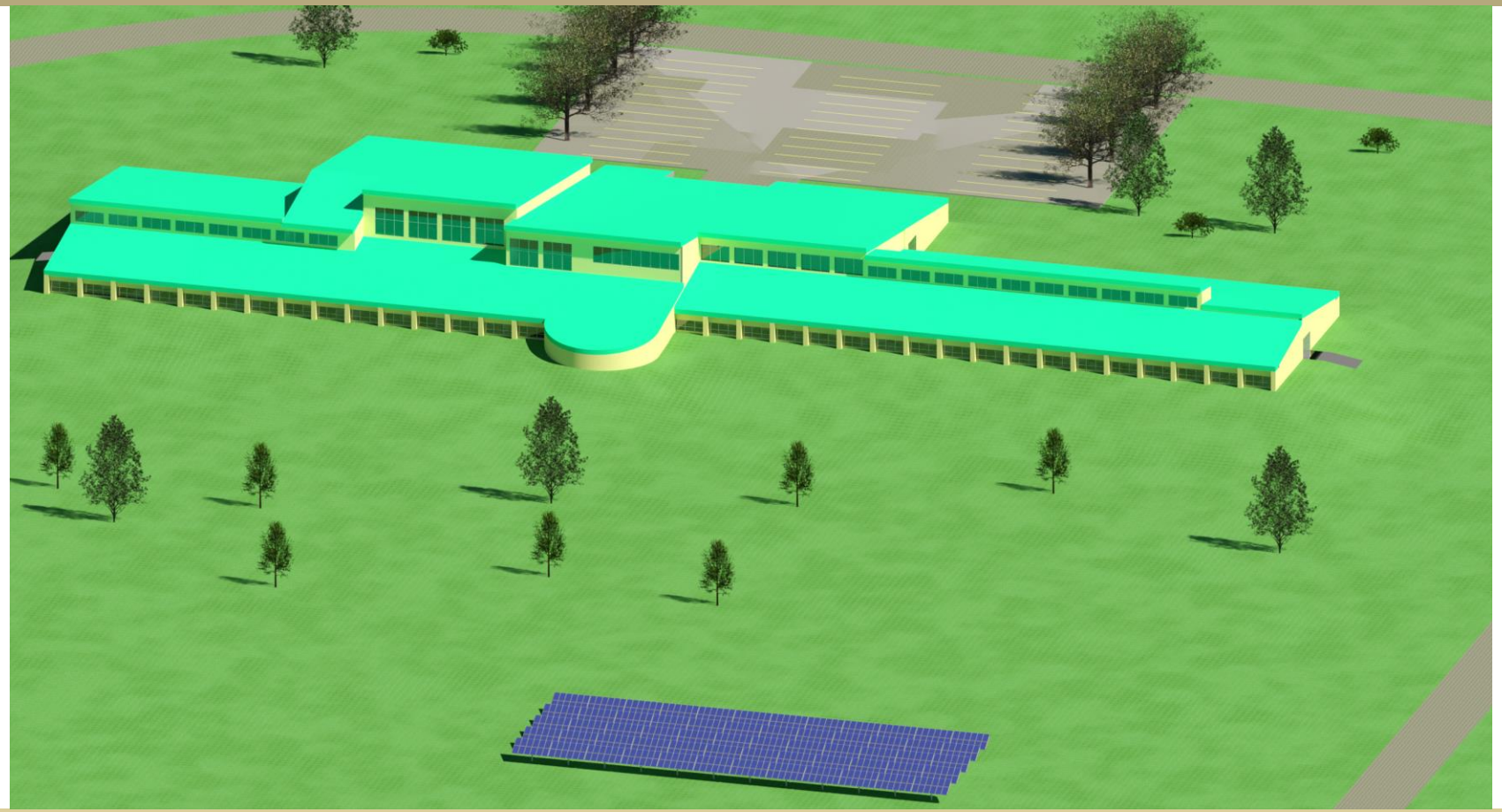
James Cole NetZero
Elementary School (ES) Division



PURDUE UNIVERSITY

U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON

JAMES COLE NET ZERO

Team

Songhao Wu
MS Civil Engineering

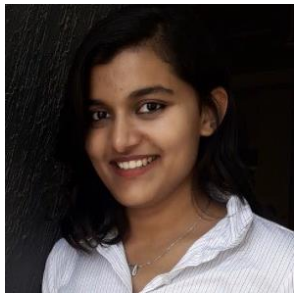
Zach Schreiber
MS Engineering Technology

Brian Tedeschi
MS Engineering Technology

Bhavya Rathna Kota
MS Construction Management

Emilio Rojas
BS Design and Construction Integration

Henry Liu
MS Engineering Technology



Namratha Kullachanda
MS Civil Engineering

James Rieser
MS Engineering Technology

Jun Kim
MS Environmental and Ecological Engineering

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Outline

- Architecture
- Comfort & Indoor Environmental Quality (IEQ)
- Engineering
- Operation
- Energy
- Innovation
- Resilience
- Financial feasibility
- Market potential

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Site Information

Stockwell, IN

Site Plan

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STUDENT

TEACHER

FACILITY STAFF

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Phased net zero energy design

Mindfulness

Model for school renovations

Disaster recovery center

Increasing sustainability education

Reasonable financial ROI

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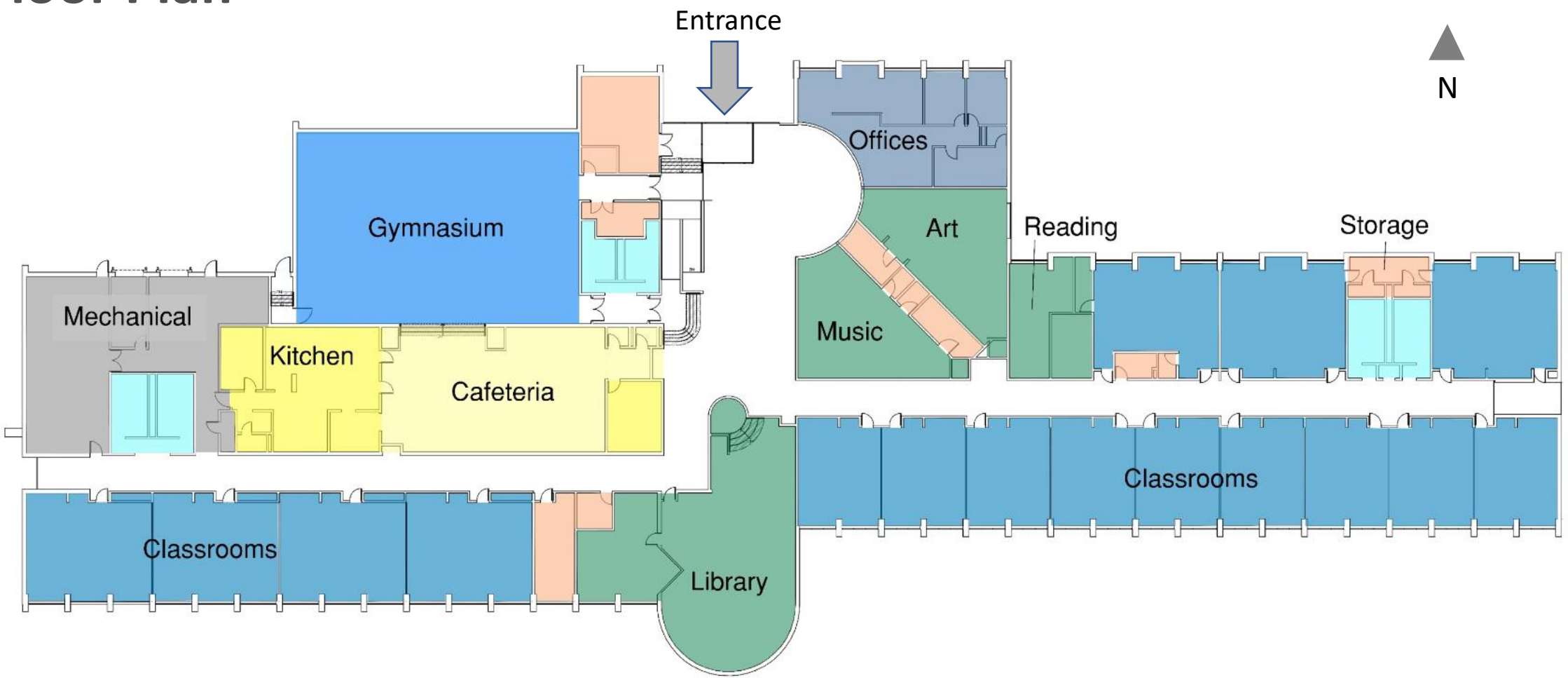
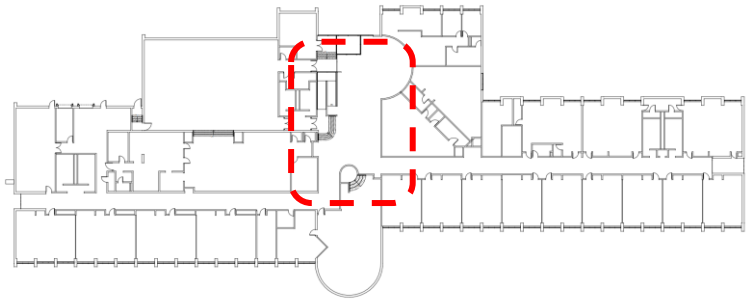
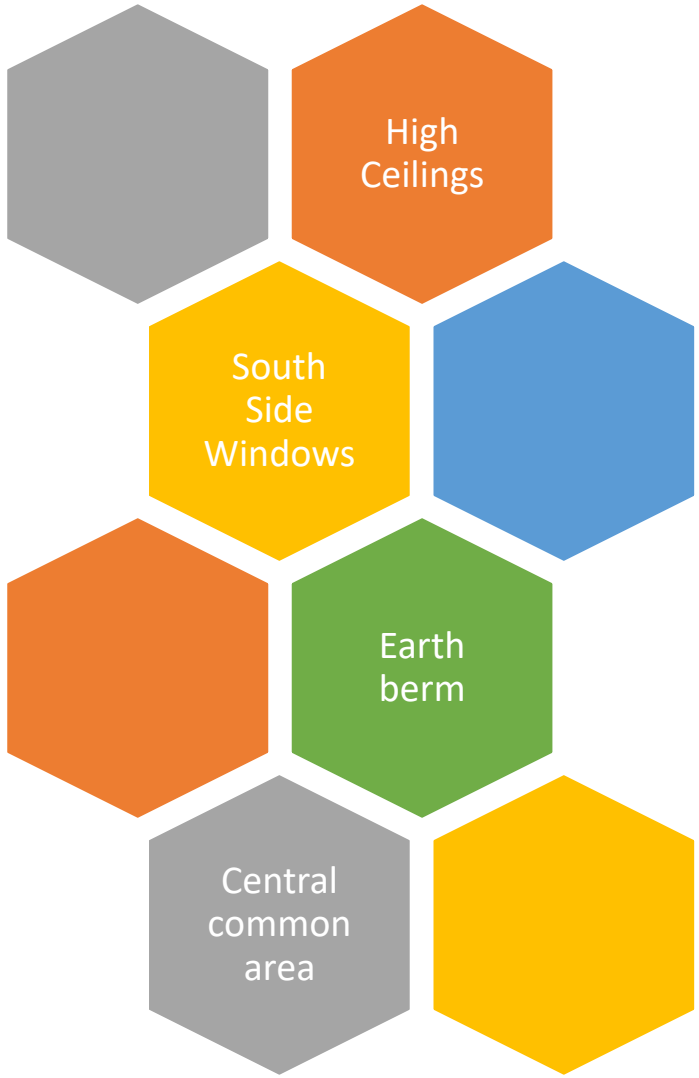
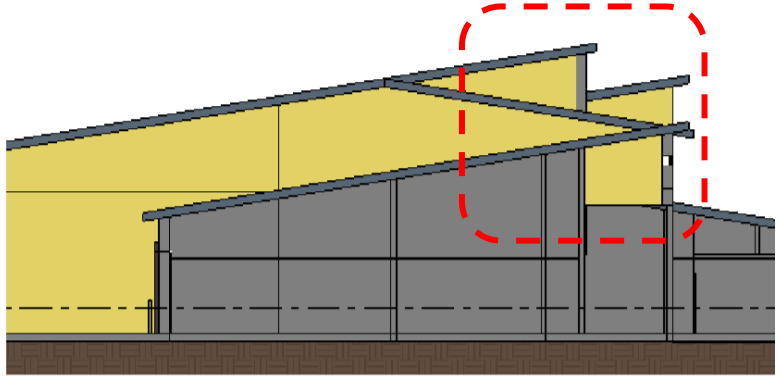
Floor Plan

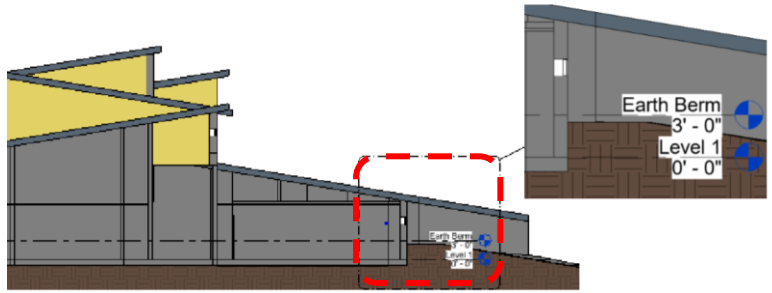

Entrance
N
Offices
Gymnasium
Art
Reading
Storage
Mechanical
Kitchen
Cafeteria
Music
Classrooms
Classrooms
Library

Existing Features









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Exterior

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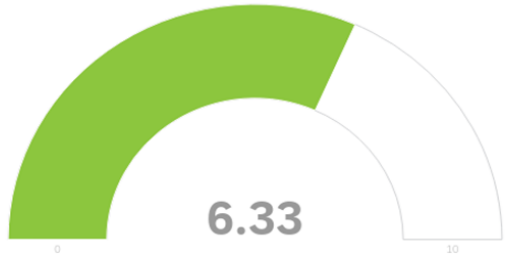
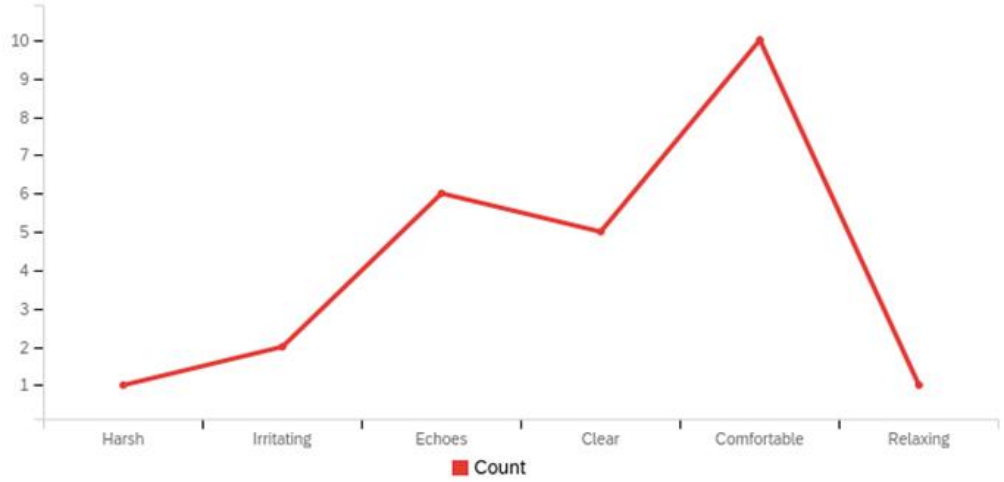
James Cole User Assessment of Building

- Target population – staff and teachers
- Objective- understand user perspective of James Cole's IEQ (existing structure)

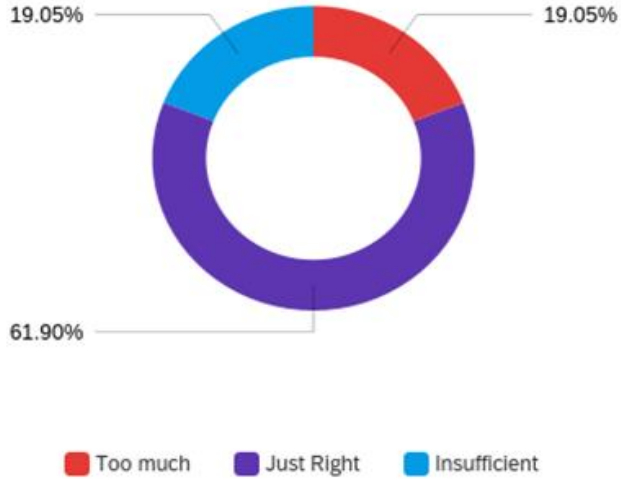
Rating of Indoor Air Quality – 6.33/10



Indoor sound quality(frequency) – Echoing of sound is an issue



Interior lighting level – approx. 40% dissatisfied



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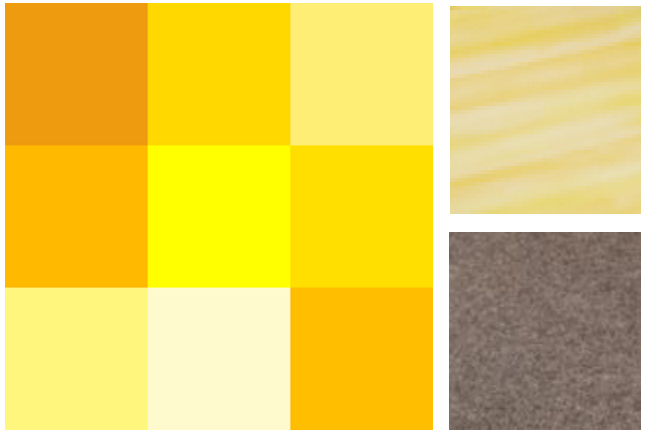
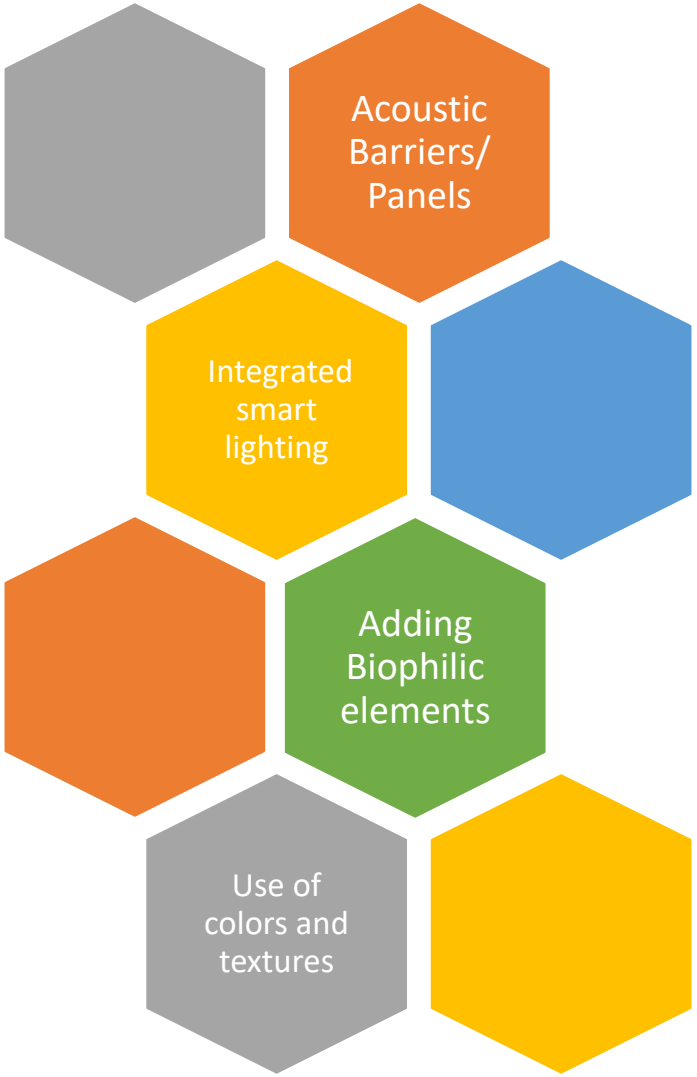
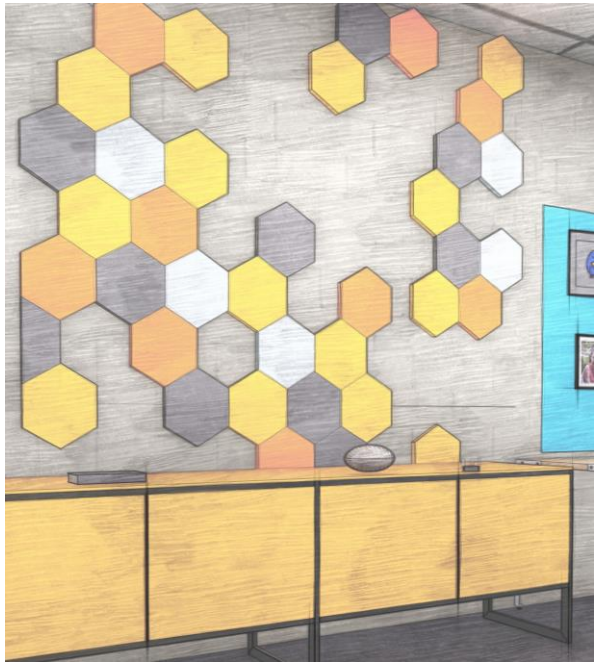
Proposed Features







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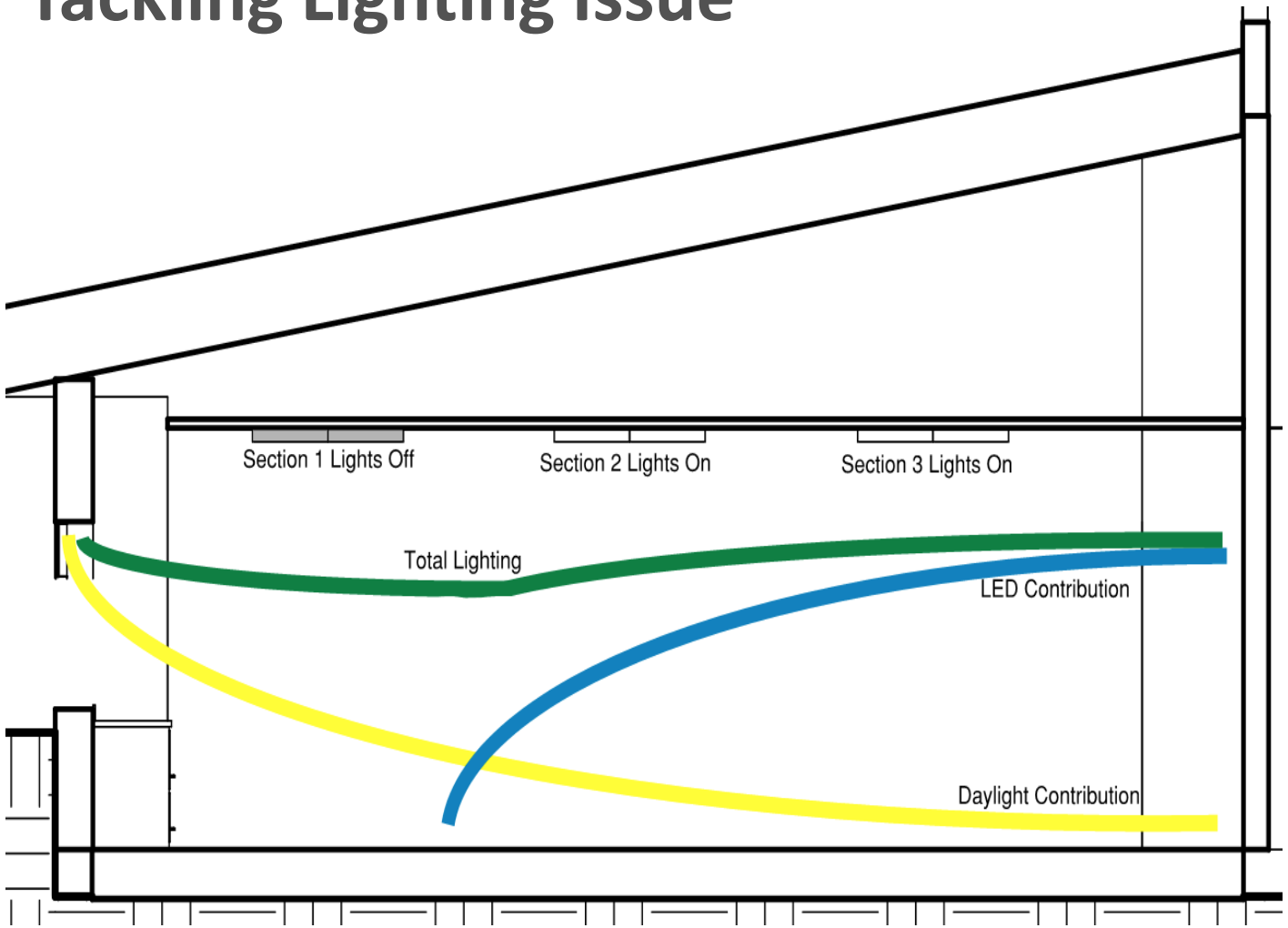
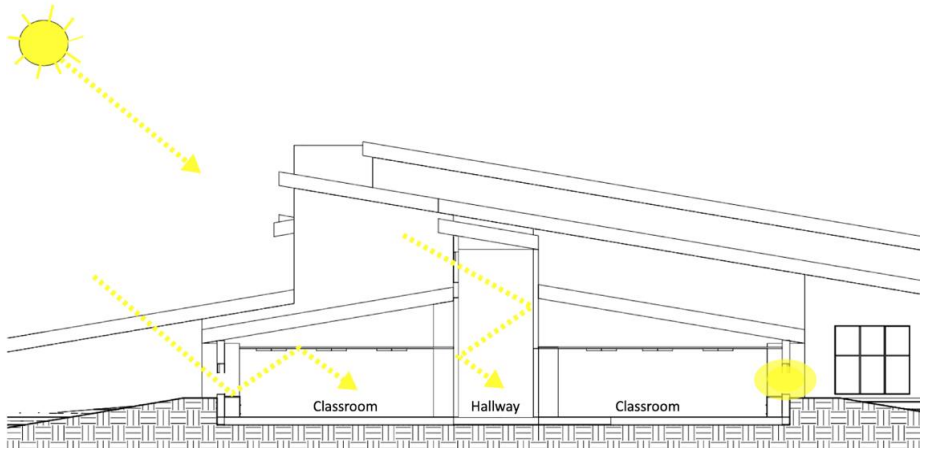
Tackling Lighting Issue



Natural lighting

- Windows and clerestory windows
- Change in lighting intensity with proximity



Integrated Smart Lighting

- Occupancy Sensors
- Section lighting controls
- Optimize/uniform interior light
- Daylight Sensors & dimmers (optional)

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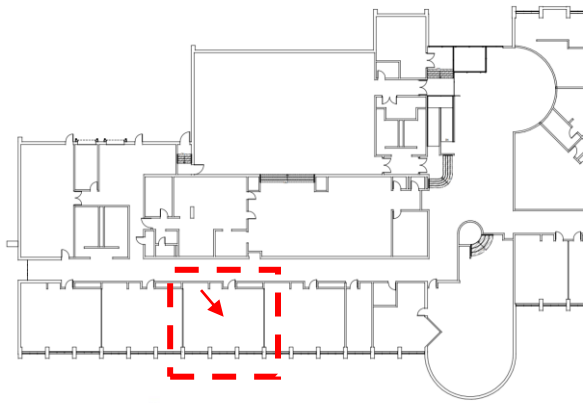
Interior Classroom



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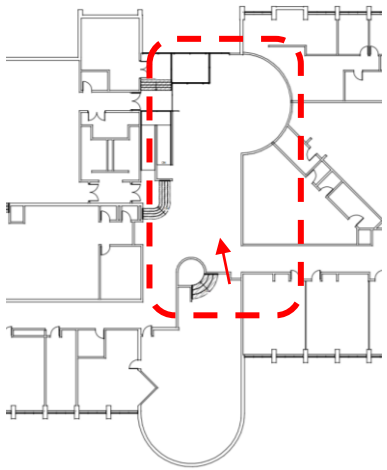
Lobby Interior



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Heating & Cooling

Pumps

Geothermal
Well Field

AHU Heat Pump

AHU w/ ERV

Zone Heat Pump (38 Total)

Zone

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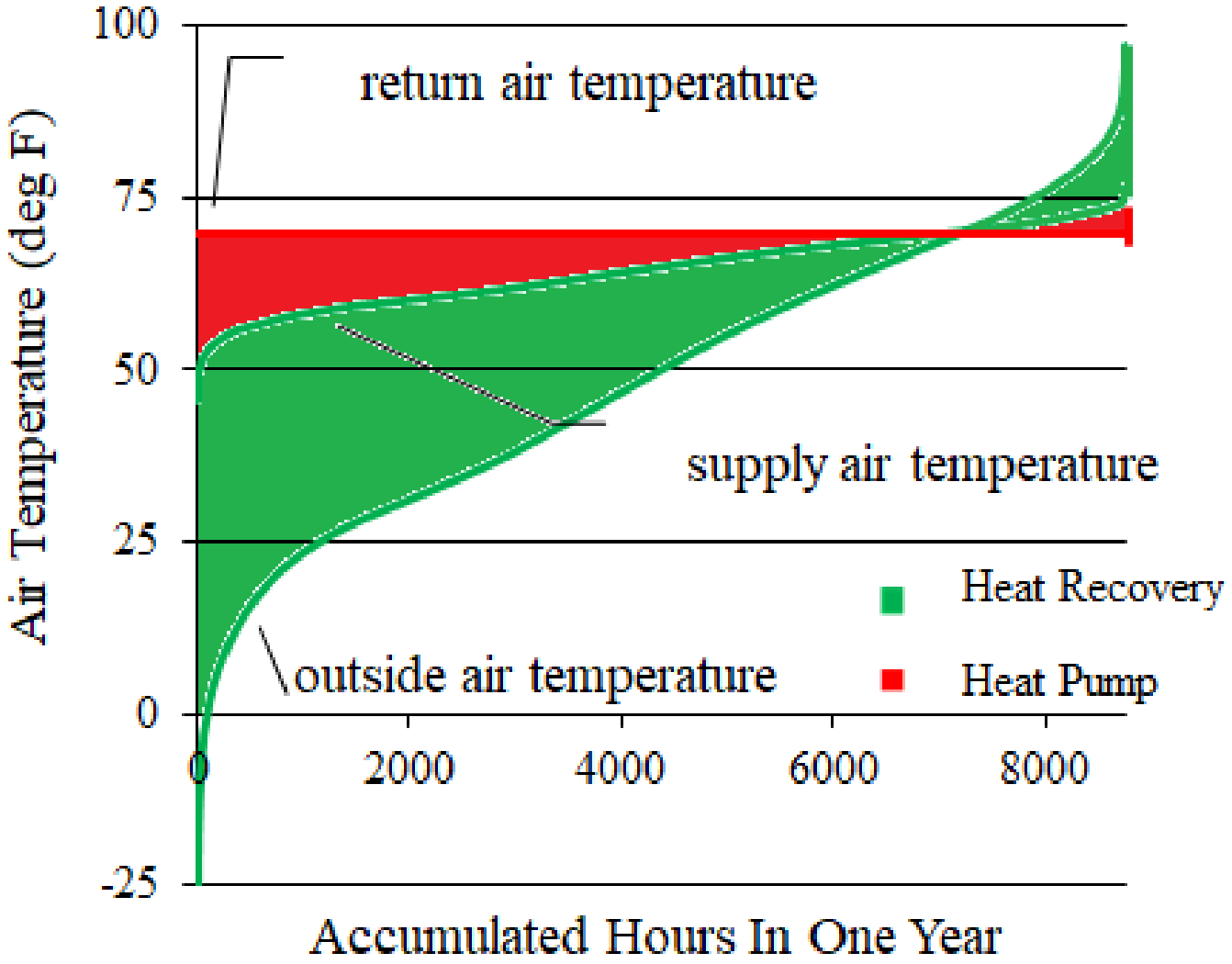
Ventilation

Make up AHU with ERV

ERV Annual Energy Savings



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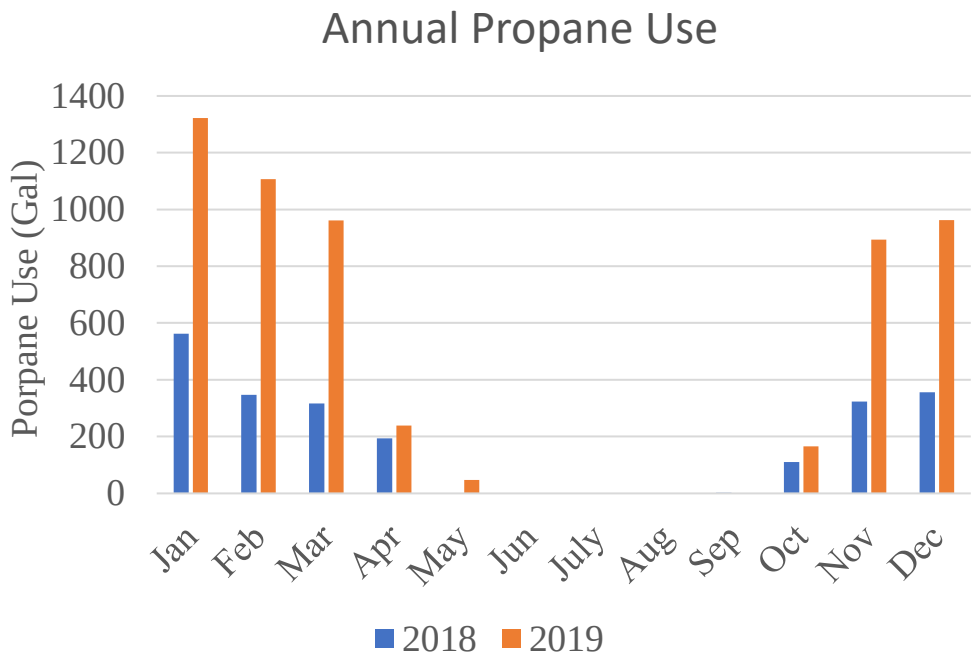
Operations

- Building Automation System (BAS)
- Recommissioning
- Training



BAS KPI's to help focus maintenance strategies

Focus Area	Key Performance Indicator (KPI)
Geothermal Heat Pump	Loop Temperatures between 40 °F (winter) and 90 °F (summer)
Air Handling Unit	Runs according to timed schedule
Hot Water	Temperature and run time within specified limits
IEQ	CO_2 levels within recommended threshold for school
Solar	Array efficiency within 10% of expected performance

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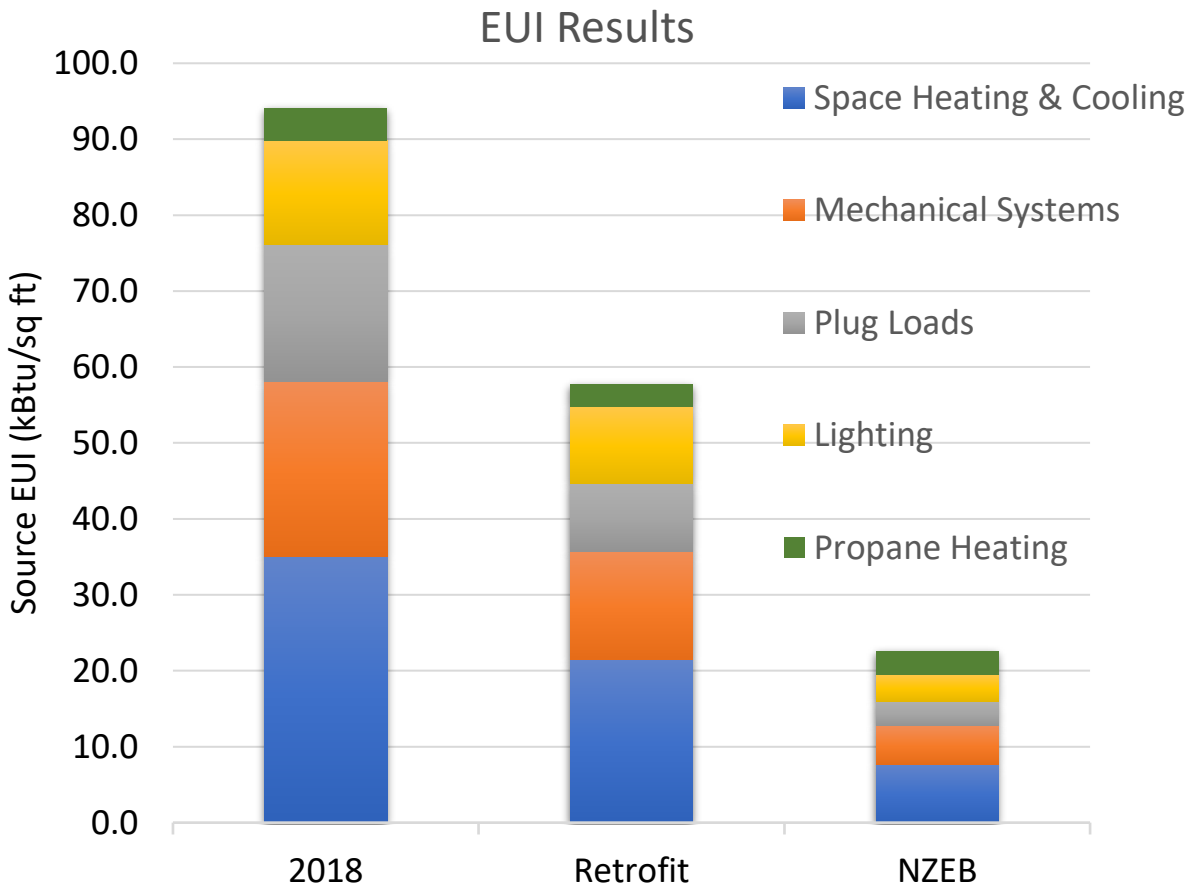
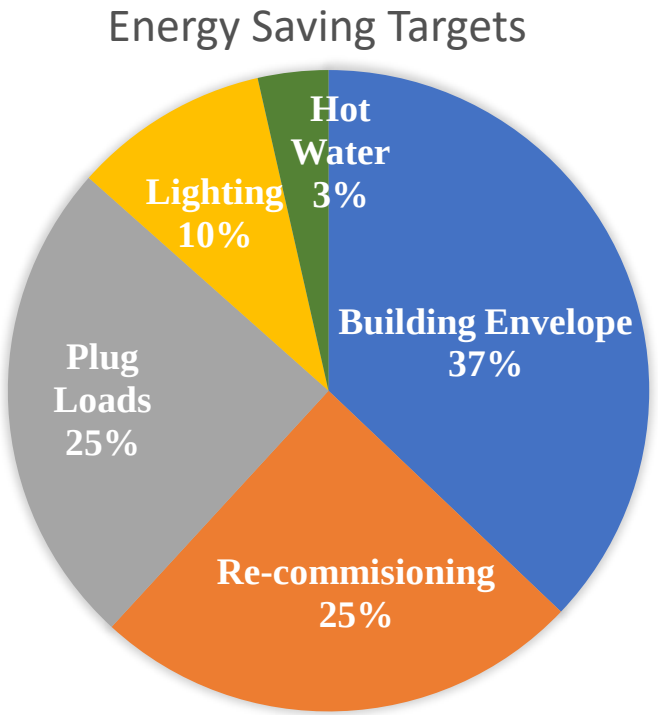
Energy Use





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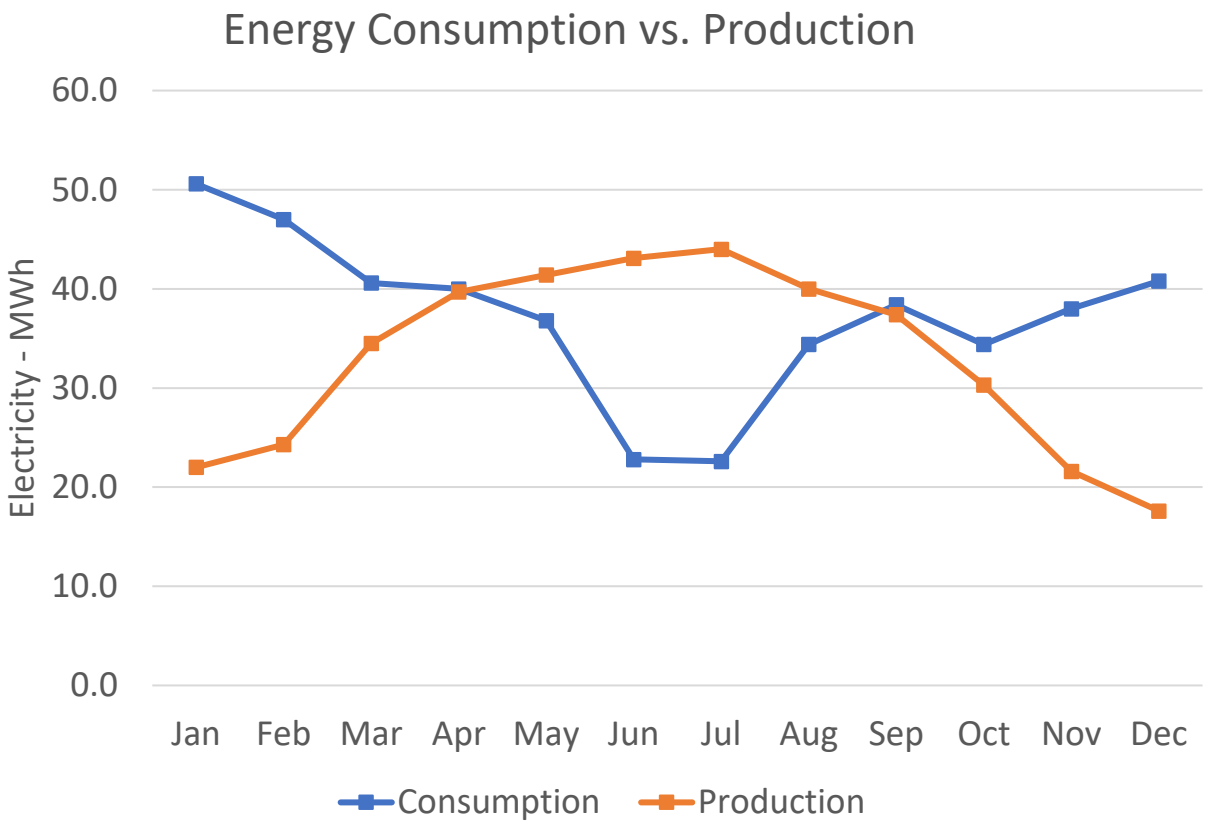
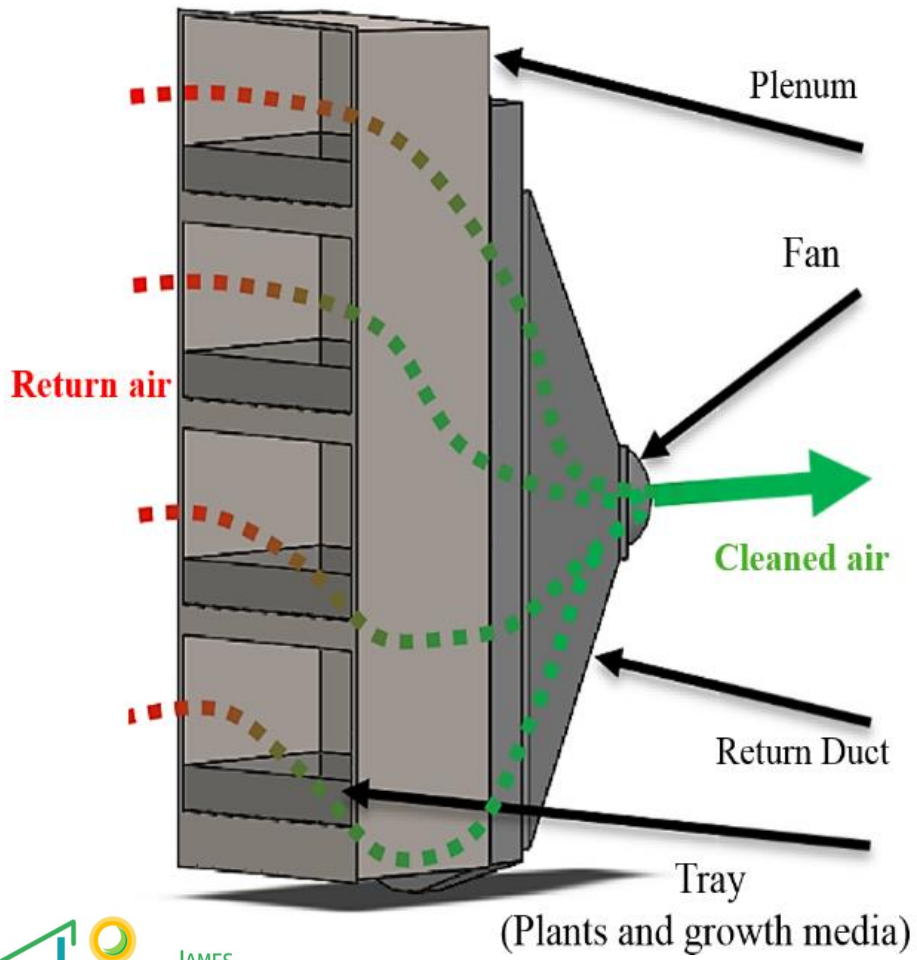
Energy Production

- 300 kW DC Solar Array
- Annual Production: 400 MWh

Solar Array Location



Biowall



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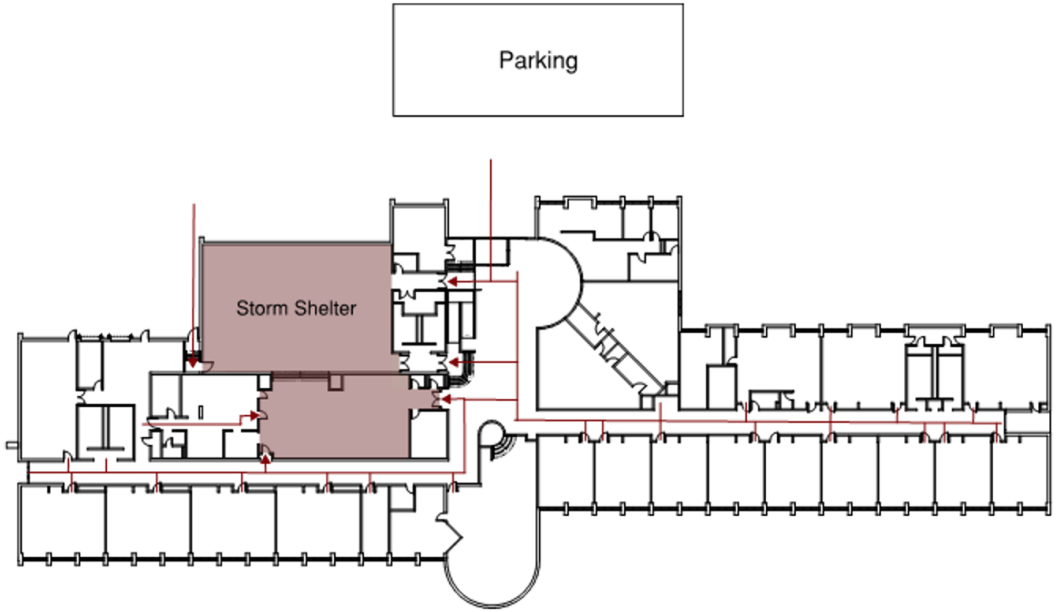
Resilience

Risk	Likelihood
Severe Storm	High
Fire	Moderate
Flood	Low
Global Flu Pandemic	Very Low



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Financial Analysis & Feasibility

	Plug Loads	Recommissioning	Lighting	Bio wall	Solar	Hot Water	Window	Roof	Totals
Initial Cost ($)	3,500	21,800	33,750	33,900	569,000	46,400	300,000	850,000	662,000
First Year Energy Savings ($)	4,460	4,460	5,550	0	44,200	820	2,200	4,460	
Breakeven Year	2	4	4	8	15	N/A	N/A	N/A	
20 Year NPV ($)	109,000	193,000	200,400	57,800	210,000	-34,800	-267,900	-784,700	770,200
Priority Level	Do Now	Do Now	Do Now	Do Now	Do Now	End of Life	End of Life	End of Life	

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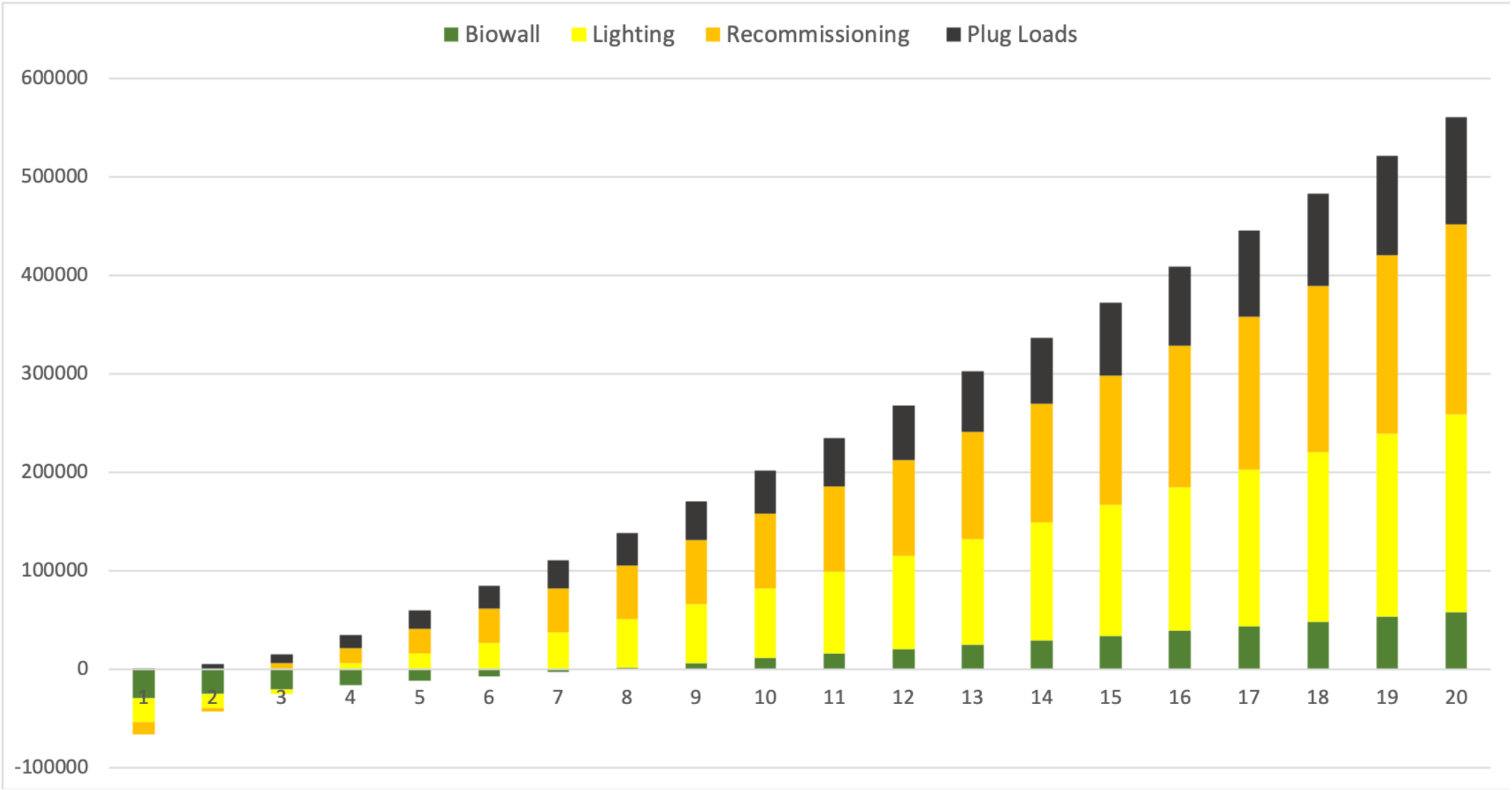

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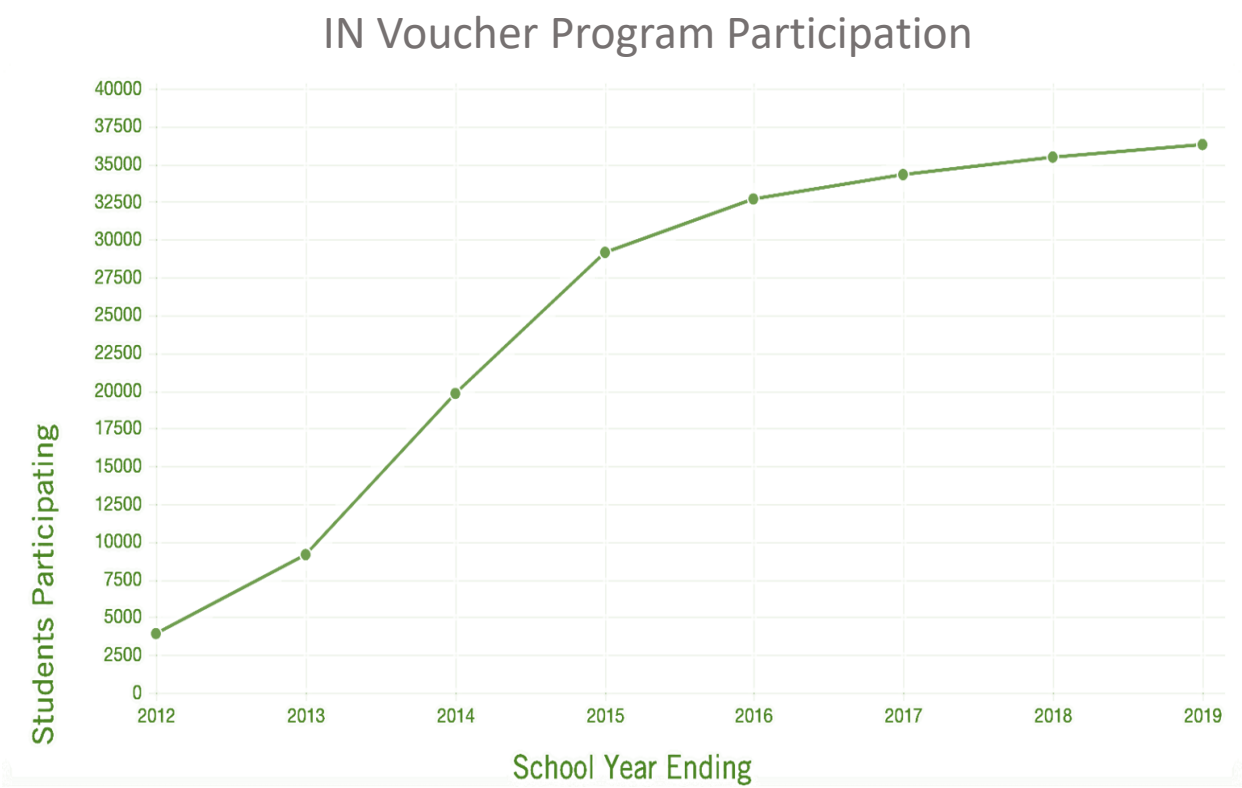
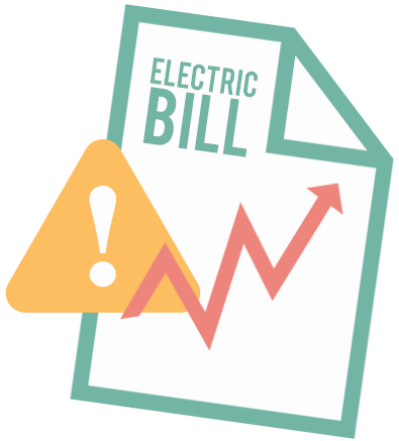
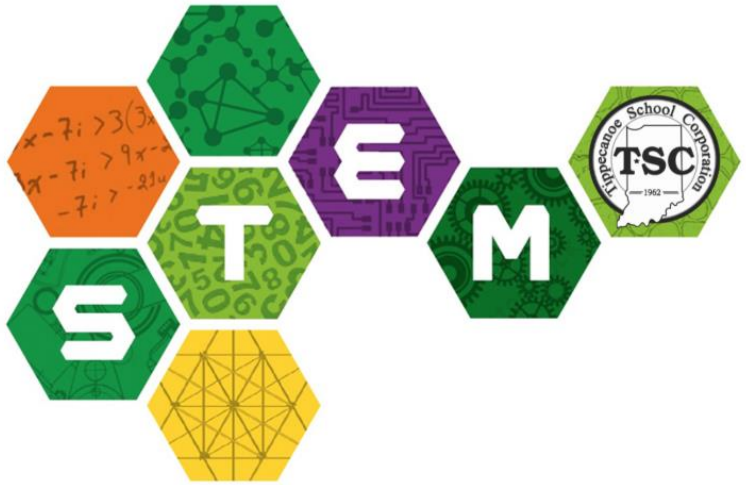
Market Analysis





Impact on Occupants

- Quality of Life
  - Mindfulness and wellness
- Education Enhancement
  - Integration of sustainable systems into STEM education



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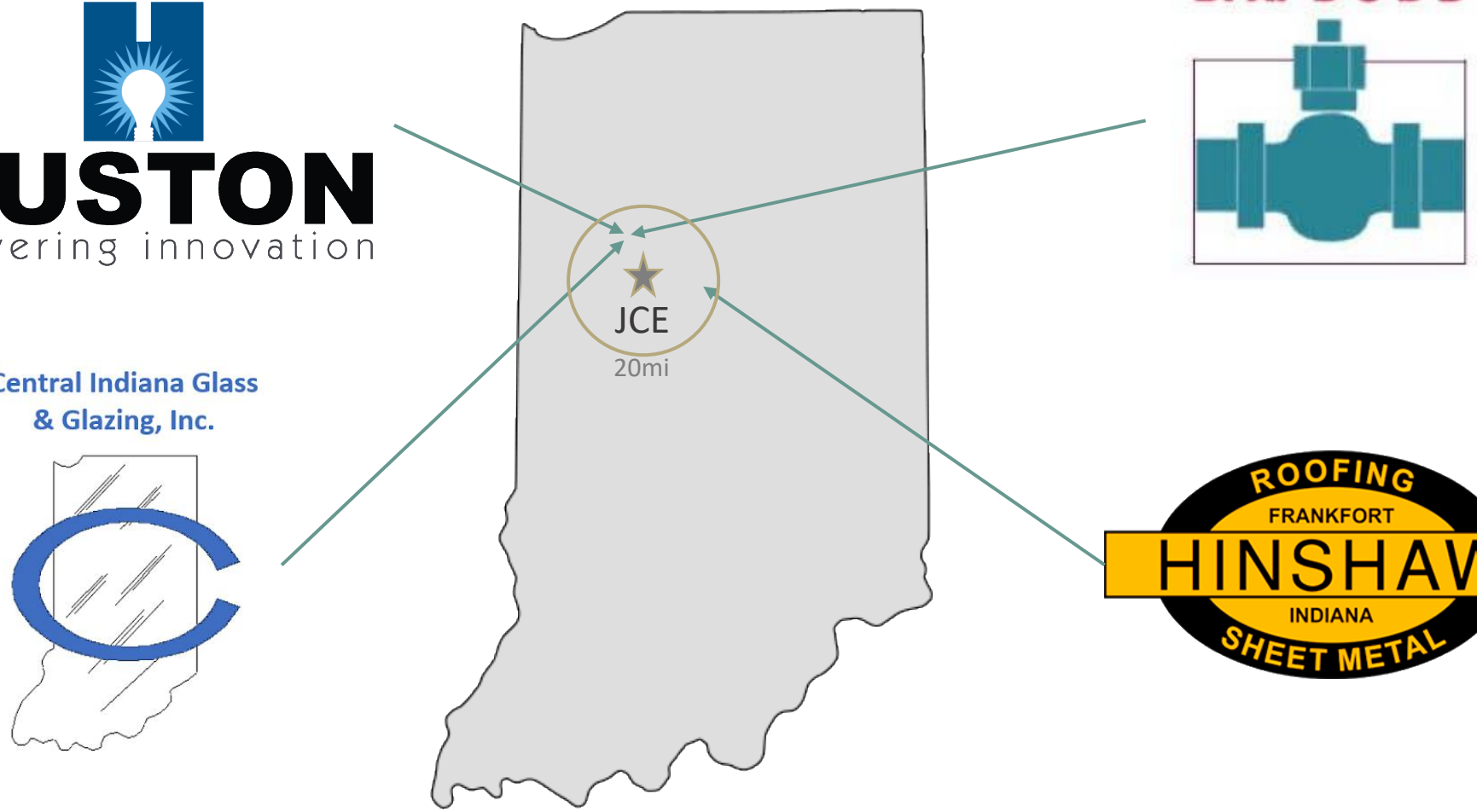
Market-ready construction

HUSTON
powering innovation

D. A. DODD



Central Indiana Glass & Glazing, Inc.

ROOFING
FRANKFORT
HINSHAW
INDIANA
SHEET METAL

JAMES COLE NET ZERO

Phased Net Zero

- Reduce Plug Loads
- Re-commission mechanical systems
- Upgrade to LED Lights

Phase I
(Do Now)

- Install solar array
- Install five Biowalls

Phase II
(Do Soon)

- Roof upgrade
- Window upgrade
- Hot water system upgrade

Phase III
(End of Life)

- Install acoustic baffles
- Install UV Lights

Phase IV
(Optional)

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Ability to Replicate

Special thanks to our industry partners

HUSTON
powering innovation

Tippecanoe School Corporation
TSC
1962

Central Indiana Glass
& Glazing, Inc.

D. A. DODD

UVR
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