



Turbine Performance Testing Variables

(40 points)

Team Name: _____

School Name: _____

Level: 4th-8th or 9th-12th

Size Restraints

Full Height of Turbine in cm (bottom of base to highest blade tip): _____

Full Width of Turbine in cm (widest point, can occur at blades or base): _____

Energy Output—60 Second Trials (30 points)

If the turbine is operating normally, only one run is required. Scoring will be based on the best run (i.e., no penalty for a bad run). Runs should be measured in Joules. **Circle Top Run.**

_____ 1st Run (J) _____ 2nd Run (J) _____ 3rd Run (J) _____ 4th Run (J)

Efficiency (10 points)

Wind Speed (m/s): _____

Horizontal axis rotor radius (cm): _____

Vertical axis rotor radius (cm) Dimension 1: _____ Dimension 2: _____

Note: Only fill in the axis measurements for the type of turbine design. Most turbines are horizontal.

Efficiency is calculated by the following methodology: Efficiency (%) = actual power generated / available power * 100

The actual power generated (watts) is the energy output of the best run (in Joules) divided by 60 seconds. Since the energy output was measured over 60 seconds, divide by 60 seconds to determine the watts.

NOTE: 1 Joule = 1 Watt · second.

$$\text{Available power (P)} = 0.59 * \frac{1}{2} * \rho * (\rho * r^2) * v^3$$

P = power in the wind (watts)

0.59 = Betz limit (theoretical maximum efficiency of wind turbine)

ρ = density of air (1 kg/m³)

r = radius of swept area (m)

v = wind velocity (m/s)

ρ = 3.14