WindCad Turbine Performance Model

BWC EXCEL-S, Grid - Intertie

Prepared For:	**Customer**	Mel Tyree
Site Location:	**Customer Site**	Bull Run, Ellenburg
Data Source:	**TrueWind Atlas**	
Date:	**5/13/2008**	

10 kW

Inputs:

Ave. Wind (m/s) =	5.464
Weibull K =	1.891
Site Altitude (m) =	280
Wind Shear Exp. =	0.143
Anem. Height (m) =	30
Tower Height (m) =	30
Turbulence Factor =	10.0%

Results:

Hub Average Wind Speed (m/s) =	5.46
Air Density Factor =	-3%
Average Output Power (kW) =	1.64
Daily Energy Output (kWh) =	**39.4**
Annual Energy Output (kWh) =	14,377
Monthly Energy Output =	1,198
Percent Operating Time =	70.8%

Weibull Performance Calculations

Wind Speed Bin (m/s)	Power (kW)	Wind Probability (f)	Net kW @ V
1	0.00	5.92%	0.000
2	0.00	10.06%	0.000
3	0.00	12.57%	0.000
4	0.22	13.48%	0.030
5	0.70	13.02%	0.091
6	1.45	11.58%	0.168
7	2.24	9.61%	0.215
8	3.20	7.49%	0.240
9	4.25	5.51%	0.234
10	5.39	3.84%	0.207
11	6.58	2.55%	0.167
12	7.89	1.61%	0.127
13	8.33	0.96%	0.080
14	8.77	0.55%	0.049
15	7.01	0.30%	0.021
16	5.26	0.16%	0.008
17	2.37	0.08%	0.002
18	2.63	0.04%	0.001
19	2.63	0.02%	0.000
20	2.63	0.01%	0.000
1997, Bergey Windpower	Totals:	99.36%	1.641

Weibull Calculations:
Wind speed probability is calculated as a Weibull curve defined by the average wind speed and a shape factor, K. To facilitate piece-wise integration, the wind speed range is broken down into "bins" of 1 m/s in width (Column 1). For each wind speed bin, instantaneous wind turbine power (W, Column 2)) is multiplied by the Weibull wind speed probability (f, Column 3). This cross product (Net W, Column 4) is the contribution to average turbine power output contributed by wind speeds in that bin. The sum of these contributions is the average power output of the turbine on a continuous, 24 hour, basis. Best results are achieved using

Instructions:

Inputs: Use annual or monthly **Average Wind** speeds. If **Weibull K** is not known, use K = 2 for inland sites, use 3 for