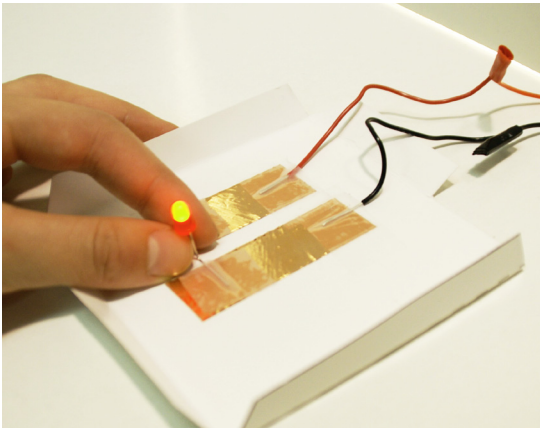


# Investigating Solar Power

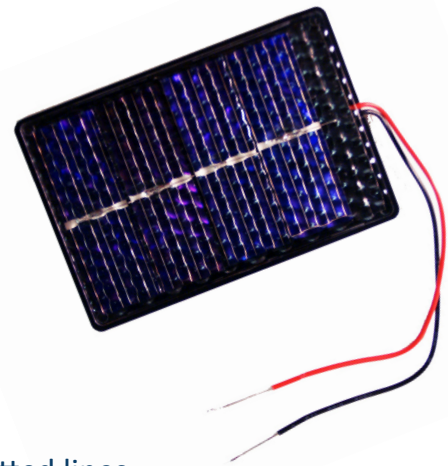


Photovoltaic (PV) cells, or solar cells, produce electricity directly from light. PV powered calculators have been common for many years, and PV cells have become especially useful for providing electricity in places that are not near existing power lines. Where do you see solar cells?

LEDs (Light Emitting Diodes) need only small amounts of current and voltage to create light. Some batteries have too much power for a single LED and will burn out the LED. LEDs come in different shapes, sizes, and colors. Some colors need more power than others. Which LEDs burn brightest with the solar panel?

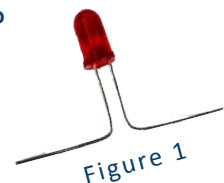
## YOU WILL NEED:

- House Template
- Solar Panel
- Copper Tape
- Clear Tape
- Scissors
- Multimeter or Voltmeter (Optional)
- 4 Red LEDs
- 1 Yellow LED
- 1 Yellow LED Mini-Light
- 1 Green LED Mini-Light
- Cardboard or Dark Paper



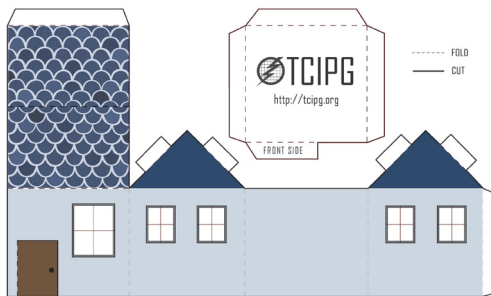
## Solar Panel Power

- Cut out the base from the house template and fold on the dotted lines.
- Remove the backing from two strips of copper tape and place them on the inside of the base as shown above.
- Use clear tape to attach the red wire from the solar panel to one of the copper tape strips. Tape the black wire to the other copper tape strip. The copper strips are good conductors so we can use this base area to make some observations about the solar panel and the LEDs.
- Place the solar panel so that it is directly in the sunlight or light source. Sunlight is the best light source for your solar panels. A desk lamp with a 100W incandescent bulb will produce enough light for the solar panel to provide measurable power.
- Bend the legs of a red LED (see figure 1). Make sure to note the longer leg – this is the anode.
- Connect the anode (the positive side) to the copper tape attached to the red wire. Connect the negative side to the black wire. What happens?
- Hook up more LEDs. How many LEDs can you power at one time? What do you observe as more lights are attached?
- Try connecting LEDs of a different color, one at a time. What do you observe?
- How can you make the brightest light?
- What works best? What doesn't have any effect?



## Solar Panel Power (cont...)

- Cover half of the solar panel. What happens to the lights? Try shading different amounts of the panel with the cardboard.
- Use a multimeter to measure the voltage output of the panel. Make a table to record the effects of shading on the output voltage.
- How do various light sources affect the performance of the solar panel? Try direct sunlight, light from a window, incandescent light bulbs, fluorescent lighting.
- What happens when you change the angle of the light source?
- Based on your observations, what can you say about the amount of power needed by a solar calculator?

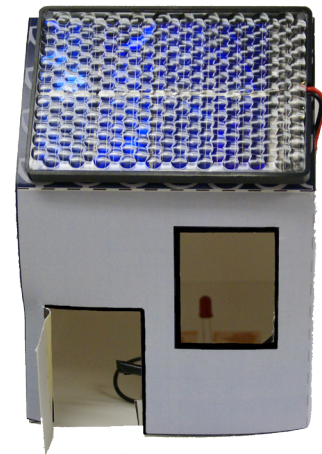


## Assemble the House

- Cut out the house.
- Score and fold on the dotted lines
- Cut out and fold the openings for the windows and doors.
- Tape or glue the tab on the side of the house to the inside of the front.
- Fold the roof.
- Insert the base so that the logo is on the bottom and the copper tape strips are inside the house.
- Use the tabs to attach the base to the house.
- Run the wires out of the house through one of the seams in the roof.
- Attach the solar panel to the roof with tape.
- Use the tabs to attach the roof to the house.
- Use what you've learned about LEDs and solar panels to light the inside of your house.

### More about LEDs

LEDs create light when electrons are pushed through two different semiconductor materials. The two materials are layered together so that electrons can only flow in one direction. The moving electrons release photons that we see as colored light. The color of the LED light depends on the type of semiconductor. LEDs don't create heat so they are more efficient and last longer than traditional light bulbs. LEDs are used to light supermarket freezer sections, streetlights, traffic lights, automobile taillights, and have recently been installed to light the giant signs in Times Square in New York City.



## LEARN MORE!

- The Story of Solar Electricity: [www.californiasolarcenter.org/fste/fste.html](http://www.californiasolarcenter.org/fste/fste.html)
- DOE solar animations including sunlight to electricity movie: [www1.eere.energy.gov/solar/animations.html](http://www1.eere.energy.gov/solar/animations.html)
- Illinois Solar Energy Association: [www.illinoissolar.org](http://www.illinoissolar.org)
- US DOE's Solar Decathlon: [www.solardecathlon.org](http://www.solardecathlon.org)
- Energy 101: Solar PV video: [www1.eere.energy.gov/multimedia/video\\_energy101\\_pv.html](http://www1.eere.energy.gov/multimedia/video_energy101_pv.html)
- How Stuff Works: [electronics.howstuffworks.com/led.htm](http://electronics.howstuffworks.com/led.htm)
- University of Illinois celebrates - LED: 50 Years: [www.led50years.illinois.edu/](http://www.led50years.illinois.edu/)
- 50 Years of LED Technology, Wired Magazine: [www.wired.com/gadgetlab/2012/10/the-history-of-led](http://www.wired.com/gadgetlab/2012/10/the-history-of-led)
- The Electronics Club - LEDs: [www.kpsec.freeuk.com/components/led.htm](http://www.kpsec.freeuk.com/components/led.htm)