

Assignment 1 – Photovoltaics – Due September 12 – (20 pts)

Activity (individual submissions)

Using the World Bank DataBank; 1) Choose an energy/environment parameter to investigate (i.e. % alternative energy use, % coal use, etc.); 2) Provide a comparison between 2-3 countries of your choosing; 3) Display your results as a plot and/or map.

<https://databank.worldbank.org/reports.aspx?source=2&Topic=5>

Problem solving (study group - submit 1 single document, typed or latex'd)

1. Sketch and label the key components of a solar cell. Be sure to reference any outside sources (i.e. NREL, not Wikipedia).
2. a. Define, in nanometers, the region of the electromagnetic spectrum corresponding to the UV, visible, IR, and microwave region of the spectrum.
b. Infrared light is commonly shown in wavenumbers (cm^{-1}). Convert your range from (a) to cm^{-1} .
c. Microwaves are commonly expressed in Hertz (Hz). Convert your range from (a) to Hz.
3. Green laser pointers operate at 532 nm. Calculate the frequency of light and the energy of the photons.
4. Using both words and equations, define band gap and work function.
5. a. Silicon with a work function of 4 eV is irradiated with UV light at 200 nm. What is the kinetic energy of the ejected electrons?
b. Sketch a plot of the kinetic energy of electrons ejected from silicon as a function of frequency of light used for irradiation.
6. The photoelectric effects allows you to determine Planck's constant using a series of experiments. How?
a. Describe the experiment you would do.
b. Derive the equation you would use.

Programming (individual submission)

Chose a programming language/platform that you will use for your Ising model simulation. If you don't have a favorite, I recommend MatLab or Python. Download/install any necessary software. Submit one piece of code and one plot.