BWC XL.1 Wind Turbine

updated 8/2/03

Bergey Windpower's newest product is the 1,000 Watt BWC XL.1. The BWC XL.1 is currently available only as a 24 VDC battery-charging system. A 48 VDC battery charging versions and a batteryless grid-intertie version (like our 10 kW GridTek system) are in development.

With a rotor diameter of 2.5 meters (8.2 ft) and a peak output of approximately 1,600 watts the XL.1 is intended for the off-grid home market in the U.S. and for rural electrification programs in developing countries. It is also a perfect upgrade system for current owners of micro-turbines, such as the Air 303 or 403.

The XL.1 combines a number of advanced technical features, including a completely new airfoil, to provide the highest efficiency yet achieved in a small wind turbine at a cost of energy ~ 10% lower than the current price leader. And, the XL.1 carries the exclusive, industry-leading, Bergey 5-year warranty. "We are very excited about the XL.1. We think customers are really going to like this machine" notes Mike Bergey, BWC's president.

The XL.1 is an up-wind, horizontal-axis, three- bladed turbine. The blades are pultruded fiberglass, a material that is over ten times stronger than the injection- molded plastic used on most small wind turbines. In fact, pultrusions have a breaking strength exceeding 100,000 psi, which is twice as strong as normal steel. "Just about any blade material will hold up in light to moderate winds. But, when the storms come, weak blades can put the whole system at risk." And the new BWC SH3045 airfoil makes the XL.1's blade probably the most efficient ever on a small wind turbine.

The photo above, on the left, shows an XL.1 installed by Brooks Solar (Chelan, WA) at a renewable energy trade fair in Oregon.

The blades attach directly to a specially designed very-low-speed permanent magnet alternator which uses state-of-the-art neodymium super- magnets. "We have designed an oversized alternator that slows the rotor down and makes the turbine very quiet." Overspeed protection is provided by the proven BWC AutoFurl passive sideways furling system. "In spite of the claims otherwise, no other overspeed protection system has proven to be more reliable or effective than AutoFurl."

The XL.1 includes the BWC PowerCenter controller which controls battery charging, has a low-end boost for superior low wind speed performance, "slow-mode" rotor idling when the batteries are full, an electrical braking system, and even includes a 30 A PWM charge controller for the solar modules that are often a part of a complete hybrid system. The PowerCenter allows an auxiliary or "dump" load to be connected to utilize excess wind (and/or solar) power after the batteries are fully charged.

Low wind speed performance is greatly enhanced by a low-end-boost circuit that optimally loads the wind turbine down to wind speeds as low as 5.6 mph (2.5 m/s). Combined with the new blade system, this circuitry allows the XL.1 to produce useful power more than 6,000 hours a year at a typical site. For reference, a typical solar system produces power 3,500 hours a year at a typical site.

The XL.1 is offered with a tubular Tilt-up tower in heights from 9 m (30 ft) to 32 m (104 ft). These kits will be be easy to install and will offer customers a complete "ready to install" kit. "There's been a need for more complete integration between turbine and tower packages for small wind turbines and we think our new line will fill that gap."

XL.1 Specifications

Type: 3 Blade Upwind
Rotor Diameter: 2.5 m (8.2 ft.)

Start-up Wind Speed: 3 m/s (6.7 mph)
Cut-in Wind Speed: 2.5 m/s (5.6 mph)
Rated Wind Speed: 11 m/s (24.6 mph)
Rated Power: 1000 Watts

Maximum Power: ~ 1,600 Watts
Cut-Out Wind Speed: None
Furling Wind Speed: 13 m/s (29 mph)
Max. Design Wind Speed: 54 m/s (120 mph)

Blade Pitch Control: None, Fixed Pitch
Overspeed Protection: AutoFurl
Gearbox: None, Direct Drive
Temperature Range: -40 to +60 Deg. C (-40 to +140 Deg. F)
Generator: Permanent Magnet Alternator
Output Form: 24 VDC Nominal

Functional Features: Low-End Boost, Slow-Mode, Electric Brake, 30A Solar Regulator, 60A Dump Load, Timed Battery Equalization, Watt Meter Display Mode, Polarity Checker.

BWC XL.1 Product Comparison (24 VDC Models)

	Air-X	Proven	Lakota	H40	XL.1	H80	AWP
Rated Power (Watts)	400	600	900	900	1000	1000	950
Rated Wind Speed	28 mph	22.5 mph	29 mph	28 mph	25 mph	26 mph	25 mph
Comparable Power, at 25 mph (Watts)	240	650	540	600	1,000	950	950
Annual Energy Output, DC kWh @ 5 m/s	360	1,300	900	1,000	1,000	1,900	1,900
Retail Price, 2Q 2003	$595	$3,338	$1,699	$1,795	$2,150	$2,365	$2,460
				(w/F 7 Wire)		(w/F 7 Wire)	
$/W at Comparable Power	$2.48	$5.14	$3.15	$2.99	$2.15	$2.49	$2.59
How Much Higher Than XL.1 Cost	15%	139%	46%	39%	0%	16%	20%
$/AEO @ 5 m/s	$1.65	$2.57	$1.89	$1.80	$1.19	$1.24	$1.29
How Much Higher Than XL.1 Cost	38%	115%	59%	50%	0%	4%	8%
Warranty	3 Years	2 Years	5 Years	2 Years	5 Years	2 Years	2 Years

Bottom Line: The XL.1 produces energy below the cost of the competition, has the most sophisticated controls in the industry, and it comes with the best warranty.

BWC XL.1 Product Comparison

Feature	Air-X	Proven	Lakota	H40	XL.1	H80	AWP
Rated RPM	2,000	500	?	1,150	490	900	350
Boost Converter	Yes	No	No	No	Yes	No	No
Slow Mode	Yes	No	No	No	Yes	No	No
Dump Load	No	No	No	Yes, Req'd	Yes, Optional	Yes, Req'd	Yes, Optional
Brake	Optional	No	No	Yes	Yes	Yes	No
Equalization	No	?	?	Yes	Yes	Yes	?
Equalization Timer	No	No	No	No	Yes	No	No
Solar Regulator	No	No	No	Optional	Yes	Optional	No
Cost of 64' Tilt Tower	Up to 47	Up to 43	Up to 47	$1,273	$1,000	$1,273	$2,350
Warranty	3 Years	2 Years	5 Years	2 Years	5 Years	2 Years	2 Years

Bergey Turbines are Just Built Better

Bergey Windpower can offer the first full 5-year warranty in the small wind turbine industry because we make the most reliable and longest lasting wind turbines available. Unfortunately, some people make the mistake of assuming that all of the major brands of small wind turbines are built equally well.

But, this just is not the case. Wind turbines are machines and some machines are designed more conservatively and carefully than others. In an honest effort to find the best value in a small wind turbine, we believe some people look too hard at the price per watt, and not hard enough at the reputation of the manufacturers and their products. The result is far too many failures of small wind turbines. In small wind turbines, reliability is what sorts out the wheat from the chaff.

Here are some of the reasons that Bergey turbines cost more than some other small wind turbines:

Fail-Safe Design: Most other small wind turbines can never be allowed to operate without an electrical load on the generator during high winds, for fear of over-speeding and failing the blades. These turbines use "dump-loads" to limit their speed. But, the whole system can be put at risk if the electrical connection to these dump loads is lost ... they are not "fail-safe." Bergey turbines can run safely without any load at all, under any wind conditions up to their maximum design wind speeds (120 mph +).

Heavy Weight Construction: Lighter is definitely not better when it comes to wind turbine reliability and longevity. Wind turbines run up to 7,500 hours per year, which is the equivalent of putting 100,000 miles a year on a car. And during storms they have to endure tremendous forces. While it's cheaper to build a light-weight, fast-turning wind turbine, the history of the industry dating back to the 1920's clearly shows that light-weight turbines don't stand the test of time. The heavy-duty Jacobs turbines from the 1930's can still be found running today. Their light-weight competitors are long gone.

Higher Strength Blades: The blades are the most critical and heavily worked part of a wind turbine. Bergey Windpower pioneered the successful use of pultruded fiberglass blades in 1980. This award-winning technology application results in blades of exceptional strength and durability. In fact, with a tensile strength exceeding 100,000 psi, the blades on Bergey wind turbines are twice as strong as steel. Some less expensive wind turbines now use molded plastic blades with glass or carbon fiber reinforcement. But, the reinforcing fibers must be very short to allow injection molding and this limits strength to approximately 25,000 psi. Many experts doubt that the useful life of these plastic blades will exceed 5-7 years, except at poor wind sites. And using aeroelastic blade flutter

(undamped torsional vibration) for over-speed control, as done by one popular micro-turbine, certainly can't help.

More Rugged Electronics: It's less expensive to cut back on the power or heat handling capacity of the electronics that are used to charge batteries. But, during storms wind turbines can operate at high power levels for hours on end. Some other brands are notorious for burning up electronics because they simply haven't designed in sufficient reserve capacity. We spend more money on electronics and heat sinks to make sure this doesn't happen.

Fully-Engineered and Warranted Towers: Bergey Windpower offers a wide range of professionally-engineered (PE-stamped) towers, which we back-up with the same 5-year warranty as offered with the wind turbines. Some manufacturers only offer partial kits and some don't offer towers at all. This puts a lot of responsibility and risk back on the customer.

In 1979 Bergey Windpower pioneered the "3-blade, upwind, PM direct-drive, passive furling" configuration that has become the standard of the small wind turbine industry worldwide. Most other manufacturers have been fiddling with their "recipe" for years and are slowly converging on the one BWC started with.

We believe that the best value in a small wind turbine is determined both by the initial cost and the cost to operate the turbine over its expected 20-30 year life. In most cases, the turbine must run reliably for 10-20 years just to re-pay its initial investment. We believe a wind turbine that may not last ten years isn't a bargain at any price. We design turbines for 30 years and our oldest installations have been operating about 22 years.

We are working to bring the costs of our wind turbines down, make them quieter, and improve their efficiency. We realize our turbines are often more expensive than those from some of our competitors, but we can assure you that those additional costs are due to the higher costs of producing a superior product. At the end of the day, as they say, you get what you pay for.

"One Should Avoid Being Penny Wise
and Pound Foolish"

Benjamin Franklin

We recommend that you ask around about issues relating to ruggedness, reliability, and longevity to make sure that you have the full picture before you buy. And compare warranties. **Ours is 5-years ... the longest in the industry.**