Capacity Factors

Physics and Mathematics of Sustainable Energy

College of the Atlantic. September 25, 2023

1. (a) What are the yearly emissions due to electricity used by the average Maine home? Put this number in perspective.
   (b) What would the emissions be if the same amount of energy was used by a home in Costa Rica? In Poland?

2. A 2MW wind turbine has a capacity factor of 0.32.
   (a) How much energy does this turbine generate in a year?
   (b) How many Maine homes could this turbine power?

3. The Hoover Dam in the Southwestern US has a nameplate capacity of 2080 MW. The average annual energy generated by the power plant from 1947 to 2008 was 4.2 billion kWh. What is the average capacity factor for the Hoover dam for this time period?

Figure 1: Aerial view of the Robert Scherer power plant north of Macon, Georgia. Photograph by wikipedia user Antennas. Released to the public domain. File source `https://en.wikipedia.org/wiki/Plant_Scherer#/media/File:Schererplant.jpg`

4. In 2018 the Scherer coal plant in Georgia, USA, generated 15,420,000 MWh of electricity. The nameplate capacity is 3.5GW.
   (a) What is the plant's capacity factor?
   (b) The average home in Georgia uses 1080 kWh per month. How many homes could the Scherer plant power?
   (c) Electricity in Georgia currently costs \$0.153/kWh. How much does the average Georgia household pay for electricity in a year?
   (d) Assuming that Scherer sells all of its electricity at the residential rate given above, what is Scherer's annual revenue?