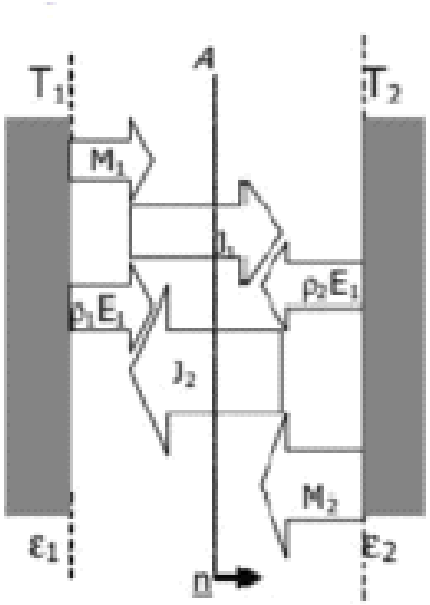
# TASK 1

Sunday, November 10, 2019 11:05 PM

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 ?

$A_1$ = 1.5 m$^2$,
$F_{12}$= 0.01 ,
$T_1$ = 298 K,
$T_2$ = 308 K,
$\sigma = 5.67 * 10^{-8} \frac{W}{m^2 K^4}$

$\epsilon_1 = \epsilon_2 = 0.1$
$\epsilon_{3,1} = \epsilon_{3,2} = 0.1$




$$\dot{Q} = \frac{A\sigma\left(T_1^4 - T_2^4\right)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + \left(\frac{1}{\epsilon_{3,1}} + \frac{1}{\epsilon_{3,2}} - 1\right)}$$

$$\dot{Q}_{12,\,N\text{ shields}} = \frac{A\sigma(T_1^4 - T_2^4)}{\left(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1\right) + \left(\frac{1}{\varepsilon_{3,1}} + \frac{1}{\varepsilon_{3,2}} - 1\right) + \cdots + \left(\frac{1}{\varepsilon_{N,1}} + \frac{1}{\varepsilon_{N,2}} - 1\right)}$$

If the emissivities of all surfaces are equal

$$\dot{Q}_{12,\,N\text{ shields}} = \frac{A\sigma(T_1^4 - T_2^4)}{(N+1)\left(\frac{1}{\varepsilon} + \frac{1}{\varepsilon} - 1\right)} = \frac{1}{N+1}\dot{Q}_{12,\text{ no shield}}$$

Therefore, when all emissivities are equal, 1 shield reduces the rate of radiation

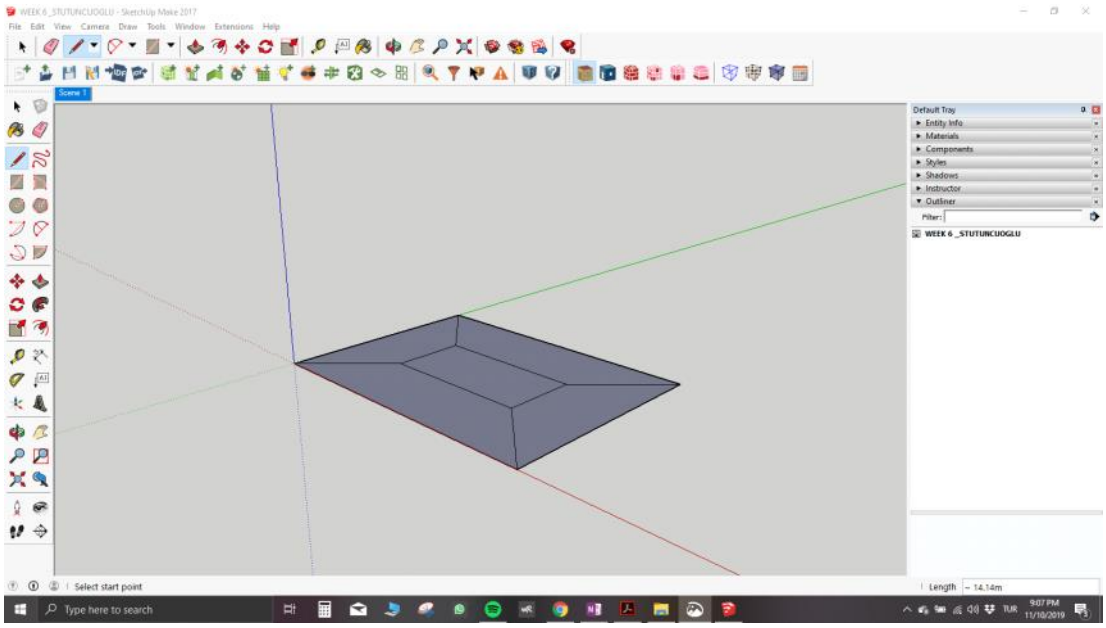
heat transfer to one-half, 9 shields reduce it to one-tenth, and 19 shields reduce it to one-twentieth (or 5 percent) of what it was when there were no shields.
So if we want to reduce to rate of radiation heat transfer to be 1 percent of the case without shields, we should add 99 shields.

$$\frac{1}{N+1}\,\dot{Q} = \frac{1}{100}\,\dot{Q} \qquad \text{N = 99}$$

# TASK 2

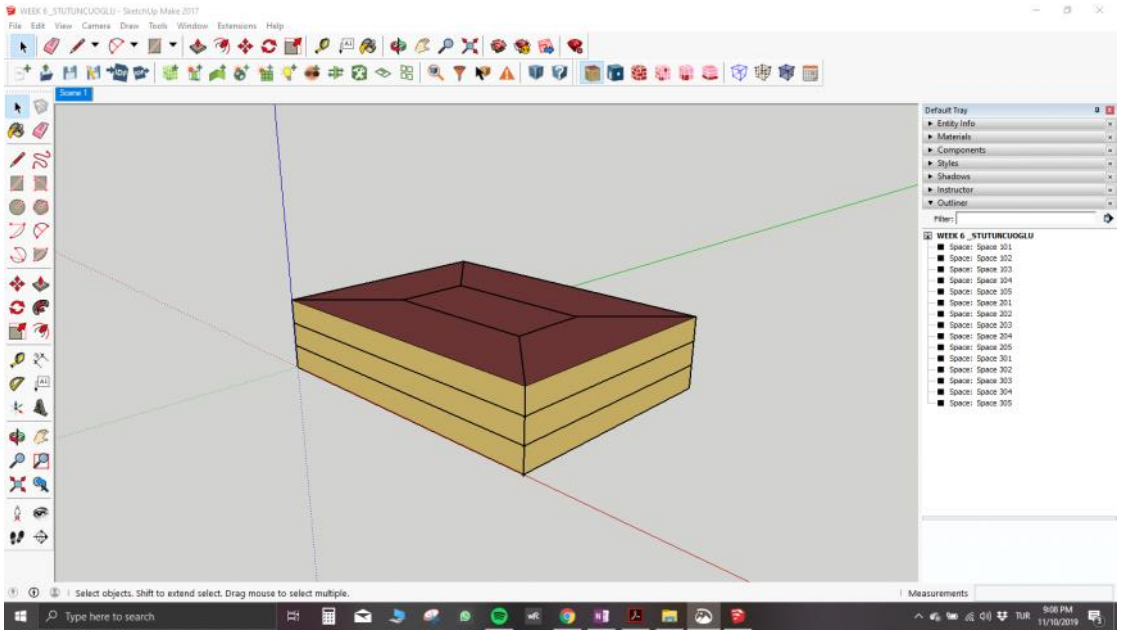
## 1.STEP

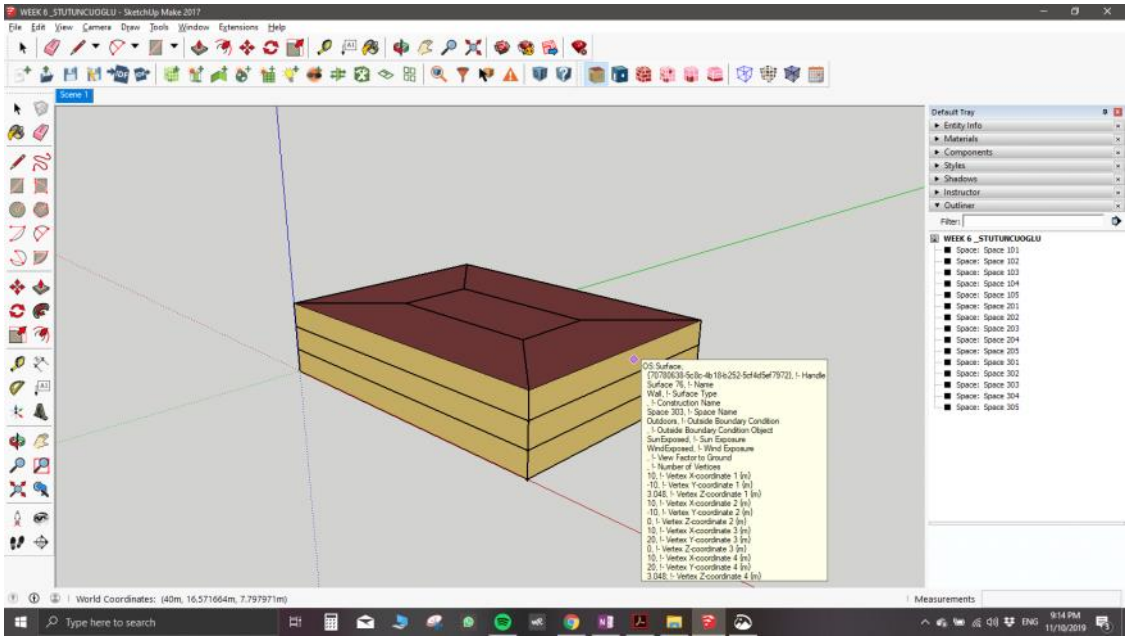
TO CREATE A ROOF FOR THE MODEL, FIRST OF ALL WE DRAW A RECTANGLE (40X30 cm) AND OFFSET INTO IT (10 cm), THEN CONNECT EACH CORNERS OF THESE RECTANGLES.
PAY ATTENTION TO DRAW IT HORIZANTALY.



## 2.STEP

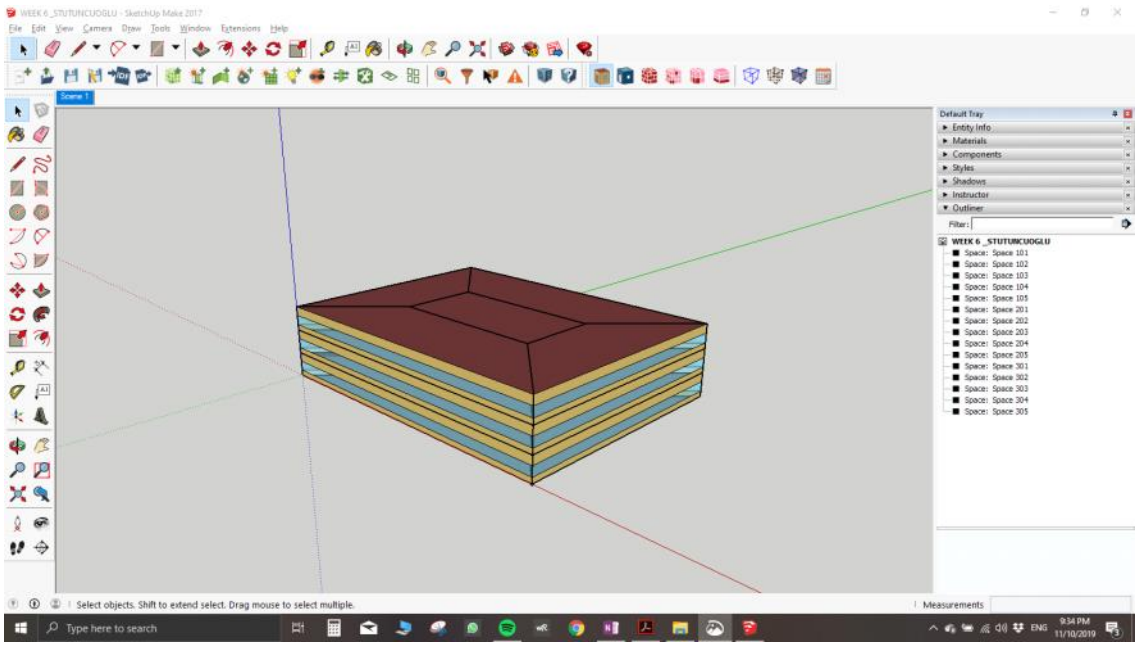
TO CREATE LEVELS FOR MODEL, FIRST SELECT THE ROOF AND CLICK ON THE 'CREATE SPACES FROM DIAGRAM' TOOLS. GIVE THE LEVEL HEIGHT AND LEVEL NUMBER.
IF WE WILL USE 'INFO TOOL' AFTER THAT, WE CAN SEE THAT THE BOUNDARY CONDITIONS ARE ASSIGNED AUTOMATICALLY.





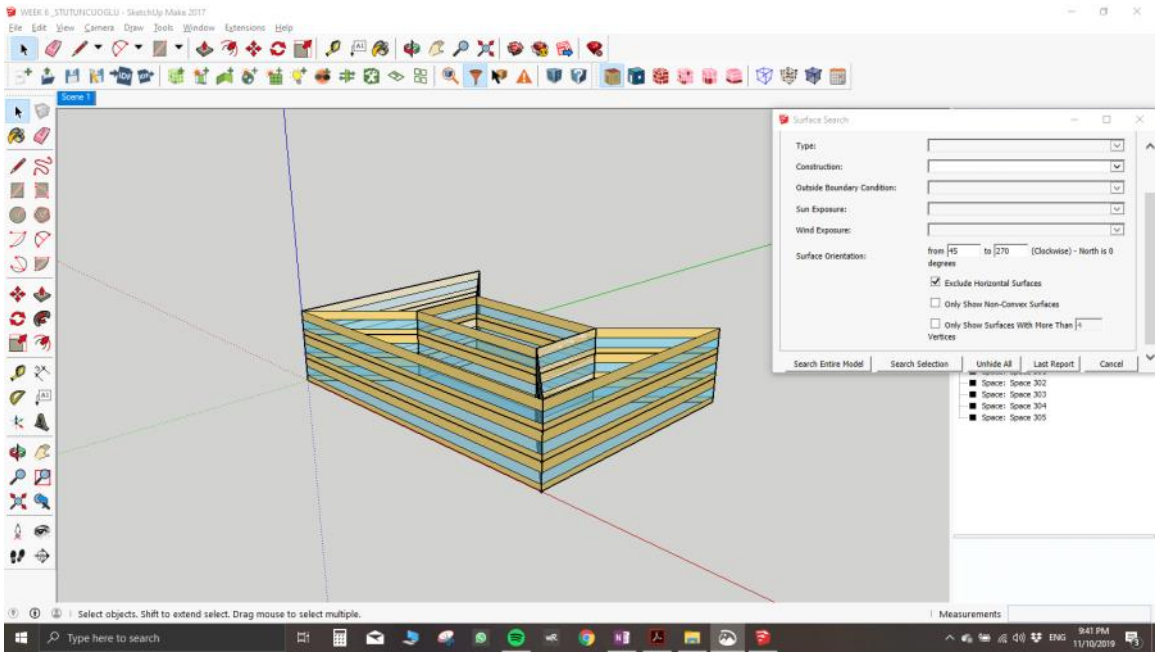
# 3.STEP

TO CREATE WINDOWS FOR MODEL, KEEP THESE STEPS :
SELECT THE BUILDING > EXTENSION > OPEN STUDIO USER SCRIPTS > ALTER OR ADD MODEL ELEMENTS > SET WINDOW TO WALL RATIO
FILL USER INPUTS.

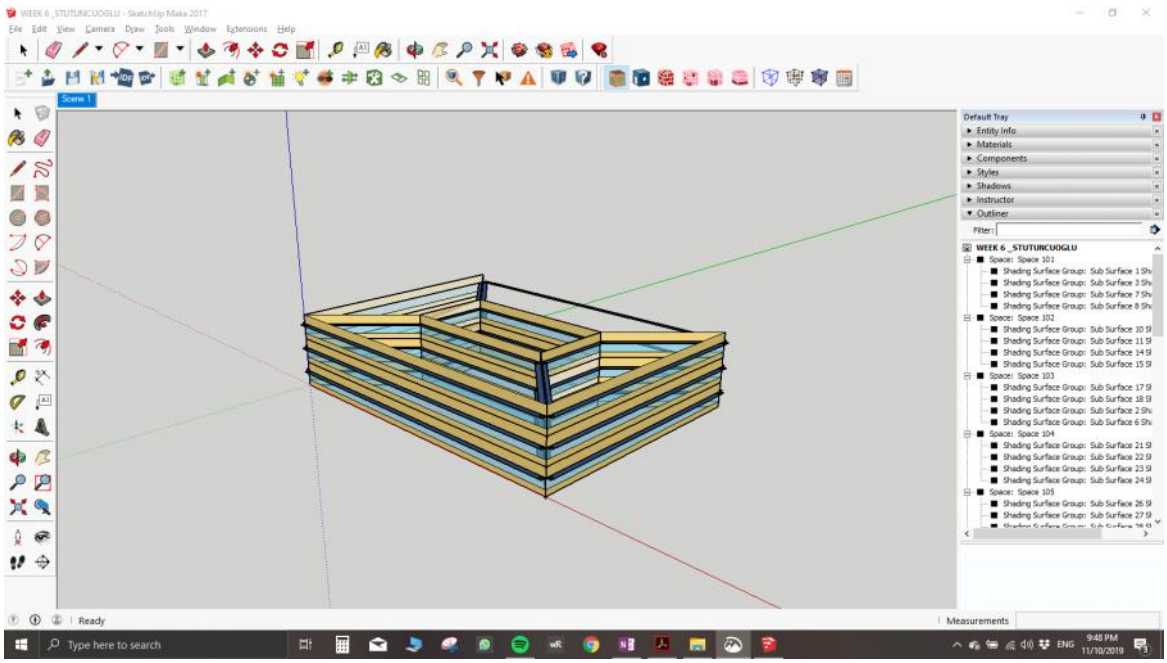


# 4.STEP

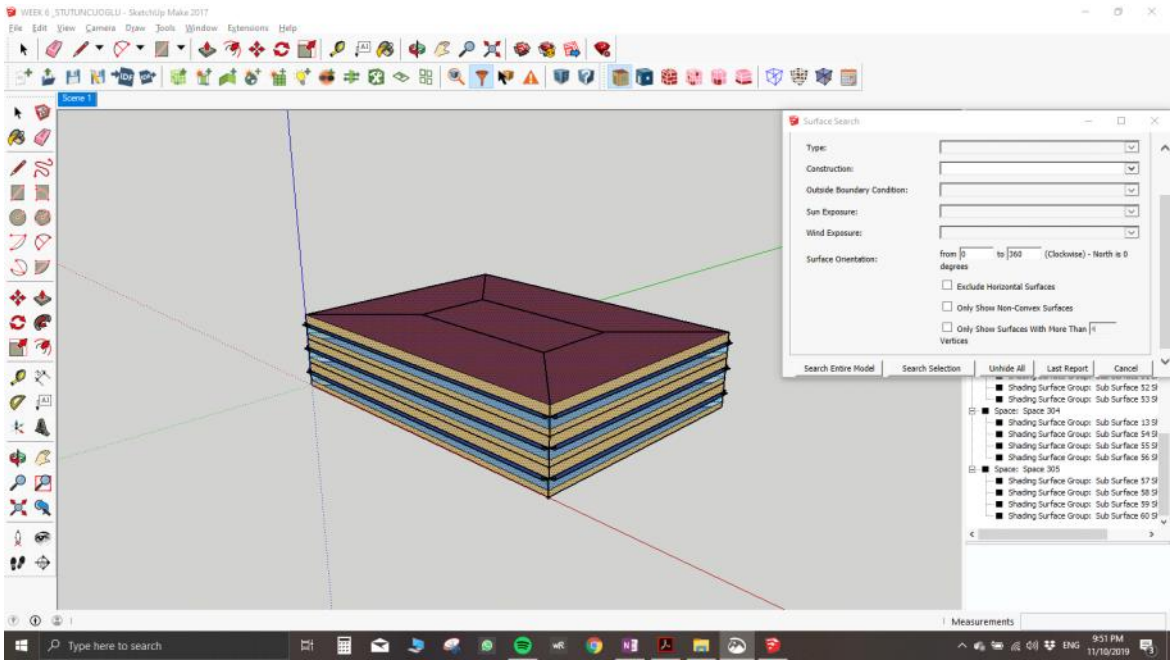
TO ADD EXTERNAL SHADING, FIRST WE SHOULD CHOOSE ALL SURFACES EXCEPT OF NORTH. TO DO THIS, KEEP THESE STEPS:
SELECT THE BUILDING > USE 'SEARCH SURFACES' TOOL > FILL THE SURFACE ORIENTATION SECTION '45' AND '270' > SEARCH SELECTION




NOW WE HIDE THE NORTH SURFACE BECAUSE WE DO NOT WANT TO ADD EXTERNAL SHADING ON THIS SURFACE. AFTER DO THAT, TO ADD EXTERNAL SHADING KEEP THESE STEPS:
SELECT THE BUILDING > EXTENSION > OPEN STUDIO USER SCRIPTS > ALTER OR ADD MODEL ELEMENTS > ADD OVERHANGS BY PROJECTION FACTORS > FILL USER INPUTS

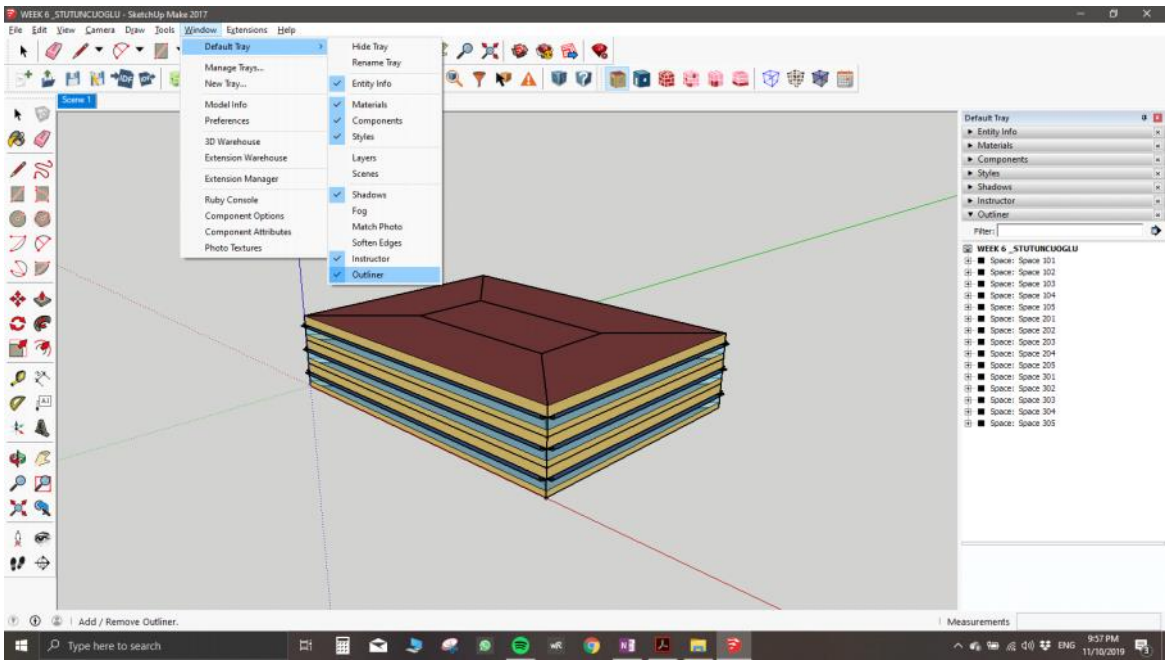



NOW WE ADDED EXTERNAL SHADINGS. TO SEE THE WHOLE BUILDING AGAIN (WITH NORTH SURFACE) OPEN AGAIN THE 'SEARCH SURFACE' TOOLS > FILL THE SURFACE ORIENTATION SECTION '0' AND '360' > SEARCH SELECTION



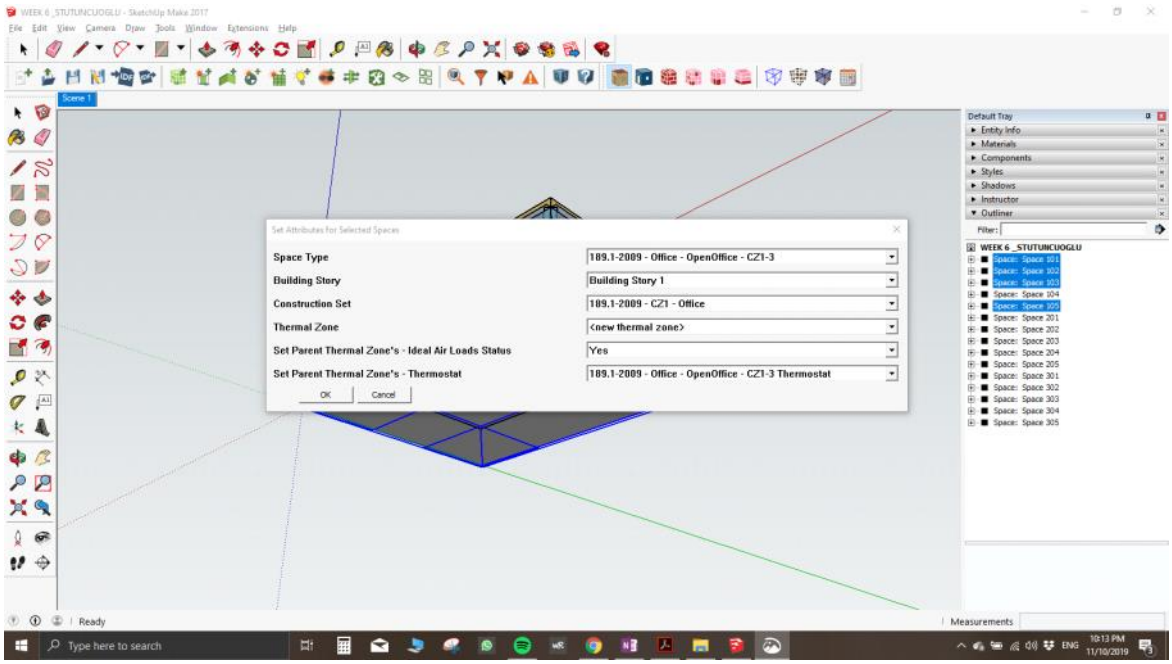
# 5.STEP

TO GIVE EACH SPACES CORRESPONDING DATA, FIRST OF ALL WE NEED THE 'OUTLINER TRAY'.
TO OPEN IT KEEP THESE STEPS:
WINDOW > DEFAULT TRAY > OUTLINER



AFTER THAT WE CAN GIVE DATA TO THE SPACES. CHOOSE THE SPACES IN THE OUTLINERS LIST ON THE RIGHT FOR EACH THERMAL ZONE AND ADD SPECIFICATIONS.
WE IMAGINE THAT THIS IS A OFFICE BUILDING AND THERE ARE OPEN OFFICES, BETWEEN THE

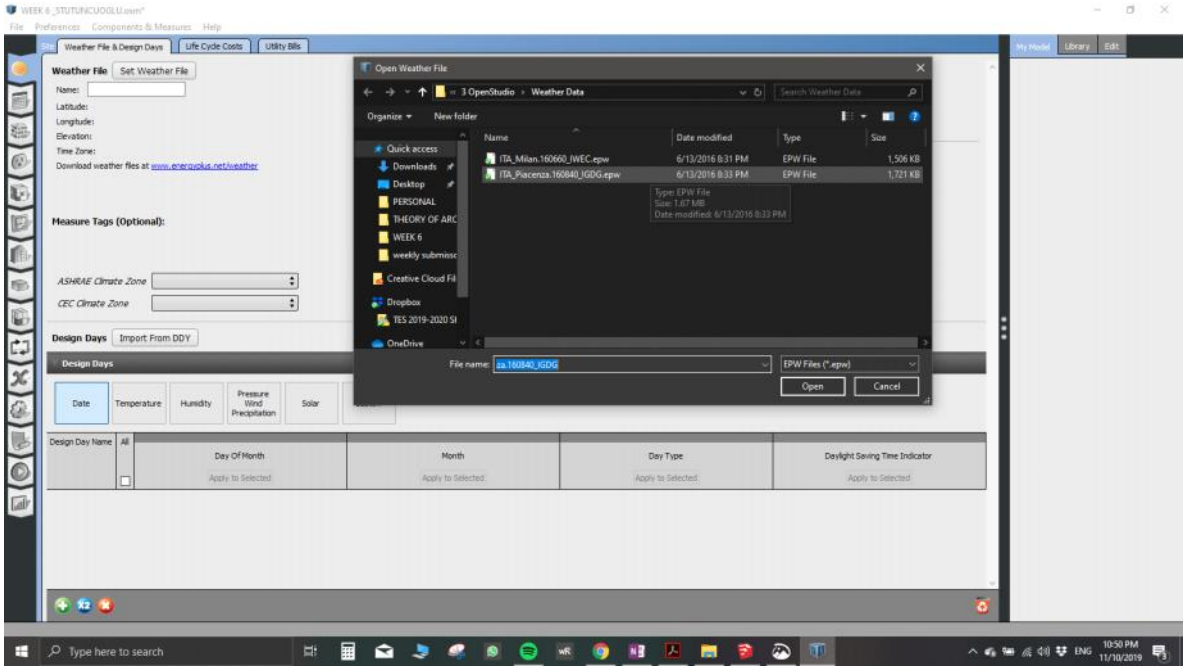
SPACES THERE IS A BREAK ROOM.
FIRST WE CHOOSE THE OPEN SPACES AREAS IN THE 1.LEVEL SHOWN AS 'SPACE 101-102-103-105'. SHOULD NOT CHOOSE THE 'SPACE 104' BECAUSE IT IS A BREAK ROOM.
AFTER CHOOSE THESE SPACES, KEEP THESE STEPS:
SET ATTRIBUTES FOR SELECTED SPACES > FILL THE BLANKS LIKE AS SHOWN AS IN THE SCREENSHOT.

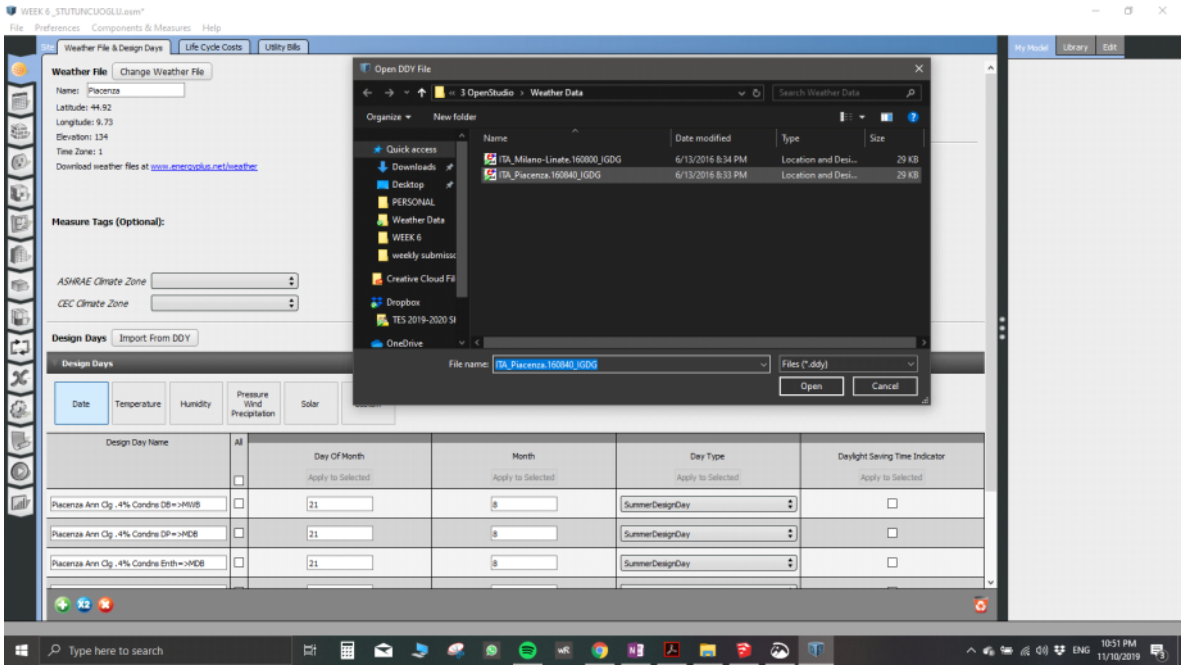



AFTER THAT, REPEAT AGAIN THE SAME STEPS FOR EACH LEVELS. PAY ATTENTION THE CHANGE 'BUILDING STORY' BLANKS ACCORDING TO LEVELS.
AND REPEAT AGAIN THE SAME STEPS FOR EACH BREAK ROOMS(SPACE 104-204-304). PAY ATTENTION TO CHANGE 'SPACE TYPE' BLANKS ACCORDING TO FUNCTION AND 'BUILDING STORY' BLANKS ACCORDING TO LEVELS.

# 6.STEP

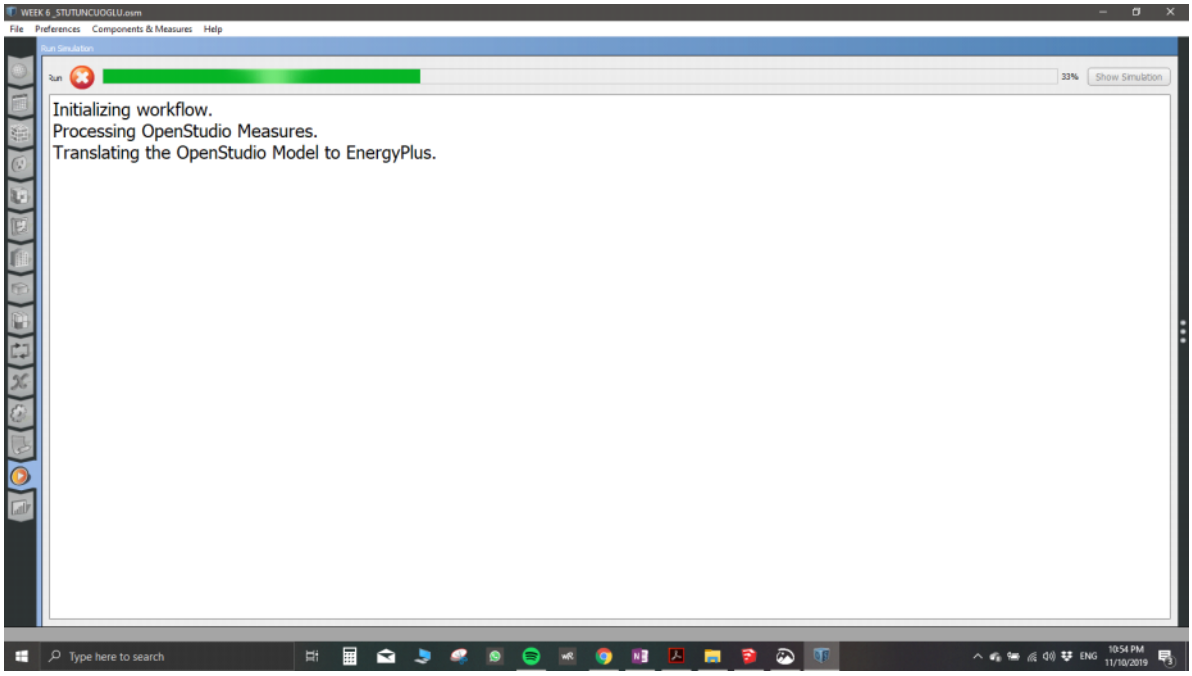
NOW WE FINISHED OUR MODEL. WE SAVE IT USING 'SAVE OPEN STUDIO MODEL AS' TOOL. TO TAKE A REPORT FROM OPEN STUDIO WE SHOULD LAUNCH THE 'OPEN STUDIO' DOCUMENT OF OUR MODEL AND ADD WEATHER DATA IN
>WEATHER FILE > CHANGE WEATHER FILE > CHOOSE FILE
AND > DESIGN DAYS > IMPORT FROM DDY > CHOOSE FILE




# 7.STEP

THEN SELECT THE 'RUN' TOOL FROM THE RIGHT TOOL BAR AND RUN THE CLICK RUN TO PROJECT.




WHEN IT IS COMPLETED, SELECT THE 'REPORT' TOOL FROM THE RIGHT TOOL BAR TO TAKE THE REPORT OF YOUR MODEL BUILDING.