Activity 04 – 1st Law Wind Systems

1. Form teams of six. Introduce each other and get comfortable.
2. Wind turbine technical information is provided in class.
3. Collaborate and answer the following questions.
4. Check solution at front of class and self-grade and show instructor each section.
5. Turn in one activity per team.

A. Given an average wind speed of 11 m/s, what is the total available power in the wind to power 70-m diameter wind turbine? Assume standard atmospheric temperature and pressure of 25°C and 101.3 kPa.

B. Assuming the blade design converts the theoretical maximum power from the wind and the gearbox and electric generator are both 85% efficient, what is the total electrical power produced?
C. How much heat must the nacelle dissipate if it is to operate at steady state? Neglect external heat inputs such as convection or radiation.

D. If the nacelle is 12-m long and 5-m square in cross-section, how much heat can be dissipated if the external surface temperature is maintained at 50°C and the forced-air convective heat transfer coefficient is $100 \frac{W}{m^2K}$?