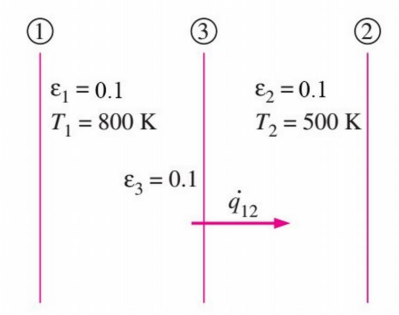
TASK1：

Considering the same example you solved in the previous assignment (radiative heat transfer between two paralle 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?



$$\dot{q}_{net_{1-2}} = \frac{\dot{Q}_{net_{1-2}}}{A} = \frac{A\sigma\,(T_2^4 - T_1^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} \div A = \frac{\sigma\,(T_2^4 - T_1^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} = \frac{5.67\times10^{-8}\times(800^4 - 500^4)}{\frac{1}{0.1} + \frac{1}{0.1} - 1} W/m^2 = 1035.82 W/m^2$$

The new heat transfer rate should be 1% of the $\dot{q}_{net_{1-2}}$

$$i.e., \dot{q}_{net_{1-2}} = \dot{q}_{net_{1-2},nshields} = \frac{1}{100}\times \dot{q}_{net_{1-2}}$$

$$\dot{q}_{net_{1-2},nshields} = \frac{\dot{Q}_{net_{1-2},nshields}}{A} = \frac{A\sigma(T_2^4 - T_1^4)}{(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1) + (\frac{1}{\varepsilon_{3,1}} + \frac{1}{\varepsilon_{3,2}} - 1) + \ldots + (\frac{1}{\varepsilon_{n,1}} + \frac{1}{\varepsilon_{n,2}} - 1)} \div A$$

$$\frac{\sigma(T_2^4 - T_1^4)}{(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1) + (\frac{1}{\varepsilon_{3,1}} + \frac{1}{\varepsilon_{3,2}} - 1) + \ldots + (\frac{1}{\varepsilon_{n,1}} + \frac{1}{\varepsilon_{n,2}} - 1)}$$

$$Autem, \varepsilon_1 = \varepsilon_2 = \varepsilon_3 = \ldots = \varepsilon_n$$

$$substitute \quad \varepsilon_1, \varepsilon_2, \varepsilon_3, \ldots, \varepsilon_n,$$

And introduce to the equation:

$$\dot{q}_{net_{1-2},n,shields} = \frac{\sigma(T_2^4 - T_1^4)}{(n+1)(\frac{1}{\varepsilon} + \frac{1}{\varepsilon} - 1)} = \frac{1}{n+1}\times\frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon} + \frac{1}{\varepsilon} - 1}$$

$$\dot{q}'_{net_{1-2}} = \dot{q}'_{net_{1-2,n,shields}} = \frac{1}{100}\times \dot{q}'_{net_{1-2}} = \frac{1}{100}\times\frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon_1}+\frac{1}{\varepsilon_2}-1} = \frac{1}{100}\times\frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon}+\frac{1}{\varepsilon}-1}$$

Since *i.e.*, $\frac{1}{n+1}\times\frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon}+\frac{1}{\varepsilon}-1} = \frac{1}{100}\times\frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon}+\frac{1}{\varepsilon}-1}$

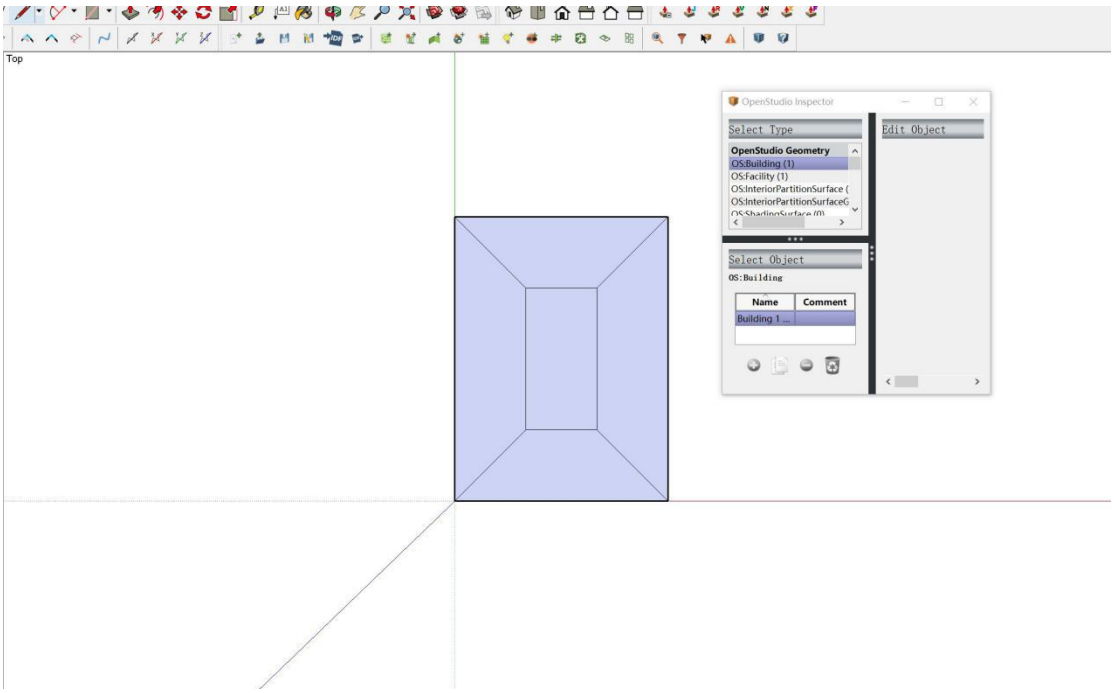
$n = 99$

To have the new heat transfer rate be 1% of the previous rate without any shields, we need 99 shields with epsilon=0.1.

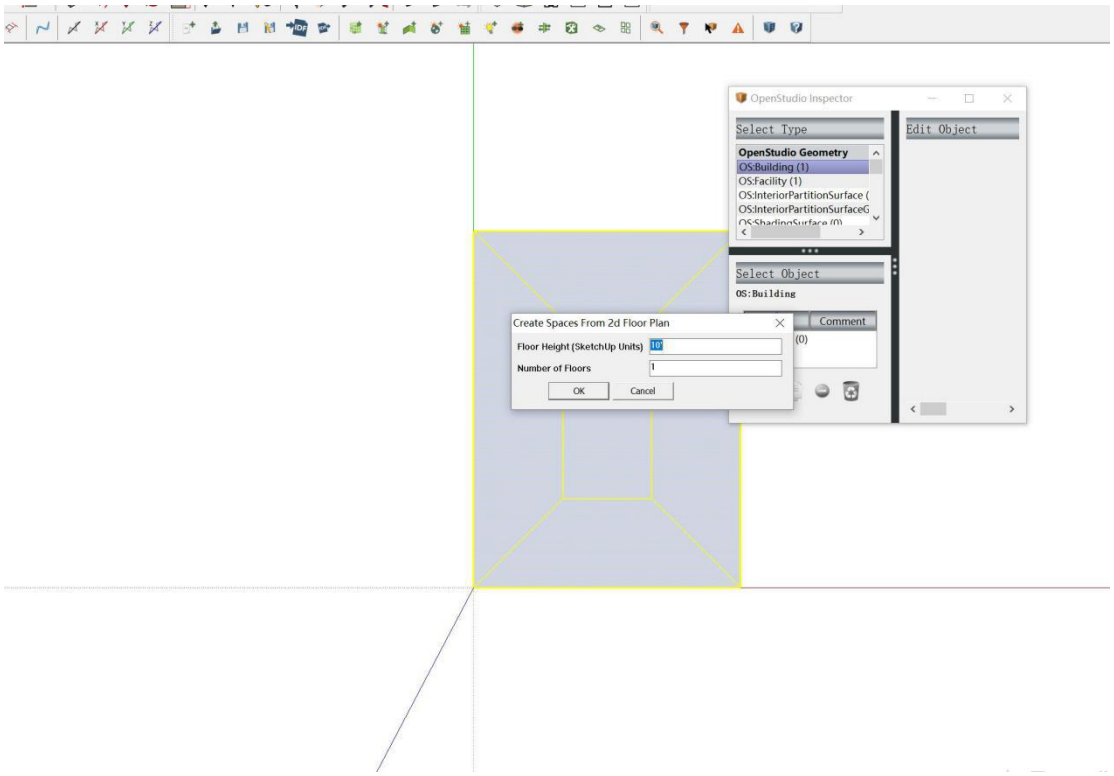
TASK2:

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

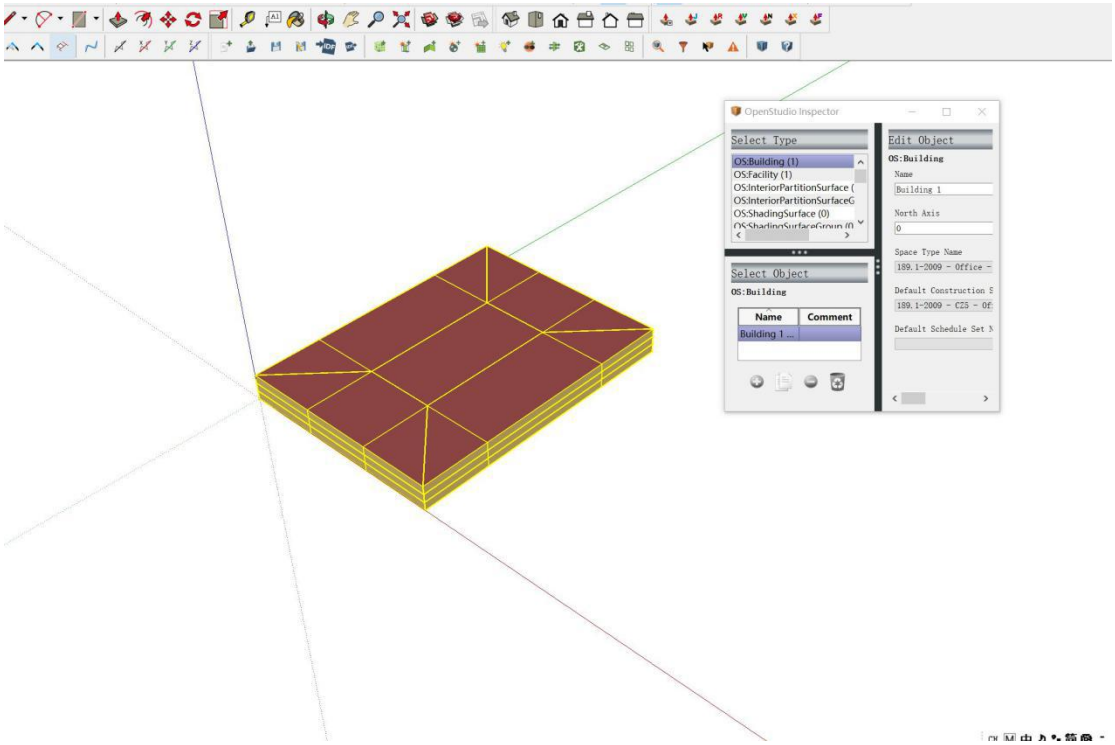
1.Create the shape of the buliding in sketch up



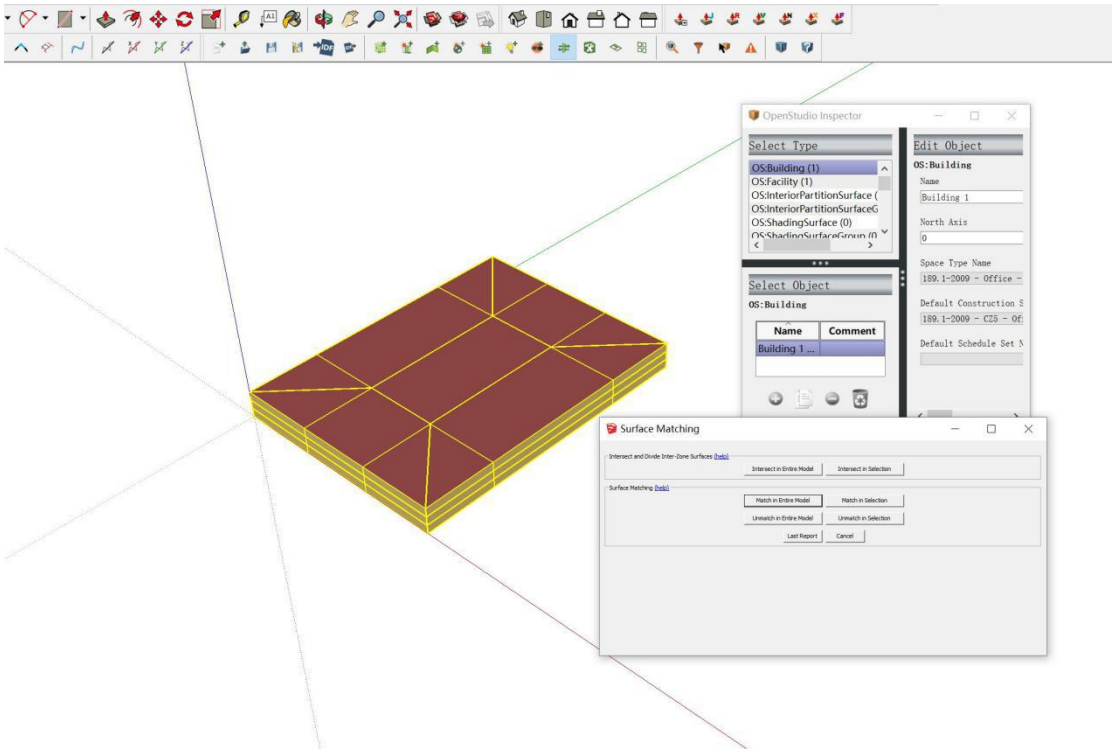
2. Use “Create spaces from diagram”create a 3 floor building.



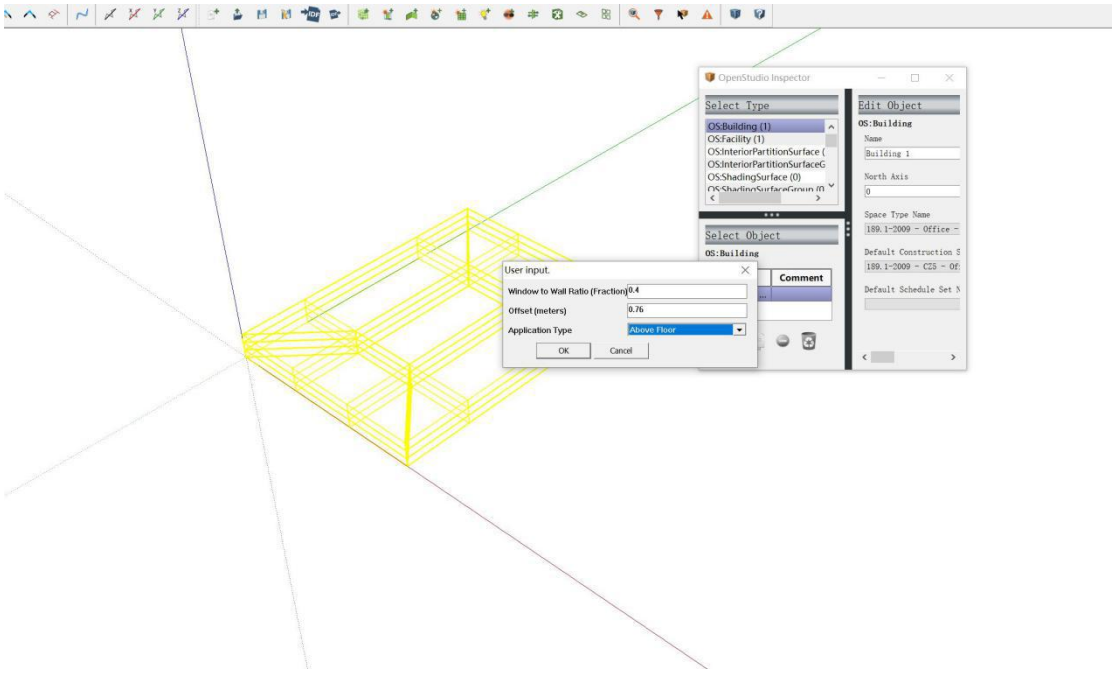
Creating the levels, new layers appear at the right side off the screen.



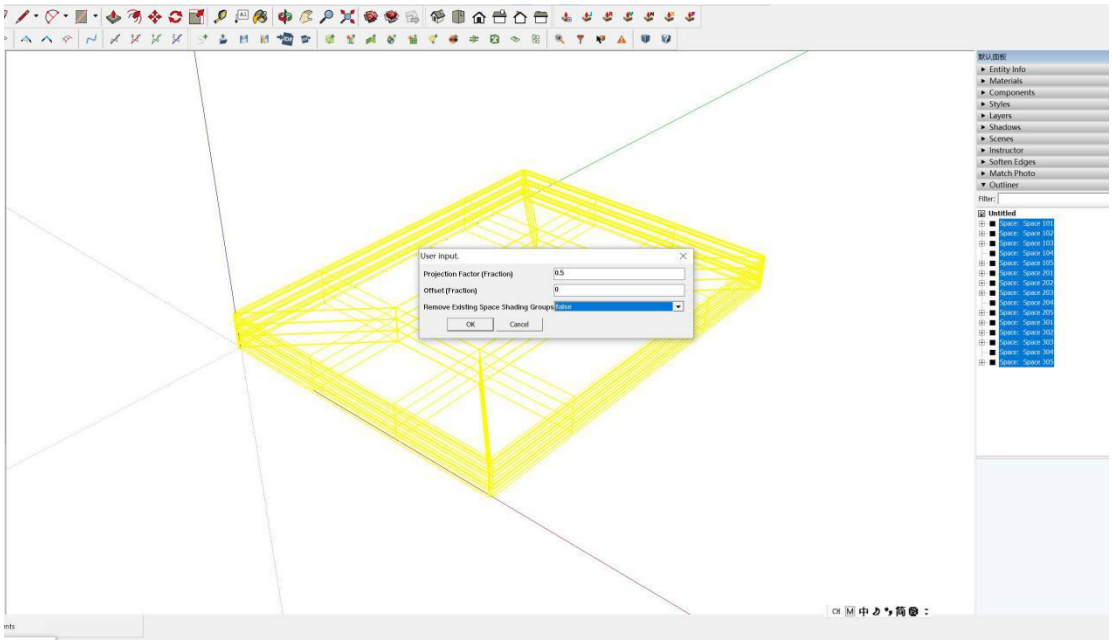
3. Click”Surface matching”.



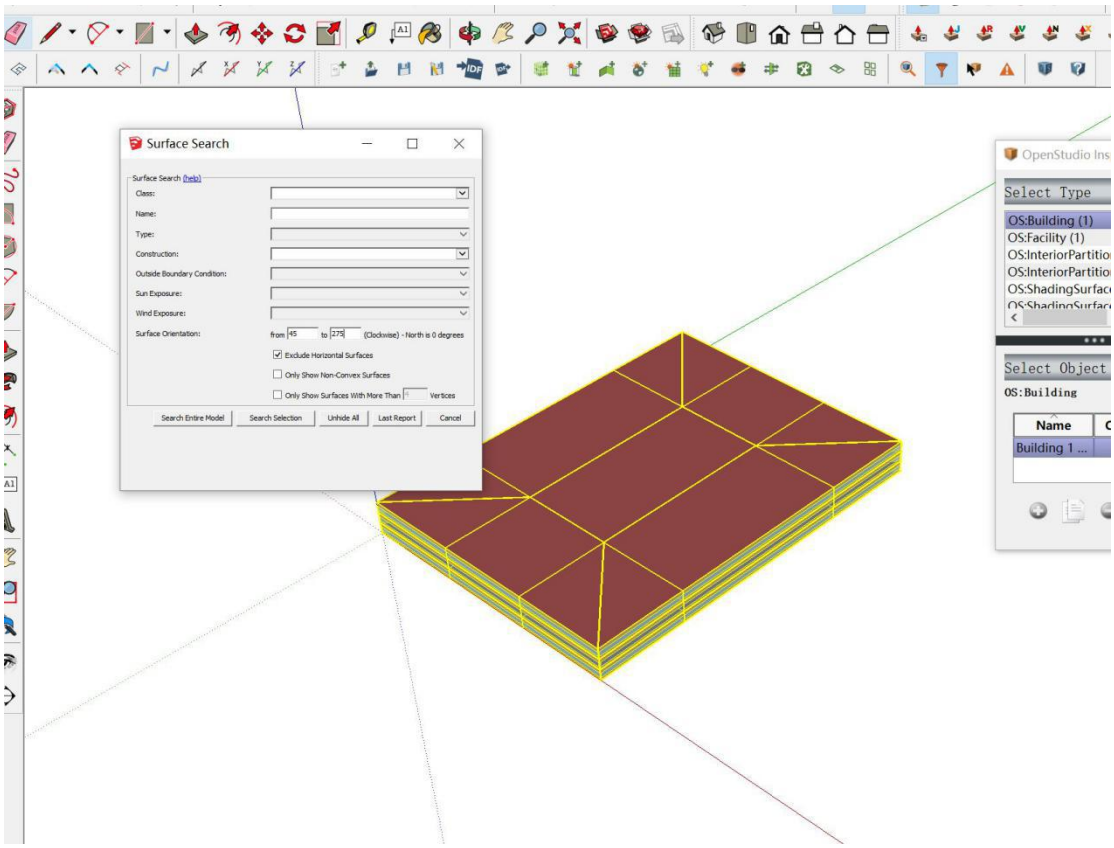
4. Windows placements.



5. Open the”Outliner”

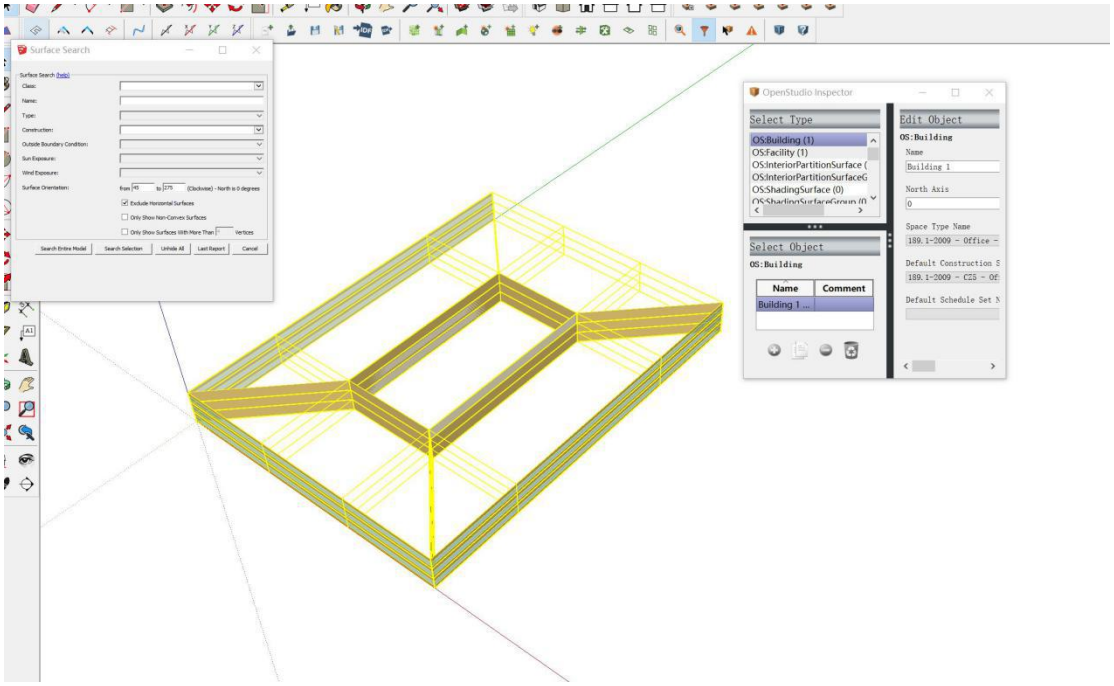


6. Check other directions besides the north.



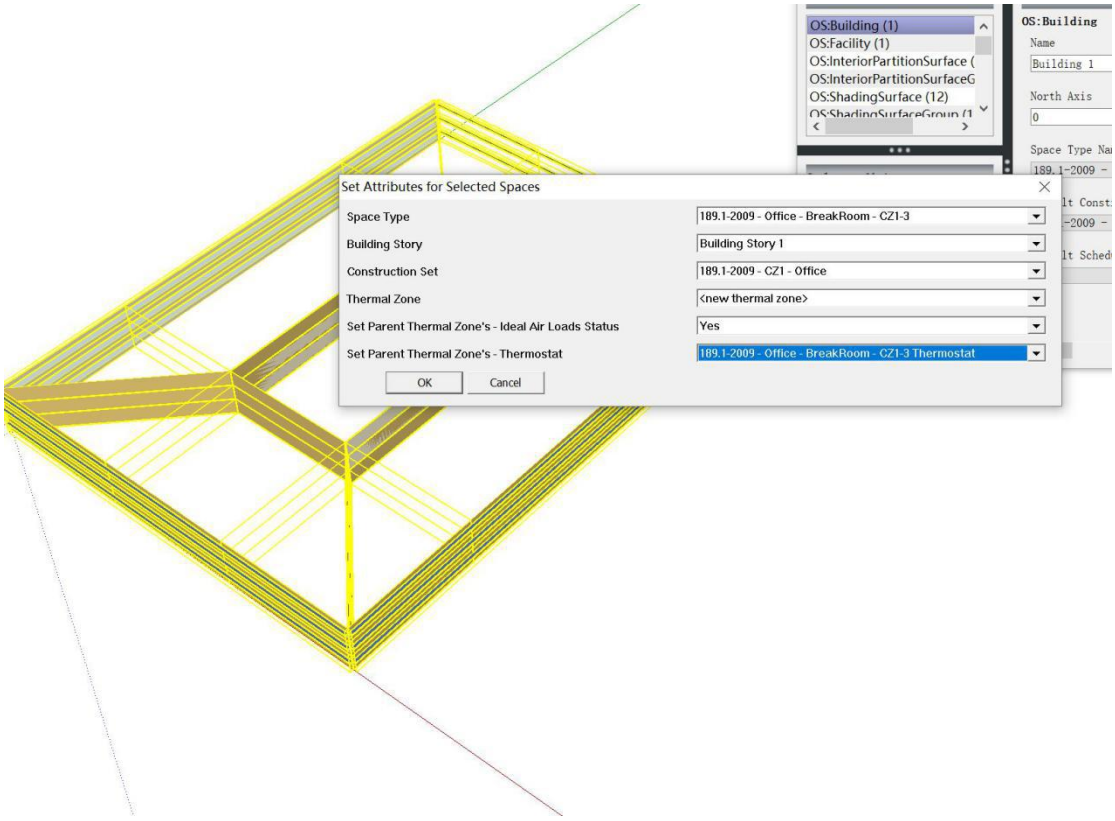
7. External shading addition.

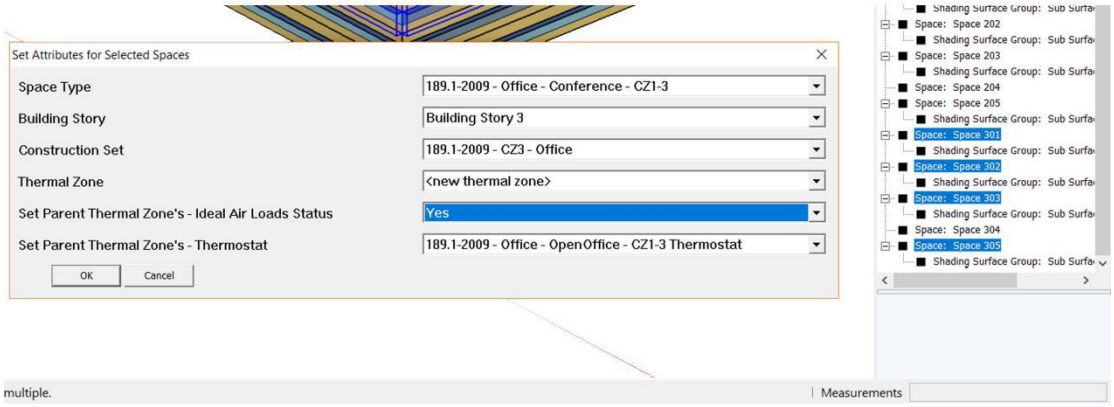
Using the search surfaces tool and applying 0 to 360 parameters we can visualize again the entire model.

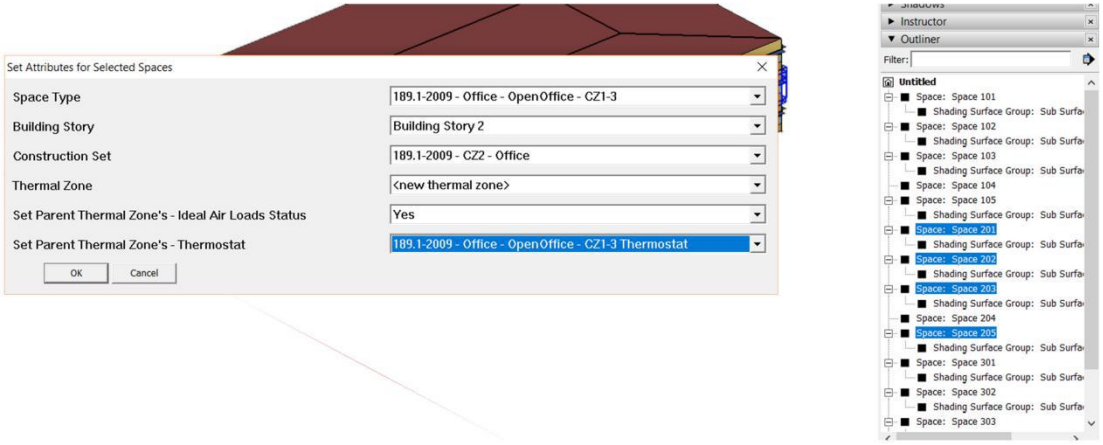


8. Adding of specifications.

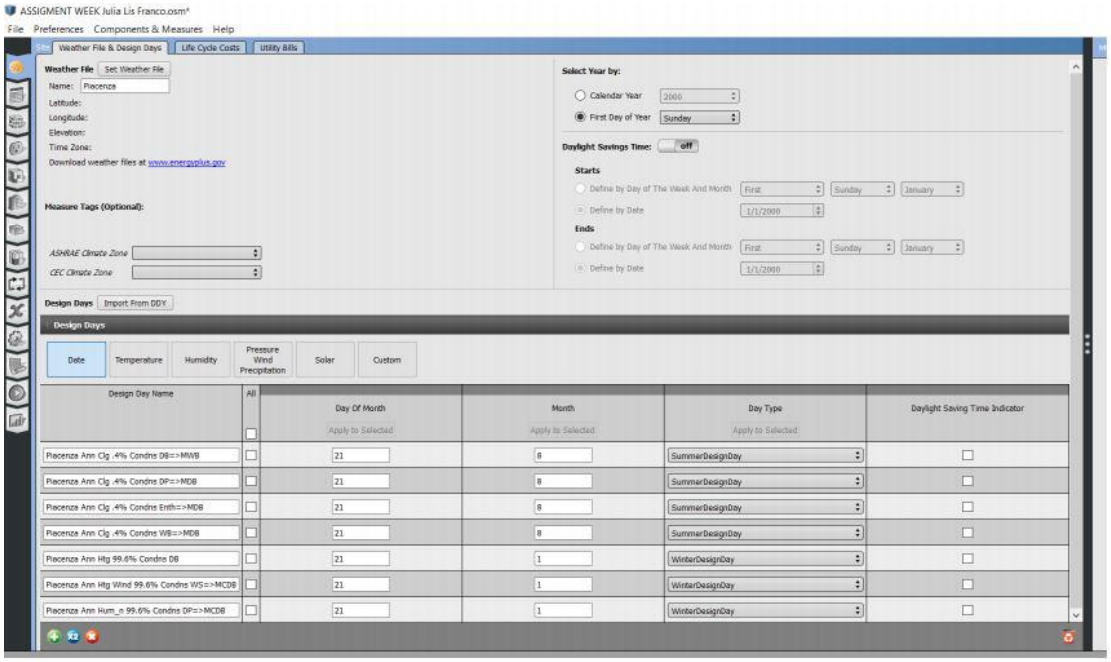
Choosing each thermal zone, we have to add the specifications.

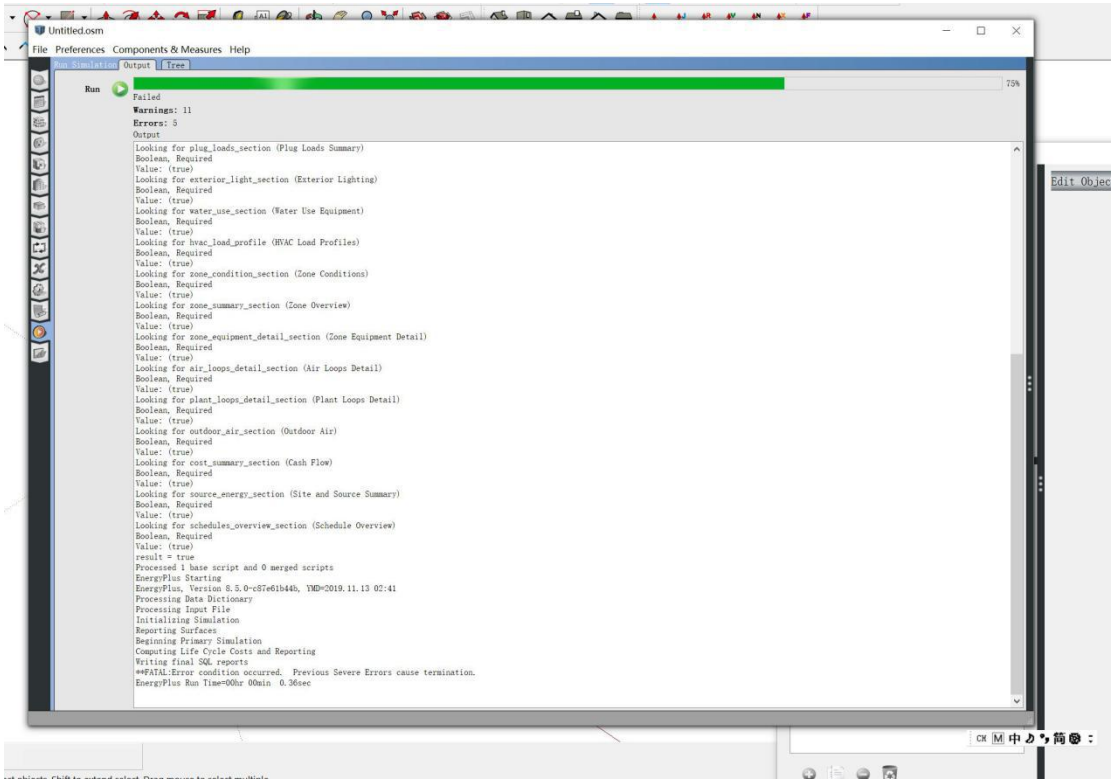




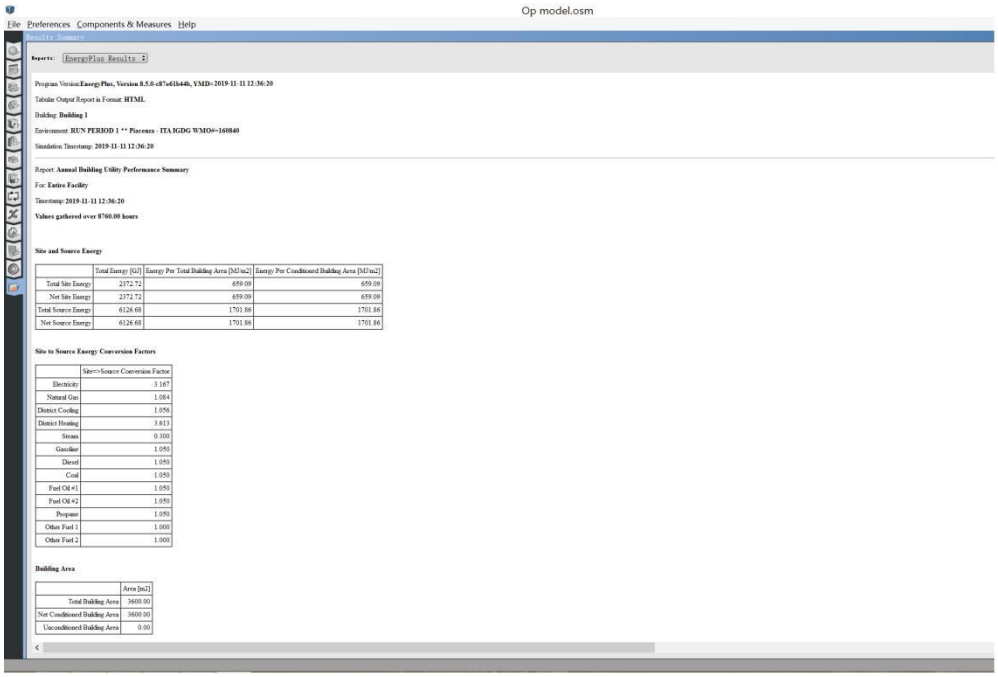


9. Open Studio launching.





10. Result reviews.


Op model.osm
File Preferences Components & Measures Help
Results Summary
Reports: EnergyPlus Results
Program Version:EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019-11-11 12:36:20
Tabular Output Report in Format: HTML
Building: Building 1
Environment: RUN PERIOD 1 ** Piacenza - ITA IGDG WMO#=160840
Simulation Timestamp: 2019-11-11 12:36:20
Report: Annual Building Utility Performance Summary
For: Entire Facility
Timestamp: 2019-11-11 12:36:20
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 2372.72 659.09 659.09
Net Site Energy 2372.72 659.09 659.09
Total Source Energy 6126.68 1701.86 1701.86
Net Source Energy 6126.68 1701.86 1701.86
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
Fuel Oil #2 1.050
Propane 1.050
Other Fuel 1 1.000
Other Fuel 2 1.000
Building Area
Area [m2]
Total Building Area 3600.00
Net Conditioned Building Area 3600.00
Unconditioned Building Area 0.00