** Task 1** Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields ?

** Task 2** You should create a pdf file with screenshots of all of the steps we went through (clearly from your own file) and explain briefly the reason behind the use of each step (in your own words!)

** Task 1** Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields ?

$$Q_{net1-2} = \frac{\dot{Q}_{net2-1}}{A} = \frac{A\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} \div A = \frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$

$$= \frac{1.5 \times (5.67 \times 10^{-8}) \times (500^4 - 800^4)}{\frac{1}{0.2} + \frac{1}{0.7} - 1} \approx 3625.41W$$

The new heat transfer rate should be 1% of the q_{net1-2}

$$q_{net1-2} = \frac{1}{100} q_{net1-2}$$

$$= \frac{\sigma(T_2^4 - T_1^4)}{(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1) + N(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1)} = \frac{1}{100} \times \frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$

$$\rightarrow 100 \times (\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1) = (\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1) + N(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1)$$

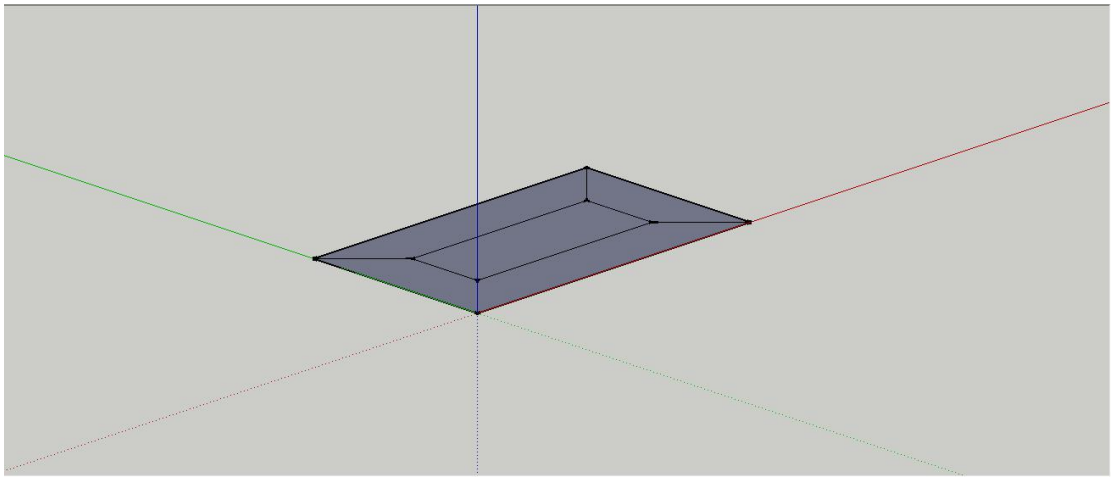
$$\rightarrow 99 \times (\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1) = N(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1)$$

$$\rightarrow N = 28$$

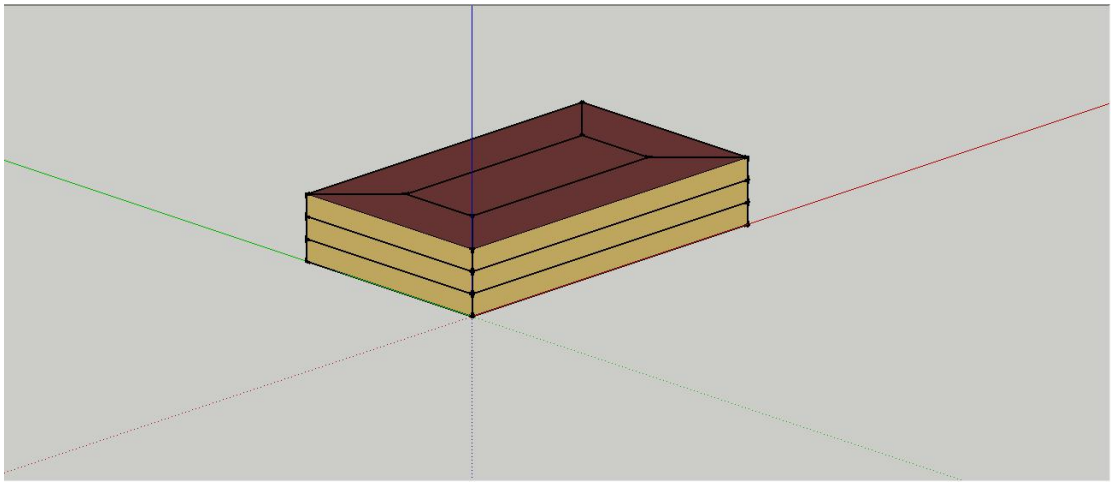
So we need 28 shields which $\varepsilon = 0.1$ for the new heat transfer rate be 1% of the previous rate without any shields.

** Task 2** You should create a pdf file with screenshots of all of the steps we went through (clearly from your own file) and explain briefly the reason behind the use of each step (in your own words!)

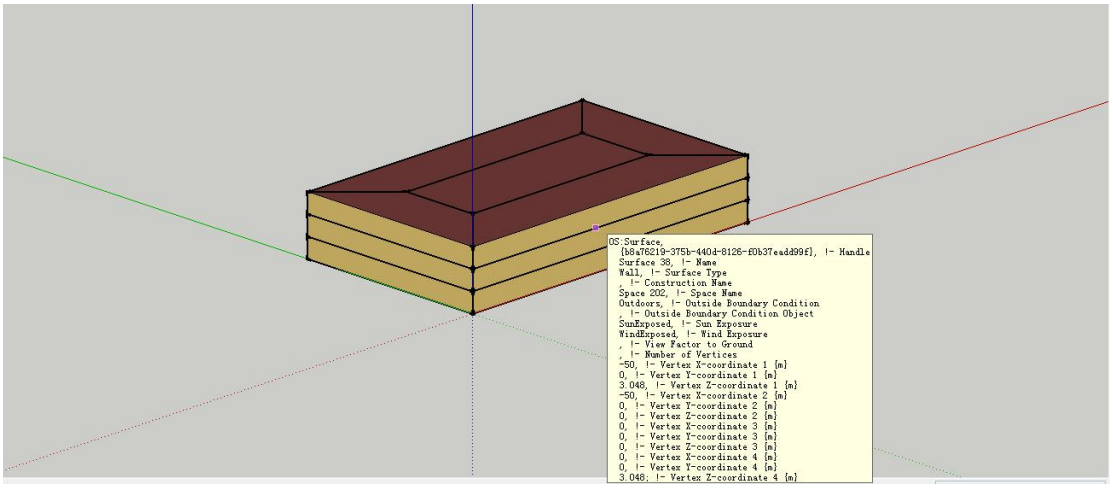
1. Draw the outline and shape of the building in Sketchup.



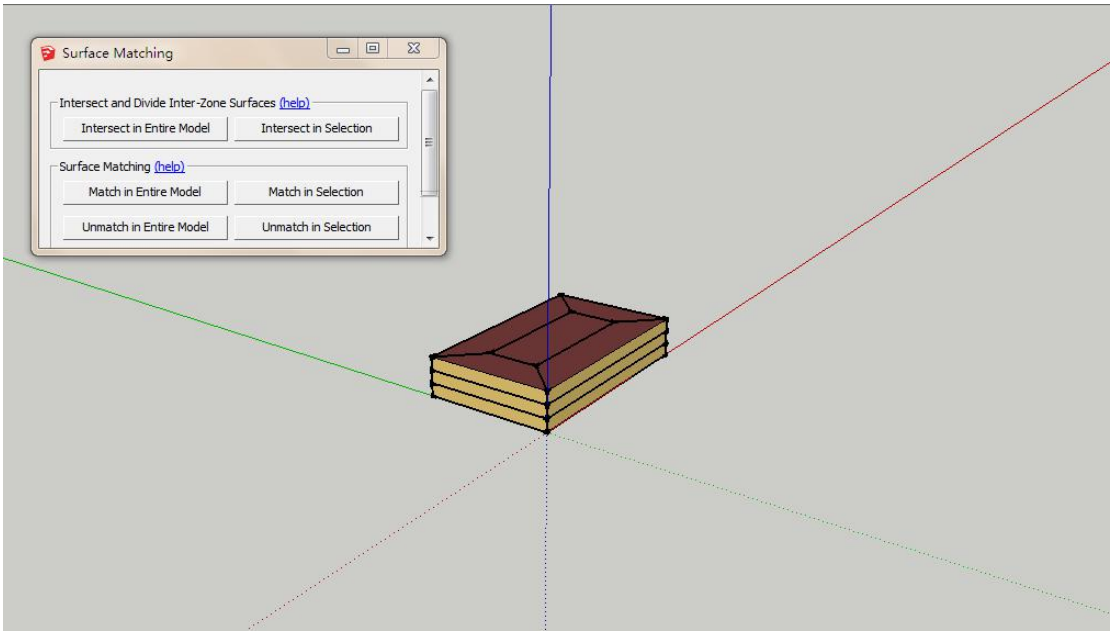
2. Use “Creat spaces from diagram”creat a 3 floor building.



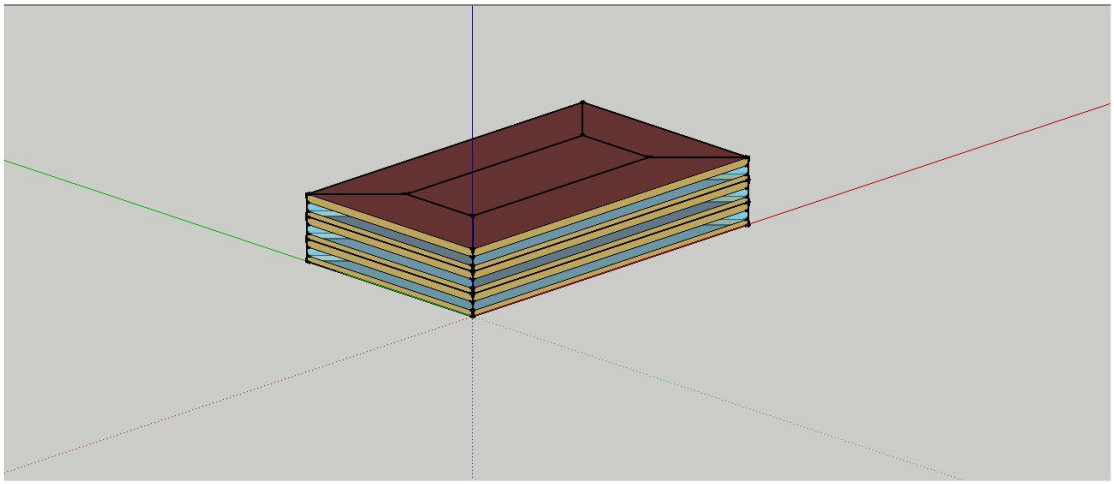
3. We can see the material information using the "Info tool".



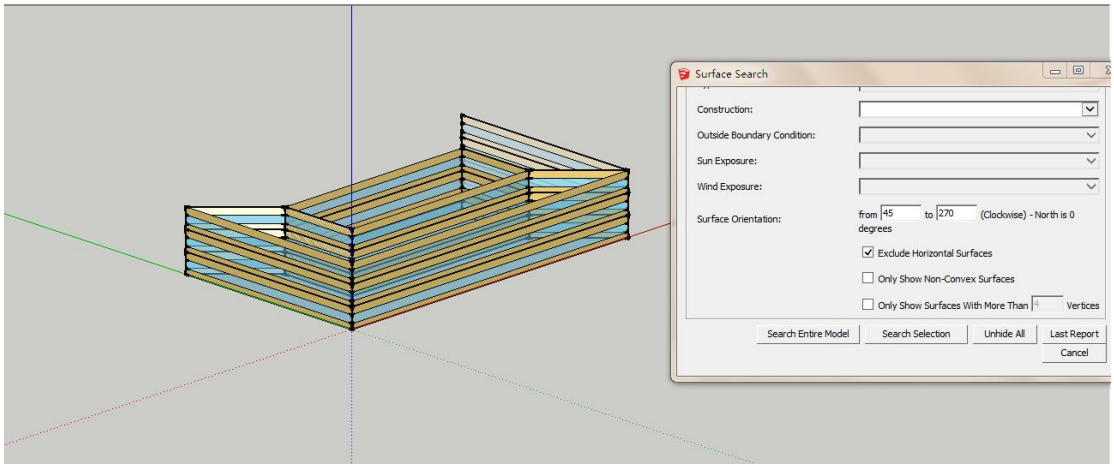
4. Click”Surface matching”.



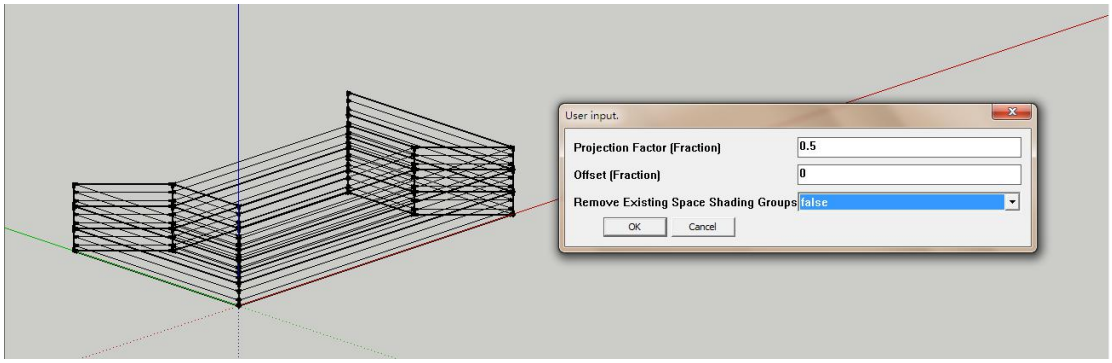
5. Click “Extensions-OpenStudio User Scripts-Alter or Add Model Elements- Set Window to Wall Ratio” to built the windows.

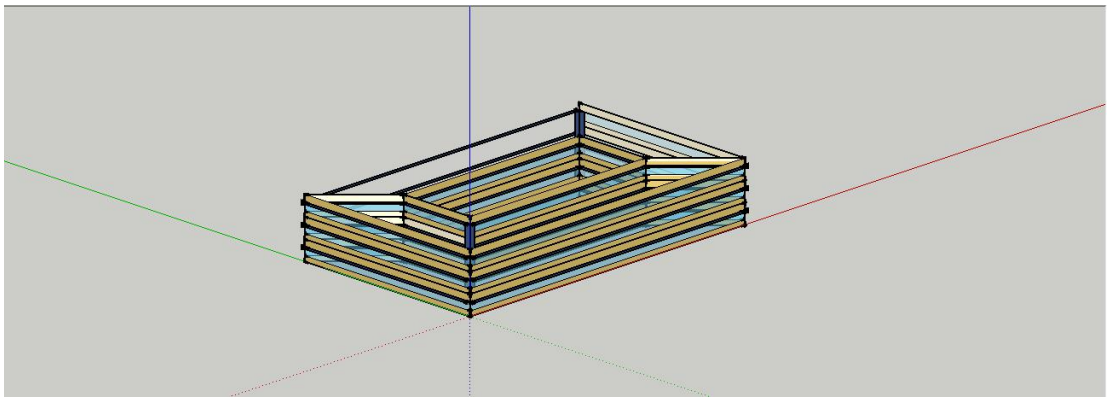


6. Check other directions besides the north.

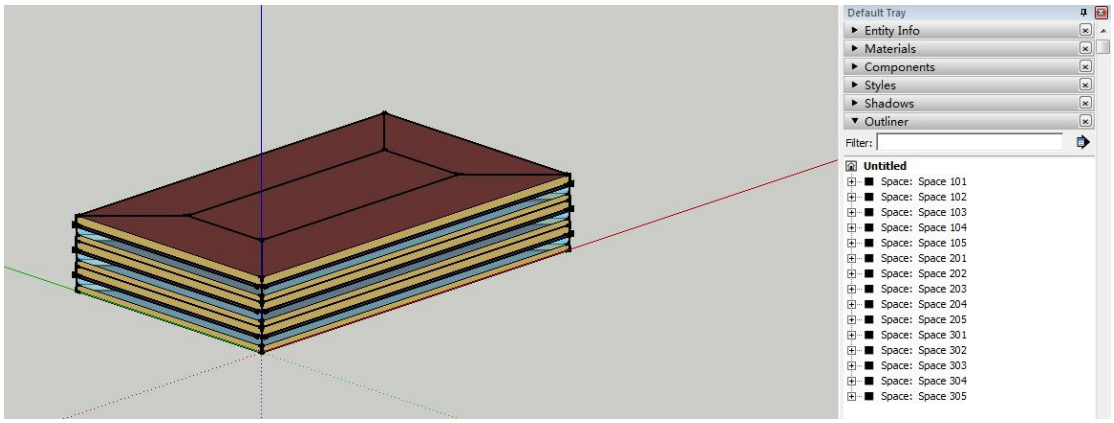


7.Click “Extensions-OpenStudio User Scripts-Alter or Add Model Elements Add Overhanges by Projection Factor” to built overhangs.

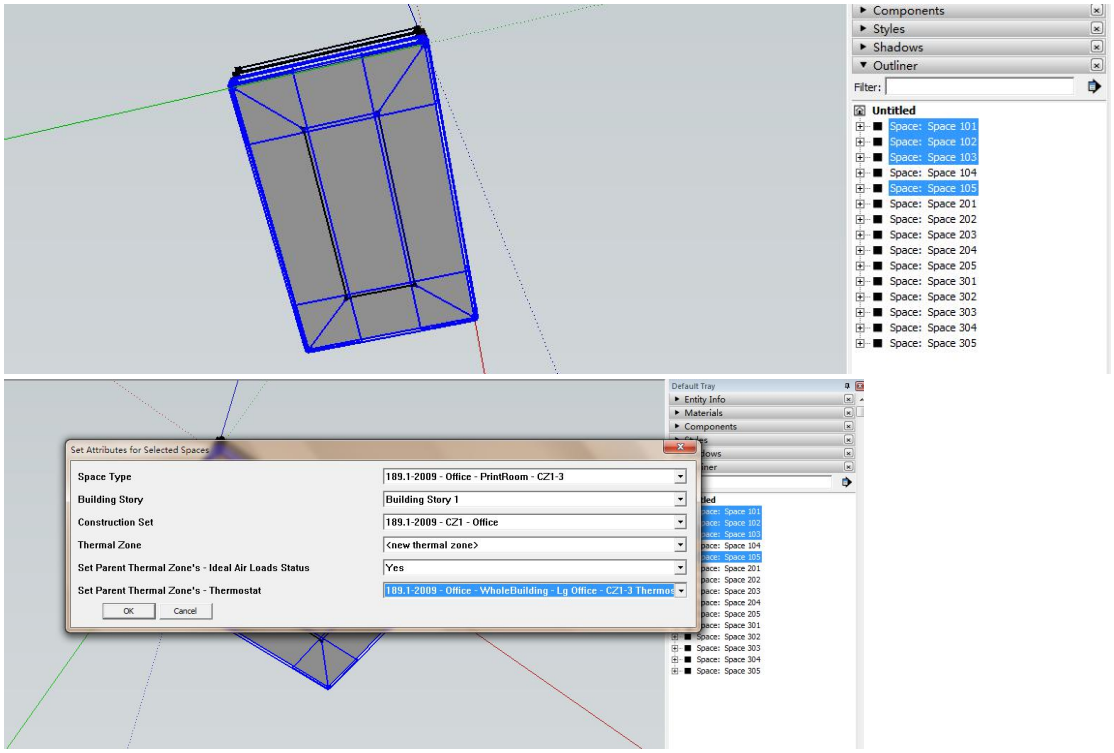


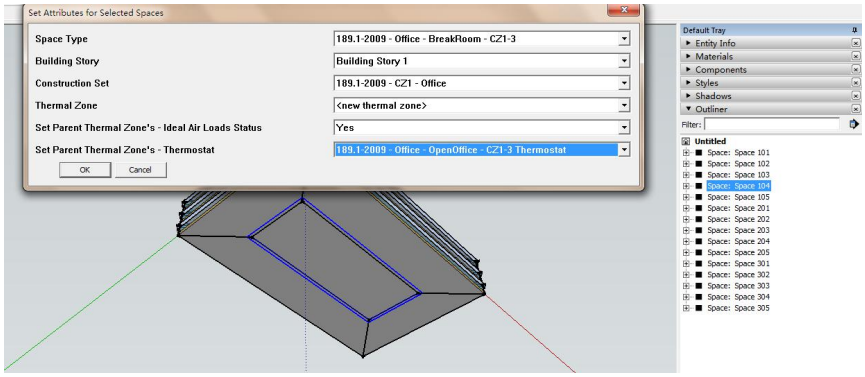


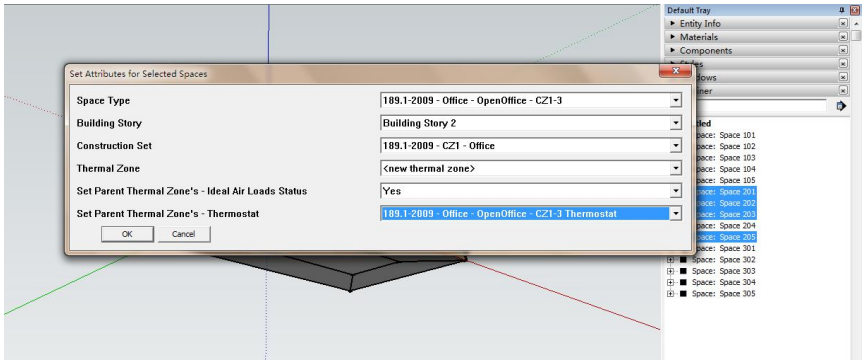
8. Open the “Window-Default Tray-Outliner”

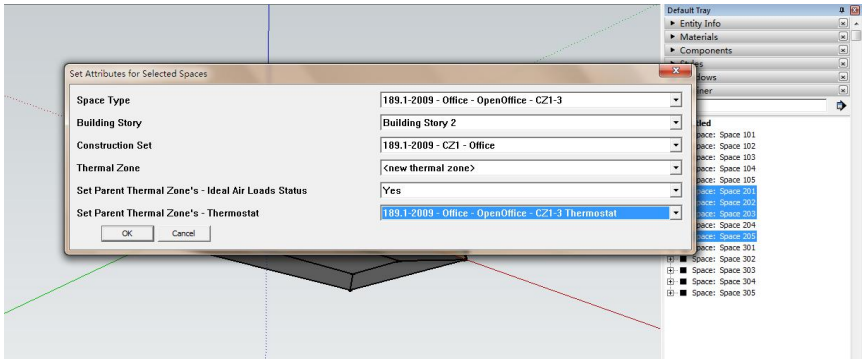


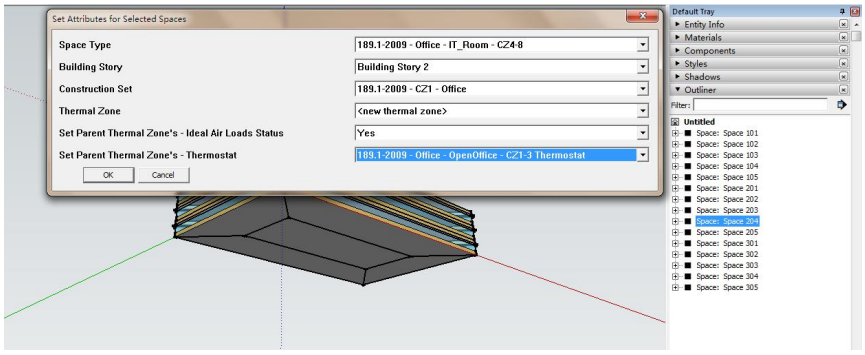
9. Choose the space of each thermal zone.



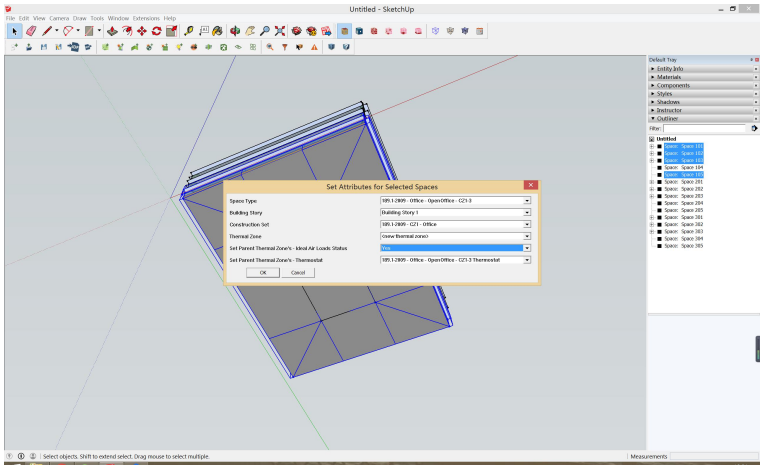


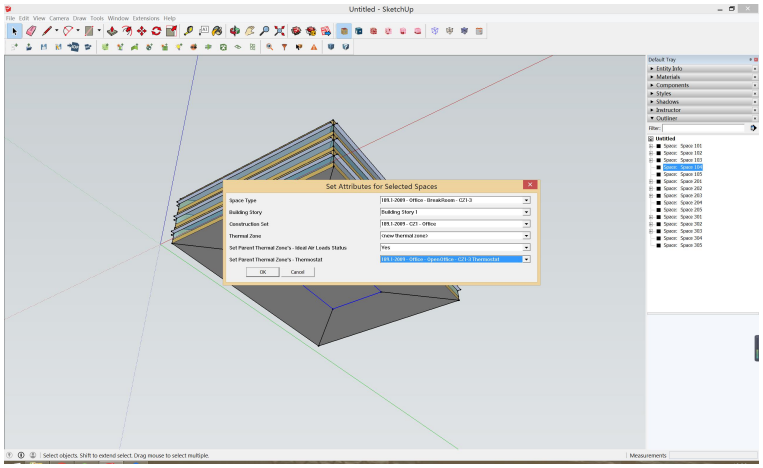


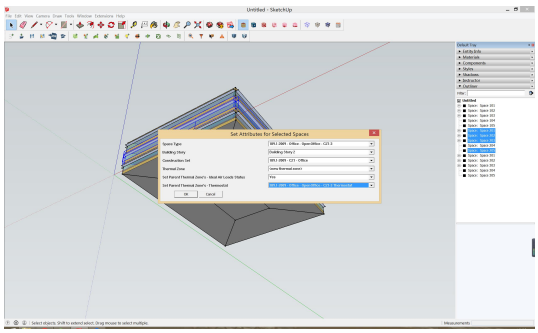


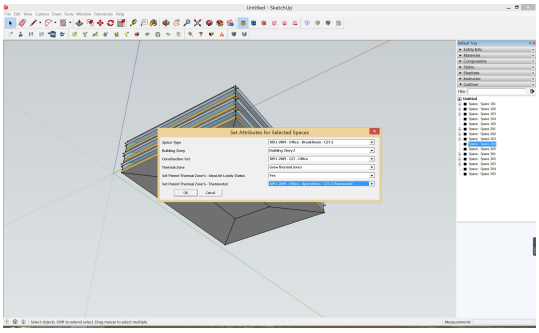


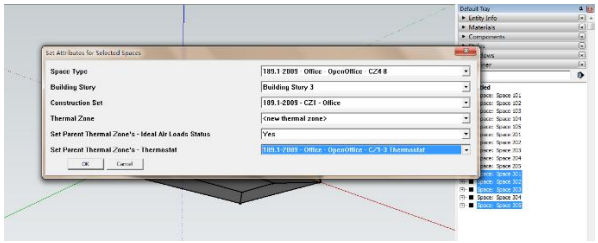
10. Click “Set Attributes for Selected Space” to set parameters.

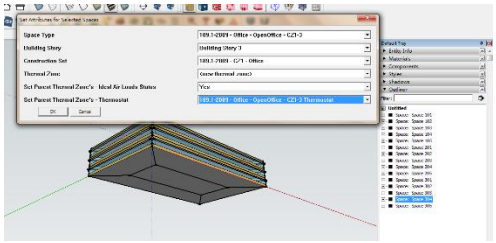




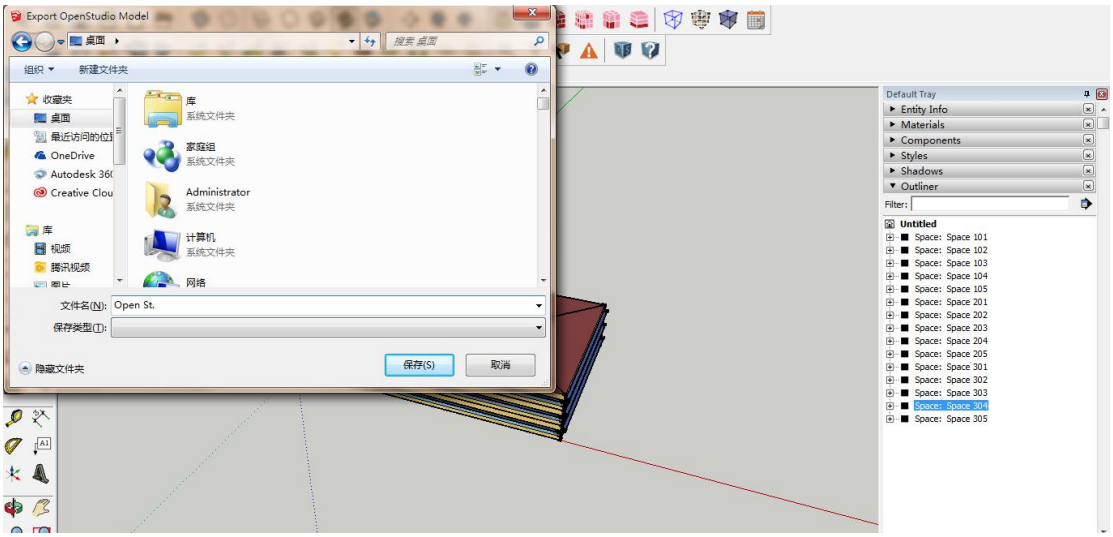




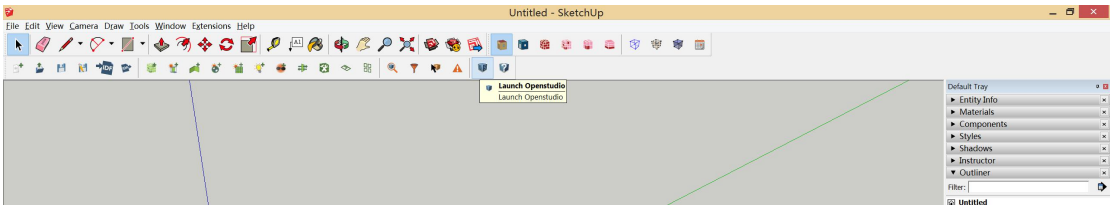




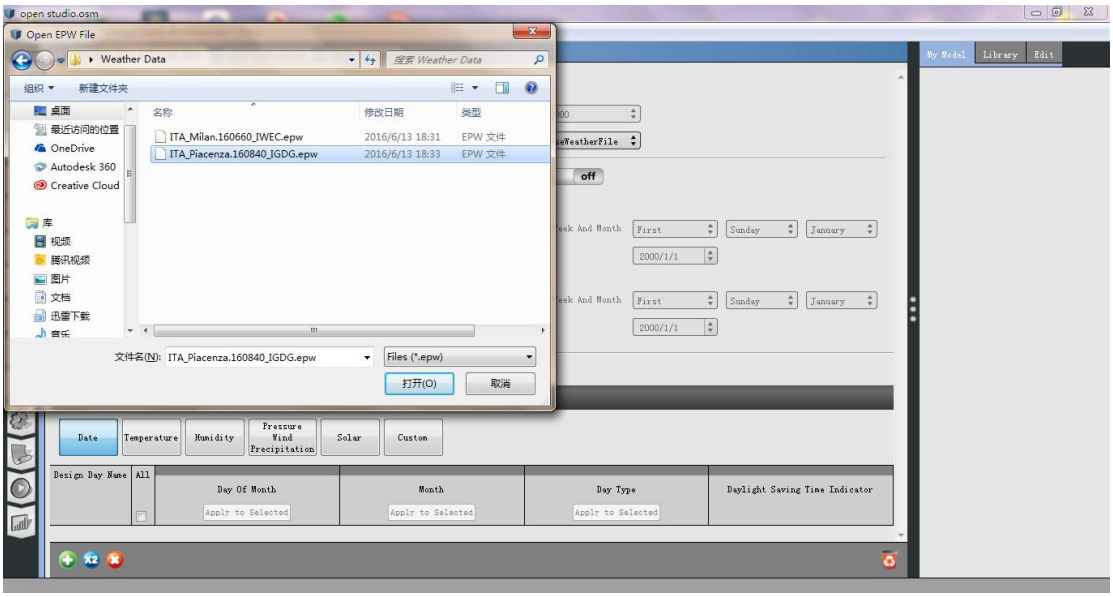
11. Save the model.



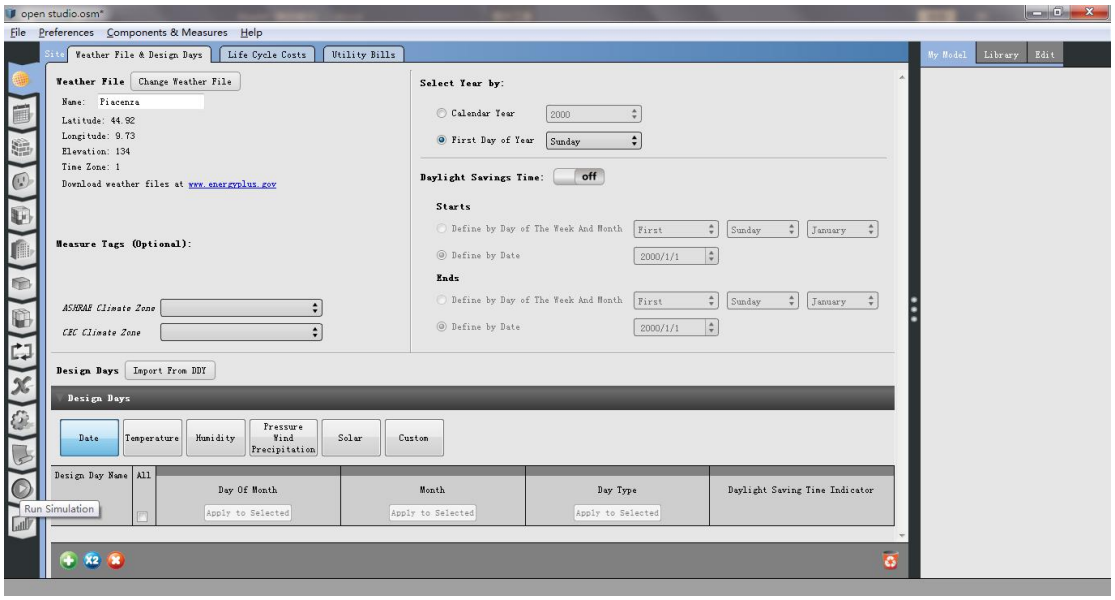
12. Run the “Launch Openstudio”.

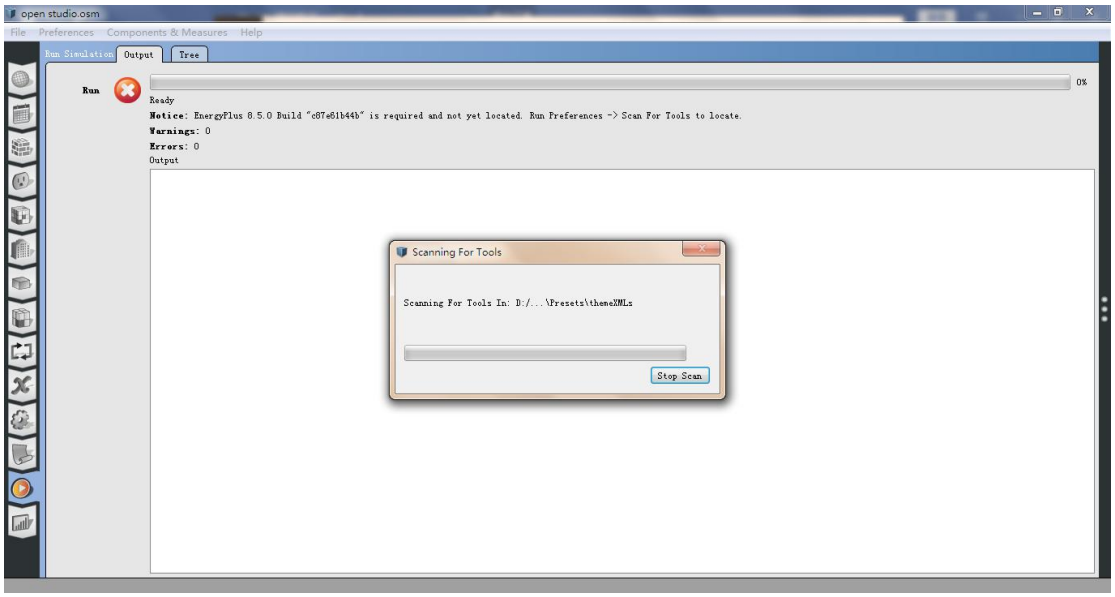


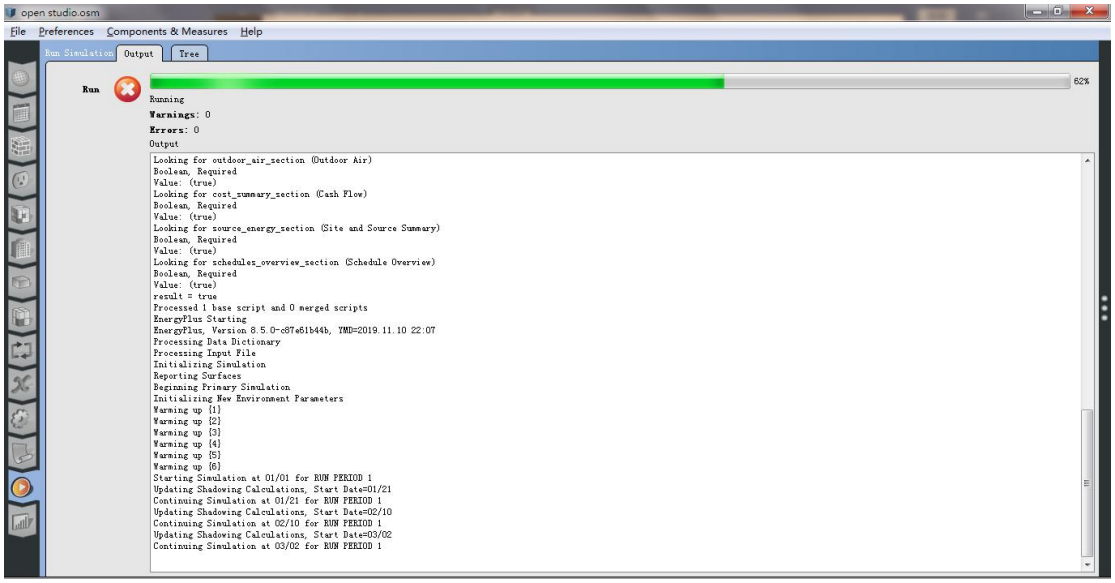
13. Add the weather data.

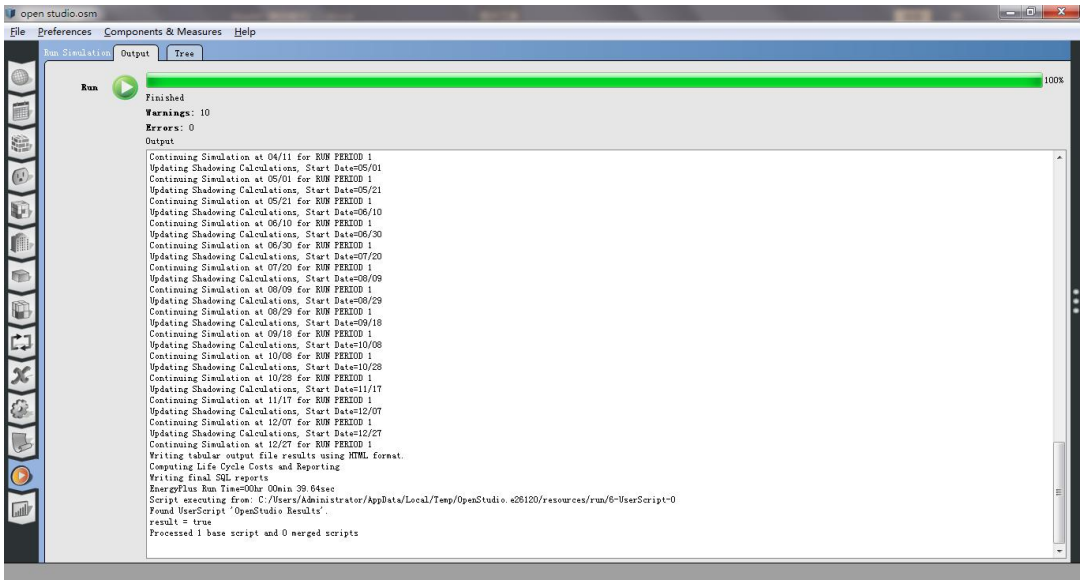


14. Click the “Run Simulation”.

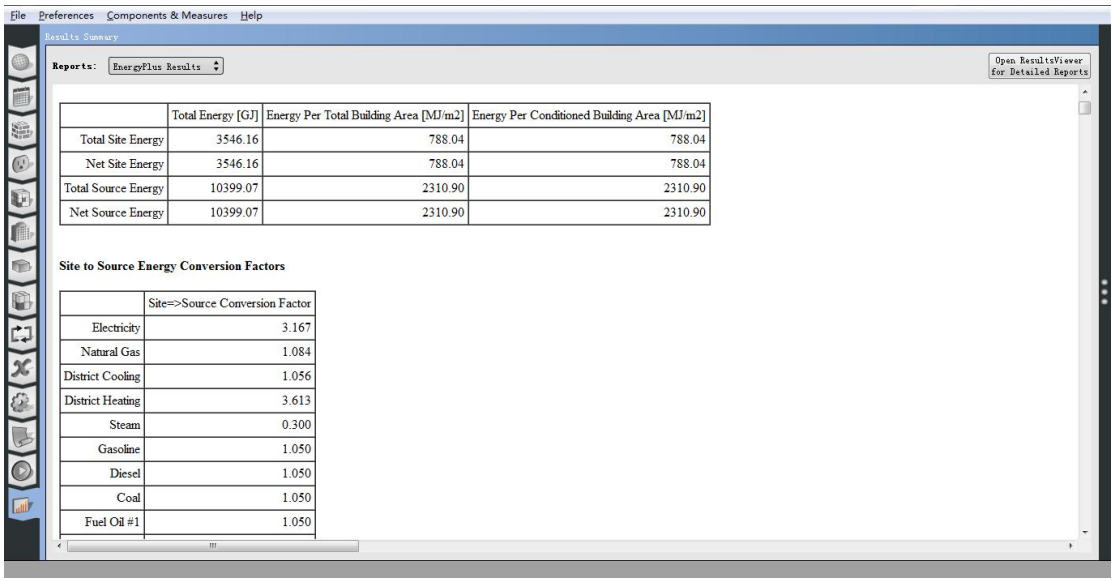

open studio.osm*
File Preferences Components & Measures Help
Site Weather File & Design Days Life Cycle Costs Utility Bills
My Model Library Edit
Weather File Change Weather File
Name: Piacenza
Latitude: 44.92
Longitude: 9.73
Elevation: 134
Time Zone: 1
Download weather files at www.energyplus.gov
Measure 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 2000/1/1
Ends
Define by Day of The Week And Month First Sunday January
Define by Date 2000/1/1
Design Days Import From DDY
Design Days
Date Temperature Humidity Pressure Wind Precipitation Solar Custom
Design Day Name All Day Of Month Month Day Type Daylight Saving Time Indicator
Apply to Selected
Run Simulation


open studio.osm
File Preferences Components & Measures Help
Run Simulation Output Tree
Run
0%
Ready
Notice: EnergyPlus 8.5.0 Build "c87e61b44b" is required and not yet located. Run Preferences -> Scan For Tools to locate.
Warnings: 0
Errors: 0
Output
Scanning For Tools
Scanning For Tools In: D:/...\Presets\themeXMLs
Stop Scan


open studio.osm
File Preferences Components & Measures Help
Run Simulation Output Tree
Run
62%
Running
Warnings: 0
Errors: 0
Output
Looking for outdoor_air_section (Outdoor Air)
Boolean, Required
Value: (true)
Looking for cost_summary_section (Cash Flow)
Boolean, Required
Value: (true)
Looking for source_energy_section (Site and Source Summary)
Boolean, Required
Value: (true)
Looking for schedules_overview_section (Schedule Overview)
Boolean, Required
Value: (true)
result = true
Processed 1 base script and 0 merged scripts
EnergyPlus Starting
EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019.11.10 22:07
Processing Data Dictionary
Processing Input File
Initializing Simulation
Reporting Surfaces
Beginning Primary Simulation
Initializing New Environment Parameters
Warming up {1}
Warming up {2}
Warming up {3}
Warming up {4}
Warming up {5}
Warming up {6}
Starting Simulation at 01/01 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=01/21
Continuing Simulation at 01/21 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=02/10
Continuing Simulation at 02/10 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=03/02
Continuing Simulation at 03/02 for RUN PERIOD 1



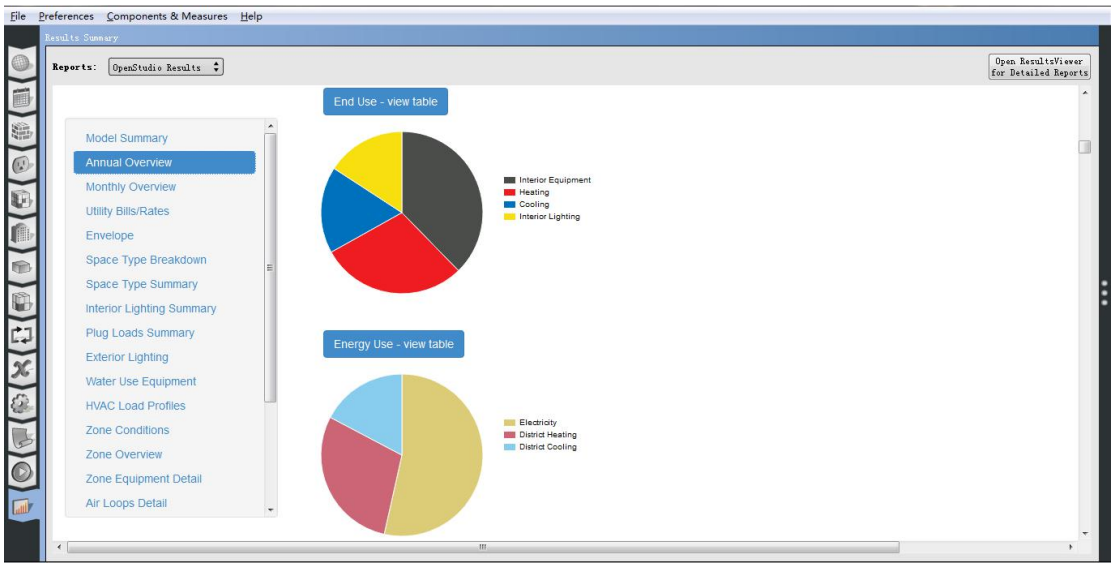
15. Show the result.

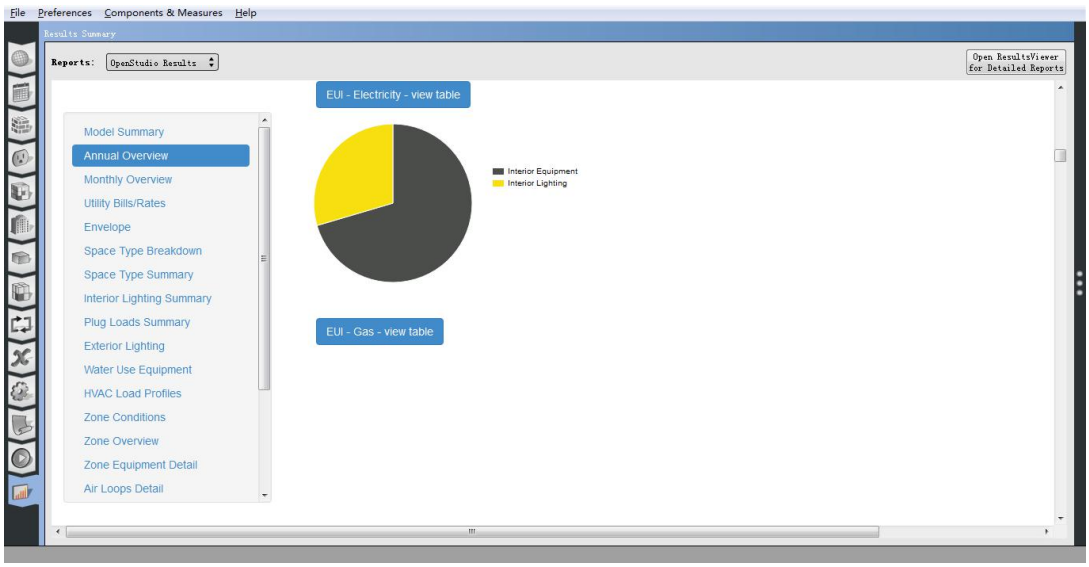


	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	3546.16	788.04	788.04
Net Site Energy	3546.16	788.04	788.04
Total Source Energy	10399.07	2310.90	2310.90
Net Source Energy	10399.07	2310.90	2310.90

Site to Source Energy Conversion Factors

	Site=>Source Conversion Factor
Electricity	3.167
Natural Gas	1.084
District Cooling	1.056
District Heating	3.613
Steam	0.300
Gasoline	1.050
Diesel	1.050
Coal	1.050
Fuel Oil #1	1.050




File
Preferences
Components & Measures
Help
Results Summary
Reports:
OpenStudio Results
Open ResultsViewer for Detailed Reports
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
EUI - Electricity - view table
Interior Equipment
Interior Lighting
EUI - Gas - view table