J·M·P Co., LTD.

Hamamatsu, Shizuoka Prefecture

THK's Ball Splines Reduce Horizontal Vibrations, Proving Essential for Wind Turbines That Rotate in Light Breezes

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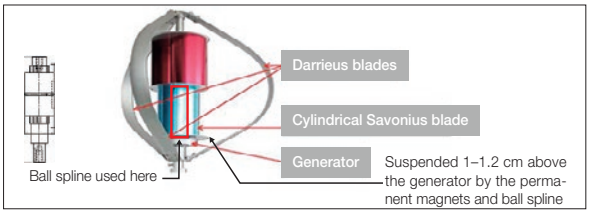
A desire to preserve an environment like ours or better for our children

When we were children, extremely hot days were very rare. It is clear that global warming has progressed. I focused on the renewable energy business because I wanted to curb that progress and preserve our current environment, if not a better one, for our children. We began working on our WinSky vertical-axis wind turbine with the goal of "WLB 88" (W: Wind-power system that generates energy through wind and solar power, L: LED lighting for reduced energy, B: Lithium-ion battery power storage, 88: 88% reduction in current energy consumption).

What is the WinSky vertical-axis wind turbine?

When developing the WinSky, we used an existing Darrieus-Savonius wind turbine model and added original improvements to increase the efficiency of power generation. (See the figure below. Savonius turbines rotate in light breezes, but they have low power generation. Conversely, Darrieus turbines generate a lot of power, but it takes time for their blades to start rotating.) These were the main improvements we made:

1. The Savonius was touching the top of the generator, causing a load when the turbine rotated. To eliminate the weight acting on the generator, we used magnetic force to lift the turbine and reduce the weight during the initial rotation to zero.
2. We expanded the surface area of the Darrieus turbine's blades, increasing the size of the area that catches the wind. As a result, it can achieve higher rotation speeds, and we can use wind power to the fullest extent. We also used the lightest materials possible so the turbine will rotate even in light breezes.
3. By improving the Darrieus blades, we eliminated part of the Savonius.
4. Noise is a common problem with small generators, but we solved that issue by preventing the formation of vortices with the reverse taper design of the blade tips.



Darrieus-Savonius wind turbine

WinSky vertical-axis wind turbine

When suspending the turbine with magnets, the most important thing is to keep it from shifting left to right. We had used THK when creating laser equipment in the past, so we felt their ball spline was the only thing that could solve this problem. We installed their product and have been conducting full-scale outdoor testing, and it has displayed absolutely no problems in terms of strength or durability. Even during Typhoon Number 24, which struck Shizuoka Prefecture in October, the turbine was able to generate power without issue.

Wind turbines generally only recover 6% of energy at a wind speed of 4 m/s, but WinSky achieves a high level of efficiency, recovering 25% at similar wind speeds.

Future developments

I would like to add WiFi capabilities and use our turbines as street lights so they can act as IoT stations. More specifically, I would like to add map displays and speakers that can safely lead disaster victims to evacuation shelters in the event of an earthquake, typhoon, or another natural disaster that causes a power outage. With technological assistance from THK, I hope to promote further developments to reduce the degree of disaster risk and increase resilience, significantly expand the prevalence of renewable energy, and improve sustainability through clean technology and using natural resources more efficiently, as outlined in the SDG targets.