Week 7

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Task 1 Summary of the main concepts about solar radiation

The sun transmits energy outwards in the form of electromagnetic wave. Solar radiation refers to the electromagnetic wave and particle flow emitted by the sun to the space.

More than 99% of the solar radiation spectrum in the upper boundary of the earth's atmosphere is between 0.15 and 4.0 microns in wavelength. About 50% of the solar radiation energy is in the visible spectrum (wavelength 0.4 ~ 0.76μm), 7% in the ultraviolet spectrum (wavelength <0.4μm),43% in the infrared spectrum (wavelength >0.76 μm), and the maximum energy is at the wavelength of 0.475 μm. Because the wavelength of solar radiation than the ground and atmosphere radiation wavelength (about 3 ~ 120 μm) much smaller, so usually called solar radiation for short-wave radiation, called the ground and atmosphere radiation for long-wave radiation. The change of solar activity and the distance between the sun and the earth will cause the change of solar radiation energy in extraterrestrial.

Solar radiation through the atmosphere, part of the ground, called direct solar radiation; The other part is the absorption, scattering and reflection of atmospheric molecules, atmospheric dust and water vapor. Part of the scattered solar radiation returns to space and the other part reaches the earth, which is called diffuse radiation. The sum of the radiation that reaching the ground is called the total radiation.

After solar radiation passes through the atmosphere, its intensity and spectral energy distribution change. The solar radiation energy reaching the ground is much smaller than in extraterrestrial. On the solar spectrum, the energy is almost extinct in the ultraviolet spectrum, decreasing to 40% in the visible spectrum and increasing to 60% in the infrared spectrum.

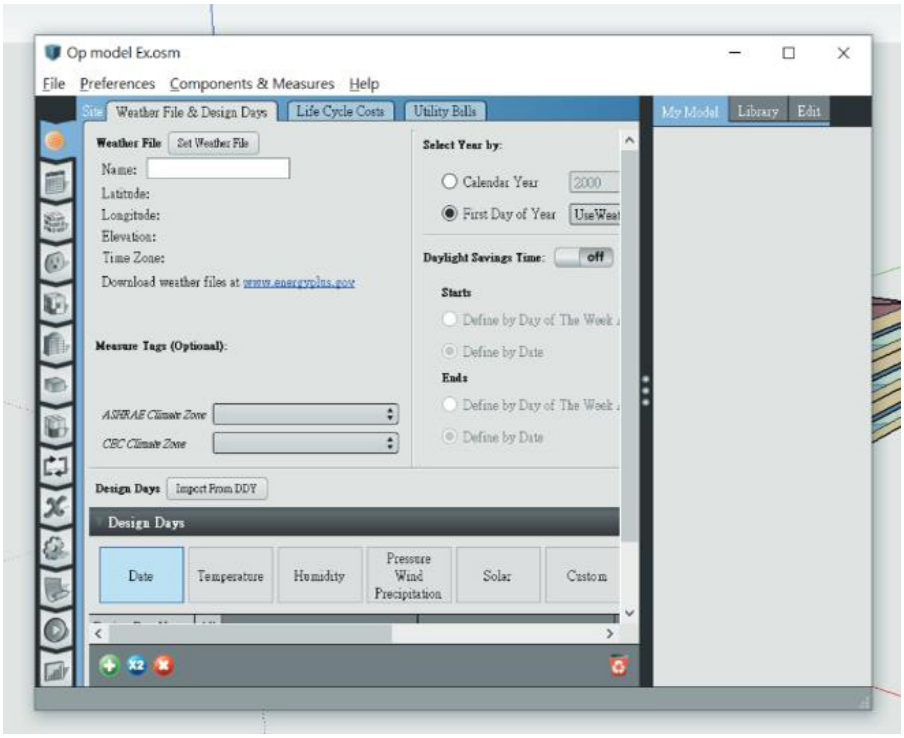
The amount of solar radiation received by the earth's surface is affected by: 1)the sun position; 2)season and climate condition; 3) the elevation of the earth's surface; 4) the duration of sunlight.

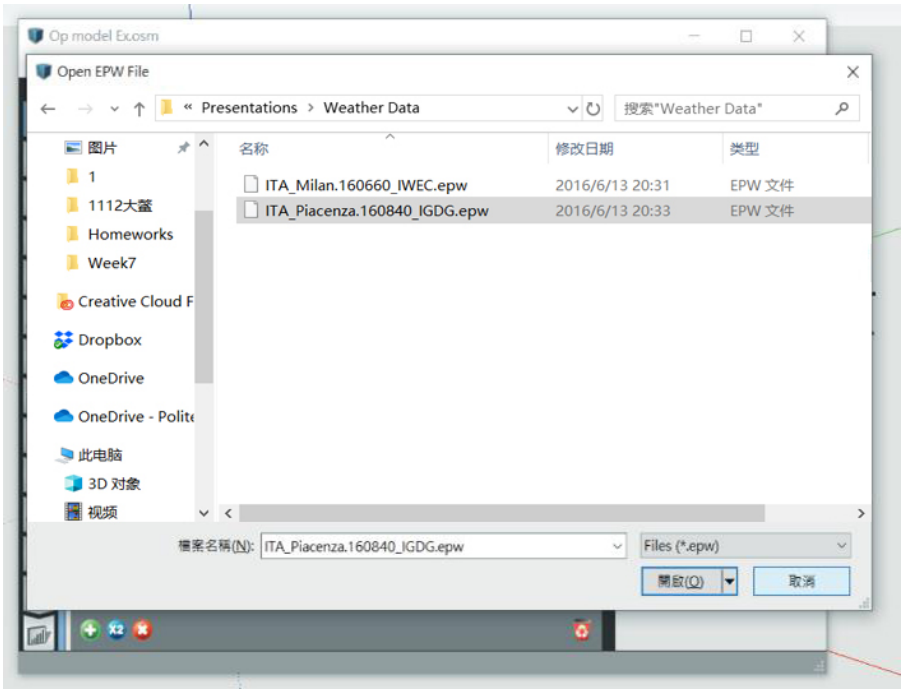
The solar elevation angle is the angle between the sun's rays and the section of the earth's surface that passes through it and connects to the center of the earth. When the elevation angle of the sun is 90°, the solar radiation intensity is the maximum. When the sun slants down on the ground, the intensity of solar

radiation is low. The solar elevation angle varies with latitude and longitude and seasons.

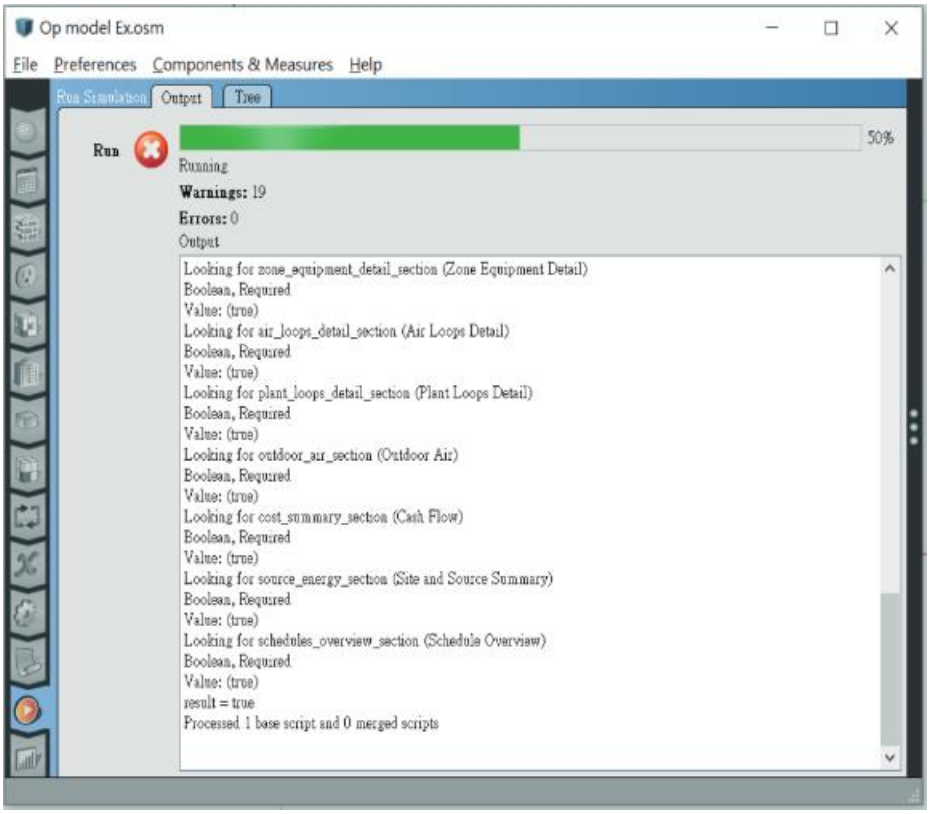
Task 2 Create a pdf file with screenshots of all of the steps we went through in the second lesson on openStudio and explain briefly the reason behind the use of each step

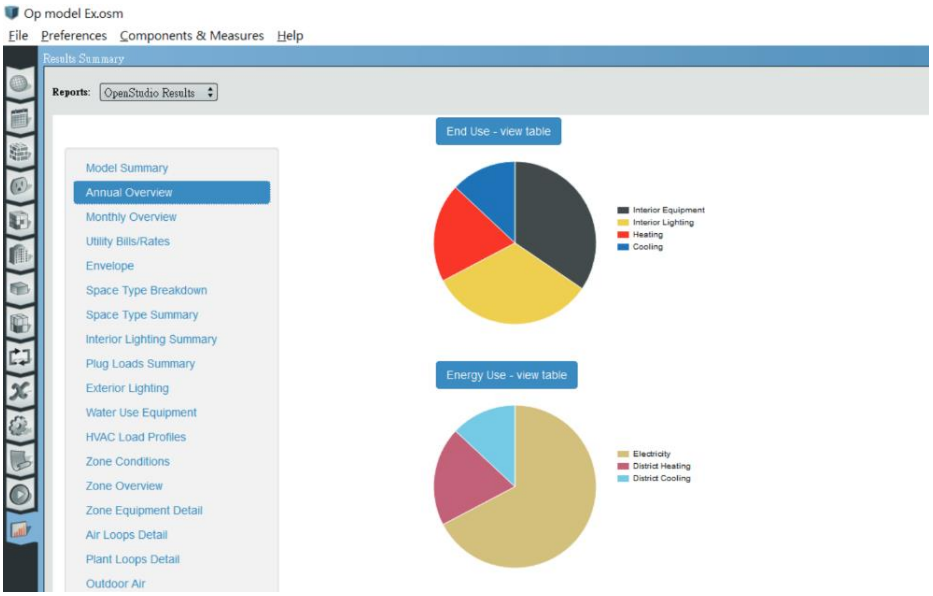
1. Importing weather data



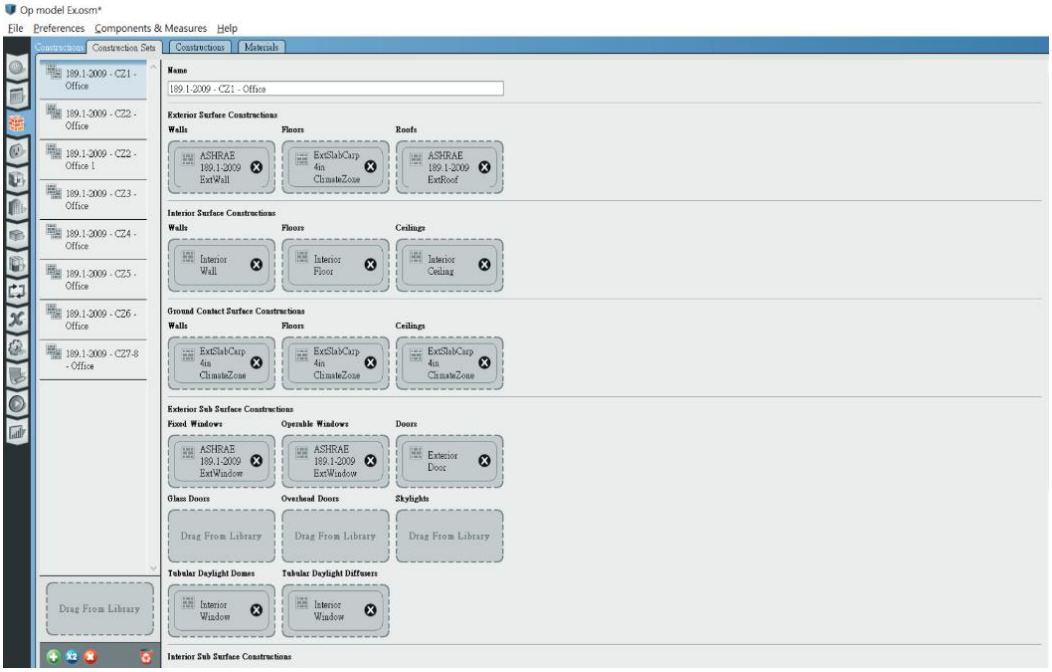


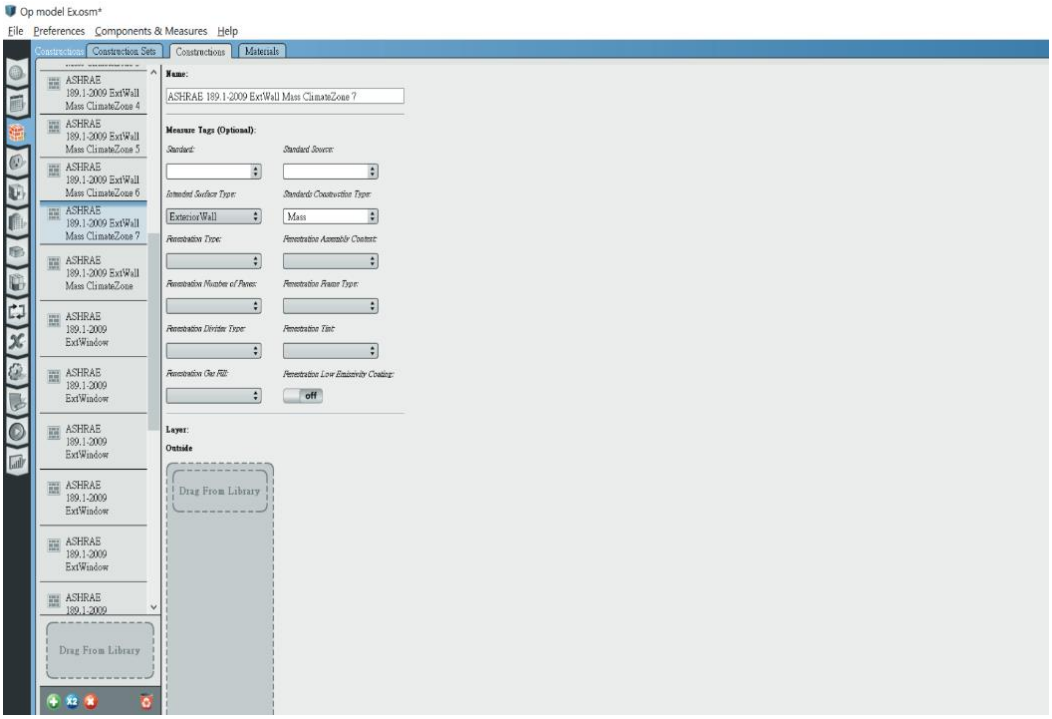
2. Run the program for analysis

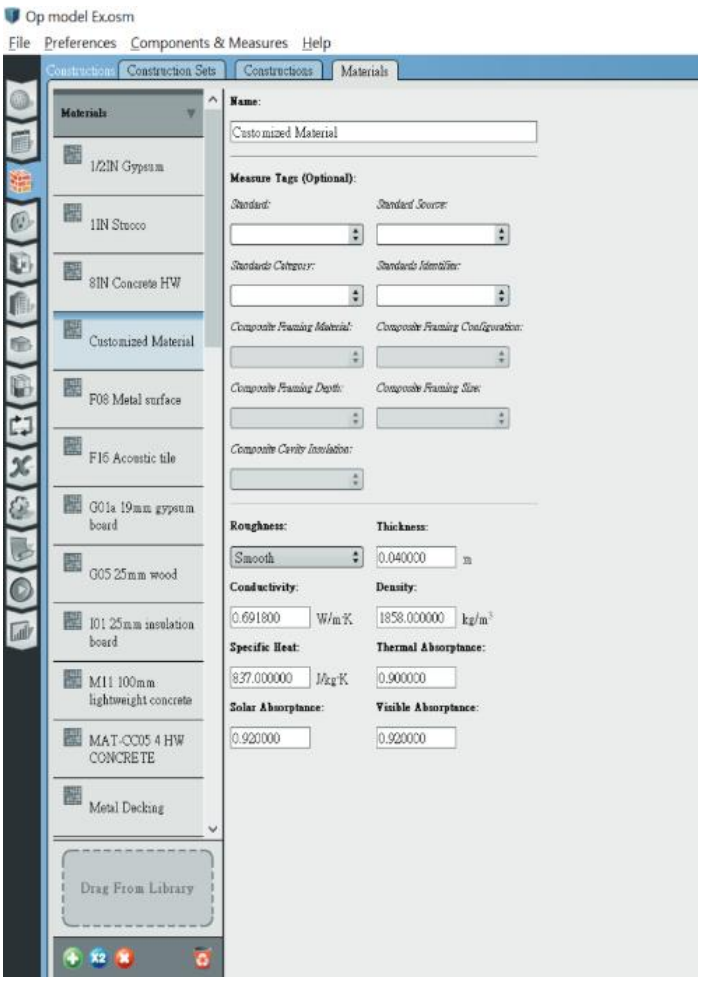




3. Using the construction sets to customizing walls and materials, and apply them to the constructures






Op model Ex.osm
File Preferences Components & Measures Help
Constructions Construction Sets Constructions Materials
Materials
1/2IN Gypsum
1IN Stucco
8IN Concrete HW
Customized Material
F08 Metal surface
F16 Acoustic tile
G01a 19mm gypsum board
G05 25mm wood
I01 25mm insulation board
M11 100mm lightweight concrete
MAT-CC05 4 HW CONCRETE
Metal Decking
Drag From Library
Name:
Customized Material
Measure Tags (Optional):
Standard:
Standard Source:
Standards Category:
Standards Identifier:
Composite Framing Material:
Composite Framing Configuration:
Composite Framing Depth:
Composite Framing Size:
Composite Cavity Insulation:
Roughness:
Thickness:
Smooth
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Conductivity:
Density:
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W/m-K
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kg/m3
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Thermal Absorptance:
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Solar Absorptance:
Visible Absorptance:
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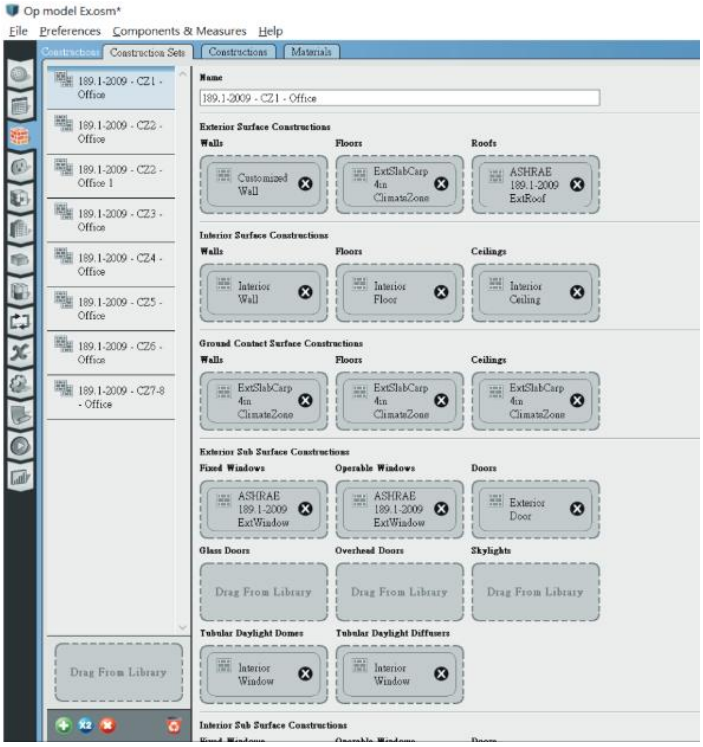
Op model Ex.osm*
File Preferences Components & Measures Help
Constructions Construction Sets Constructions Materials
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189.1-2009 - CZ2 - Office
189.1-2009 - CZ2 - Office 1
189.1-2009 - CZ3 - Office
189.1-2009 - CZ4 - Office
189.1-2009 - CZ5 - Office
189.1-2009 - CZ6 - Office
189.1-2009 - CZ7-8 - Office
Drag From Library
Name
189.1-2009 - CZ1 - Office
Exterior Surface Constructions
Walls
Floors
Roofs
Customized Wall
ExtSlabCarp 4in ClimateZone
ASHRAE 189.1-2009 ExtRoof
Interior Surface Constructions
Walls
Floors
Ceilings
Interior Wall
Interior Floor
Interior Ceiling
Ground Contact Surface Constructions
Walls
Floors
Ceilings
ExtSlabCarp 4in ClimateZone
ExtSlabCarp 4in ClimateZone
ExtSlabCarp 4in ClimateZone
Exterior Sub Surface Constructions
Fixed Windows
Operable Windows
Doors
ASHRAE 189.1-2009 ExtWindow
ASHRAE 189.1-2009 ExtWindow
Exterior Door
Glass Doors
Overhead Doors
Skylights
Drag From Library
Drag From Library
Drag From Library
Tubular Daylight Domes
Tubular Daylight Diffusers
Interior Window
Interior Window
Interior Sub Surface Constructions