

URBAN TURBINE



The *qr5* uses a Darrieus lift-type vertical axis wind turbine (VAWT) design, which doesn't require wind from a consistent direction to continue producing power. Its unique design marries pleasing aesthetics with practical noise and vibration damping.

A specialist in "microgeneration" of electric power from wind turbines, the London, U.K.-based firm, quietrevolution, has logged four installations to date of its *qr5* vertical-axis wind turbine (VAWT) and says it has 100 more in stages of planning and approval.

There are several types of VAWT, all of which use airfoils vertically mounted on a rotating shaft or framework. The *qr5* (5m/16.4 feet high by 3m/16.4 ft in diameter) is based on the Darrieus concept, named after the French aeronautical engineer Georges Jean Marie Darrieus, who patented it in 1931. Darrieus turbines use lift forces generated by the wind passing over its airfoils to create rotation.

The *qr5* was based on this design primarily because it can harvest wind from any direction, a virtue in urban settings, where ideal siting — a location without obstructions — is unlikely and wind turbulence is almost inevitable. Developed specifically for integration into new and existing city buildings, the *qr5* also uses patented active-gust response technology to provide an estimated 20 to 40 percent more energy than a similar-sized, conventional horizontal axis wind turbine in the same setting. In addition, the *qr5* blade's helical shape has aesthetic appeal, making it less visually intrusive, and aerodynamics that significantly reduce torque pulses and varying loads, which would be transferred into building structures. This nearly negates noise and vibration — a plus for a turbine that turns as fast as 300 rpm and develops centrifugal force as high as 200 Gs.

The *qr5* turbine can be ground-mounted on a 9m or 15m (29.5 ft or 49.2 ft) mast, or roof-mounted on a 3m or 6m (9.8 ft or 19.7 ft) mast. The rotor is constructed of carbon fiber/epoxy composite spars and blades, all built by Aviation Enterprises Ltd. (AEL, West Berkshire, U.K.), which also builds the Marine Current Turbine (MCT) rotor blades (see p. 28). Carbon fiber was selected to meet the 25-year fatigue life of the turbine, which translates to more than 1 billion cycles. The *qr5* blades and spars are currently made using prepreg supplied by Advanced Composites Group Ltd. (Heanor, Derbyshire, U.K.) and oven-cured; but processing is moving to the autoclave as production volumes ramp up, which will shorten cure from 16 to 5 hours.

Priced at roughly £25,000 (\$50,000 USD), the *qr5* costs between £5,000 (\$10,000 USD) and £10,000 (\$20,000 USD) to install, is rated at 6 kW and has an expected output of 9600 kWh per year at an average annual wind speed of 5.8 m/sec (19 ft/sec). It is, thus, capable of providing 10 percent of the energy requirements for a 600m² (6,458 ft²) office building.