Week6 Assignment

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:

$$\dot{q}_{12}=\frac{\dot{Q}_{12}}{A}=\frac{A\sigma(T_1^4-T_2^4)}{\frac{1}{\varepsilon_1}+\frac{1}{\varepsilon_2}-1}\div A=\frac{5.67\times10^{-8}\times(800^4-500^4)}{\frac{1}{0.2}+\frac{1}{0.7}-1}\approx 3625.3491\text{W}$$

$$\dot{q}'_{12shield}=\frac{\dot{Q}_{12shield}}{A}$$

$$=\frac{A\sigma(T_1^4-T_2^4)}{(\frac{1}{\varepsilon_1}+\frac{1}{\varepsilon_2}-1)(\frac{1}{\varepsilon_{3.1}}+\frac{1}{\varepsilon_{3.2}}-1)...(\frac{1}{\varepsilon_{n.1}}+\frac{1}{\varepsilon_{n.2}}-1)}\div A$$

$$=\frac{\sigma(T_1^4-T_2^4)}{(\frac{1}{\varepsilon_1}+\frac{1}{\varepsilon_2}-1)(\frac{1}{\varepsilon_{3.1}}+\frac{1}{\varepsilon_{3.2}}-1)...(\frac{1}{\varepsilon_{n.1}}+\frac{1}{\varepsilon_{n.2}}-1)}$$

$$\varepsilon_1=\varepsilon_2=\varepsilon_3=\cdots=\varepsilon_{n-1}=\varepsilon_n=0.1$$

$$\dot{q}'_{12shield}=\frac{\sigma(T_1^4-T_2^4)}{(\frac{1}{\varepsilon_1}+\frac{1}{\varepsilon_2}-1)(\frac{1}{\varepsilon_{3.1}}+\frac{1}{\varepsilon_{3.2}}-1)...(\frac{1}{\varepsilon_{n.1}}+\frac{1}{\varepsilon_{n.2}}-1)}$$

$$=\frac{\sigma(T_1^4-T_2^4)}{(n+1)(\frac{1}{0.1}+\frac{1}{0.1}-1)}=\frac{1}{100}\times\frac{\sigma(T_1^4-T_2^4)}{(\frac{1}{0.2}+\frac{1}{0.7}-1)}$$

$$\rightarrow n=28$$

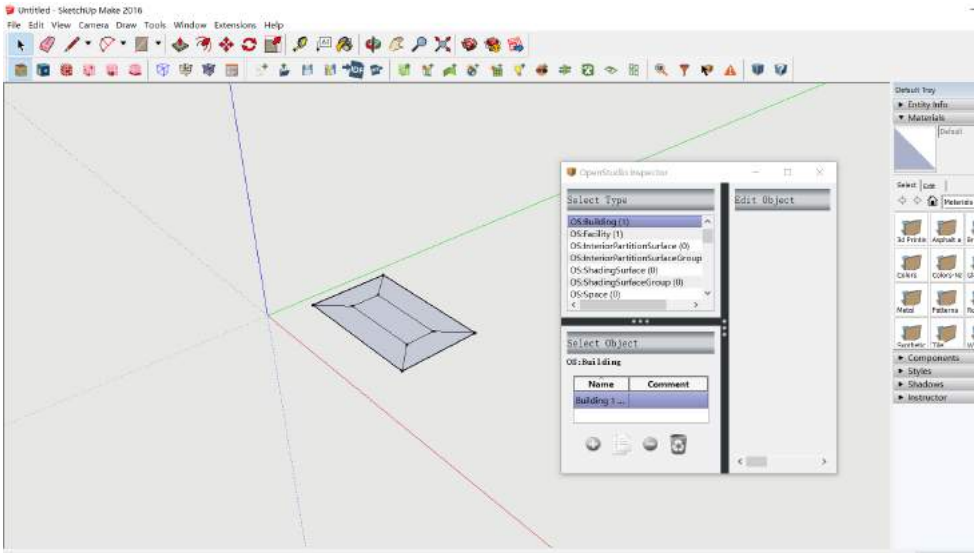
So we need 28 shields with epsilon=0.1 in order to have the new heat transfer rate to be 1% of the case without shields.

Task2：

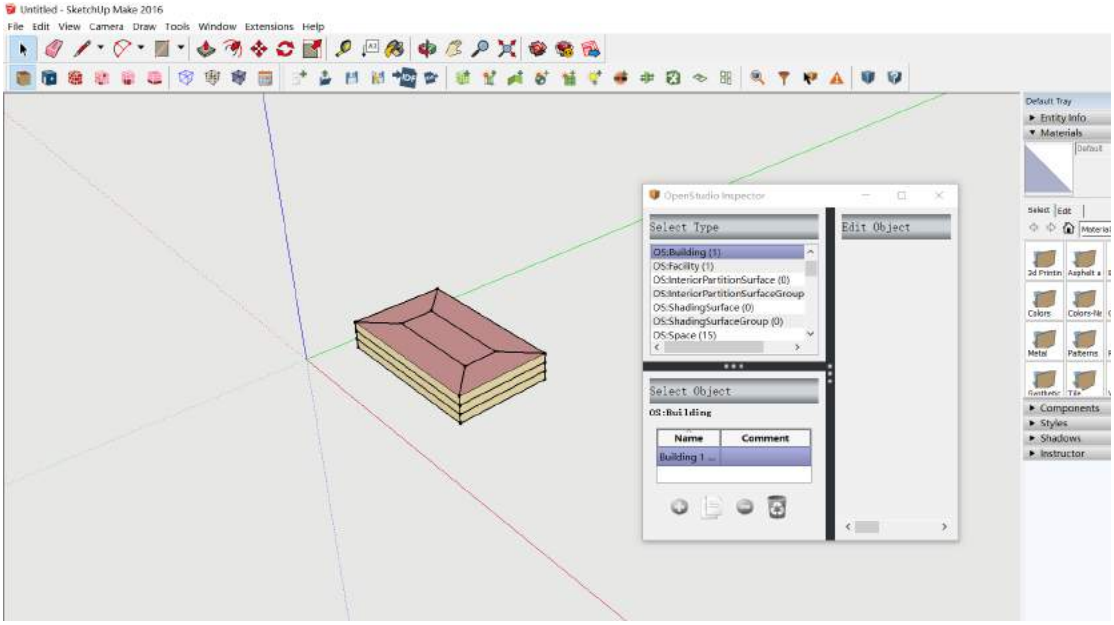
You should create a pdf file with screenshots of all the steps we went through (clearly from your own file) and explain briefly the reason behind the use of each step (in your own words)

Answer:

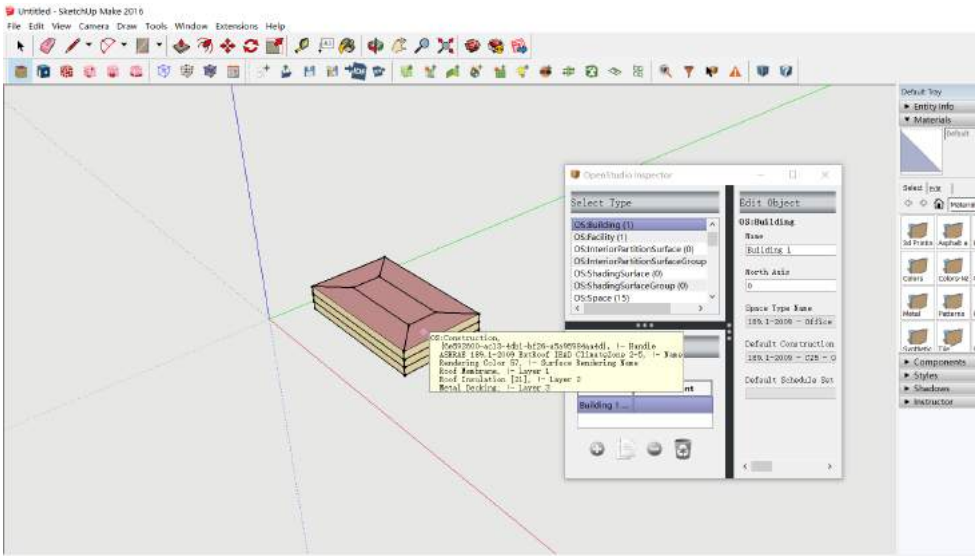
1. At first, draw the outline and shape of the building in Sketchup.



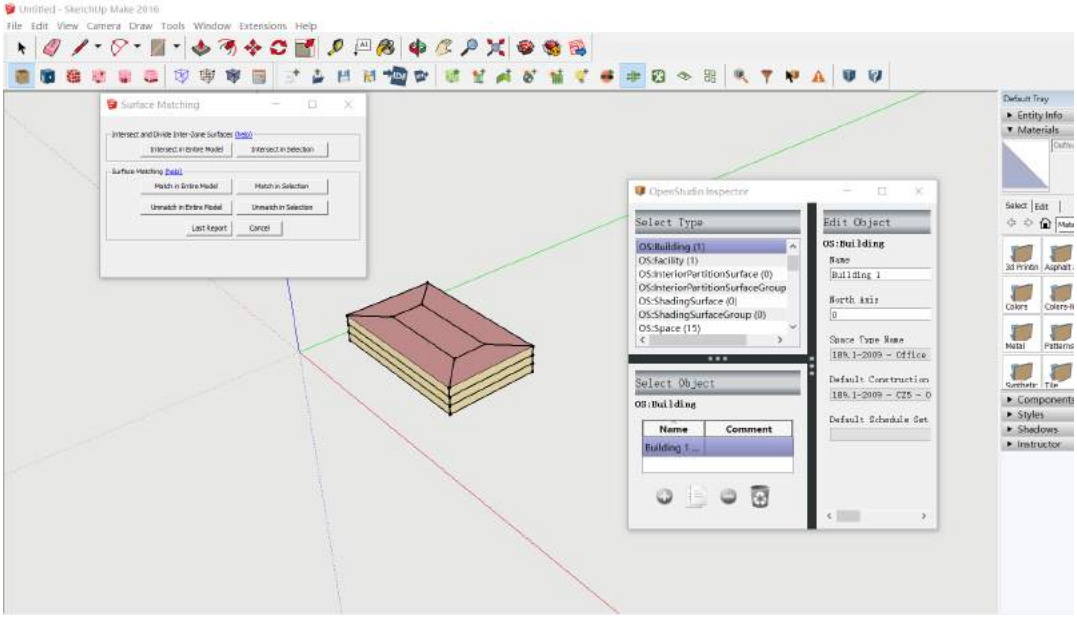
2. Use the command “Creat spaces from diagram” to creat a three floors building.



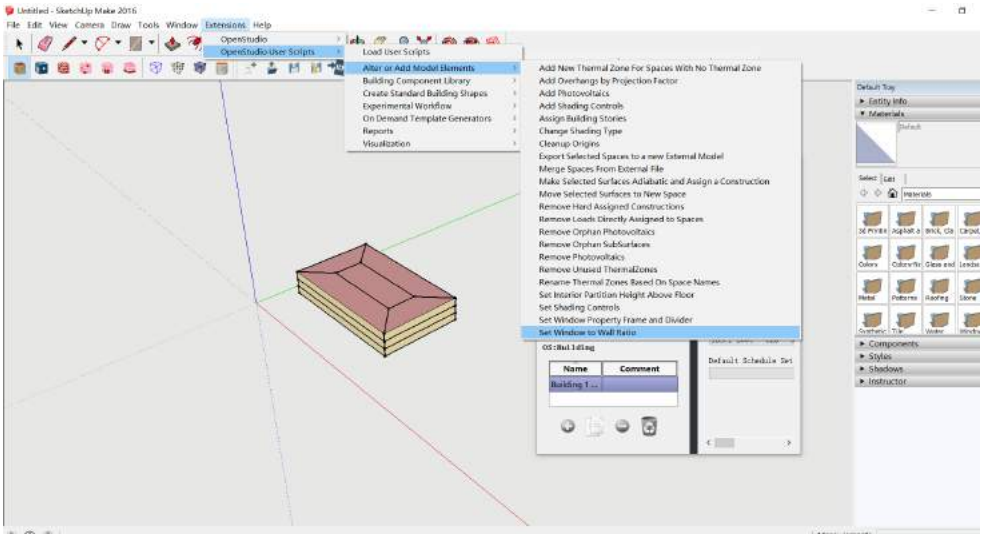
3. By using the command “Info tool”, you can see the material information about the building.

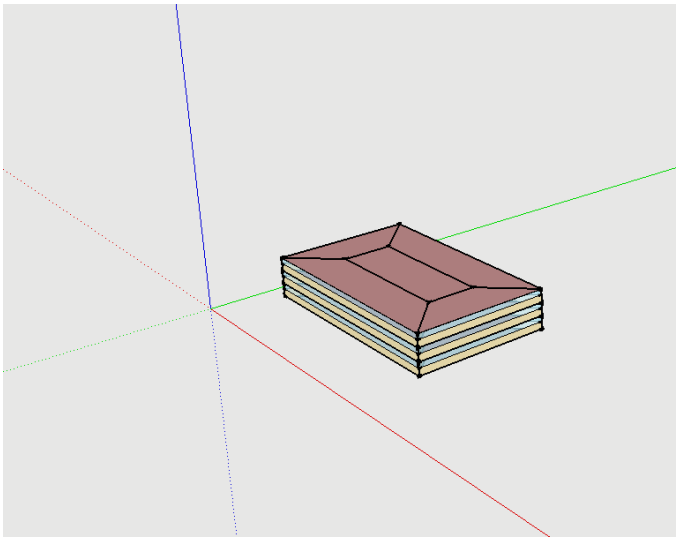


4. Then click the command “Surface matching”.

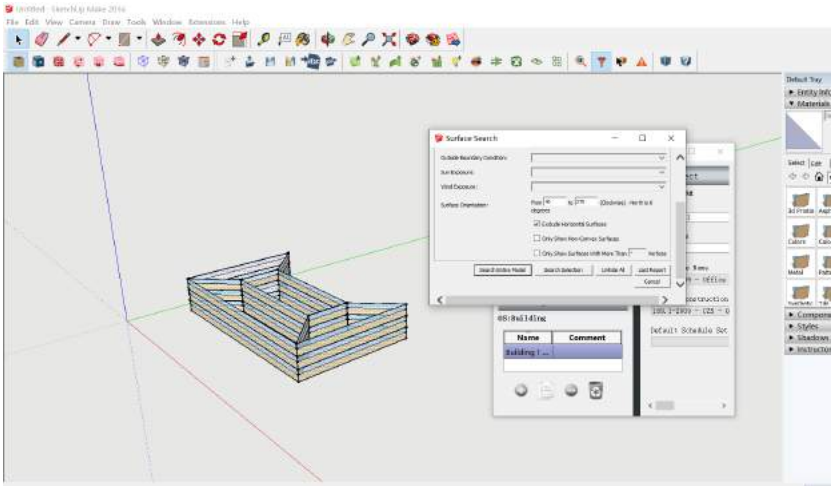


5. Find “User input” and build windows by using “Windows to Wall Ratio “.

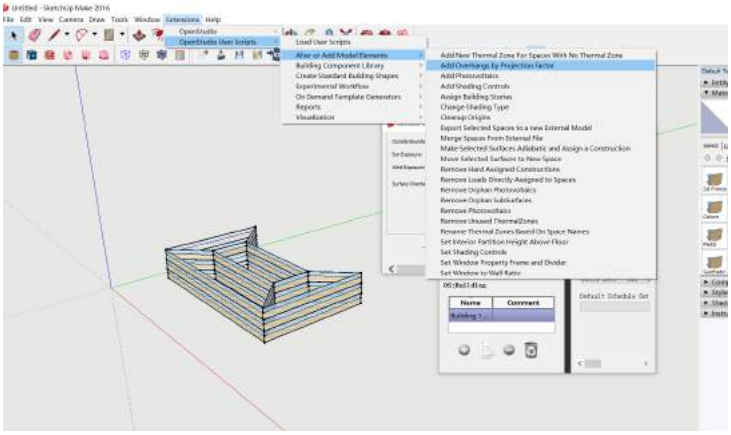


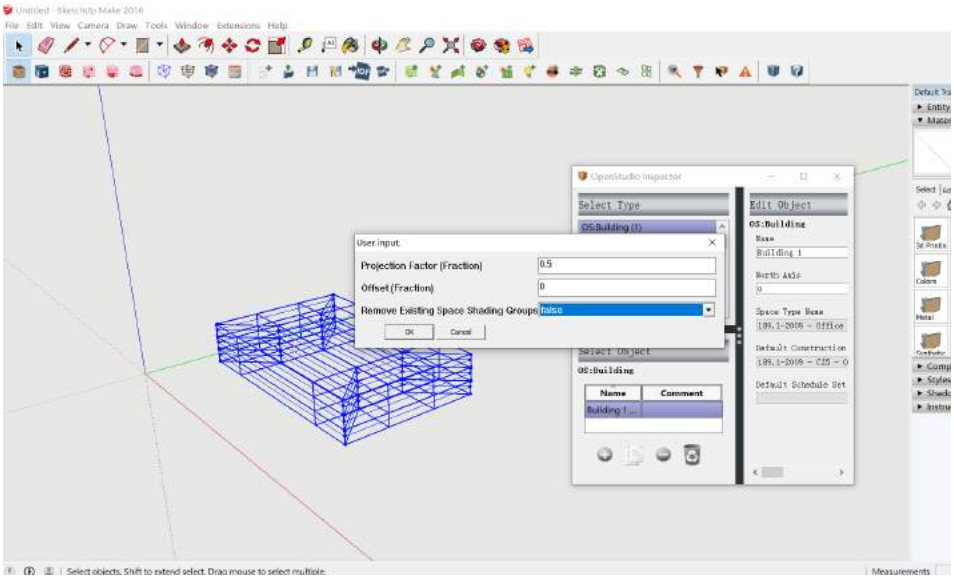


6. Find “Surface search”, you can use Surface Orientation to build the windows on other side.

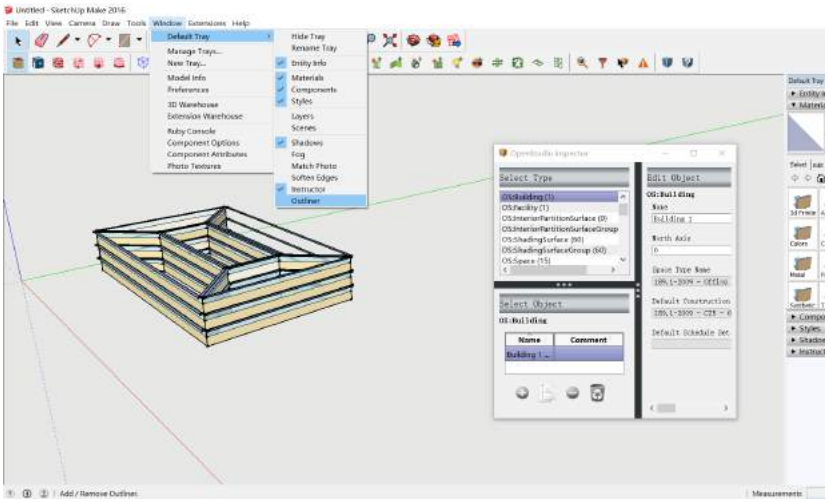


7. Next step is make overhangs by using “ Projection Factor” .

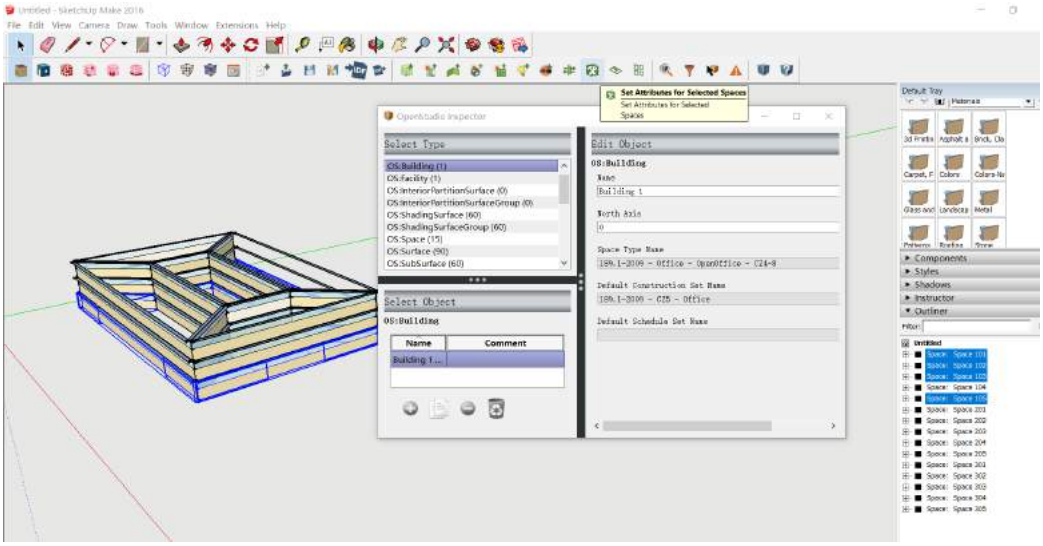




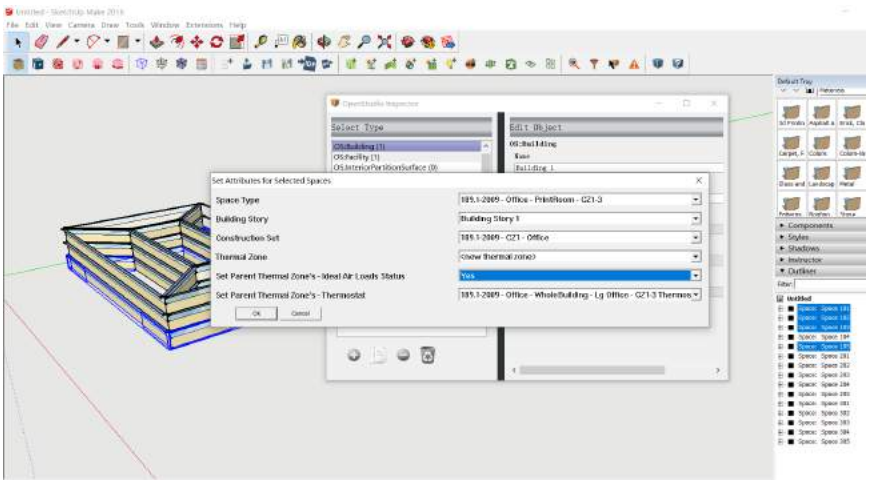
8. Open“Default Tray”.

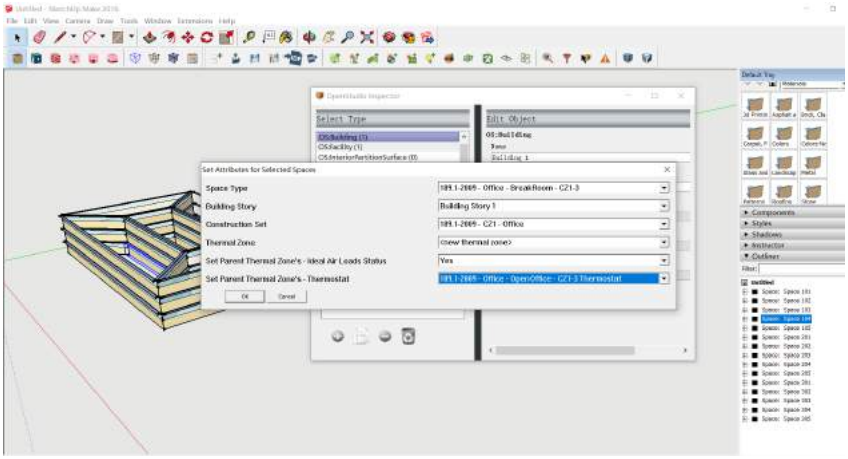


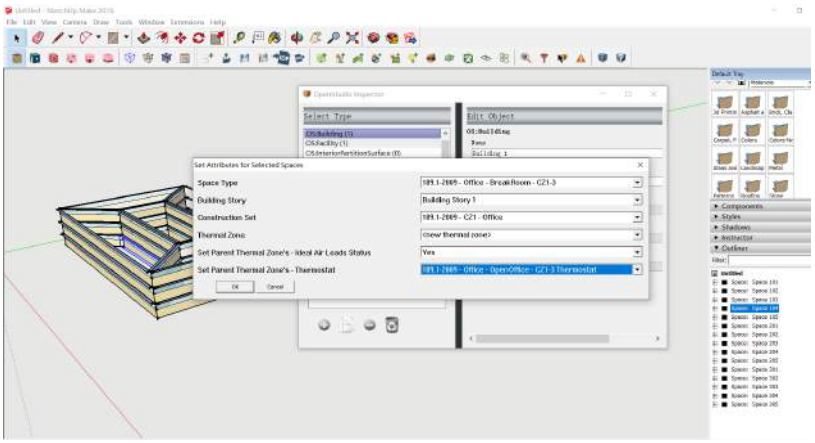
9. Choose the space of each thermal zone .

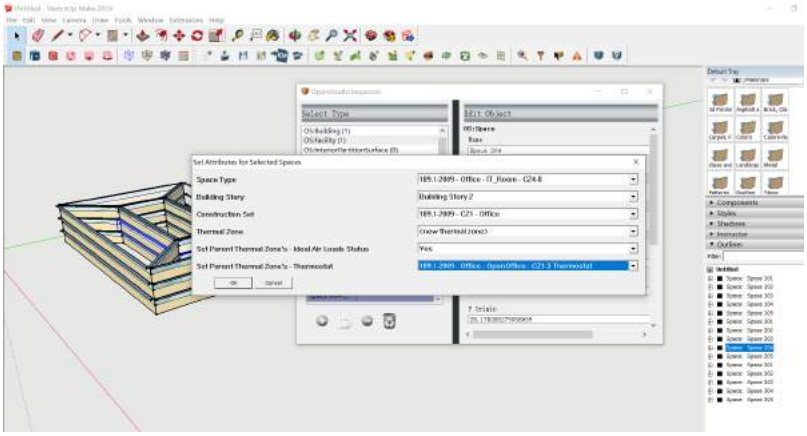


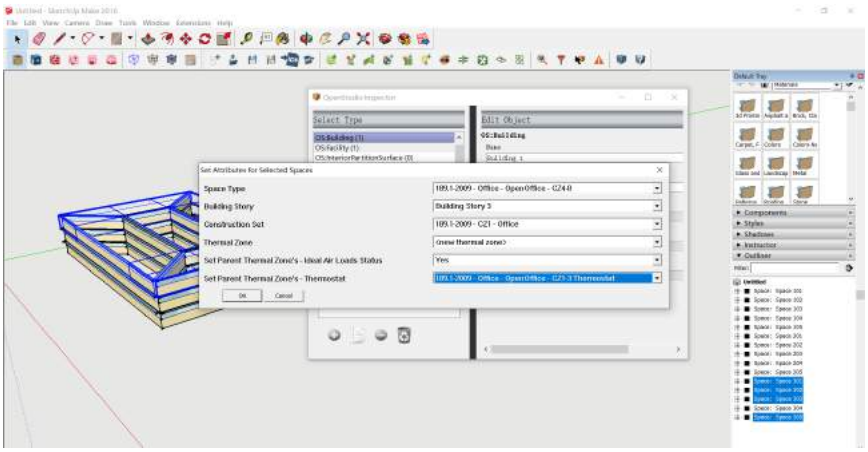
10. Using “ Set Attributes for Selected Spaces” to set parent thermal zone’s thermostat.

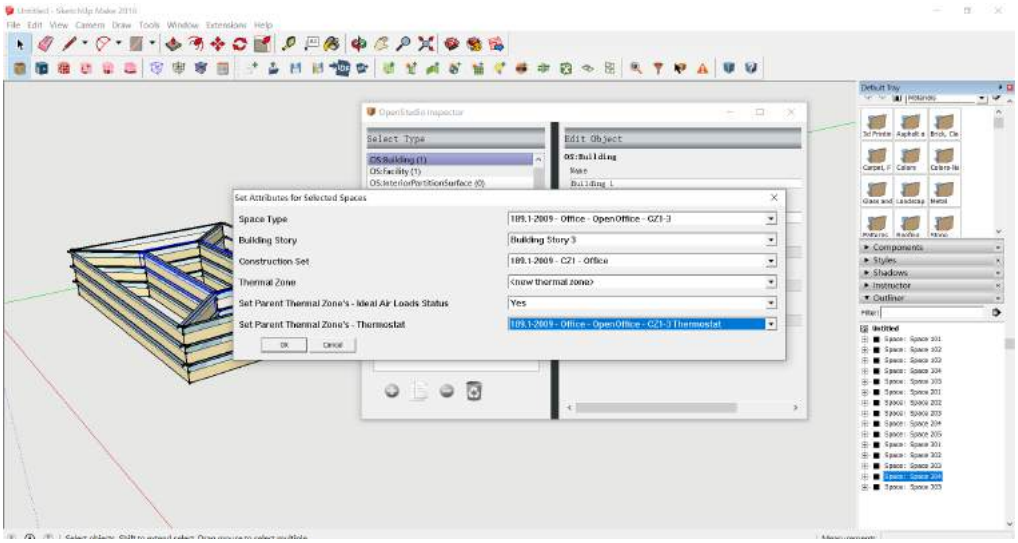

Set Attributes for Selected Spaces
Space Type
90.1-2009 - Office - PrintRoom - G21-3
Building Story
Building Story 1
Construction Set
90.1-2009 - G21 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
90.1-2009 - Office - WholeBuilding - Lg Office - G21-3 Thermos
OK
Cancel


Set Attributes for Selected Spaces
Space Type
90.1-2009 - Office - BreakRoom - G21-3
Building Story
Building Story 1
Construction Set
90.1-2009 - G21 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
90.1-2009 - Office - OpenOffice - G21-3 Thermostat
OK
Cancel

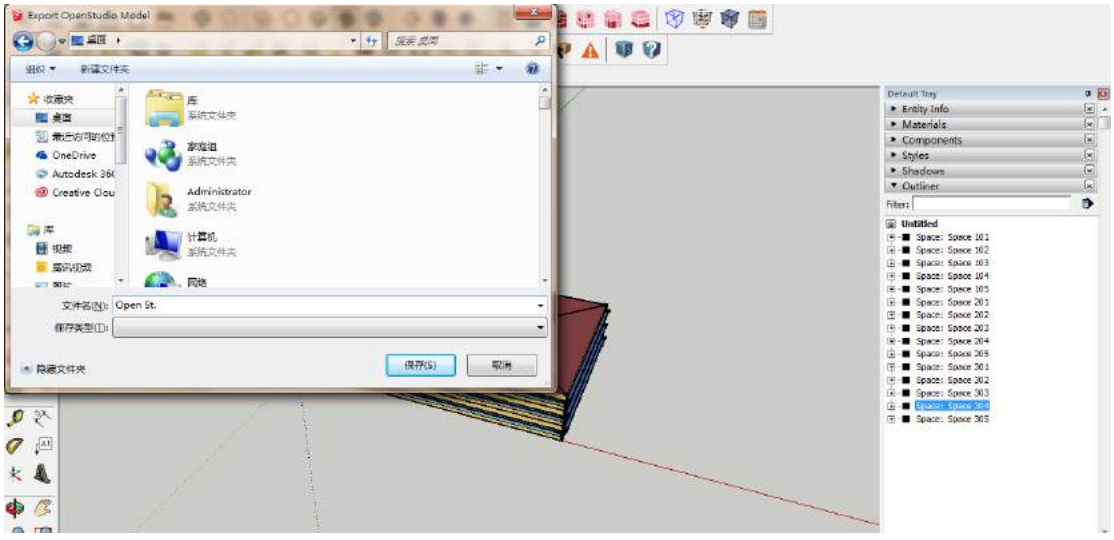

Set Attributes for Selected Spaces
Space Type
90.1-2009 - Office - BreakRoom - G21-3
Building Story
Building Story 1
Construction Set
90.1-2009 - G21 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
90.1-2009 - Office - OpenOffice - G21-3 Thermostat
OK
Cancel


Set Attributes for Selected Spaces
Space Type
90.1-2009 - Office - IT_Room - G24-8
Building Story
Building Story 2
Construction Set
90.1-2009 - G23 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
90.1-2009 - Office - OpenOffice - G21-3 Thermostat
OK
Cancel

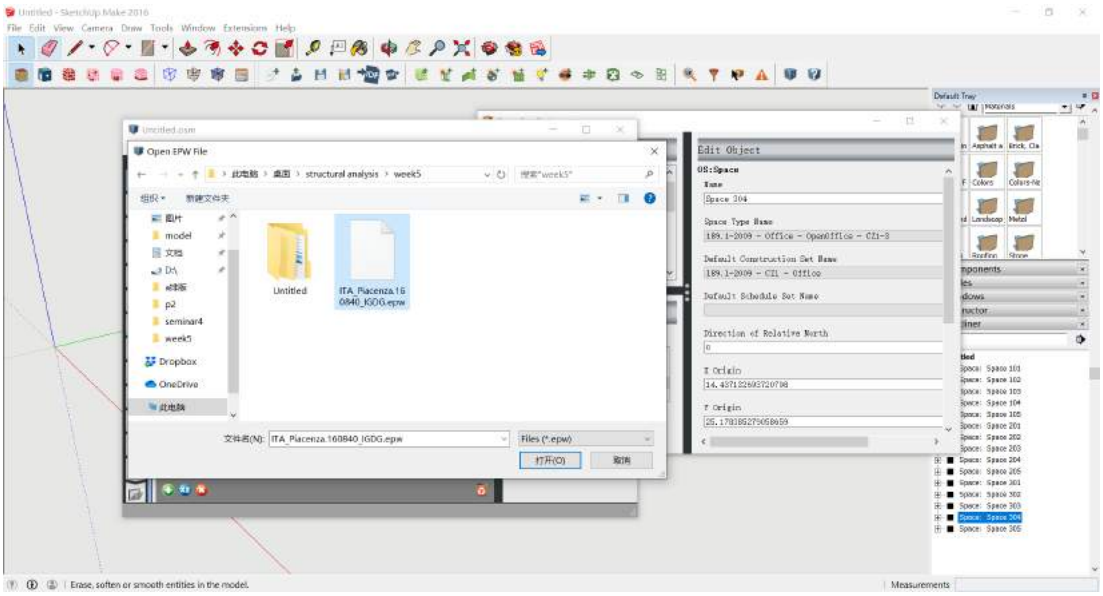




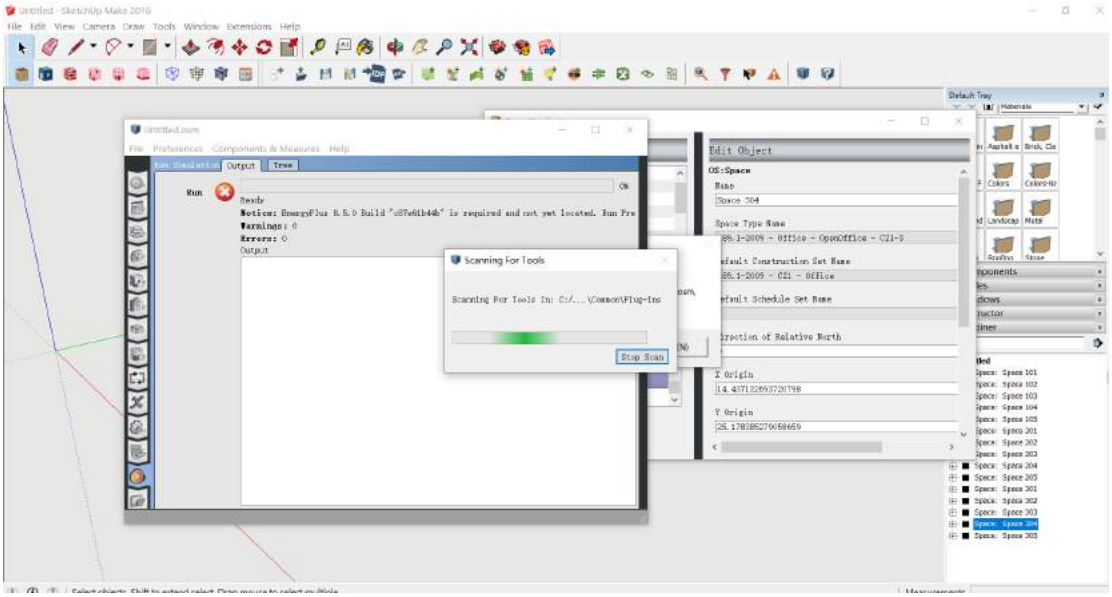
11.Saving the model.

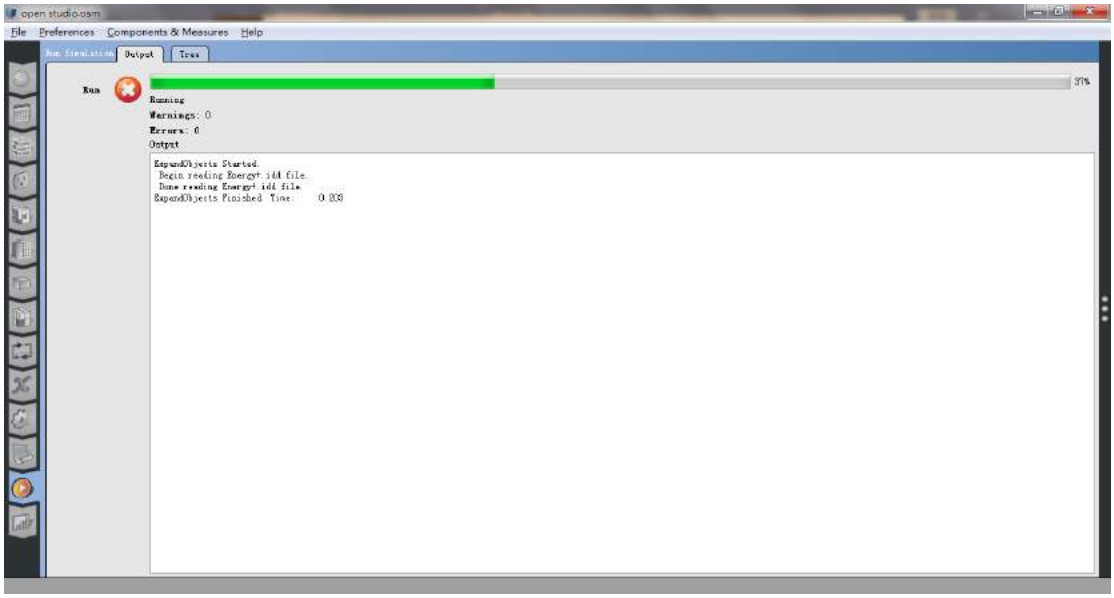


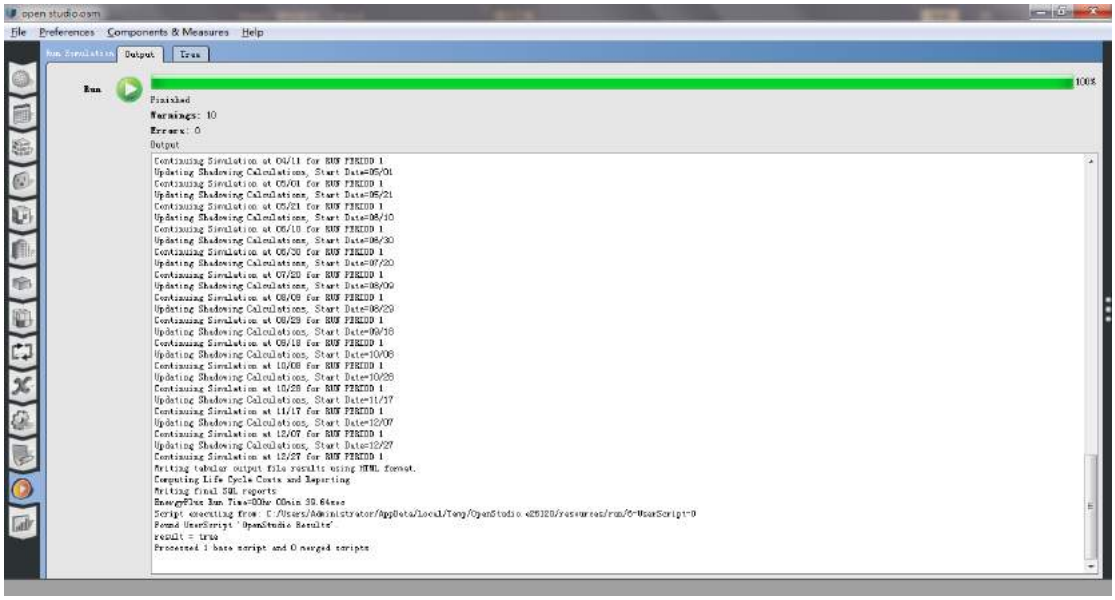
12. Run the “ Launch Open Studio” and add the design date .



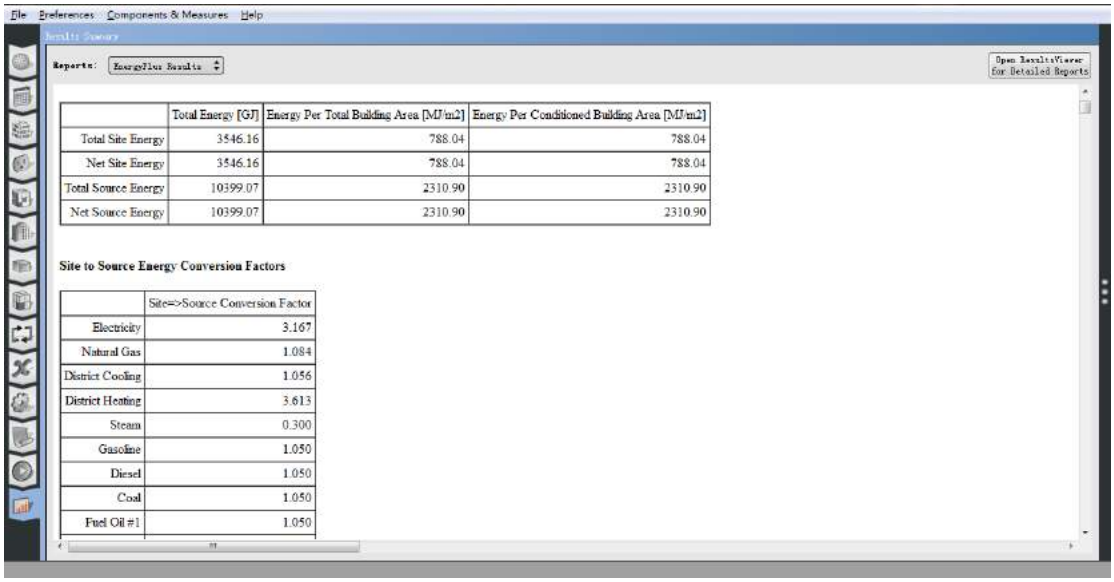
13. Click the “ Run Simulation” .



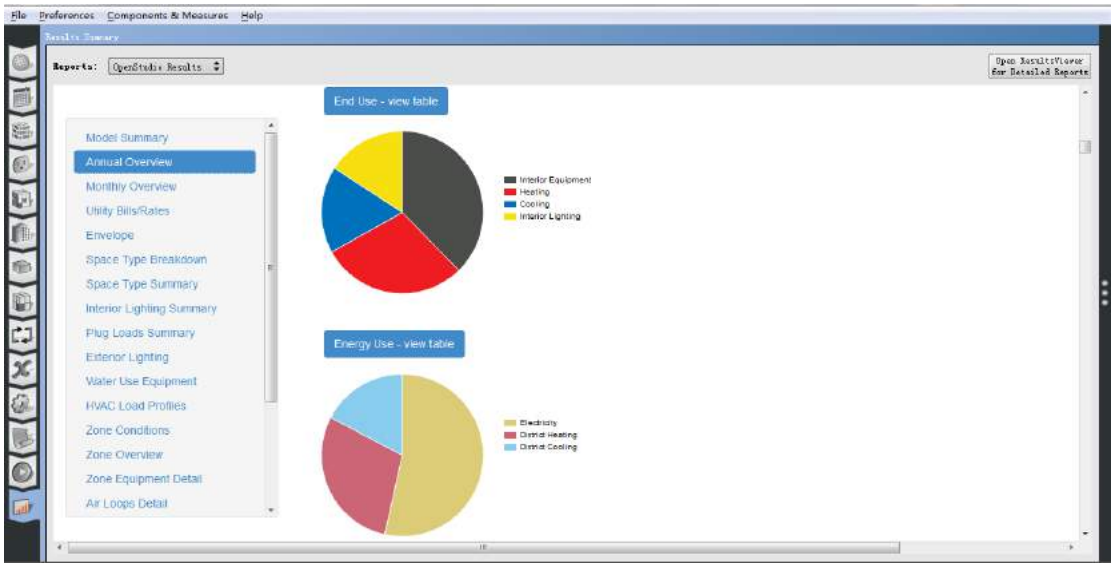
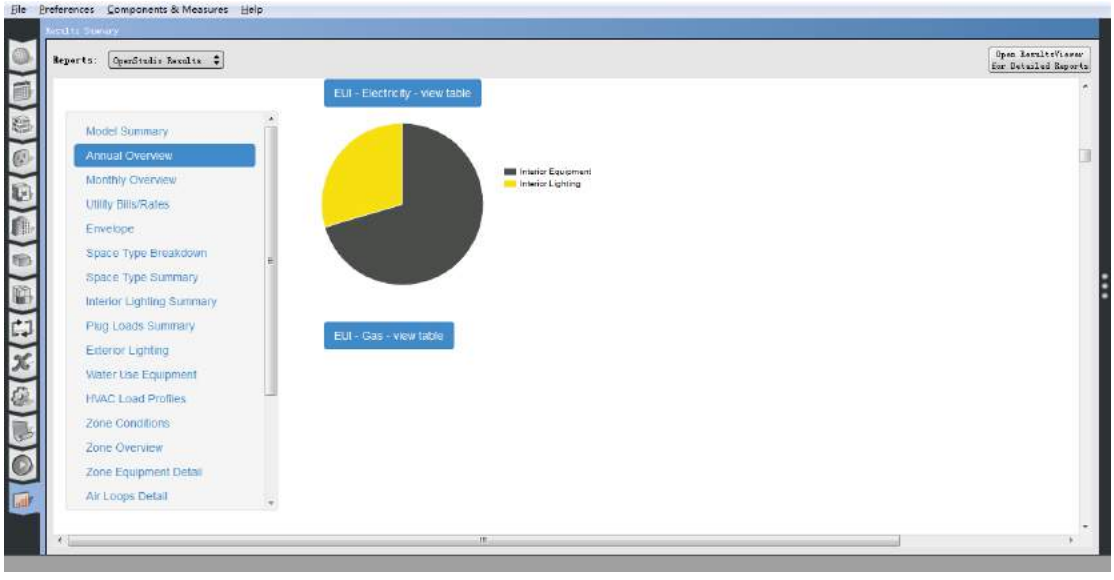




14. You can see the Result Summary .



	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