Introduction to Sketchbox

Simplified energy modeling tool for your classroom

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Accelerating climate solutions. For everyone.

We deliver research, technical assistance, financing, education and training, and programs for stakeholders.

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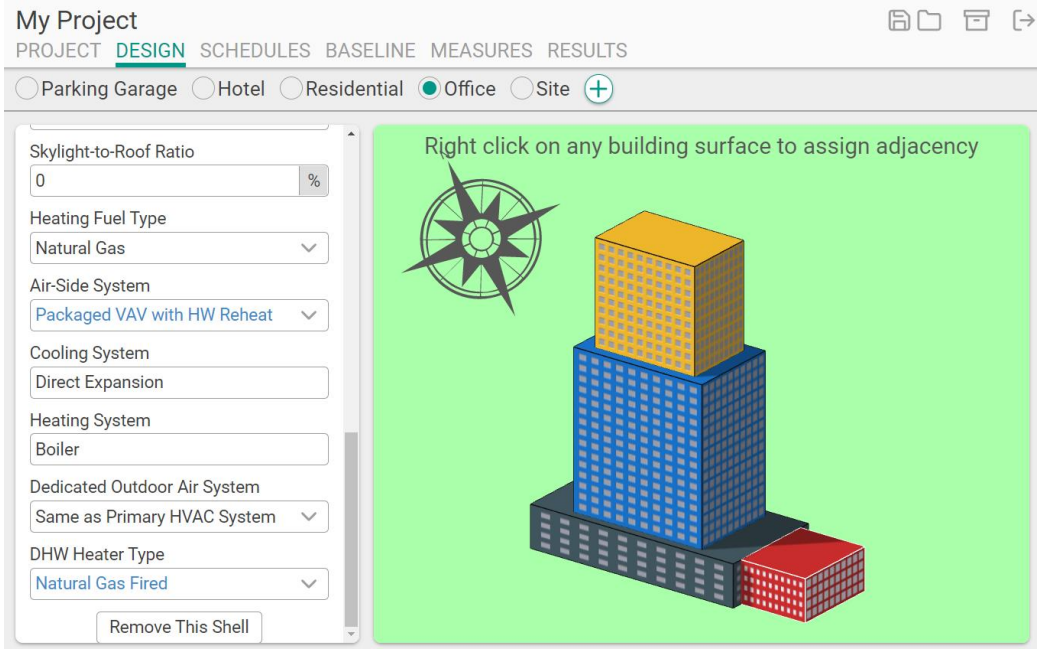
What Is It?

Concept energy modeling tool

- Intuitive user interface
- Helps designers focus on what matters
- Supports most building types and HVAC system types
- 10x faster than traditional energy models



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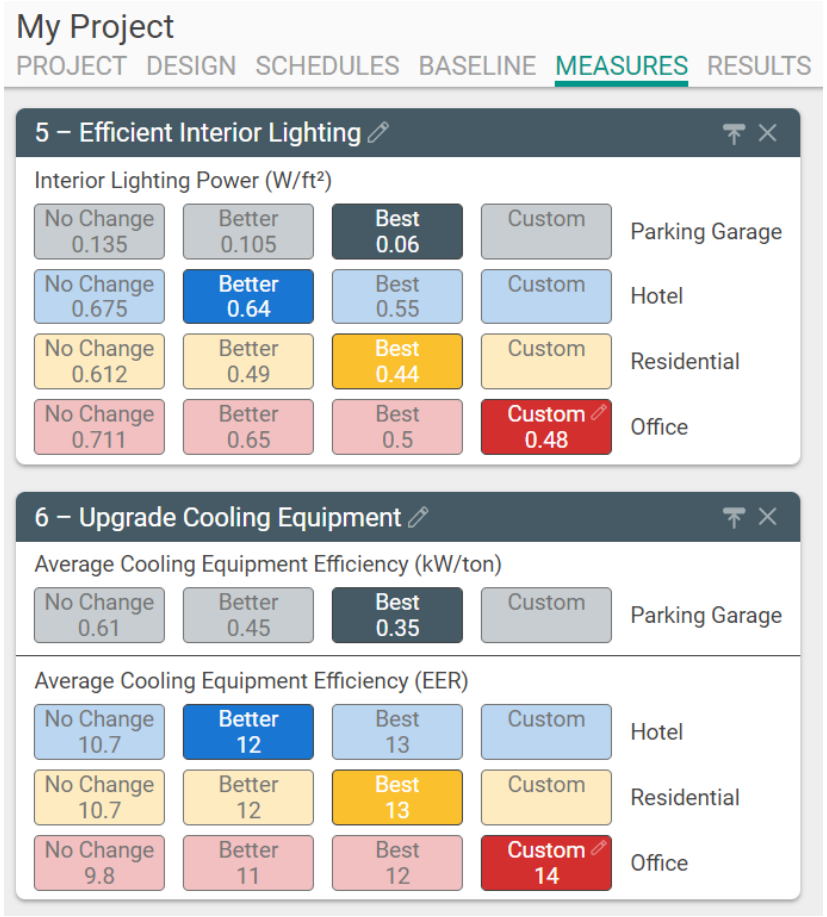
Technical Overview

- Cloud-based modeling tool
- Based on DOE2 engine
  - Fast run time
  - Open source
- Includes all commercial building types including schools and multifamily
- Advanced HVAC options
  - Dedicated outside air (DOAS)
  - Ground-source heat pump (GSHP)
  - Variable refrigerant flow (VRF)
  - Radiant systems



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Results

- Visual results
- Measure-by-measure results
- Customizable
- Automatic energy efficiency recommendations based on real project experience
- Quickly evaluate 60+ common efficiency strategies

Sketchbox simplified energy modeling tool

Received a **grant** to support lessons for tech colleges and high schools

- Educate students on energy efficiency and building design
- Approachable for less technical users
- Remote-hosted, scalable to many users
- Interactive web browser interface, works on mobile
- *FREE!*

Building Energy Simulation

SOFTWARE & SERVICE LEARNING

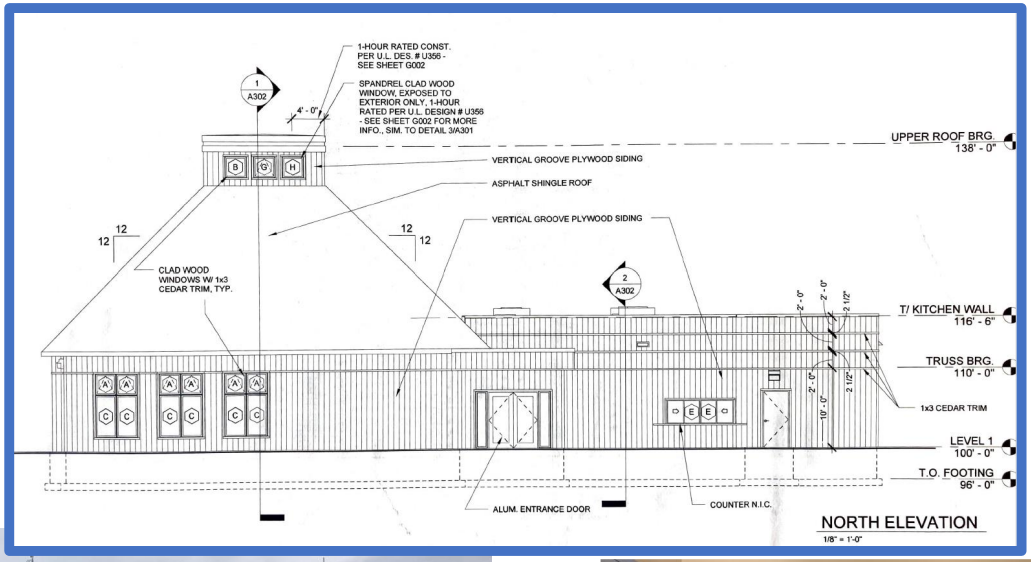
- 2nd-year class after HVAC, lighting and other building energy use fundamentals

NORTHEAST
WI Technical College

jenny.brinker@nwtc.edu

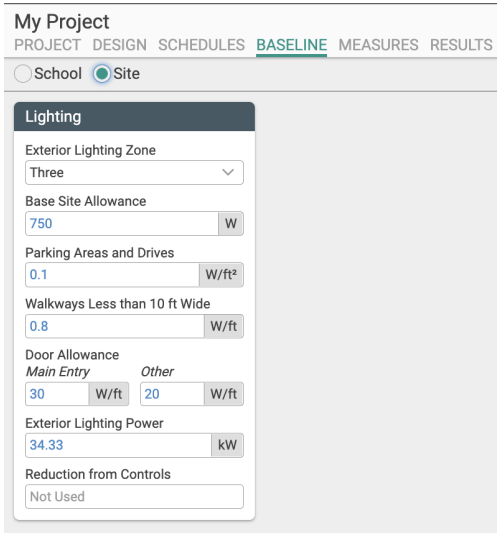
Brown County N.E.W. Zoo

Mayan Restaurant

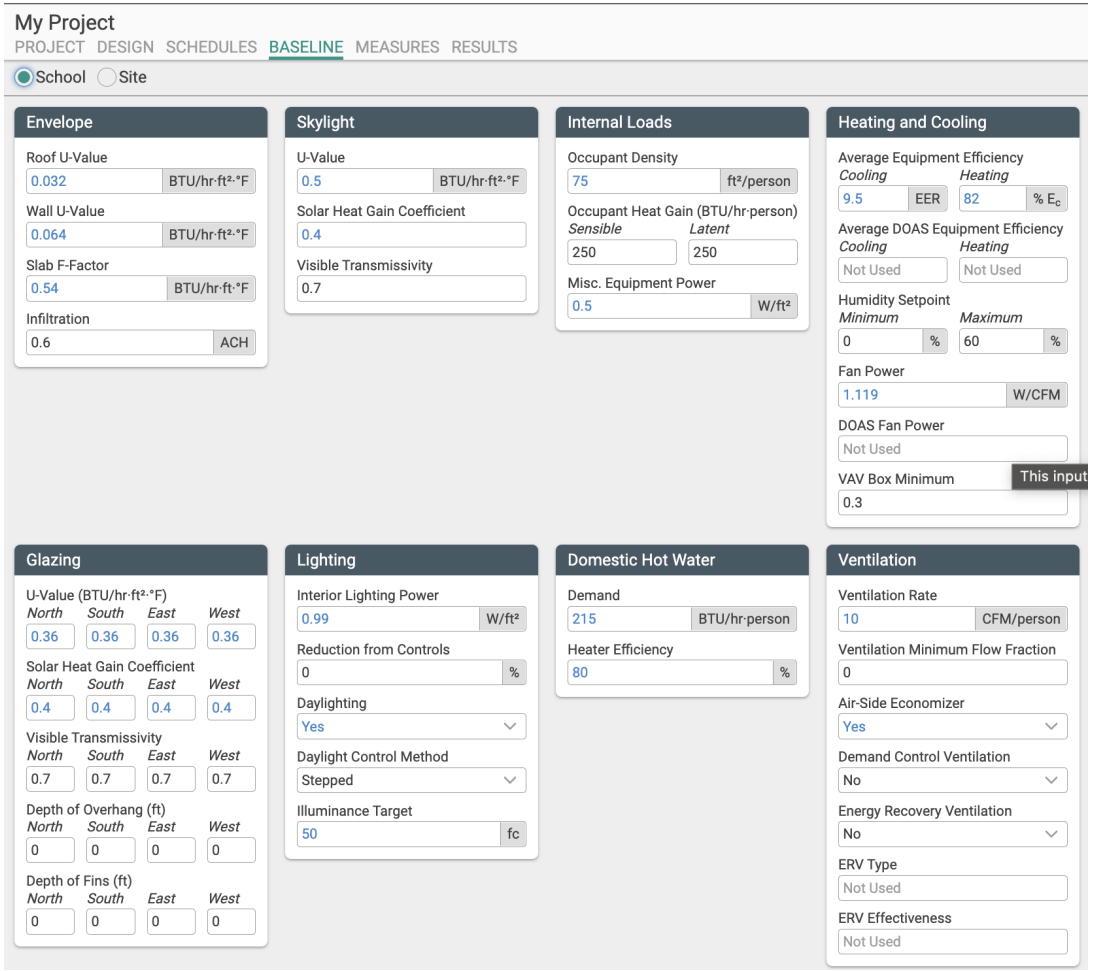


NORTHEAST
WI Technical College

BASELINE

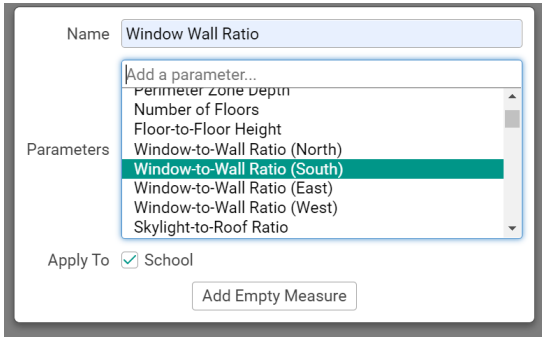


Leave both options under Baseline (School and Site) as is

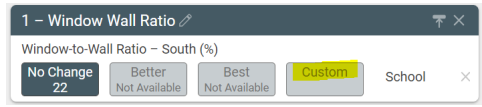


MEASURES

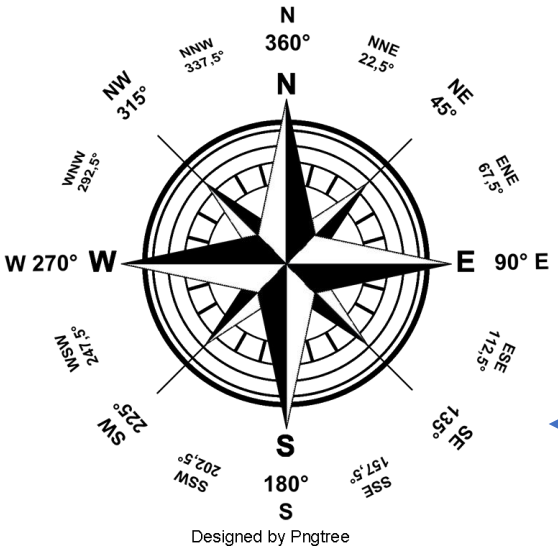
Select "Add Measures"



Select the "Window to Wall Ratio" and "Orientation" that holds potential for optimizing the buildings energy efficiency by your geographical location

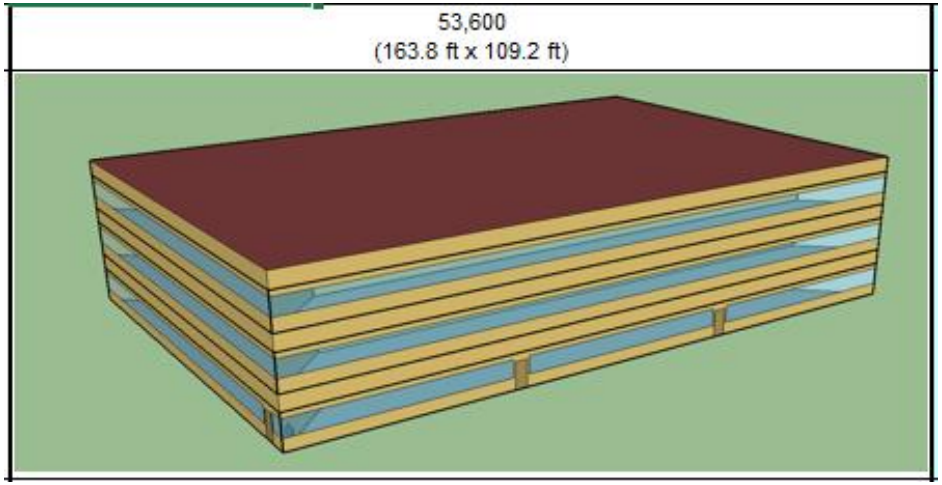


Select "Custom" to input
a new "Window to Wall Ratio" and "Orientation"



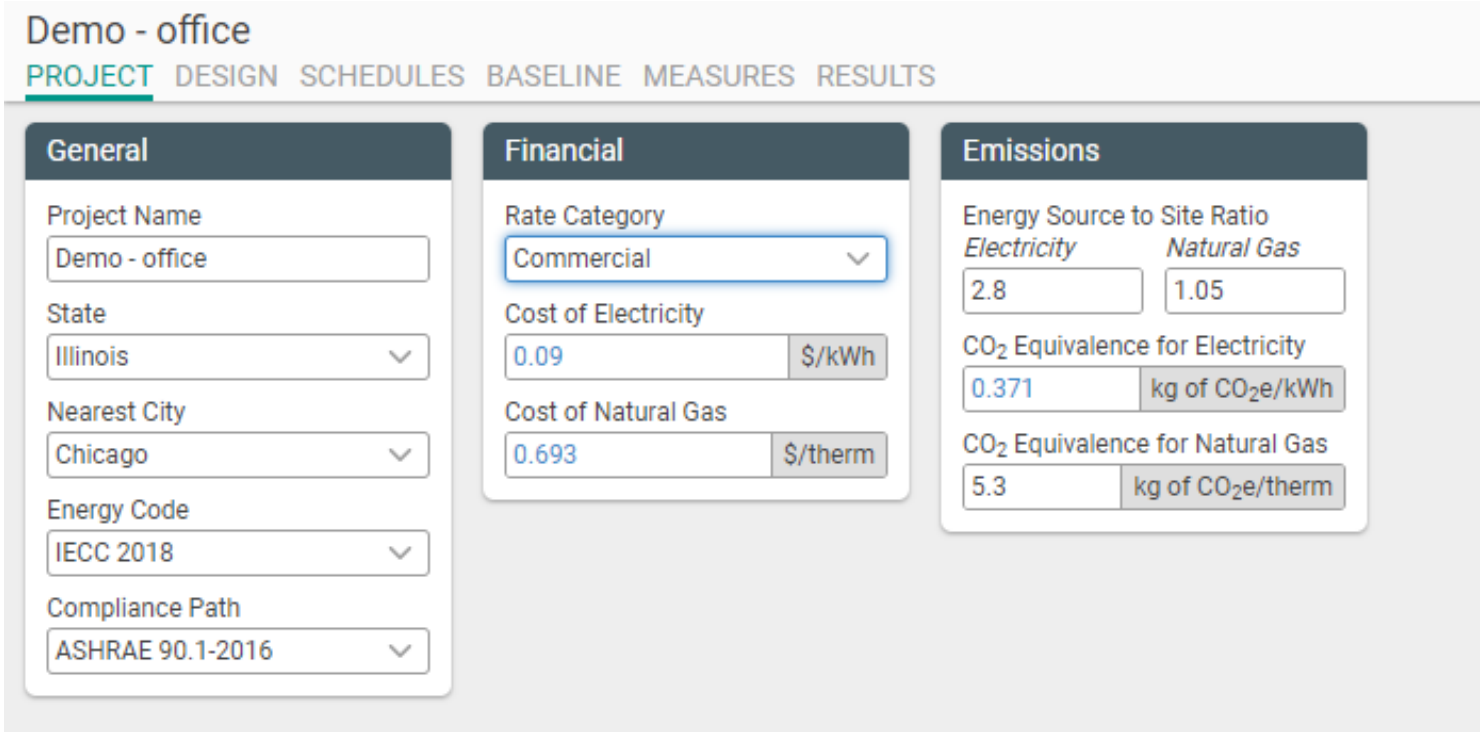
Reference for degree orientation

Prototype model – Medium office

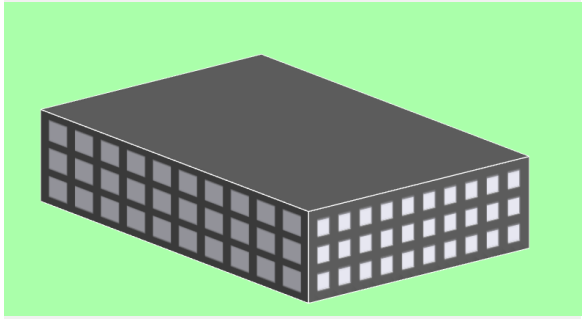


- Location – Chicago, Zone 5A
- Medium office
- 60,000 sf
- 3 floors
- All electric building

Project Description



Project Design



Geometry

Name
Office
Color
Building Type
Office - Medium
Parent Shell
None
Adjacency
Not Used
Area
60000
ft²
Aspect Ratio
1.5
Floors
Number
3
Height
13
ft
Perimeter Zone Depth
15
ft

Building description

Heating Fuel Type
Electricity
Air-Side System
Packaged Heat Pumps
Cooling System
Water Source Heat Pumps
Heating System
Water Source Heat Pumps
Dedicated Outdoor Air System
Same as Primary HVAC System
DHW Heater Type
Electric Resistance

HVAC

Medium office - Schedules

Weekday

Schedule Type: Simplified

Use Simple Thermostats

Occupancy: Normal

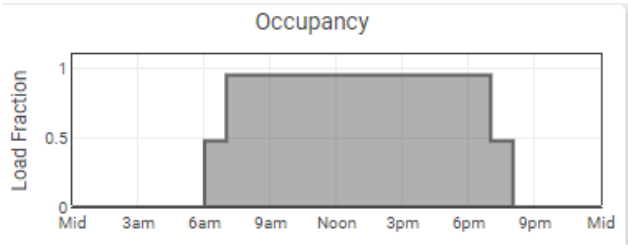
Weekday Schedule
7 am to 7 pm

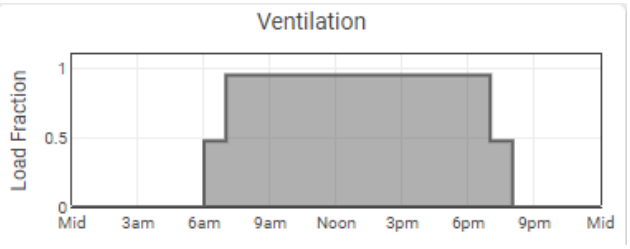
Weekend

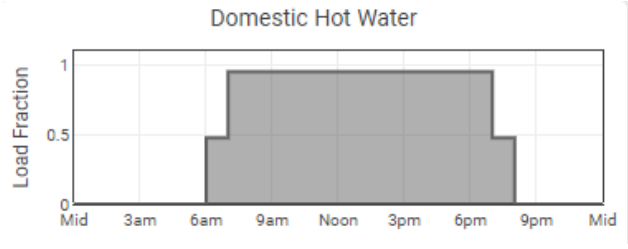
Schedule Type: Simplified

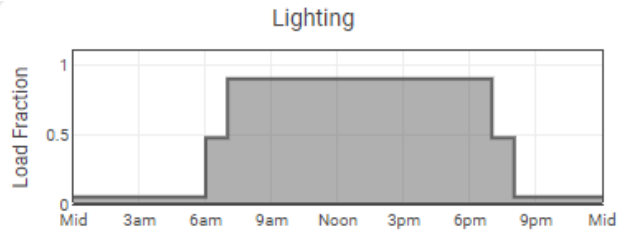
Use Simple Thermostats

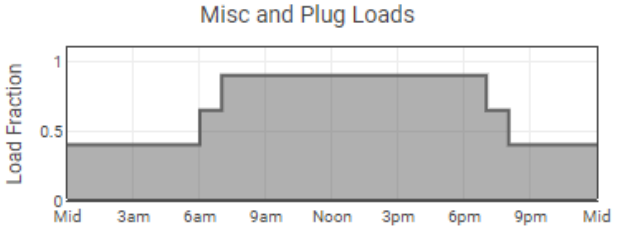
Occupancy: Never Occupied











Medium office - Schedules

Thermostats

Cooling Setpoint

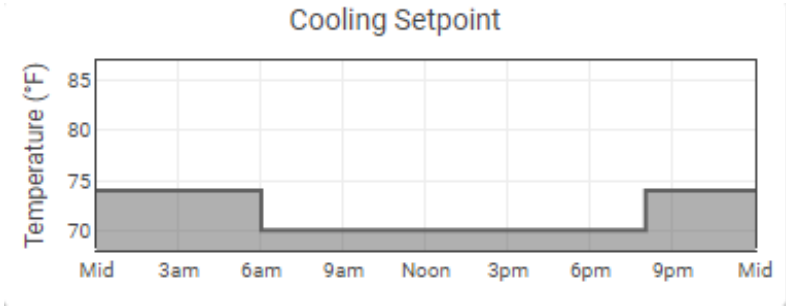
Occupied	*Unoccupied*
70 °F	74 °F

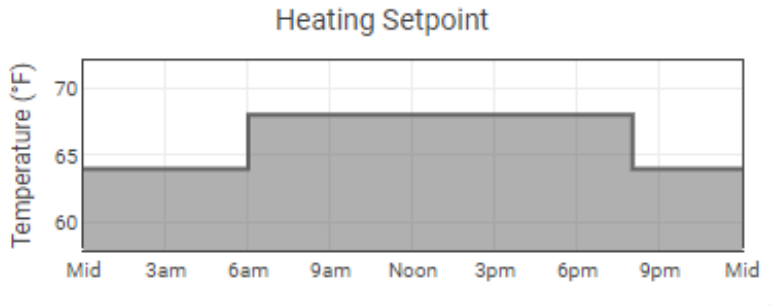
Heating Setpoint

Occupied	*Unoccupied*
68 °F	64 °F

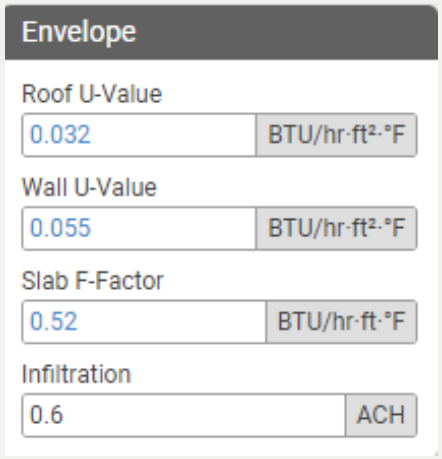
Setpoint Offset

Cooling	*Heating*
0 °F	0 °F

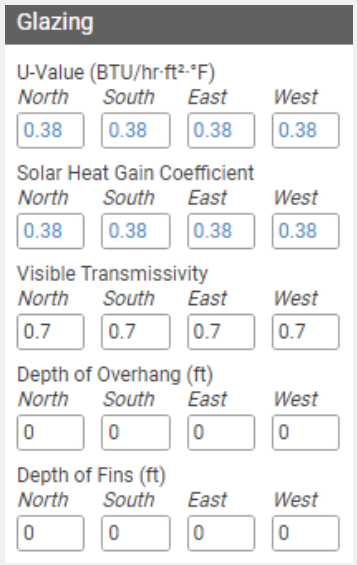




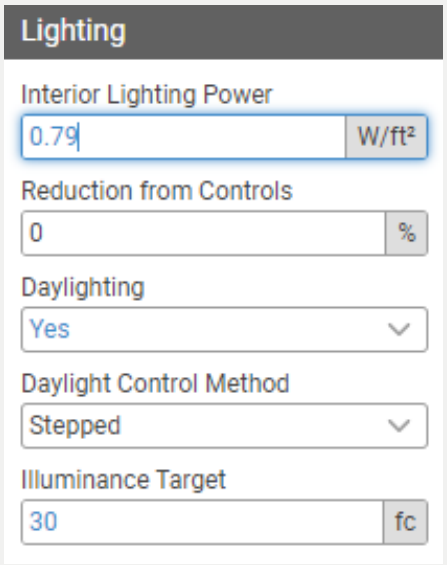
Baseline – Envelope and Lighting



Envelope



Glazing



Lighting

Medium office - HVAC

Heating and Cooling

Average Equipment Efficiency

Cooling		*Heating*	
13	EER	4.3	COP

Average DOAS Equipment Efficiency

Cooling		*Heating*	
13	EER	4.3	COP

Humidity Setpoint

Minimum		*Maximum*	
0	%	60	%

Fan Power

0.821 W/CFM

DOAS Fan Power

1.119 W/CFM

VAV Box Minimum

Not Used

Ventilation

Ventilation Rate

17 CFM/person

Ventilation Minimum Flow Fraction

0

Air-Side Economizer

Yes

Demand Control Ventilation

No

Energy Recovery Ventilation

No

ERV Type

Not Used

ERV Effectiveness

Not Used

Medium office - ECMs

1 – Upgrade Roof Insulation

Roof U-Value (BTU/hr·ft²·°F)

No Change	Better	Best	Custom	
0.032	0.03	**0.028**		Office

2 – Upgrade Wall Insulation

Wall U-Value (BTU/hr·ft²·°F)

No Change	Better	Best	Custom	
0.055	0.043	**0.036**		Office

3 – Improve Glazing U-Value

Glazing U-Value – North (BTU/hr·ft²·°F)

No Change	Better	Best	Custom	
0.38	0.34	**0.3**		Office

Glazing U-Value – South (BTU/hr·ft²·°F)

No Change	Better	Best	Custom	
0.38	0.34	**0.3**		Office

Glazing U-Value – East (BTU/hr·ft²·°F)

No Change	Better	Best	Custom	
0.38	0.34	**0.3**		Office

Glazing U-Value – West (BTU/hr·ft²·°F)

No Change	Better	Best	Custom	
0.38	0.34	**0.3**		Office

4 – Improve Glazing SHGC

Glazing Solar Heat Gain Coefficient – North

No Change	Better	Best	Custom	
0.38	0.3	**0.25**		Office

Glazing Solar Heat Gain Coefficient – South

No Change	Better	Best	Custom	
0.38	0.3	**0.25**		Office

Glazing Solar Heat Gain Coefficient – East

No Change	Better	Best	Custom	
0.38	0.3	**0.25**		Office

Glazing Solar Heat Gain Coefficient – West

No Change	Better	Best	Custom	
0.38	0.3	**0.25**		Office

5 – Efficient Interior Lighting

Interior Lighting Power (W/ft²)

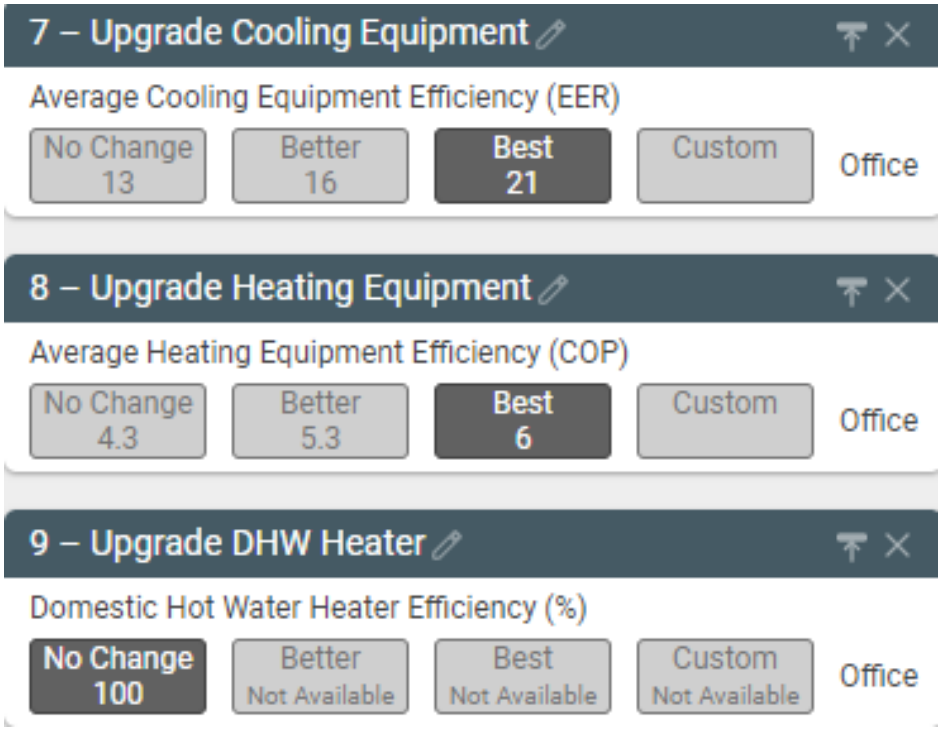
No Change	Better	Best	Custom	
0.79	0.65	**0.5**		Office

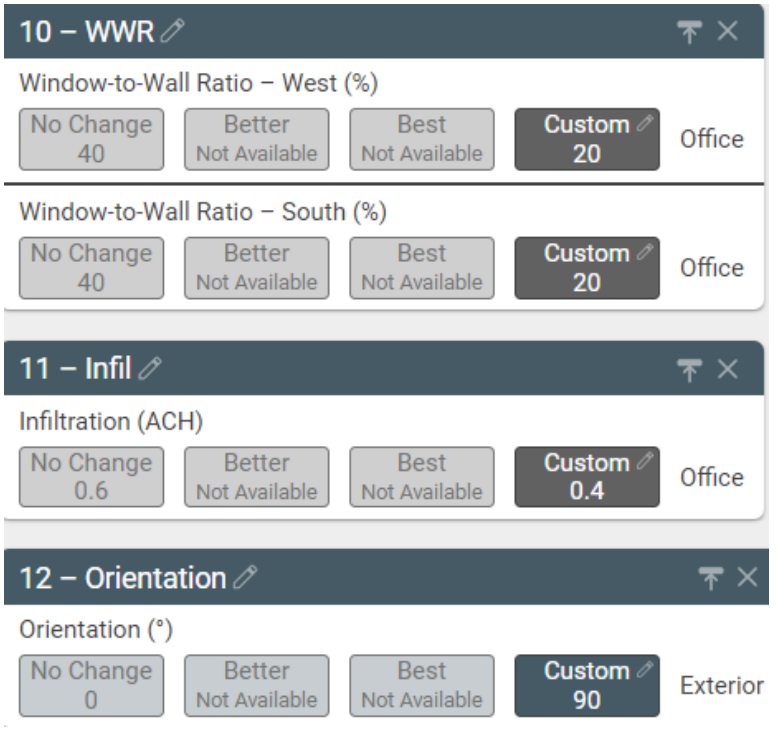
6 – Efficient Exterior Lighting

Exterior Lighting Power (kW)

No Change	Better	Best	Custom	
3.93	2.67	**1.46**		Exterior

Medium office - ECMs

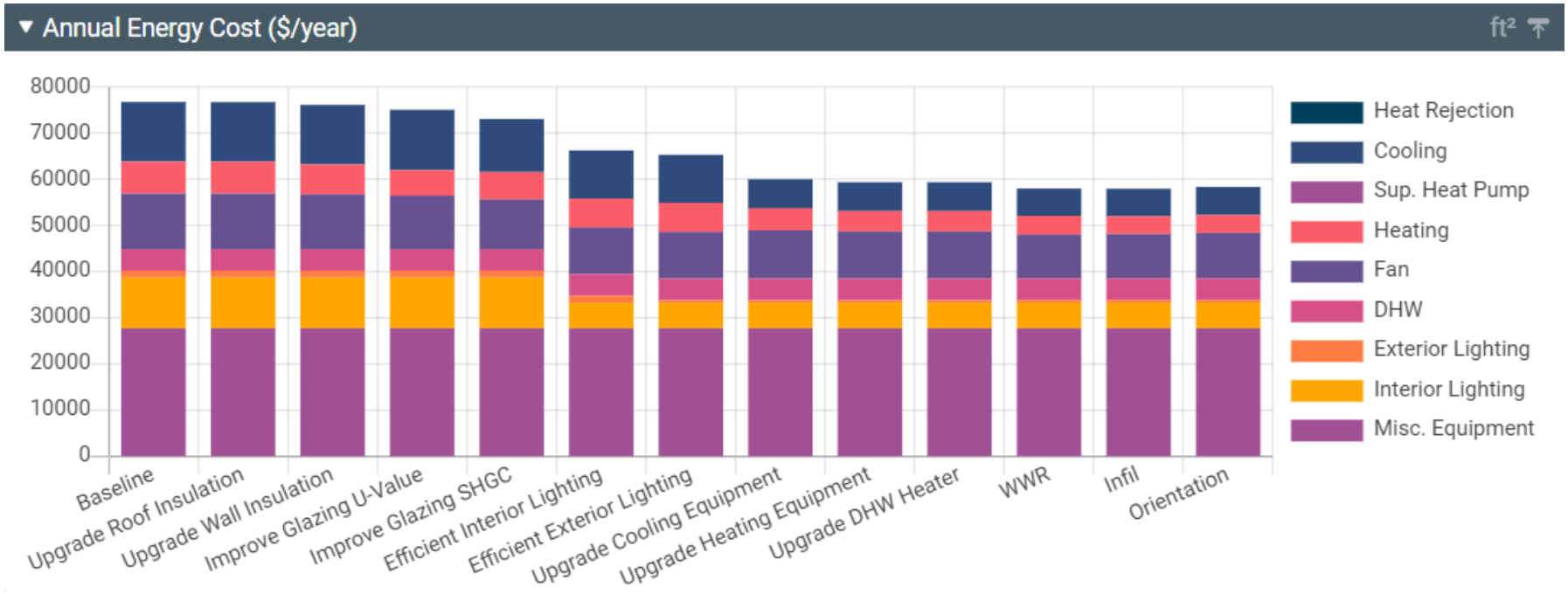




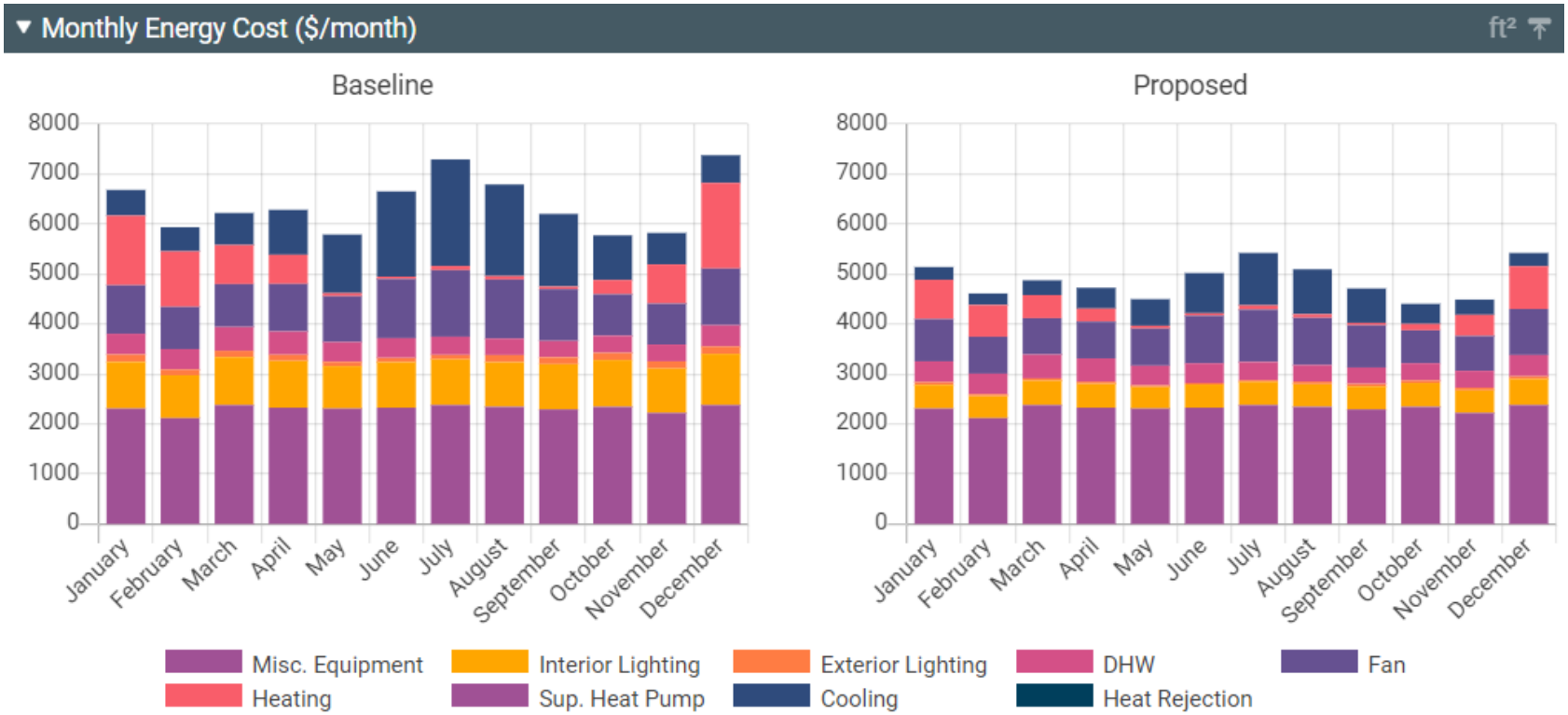
Results – Annual energy use summary

Annual Summary	Baseline	Proposed	Absolute Savings	Relative Savings
Energy Cost ($)	85,902	64,646	21,256	25%
Electric Consumption (kWh)	954,422	718,227	236,195	25%
Natural Gas Consumption (therm)	7	7	0	0%
Site EUI (kBtu/ft²)	54.3	40.9	13.4	25%
Source EUI (kBtu/ft²)	152	114.4	37.6	25%
CO_2 Equivalent (kg of CO_2e)	354,128	266,498	87,630	25%

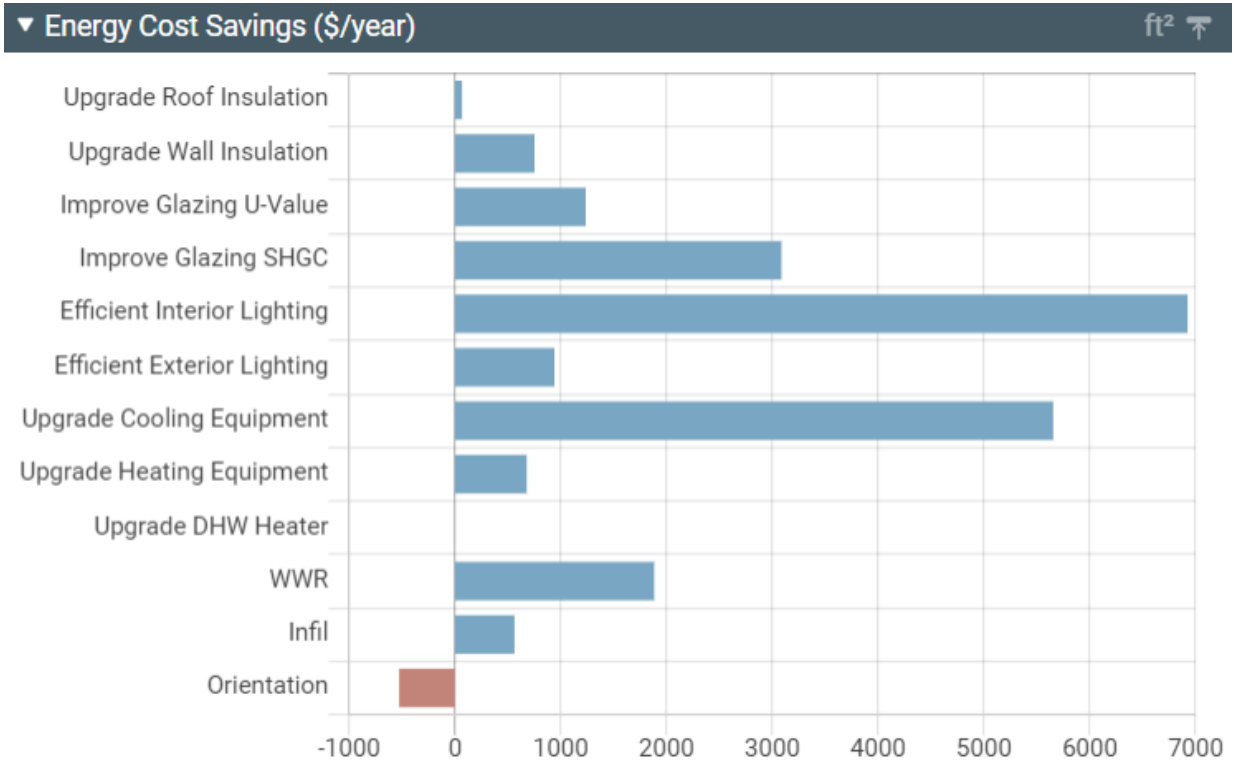
Results – Annual energy cost



Results – Monthly energy cost



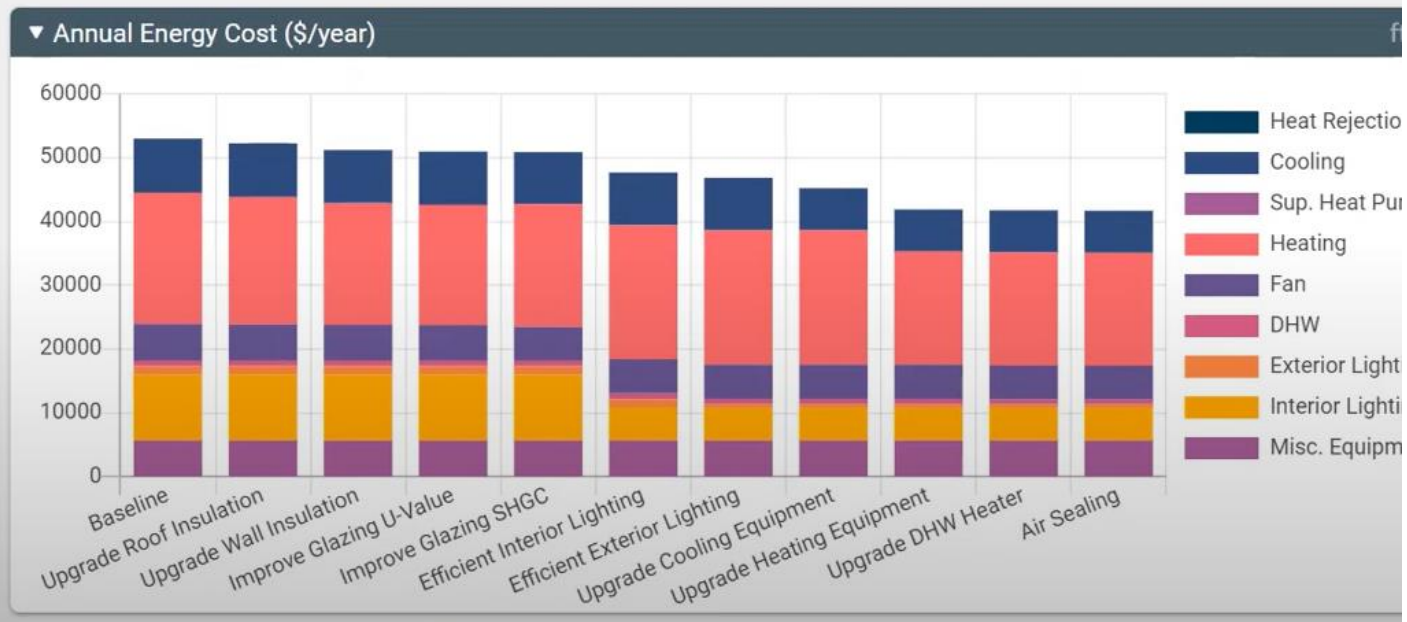
Results – Monthly energy cost



PROJECT DESIGN SCHEDULES BASELINE MEASURES RESULTS

Annual Summary ft²

	Baseline	Proposed	Absolute Savings	Relative Savings
Energy Cost ($)	53,374	42,089	11,285	21%
Electric Consumption (kWh)	354,617	263,156	91,460	26%
Natural Gas Consumption (therm)	30,965	26,559	4,406	14%
Site EUI (kBtu/ft²)	39.1	32.3	6.8	17%
Source EUI (kBtu/ft²)	60.4	48.2	12.1	20%
CO_2 Equivalent (kg of CO_2e)	295,675	238,391	57,284	19%



Create lessons

- Demonstrate how building systems interact
- Explain energy savings beyond code baseline
- Discuss energy efficiency measures that have the most impact
- Examine pathways to net zero buildings
- Identify carbon impacts
- Model your own school

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https://slipstreamdemo.paperform.co/

Learn more about Sketchbox for your classroom

- Received a **grant** to support lessons for tech colleges and high schools
- Looking for **teachers** to help guide the lessons so it is suitable for learning.
- **Inspire** students to consider careers in the emerging clean energy sector
- **Contact us** if interested to pilot Sketchbox in your class or to learn more.

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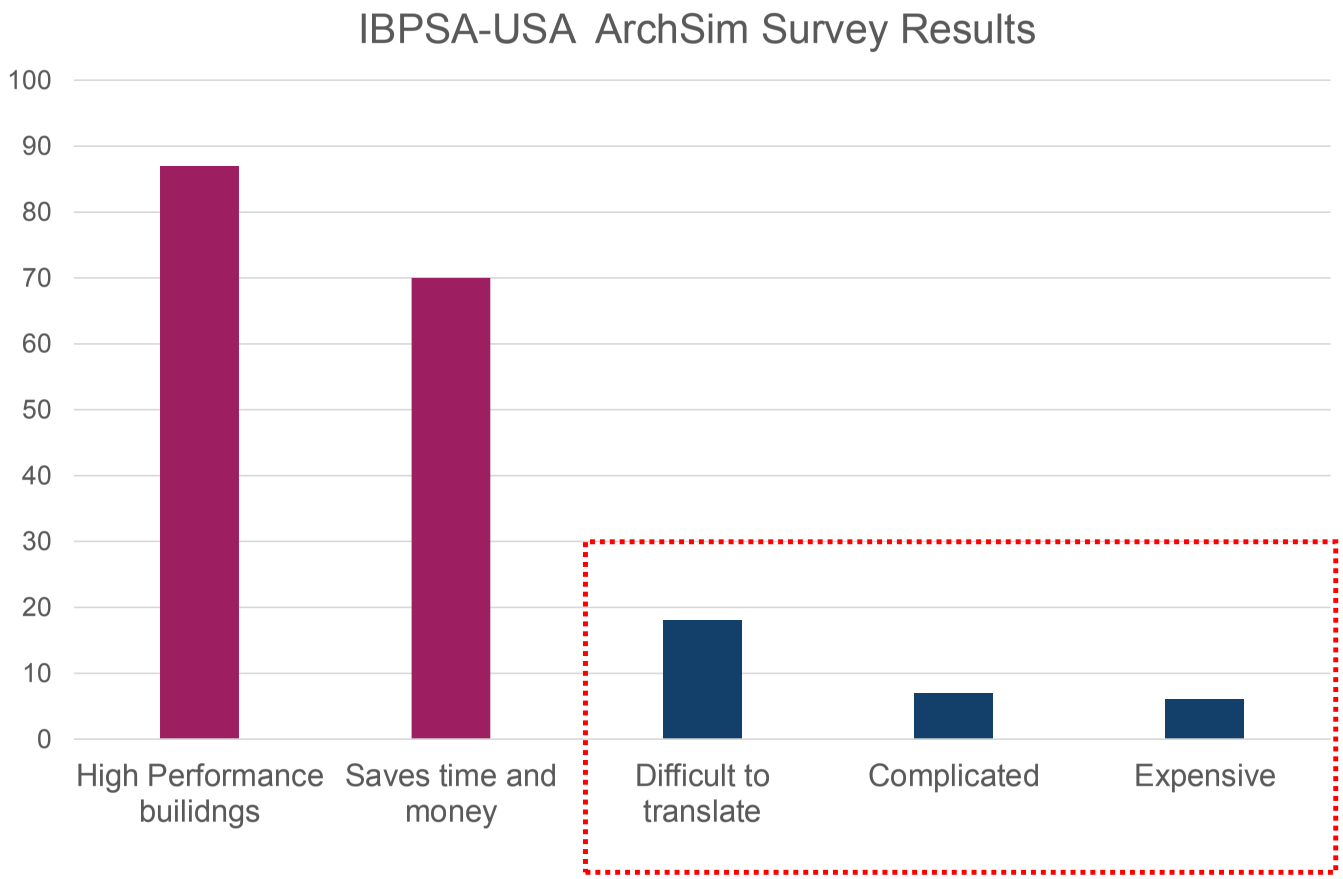
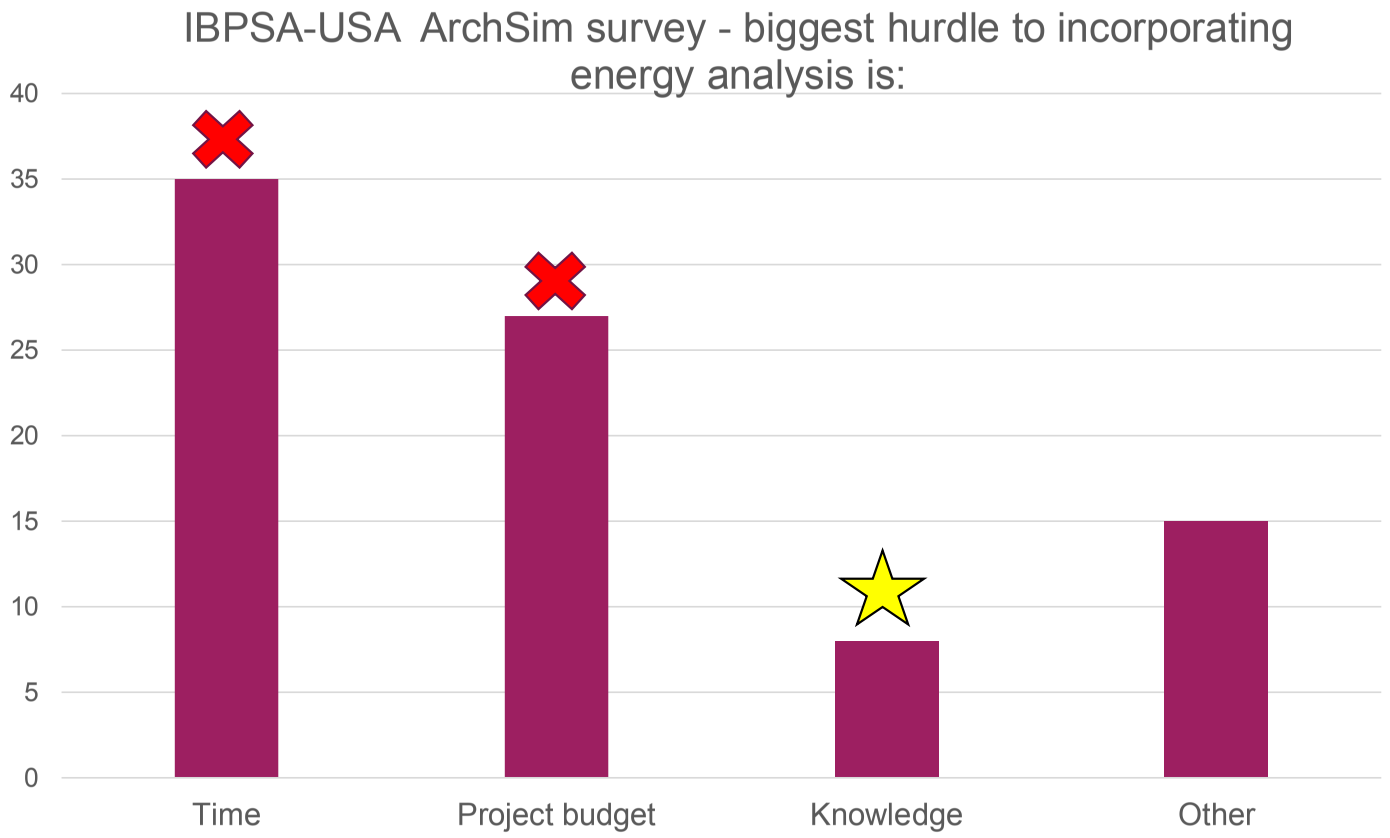
Backup

Early design modeling



Early design modeling



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What is BEM?

"Whole-Building Energy Modeling (BEM) is a versatile, multipurpose tool that is used in new building and retrofit design, code compliance, green certification, qualification for tax credits and utility incentives, and real-time building control. BEM is also used in large-scale analyses to develop building energy-efficiency codes and inform policy decisions." (Energy.gov)

- **Architectural Design**
- **HVAC Design and Operation**
- **Building Performance Rating**
- **Building Stock Analysis**