Windpower, Areas, Proportions

Physics and Mathematics of Sustainable Energy

College of the Atlantic. September 30, 2025

1. You are planning a party and have determined how many tacos you need to make. At the last minute you learn that 10% more people will be attending your party. How many more tacos do you now need to make?

2. Suppose you have a pizza of a certain area. If you double the radius of the pizza, what happens to the pizza's area?

3. Suppose you have a pizza of a certain area. If the radius of the pizza increases by 10%, what happens to the pizza's area?

4. Suppose you have a spherical balloon of a certain volume. If the radius of the balloon increases by 10%, what happens to the balloon's volume?

5. Suppose that a certain wind turbine generates a certain amount of energy per month. What would happen to the energy generated per month if:

   (a) The diameter of the blades was increased by 10%?
   (b) The turbine was re-located someplace where the average wind speed was 10% higher?

6. 54 kilometers is how many meters?

7. 54 square kilometers is how many square meters?

8. If a square has an area of 54 square kilometers, what is the side of the square?

9. 54 square kilometers is how many hectares?

10. 54 square kilometers is how many acres?

11. 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 MHw 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?