Solar PV

Physics and Mathematics of Sustainable Energy

College of the Atlantic. October 14, 2022

1. The average insolation in Bar Harbor, ME, is 4.29 kWh/day/m^2. Convert this to W/m^2.

2. The solar intensity in Portland, OR, is around 160 W/m^2. Convert this to kWh/day/m^2.

3. The solar intensity in Hancock County, Maine is around 160 W/m^2. Convert this to kWh/day/m^2.

4. A typical new house in the US might have around 50 m^2 of rooftop on which solar panels can be installed. The average monthly electricity consumption for a US home is around 900 kWh/month.

   (a) How much electrical energy would be generated by these solar panels in a month? In a year?
   (b) How much would a year's worth of this electricity be worth in Maine?
   (c) How does this amount of electricity compare to the electricity used in the home?
   (d) How does this compare to the total amount energy used in the US per person per year?
   (e) If this electricity displaced electricity that was generated with a carbon intensity of 450 g of CO_2, how much less CO_2 would be emitted as a result? Is this a little or a lot?

5. Suppose we want to generate 50 kWh of electricity per day from solar for each person in the U.S.

   (a) How much area is required per person? Assume that we have solar farms that get 10W/m^2.
   (b) How much land would it take to do this for every person in the U.S?
   (c) How big an area is this? (What size square has this area?)