

# Submission 6 - Technical Environmental Systems

- Considering the same example solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with  $\epsilon = 0.1$  should be added in order to have the new heat transfer rate to be 1% of the case without shields ?

## Case 1: Without shields

$$\epsilon_1 = 0.1$$

$$\epsilon_2 = 0.1$$

$$T_1 = 800K$$

$$T_2 = 500K$$

Net heat transfer without shields

$$\frac{Q_{net}}{A} = 5.67 * 10^{-8} * \frac{(800^4 - 500^4)}{\left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)} = 1035.82 W/m^2$$

## Case 2: With shields to reduce the heat transfer by 1%

Heat transfer with n shields in between = 1% of  $1035.82 W/m^2 = 10.358 W/m^2$

$$\frac{Q_n}{A} = \frac{1}{(N - 1)} * \frac{Q_{net}}{A}$$

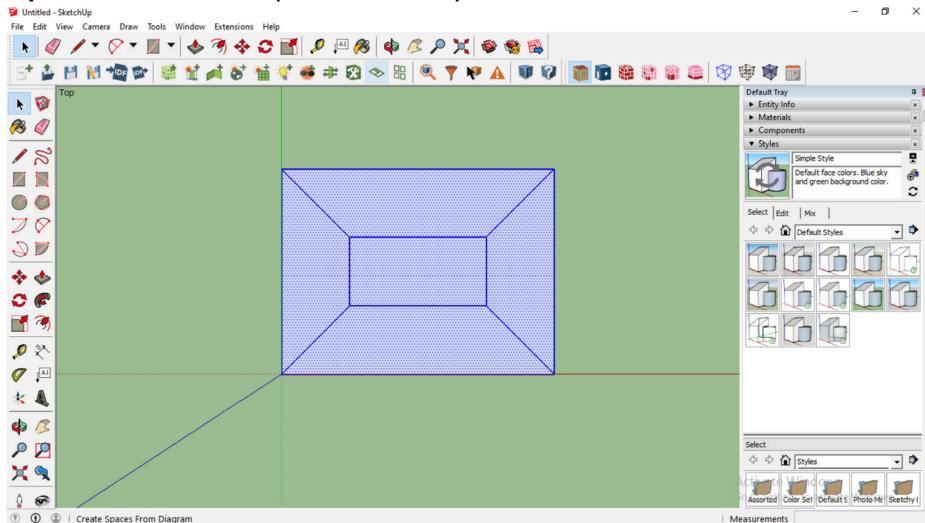
$$\text{Also, } \frac{Q_n}{A} = 1/100 * \frac{Q_{net}}{A}$$

Therefore,  $N=99$

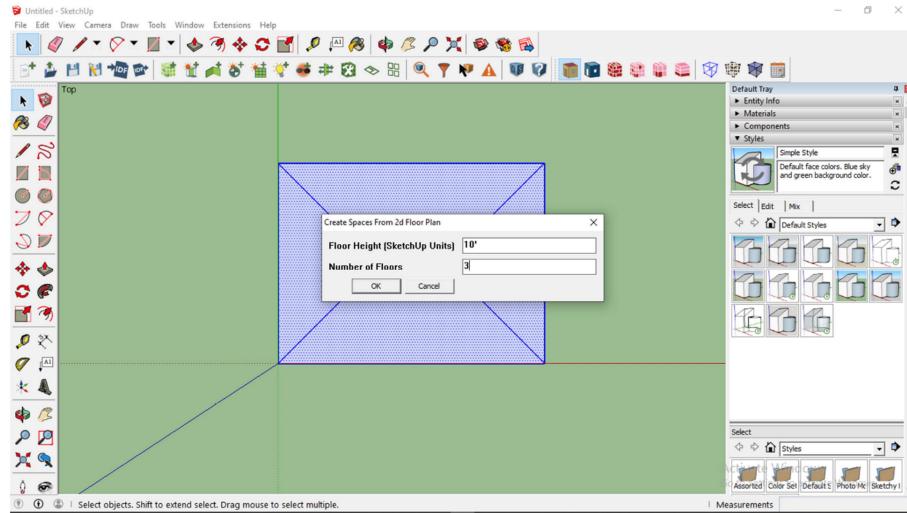
No. of shields = 99

- Create a PDF with screenshots of the steps and explain the reason behind it.

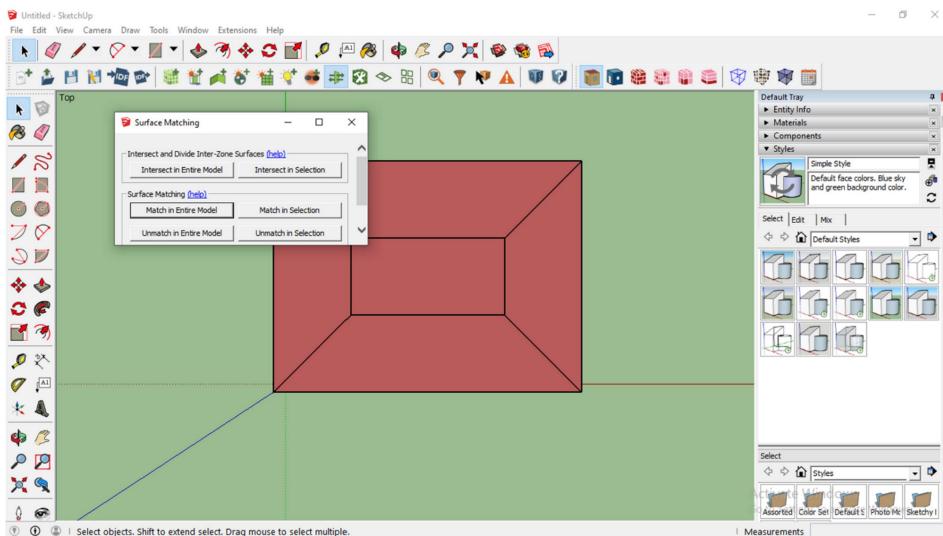
### Step 1: Create the floor plan to be analyzed.



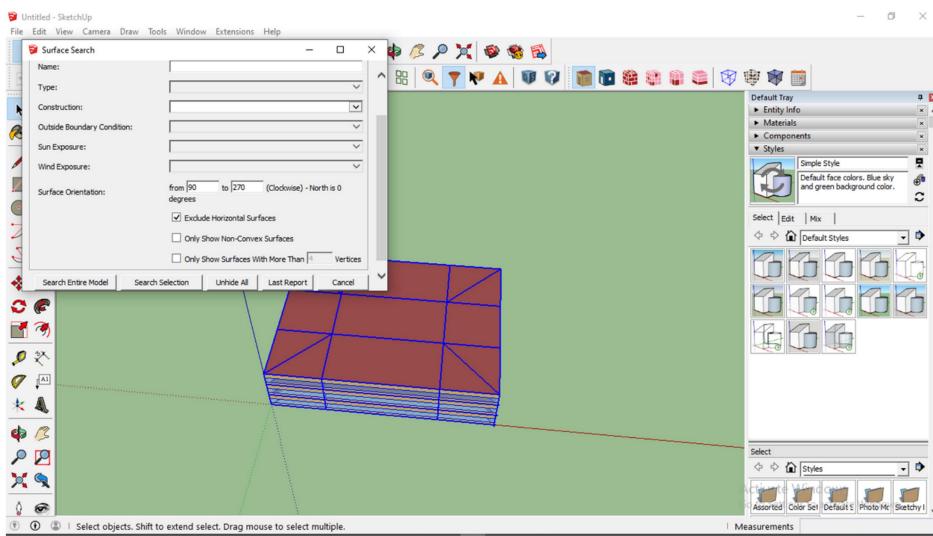
**Step 2:** Use the tool 'create space from diagram' to create levels and form a building by specifying the no. of floors and floor-floor height.



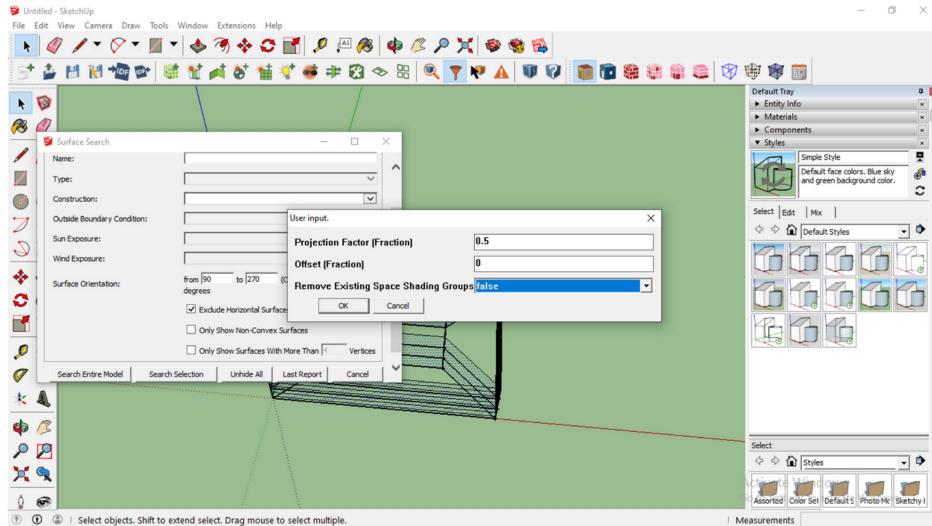
**Step 3:** Use 'Surface match tool' to match all the surfaces of the building



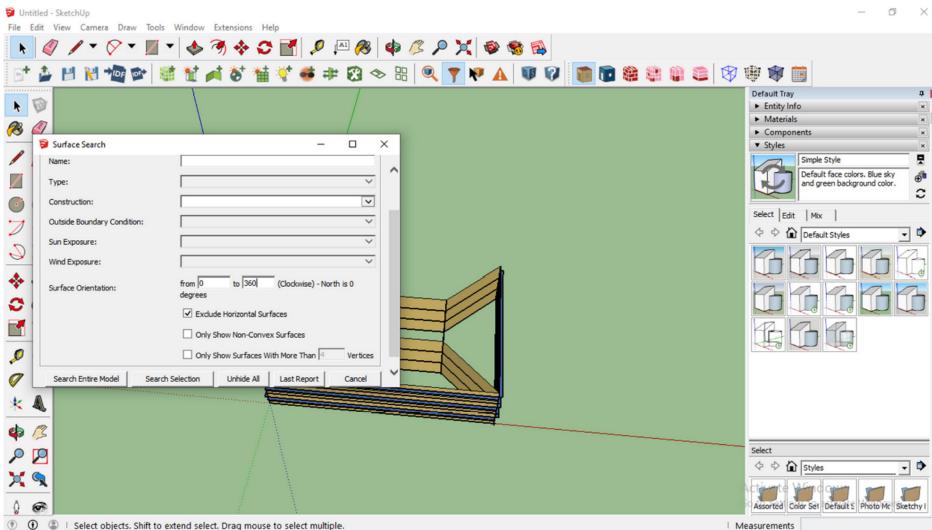
**Step 4:** Select the faces of the model. Use 'Surface search' to filter the selection to every façade except the north face.



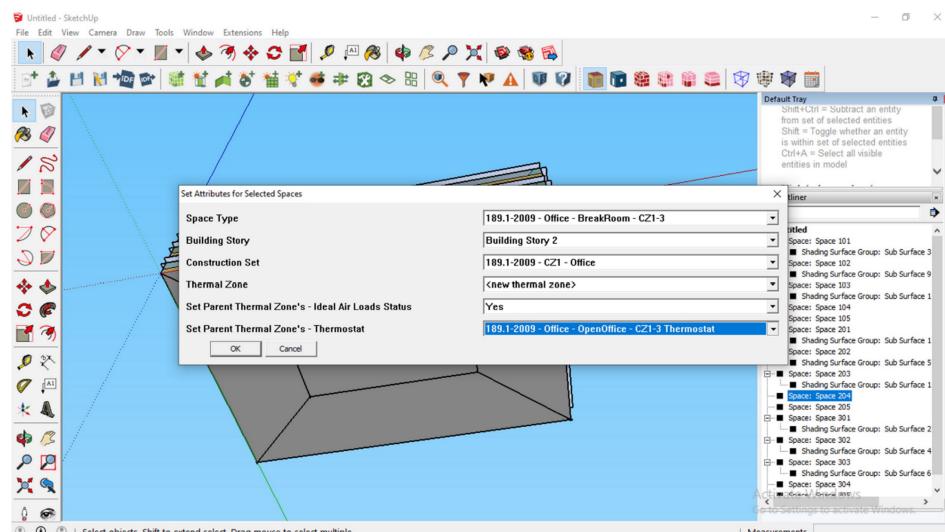
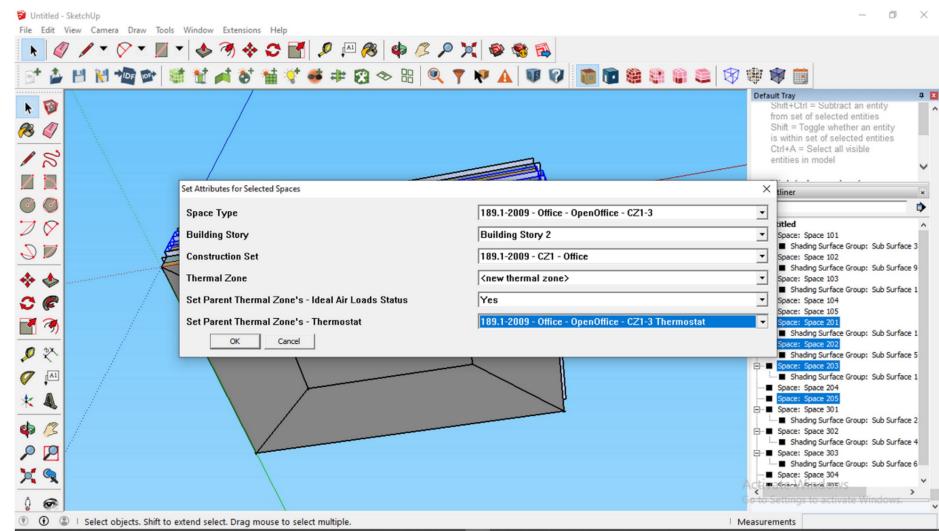
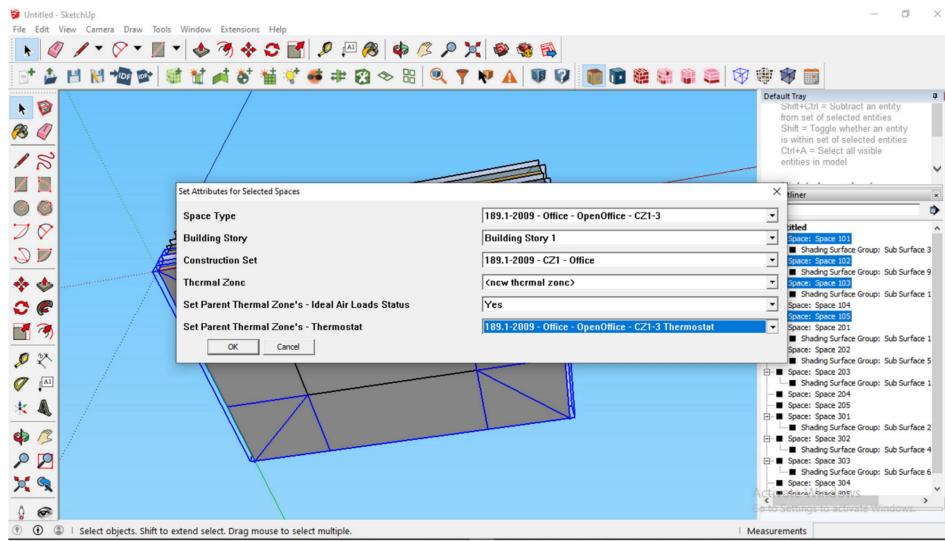
**Step 5:** To add overhangs to the selected facades, go to Extensions -> Open Studio -> Add overhangs by projection factor -> Ok.

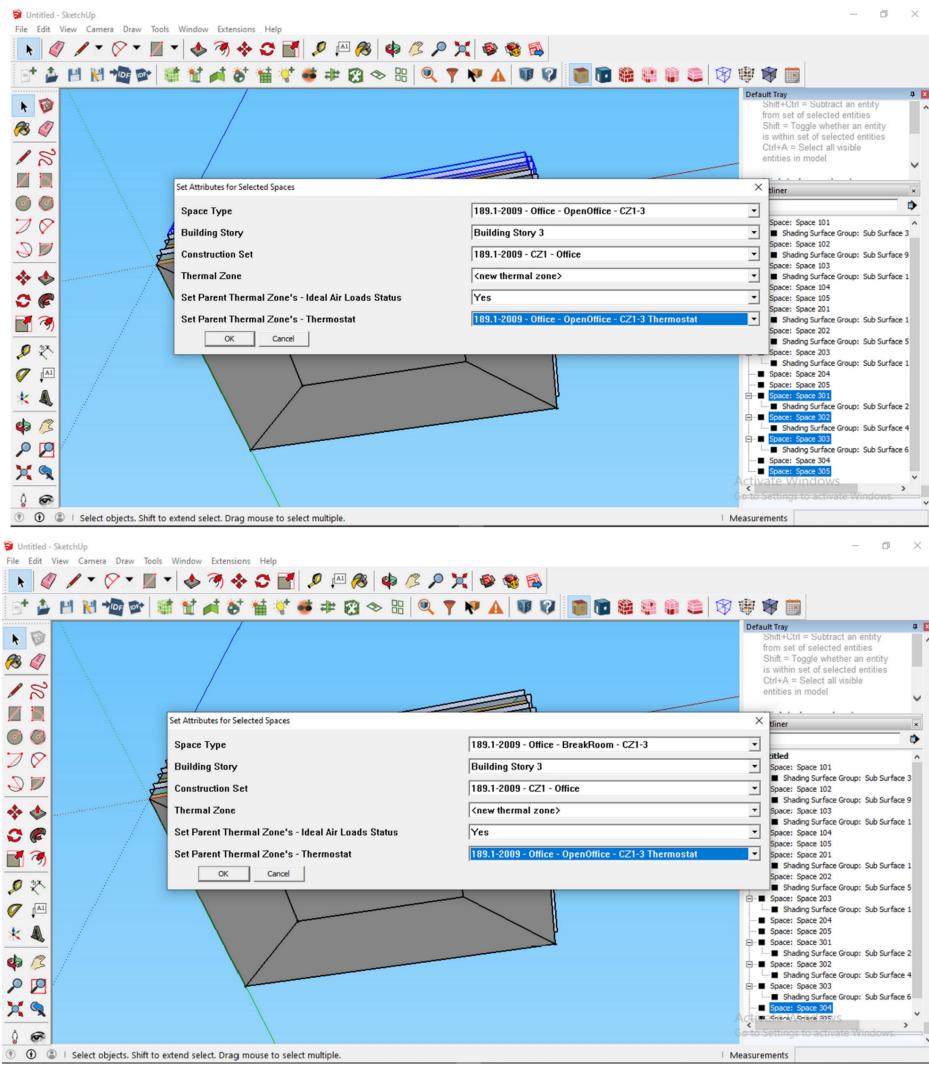


**Step 6:** Return back to the complete model through 'Surface search' filter.



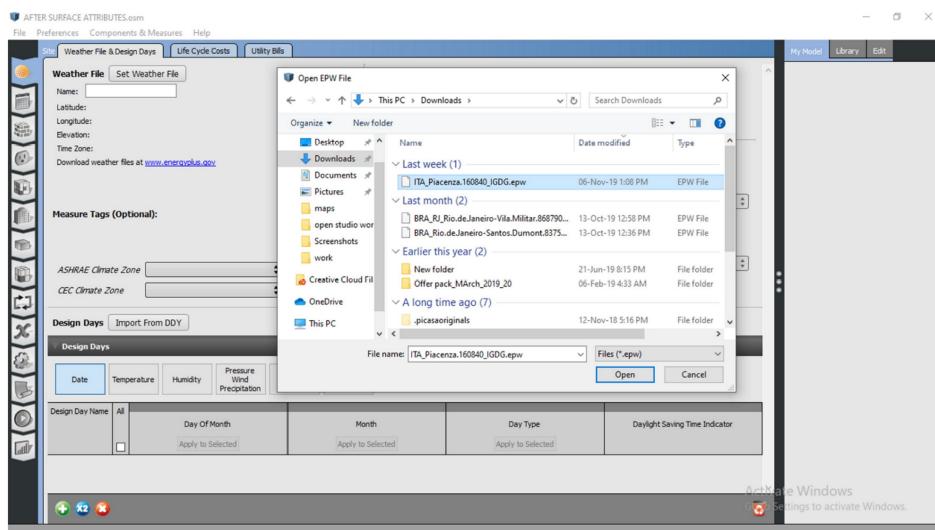
**Step 7:** Select the different floors as per their function and use the tool 'set attributes for selected spaces', providing the appropriate values.



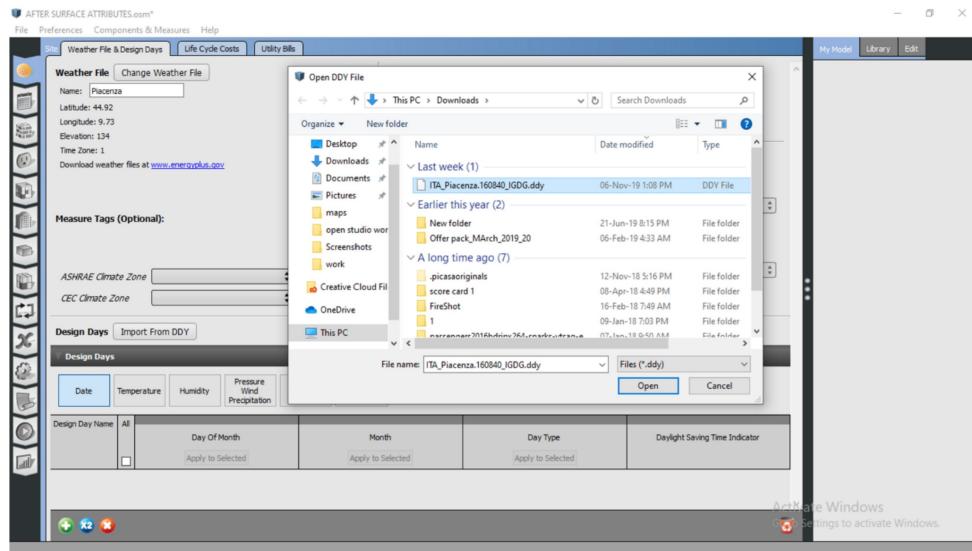


### Step 8: Save the file using 'Save As' option, in the format of '.osm'

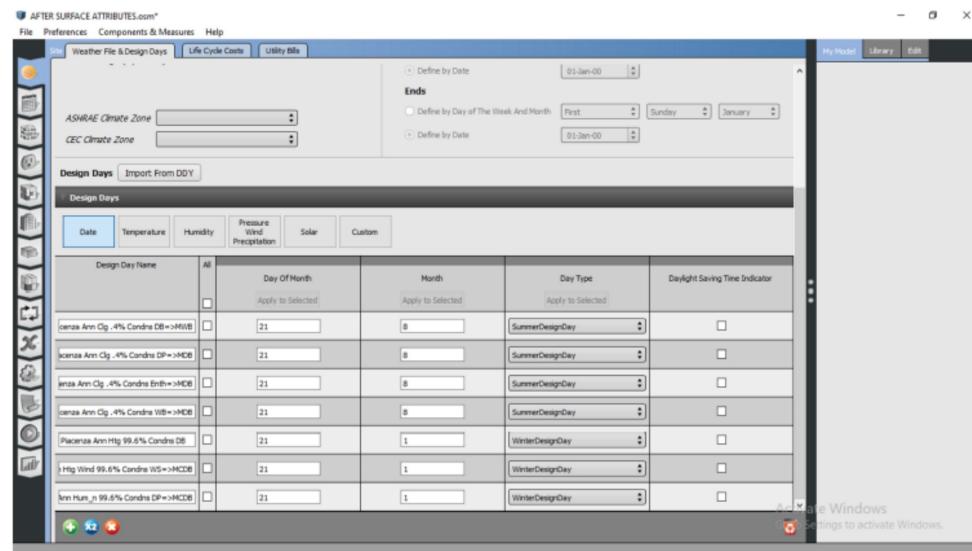
Open 'Open Studio' interface. Insert the .epw file for piacenza in the weather details



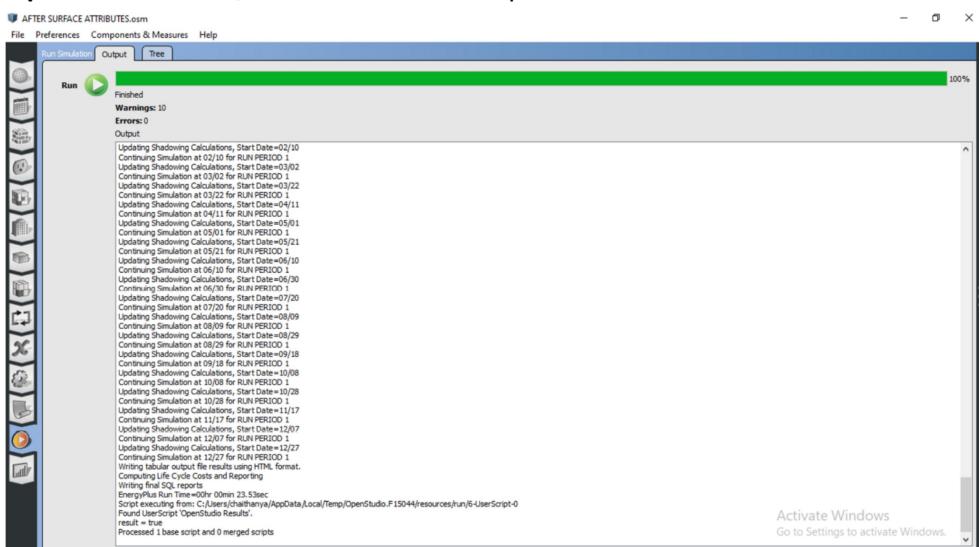
### Step 9: Insert the same .epw file in the details for Design Days.



### Step 10: Certain data are then available in the section under 'Design Days'.



### Step 11: Run the file, and wait for it to complete.



## Step 12: The following report is then available for analysis

The screenshot shows the 'Results Summary' window for EnergyPlus version 8.5.0. The window title is 'AFTER SURFACE ATTRIBUTES.com'. The menu bar includes 'File', 'Preferences', 'Components & Measures', and 'Help'. The top right corner has a 'Table of Contents' button. The main content area displays the following information:

Program Version: EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019.11.12 22:53  
Tabular Output Report in Format: HTML  
Building: Building 1  
Environment: RUN PERIOD 1 \*\* Piacenza - ITA IGDG WMO#=160840  
Simulation Timestamp: 2019-11-12 22:53:34

Report: Annual Building Utility Performance Summary  
For: Entire Facility  
Timestamp: 2019-11-12 22:53:34  
Values gathered over 8760.00 hours

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m <sup>2</sup> ]	Energy Per Conditioned Building Area [MJ/m <sup>2</sup> ]
Total Site Energy	2369.07	658.07	658.07
Net Site Energy	2369.07	658.07	658.07
Total Source Energy	6122.85	1700.79	1700.79
Net Source Energy	6122.85	1700.79	1700.79

Activate Windows  
Go to Settings to activate Windows.