Windpower and Areas

Physics and Mathematics of Sustainable Energy

College of the Atlantic. October 3, 2025

1. The Hog Creek Wind Project in Ada, Ohio, has a nameplate capacity of 66 MW. Over the last four years, on average, it has generated 204,000 MWh of electricity.

   - What is the wind farm's capacity factor?
   - What is the actual (not nameplate) power delivered by the wind farm?
   - The area of the wind farm is very roughly 20 km^2. What is the power density of the wind farm in W/m^2?
   - The average Ohio home uses 873 kWh a month. About how many homes could the Hog Creek wind farm supply electricity to?

2. Residential electricity use in Maine is very roughly 5 million MWh/year. What area of land would be needed to generate this electricity from terrestrial windpower?

   (a) Answer in square meters and square kilometers.

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

   (c) If this amount of electricity was generated using existing methods, how much CO_2 would be released into the atmosphere? Express your answer in tons per person.