

Solar Energy 2026/2027

Laboratory Guide LW1: Solar Panel IV Curves (temperature dependence and shadows)

The aim of this laboratory task is to study different electrical connections between PV modules by tracing the IV curve of:

- One PV module,
- Two PV modules connected in series,
- Two PV modules connected in parallel.

The following parameters should be determined:

- Short-circuit current,
- Maximum power,
- Efficiency,
- Series resistance,
- Voltage thermal coefficient,
- Open-circuit voltage,
- Fill factor,
- Characteristic resistance,
- Shunt resistance,
- Current thermal coefficient.

In addition, the shadowing effect for the previous 3 configurations is studied by measuring the short-circuit current and the open-circuit voltage when:

- A module is shadowed,
- A line of cells is shadowed,
- Half of a cell is shadowed.

You should repeat these measurements after adding a bypass diode to the system.

You should manually measure the short-circuit current and the open-circuit voltage for several temperature values for the different connections of the PV modules.

Challenge: Find the point of the IV curve that corresponds to the MPP through the manual measurements. Then check your estimate with the IV curve tracer.

Notes:

You will use an IV tracer to facilitate the measurements, so you should bring your own personal computer and install the Arduino IDE on your computer beforehand (<https://www.arduino.cc/en/software/>).

- PV modules with 300 mA of short-circuit current and 1.5V of open-circuit voltage are available in the laboratory, as well as variable resistors, a breadboard, multimeters, thermocouples, and a solar simulator.

The file to be delivered should be named as G#_LW1 and be submitted through Moodle.