ECE 333 Green Electric Energy

Homework 3

Date set: 09/28/2021

Solution to be uploaded on course website: Tuesday, 10/05/2021

Quiz Date: Thursday, 10/07/2021 (during class)

The quiz has one or more problems based on the assigned problems below

Reading:

Text: From Masters' 2nd edition

chapter 7 (sections 7.5, 7.6, 7.7.1, 7.7.2 and 7.8)

Solve the following problems:

Text: 7.6, 7.7

Problem a. (*i*) **Sketch** the ideal power curve of the turbine with the following characteristics:

- rated speed is 14 *m/s*
- cut-in speed is 5 *m/s*
- rated power is 1.25 *MW*
- furling or cut-out speed is 20 *m/s*

(*ii*) **Given** part (*i*), calculate the energy produced in one day if the wind blows continuously between 15 and 20 *m/s* all day

(*iii*) Can the energy produced in one year be determined if you are told that the average wind speed is 14 *m/s*? Explain why.

Problem b. Suppose an anemometer is mounted in a countryside area with many trees at a height of 10 *m* and its measurements indicate a 4.5-*m/s* average wind speed.

(*i*) **Estimate** the average wind power at a height of 80 *m*, assuming Rayleigh statistics and under the following weather conditions

- 15^oC
- -5^oC

(*ii*) Suppose a 1300-kW wind turbine with 60-m rotor diameter is located in those winds. **Determine** the annual energy production with a 30% wind turbine efficiency for each of the weather conditions

(*iii*) **Evaluate** the wind turbine capacity factor for each of the weather conditions