

## Wind Turbine Design Problem -1

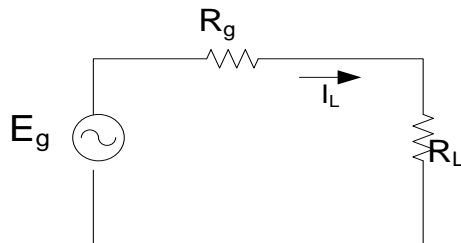
### Requirements and Assumptions

- 1 Turbine must deliver a minimum of 1.0 watt into a 10 ohm load
- 2 Maximum wind speed is 14 mph
- 3 RPM max = 1000 RPM
- 4 Assume  $C_p = 0.3$
- 5  $R_g = 12$  ohms max
- 6 (4) Magnets  $B = 0.1.8$  T
- 7 Magnet Area = 0.001 m
- 8 Wind Blade height max = 14 in

### Design

- 1 Design turbine
- 2  $V_L = ?$
- 3  $P_T = ?$
- 4 Wind turbine area (A) = ?

Hint: Equations you will need



$$P_g = (E_g)^2 / (R_g + R_L)$$

$$P_L = (V_L)^2 / (R_L) = 1 \text{ watt}$$

$$V_L = E_g (R_L / (R_g + R_L))$$

$$P_T = (V_L^2 / R_L) (1 + R_G / R_L)$$

$$V_{rms} = 0.707 * N * A * P * B * Z$$

$$P_{WT} = 0.5 * \rho * A * v^3 * C_{PB} * C_{PT}$$

BETZ LAW- $C_{PB}$	0.59
VAWT- $C_{PT}$	0.3
AIR DENSITY $\rho$	1.23