Turbine Performance Score Sheet

(40 points)

Team Name:_____

School Name: _____

Division: ☐ 4th-8th or ☐ 9th-12th

Energy Output—60 Second Trials (35 points)

Scoring will be based on the best run (no penalty for a bad run). Runs are measured in Joules. **Circle Top Run.**

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

_____ (J) 5th Run _____ (J) 6th Run _____ (J) 7th Run _____ (J) 8th Run

Catastrophic Failure (Does Not Impact Scoring)

☐ Did not occur ☐ High Priority ☐ Low Priority

Efficiency (5 points)

Wind Speed (m/s):_____

Horizontal axis: Rotor radius (cm):_____

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

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

Additional Details About Efficiency Calculation

Efficiency of Wind Turbine (%) = actual power generated ÷ available power × 100

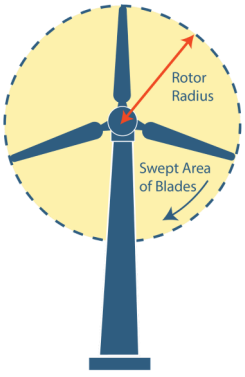
Actual Power Generated = energy production (Joules) of the turbine's best run ÷ 60 seconds

Explanation: Joules = Watts × Seconds; therefore Power (Watts) = energy production (Joules) ÷ time of run (60 seconds)

Available power (P) = $0.59 * ½ * \rho * A * V^3$

- P = power in the wind (watts)
- 0.59 = 59% = Betz limit (theoretical maximum efficiency of wind turbine)
- ρ = density of air (assumed to be 1 kg/m^3)
- A = swept area of turbine (square meters)
  - Horizontal axis turbine = π × $radius^2$ (where π = 3.14)
  - Vertical axis turbine = 1/2 × Dimension 1 × Dimension 2
- V = wind velocity (meters/second)

Horizontal Axis Swept Area



Vertical Axis Swept Area