WEEK 7

2019年11月18日 18:45

QUESTIONS

Task 1

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

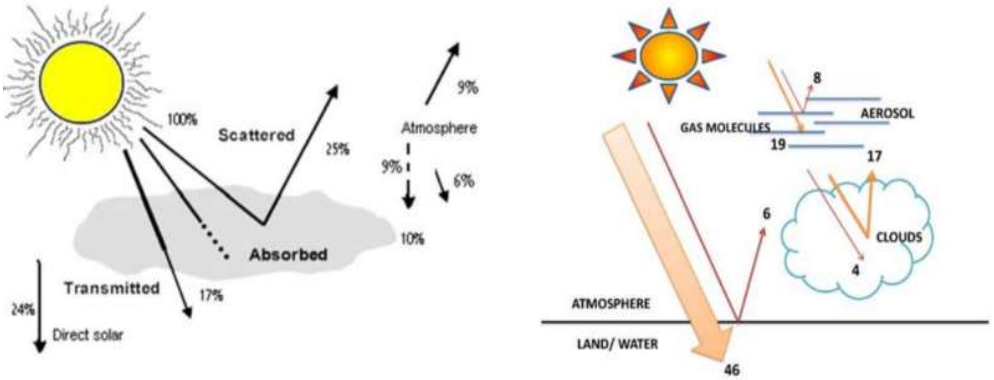
Task 2

You 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!)

ANSWERS

1. **Summary of solar radiation**

1) **Solar radiation** is radiant energy emitted by the sun from a nuclear fusion reaction that creates electromagnetic energy. The spectrum of solar radiation is close to that of a black body with a temperature of about 5800 K. About half of the radiation is in the visible short-wave part of the electromagnetic spectrum. The other half is mostly in the near-infrared part, with some in the ultraviolet part of the spectrum.
2) When the solar radiation arrives the Earth's surface, due to **dispersion** and **absorption** effects (with all kinds of objects), the radiative energy would be attenuated in spectral **distribution** and in total **irradiance**.

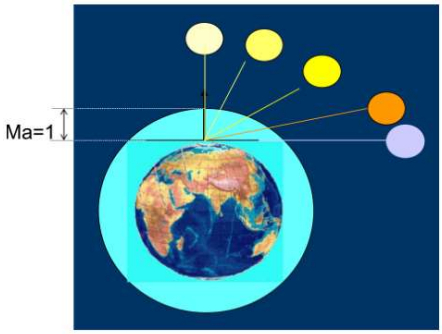


3) **Diffuse solar radiation** is solar radiation deflected in all directions: $G_d(W/m^2)$.
4) **Direct (Beam) solar radiation** is solar radiation which part maintains the incidence direction as only direction: $G_b(W/m^2)$

5) **Solar radiation absorption** is related to the medium like water(H_2O), ozone(O_3) and carbon dioxide(CO_2).
   → The absorption bands of water vapor is centered at 1.0, 1.4, 1.8μm.
   → That of water and carbon dioxide are when wavelength $\lambda > 2.5\mu m$.
   → Ozone absorbs almost all ultraviolet component of solar radiation for wavelength $\lambda < 0.29\mu m$.

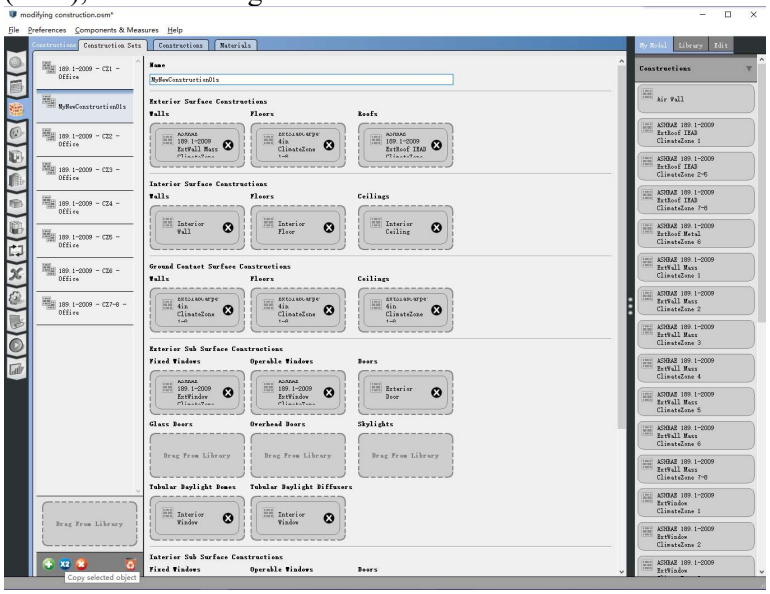
6) The solar radiation, available on the Earth's surface for conversion in other energy forms, depends on:

- 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*).

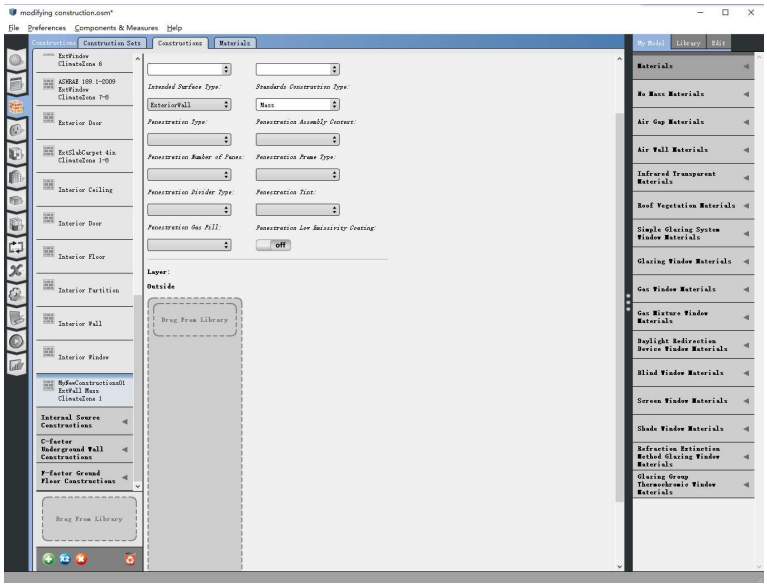


2. OpenStudio

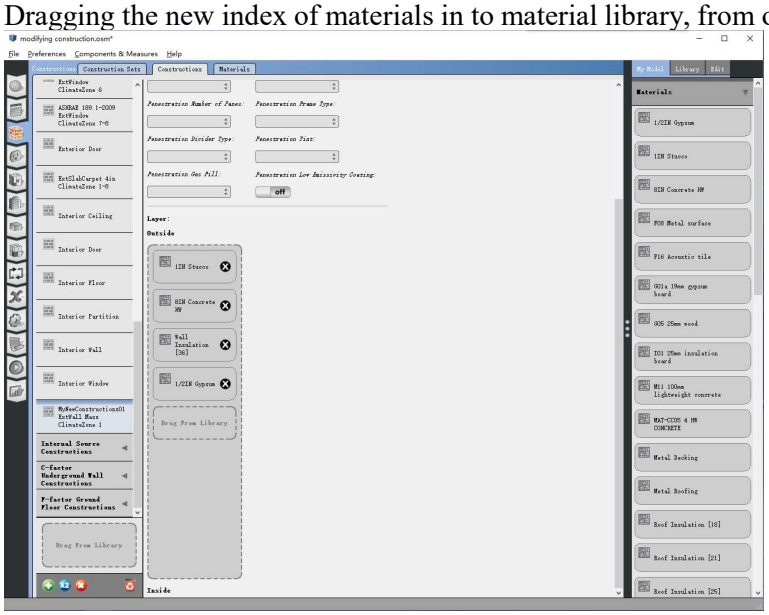
1) Opening previous osm file, choosing one task of construction sets and copying it in constructions tab (third), then renaming it.



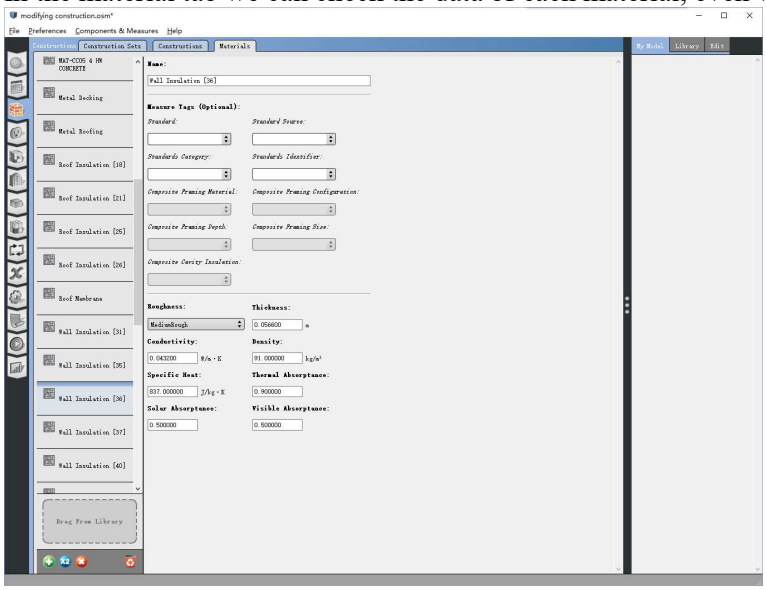
2) In the constructions, we can switch the certain materials of every structure. For example here we redefine the materials of external wall of 1st floor, and we cancel all original materials of outside.

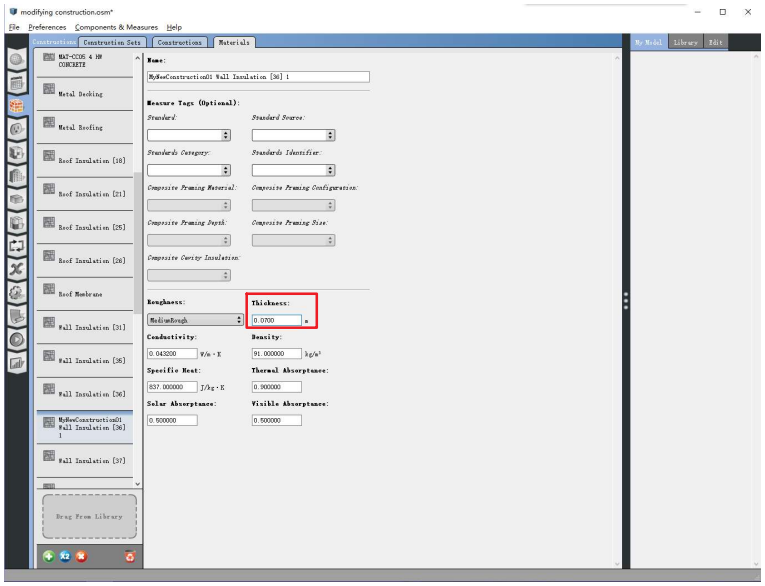


3) Dragging the new index of materials in to material library, from outside to inside.

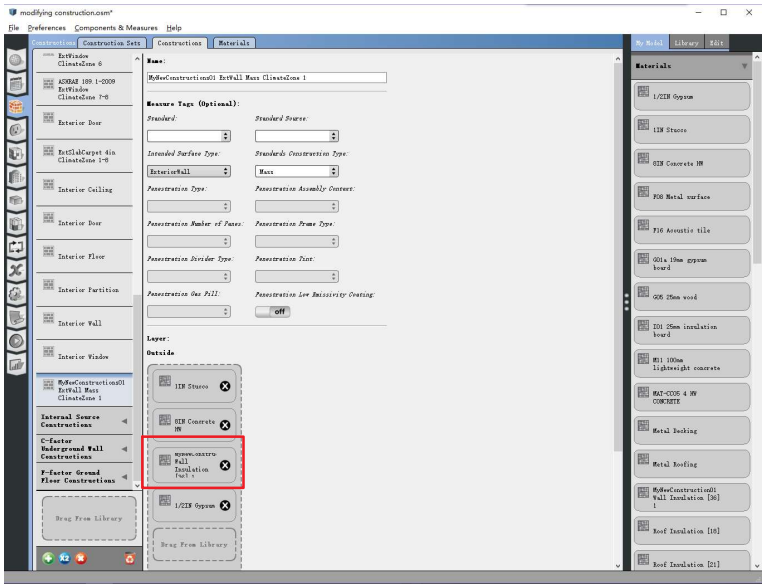


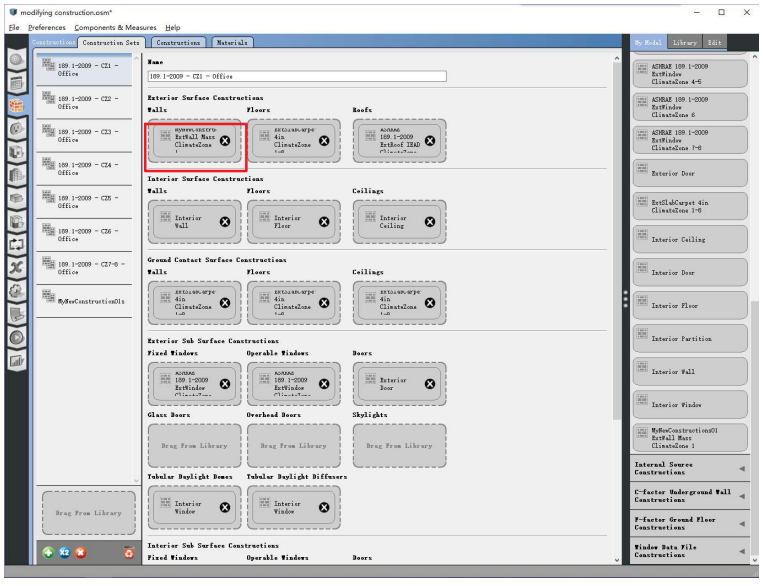
4) In the material tab we can check the data of each material, even we can create new one.



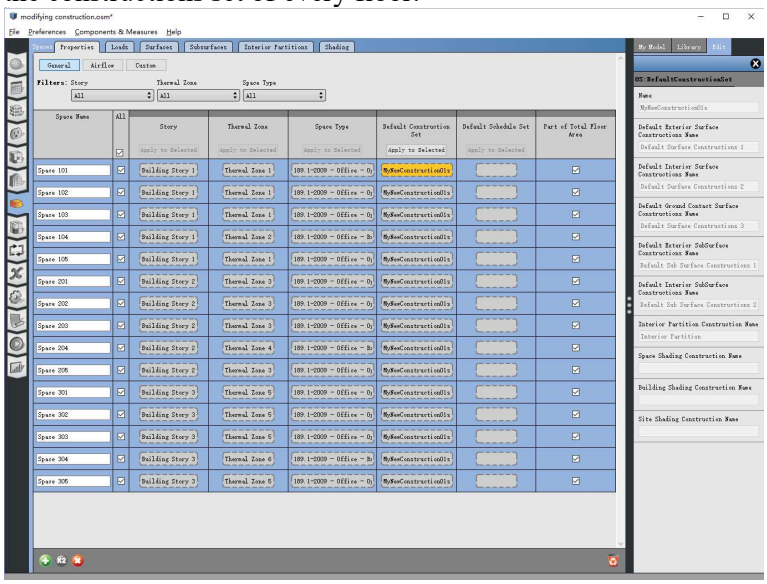


5) Going back to constructions, replacing the original material with new created one, then replacing also constructions set.

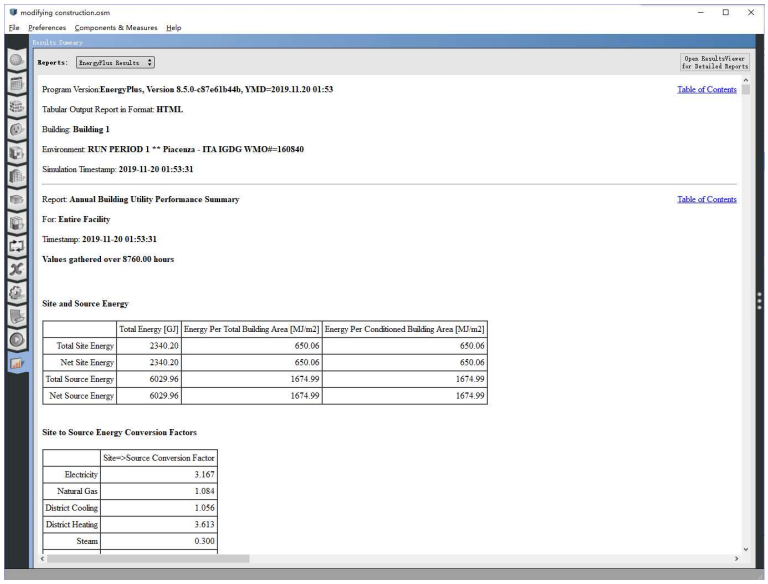




6) In the space tab, we replace the constructions set of certain floors to our created set. Here we redefine the constructions set of every floor.



7) Outputting and checking the result. We can see the decrease of energy cost due to thickness increase of the wall insulation.



Program Version:**EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019.11.20 01:53**

Tabular Output Report in Format: **HTML**

Building: **Building 1**

Environment: **RUN PERIOD 1 ** Piacenza - ITA IGDG WMO#=160840**

Simulation Timestamp: **2019-11-20 01:53:31**

Report: **Annual Building Utility Performance Summary**

For: **Entire Facility**

Timestamp: **2019-11-20 01:53:31**

Values gathered over 8760.00 hours

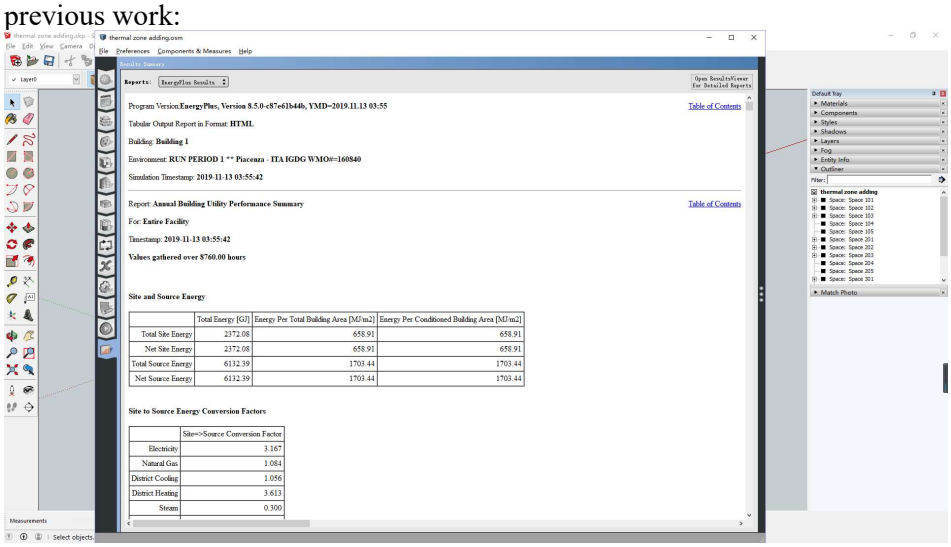
Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	2340.20	650.06	650.06
Net Site Energy	2340.20	650.06	650.06
Total Source Energy	6029.96	1674.99	1674.99
Net Source Energy	6029.96	1674.99	1674.99

Site to Source Energy Conversion Factors

	Site=>Source Conversion Factor
Electricity	3.167
Natural Gas	1.084
District Cooling	1.056
District Heating	3.613
Steam	0.300

previous work:



Program Version:**EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019.11.13 03:55**

Tabular Output Report in Format: **HTML**

Building: **Building 1**

Environment: **RUN PERIOD 1 ** Piacenza - ITA IGDG WMO#=160840**

Simulation Timestamp: **2019-11-13 03:55:42**

Report: **Annual Building Utility Performance Summary**

For: **Entire Facility**

Timestamp: **2019-11-13 03:55:42**

Values gathered over 8760.00 hours

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	2372.08	658.91	658.91
Net Site Energy	2372.08	658.91	658.91
Total Source Energy	6132.39	1703.44	1703.44
Net Source Energy	6132.39	1703.44	1703.44

Site to Source Energy Conversion Factors

	Site=>Source Conversion Factor
Electricity	3.167
Natural Gas	1.084
District Cooling	1.056
District Heating	3.613
Steam	0.300