

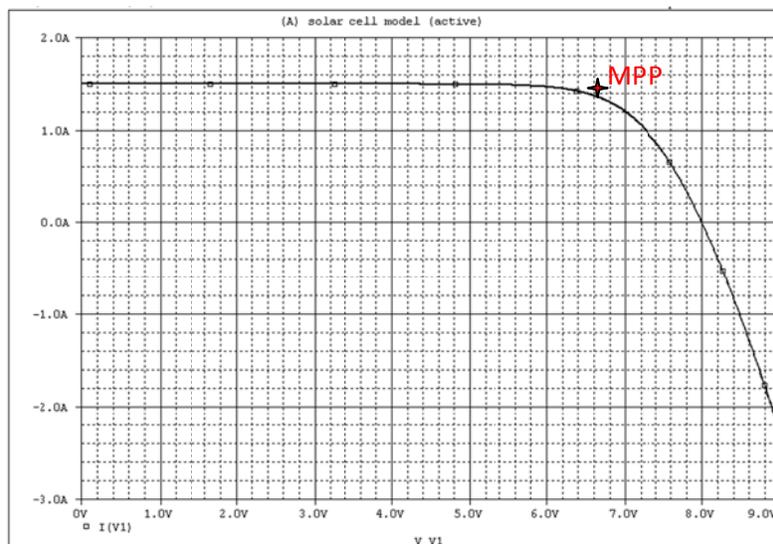
Lab 1: Solar Basics

Pre Lab

Safety: Read the Safety Rules and Suggestions document posted on K-State Online and bring the completed form to lab.

Formatting: Review the Outline, Formatting, and Grading document and understand what you'll be expected to turn in and what format your work should be in.

Review of photovoltaic IV curves: Consider the simulated IV curve below.



1. What is the short circuit current and open circuit voltage?
2. Estimate the maximum power voltage and current and mark the maximum power point on the curve.
3. Estimate the fill factor for this curve. What is the best fill factor possible?
4. Draw a circuit that could be used to find this curve for any given PV panel.

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5. By drawing your own curves, show how the IV curve of a PV cell changes with temperature.

6. By drawing your own curves, show how the IV curve of a PV cell changes with irradiation.

Bypass diodes:

1. What are bypass diodes and why are they important in solar arrays?

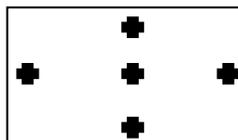
Lab Exercises

Measuring IV curves:

We'll be using these curves for other labs, so be sure and save electronic copies of every curve you take, noting the irradiance for each one.

Unfortunately we don't have the sun in the lab. On the other hand, it's a whole lot cooler down there sans sun. Anyway, without the sun or a really nice light array, we won't be able to get a uniform distribution of light across our PV panels and still have enough power to do anything. Therefore we'll shine a decent amount of light across the panel and make an estimate as to the average irradiance incident to it.

1. Prop the PV panel up almost vertically and place the worklight some known distance from it.
2. Using the Daystar irradiance meter, measure and record the W/m^2 at the places marked below. Average the values.
 - a. How wide of a range do the measurements cover? What does that say about the quality of your estimate?



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3. Use the GreenMountain IV-Stat software to find the IV curve for your panel. Use the config file “10W panel from 210,” and use the connections on the back of the instrument. Note the average irradiance you estimated. **Only have the worklight on while you’re actually running the software**; why might this matter?

4. Take two more curves: one with higher irradiance across the panel and one with lower irradiance across it. Be sure to note the irradiance estimate each time.
 - a. Can you see a correlation between the amount of irradiance and the curve? Explain.

5. Place the worklight about 11” from the panel and take a curve. Leave the worklight on for at least 5 minutes then take another curve.
 - a. How does the 2nd curve differ from the 1st? Explain.

6. Obtain a copy of the datasheet for your panel and compare your results to the manufacturer’s.

Bypass Diodes

1. Using a “Deluxe Solar Educational Kit” PV panel, a 300Ω resistor, and a diode, show what benefits bypass diodes provide.