More Windpower

Physics and Mathematics of Sustainable Energy

College of the Atlantic. 8 October 2021

1. Residential electricity use in Maine is 21 billion kWh/year. What area of land would be needed to generate this electricity from terrestrial windpower?

   (a) Answer in square meters, square kilometers, square miles, and acres.

   (b) A square of what side (in km or miles) has this same area?

2. First Wind claims that the 34 MW of wind capacity at its Bull Hill wind installation is sufficient to power 15,000 Maine homes. Does this seem right? The average Maine home uses around 520 kWh per month.[1]

3. The Hog Creek Wind Project in Ada, Ohio, has a nameplate capacity of 66 MW. In 2020 it generated 200,813 MWh of electricity.

   - What is the wind farm's capacity factor?
   - The average Ohio home uses 873 kWh a month. About how many homes could the Hog Creek wind farm supply electricity to?

4. The average Maine home uses 520 kWh of electricity a month. The carbon intensity[2] of electricity in Maine is 300 grams per kWh. What is the total yearly emissions associated with the home's electricity? Put this number in perspective.

[1] `http://www.businesswire.com/news/home/20111115006743/en/Wind-Announces-Agreement-Vestas-Purchase-77-V10` 8, `http://www.thewindpower.net/windfarm_en_16013_bull-hill.php`.

[2] At least this is what it was at 8pm on October 7, 2021, according to `https://app.electricitymap.org/zone/US-NE-ISNE`.