> **Provide a summary of the main concepts that went through about solar radiation (formulas are not needed)**

Solar radiation, often called the solar resource, is a general term for the electromagnetic radiation emitted by the sun. The amount of solar radiation that reaches any one spot on the Earth's surface varies according to:
- the **Sun position** in the sky (altitude α and azimuth γ_s angles), which changes daily and seasonally (declination angle δ);
- the **weather condition**, both continental and microclimatic (atmosphere clearness);
- the **site altitude** over the see level;
- sunshine hours (**day length**).

Solar constant is the total radiation energy received from the Sun per unit of time per unit of area on a theoretical surface perpendicular to the Sun's rays and at Earth's mean distance from the Sun. It is most accurately measured from satellites where atmospheric effects are absent. The value of the constant out of the Earth's atmosphere is approximately 1367 $W/_{m^2}$. The value on the Earth's surface is 1000 $W/_{m^2}$.

The atmosphere filters the Sun's rays to a certain extent, as does each body, causing:
- **dispersion** (scattering of the rays),
- **absorption**

DISPERSION
The scattering phenomena is defined as:
- a black reflection (albedo) of part of the incident radiation on the atmosphere forward sidereal space;
- the "appearance" of radiation deflected in all directions, denoted as diffuse radiation.

The total radiation received from the sun, of a horizontal surface at the level of the ground for a serene day, is the sum of direct and diffuse radiation:
- **direct radiation (G_b)** is also sometimes called "beam radiation" or "direct beam radiation". It is used to describe solar radiation traveling on a straight line from the sun down to the surface of the earth. Direct radiation depends on the orientation of receiving surface.
- **diffuse radiation (G_d)** , on the other hand, describes the sunlight that has been scattered by molecules and particles in the atmosphere but that has still made it down to the surface of the earth.

ABSORPTION
Solar radiation absorption is due to some atmospheric components, especially ozone, water and carbon dioxide, which absorb the incident radiation in specific wavelength bands consequently modifying its energetic spectrum.
The absorbed solar energy is converted into internal energy and therefore reemitted in the far infrared (long wave) in all the directions.

To measure solar radiation it's possible to use the following **instruments**:
- **pyranometer**: measures the total solar irradiance G_{tot}
- **pyranometer with shadow band**: measures only diffuse irradiance G_d
- **normal pyrheliometer**: measures only direct beam solar irradiance G_b

> SketchUp – OpenStudio exercise
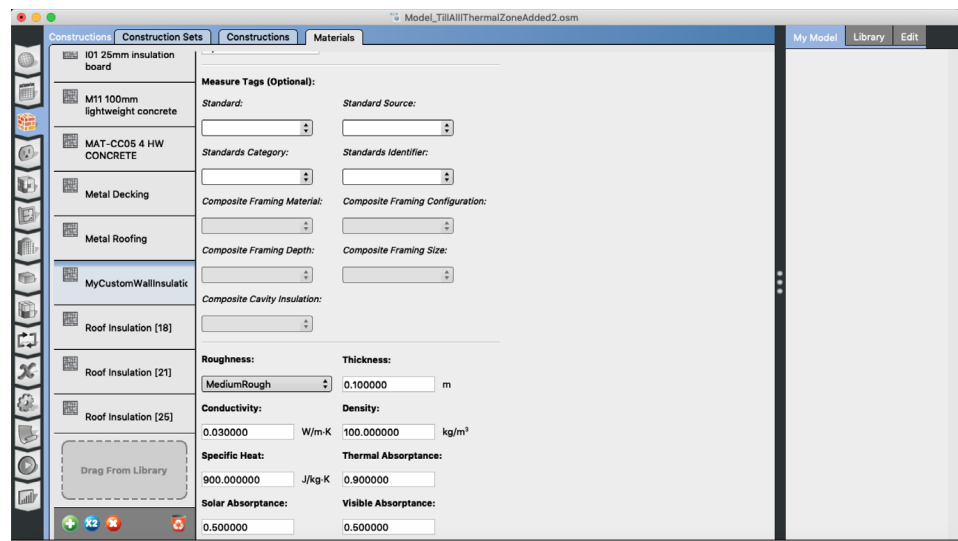
1. Modify Constructions

Till here we are using default construction but it's possible to change some of the construction in the *Customize Construction Set*. Starting from the previuos model use the command *Construction* in the left bar and create a new *Construction Set* selecting one of the exhisting *Construction Set* ans use the command X2. Call the new one *MyConstructionSet*.
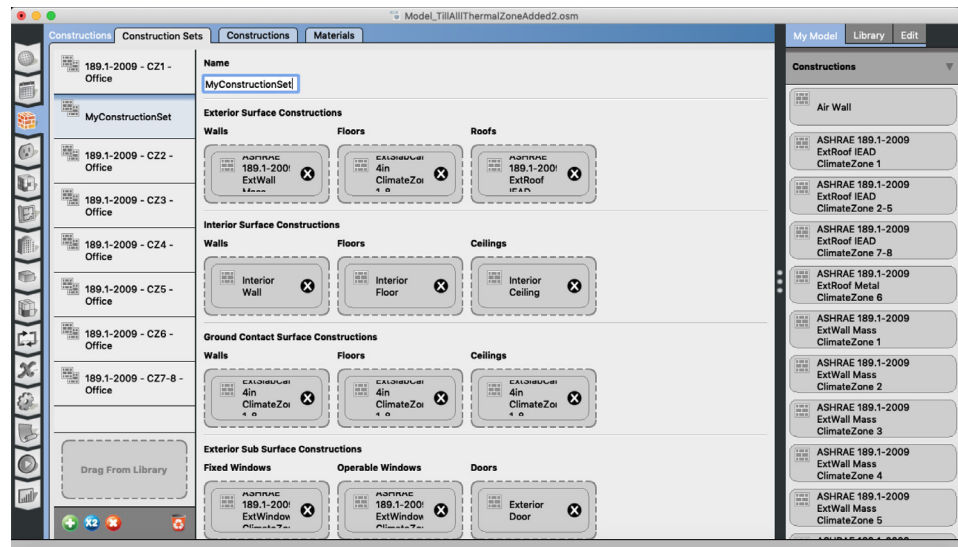

It's also possible to modify the type of *Construction* like, for example, the layers of the external wall. Using the same method create a new *Construction* called *MyCustomExternalWall*.
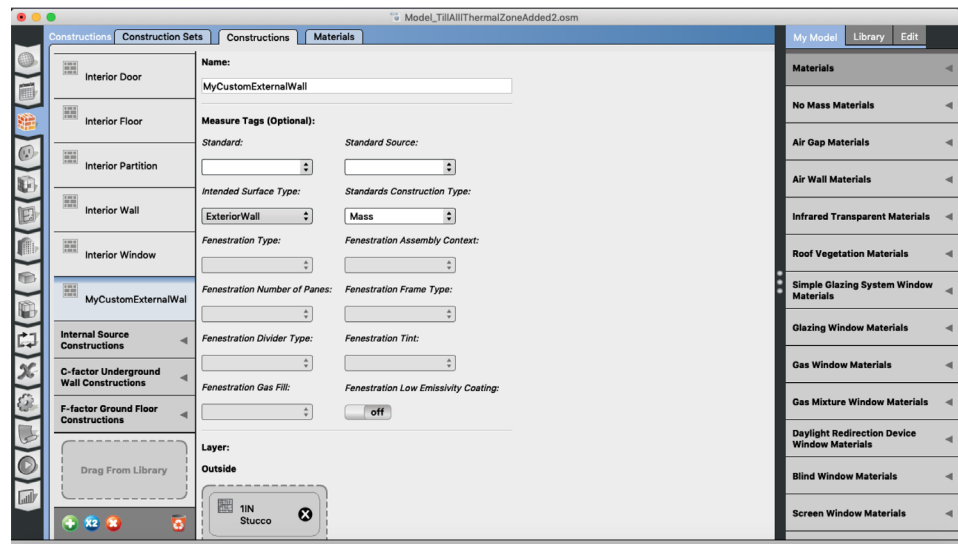
Going more deeper, it's possible to change also the characteristic of the *Material*.
In this page you can decide, for example, the *Thickness*, the *Conductivity*, the *Density*, the *Specific Heat*, the *Thermal Absorptance*, the *Solar Absorptance* and the *Visible Absorptance* of our new *MyCustomWallInsulation*.

Once defined the new *MyCustomWallInsulation*, aplly this to *MyCustomExternalWall* by dragging from the right column.
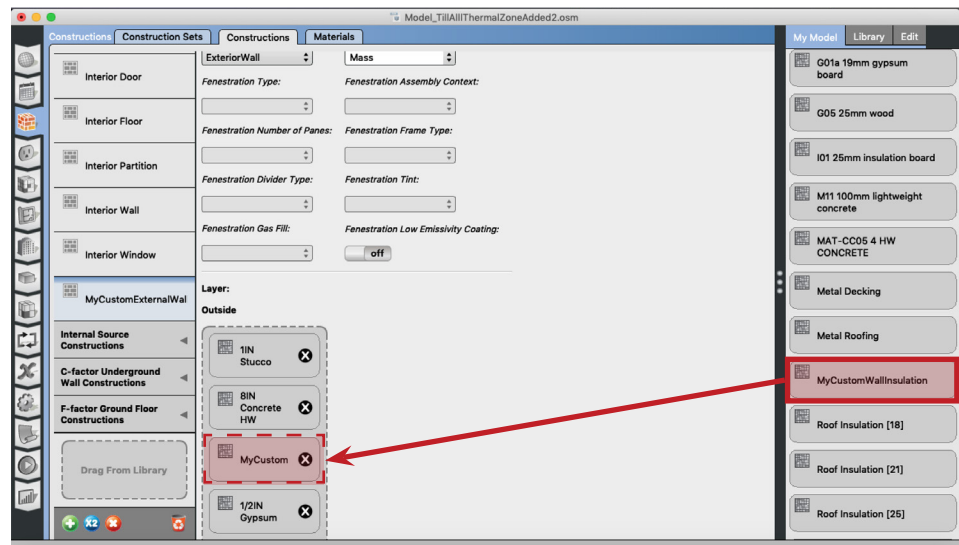
Once defined the new *MyCustomExternalWall*, aplly this to *MyCostumerSet* by dragging from the right column.
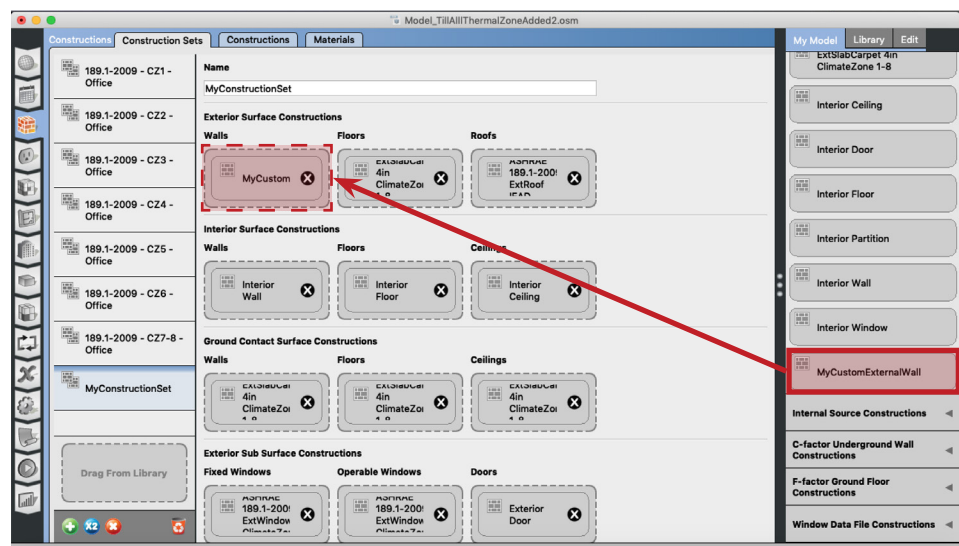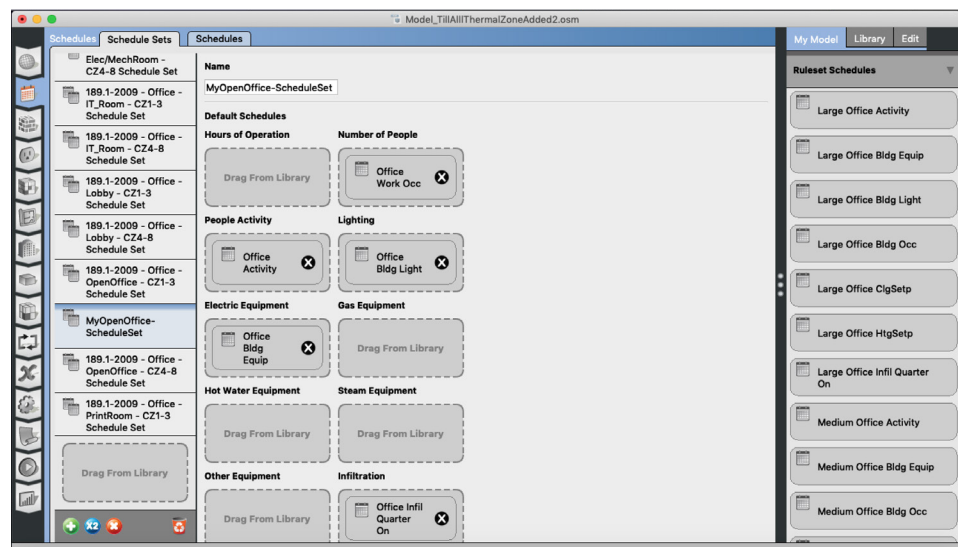

Once defined the new *MyCustomSet*, go to **SPACES** and apply *MyConstructionSet* to the spaces in the coloum *DEFAULT CONSTRUCTION SET*.
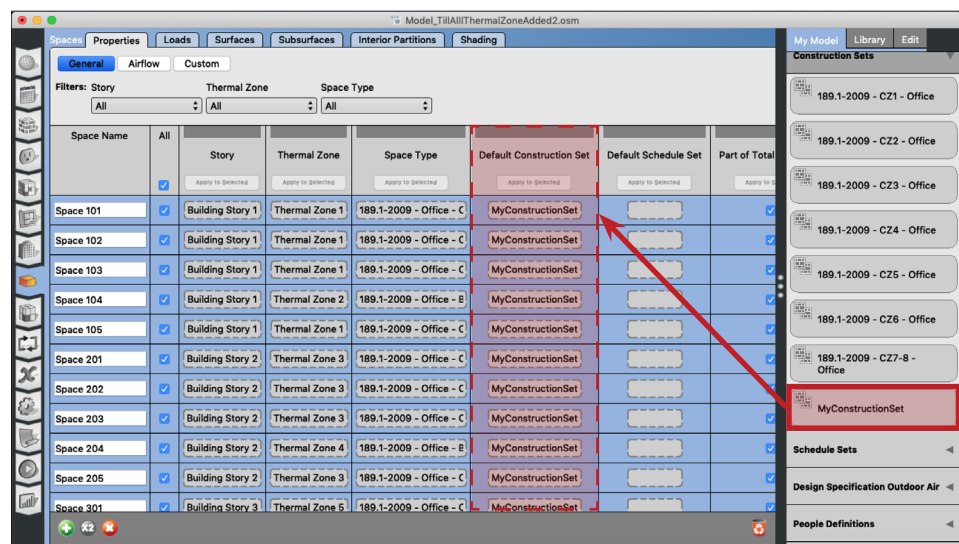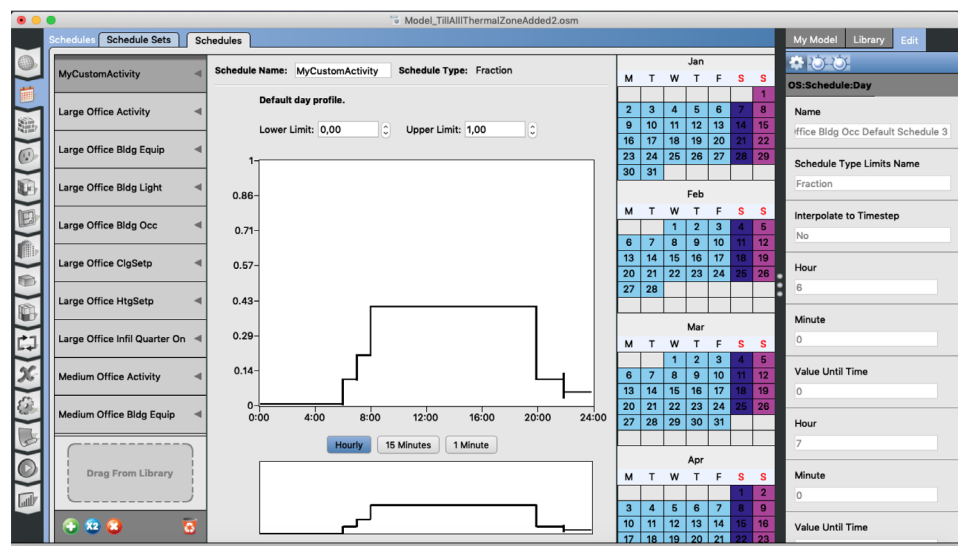
2. Modify Schedule

Another possibility is schedule number of people and furniture. For example in *SCHEDULE SETS* is possible to *create a new MyOpenOffice-ScheduleSet.*

Using the *SHEDULES* botton is also possible to define, for example, the number of people, the type of activity, lighting and electric equipment, etc...

In *SCHEDULESET* is now possible to define *MyCustomOpenOffice-ScheduleSet* according to the new *MyCustumActivity*, *MyCustumEquipment*, *MyCustomLigh* and *MyCustomOccupancy*.
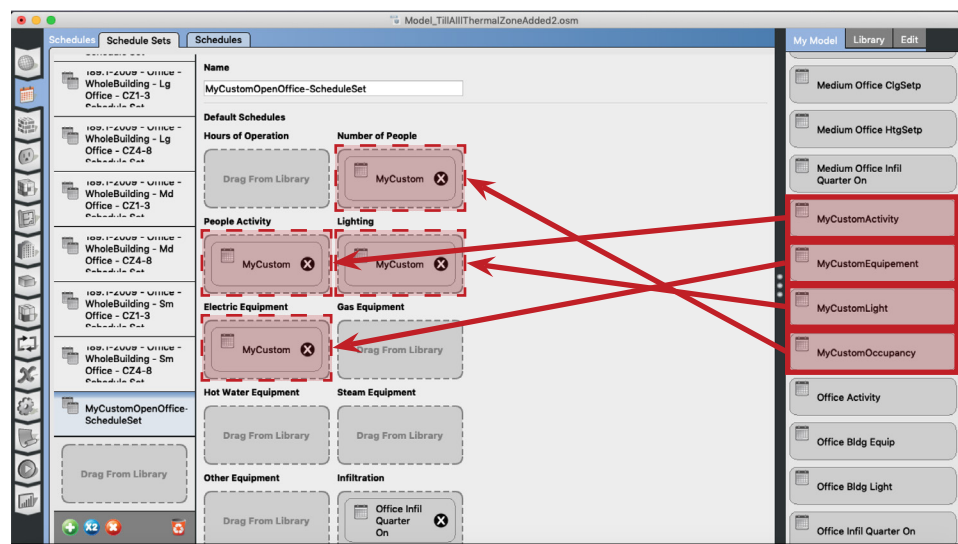
3. Modify Loads

Using the page *Loads > People Definition* is possible to define *MyOpenOffice-PeopleDefinition* and put the value, for example, of *People per Space Floor Area.*

In the page *Loads* is also possible to define characteristics of the building like *Lights, Luminaire, Electric Equipement, Gas Equipement, Steam Equipement* ect..

At the end is possible to check all the data entered on the page *Space Type*.