

Homework 5 - Wind Turbine Economics (100 points)

A. INSTRUCTION

(a) Due: 8:00pm (Check Class web page for the date)

(b) Scoring Rubric

pts	#1	#2, #3
40	Correct answer with Program file (Excel, for example) attached	
30	Correct answer <u>without</u> program file attachment	Correct answer with detailed calculation displayed
20	Incorrect answer with Program file (Excel, for example) attached	Incorrect answer with detailed calculation displayed
0	Incorrect answer without file attachment	Correct/Incorrect answer without calculation displayed

(c) Submission extension: granted upon request

B. PROBLEM

#1. Solve the question below by Turbine Specification (as provided on the right) [40 pts]

#2. Solve the question below by CF [30 pts]

(Question) A 29.2-m diameter wind turbine having a rated power of 250 kW is installed at a site having Rayleigh wind statistics with an average wind speed of 10 m/s at the hub height.

(a) Find the annual energy generated,

(b) From the result, find the overall average efficiency of this turbine in these winds,

(c) Find the productivity in terms of kWh/yr per m² of swept area.

#3. A wind farm project has forty (40) 1500-kW turbines with 64-m blades. Capital costs are \$60 million and the annualized O&M cost is \$1.8 million/yr. The project will be financed with a \$60 million, 20-year loan at 7% interest. Turbines are exposed to Rayleigh winds averaging 8.5 m/s. What would be the electric energy cost [\$/kWh] over the 20-year period? [30pts]

Manufacturer:	Wind World
Rated Power (kW):	250
Diameter (m):	29.2
Windspeed	
<u>v (m/s)</u>	<u>kW</u>
0	0
1	0
2	0
3	0
4	0
5	12
6	33
7	60
8	92
9	124
10	153
11	180
12	205
13	224
14	238
15	247
16	253
17	258
18	260
19	259
20	256
21	250
22	243
23	236
24	230
25	224
26	0

Source: Mostly based on d