Why are compact fluorescent bulbs more efficient?

A laboratory experiment from the Little Shop of Physics at Colorado State University





Overview

We see a relatively limited range of the electromagnetic spectrum. Compact fluorescent bulbs emit light in the range we can see, but incandescent bulbs emit a lot more, as we will show. Since the give off so much electromagnetic radiation that is "invisible", they aren't as efficient; most of their energy is wasted.

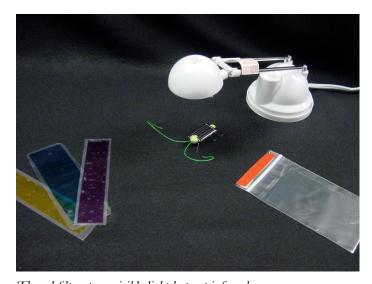
Theory

The energy to run the solar cell is going to come from the light bulb, but much of it, as we'll see, is in a range that your eyes can't see. Since you can't see it, this energy is in a sense "wasted." But it can still run a solar cell!

Necessary materials:

- Small desk lamp with incandescent bulb
- One solar grasshopper, or other solar toy
- Gel filters in cyan, magenta, and yellow
- Rosco Thermashield protected in a small sealed plastic bag. This is a filter that reflects near infrared radiation.
- Other light sources. It's good to have a compact fluorescent bulb to compare with an incandescent bulb.

The Thermashield and gel filters are from a theatre supply company called Stage Stop. The Thermashield gel must be protected; we sealed them them in plastic bags. We laminated the gels so they would last longer.



The gel filters pass visible light but not infrared.

Doing the Experiment

Do this:

- Place the solar grasshopper on a flat surface.
- What happens when you put the incandescent bulb over the grasshopper?
- What happens when you use the compact fluorescent bulb?
- Turn on your desk lamp and adjust the height so the grasshopper bounces.
- Put the thermashield between the solar grasshopper and the light. What happens?
- Stack the cyan, magenta, and yellow filters together and place between the grasshopper and the light. What do you notice?
- Try other materials to see which block infrared and which do not.

Summing Up

This is a nice way to show the relative efficiency of the different bulbs.

For More Information

CMMAP, the Center for Multi-Scale Modeling of Atmospheric Processes: http://cmmap.colostate.edu

Little Shop of Physics: http://littleshop.physics.colostate.edu