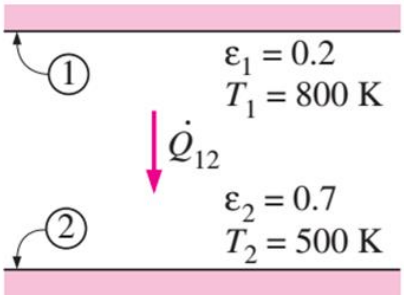
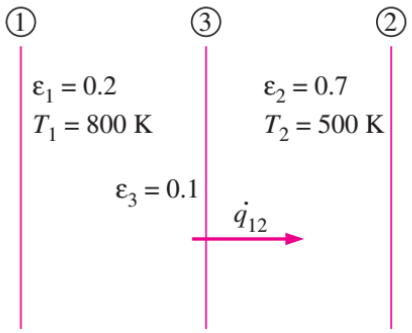
Question 1 : **How many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields?**



$$\dot{Q}_{from\ previous\ example} = 3625.4$$

1 % of Q. = 36.254

$$\dot{Q}_{\text{no of sheilds}} = \frac{A\,\sigma(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} - \frac{1}{\epsilon_2} + 1\right) + \left(\frac{1}{\epsilon_{N,1}} - \frac{1}{\epsilon_{N,2}} + 1\right)}$$



$where\ \dot{Q}_{\text{no of sheilds}} = 36.254\text{W}$

$\varepsilon_{sheild} = 0.1$

$$\dot{Q}_{\text{no of sheilds}} = \frac{A\,\sigma(800^4 - 500^4)}{\left(\frac{1}{0.7} - \frac{1}{0.2} + 1\right) + \left(\frac{1}{0.1} - \frac{1}{0.1} + 1\right)(N+1)}$$

$$36.254 = \frac{A\,\sigma(800^4 - 500^4)}{\left(\frac{1}{0.7} - \frac{1}{0.2} + 1\right) + \left(\frac{1}{0.1} - \frac{1}{0.1} + 1\right)(N+1)}$$

N = 27.28 shields round up & Down and check the formula.

Plug In the Variable:

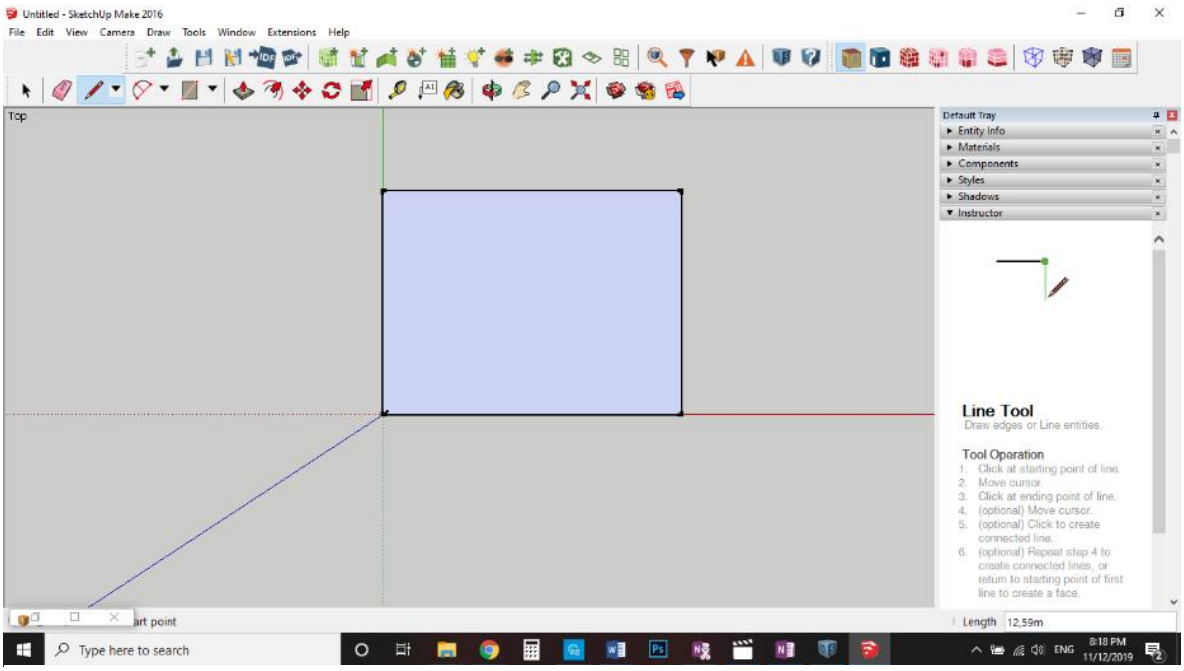
$$\dot{Q}_{\text{no of sheilds}} = \frac{19680.57}{5.428 + \left(\frac{1}{0.1} - \frac{1}{0.1} + 1\right)(27+1)} = 36.62\text{W (Not enough)}$$

$$\dot{Q}_{\text{no of sheilds}} = \frac{19680.57}{5.428 + \left(\frac{1}{0.1} - \frac{1}{0.1} + 1\right)(28+1)} = 35.3695\text{ W (reached the Goal} \leq 36.254)$$

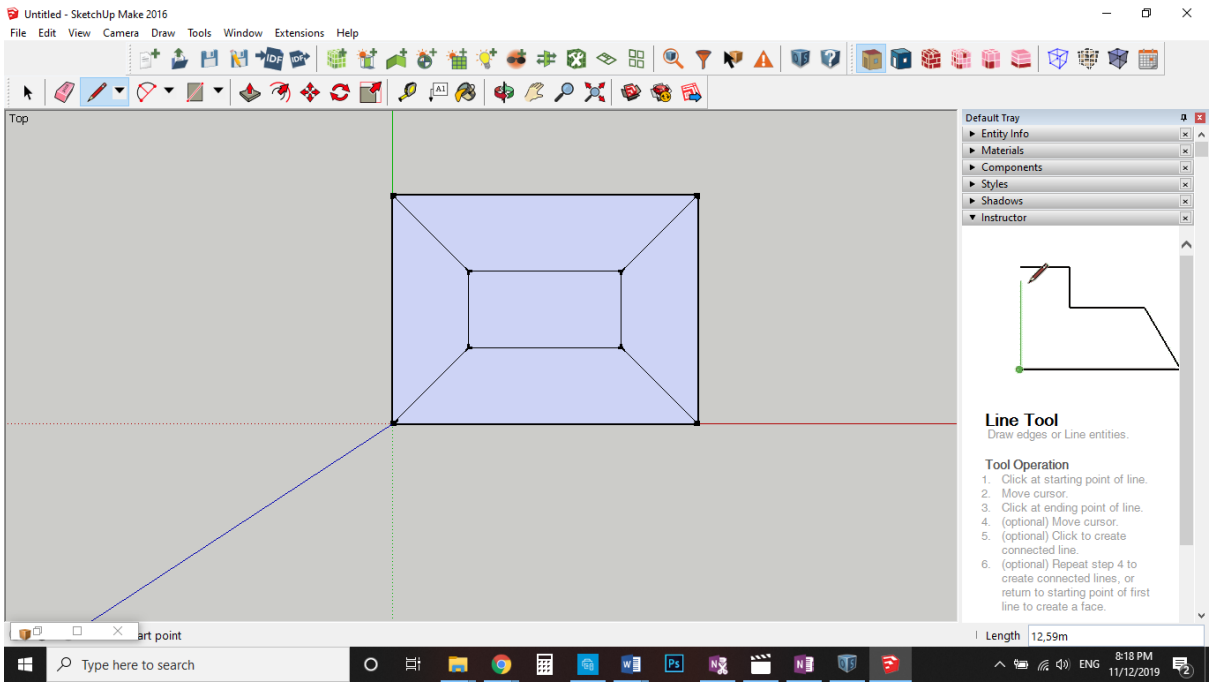
$$\dot{Q}_{\text{no of sheilds}} = \mathbf{35.3695\ W}$$

Therefore, I need 28 shields to reach 1% of the pervious Q.

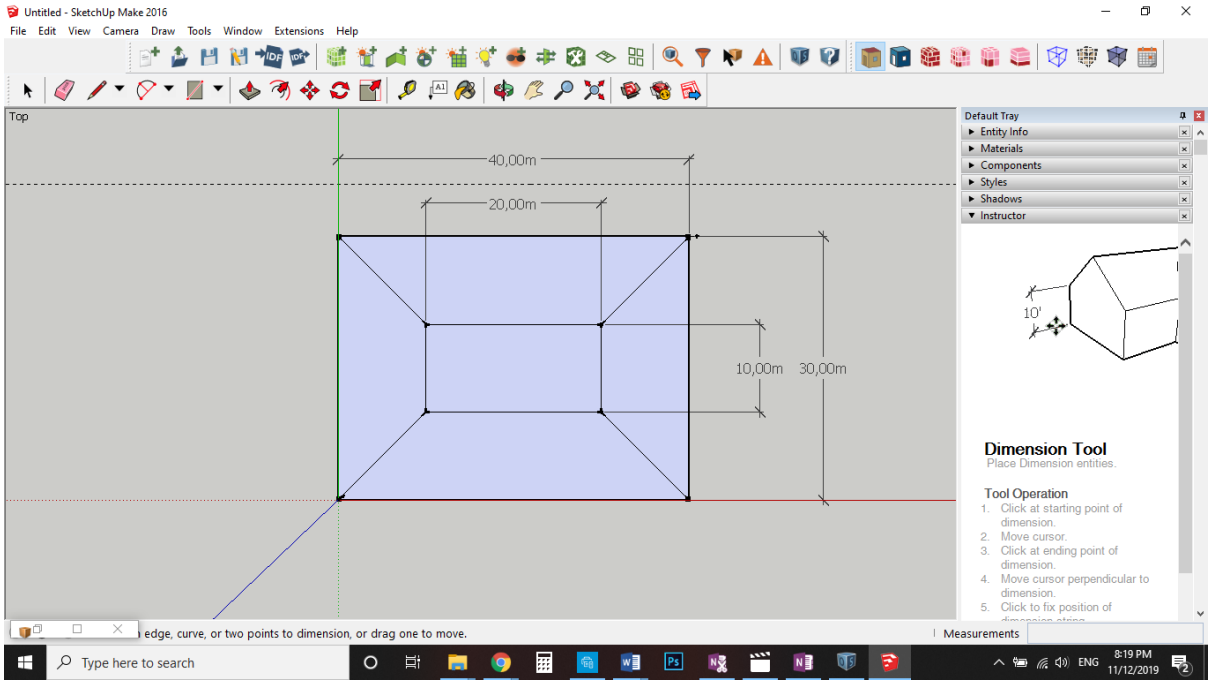
Question 2 : Open Studio Steps:

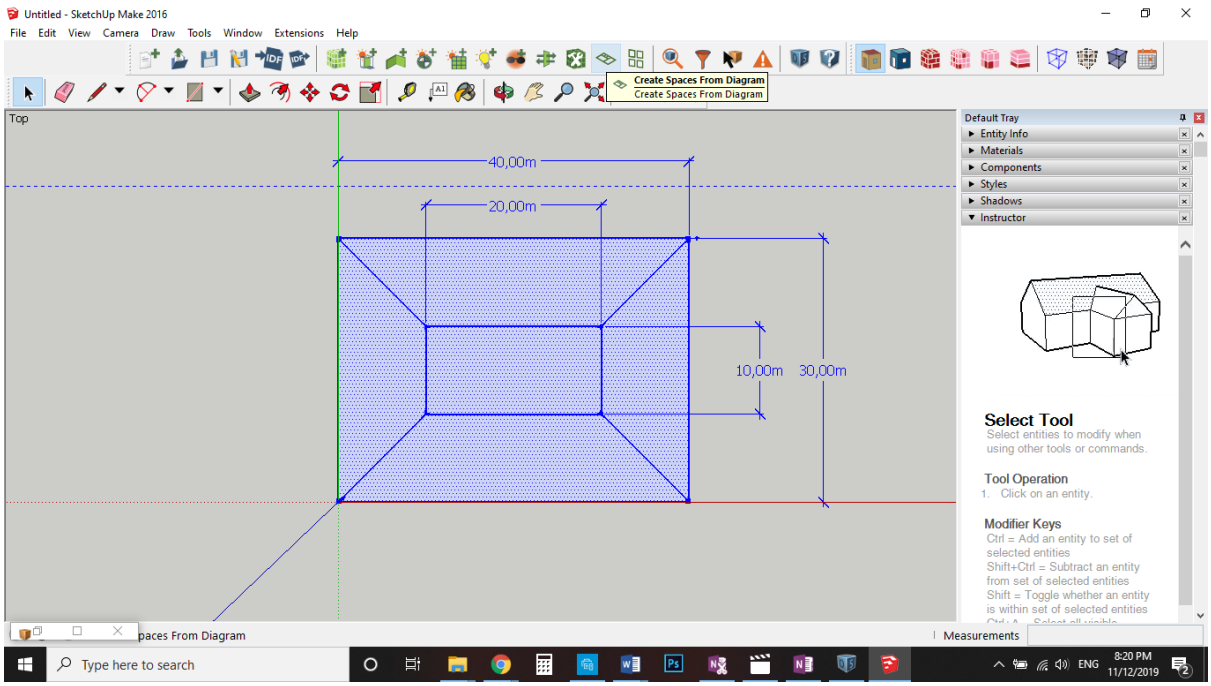


First, we set the north so that when we conduct the window analysis it is accurate. And then draw the rectangular base of the building (40*30)

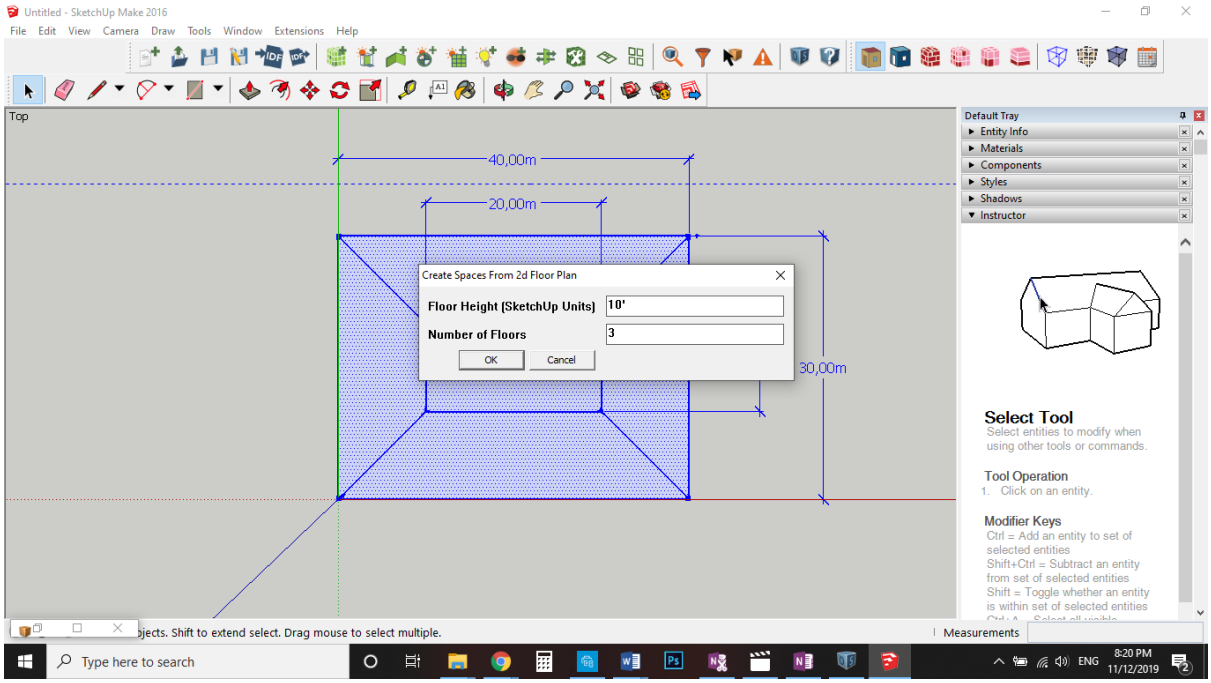


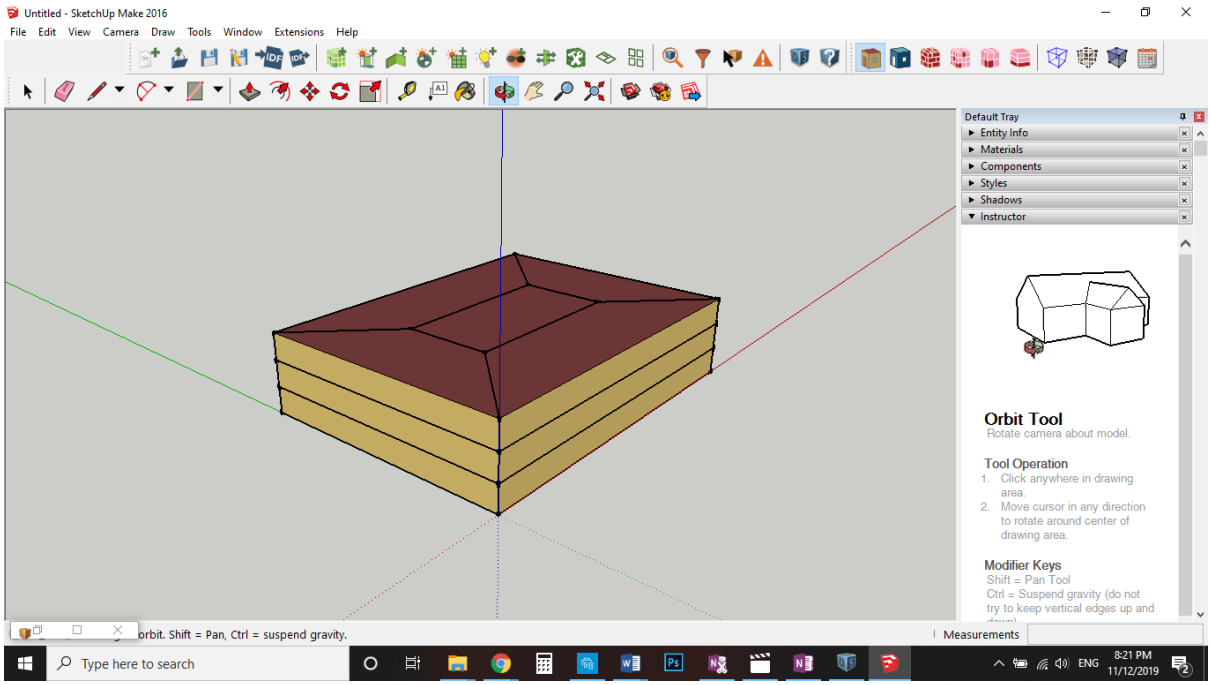
Then we offset by 10 m from all directions and connect the lines.

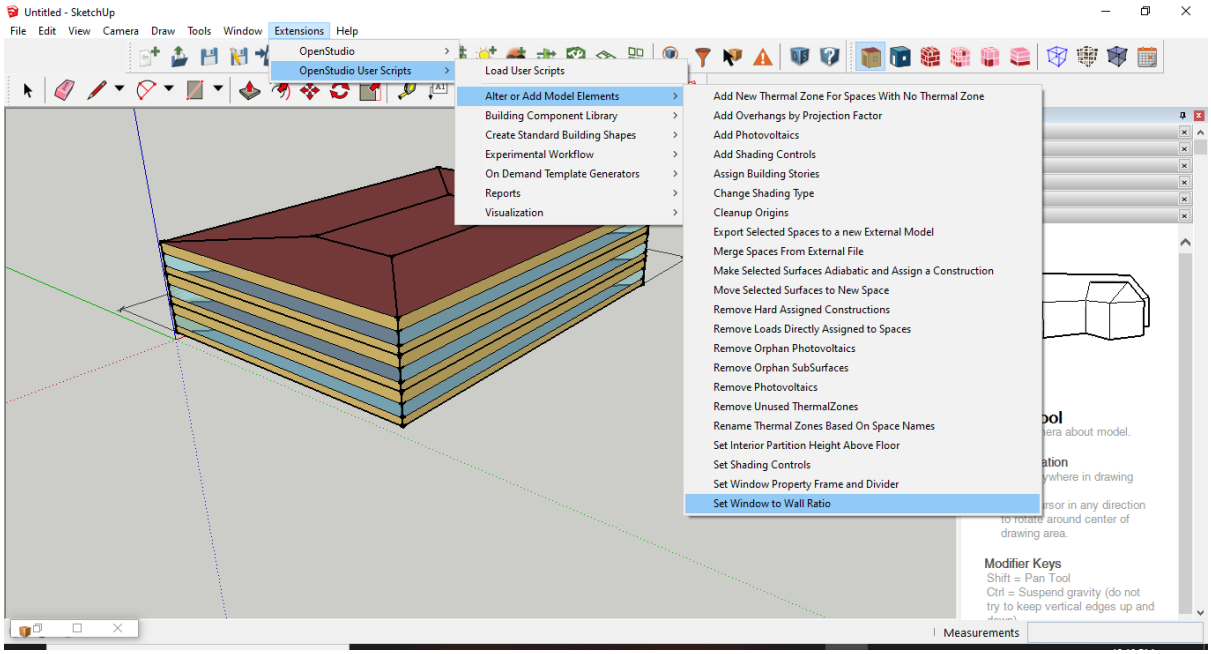




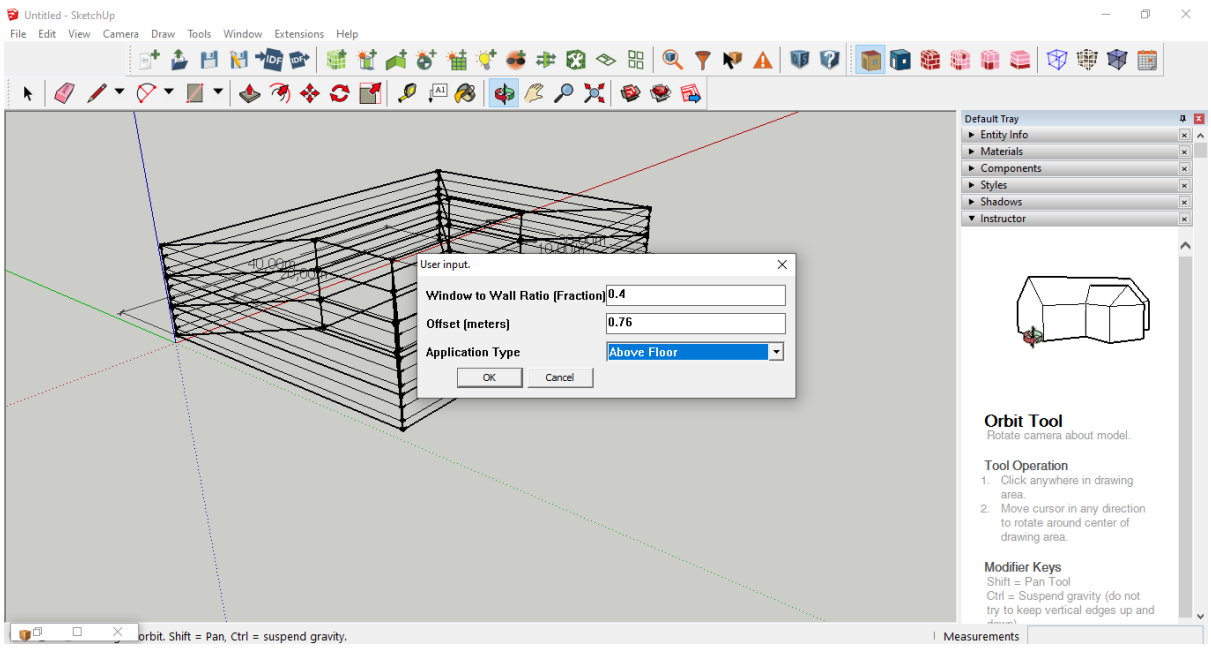
After that we select the base and select create spaces from diagram so that it transform our base into spaces with volumes according to the number of floors we need with the desired floor height


Untitled - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help
Top
40,00m
20,00m
30,00m
Create Spaces From 2d Floor Plan
Floor Height (SketchUp Units) 10'
Number of Floors 3
OK
Cancel
Default Tray
Entity Info
Materials
Components
Styles
Shadows
Instructor
Select Tool
Select entities to modify when using other tools or commands.
Tool Operation
1. Click on an entity.
Modifier Keys
Ctrl = Add an entity to set of selected entities
Shift+Ctrl = Subtract an entity from set of selected entities
Shift = Toggle whether an entity is within set of selected entities
jects. Shift to extend select. Drag mouse to select multiple.
Measurements
Type here to search
ENG
8:20 PM
11/12/2019

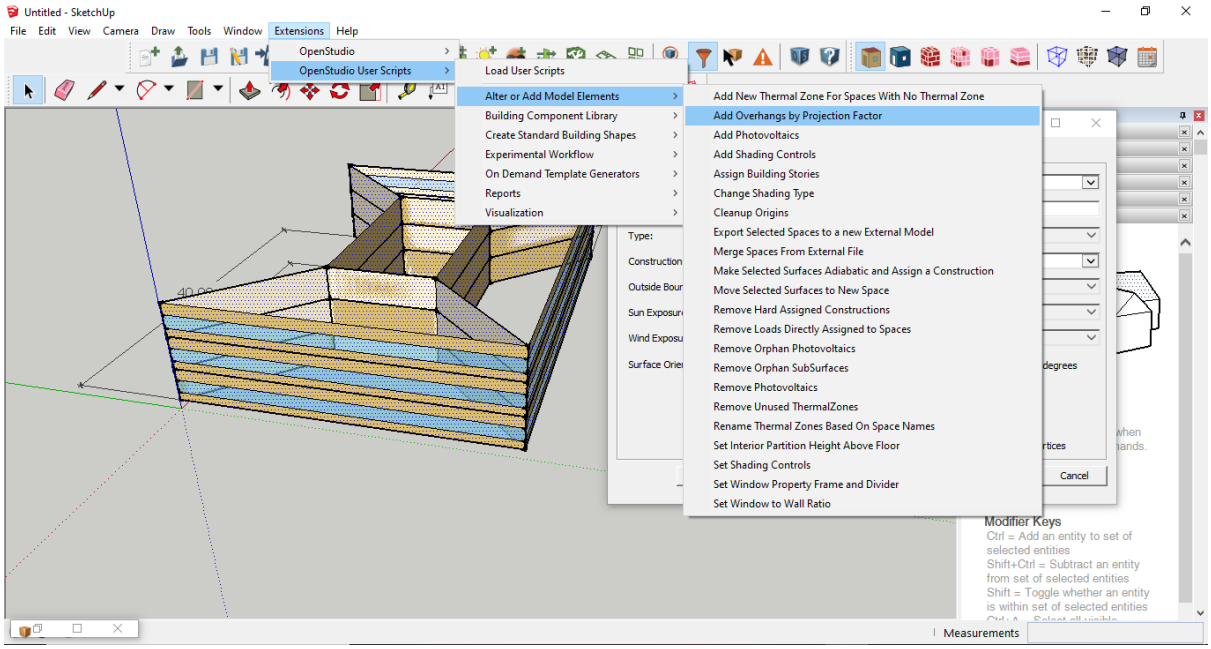

Untitled - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help
Default Tray
Entity Info
Materials
Components
Styles
Shadows
Instructor
Orbit Tool
Rotate camera about model.
Tool Operation
1. Click anywhere in drawing area.
2. Move cursor in any direction to rotate around center of drawing area.
Modifier Keys
Shift = Pan Tool
Ctrl = Suspend gravity (do not try to keep vertical edges up and
orbit. Shift = Pan, Ctrl = suspend gravity.
Measurements
Type here to search
ENG
8:21 PM
11/12/2019



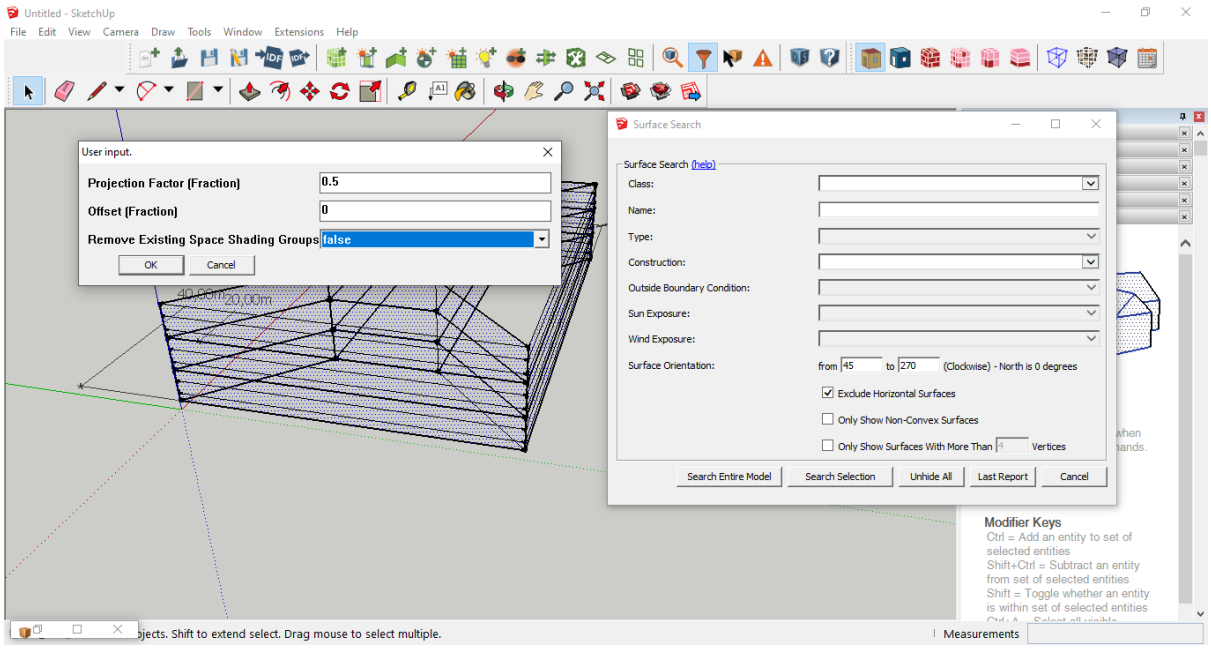
After that we need to add windows to our building so that we can study how it interacts with the environment.



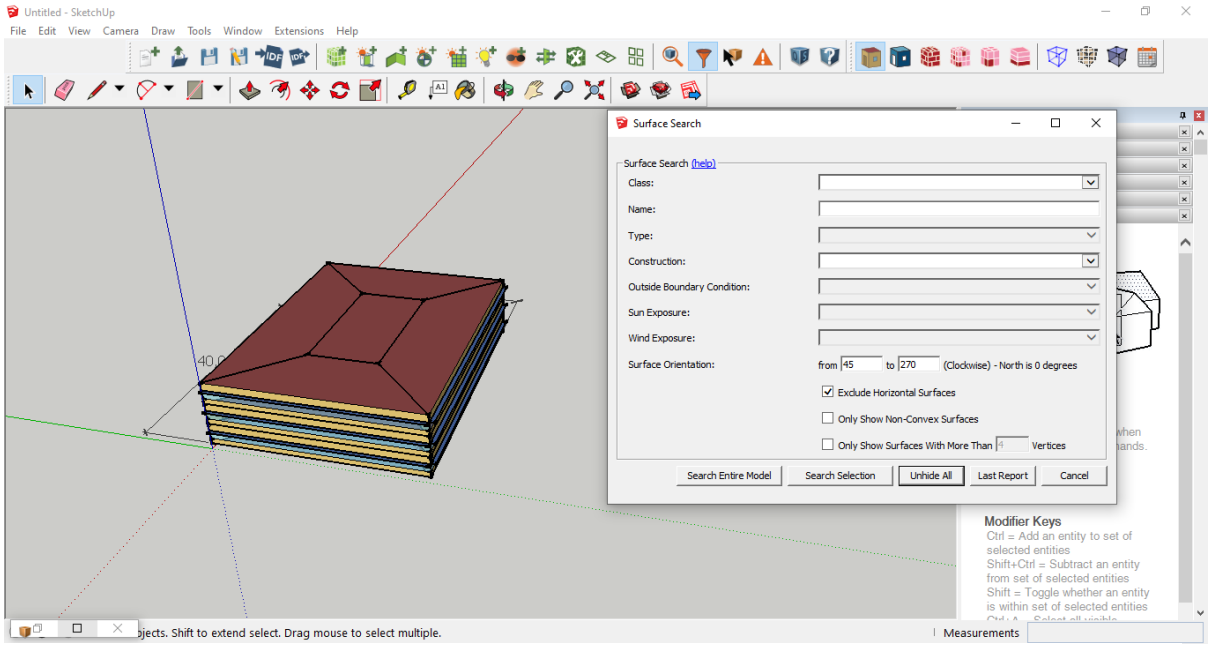
After that we choose the window to wall ratio in order to determine how wide and high are the windows.



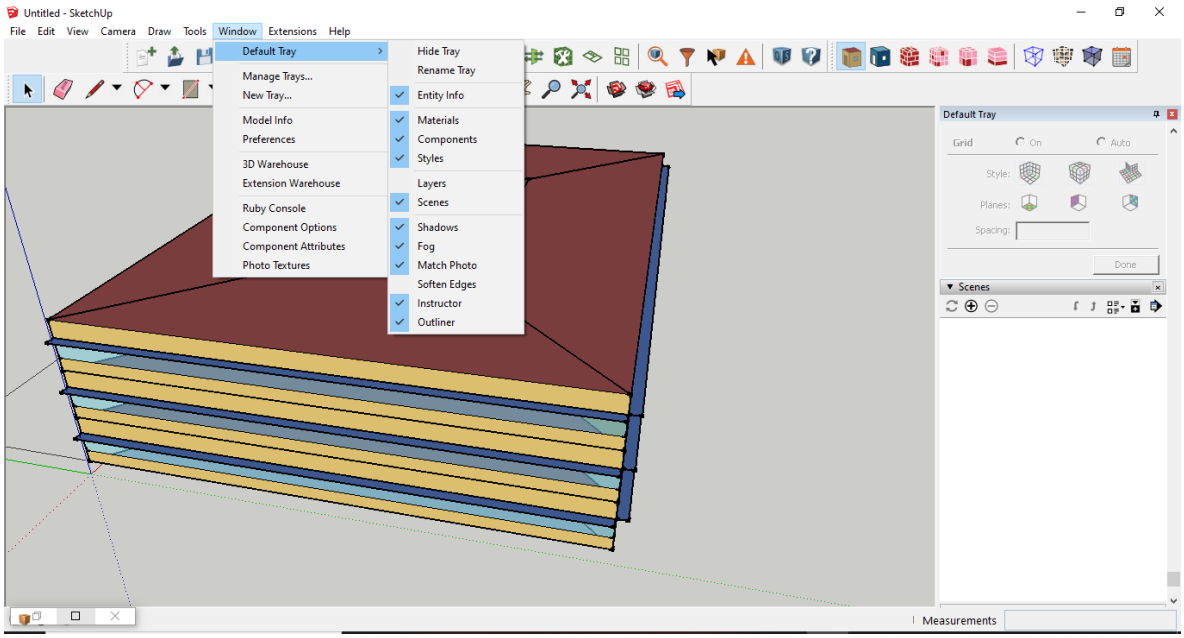
Now that we have our windows we need to add shading devices on them so we choose add model elements.



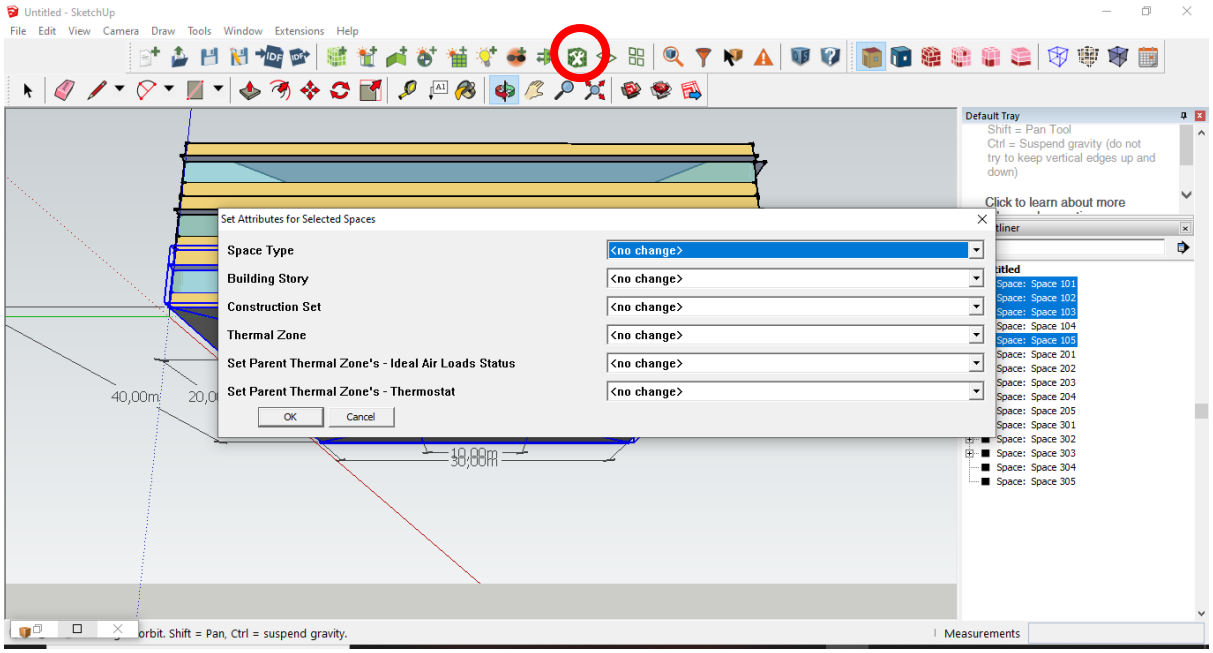
We exclude the North since it does not have direct sunlight so it doesn't need it that's why the angles are 270 also we check on exclude horizontal surfaces because we are after the walls not the floors.



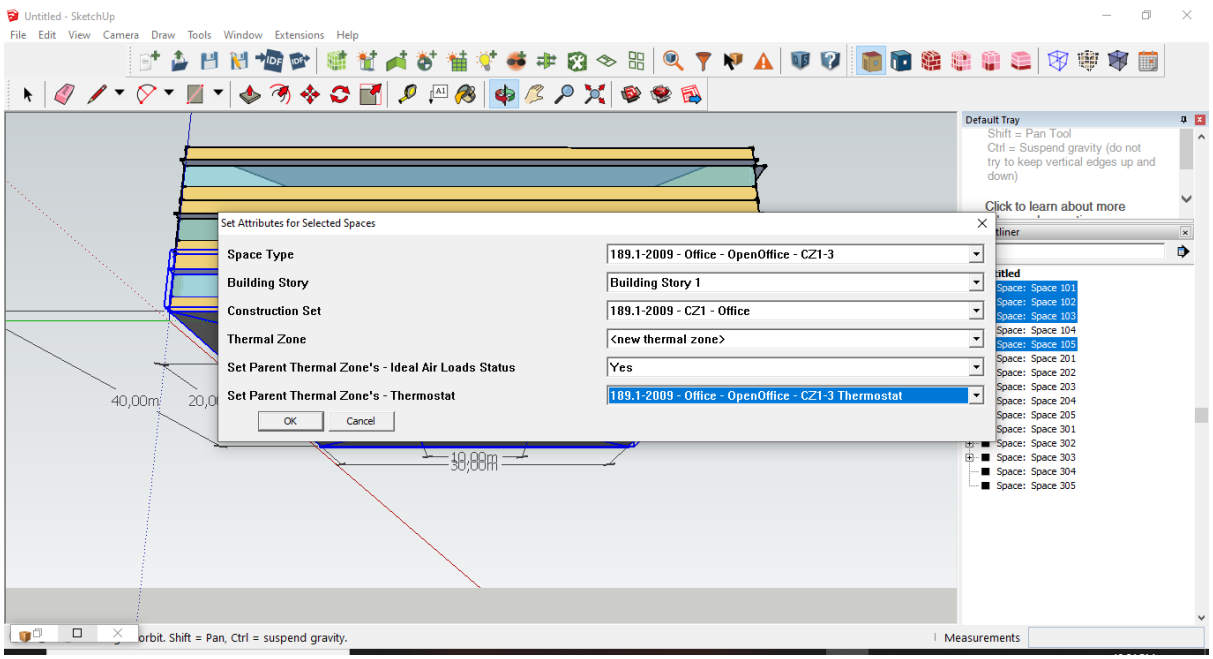
After that we select unhide all so that the building appears again with the windows.

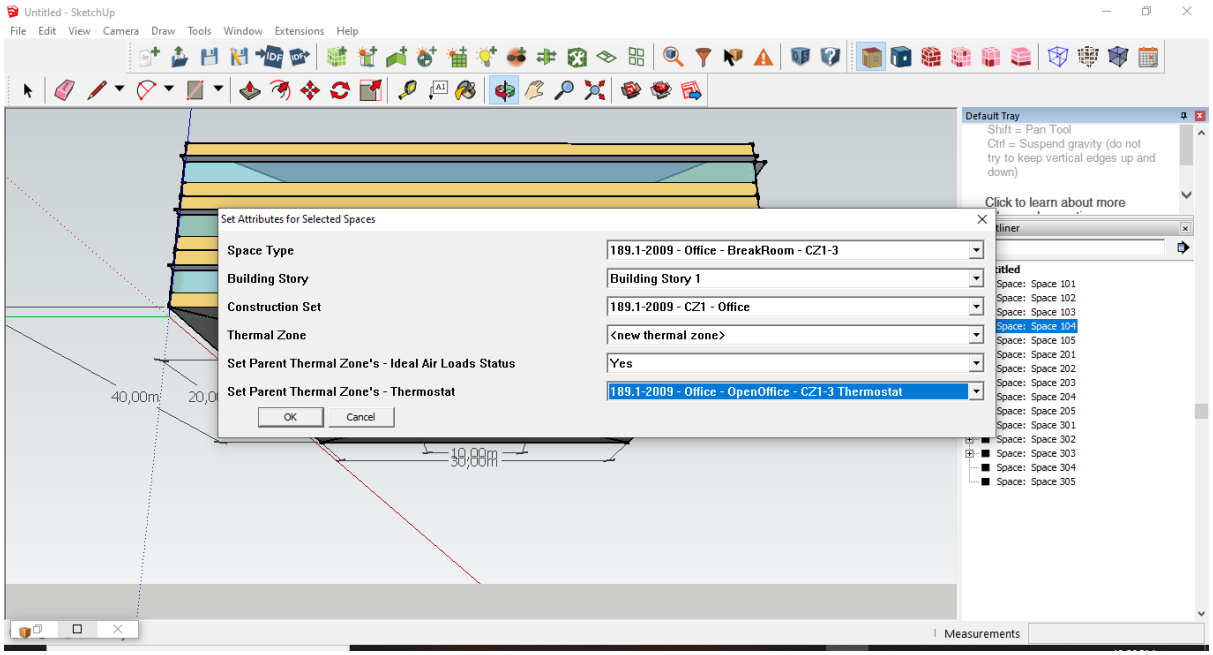


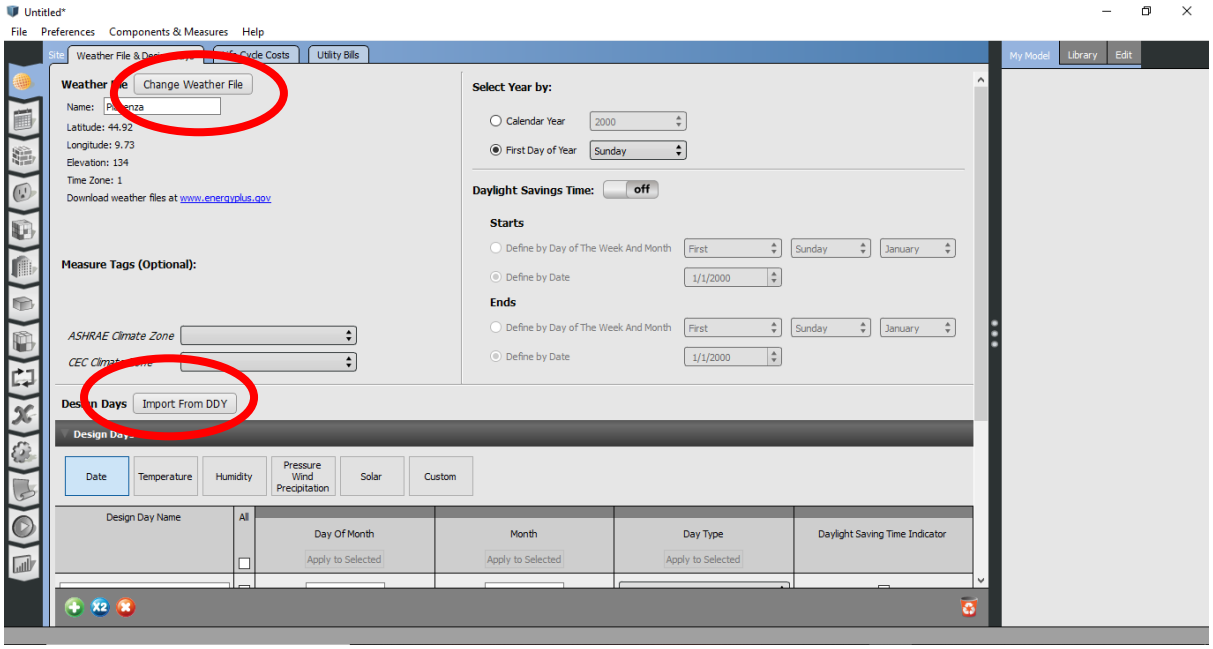
We then start the definition of every space of every floor of the building.



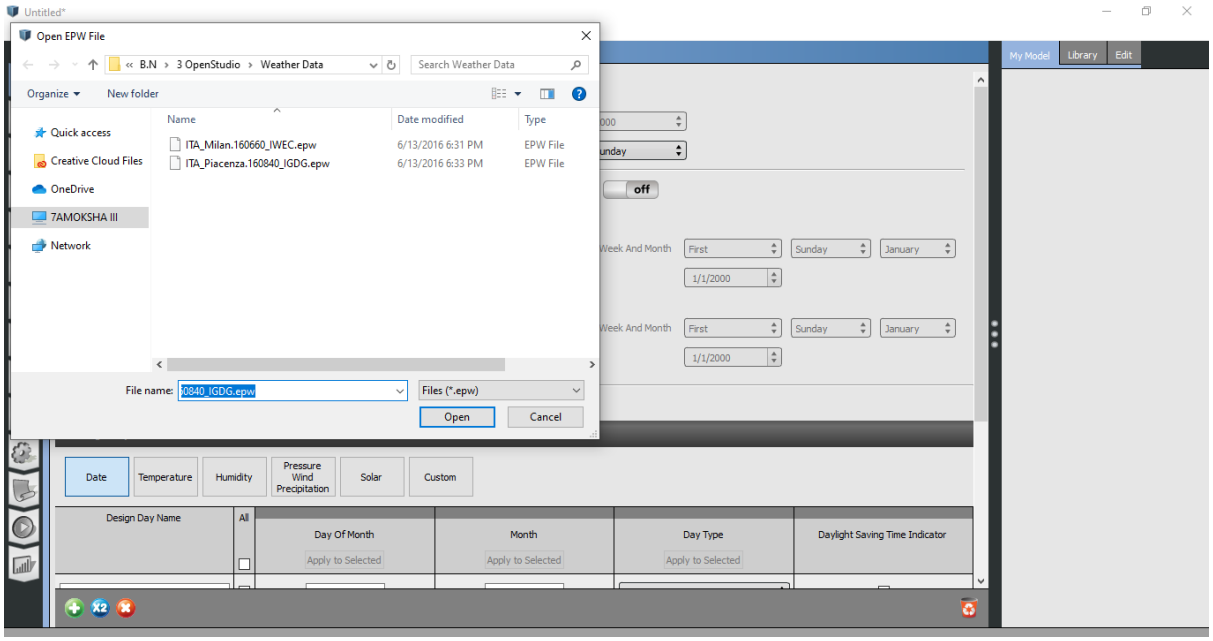
We choose the open office spaces as from spaces 01 to 05 and exclude the 04 zone because it is a break area so a different function and then we define the space ventilations and thermal zone.

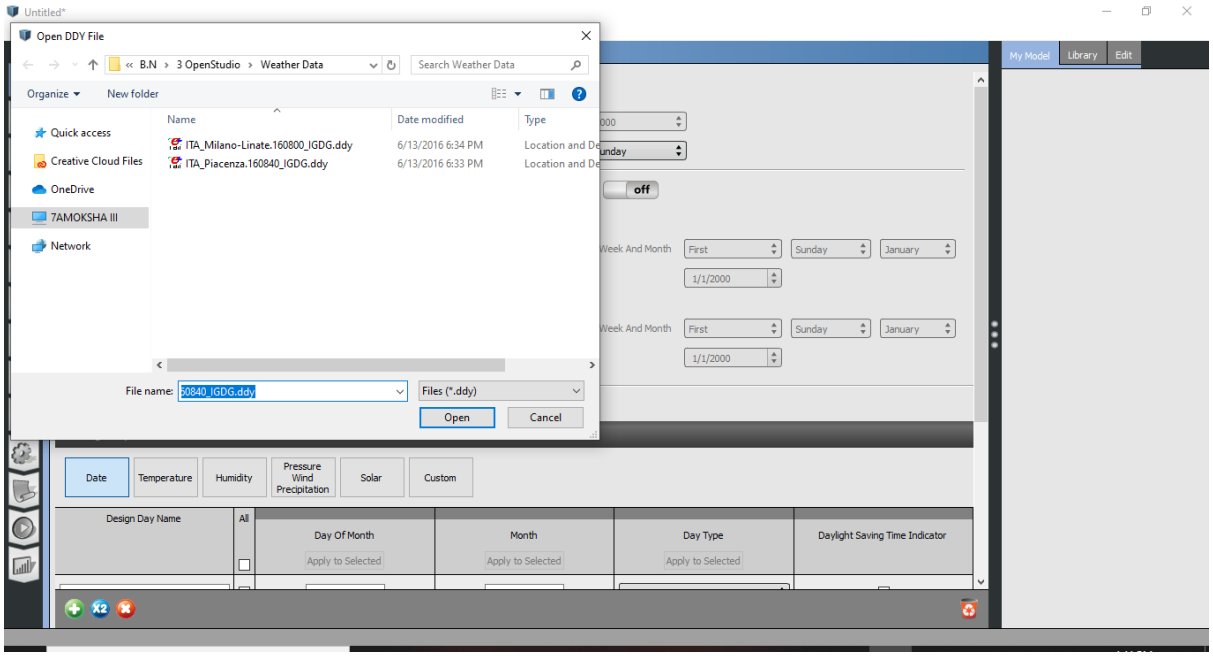


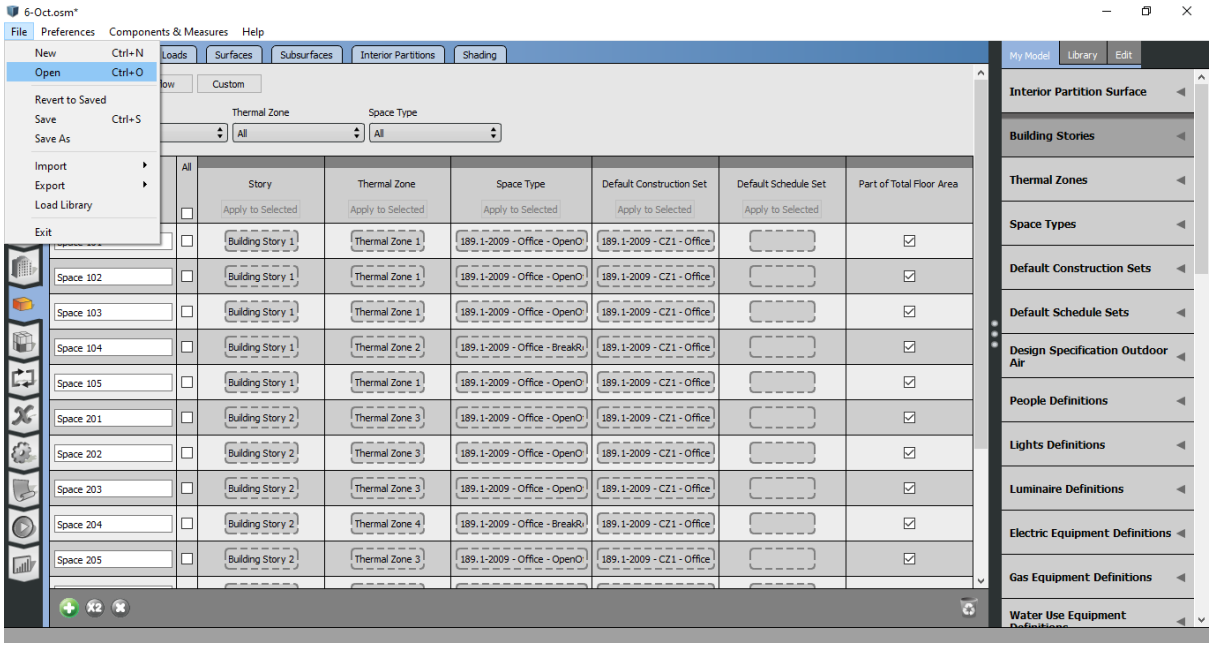




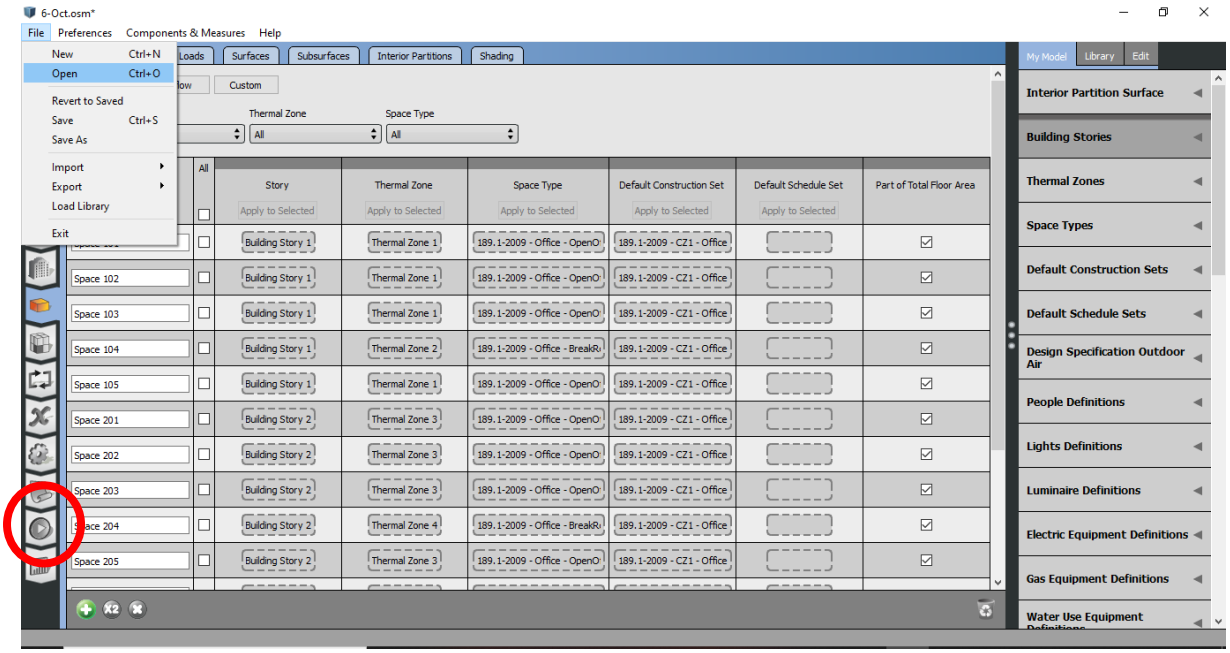
After we repeat the steps for every floor, we then open Open Studio after closing SketchUp send saving from the Open Studio tab save project so that it saves as an .osm not .skt file. We then import the Piacenza weather file and then we import the ddy Piacenza File so that it defines the building in Piacenza and run the simulation.


Untitled*
Open EPW File
B.N › 3 OpenStudio › Weather Data
Search Weather Data
Organize
New folder
Quick access
Creative Cloud Files
OneDrive
7AMOKSHA III
Network
Name
Date modified
Type
ITA_Milan.160660_IWEC.epw
6/13/2016 6:31 PM
EPW File
ITA_Piacenza.160840_IGDG.epw
6/13/2016 6:33 PM
EPW File
File name:
0840_IGDG.epw
Files (*.epw)
Open
Cancel
My Model
Library
Edit
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

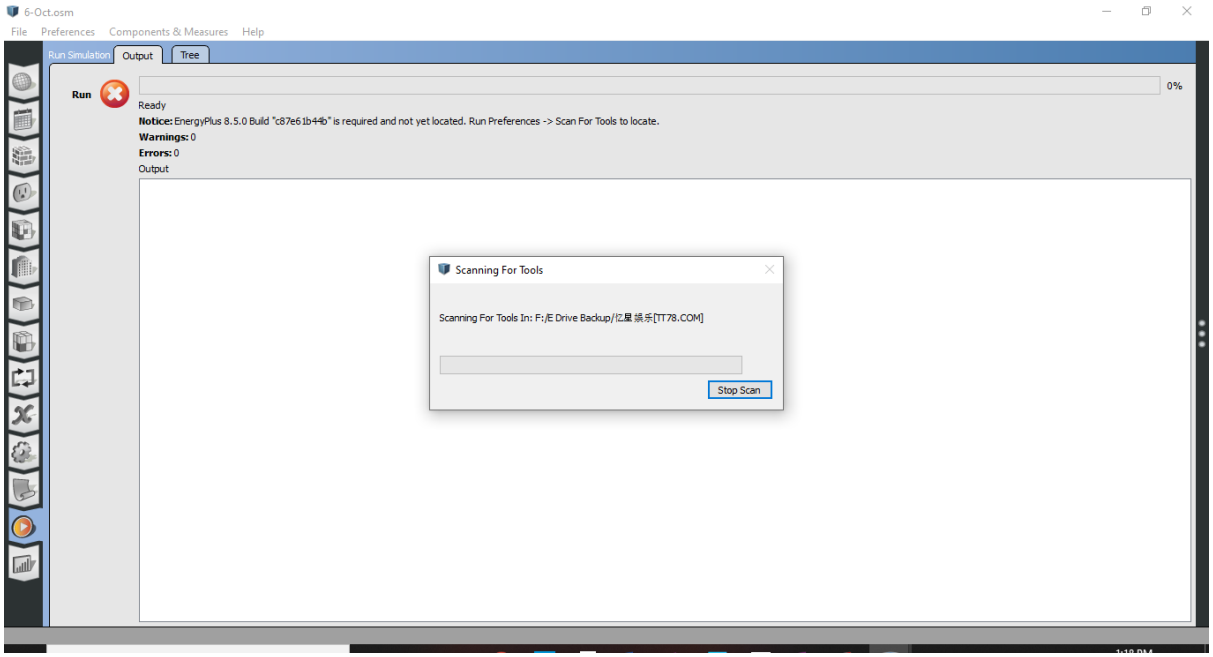

Untitled*
Open DDY File
B.N › 3 OpenStudio › Weather Data
Search Weather Data
Organize
New folder
Quick access
Creative Cloud Files
OneDrive
7AMOKSHA III
Network
Name
Date modified
Type
ITA_Milano-Linate.160800_IGDG.ddy
6/13/2016 6:34 PM
ITA_Piacenza.160840_IGDG.ddy
6/13/2016 6:33 PM
File name:
0840_IGDG.ddy
Files (*.ddy)
Open
Cancel
My Model
Library
Edit
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

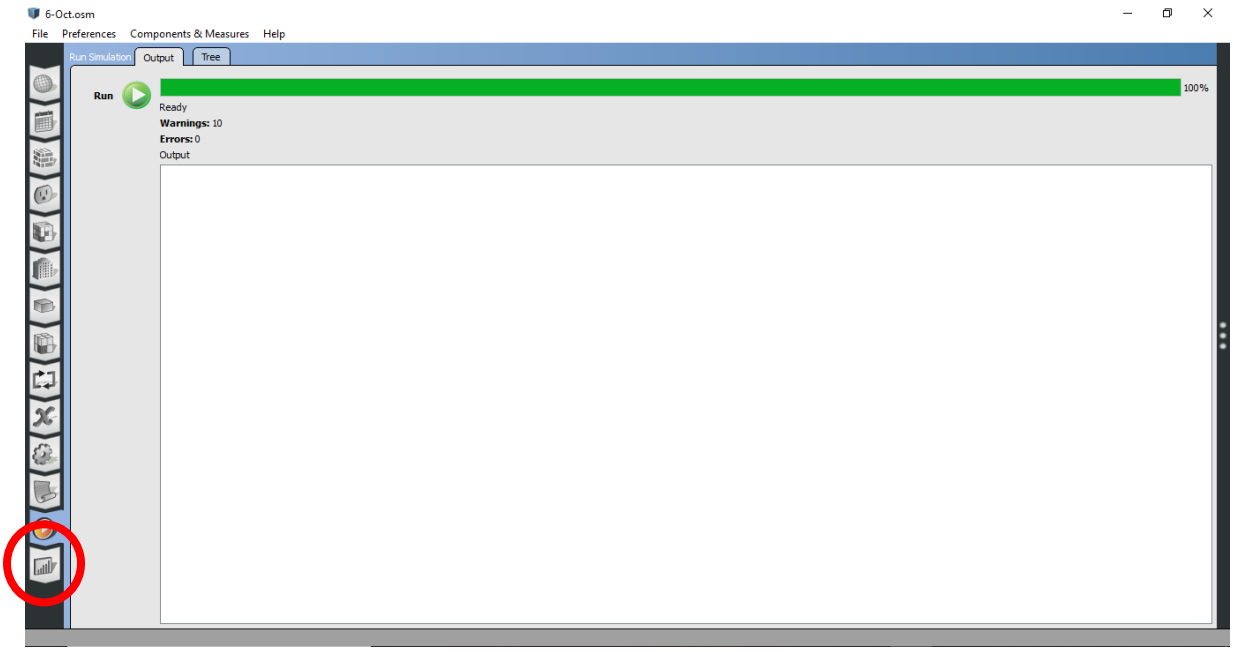


After that we open the saved .osm file to import the spaces and run the simulation of them.

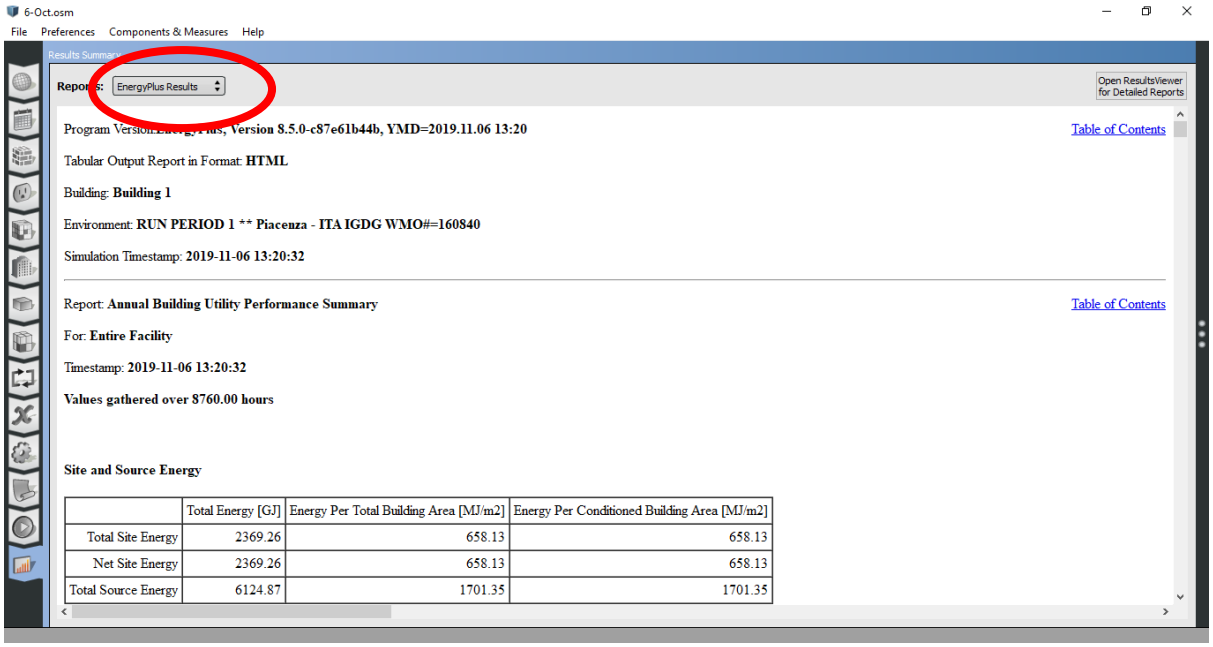


After that go to the run simulation tab to run the simulation of the spaces after checking that the imported spaces are correct.





After it successfully runs, go to the show results tab and view the simulation results.



	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	2369.26	658.13	658.13
Net Site Energy	2369.26	658.13	658.13
Total Source Energy	6124.87	1701.35	1701.35

After that go to the Show results tab and then choose Energy Plus Tab to see he results in another Mode to view the building energy consumption and so on.