WEEK 6 – ASSIGNMENT

** 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 ?

From the previous assignment

σ = 5.67 x 10-8

T1=800k   T2= 500k

$$\dot{Q}_{12} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$

$Q_{12}= A\ \frac{5.670\times10^{-8}\ \times(800^4 - 500^4)}{\frac{1}{0.2}+\frac{1}{.7}-1} = A \times \frac{19680}{5.42}$ = **3625.4w/m²**

With shields When $\varepsilon_3 = 0.1$

$\sigma(T_1^4\text{-}T_2^4) / (1/\varepsilon_1+ 1/\varepsilon_2 \text{-}1) + n (1/\varepsilon_3+ 1/\varepsilon_3 \text{-}1) = \sigma(T_1^4\text{-}T_2^4) / (1/\varepsilon_1+ 1/\varepsilon_2 \text{-}1)$

$(1/\varepsilon_1+ 1/\varepsilon_2 \text{-}1)+ n (1/\varepsilon_3+ 1/\varepsilon_3 \text{-}1) = 100 (1/\varepsilon_1+ 1/\varepsilon_2 \text{-}1)$

$(1/0.2+ 1/0.7 \text{-}1)+ n (1/0.1+ 1/0.1\text{-}1) = 100(1/0.2+ 1/0.7 \text{-}1)$

5.43+19n=543

19n = 543-5.43

19n = 537.57

N = 537.57/19 = 28.29

N = 28 shields

Task 2

** 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!)
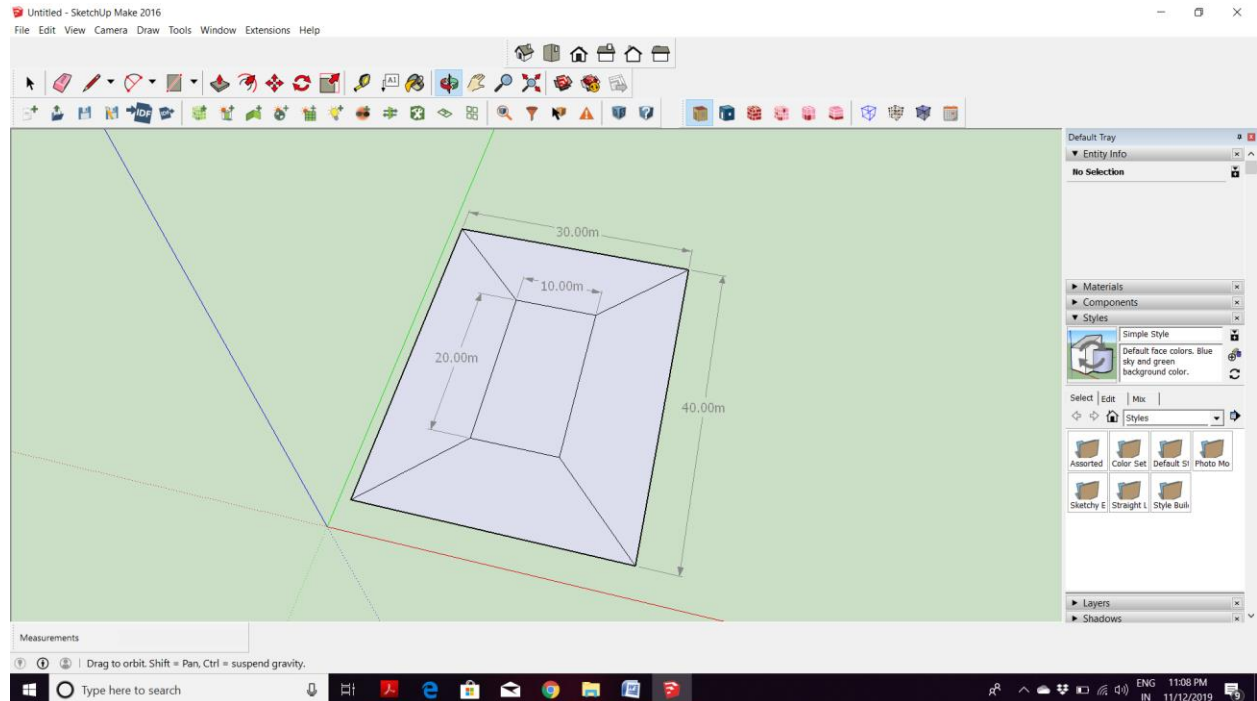
Create a rectangle of 30 x 40m and create another rectangle inside it by offsetting the bigger rectangle by 10m and join the edges
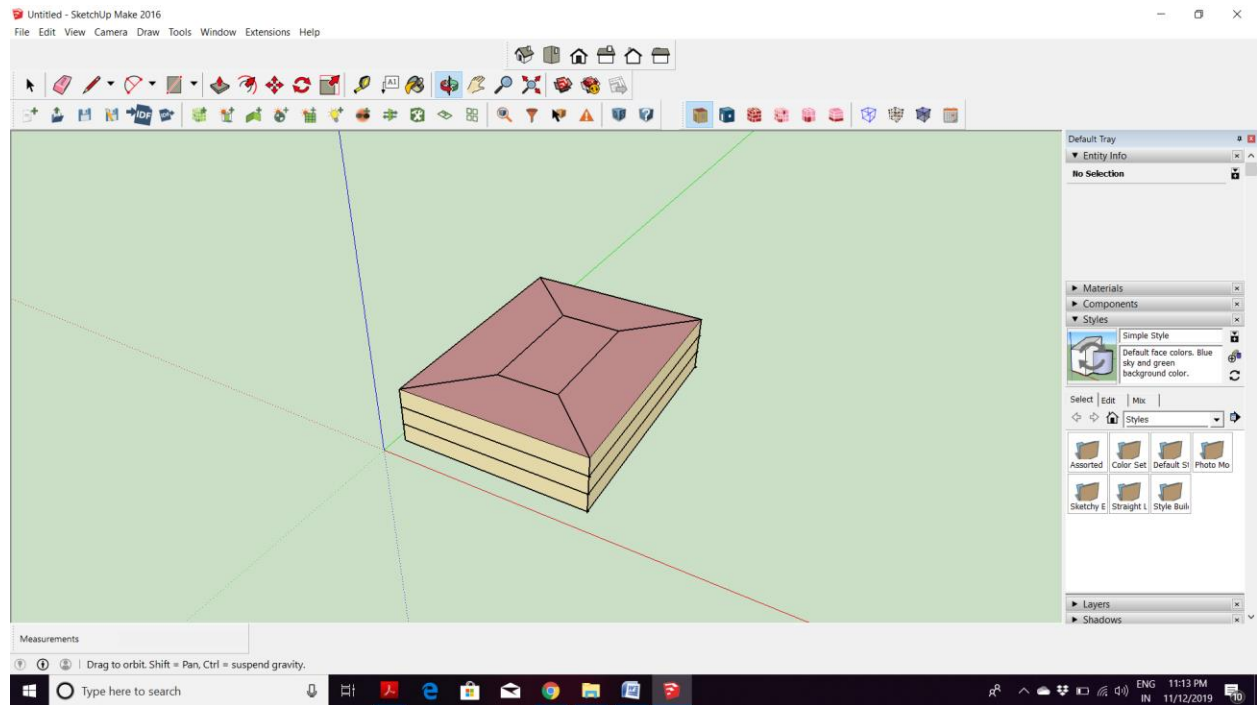
Click on 'create spaces from diagram' tool to define height of each floors.
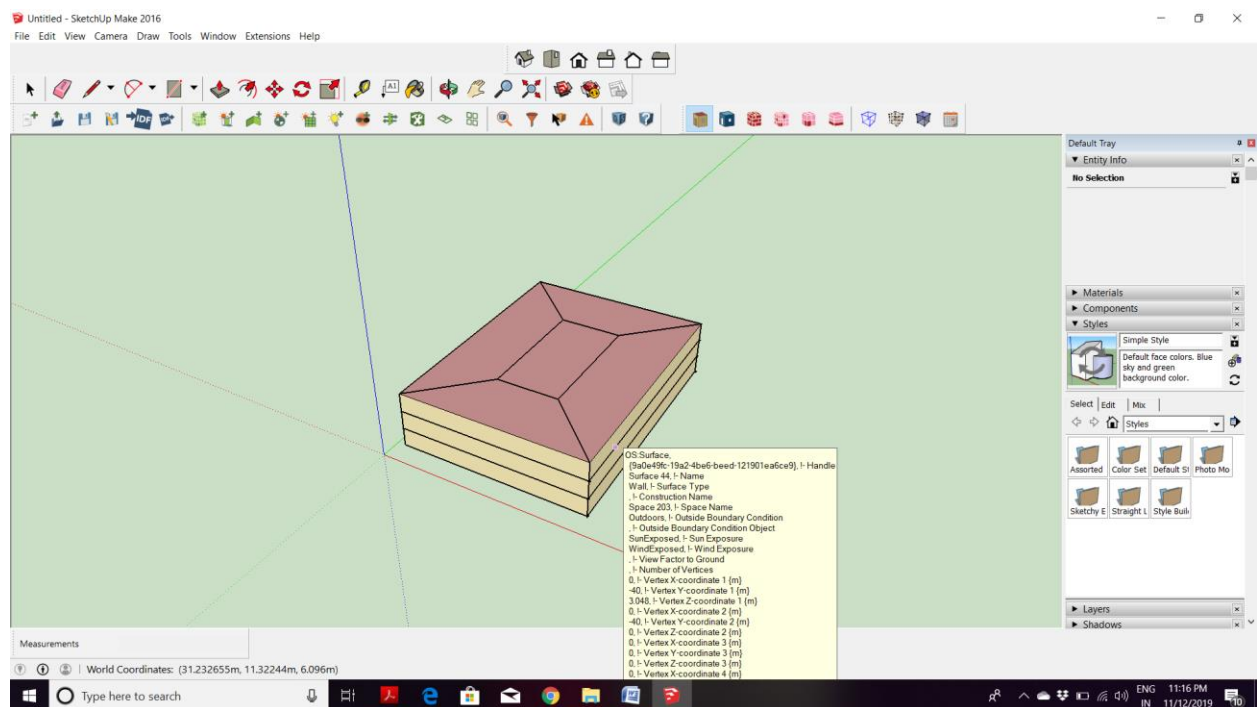
Click on the info tool to see the properties of each surface
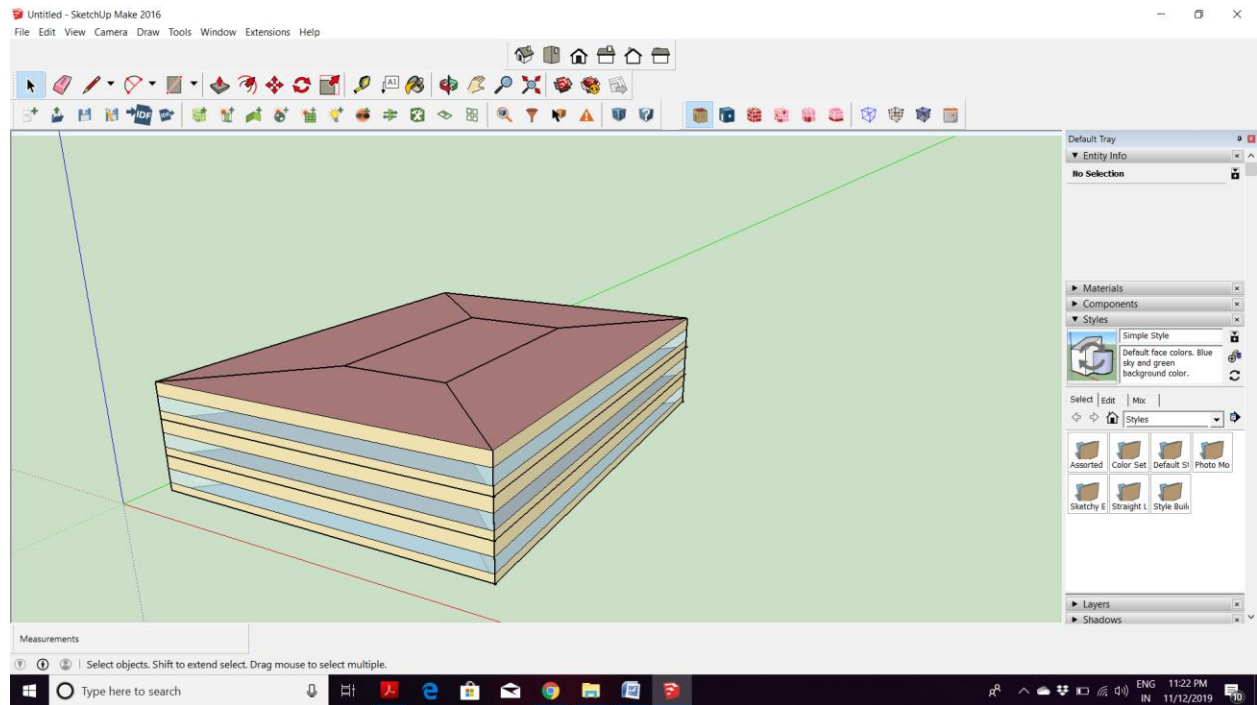
To create windows click on surface matching tool to match all the surfaces and click on set window to wall ratio and give the values to create windows
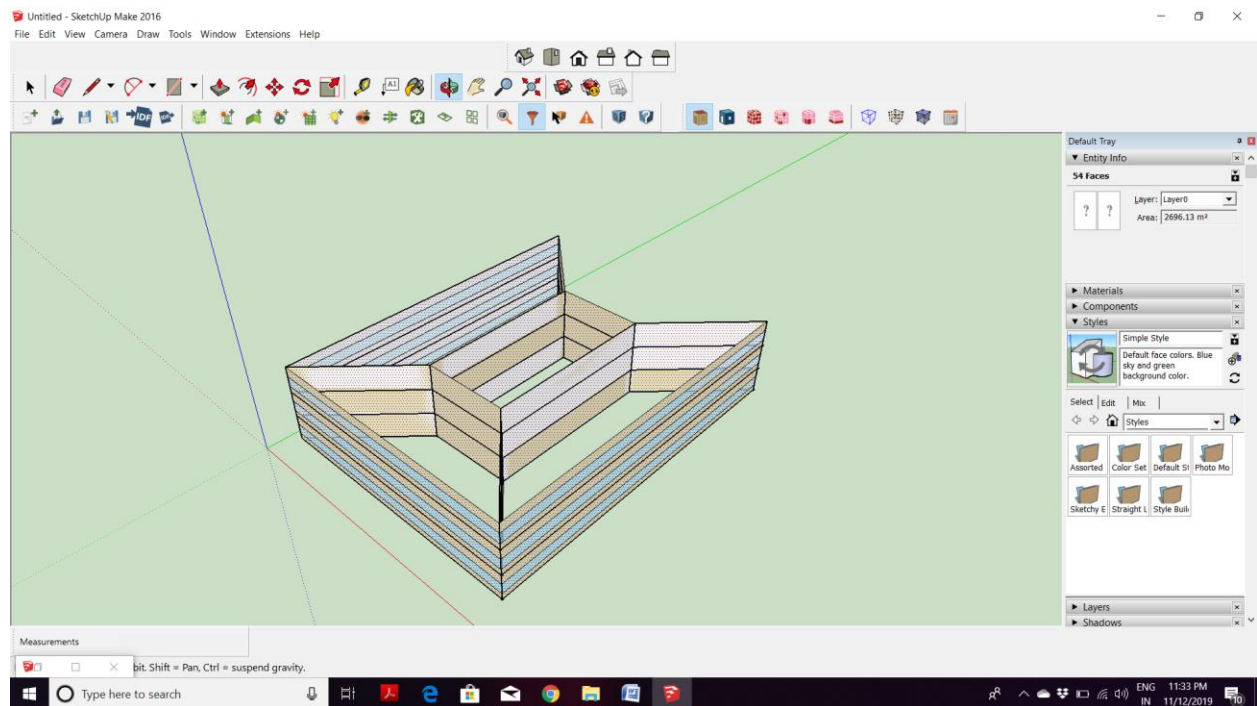
Select the entire model surface expect north side . Click on 'search surface' tool to exclude the surface to provide shading and give the surface orientation from 90 to 360.
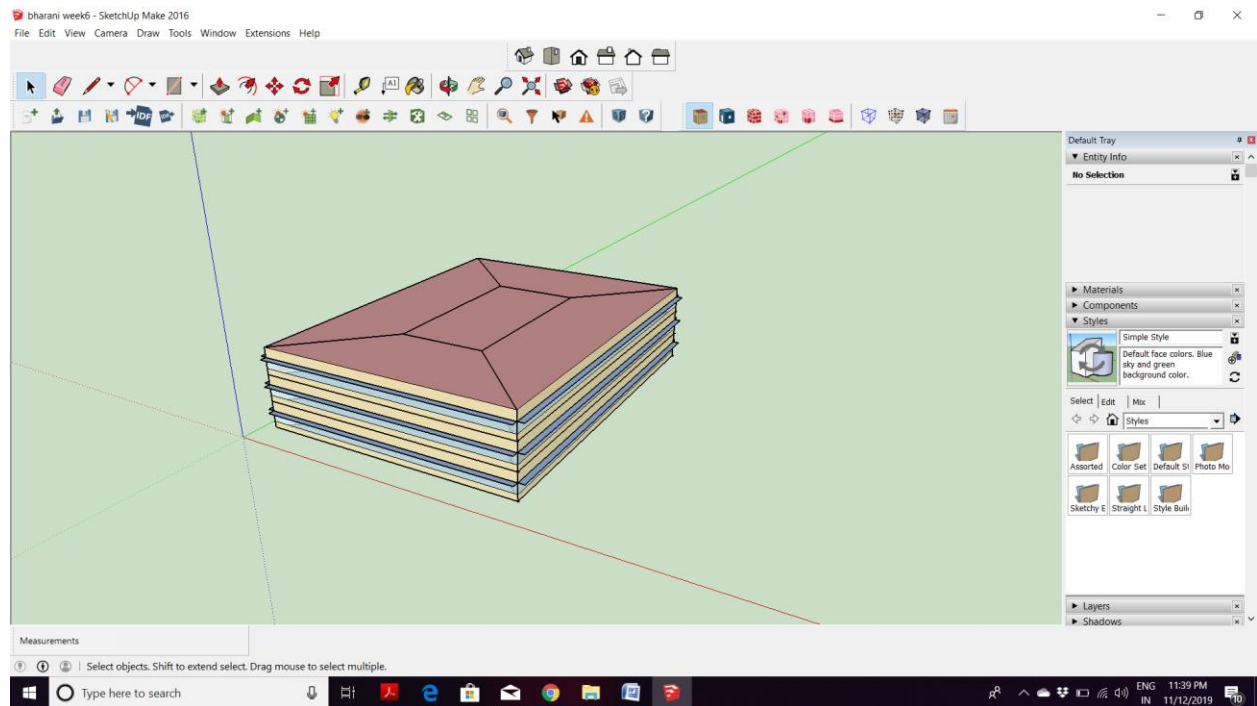
Click on 'Add overhangs by projection factor' and give projection factor value to provide sun shades.
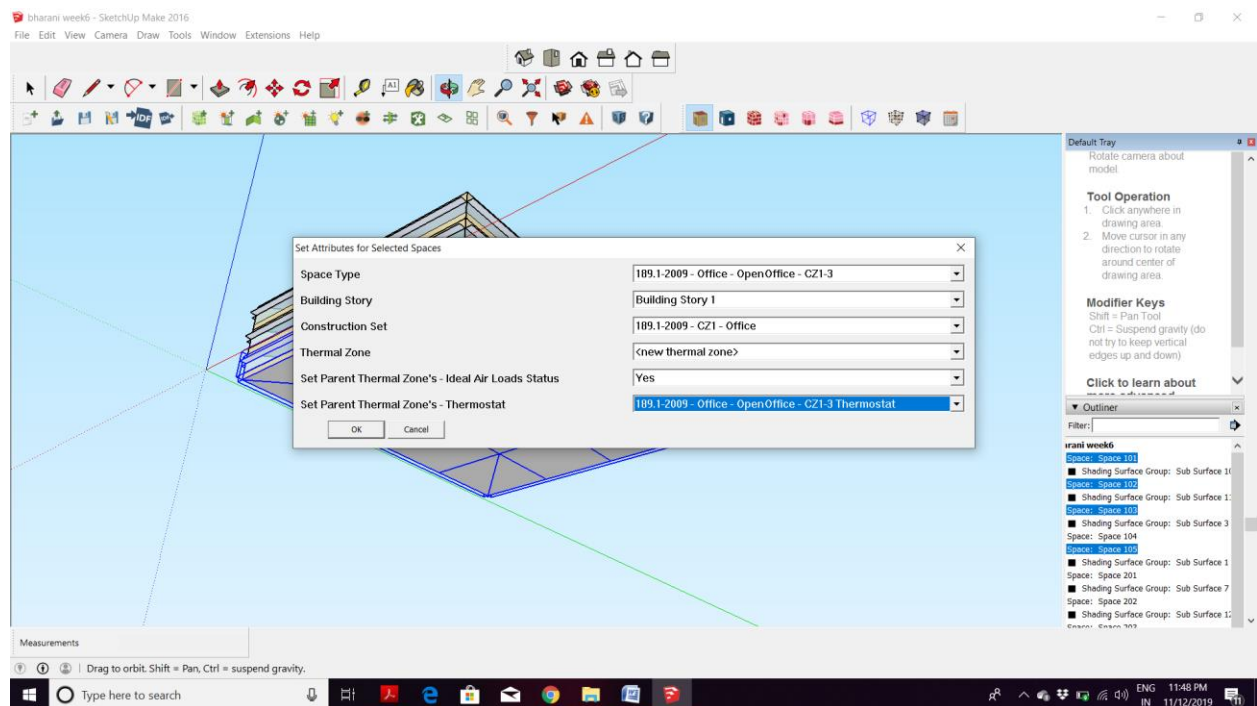
Click on 'set attributes for the selected spaces' to provide thermal zones for spaces

Repeat the process for each floor.

Click on save as and save the process
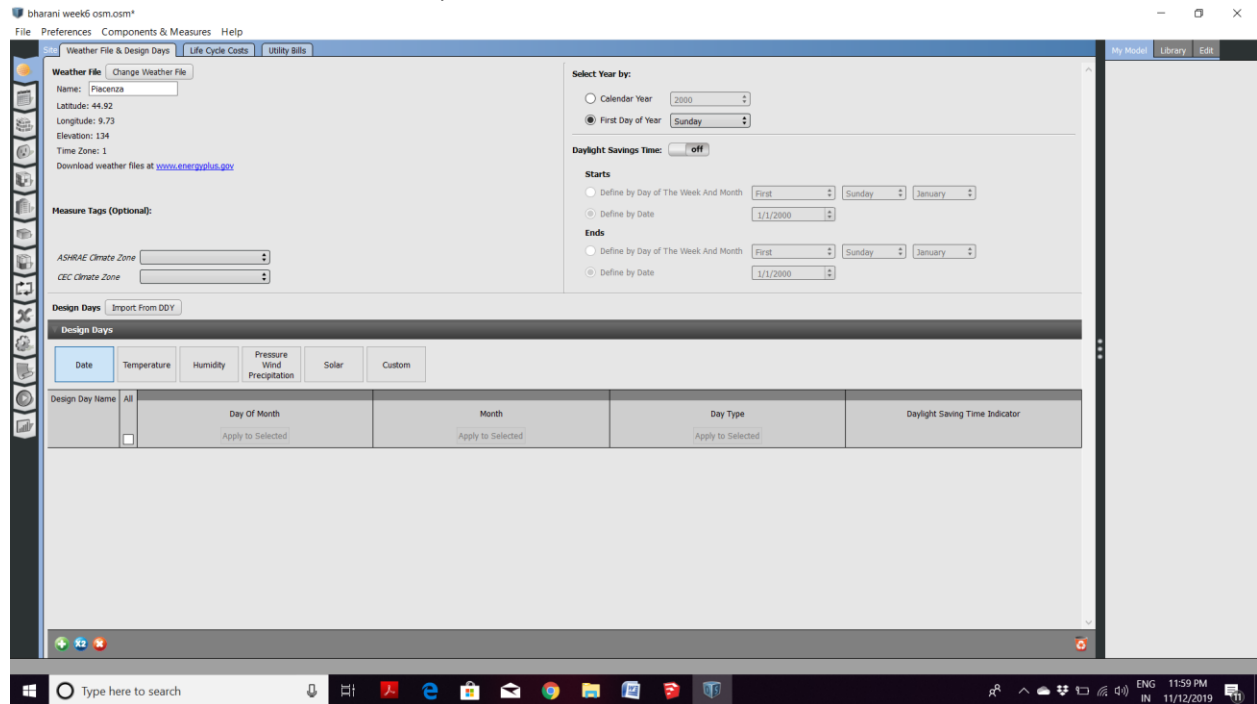
Open the 'OPEN STUDIO' software and input weather data of Piacenza and load the sketchup file and click run simulation to calculate energy datas.

OpenStudio Results

Model Summary

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	2,242,801	kBtu
Total Building Area	38,750	ft^2
EUI (Based on Net Site Energy and Total Building Area)	57.88	kBtu/ft^2
OpenStudio Standards Building Type		

Weather Summary

	Value
Weather File	Piacenza - ITA IGDG WMO#=160840
Latitude	44.92
Longitude	9.73
Elevation	440 (ft)
Time Zone	1.00
North Axis Angle	0.00
ASHRAE Climate Zone	

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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
Plant Loops Detail
Outdoor Air
Cash Flow
Site and Source Summary
Schedule Overview

Definition	Value	Unit	Inst. Multiplier
189.1-2009 - Office - OpenOffice - CZ1-3 People Definition	0.0052	people/ft^2	1.0
189.1-2009 - Office - OpenOffice - CZ1-3 Electric Equipment Definition	0.7100	W/ft^2	1.0
189.1-2009 - Office - OpenOffice - CZ1-3 Lights Definition	0.9900	W/ft^2	1.0
189.1-2009 - Office - OpenOffice - CZ1-3 Infiltration	0.0595	cfm/ext surf area ft^2	
189.1-2009 - Office - OpenOffice - CZ1-3 Ventilation (outdoor air method Sum)	20.0000	cfm/person	

Interior Lighting Summary

Interior Lighting Summary

	Zone	Lighting Power Density (W/ft^2)	Total Power (W)	Schedule Name	Scheduled Hours/Week (hr)	Actual Load Hours/Week (hr)	Return Air Fraction	Consumption (kWh)
THERMAL ZONE 3 189.1-2009 - OFFICE - BREAKROOM - CZ1-3 LIGHTS	THERMAL ZONE 3	1.08	2325.0	OFFICE BLDG LIGHT	61.85	61.85	0.0000	7497.22
THERMAL ZONE 4 189.1-2009 - OFFICE - BREAKROOM - CZ1-3 LIGHTS	THERMAL ZONE 4	1.08	2325.0	OFFICE BLDG LIGHT	61.85	61.85	0.0000	7497.22
THERMAL ZONE 6 189.1-2009 - OFFICE - BREAKROOM - CZ1-3 LIGHTS	THERMAL ZONE 6	1.08	2325.0	OFFICE BLDG LIGHT	61.85	61.85	0.0000	7497.22
THERMAL ZONE 1 189.1-2009 - OFFICE - OPENOFFICE - CZ1-3 LIGHTS	THERMAL ZONE 1	0.99	10656.27	OFFICE BLDG LIGHT	61.85	61.85	0.0000	34369.45
THERMAL ZONE 2 189.1-2009 - OFFICE - OPENOFFICE - CZ1-3 LIGHTS	THERMAL ZONE 2	0.99	10656.27	OFFICE BLDG LIGHT	61.85	61.85	0.0000	34369.45
THERMAL ZONE 5 189.1-2009 - OFFICE - OPENOFFICE - CZ1-3 LIGHTS	THERMAL ZONE 5	0.99	10656.27	OFFICE BLDG LIGHT	61.85	61.85	0.0000	34369.45

Plug Loads Summary

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File   Preferences   Components & Measures   Help

Results Summary

Reports: OpenStudio Results

Open ResultsViewer for Detailed Reports

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Plant Loops Detail
Outdoor Air
Cash Flow
Site and Source Summary
Schedule Overview

Office Bldg Light

Office Infil Quarter On

Office Misc Occ

Office Work Occ

Small Office ClgSetp

Small Office HtgSetp

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