

MSU-Wind Applications Center: Wind Resource Worksheet

Theoretical Power Calculation

Equations:

$$\text{Theoretical Power}[w] = \frac{1}{2} * A * \rho * v^3 * .59 \quad \rho = \frac{\text{Pressure}}{R * \text{Temperature}}$$

A= swept area ρ = air density v = velocity R= universal gas constant

Steps:

1. Measure wind speed from fan using anemometer and data logger.
 - a. Low Setting: _____ m/s
 - b. High Setting: _____ m/s
2. Record temperature of room from temperature sensor and data logger.
 - a. Temp: _____ °C
3. Calculate Swept Area (A)
 - a. Measure radius of turbine blade setup. Radius: _____ m
 - b. Area = $\pi r^2 = \pi * (\text{_____})^2 = \text{_____} \text{ m}^2$
4. Air Density (ρ)
 - a. Pressure 1 inHg = 3,386.389 pascals at 0 °C
Pressure _____ in Hg * 3,386.39 = _____ pa
 - b. Temperature _____ °C + 273 = _____ °K
 - c. Universal Gas Constant (R)
R = 287.058 J/(kg*K)
 - d. $\rho = \text{_____} / (\text{_____} * \text{_____}) = \text{_____} \text{ kg/m}^3$
5. Theoretical Power
 - a. Low Setting Theoretical Wind Power
 - i. Power = $\frac{1}{2} * \text{_____} * \text{_____} * \text{_____} * .59 = \text{_____}$ (watts)
 - b. High Setting Theoretical Wind Power
 - i. Power = $\frac{1}{2} * \text{_____} * \text{_____} * \text{_____} * .59 = \text{_____}$ (watts)