ENGINEERING ANOTHER WORLD

Powering systems to make vacations on the moon a reality

Solar irradiation quantifies the amount of energy received on a surface over time - and it is the principal data needed for sizing and estimating the performance of photovoltaic (PV) systems. Solar irradiation is expressed in units of watt-hours per square meter (Wh/m^2) or kilowatt-hours per square meter (kWh/m^2).

At the surface of the Earth, the magnitude of solar irradiance changes throughout the day, beginning near zero during nighttime, increasing as the sun rises, peaking at noon, and decreasing to zero as the sun sets. Solar irradiation can be calculated with the formula:

$$H = E \cdot t$$

where

H = solar irradiation (Wh/m^2)
E = average solar irradiance (W/m^2)
t = time (hr)

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(continued)

Problem

1. What is the total solar irradiation if the average solar irradiance is 800 W/m^2 over 480 minutes?

    a. 384 kWh/m^2
    b. 6.4 kWh/m^2
    c. 384,000 kWh/m^2
    d. 640 kWh/m^2
    e. 6400 kWh/m^2

2. Determine the solar irradiance that will result in a total irradiation of 4.8 kWh/m^2 if there is sunlight for only 480 minutes.

    a. 600 W/m^2
    b. 2304 W/m^2
    c. 0.01 W/m^2
    d. 100 W/m^2
    e. 10 W/m^2