TES Technical Environmental System

Week # 7 Assignment

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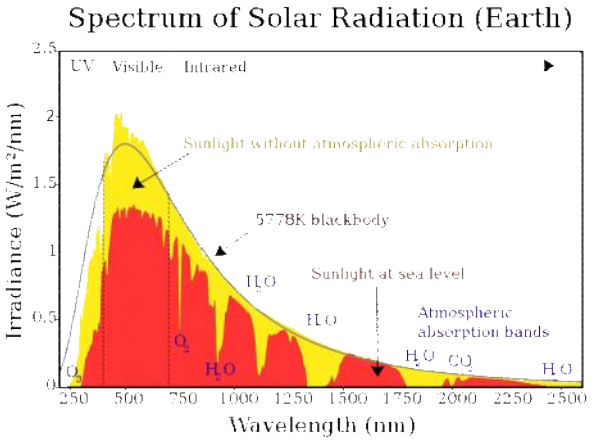
Task 1: Provide a summary of the main concepts that went through about solar radiation (formulas are not needed)

The Solar radiation is radiant energy. It is emitted by the sun caused by a nuclear fusion reaction that creates electromagnetic energy.

The Sun is similar to a black body since its spectrum of radiation is close to that of a black body with a temperature of 5800 K.

Sunlight is a part of the visible electromagnetic radiation emitted by the sun, along with the invisible part to the human eye which is infrared, and ultraviolet light.

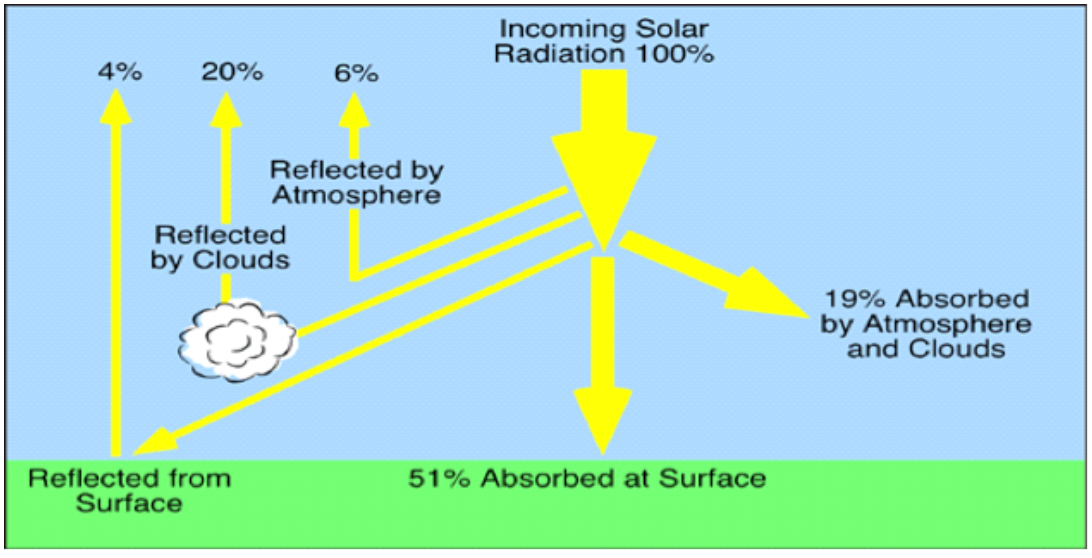


When solar radiation is not blocked by clouds it is experienced as sunshine (combination of bright light, and radiant heat)

When it is blocked by clouds, it is experienced as diffused light.

The maximum yearly average solar radiation density (called Solar constant G_SC equal to 1367 W/m^2

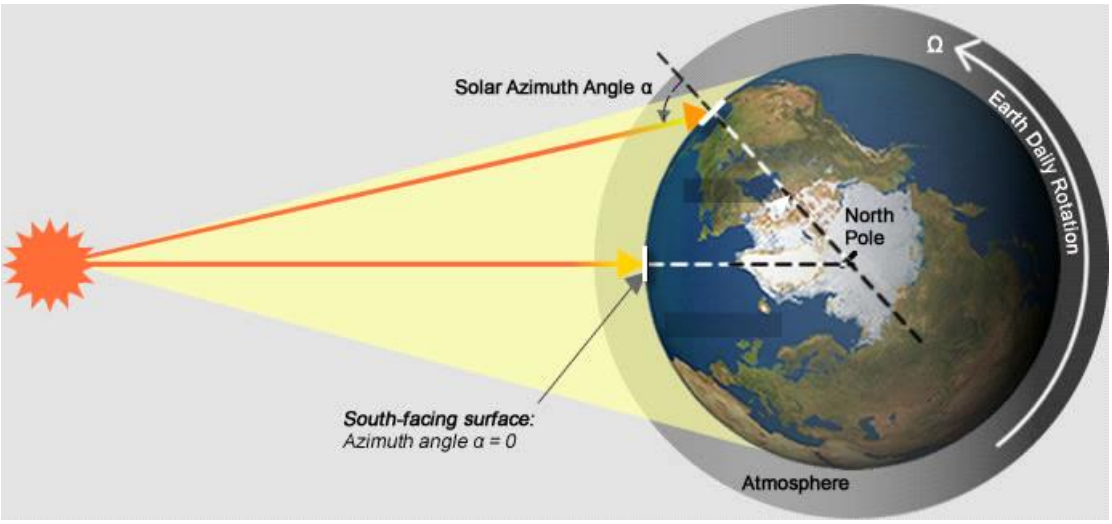
The wavelengh of the solar radiatio is between 0.3 and 2.5 Um



The part of the solar radiation that crosses the atmosphere of planet earth is dispersed, distributed, modified. Part of it is reflected by the clouds, aother part is reflected by the surface of earth, another part is absorbed by earth surface, another part is transmitted through the clouds,…

Note that the part of the radiation that was in-interrupted by the clouds, or any other obstacles and reaches earth surface is calles "direct solar radiation".

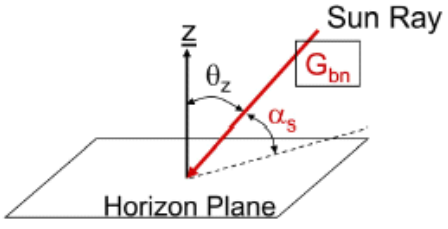
The absorbed part of the solar radiation is converted to internal energy and re-emitted again.



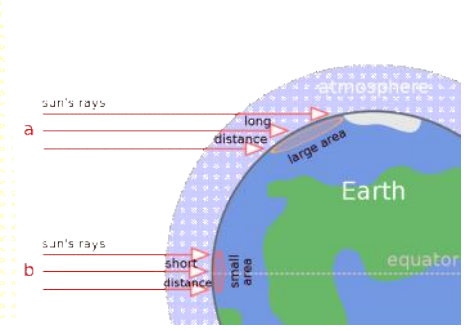
On the Zenith Line, Solar radiation cross the smallest width of the atmosphere before reaching the surface. However with other angles, solar radiations cross larger distances before reaching the

The Solar height angle alfa a is the cmplementary angle to the solar zenithal angal

$$\alpha_s = 90° - \theta_z$$



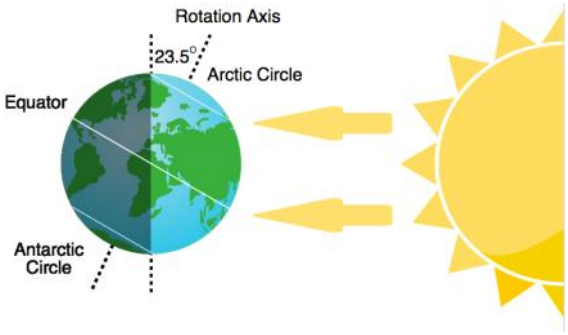
We note that the Sunflux is distributed on area when the Zenithal angle is large.

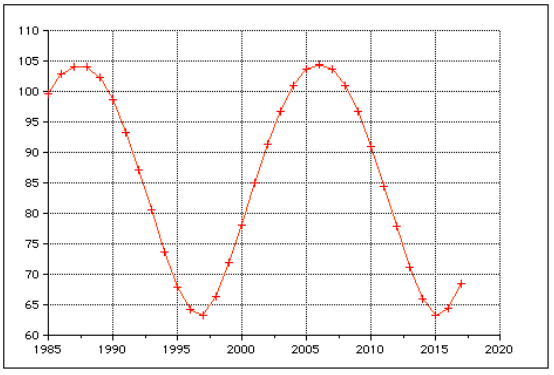


For the conversion to other energy forms, solar radiations depend on:

1- Sun position in the Sky
2- Weather condition
3- Site altitude
4- Sunshine hours

Since the earth turn around its axe with an angle of 23.5 degres, the circle of illumination is inclination compared to the axis between -23.5 and +23.5 (called declination angle= differencial boundary between day and light diagram).





What is a Pyranometer?

Used for measuring solar irradiance on a planar surface and it is designed to measure the solar radiation flux density (W/m^2).

What is a Pyrheliometer?

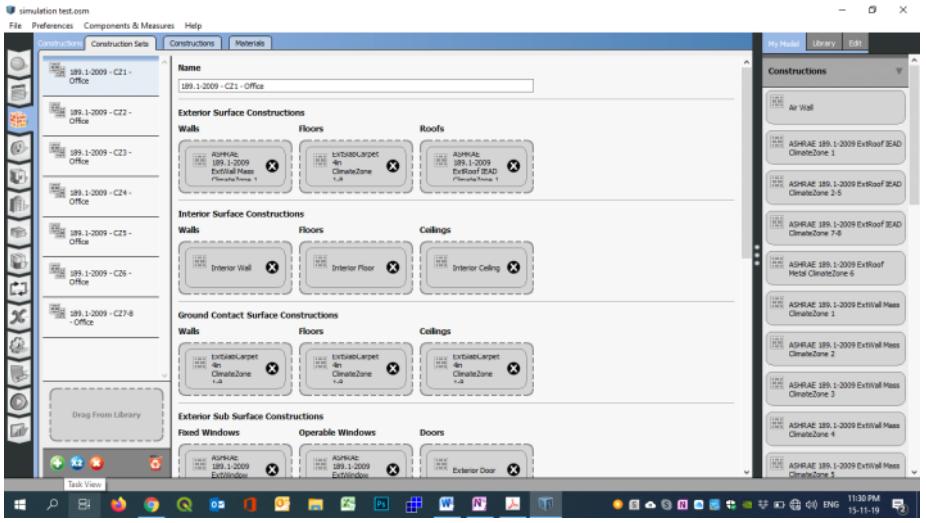
Used for measuring of direct beam solar irradiance.

Sunlight enters the instrument through a window and is directed onto a thermopile which converts heat to an electrical signal that can be recorded.

Task 2: Create a pdf file with screenshots of all of the steps we went through in the second lesson on openStudio and explain briefly the reason behind the use of each step (in your own words!)

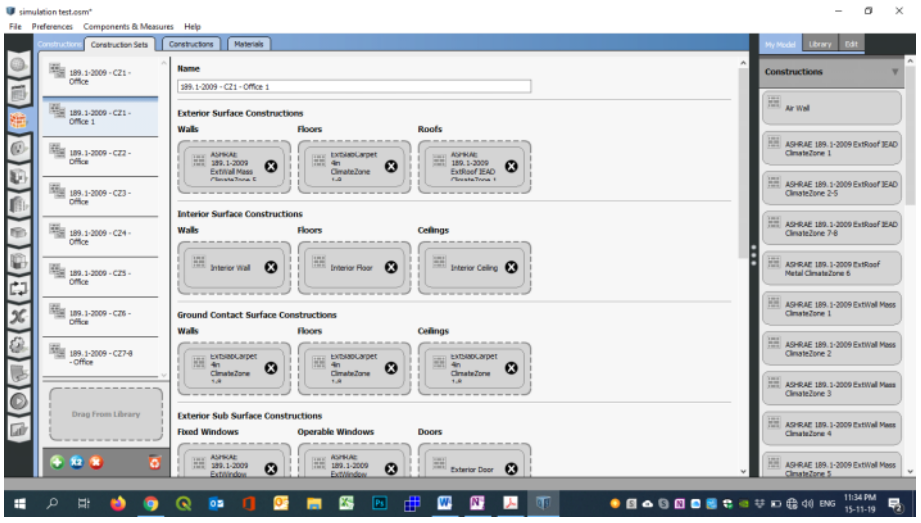
Objective: Change the material composition and type of a wall, and to apply it to a group of walls, for example: external walls. Than assign these external wall to a project. Finally, Run a test, and compare the results.

Step 1: Open "Open Studio " software, and open the saved test result of the previous session.

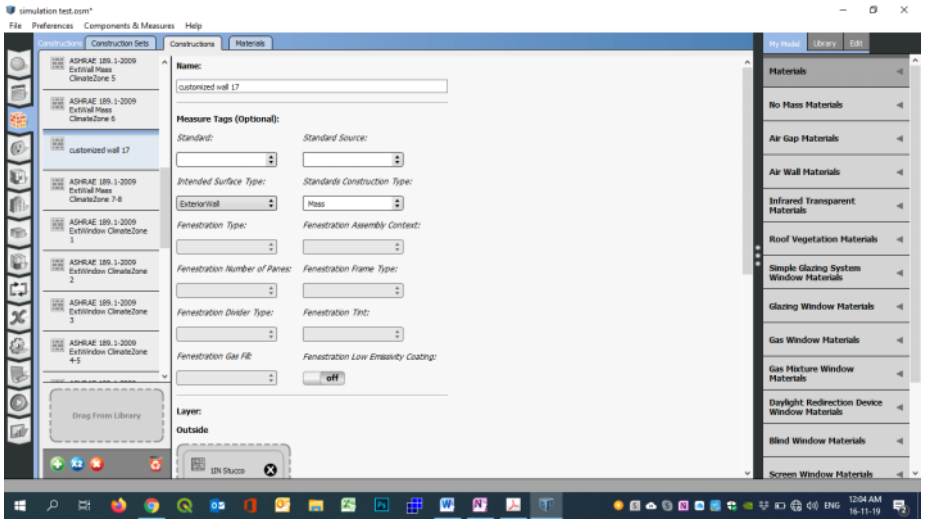


Step 2: We will start from the beginning by "Construction Sets" , passing by "Constructions" , and finishing by "Materials".

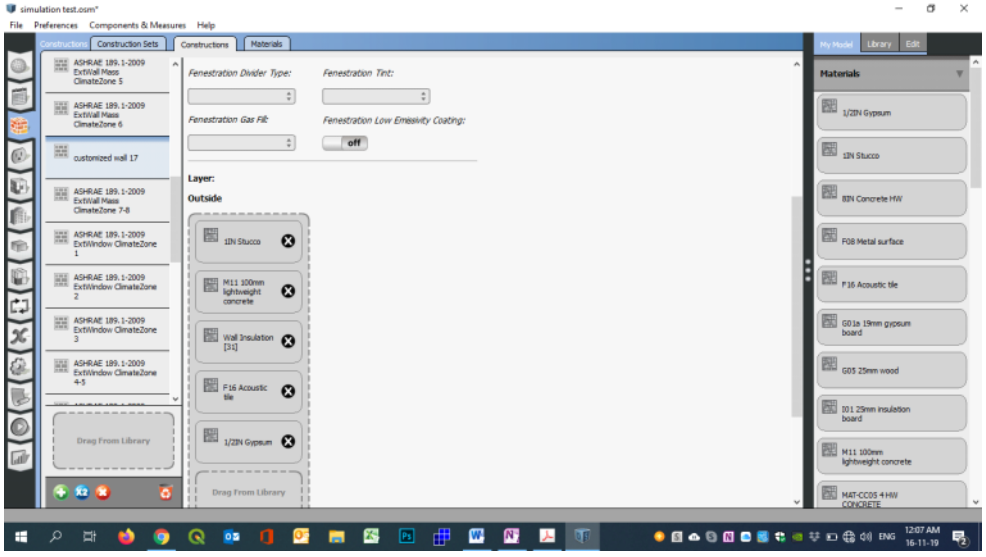
Click on "Construction Sets" tab, click on the first of the list "189.1-2009 - CZ1 - Office", click the symbol "X2" (which means duplicate), and change the name of the new created construction set a name of your choice.



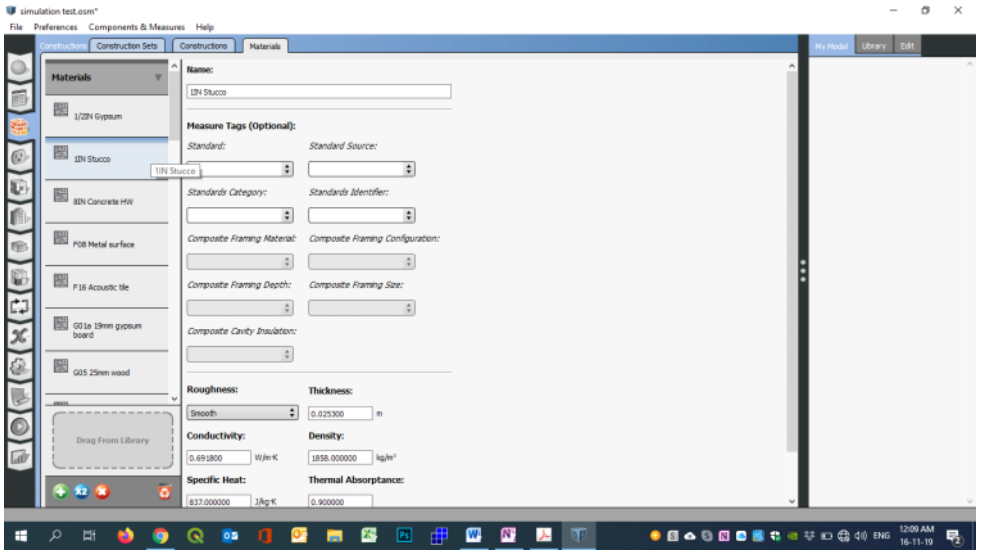
Step 3 : Click on "Constructions" tab, click on the external wall type layer type if the external walls are the subject of modification "ASHRAE 189.1-2009 ExtWall Mass ClimateZone 1", click the symbol "X2" , and change the name of the new created construction set to a name of your choice.



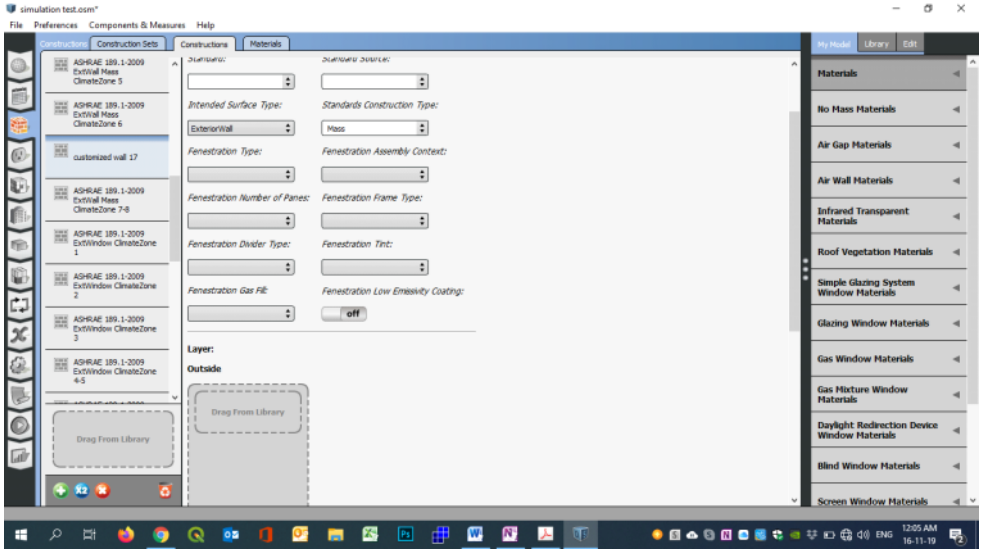
Scroll down, and check the list of the composition of the external walls. In order to change the type wall, we need to change the materials of which the wall is made from, which are: Stuco, Concrete, insulation, Gypsum. So we need to change the composition of these four items.



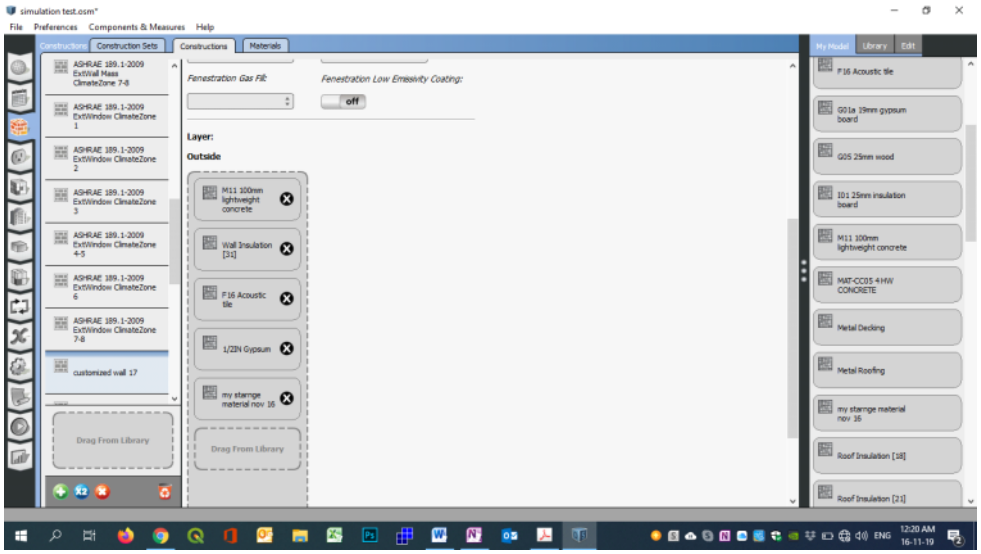
Step 4: Click on "Materials" tab, click and open "Materials" in the list at left, search for the items viewed previously (concrete, insulation…), click and duplicate the desired ones. Change the names of the copied versions, and change some of the features like (size, thickness..)



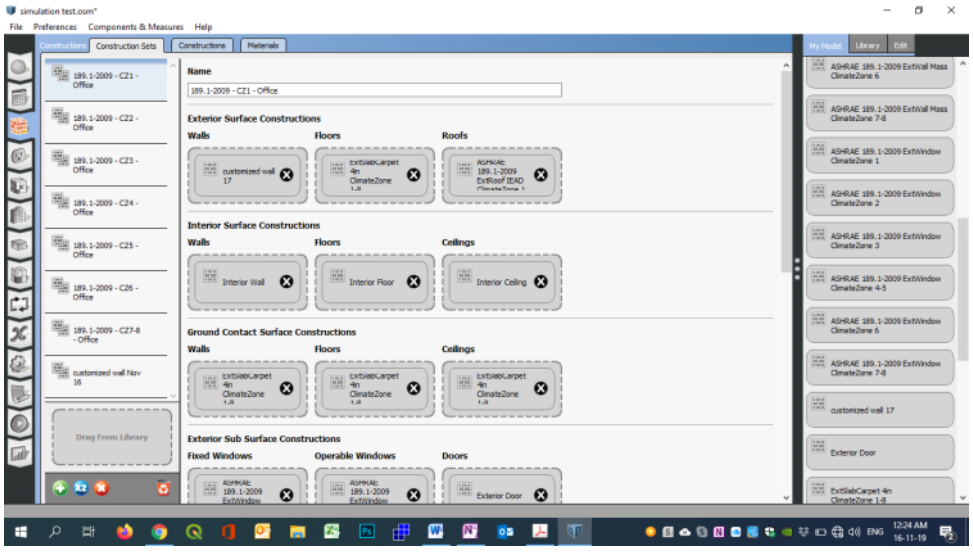
Step 5: Go back to the "Constructions" tab, search for the project name created when in "Constructions" tab specific for the external walls (the duplicated one!!!),



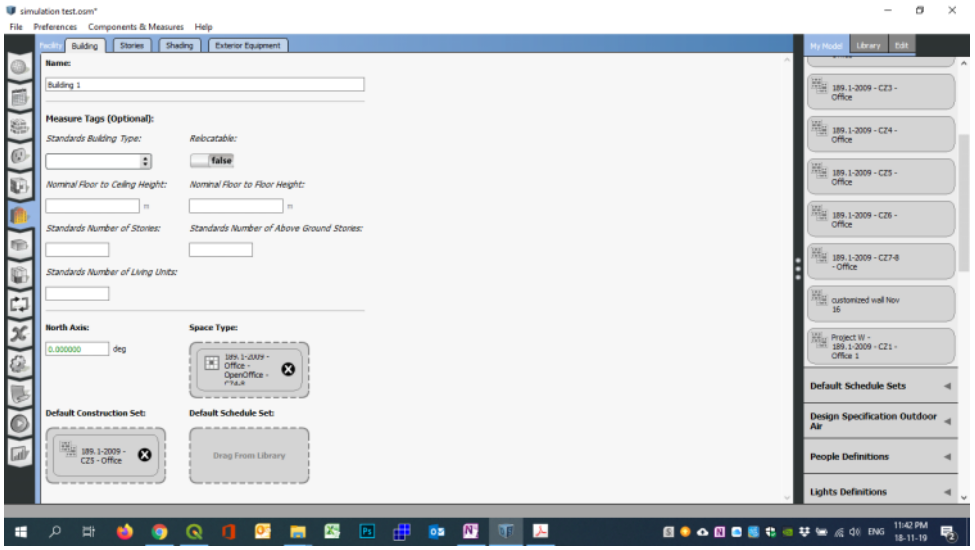
Remove all the components. Replacing them by the new materials created when in "Materials" tab, going to the list of Materials located on the right of the screen, clicking and draging the newly materials to the empty slots.



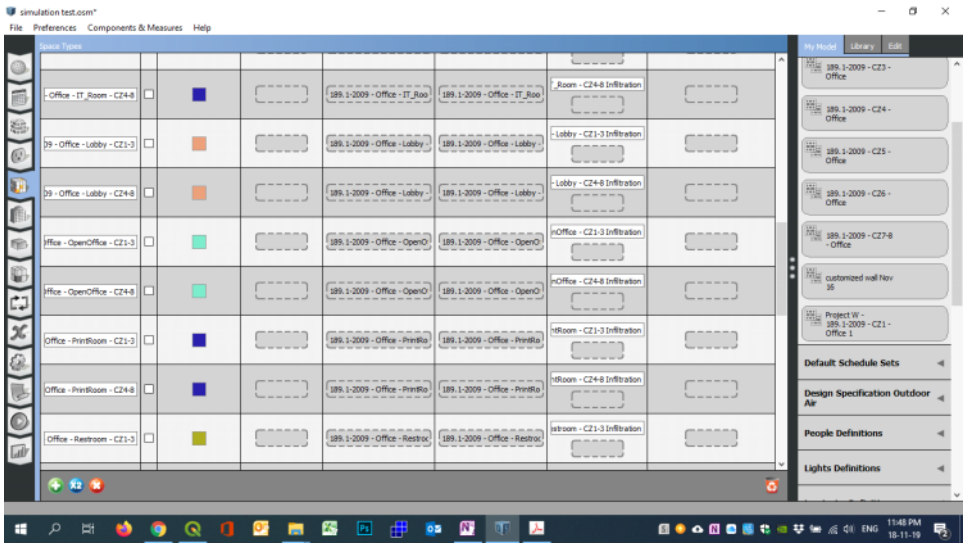
Step 6: Go back to "Construction sets", search in "Constructions" in the list on the right side of the sreen for the external wall type name to which you assigned the materials. Click and drag it to the slot beneath the "Exterior Surface Constructions, Walls".



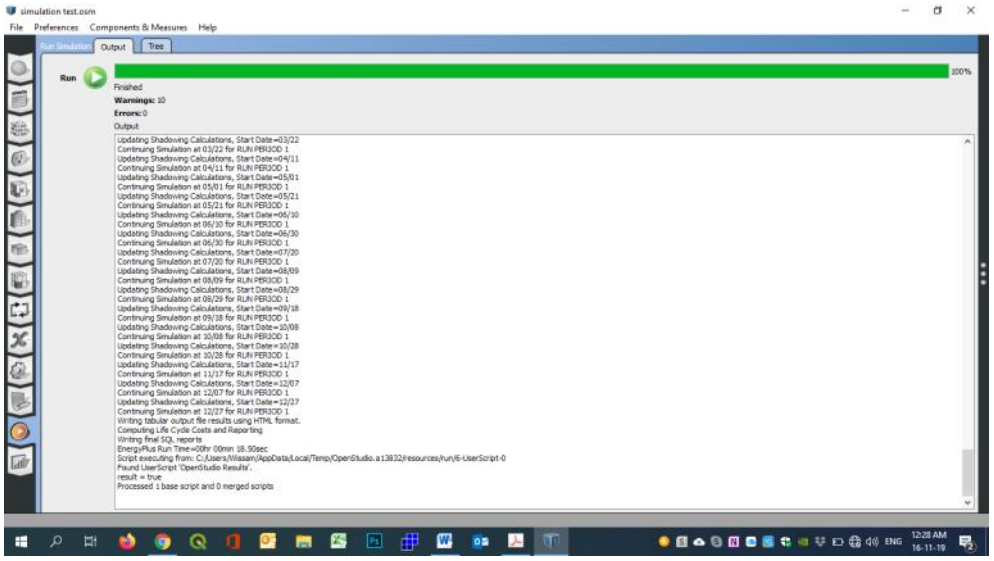
Step 7: Go to "Facility", Search under "Default Construction sets" (in the list at right of the screen) for for the Construction set you created. Click and drag it beneath the slot of "Default construction set".



Step 8: Go to "Space Types", search in the table for the space type the construction set is used in, for eaxample: open office. Search in the list at right, in the Default construction set, for the newly created construction set, click and drag it into all slots, under "Default construction set" for all "open office" space types.



Step 9: Run The Test



Step 9: Compare the results

Thank you,