

Solar Panel Energy Lab

Classroom worksheet · Interactive simulation: <https://lkforge.com/tools/physics/solar-panel/>

Name: _____ Date: _____

Learning objectives

- Relate panel output to irradiance and area.
- Describe how orientation affects output.
- Define panel efficiency.

Variables to change

- Sunlight intensity (irradiance)
- Panel angle
- Panel area
- Temperature

Procedure

1. Set full sun and note the power output.
2. Reduce the irradiance (clouds) and observe the change.
3. Tilt the panel away from the sun and observe the drop.

Observations

Record power output versus irradiance and versus panel angle to the sun.

Questions

1. How does output depend on irradiance?
2. What is panel efficiency?

3. Why does orientation matter?
4. How does area affect output?
5. What converts light to electricity in a solar cell?

Answer key (instructors)

- **1.** Roughly proportional — more sunlight per area gives more power.
- **2.** The fraction of incident solar energy converted to electricity (typically ~15–22%).
- **3.** Output is highest when the panel faces the sun directly; tilting reduces the effective irradiance by $\cos(\text{angle})$.
- **4.** Output is proportional to panel area at a given efficiency and irradiance.
- **5.** The photovoltaic effect — photons free charge carriers in a semiconductor, driving a current.

A solar panel's output rises with irradiance and area and is greatest when it faces the sun (falling as $\cos$ of the tilt away from it). Efficiency (~15–22%) is the fraction of sunlight converted to electricity via the photovoltaic effect.