

# Efficiency of conversion

$\eta$  - important metric of system performance!

## What can we learn from efficiency analysis?

- What fraction of available energy is lost in the conversion
- How one device is compared to another
- What is the performance limit

Devices are compared by nominal efficiency measured at **standard conditions** [ASTM G173 guide ]:

- Air temperature 25 °C
- Irradiance of 1000 W/m<sup>2</sup> (clear sky)
- [Air mass \(AM\)](#) of 1.5G
- Panel oriented perpendicular to the light beam

When the exterior conditions are kept constant , measured efficiency is solely a device characteristic.

*System performance data*

Power, voltage, current density..



*Usable power density*

Delivered by the conversion device

$$\eta = \frac{P_{out}}{P_{in}} \times 100\%$$

If we have solar irradiance measured and device performance data collected, we can tell at what efficiency the system operates

*Irradiance*

power density of solar energy flux at the energy conversion device



*Solar resource data*

for a specific locale at specific conditions