Solar Cells Lab - Part I - Photovoltaics

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Lab Material:
- 1 PV Module Si monocrystalline
- 1 PV Module Si polycrystalline
- 1 adjustable stand
- 1 Solarimeter
   - to measure the direct+diffuse incident radiation

- 1 Experimental bench including
    - 1 Charge controller w/o Maximum Power Point Tracker
    - 1 Charge controller with Maximum Power Point Tracker
    - 1 Fuse box (Use it !)
    - 1 Inverter 12V to 240 V, 250 W
    - 1 Rheostat
- 1 Lead battery
- 3 more rheostats
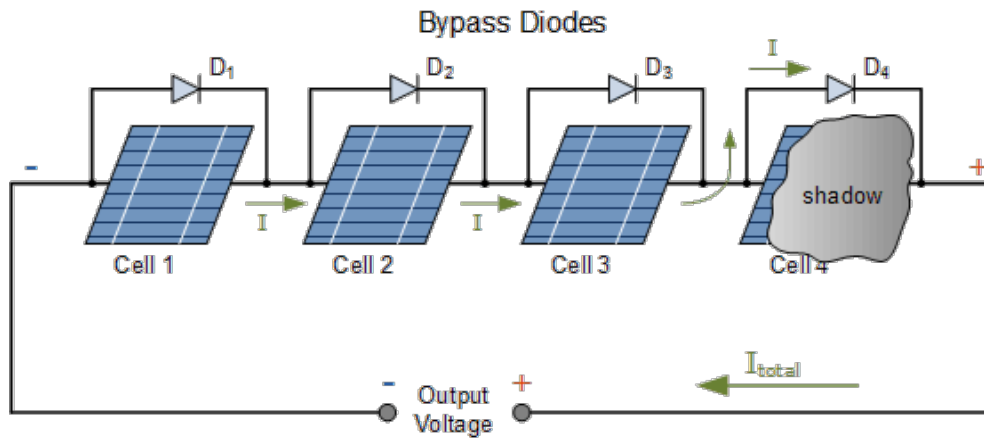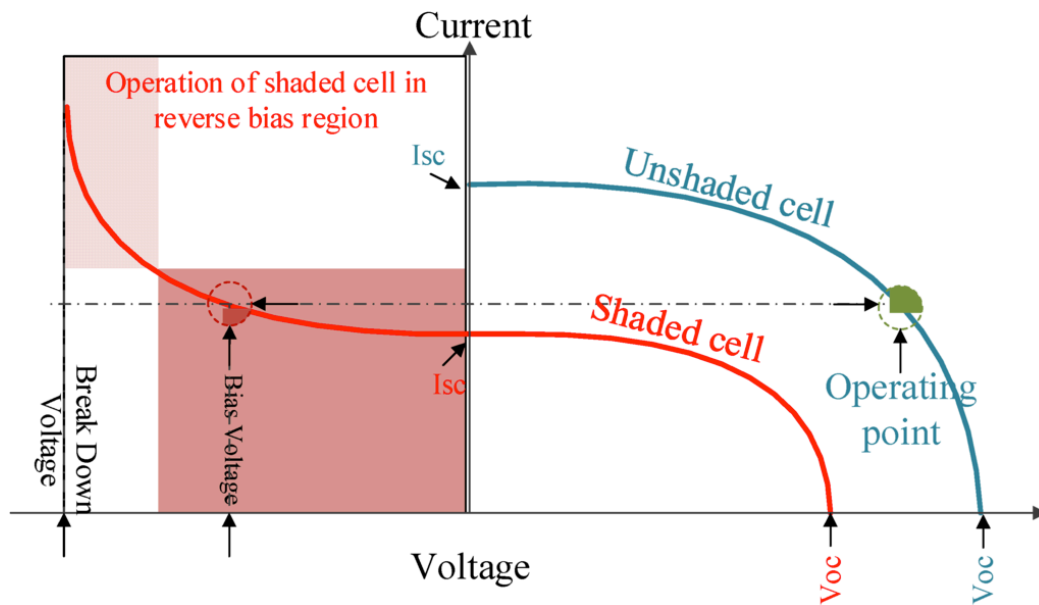- 4 multimeters
- Cables
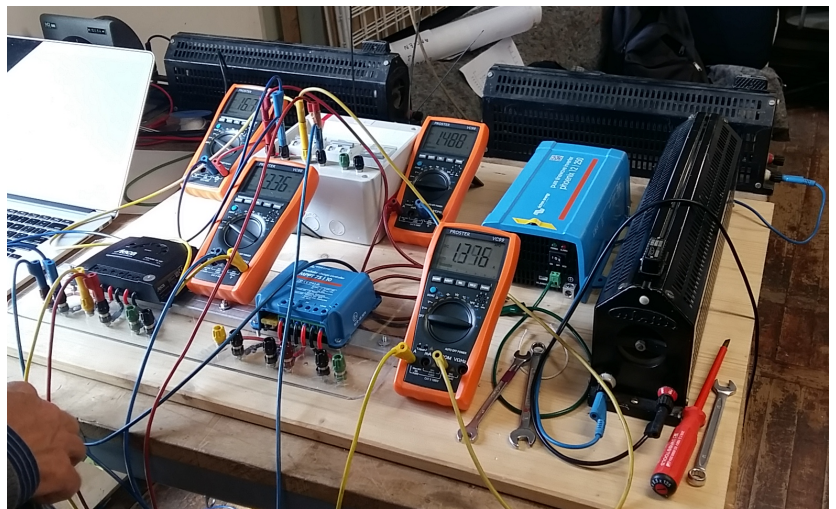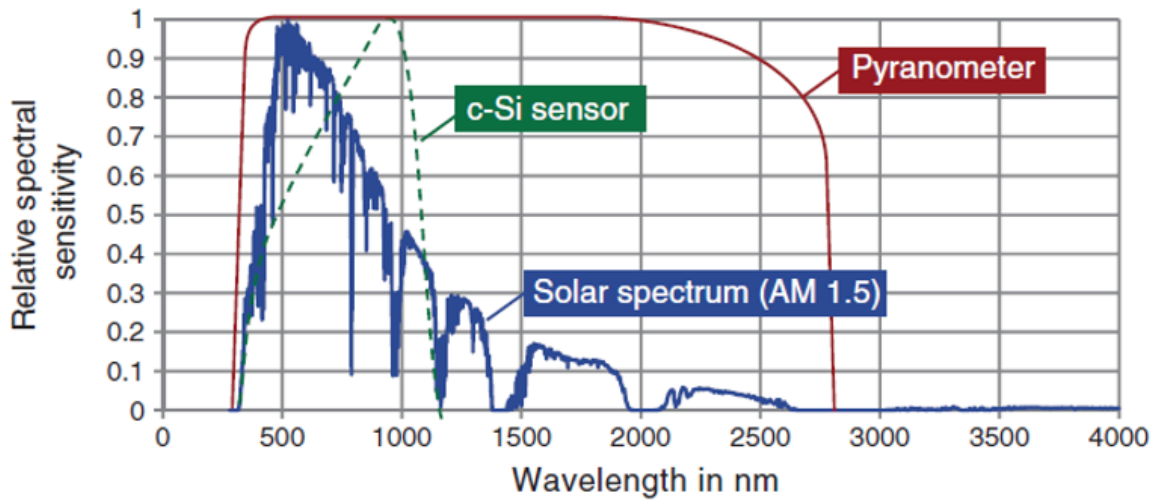
Measuring Irradiance : Spectral sensitivity of a Pyranomater and a c-Si based Solarimeter.
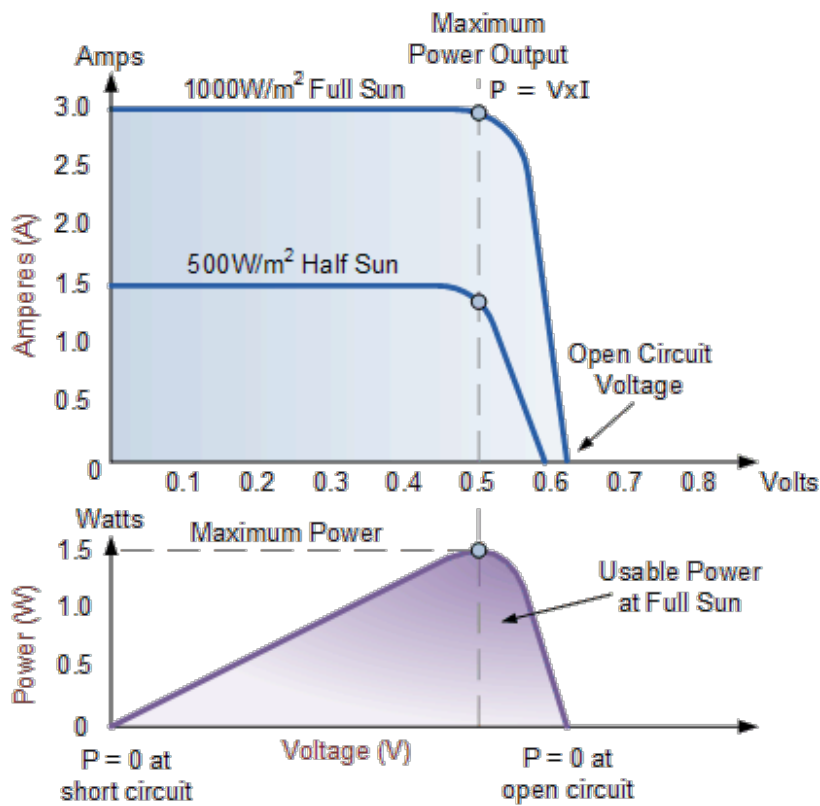
Characteristic of a PV panel

Bypass Diodes

Bypass diodes to protect against shaded cells.

Characteristic of a PV panel (showing reverese bias region)

Step 0:

Find the optimal azimuth and inclination of the panel. You can use the « Solar Max ».

Step 1:

Measure the characteristics of the two PV panels.

- Measure and plot the Current I vs. Voltage U curve by loading the PV panel with the rheostat(s).
- You will have to correct for the solar irradiance which you measure with the solarimeter at each point.
- Calculate the Power P and plot it versus the Voltage U.
- Calculate the efficiency of the panels

Step 2:

For each of the following four setups, measure the voltage and current from the PV modules and the voltage and current at the battery.

Charge the battery with one panel and the normal charge controller.

Charge the battery with one panel and the MPPT charge controller.

Charge the battery with both panels in series and the normal charge controller.

Charge the battery with both panels in series and the MPPT charge controller.

In the last setup, create partial shade on one of the modules. Observe the reaction of the MPPT. Remove the shade. Observe the behavior again.

Step 3 : Session with simulation tool

1) Use a simulation tool like PVSyst to calculate the yield over the day / over the year in your home country

2) Determine effect of direction w.r.t south (north) and inclination of panel