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SWCC Summary Report

Manufacturer: **Bergey Windpower Company**

Wind Turbine Model: **Excel 6** (240 VAC, 1-phase, 60 Hz)

Certification Number: **SWCC-10-11**



The above-identified Small Wind Turbine is certified by the Solar Rating & Certification Corporation - Small Wind Certification Program to be in conformance with the AWEA *Small Wind Turbine Performance and Safety Standard* (AWEA Standard 9.1 – 2009). For the SWCC Certificate visit: www.smallwindcertification.org

This report summarizes the results of testing and certification of the Bergey Windpower Company Excel 6 in accordance with AWEA Standard 9.1-2009. The Excel 6 is a 3-blade, upwind, horizontal axis wind turbine with a swept area of 30.2 m². The tested configuration utilized a Powersync II inverter and a Bergey 25 m (80 ft) guyed-lattice tower. Field tests were conducted at the Alternative Energy Institute/West Texas A&M University (AEI/WTAMU) facility in Canyon, Texas from July 14, 2011 to October 15, 2012.

1. Turbine Ratings

The Excel 6 performance testing was conducted in accordance with Section 2 of AWEA Standard 9.1-2009. The resulting turbine ratings, tabulated graphical Annual Energy Production (AEP), and graphical and tabulated power curve are given below.

AWEA Rated Annual Energy @ 5 m/s	9,920 kWh
AWEA Rated Sound Level	47.2 dB(A)
AWEA Rated Power @ 11 m/s	5.5 kW
Peak Power @ 16 m/s	6.7 kW

2. Tabulated Annual Energy Production (AEP)

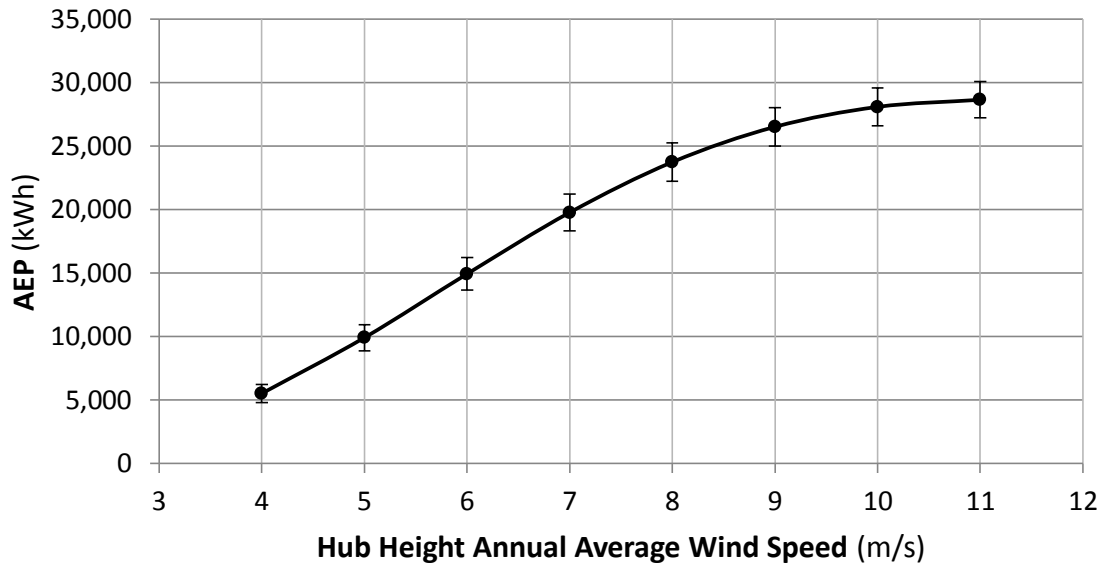
Corrected to a sea level air density of 1.225 kg/m³

Hub Height Annual Average Wind Speed (m/s)	AEP Measured (kWh)	Standard Uncertainty in AEP (kWh)	Standard Uncertainty in AEP (%)	AEP Extrapolated (kWh)
4	5,522	721	13%	5,522
5	9,919	1,034	10%	9,919
6	14,940	1,287	9%	14,967
7	19,777	1,445	7%	19,944
8	23,749	1,516	6%	24,298
9	26,523	1,521	6%	27,740
10	28,096	1,482	5%	30,200
11	28,657	1,417	5%	31,745

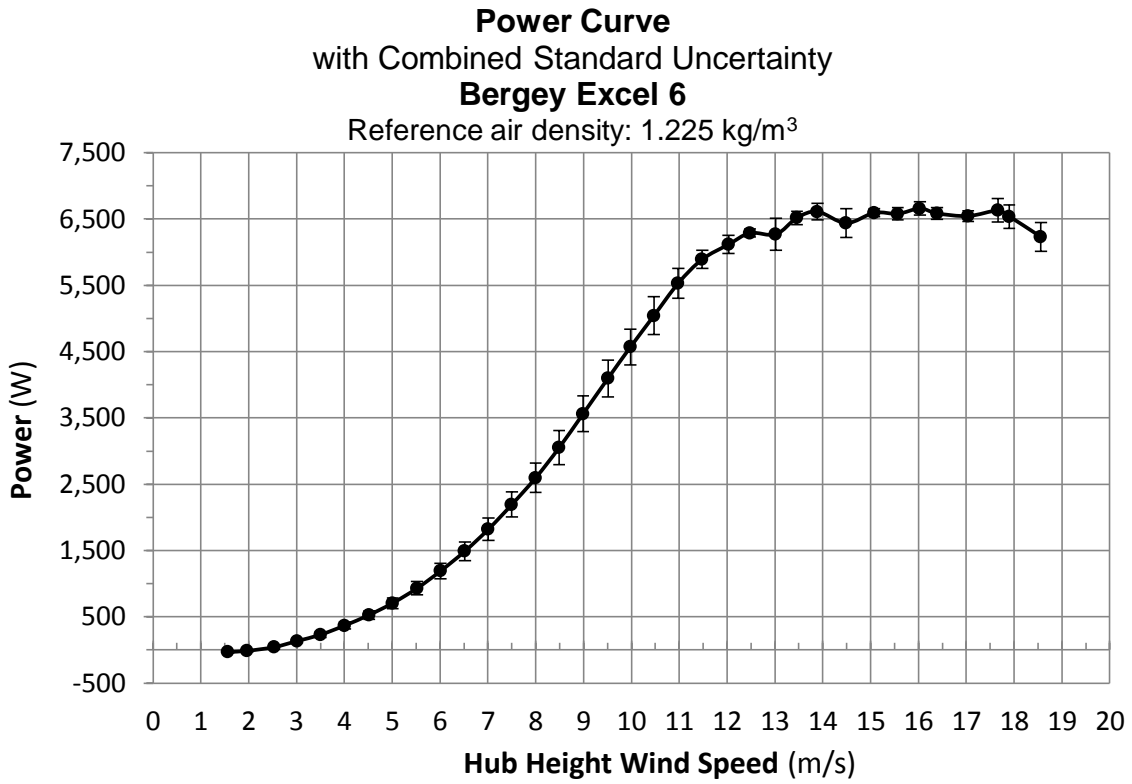
3. Annual Energy Production Curve

Estimated Annual Energy Production (AEP-measured) with Standard Uncertainty Bergey Excel 6

Reference air density: 1.225 kg/m³



4. Power Curve



5. Tabulated Power Curve

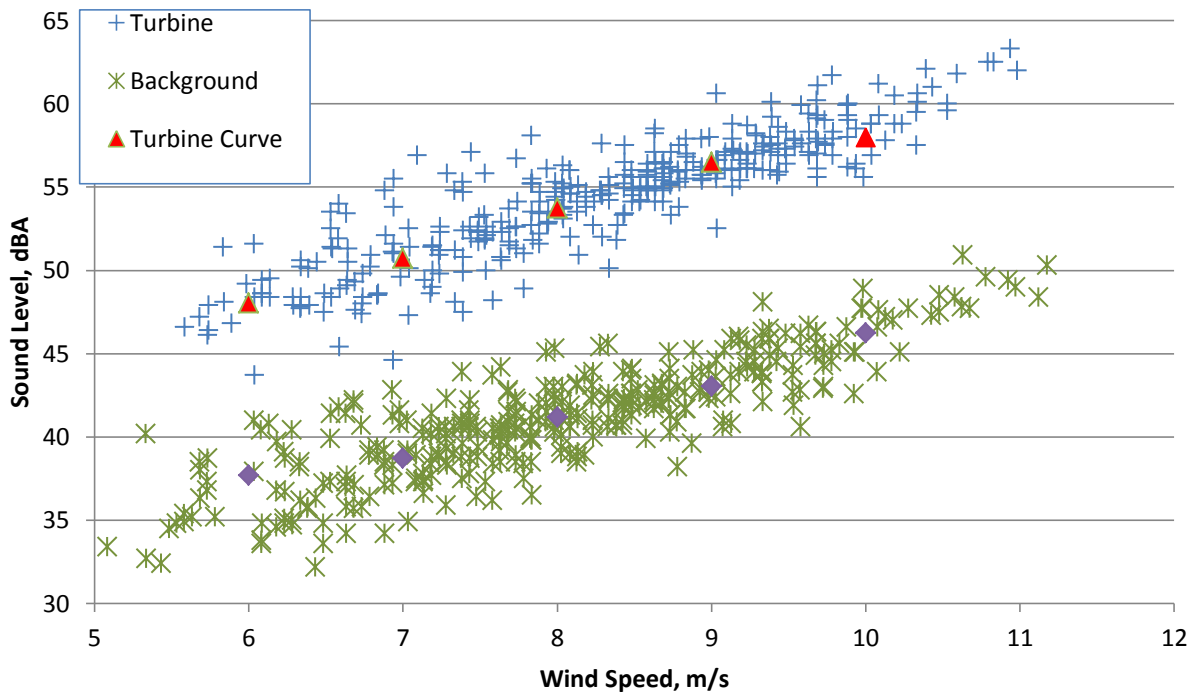
Corrected to a sea level air density of 1.225 kg/m ³					Category A	Category B	Combined
Bin No.	Hub Height Wind Speed	Power Output	Cp	1-minute samples	Standard Uncertainty, Si	Standard Uncertainty, Ui	Standard Uncertainty, Ci
	<i>m/s</i>	<i>Watts</i>			<i>Watts</i>	<i>Watts</i>	<i>Watts</i>
1.5	1.57	-31	-	211	12	6	13
2.0	1.97	-13	-	473	8	13	16
2.5	2.53	42	0.14	660	6	27	28
3.0	3.01	134	0.27	891	6	29	30
3.5	3.50	230	0.29	1172	5	43	43
4.0	4.01	369	0.31	1094	8	52	52
4.5	4.52	529	0.31	1366	7	64	64
5.0	5.01	707	0.30	1812	6	80	81
5.5	5.52	931	0.30	2186	7	100	101
6.0	6.01	1190	0.30	2722	6	120	120
6.5	6.52	1490	0.29	3203	7	142	142
7.0	7.01	1820	0.29	3659	7	168	168
7.5	7.50	2193	0.28	3836	7	189	189
8.0	8.00	2597	0.27	3974	8	220	220
8.5	8.49	3051	0.27	3538	9	256	257
9.0	8.99	3562	0.26	2652	12	272	272
9.5	9.51	4097	0.26	1909	13	277	277
10.0	9.98	4570	0.25	1470	14	271	272
10.5	10.47	5041	0.24	1134	21	284	285
11.0	10.98	5532	0.23	732	29	223	224
11.5	11.48	5892	0.21	522	22	136	137
12.0	12.03	6116	0.19	312	32	133	137
12.5	12.48	6288	0.17	185	32	50	59
13.0	13.02	6269	0.15	126	139	199	243
13.5	13.46	6517	0.14	73	42	93	102
14.0	13.89	6611	0.13	50	42	118	125
14.5	14.49	6439	0.11	48	185	113	217
15.0	15.08	6595	0.10	34	30	52	61
15.5	15.57	6579	0.09	21	30	86	91
16.0	16.03	6659	0.09	24	30	98	103
16.5	16.39	6586	0.08	27	68	57	89
17.0	17.04	6545	0.07	21	18	78	81
17.5	17.66	6629	0.07	19	18	176	177
18.0	17.90	6539	0.06	14	18	176	177
18.5	18.56	6231	0.05	20	9	219	219

6. Tabulated Acoustic Data

The Excel 6 was tested in accordance with Section 3 of AWEA Standard 9.1-2009. The tabulated Sound Power Level is provided for specific wind speed bins.

Wind Speed at 10m Height <i>m/s</i>	Apparent Sound Power Level <i>dB(A)</i>	Combined Uncertainty <i>dB(A)</i>
6	84.0	3.0
7	86.8	3.3
8	89.9	2.6
9	92.7	2.3
10	94.1	2.8

7. Graphical Acoustic Data



Measured sound data as a Function of Wind Speed; from AEI

8. Duration Testing

The Bergey Excel 6 successfully completed a Duration Test for an IEC Class II Small Wind Turbine. The testing was performed from July 14, 2011, to March 13, 2012 with an Operational Time Fraction of 100%. The highest instantaneous wind speed recorded during the test was 29.7 m/s (66.4 mph). The average turbulence intensity at 15 m/s was 10.3%.

9. Mechanical Strength Analysis

The mechanical strength analysis was found to be in conformance with IEC 61400-2 as modified by section 4 of AWEA Standard 9.1 – 2009 for an IEC Class II Small Wind Turbine.

10. Safety and Function testing

Safety and Function testing was found to be in conformance with sections 4.3 and 4.4 of AWEA Standard 9.1 – 2009.

11. Manufacturer Tower Design Requirements (SRCC is not responsible for any errors in the document below, which is provided by the manufacturer).

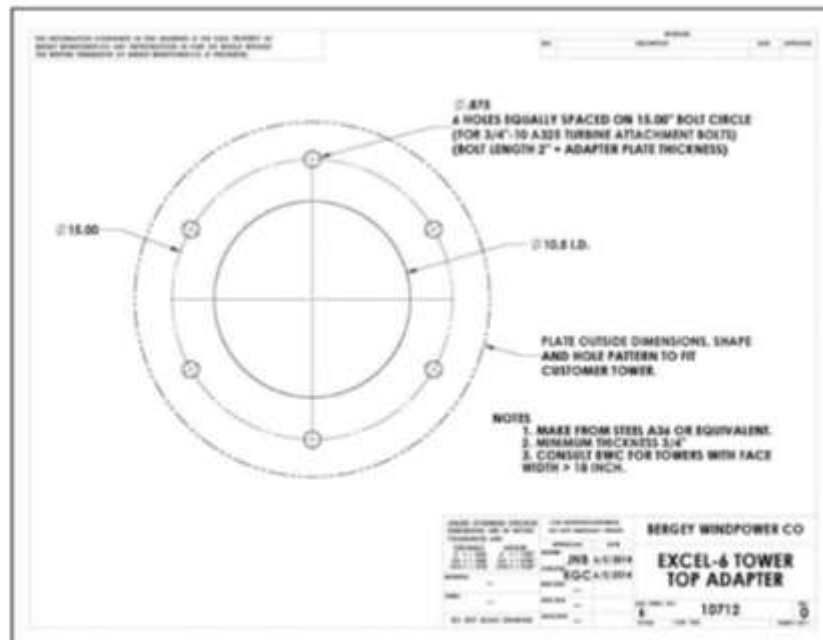
BASIC TOWER REQUIREMENTS for the BWC EXCEL 6 WIND TURBINE

Customer supplied towers for the BWC EXCEL 6 should meet the following requirements:

Tower Height: 60 ft (18 m) minimum, 80 ft (24 m) or higher recommended
Design Wind Speed: 120 mph (54 m/s)
Turbine Weight: 800 lb (365 kg)
Turbine Thrust Load: 1850 lb (840 kg) @ any wind \geq 40 mph (18 m/s)
Yaw-Induced Moment: 4500 ft-lb (6100 N-m)
Blade Clearance: The top 9 ft (2.75 m) of the tower must not extend beyond a 15 inch (0.38 m) radius from the tower centerline.
Tower Plumb Tolerance: Up to 0.25° tolerance from plumb allowed.
Tower Stiffness: Tilt at the top of the tower should be no more than 2.0° for consistent furling. Deflection of monopole towers at 50 mph should be no more than 1.0% of tower height; at 120 mph no more than 2.5% of tower height. (For a 120 ft tower this would be 14.4 in and 36.0 in, respectively.) Overly flexible towers can cause vibration and/or fatigue problems. A civil engineer should approve the tower.

Turbine Mounting:

- Provisions shall be made for mounting strain relief for tower wiring, tower climbing anti-fall equipment and access holes where appropriate.
- The top of the tower shall be designed to allow the connection of the power cable to the turbine in the turbine's tower adapter plate.
- Tower connection adapter shall be made using the pattern illustrated below.
- Tower turbine connection bolts shall be A325 3/4"-10 with nuts plus PAL nuts. Required bolt length is (adapter plate thickness + 2.0) inches.



Revised June 5 2014