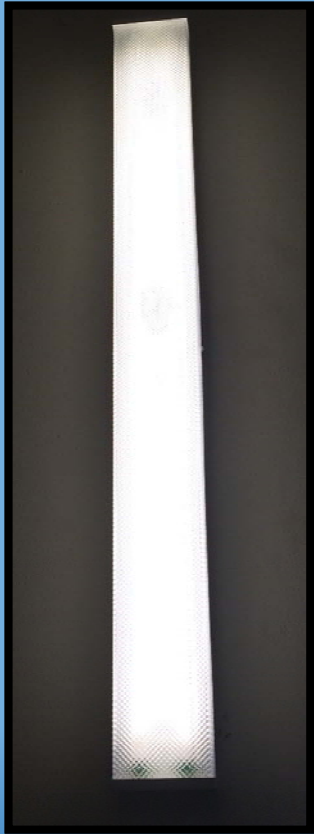
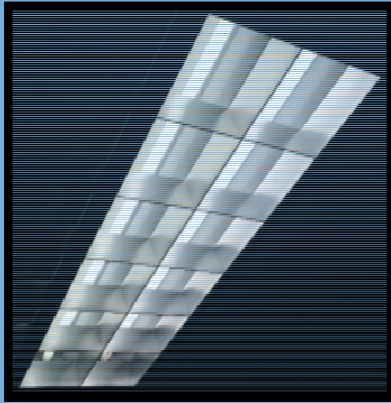
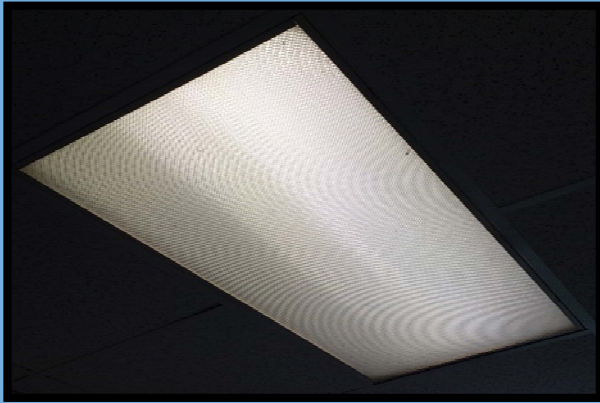
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Current Lighting



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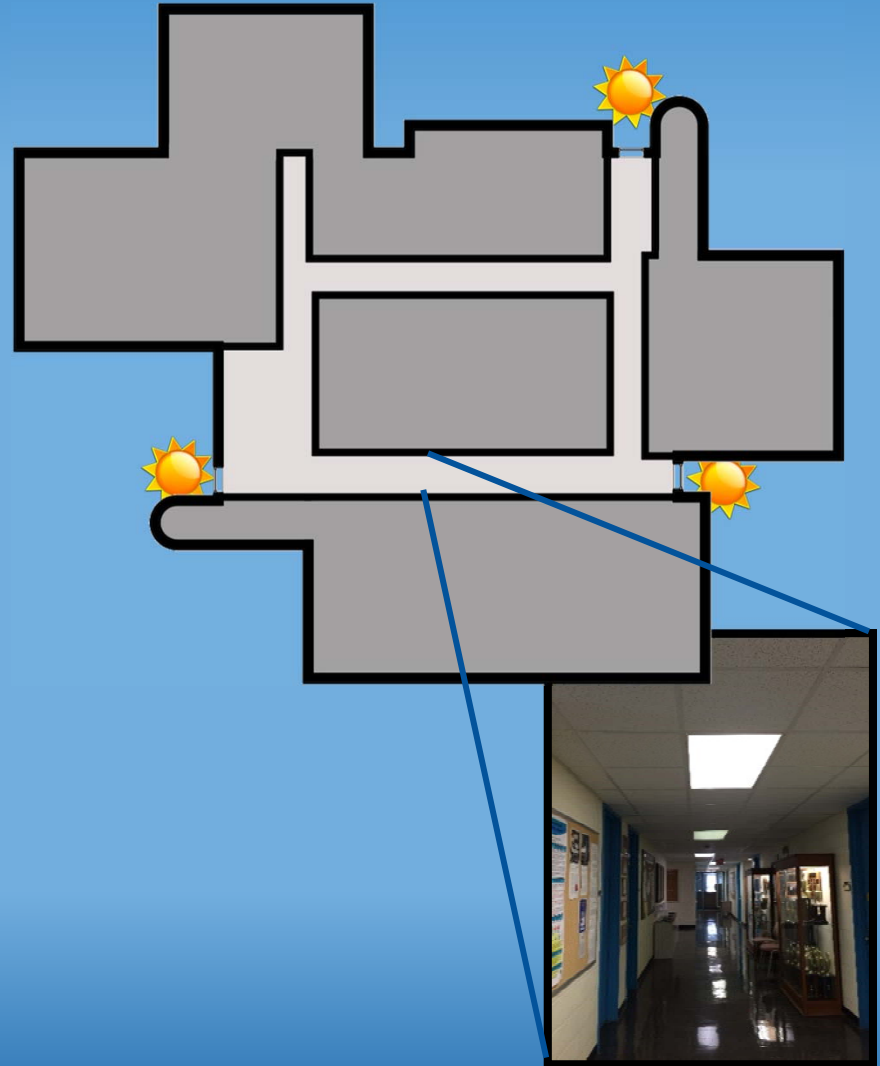
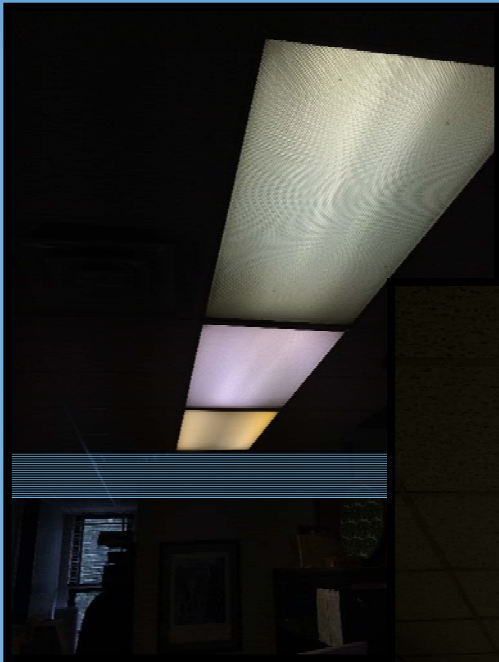
Lighting

Microgrid

Construction

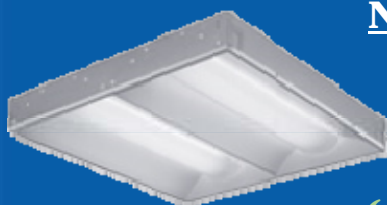
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Current Lighting



Lighting Retrofit

Retrofit Kits



Number of Fixtures:

233

Wattage:

38.52 W

(-57.48 W/fixture)



Number of Fixtures:

342

Wattage:

50

(-57.48 W/fixture)

Industrial grade

LED Replacements

Fixture Location

Fixtures

Offices, Labs, Classrooms,
Halls, Conference Rooms

859

Stair lighting

18

Displays & Entry

7

Egress and Exterior

21



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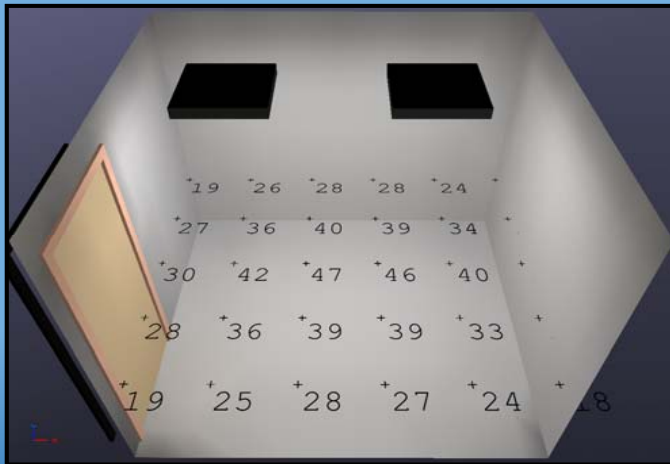
Construction

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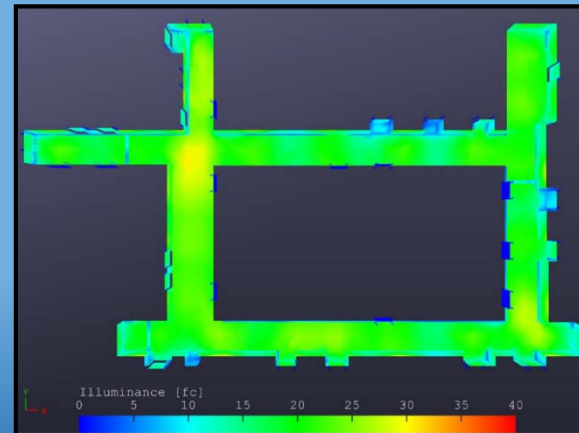
LED Technology



From Lithonia's Catalog



Elum Tools Rendering of Office



Pseudocolor of Corridor



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ENERGY AND COST SAVINGS OF LIGHTING RETROFIT

	Scheduled Hours (Weekly)	Existing Fixture	Number of Fixtures	Wattage	Existing Consumption (kWh)	Retrofit Fixture	Number of Fixtures	Wattage	Retrofit Consumption (kWh)	
INTERIOR	60	2X4 Parabolic 3L	233	96	1342	2RTL4R	233	38.52	539	
	60	2X4 Parabolic Industrial	342	96	1970	2TLED	342	50	1026	
	60	2X2 Parabolic U-tube	9	93	50	2RTL2R	9	40.08	22	
	60	2X2 Parabolic 3L	40	84	202	2RTL2R	40	40.08	96	
	60	1X4 Parabolic 2L	76	64	292	RTL	76	40.68	186	
	168	1X4 Industrial 2L	159	64	1710	TLX4	159	46	1229	
	60	Display	3	80	14	TL4	3	30	5	
	60	1x1 Square Fixture	2	20	2	RT5D LED	2	41	5	
	60	Luminous Ceiling	2	480	58	Cubic-A2	2	137	16	
	168	Stairwell Fixture	18	64	194	TLX4	18	46	139	
	168	Exit Signs	13	14	31	EDG	13	2.5	5	
EXTERIOR	91	Lamp Post	1	100	9	Louis Poulsen KIPP 416 Luminair models	1	100	9	
	91	Wall Pack	3	100	27	LED Mini Wall Sconce	3	9	2	
	91	Square	3	20	5	CREE LED Light Bulbs	3	11	3	
Total Number of Fixtures:			904	Total kWh:	5906	Total Number of Fixtures:	904	Total kWh:	3282	
					Annually:	289374			Annually:	160842
					Cost:	\$ 72,343.60			Cost:	\$ 40,210.40

Annual Savings: 129,000 kWh \$32,000



Controls

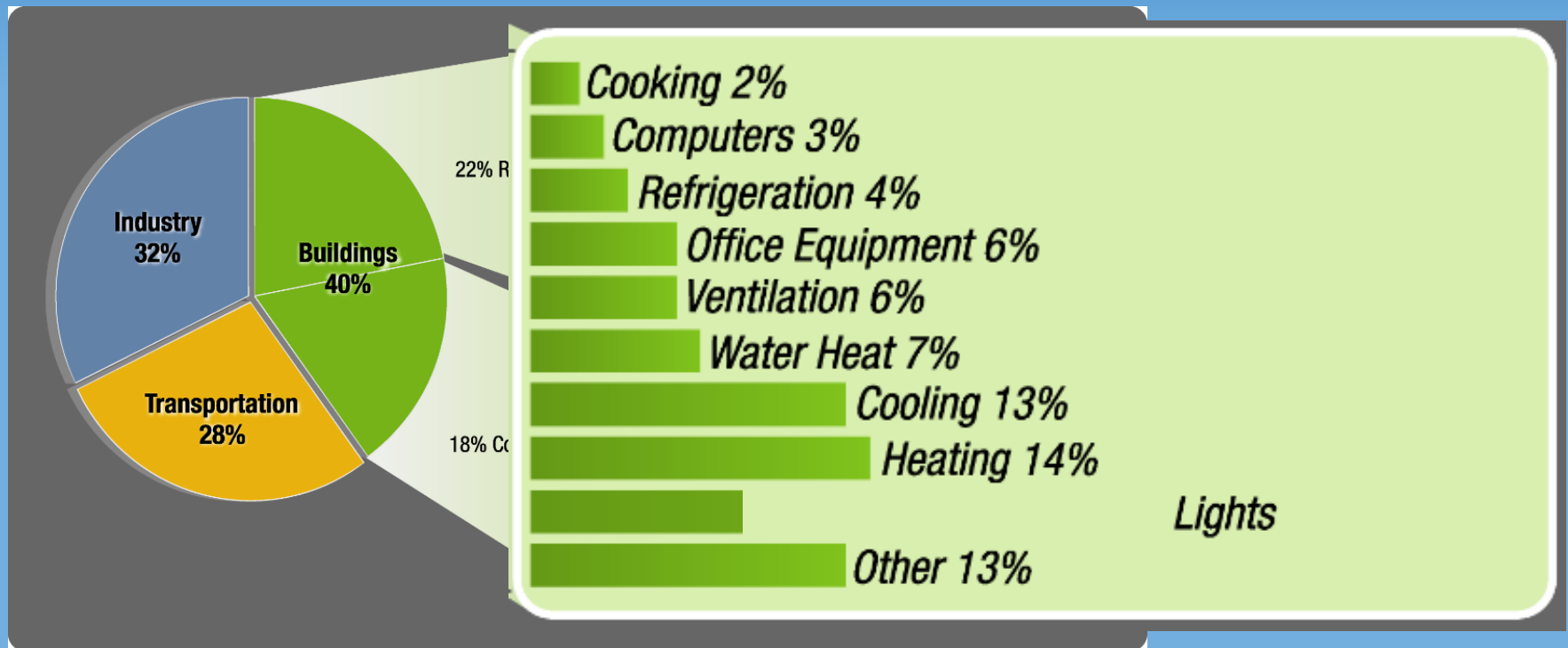


Figure prepared by National Renewable Energy Laboratory and the U.S. Department of Energy



FRIDAY NIGHT LIGHTS OUT!



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Controls

Vacancy Sensor



- Manually on by User
- Automatically off after 15 minutes

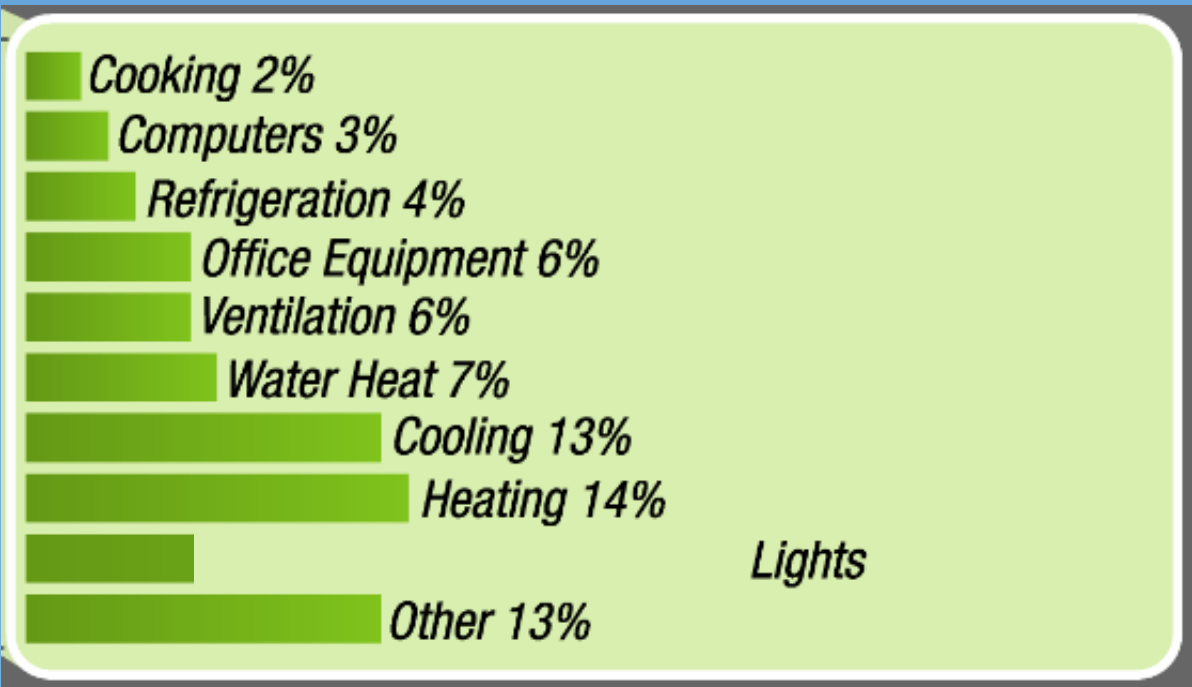


Figure prepared by National Renewable Energy Laboratory and the U.S. Department of Energy



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Critical Load identified as 46.1 kW

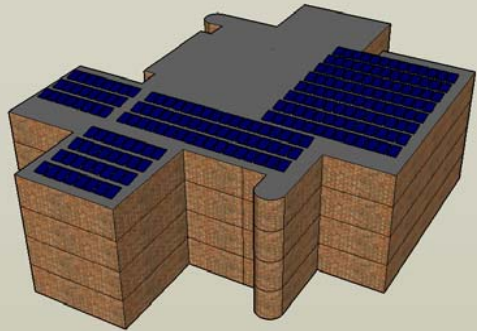


Life Safety
4.6 kVa



Mechanical Systems
25 kVa

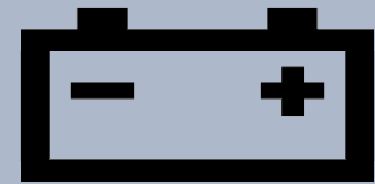




53.25 kW Solar Array

EMS

Energy Mgmt. System



20.9 kWh Battery Bank

**RESILIENT
MICROGRID TO
MEET THE
CRITICAL LOAD
DEMAND**



Load



Generator



Grid



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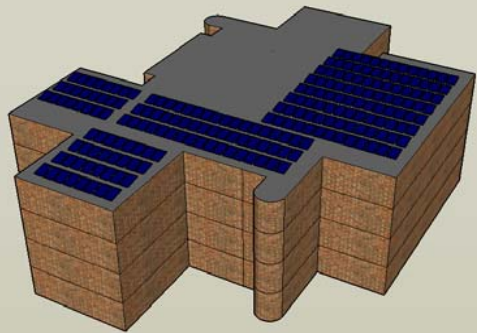
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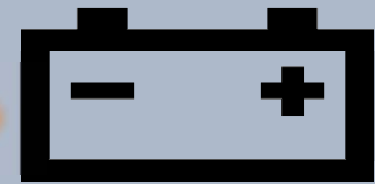
Outreach



53.25 kW Solar Array

EMS

Energy Mgmt. System



20.9 kWh Battery Bank

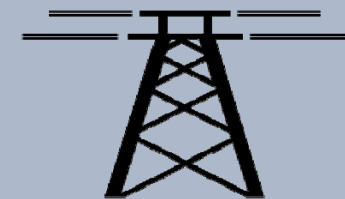
**RESILIENT
MICROGRID TO
MEET THE
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DEMAND**



Load



Generator



Grid



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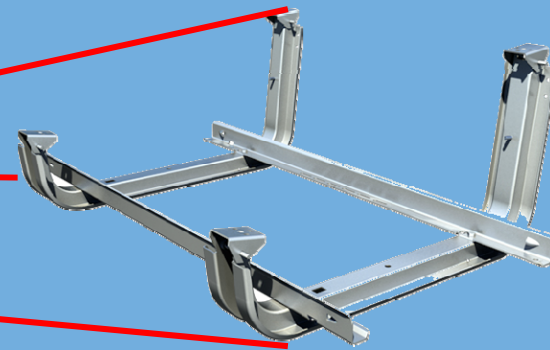
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Components



Ballasted Flat Rack Roofing
\$11,850



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Components



213 Westinghouse
WTW-250-1-DC4-0-B
53.25 kW
\$79,875



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Components



- Array 1: One ABB (Power-One) PVI-6000-OUTD
\$2,000
- Array 2: Three SMA America SB7000TL-US-22
\$8,400
- Array 3: Three SMA America SB9000TL-US
\$8,754



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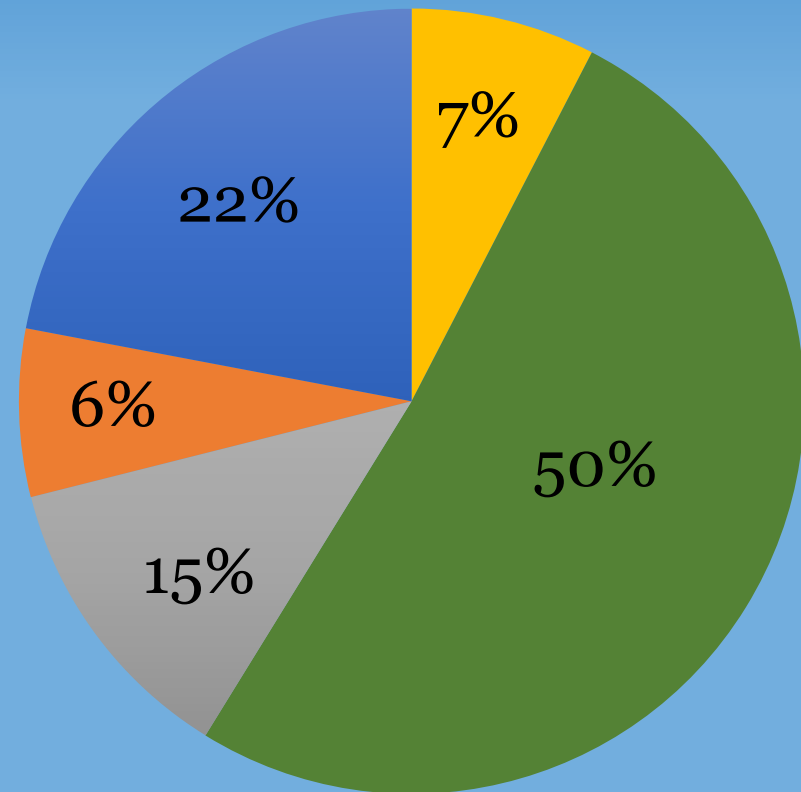
Components



28 EnerSys Genesis
Pure Lead XE95 0790-6001
(20.9 kWh)
\$10,775

Microgrid Breakdown

Description	Cost
Racking	\$11,850
PV Panels	\$79,875
Inverter	\$19,150
Batteries	\$10,775
Other Costs	\$34,350
Project Total	\$156,000



■ Racking ■ PV Panels ■ Inverters ■ Batteries ■ Other Costs

Construction Management



Nicholas Kolesar
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Main Focus for PSU

- Student & Faculty Safety
- Summer
- Resilient power for animal lab spaces
- Payback Period – 10 years



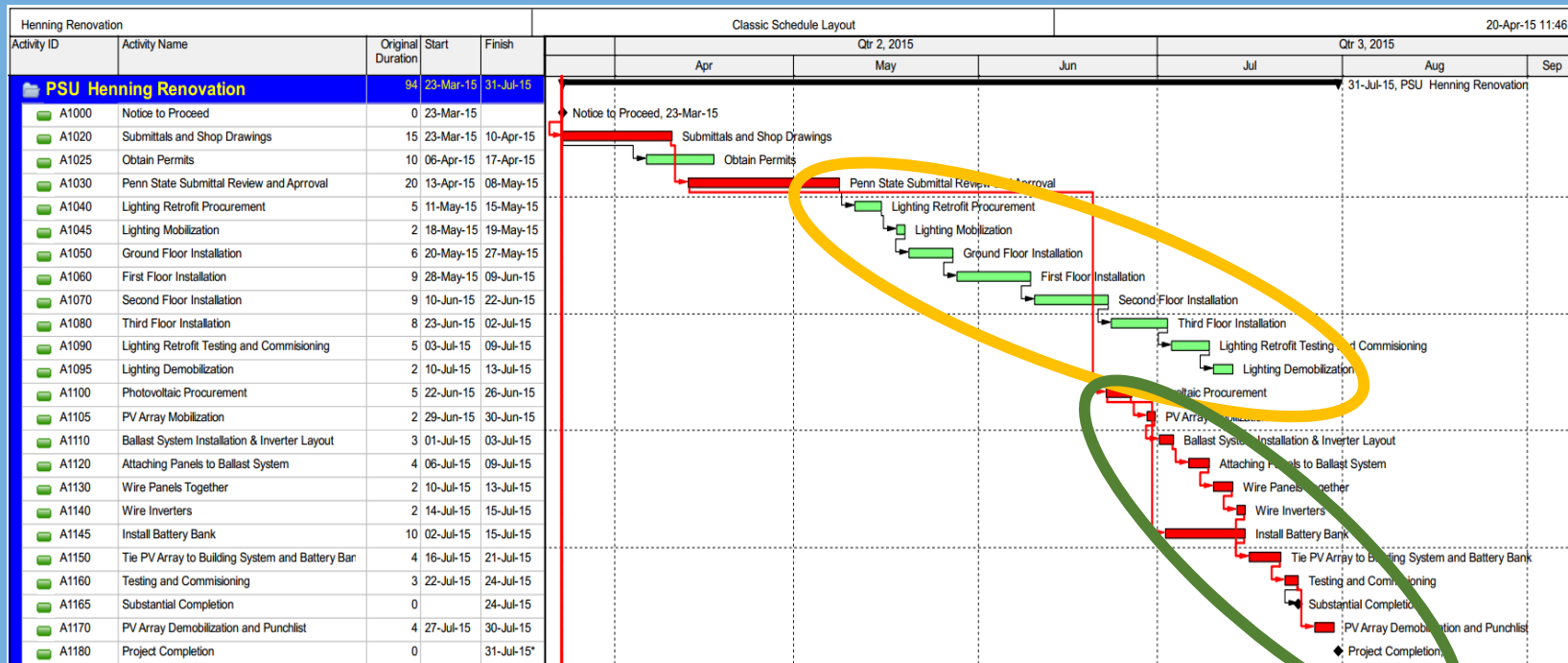
Schedule



Lighting



Microgrid



Procurement – 7 weeks

Lighting Retrofit – 8 weeks

PV Array – 5 weeks

Total – 17 weeks



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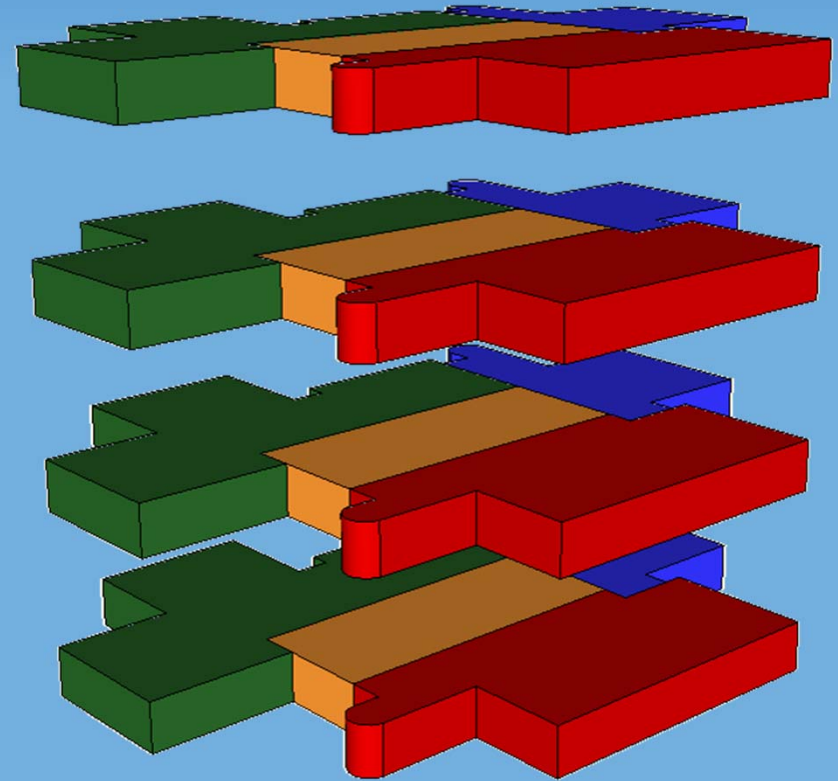
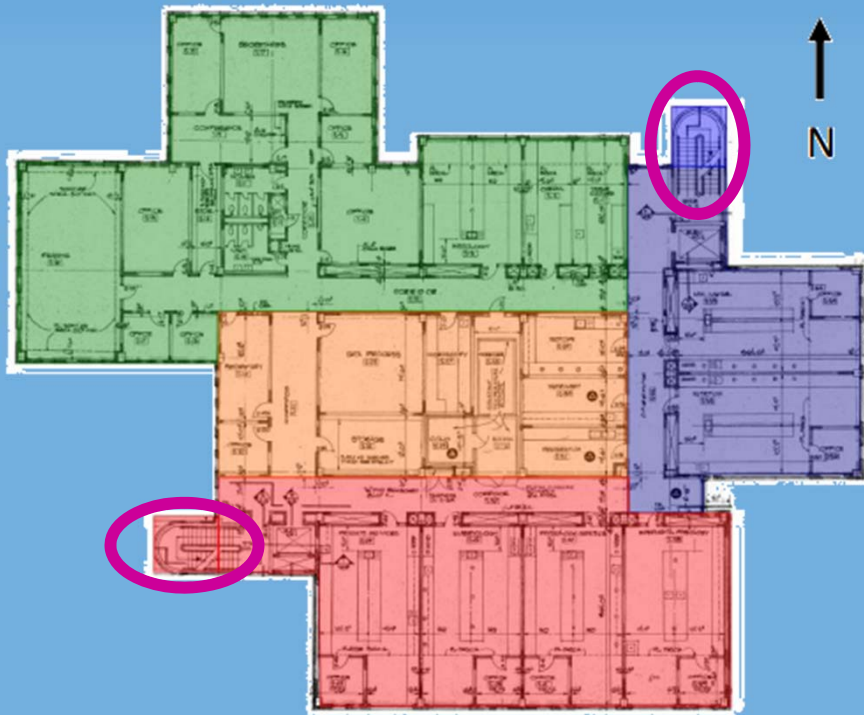
Lighting

Microgrid

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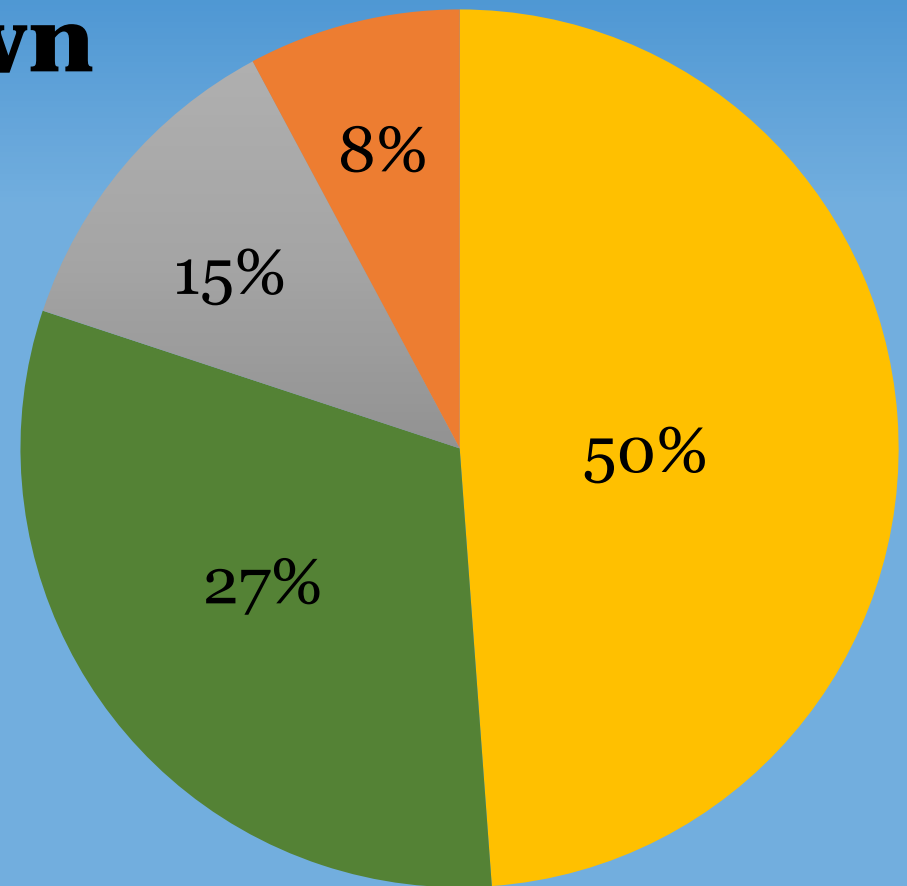
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Sequencing



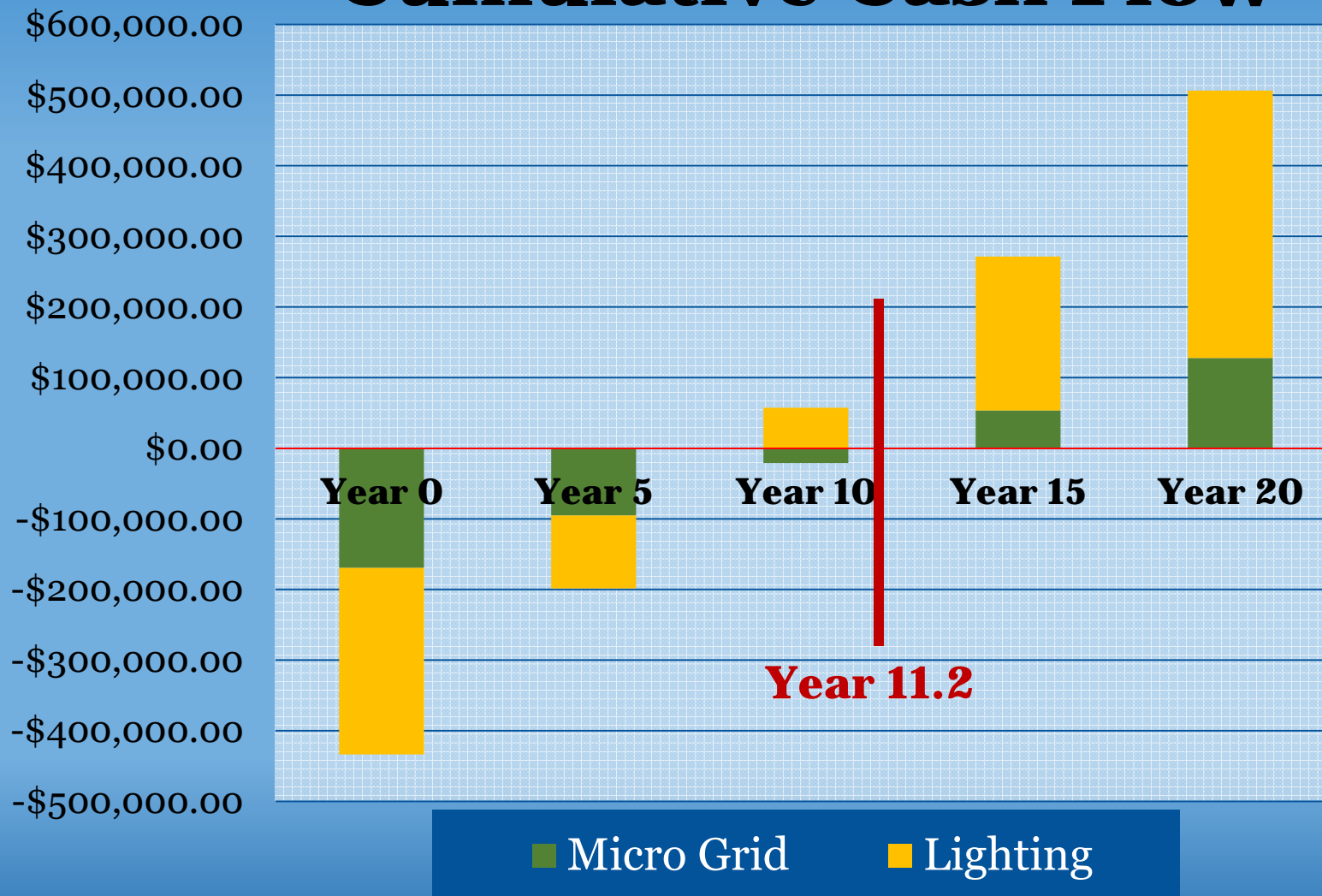
Estimate Breakdown

Description	Cost
Lighting	\$264,096
Microgrid	\$169,526
O & P	\$65,043
Other Costs	\$28,772
Project Total	\$527,437



■ Lighting ■ PV Array ■ O & P ■ Other Costs

Cumulative Cash Flow



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East Halls Freshman Dormitories



**14 Residence Halls
and Johnston
Commons**

**4, 000
Freshman Residents**

117 MWh/week



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Tabling and Student Interaction



Ten Easy Ways to Reduce Energy in your Dorm Hall



1. Turn off your lights when you leave the room.
2. Unplug any chargers or appliances when not in use.
3. Take the stairs instead of the elevator.
4. Use cold water doing laundry and skip the dryer when possible.
5. Save hot water by taking a shorter shower.
6. Purchase Energy Star label appliances.
7. Get outside and enjoy the fresh air!
8. Alter your appliance settings to save energy or use a power strip.
9. Use your windows and curtains to control your room temperature.
10. Double your impact; convince a friend to do the same!

Reduce your usage as a building to win the competition. Check out <http://buildingdashboard.net/psu/#/psu> for daily updates and energy data.

Remember, the competition ends April 12, so start saving now!



To learn more about NECA or Eco-Reps, visit: sustainability.psu.edu



Tabling and Community Interaction



CELEBRATE EARTH WEEK!



April 18 – April 25

Week Events:




Free Movie Showings!

Speakers,
Music,
and more!



Volunteer Opportunities



EARTH DAY 2015
IT'S OUR TURN TO LEAD
#EarthDayPSU15

Main Event:

#sustainPSU

HUB-Robeson Center
Wednesday, April 20
11 am – 3 pm

Win prizes, interact with clubs, and
make a pledge to be more sustainable

A detailed list of events for Earth Week can be found online at: <http://sustainability.psu.edu/2015-earth-week>



To learn more about NECA, Eco-Reps, or if you want to see what PSU is doing to make the world a better place, visit:
sustainability.psu.edu



LOCAL

Alumnus receives research grant

Alec's Lemonade Stand Foundation aids Haiti leukemia research

NECA reassesses campus building

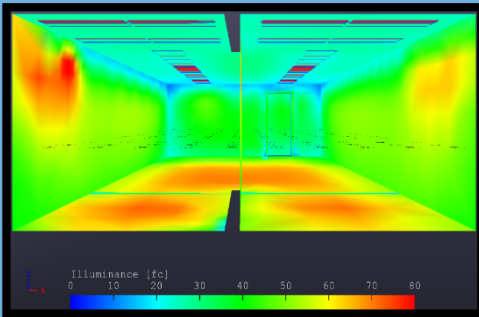
The National Electrical Contractors Association is proposing a more energy efficient building.

Council discusses possible changes

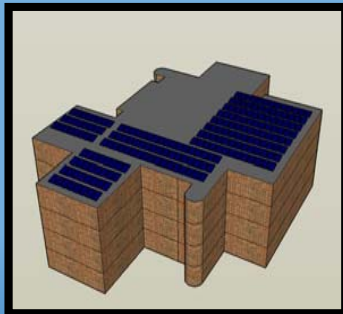
The Board of Trustees is discussing possible changes to the University Park campus.

Friday, April 17, 2015
4:00 p.m. in the NCB Auditorium, University Park Campus

Project Summary



**LED Lighting Retrofit with
Vacancy Sensors**



Microgrid with Solar PV Array



Safety



Economic Feasibility



Business Development



Student Education

Total Cost:
\$527,000

Payback Period:
11.2 years



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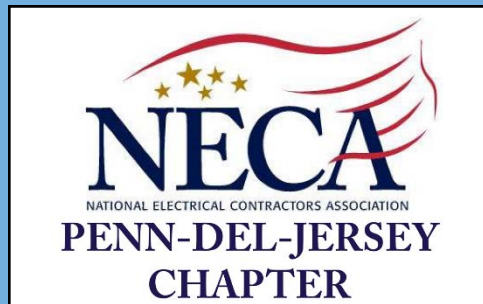
Special Thanks

NECA Penn-Del-Jersey Chapter

Faculty and Advisors

Penn State NECA Alumni

Members of the PSU NECA Student Chapter



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