TUTORIAL ON ENERGY3D

SOLARIZE UARK CAMPUS

System Integration and Design Informatics Laboratory

Quick Tips

1. To delete any existing feature, just select that feature and press “Delete” key.
2. To undo an operation, press “Crtl +Z”.
3. To get into the 2D mode, go to the “View” menu on the taskbar and select “2D Top View” (shortcut Ctrl +T). To get back in the normal mode, make sure you click on “2D Top View” option again.
4. If you want to get additional information of an artifact, you need to select the object and right click the mouse. But some parameters of an artifact do not affect the design cost and annual yield energy (AYE). This tutorial enlists parameters that have direct relation with design cost or AYE.
5. You can resize an object by dragging the white control point. You can move an object by dragging the orange control point.
6. You can quickly access the information of a design artifact on the right-hand-side panel.
7. If you encounter any errors, please ignore them and your design will not be affected. In case your design cannot be proceeded, please save the file and reopen it to continue your work.

Glossary

Annual yield energy	Annual yield energy refers to the total energy a solar system yields over the whole year.
Heliodon	Heliodon is a device for adjusting the angle between the ground and the sun beam. In Energy3D, heliodon helps to investigate the building in three dimensional solar beams at various dates and time of the day.
Irradiance heat map	Irradiance is the measurement of cumulative amount of light energy from a particular source over a given area for a defined period of time. Heat map indicates the amount of energy of that particular area.
Azimuth	The azimuth angle is defined as a horizontal angle measured clockwise from a north baseline.
Solar cell efficiency	The efficiency of how a portion of energy in the form of sunlight can be converted into electricity via solar panel.
Nominal operating cell temperature	The nominal operating cell temperature is the surface temperature that the solar panel array reaches if it is exposed to 0.8 kW/m^2 of solar radiation, an ambient temperature of 20°C, and a wind speed of 1 m/s.

This tutorial is for the design contest of Solarize UARK Campus using Energy3D software. Energy3D is a simulation-based computer-aided design (CAD) tool for green buildings and power stations that harness renewable energy to achieve sustainable development. The tutorial provides you with quick reference to the basic operations in Energy3D.

Solar Panel Operation

Add solar panel rack: You can add solar panel rack by clicking the solar panel button (Figure 1).

Solar rack size: If you select solar rack, you can drag the white control points to size the panel you want. You can also right click on the solar panel, and select the "Size" option to enter exact values.

Move and Rotate: For moving the solar panel, you need to select it first. Then click the orange control point and drag it to you desired position. If you want to rotate the solar panel along with the foundation, keep clicking the "Rotate" button until you get the desired position (see Figure 1). You can also rotate from Azimuth option which is described in Azimuth section.

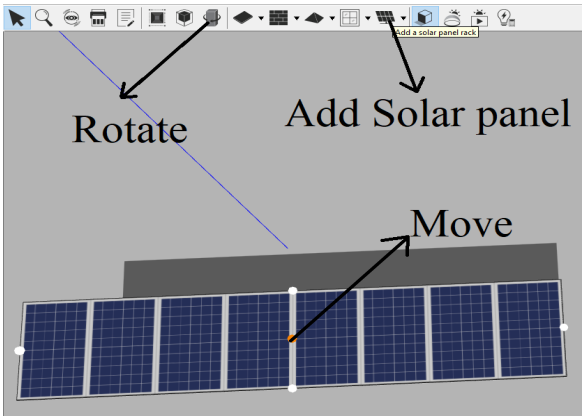


Figure 1. Move and rotate

Solar panel tilt angle: The solar panel, if is properly tilted, can increase the amount of solar radiation. The optimum tilt angle depends on the location and height of site. To change the tilt angle, right click on the solar panel and select the "Fixed Tilt Angle" option.

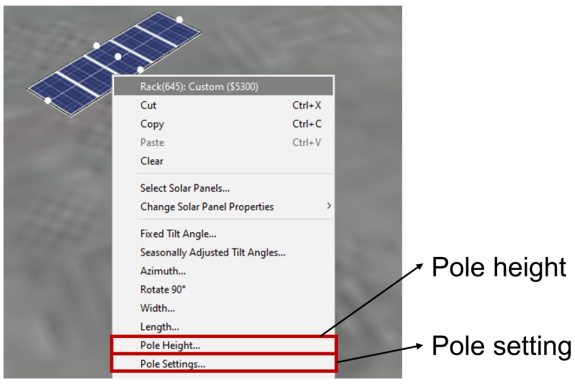


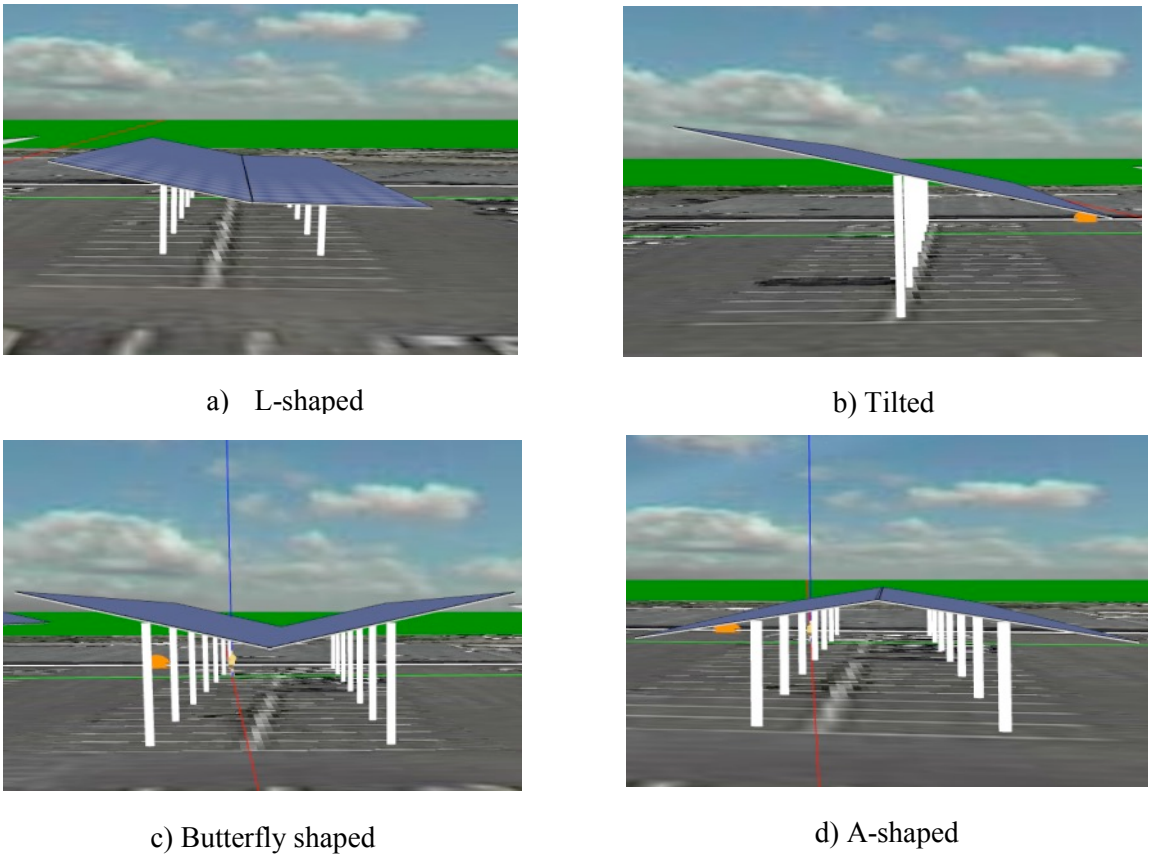
Figure 2. Pole height and pole setting

Pole settings of the solar racks: You can set the number of the pole of the rack by right clicking the solar panel and selecting "Pole Settings" option. Also, you can set the height by selecting the "Pole height" option. The height should be set in a way that the pedestrian and the vehicle can easily move yet the cost is reasonable. (Figure 2)

Azimuth: To place the solar panel in a proper direction, you may need to rotate it. Azimuth option can be used to rotate the solar panel. To rotate, right click on the solar panel and set the value of "Azimuth". You can also rotate solar panel using the rotate button from the toolbar.

Solar panel layout: There are different layouts for solar panel design (e.g., tilted solar panel, butterfly solar panel, etc.). To create an arrangement, first, select a rack and place it in accordance with the parking lot mark. You can choose two racks and put them sidewise. By adjusting the tilting angle of the racks, you can achieve an optimal layout for a specific parking lot. Make sure that there is a minimum gap between the edges of the solar racks (see Figure 3).

Solar panel model: You can change the solar panel by right clicking on the solar, go to "Change Solar Panel Properties", and then go to "Model" to select from the dropdown menu.



a) L-shaped

b) Tilted

c) Butterfly shaped

d) A-shaped

Figure 3: Different layouts of solar panel rack

Heliodon Simulator, Show Shadow and Irradiance Heat Map

Show heliodon: You can check the sun path using Heliodon simulator (Figure 4).

Show shadow and animate sun: If you click the shadow button and the sun animation button on the task bar, you can watch how an object casts shadow on the ground and how sunlight shines into the ground and the sun moves across the sky.

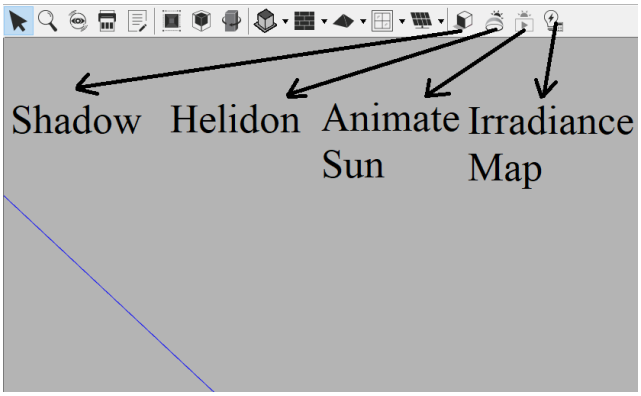


Figure 4. Heliodon, shadow and heat map

Show irradiance heat map: You can use the solar radiation simulator to evaluate the daily solar potential or daily-absorbed solar energy of the structure. Blue color in a heat map represents a low value of solar heat and red represents a high value of solar heat.

Annual Yield Analysis

To analyze the annual yield energy, **first select the foundation on which you have built your structure**, then go the analysis tab, under the "Solar Panels" menu you can select "Annual Yield Analysis of Solar Panels" option (see Figure 5). Y**ou can also press F4 to start the annual yield analysis. Do not use other options**. You will be asked "Do you want to keep the results of this run?" Please choose "Yes" so that you can compare this result with you next run.

Design Cost

You can get the total design cost of your parking lot by looking at the side bar of the main design window (Figure 6). It will show you the solar panel and its related cost such as cleaning, maintenance cost of the solar panel. **You can also use F7 to access the cost information.**

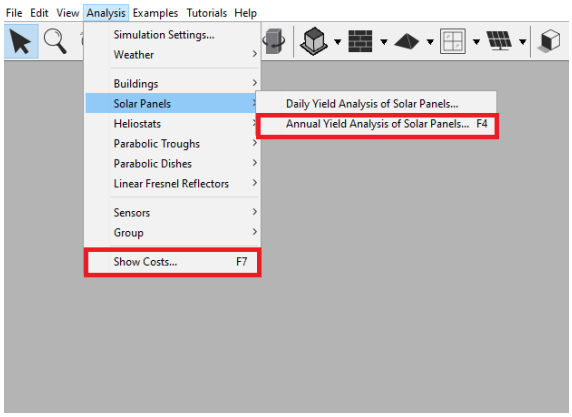


Figure 5. Annual yield energy

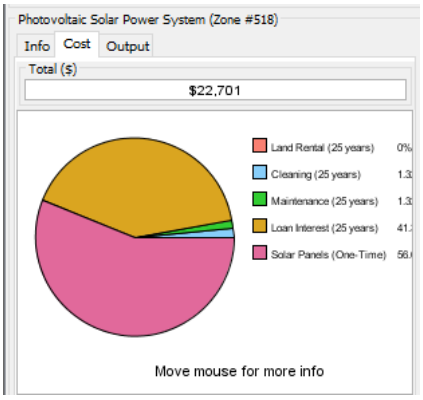


Figure 6. Total cost of the parking lot