

Physics and Mathematics of Sustainable Energy

Homework Two

Due April 11, 2014

1. In the field of hydrology, water flowing into a reservoir at a rate of 1000 gal/s is known as a *kiloCline*. If 2 kiloClines flow into an initially empty reservoir for 3 hours, how much water is in the reservoir? State your answer in kCh and gallons.
2. A medium-sized electric heater draws around 2 kW. The heater is on for three hours. How much energy has the heater used? State your answer in kWh and Joules.
3. Suppose you switch your Maine house from 100W light bulbs to 20W compact fluorescent bulbs. (State clearly any assumptions you need to make to answer these questions.)
 - (a) How much less CO₂ per year is emitted into the atmosphere as a result of this action? Is this a lot or a little?
 - (b) How much money would you save?
4. A 2000 kW hair dryer is plugged into a 240V outlet in France.
 - (a) What current flows through the hair dryer?
 - (b) What is the resistance of the hair dryer?
5. The typical US household uses 900 kWh of electricity each month.
 - (a) Assuming that there are three people per household, how many kWh of electric energy per person per day is used?
 - (b) Solar PV converts sunlight into electricity. One square meter of solar panels will generate around 10W of power. What area of panels would be needed to provide the electrical energy for a typical US house?
 - (c) What area of solar panels would be needed to provide electrical energy for a town of 10,000? Come up with a useful way to visualize this area.