#Task 1

***Solar radiation** is radiant energy emitted by the sun from a nuclear fusion reaction that creates electromagnetic energy.

The spectrum of solar radiation is close to that of a black body with a temperature of about 5800 K. About half of the radiation is in the visible short-wave part of the electromagnetic spectrum.

The other half is mostly in the near-infrared part, with some in the ultraviolet part of the spectrum.

The solar radiation we receive on the Earth is attenuated both in spectral distribution and in total irradiance because of dispersion and absorption phenomena.

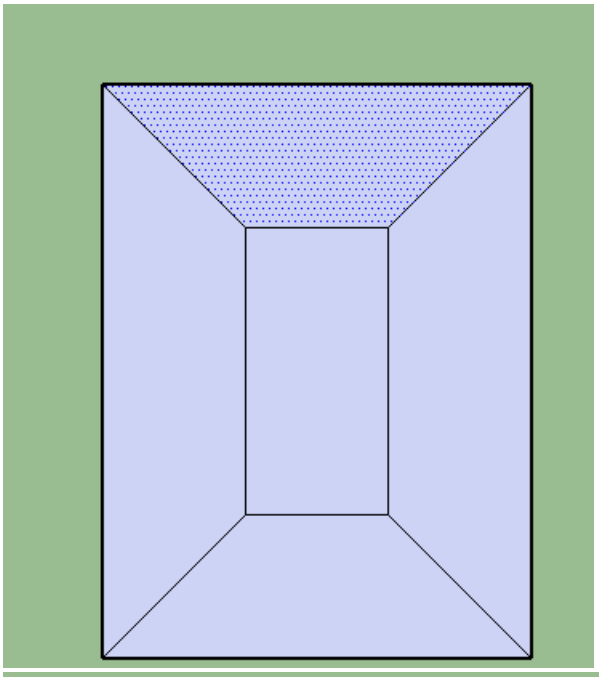
***(Absorption):** Solar radiation absorption is due to some atmospheric components, especially ozone, water and carbon dioxide. Stratospheric ozone absorbs almost all the ultraviolet component of the solar radiation for wavelength less than 0.29 µm, water vapor has important absorption bands in the infrared field, centered at 1.0, 1.4, and 1.8 µm. Over 2.5 µm the atmosphere becomes practically opaque to solar radiation for the strong absorption due to water and carbon dioxide.

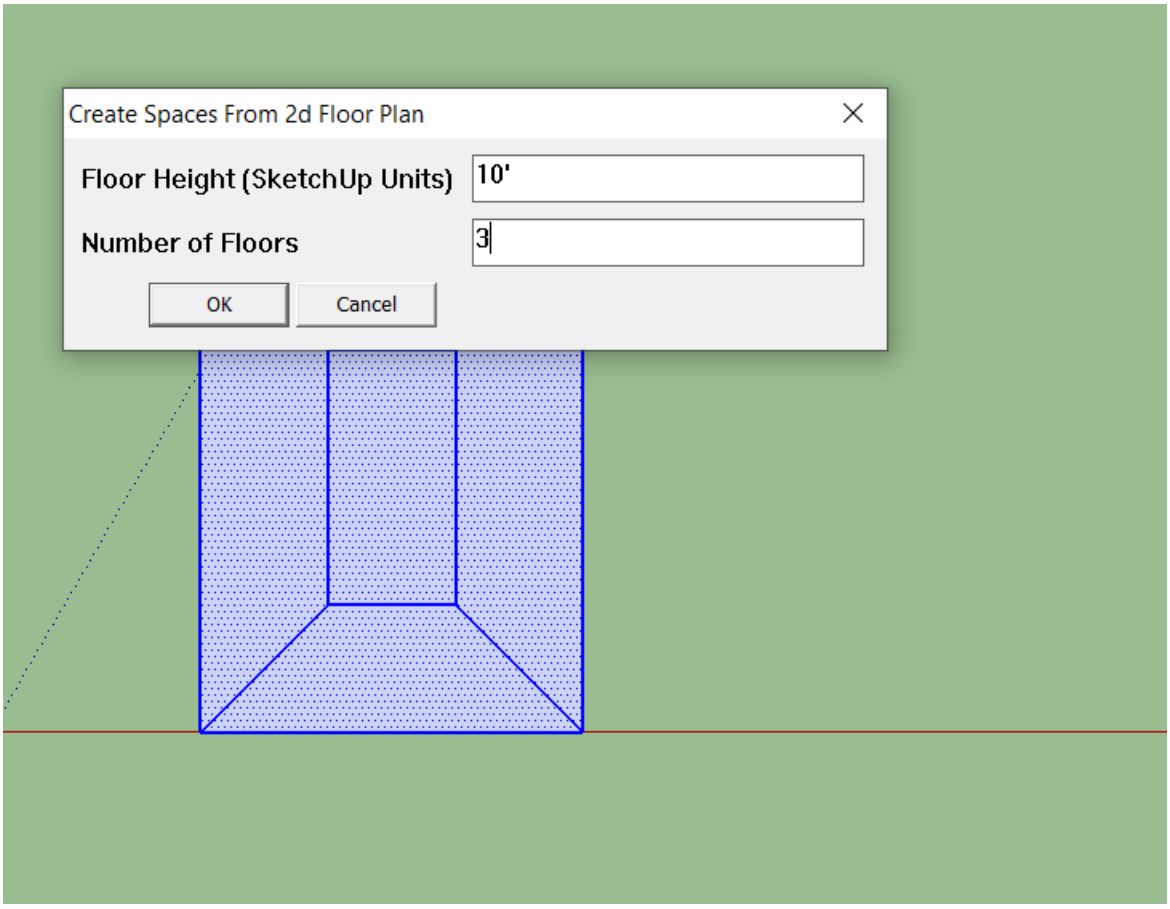
***(Availability):** The solar radiation, available on the Earth's surface for conversion in other energy forms, depends on the sun position, the weather condition, the site altitude over the sea level, and the daylight hours.

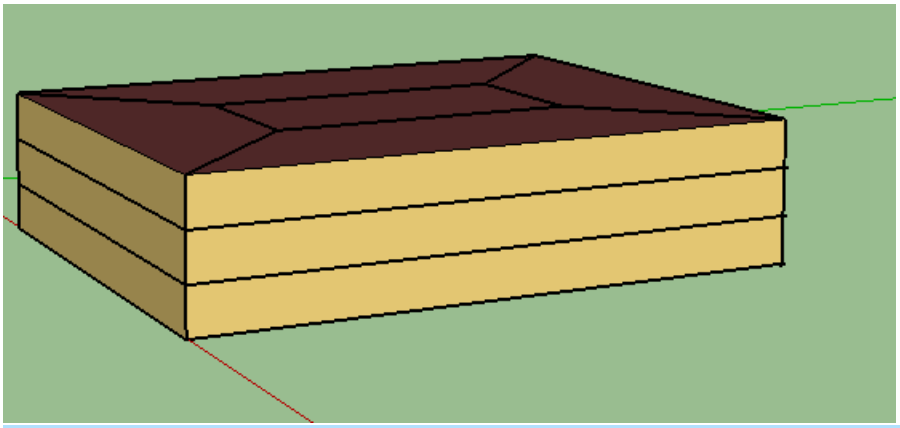
***(Diffuse and direct beam):** The solar radiation reaching the Earths surface can be divided into two types of solar radiation: Direct beam solar radiation and diffuse solar radiation. As sunlight passes through the atmosphere, some of it enters the surface of the Earth direct and undisturbed - the so-called beam solar radiation. Beam solar radiation throws sharp shadows and can be focused. Another component of sunlight is the diffuse solar radiation, on its way through the atmosphere it is absorbed, scattered, or reflected by dust, water vapor, clouds, pollutants, etc. Diffuse solar radiation does not throw sharp shadows and cannot be focused. The sum of the diffuse and direct beam solar radiation is called global solar radiation.

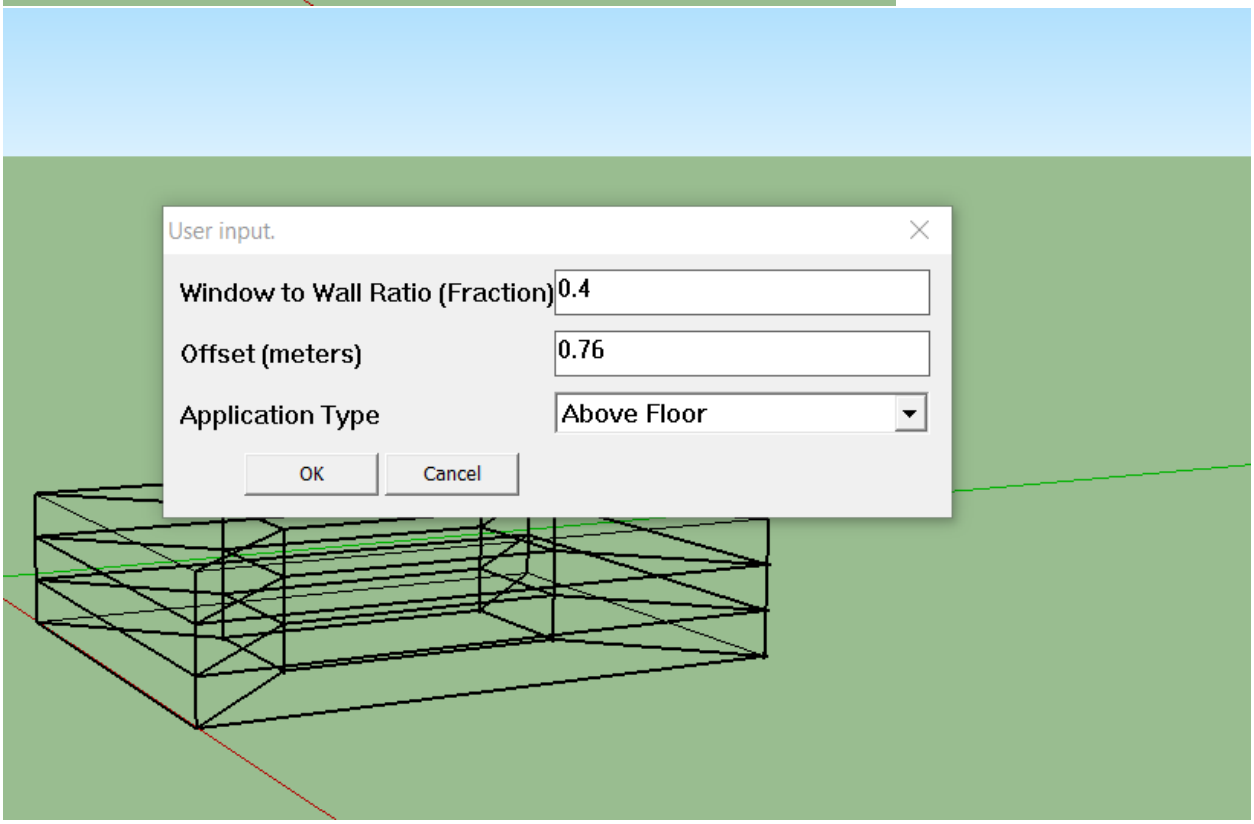
***(Density):** The maximum yearly average solar radiation density is the solar constant, which is the solar irradiance, its value is 1367 W/m2 .

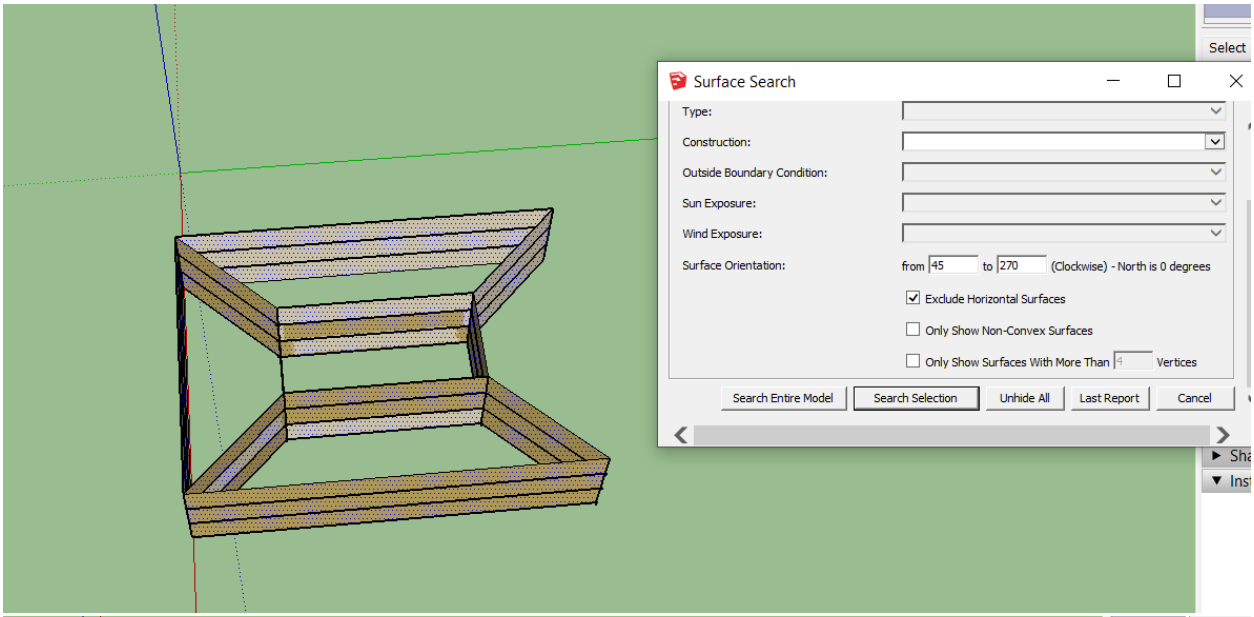
#Task 2

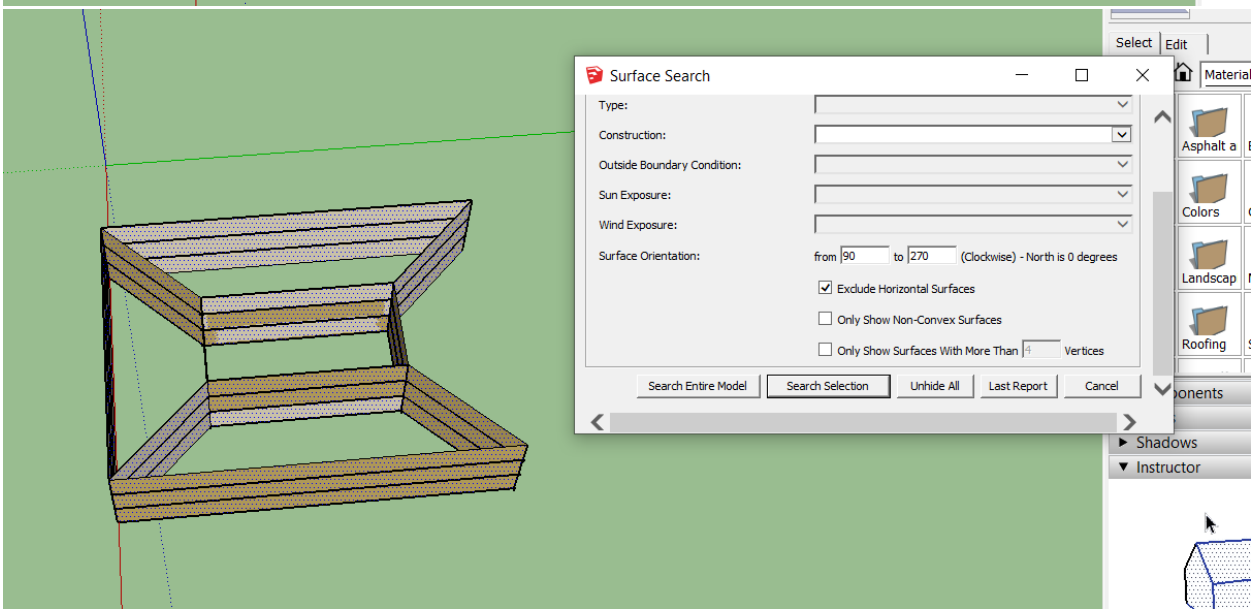


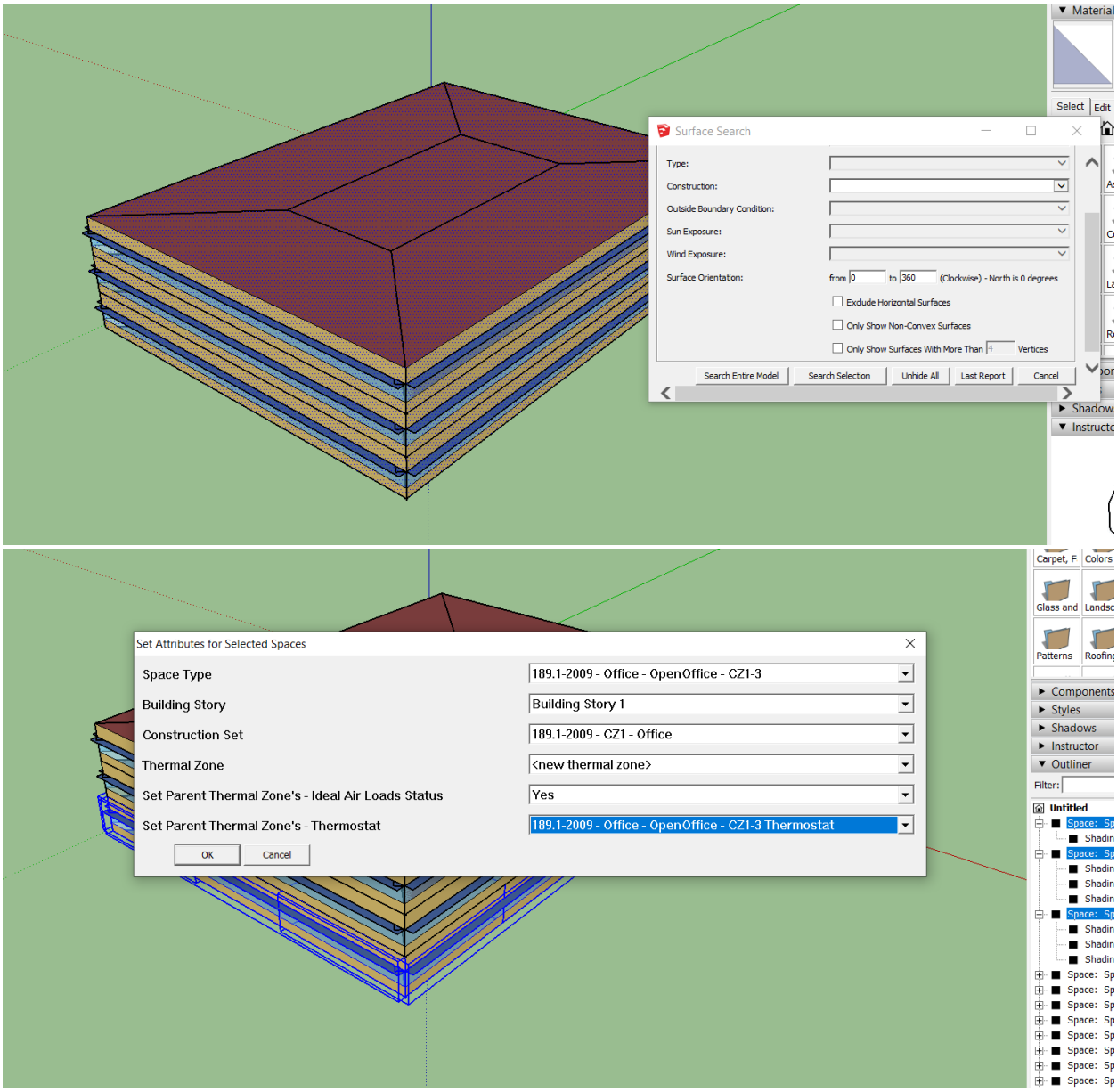

Create Spaces From 2d Floor Plan
Floor Height (SketchUp Units)
10'
Number of Floors
3
OK
Cancel

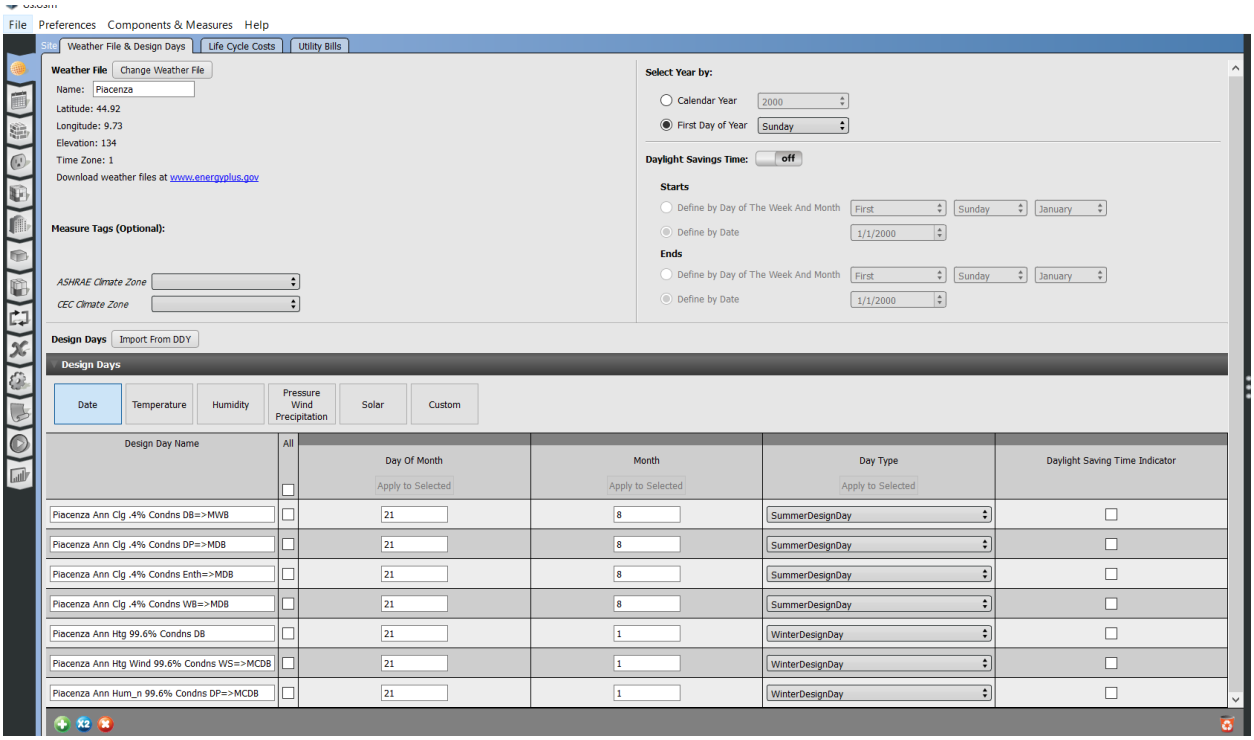


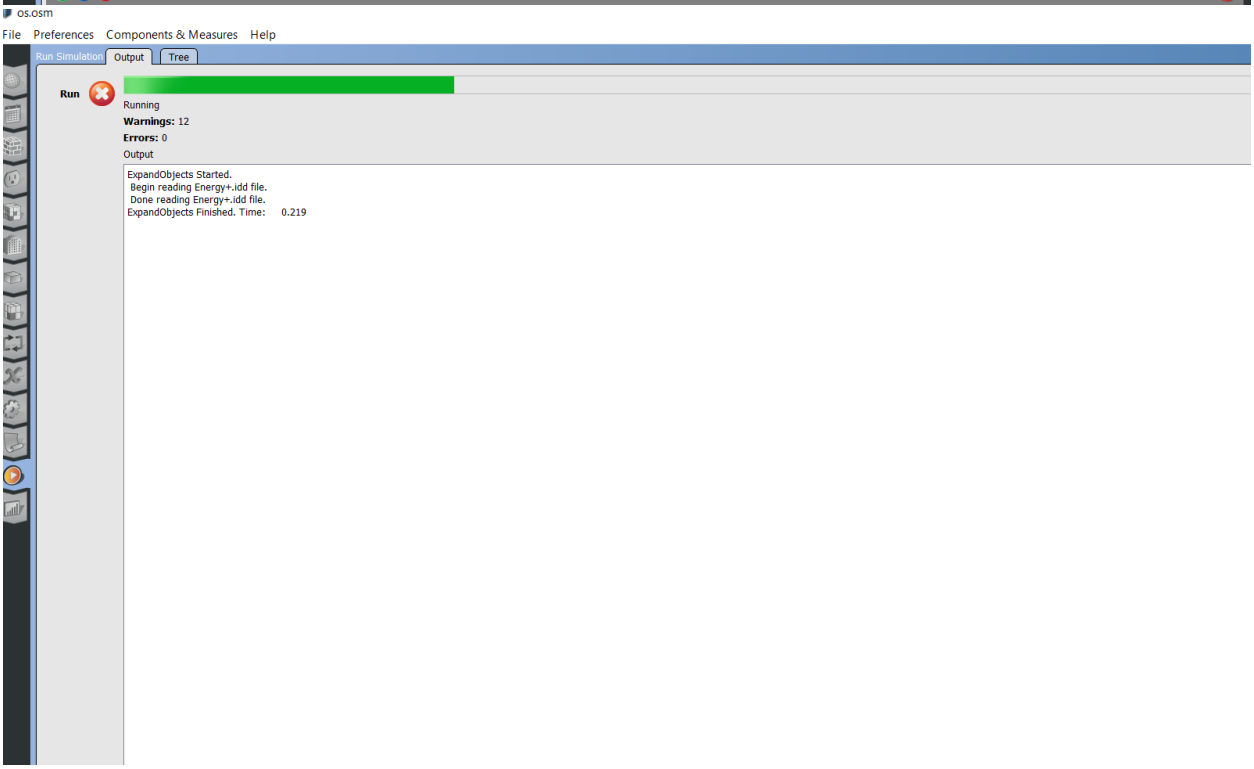

User input.
Window to Wall Ratio (Fraction)
0.4
Offset (meters)
0.76
Application Type
Above Floor
OK
Cancel

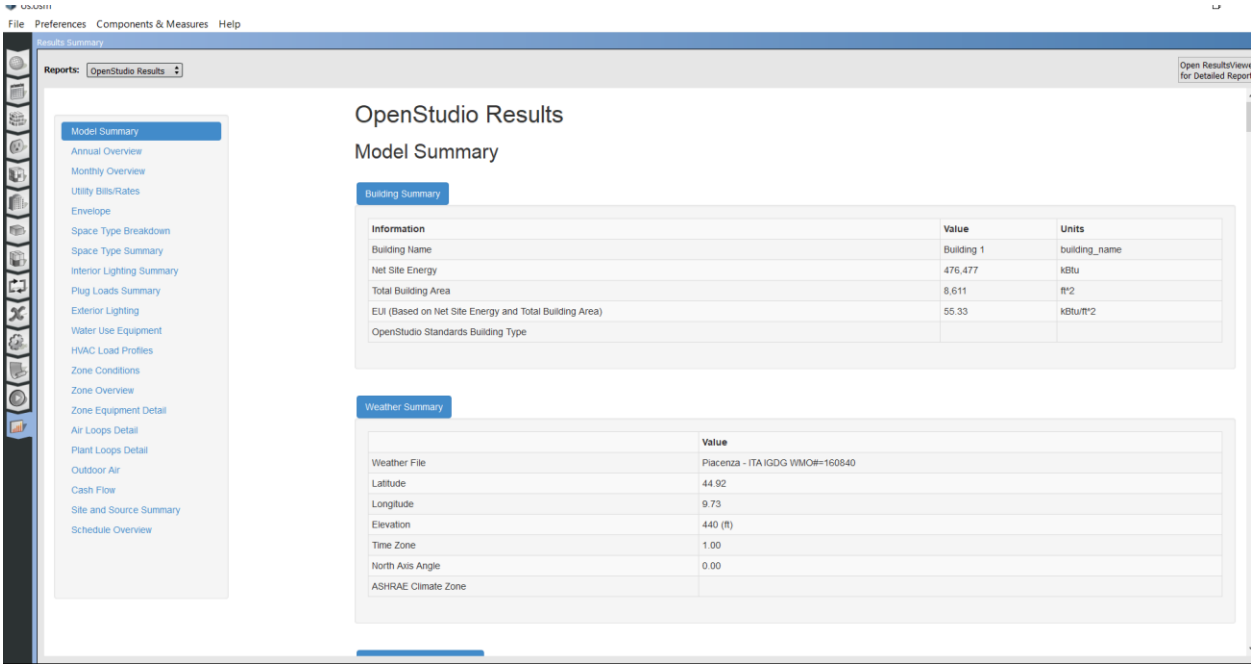

Select
Surface Search
Type:
Construction:
Outside Boundary Condition:
Sun Exposure:
Wind Exposure:
Surface Orientation:
from 45 to 270 (Clockwise) - North is 0 degrees
Exclude Horizontal Surfaces
Only Show Non-Convex Surfaces
Only Show Surfaces With More Than 4 Vertices
Search Entire Model
Search Selection
Unhide All
Last Report
Cancel

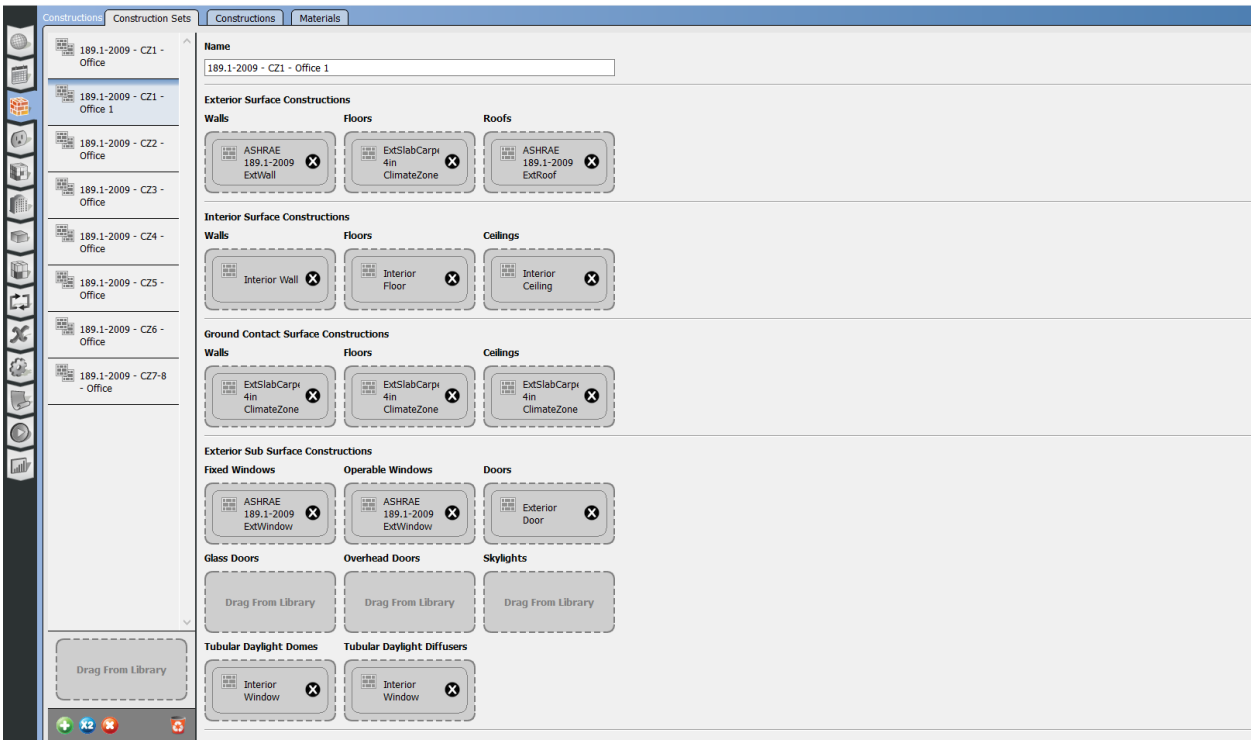

Select
Edit
Material
Surface Search
Type:
Construction:
Outside Boundary Condition:
Sun Exposure:
Wind Exposure:
Surface Orientation:
from 90 to 270 (Clockwise) - North is 0 degrees
Exclude Horizontal Surfaces
Only Show Non-Convex Surfaces
Only Show Surfaces With More Than 4 Vertices
Search Entire Model
Search Selection
Unhide All
Last Report
Cancel
Asphalt a
Colors
Landscap
Roofing
Shadows
Instructor

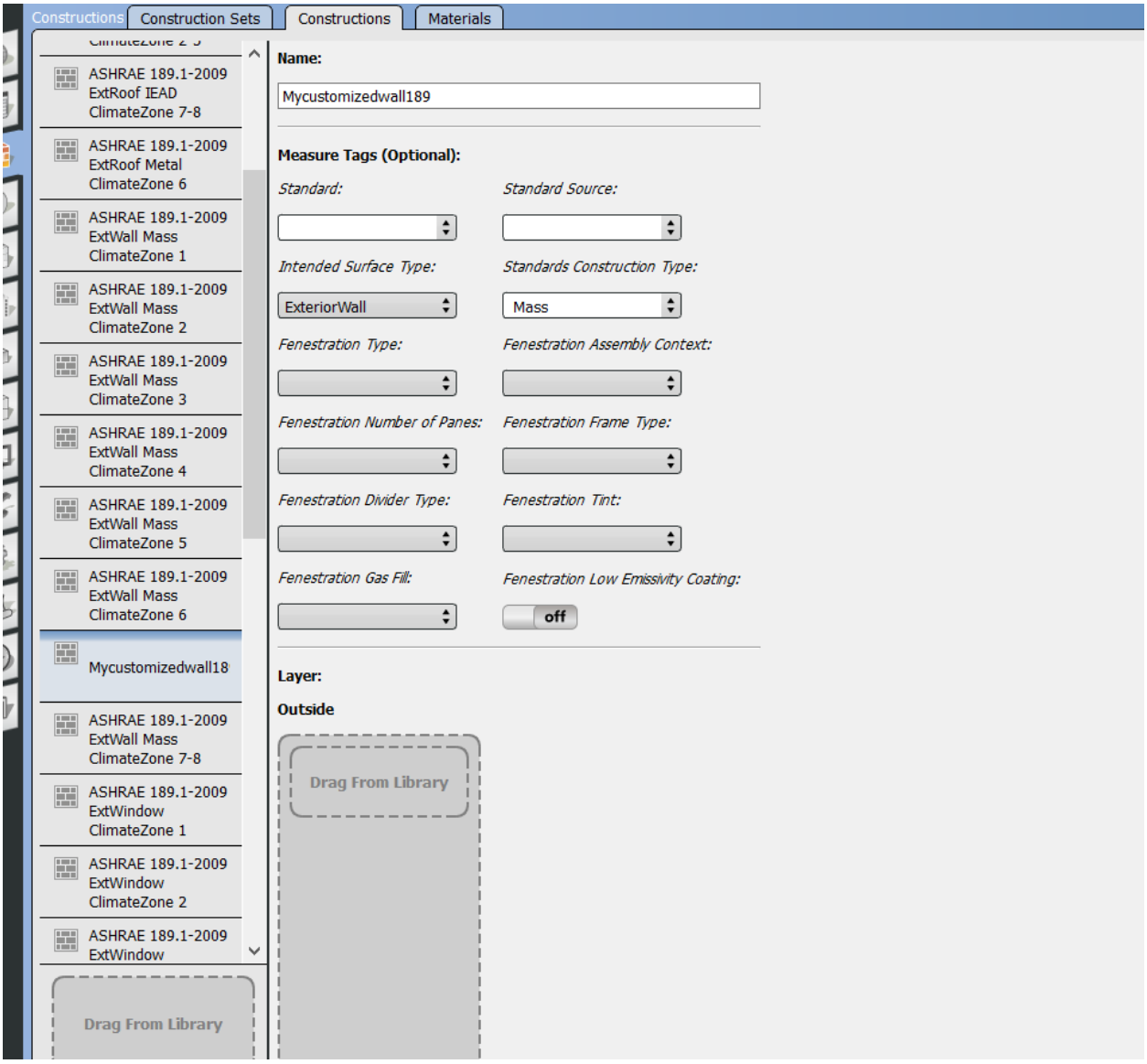

Surface Search
Type:
Construction:
Outside Boundary Condition:
Sun Exposure:
Wind Exposure:
Surface Orientation:
from 0 to 360 (Clockwise) - North is 0 degrees
Exclude Horizontal Surfaces
Only Show Non-Convex Surfaces
Only Show Surfaces With More Than Vertices
Search Entire Model
Search Selection
Unhide All
Last Report
Cancel
Material
Select
Edit
Shadow
Instructo
Set Attributes for Selected Spaces
Space Type
189.1-2009 - Office - OpenOffice - CZ1-3
Building Story
Building Story 1
Construction Set
189.1-2009 - CZ1 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
189.1-2009 - Office - OpenOffice - CZ1-3 Thermostat
OK
Cancel
Components
Styles
Shadows
Instructor
Outliner
Filter:
Untitled

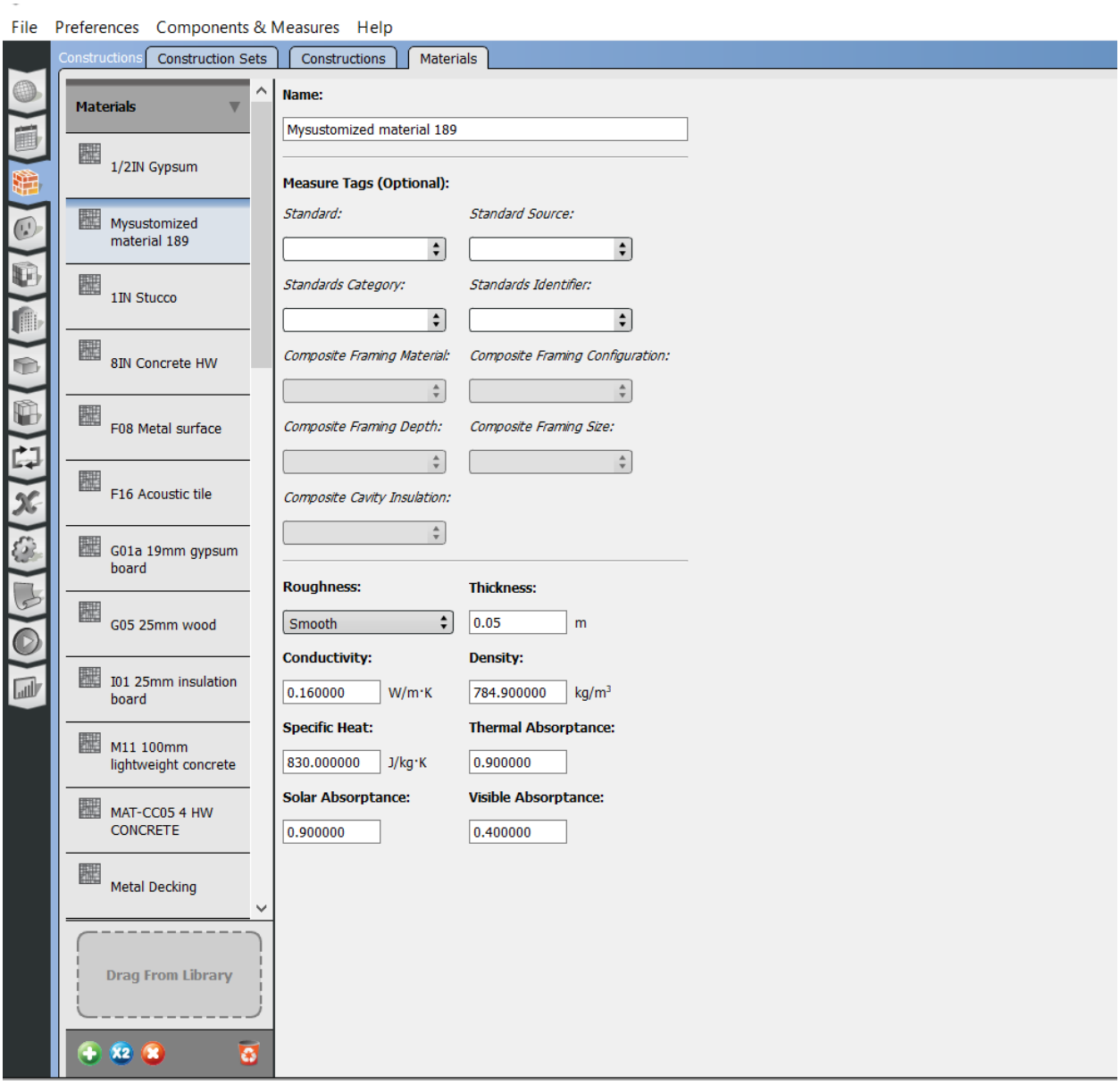

File Preferences Components & Measures Help
Site
Weather File & Design Days
Life Cycle Costs
Utility Bills
Weather File
Change Weather File
Name: Piacenza
Latitude: 44.92
Longitude: 9.73
Elevation: 134
Time Zone: 1
Download weather files at www.energyplus.gov
Measure Tags (Optional):
ASHRAE Climate Zone
CEC Climate Zone
Select Year by:
Calendar Year 2000
First Day of Year Sunday
Daylight Savings Time: off
Starts
Define by Day of The Week And Month First Sunday January
Define by Date 1/1/2000
Ends
Define by Day of The Week And Month First Sunday January
Define by Date 1/1/2000
Design Days
Import From DDY
Design Days
Date
Temperature
Humidity
Pressure Wind Precipitation
Solar
Custom
Design Day Name
All
Day Of Month
Apply to Selected
Month
Apply to Selected
Day Type
Apply to Selected
Daylight Saving Time Indicator
Piacenza Ann Clg .4% Condns DB=>MWB 21 8 SummerDesignDay
Piacenza Ann Clg .4% Condns DP=>MDB 21 8 SummerDesignDay
Piacenza Ann Clg .4% Condns Enth=>MDB 21 8 SummerDesignDay
Piacenza Ann Clg .4% Condns WB=>MDB 21 8 SummerDesignDay
Piacenza Ann Htg 99.6% Condns DB 21 1 WinterDesignDay
Piacenza Ann Htg Wind 99.6% Condns WS=>MCDB 21 1 WinterDesignDay
Piacenza Ann Hum_n 99.6% Condns DP=>MCDB 21 1 WinterDesignDay

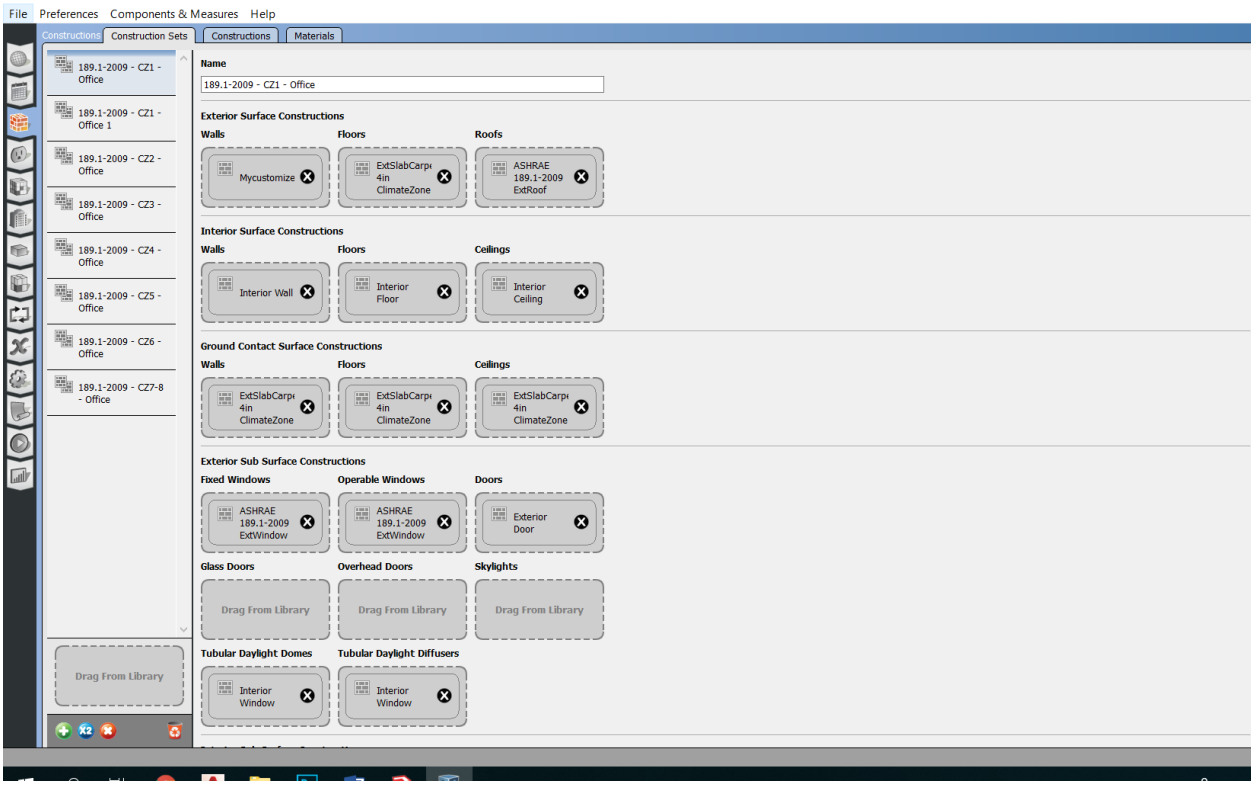

os.osm
File Preferences Components & Measures Help
Run Simulation
Output
Tree
Run
Running
Warnings: 12
Errors: 0
Output
ExpandObjects Started.
Begin reading Energy+.idd file.
Done reading Energy+.idd file.
ExpandObjects Finished. Time: 0.219


File Preferences Components & Measures Help
Results Summary
Reports: OpenStudio Results
Open ResultsView for Detailed Report
Model Summary
Annual Overview
Monthly Overview
Utility Bills/Rates
Envelope
Space Type Breakdown
Space Type Summary
Interior Lighting Summary
Plug Loads Summary
Exterior Lighting
Water Use Equipment
HVAC Load Profiles
Zone Conditions
Zone Overview
Zone Equipment Detail
Air Loops Detail
Plant Loops Detail
Outdoor Air
Cash Flow
Site and Source Summary
Schedule Overview
OpenStudio Results
Model Summary
Building Summary
Information | Value | Units
Building Name | Building 1 | building_name
Net Site Energy | 476,477 | kBtu
Total Building Area | 8,611 | ft^2
EUI (Based on Net Site Energy and Total Building Area) | 55.33 | kBtu/ft^2
OpenStudio Standards Building Type
Weather Summary
Value
Weather File | Piacenza - ITA IGDG WMO#=160840
Latitude | 44.92
Longitude | 9.73
Elevation | 440 (ft)
Time Zone | 1.00
North Axis Angle | 0.00
ASHRAE Climate Zone


Constructions
Construction Sets
Constructions
Materials
189.1-2009 - CZ1 - Office
189.1-2009 - CZ1 - Office 1
189.1-2009 - CZ2 - Office
189.1-2009 - CZ3 - Office
189.1-2009 - CZ4 - Office
189.1-2009 - CZ5 - Office
189.1-2009 - CZ6 - Office
189.1-2009 - CZ7-8 - Office
Drag From Library
Name
189.1-2009 - CZ1 - Office 1
Exterior Surface Constructions
Walls
Floors
Roofs
ASHRAE 189.1-2009 ExtWall
ExtSlabCarpet 4in ClimateZone
ASHRAE 189.1-2009 ExtRoof
Interior Surface Constructions
Walls
Floors
Ceilings
Interior Wall
Interior Floor
Interior Ceiling
Ground Contact Surface Constructions
Walls
Floors
Ceilings
ExtSlabCarpet 4in ClimateZone
Exterior Sub Surface Constructions
Fixed Windows
Operable Windows
Doors
ASHRAE 189.1-2009 ExtWindow
Exterior Door
Glass Doors
Overhead Doors
Skylights
Drag From Library
Tubular Daylight Domes
Tubular Daylight Diffusers
Interior Window


Constructions
Construction Sets
Constructions
Materials
ASHRAE 189.1-2009 ExtRoof IEAD ClimateZone 7-8
ASHRAE 189.1-2009 ExtRoof Metal ClimateZone 6
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 1
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 2
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 3
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 4
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 5
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 6
Mycustomizedwall18
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 7-8
ASHRAE 189.1-2009 ExtWindow ClimateZone 1
ASHRAE 189.1-2009 ExtWindow ClimateZone 2
ASHRAE 189.1-2009 ExtWindow
Drag From Library
Name:
Mycustomizedwall189
Measure Tags (Optional):
Standard:
Standard Source:
Intended Surface Type:
ExteriorWall
Standards Construction Type:
Mass
Fenestration Type:
Fenestration Assembly Context:
Fenestration Number of Panes:
Fenestration Frame Type:
Fenestration Divider Type:
Fenestration Tint:
Fenestration Gas Fill:
Fenestration Low Emissivity Coating:
off
Layer:
Outside
Drag From Library


File
Preferences
Components & Measures
Help
Constructions
Construction Sets
Constructions
Materials
Materials
1/2IN Gypsum
Mysustomized material 189
1IN Stucco
8IN Concrete HW
F08 Metal surface
F16 Acoustic tile
G01a 19mm gypsum board
G05 25mm wood
I01 25mm insulation board
M11 100mm lightweight concrete
MAT-CC05 4 HW CONCRETE
Metal Decking
Drag From Library
Name:
Mysustomized material 189
Measure Tags (Optional):
Standard:
Standard Source:
Standards Category:
Standards Identifier:
Composite Framing Material:
Composite Framing Configuration:
Composite Framing Depth:
Composite Framing Size:
Composite Cavity Insulation:
Roughness:
Smooth
Thickness:
0.05
m
Conductivity:
0.160000
W/m·K
Density:
784.900000
kg/m3
Specific Heat:
830.000000
J/kg·K
Thermal Absorptance:
0.900000
Solar Absorptance:
0.900000
Visible Absorptance:
0.400000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Help
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Construction Sets
Constructions
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189.1-2009 - CZ1 - Office
189.1-2009 - CZ1 - Office 1
189.1-2009 - CZ2 - Office
189.1-2009 - CZ3 - Office
189.1-2009 - CZ4 - Office
189.1-2009 - CZ5 - Office
189.1-2009 - CZ6 - Office
189.1-2009 - CZ7-8 - Office
Drag From Library
Name
189.1-2009 - CZ1 - Office
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