MSU-Wind Applications Center: Wind Resource Worksheet

Theoretical Power Calculation

Equations:

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

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. Calulate Swept Area (A)
    a. Measure radius of turbine blade setup. Radius:_____m
    b. Area = $\pi r^2 = \pi * (\_\_\_\_\_)^2 =$ _____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. Temperture _____°C + 273 = _____°K
    c. Universal Gas Constant (R)
    R = 287.058 J/(kg*K)
    d. ρ = _____/(_____*_____)= _____kg/m^3
5. Theoretical Power
    a. Low Setting Theoretical Wind Power
        i. Power= ½*_____*_____*_____*.59 = _____ (watts)
    b. High Setting Theoretical Wind Power
        i. Power= ½*_____*_____*_____*.59 = _____ (watts)

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Test Turbine Power Calculation

Equations:

Power= I*V

I= Current V= Voltage

Steps:

1. Measure the voltage from turbine using multimeter.
    a. Low Speed _____V High Speed _____ V
2. Measure the current using the multimeter with resistor and multimeter
    a. Low Speed _____a High Speed _____ a
3. Actual Power Produced from turbine
    a. Low Speed Power= _____ * _____ = _____ w
    b. High Speed Power = _____*_____=_____w

Turbine Efficiency

Equations:

Actual Power Produced/ Theoretical Power = η

η= efficiency

Steps:

1. Low Speed Efficiency _____/_____ = _____ *100 = _____%
2. High Speed Efficiency _____/_____= _____ *100 = _____%

Summary of Results	Low Wind Speed	High Wind Speed
Theoretical Power		
Actual Power		
Efficiency		