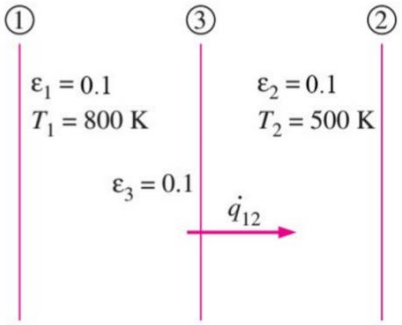
ZHANG XIAOXUAN 10710452

Task1:

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 ?

ANSWER:



$$\dot{q}_{12,\ \text{no sheilds}} = \dot{q}_{12}$$

$$= \frac{\dot{Q}_{12}}{A}$$

$$= \frac{\sigma A(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} \div A$$

$$= \frac{\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} = \frac{5.67 * 10^{-8} * (800^4 - 500^4)}{\frac{1}{0.1} + \frac{1}{0.1} - 1}$$

$$= 1035.82 \frac{W}{m^2}$$

$$\dot{q}'_{12} = \dot{q}_{12,\ \text{N sheilds}} = \frac{1}{100} * \dot{q}_{12}$$

$$\dot{q}_{12,\ \text{N sheilds}} = \frac{\dot{Q}_{12,\ \text{N sheilds}}}{A}$$

$$= \frac{\sigma A(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + \left(\frac{1}{\epsilon_{3,1}} + \frac{1}{\epsilon_{3,2}} - 1\right) + \cdots + \left(\frac{1}{\epsilon_{N,1}} + \frac{1}{\epsilon_{N,2}} - 1\right)} \div A$$

$$= \frac{\sigma(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + \left(\frac{1}{\epsilon_{3,1}} + \frac{1}{\epsilon_{3,2}} - 1\right) + \cdots + \left(\frac{1}{\epsilon_{N,1}} + \frac{1}{\epsilon_{N,2}} - 1\right)}$$

$$= \frac{\sigma(T_1^4 - T_2^4)}{(N+1)\left(\frac{1}{\epsilon} + \frac{1}{\epsilon} - 1\right)} = \frac{1}{N+1}\dot{q}_{12}$$

$$\epsilon = \epsilon_1 = \epsilon_2 = \epsilon_3 = \cdots = \epsilon_N = 0.1$$

$$\dot{q}'_{12} = \dot{q}_{12,\ \text{N shields}}$$

$$\frac{1}{100} * \dot{q}_{12} = \frac{1}{N+1}\dot{q}_{12}$$

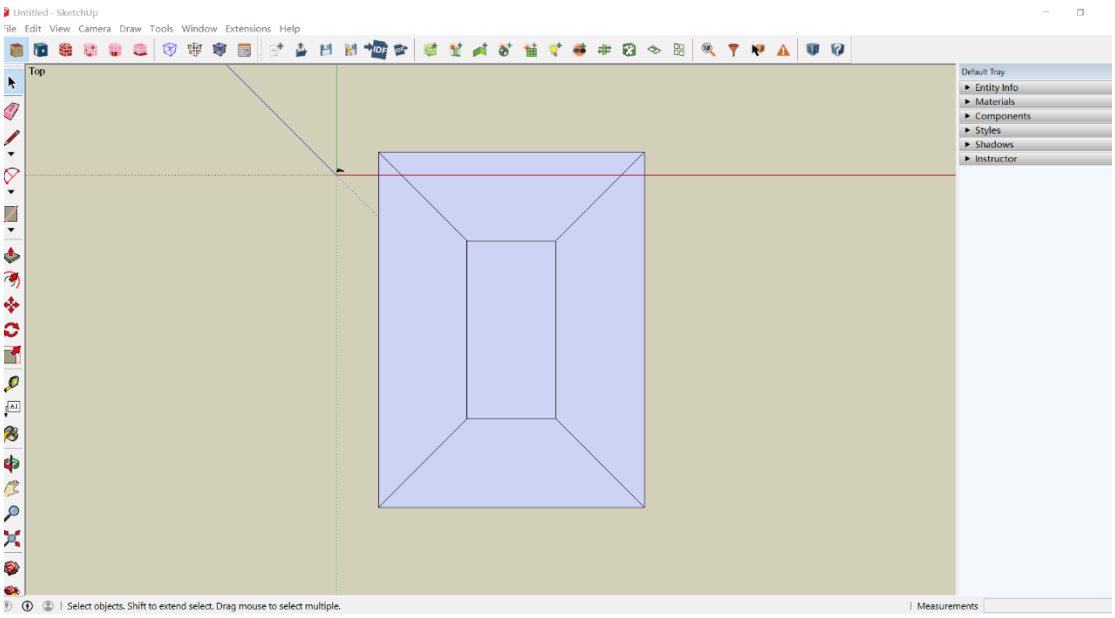
N=99

So we need 99 shields of which $\varepsilon = 0.1$.

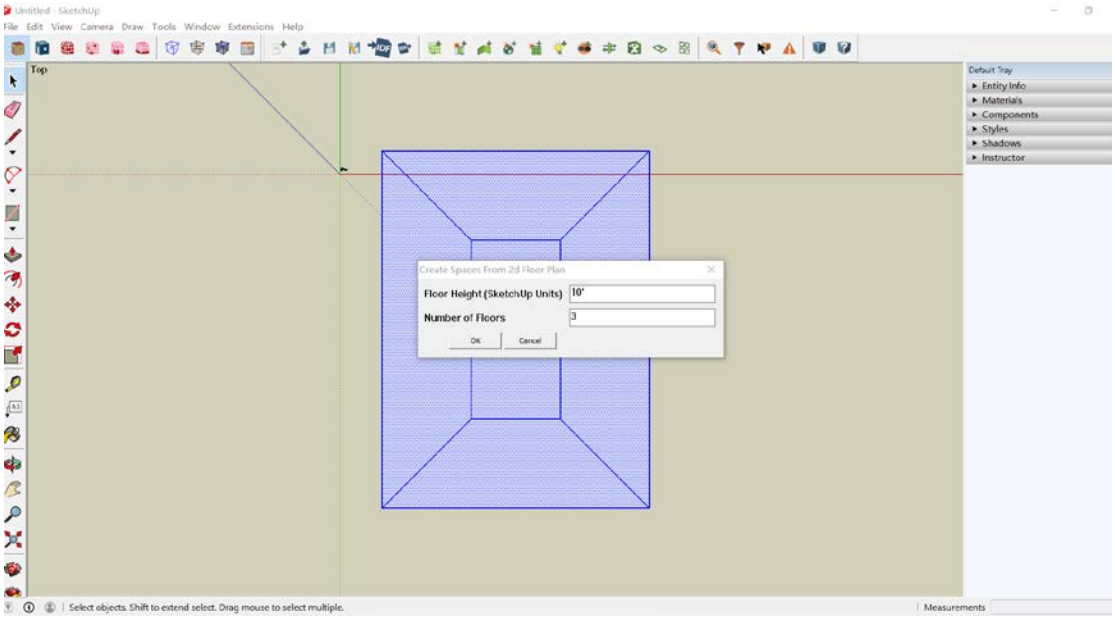
Task 2:

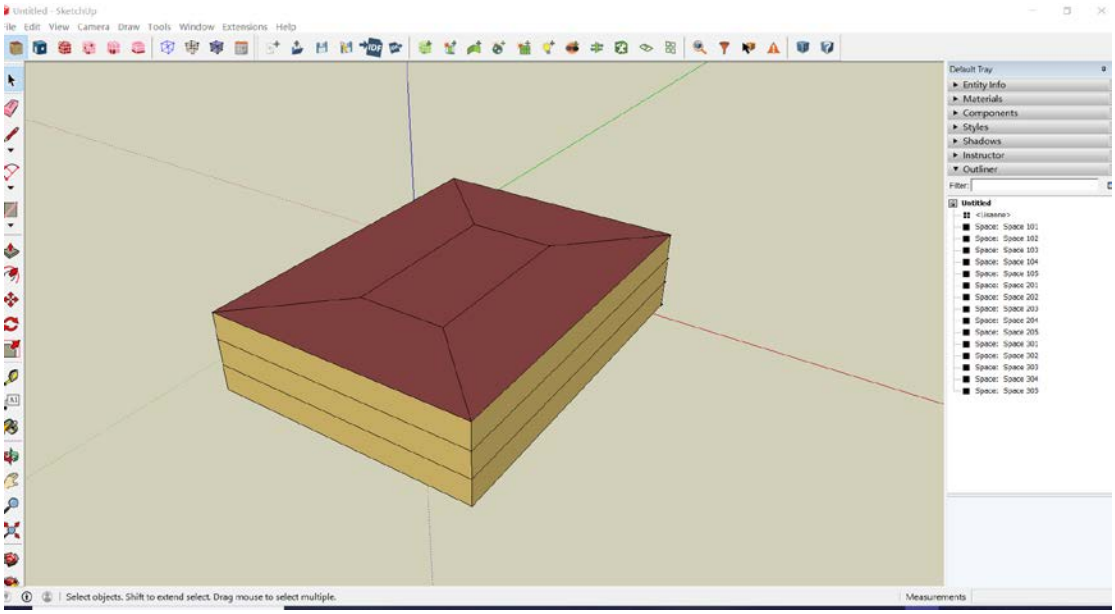
You should create a pdf file with screenshots of all of the steps we went through (clearly from your own file) and explain briefly the reason behind the use of each step (in your own words!)

1. Create a 40m*30m rectangle ,then create another rectangle with an offset of 10 m, connect each corner with 4 lines.

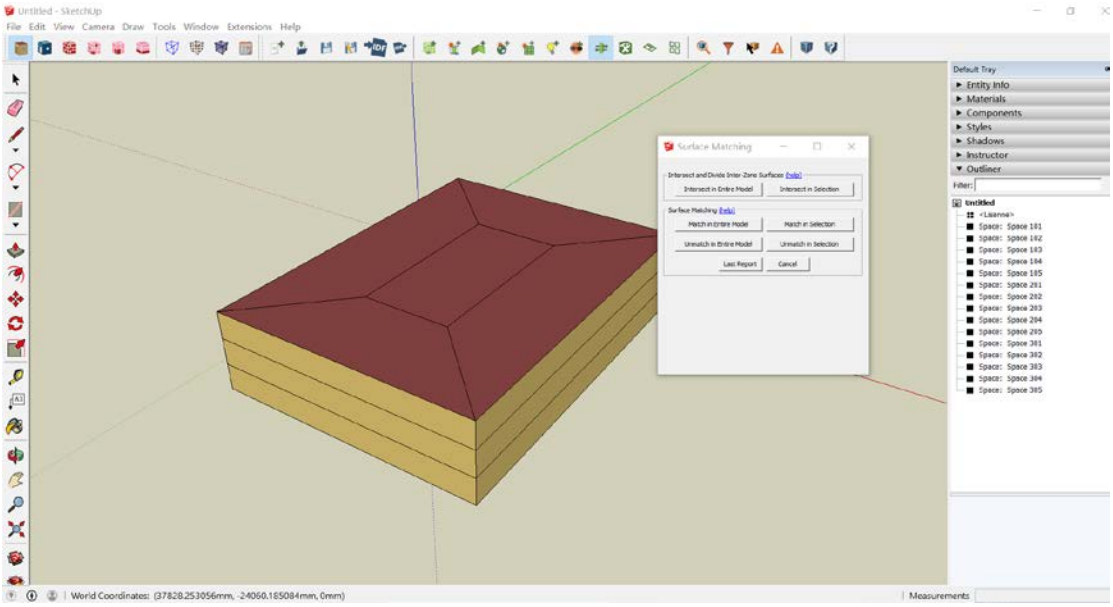


2. Use “create spaces from diagram” to set up a building of 3 levels,

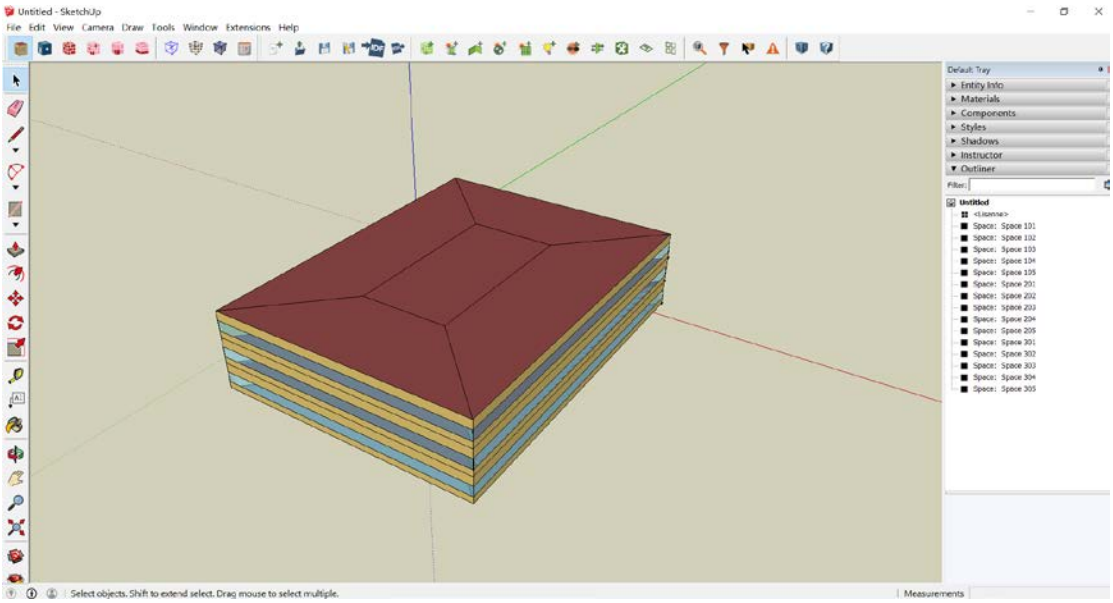




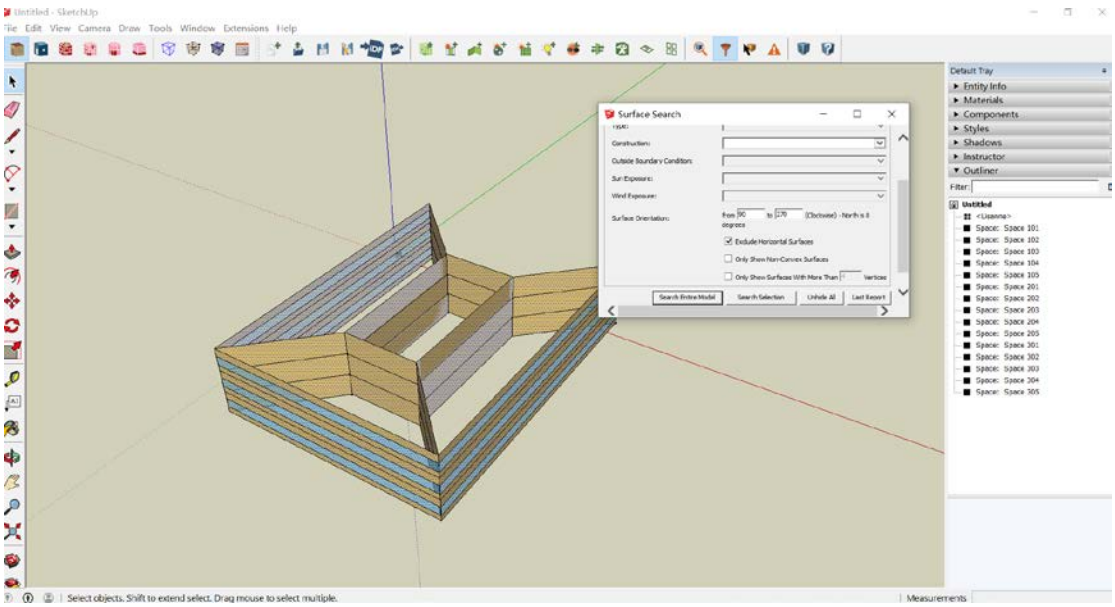
3. Using ”surfaces matching” ,this step is mandatory to be able to create the windows.



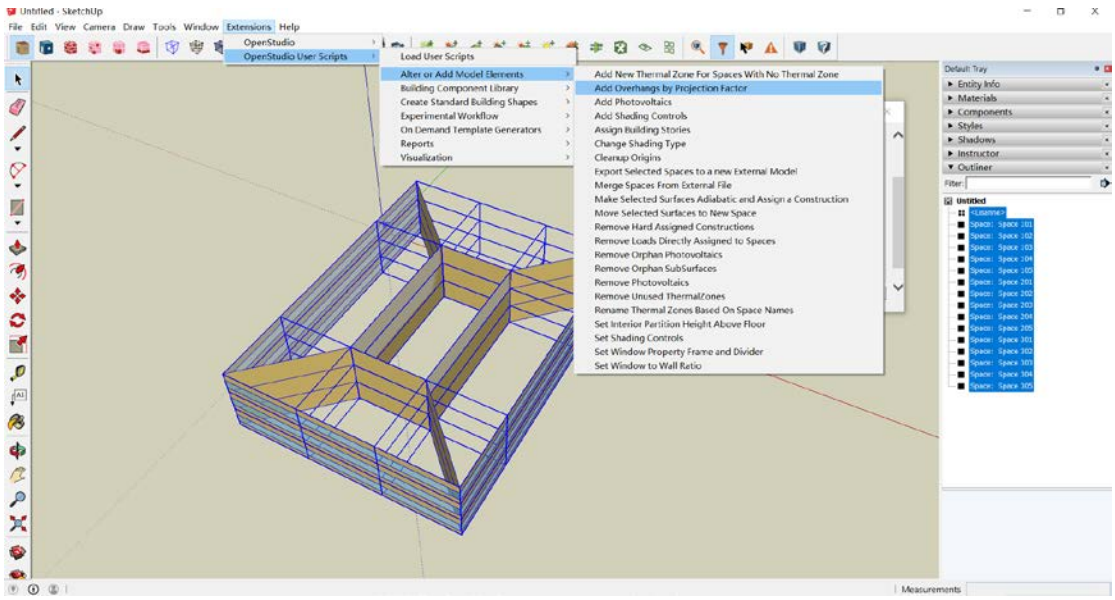
4. Install the windows.

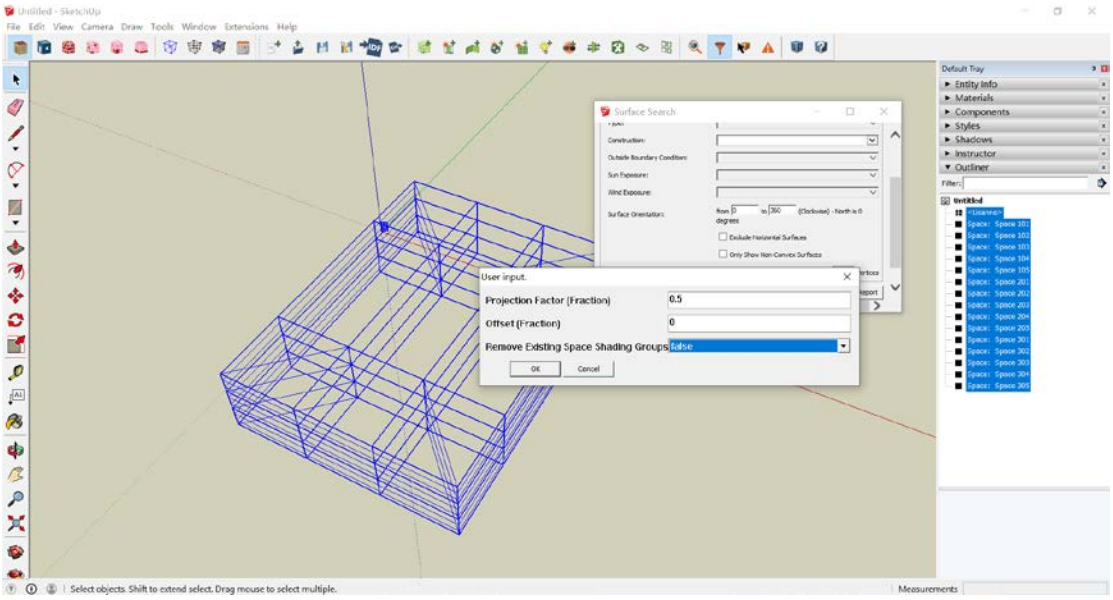


5. Using “Search Surfaces” to select all the surfaces except the north one.

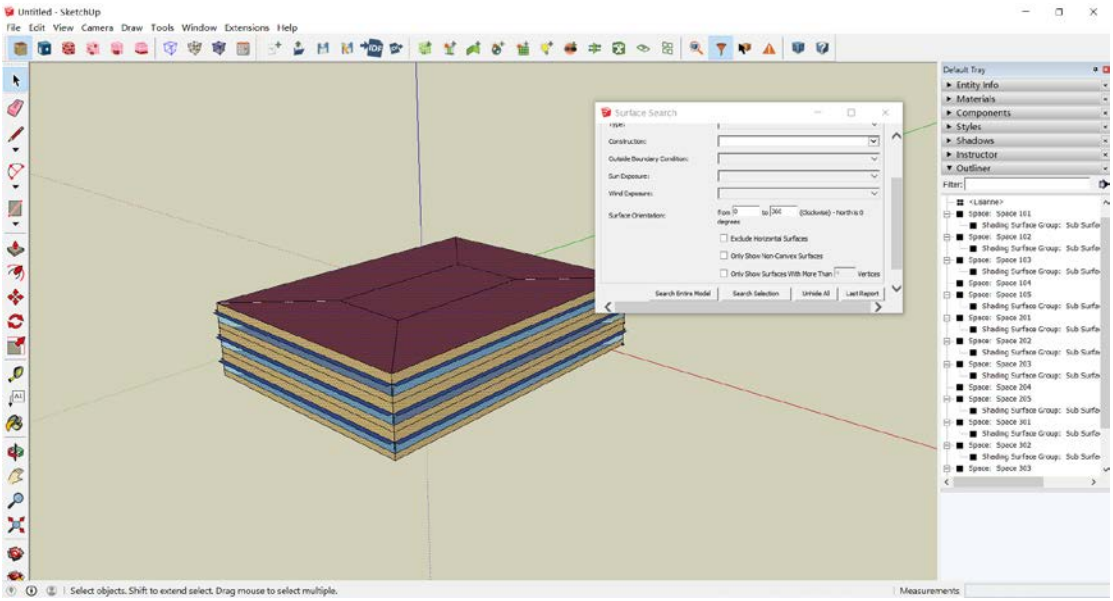


6.Add external shading

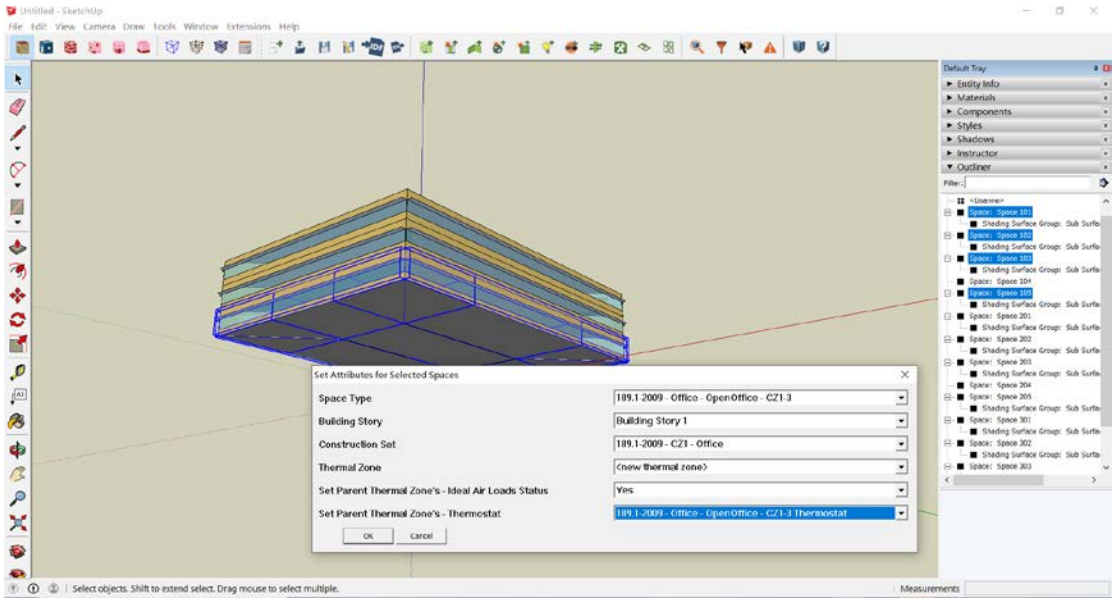


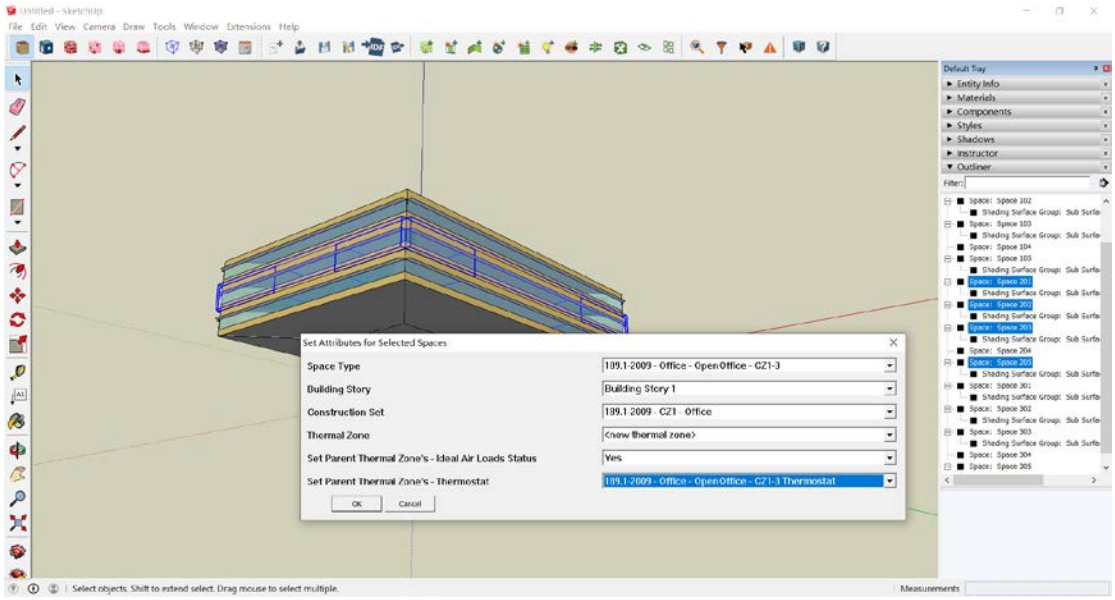


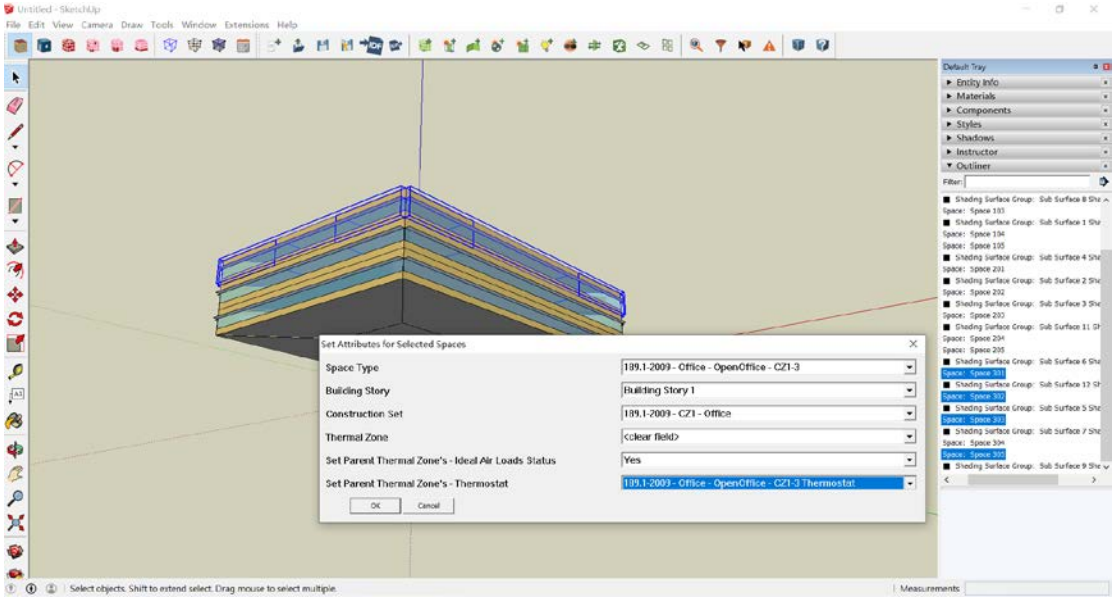
Go back to the previous selection to see the entire model again.



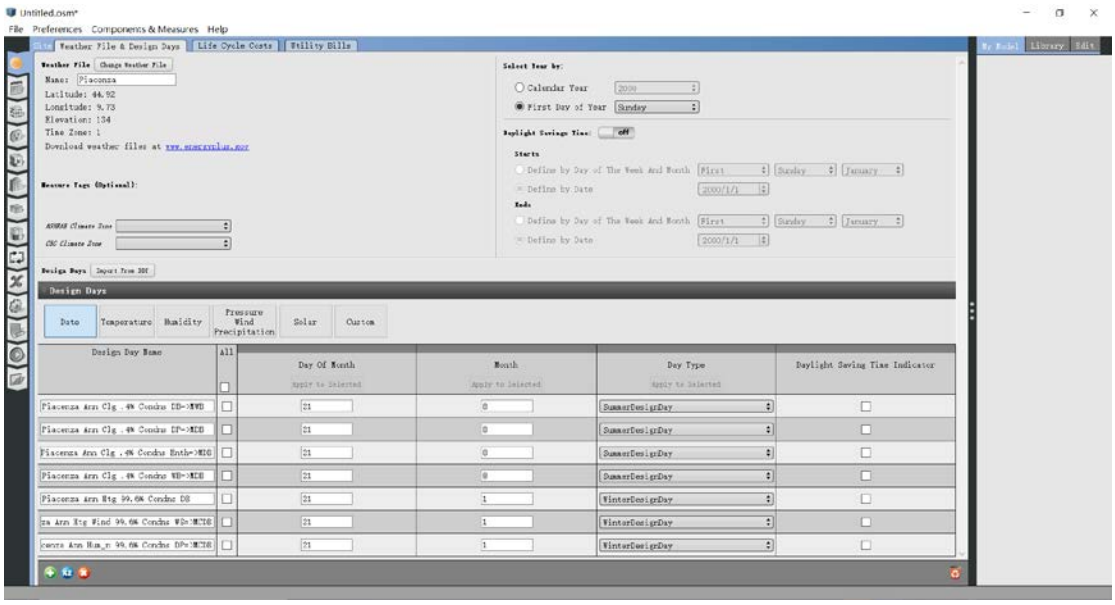
7.Use “Set attributes for selected spaces” to choose the spaces of each thermal zone and we add specifications.


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

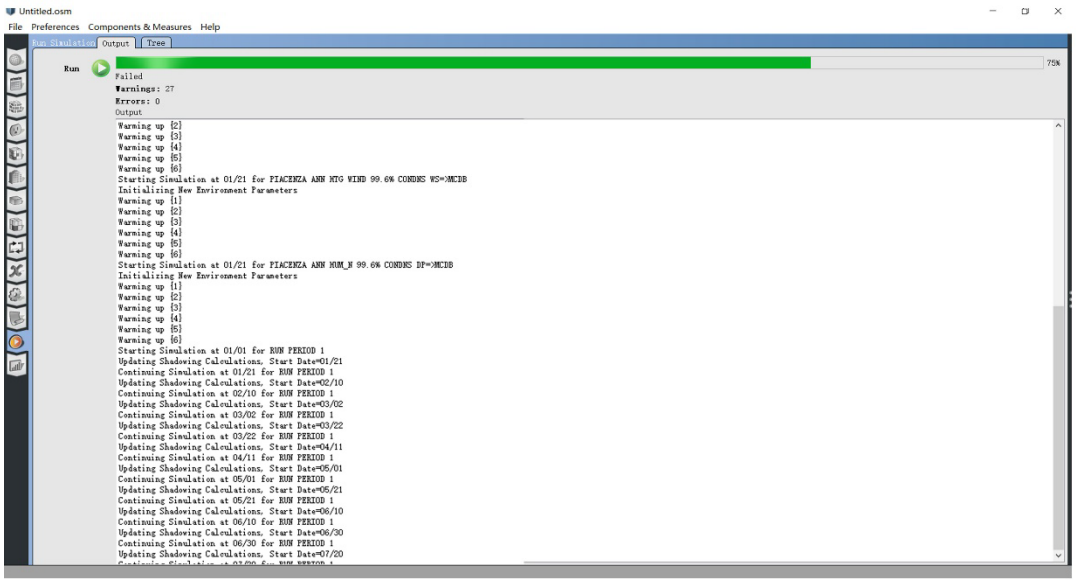

Set Attributes for Selected Spaces
Space Type
189.1-2009 - Office - OpenOffice - CZ1-3
Building Story
Building Story 1
Construction Set
189.1-2009 - CZ1 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
189.1-2009 - Office - OpenOffice - CZ1-3 Thermostat
OK
Cancel


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
<clear field>
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

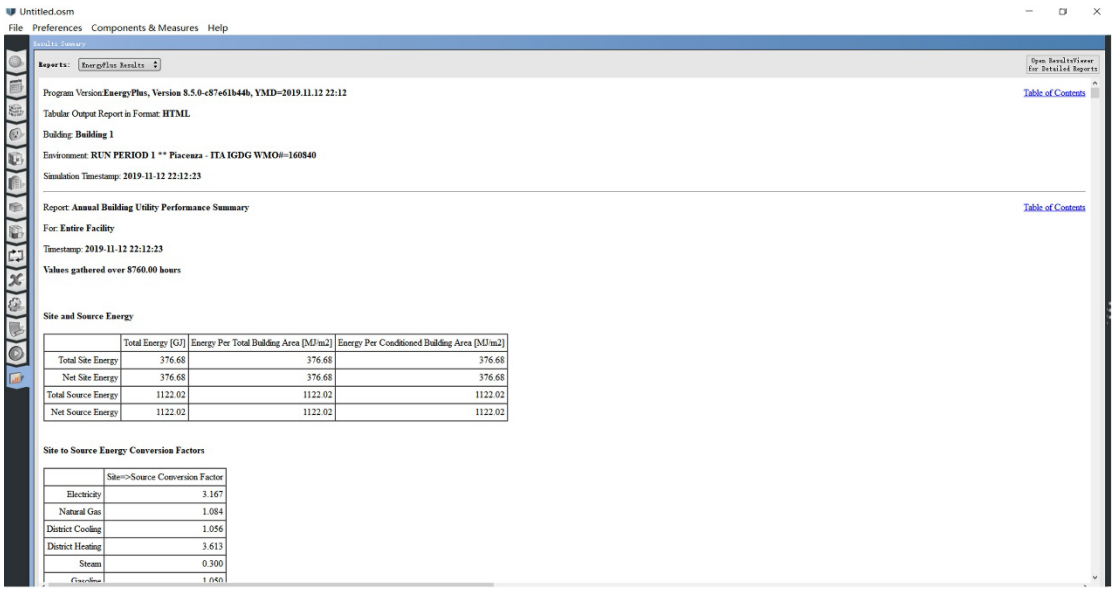
8. Launch OpenStudio and add the weather data using the "ITA_Piacenza.160840_IGDG.ddy" file .



Run the model analysis.



9.Review the results.


Untitled.osm
File Preferences Components & Measures Help
Results Summary
Reports: EnergyPlus Results
Open ResultsViewer for Detailed Reports
Program Version:EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019.11.12 22:12
Table of Contents
Tabular Output Report in Format: HTML
Building: Building 1
Environment: RUN PERIOD 1 ** Piacenza - ITA IGDG WMO#=160840
Simulation Timestamp: 2019-11-12 22:12:23
Report: Annual Building Utility Performance Summary
Table of Contents
For: Entire Facility
Timestamp: 2019-11-12 22:12:23
Values gathered over 8760.00 hours
Site and Source Energy
Total Energy [GJ] | Energy Per Total Building Area [MJ/m2] | Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy 376.68 376.68 376.68
Net Site Energy 376.68 376.68 376.68
Total Source Energy 1122.02 1122.02 1122.02
Net Source Energy 1122.02 1122.02 1122.02
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