Technology Background of the 2-Bladed Wind Tulip

The Different Types of Wind Turbines

One way of classifying wind turbines is vertical and horizontal axis, referring to the way they rotate. Horizontal axis turbines are the big ones or smaller ones like them. All horizontal turbines are lift; vertical can be either lift or drag.

In the past, higher efficiency was thought to depend on the lift effect--the way that airplane wings work, by using different pressures on each side to draw an object through the air. Lift types are usually more efficient and cost-effective for placement in an open field, if one does not care about the bird or noise issue.

Drag types (vertical axis) work by the wind pushing against the blade and have some variety of a cup shape to capture the wind. In the past, they were considered to be less noisy but less efficient. The Flower Turbines Wind Tulips are drag.

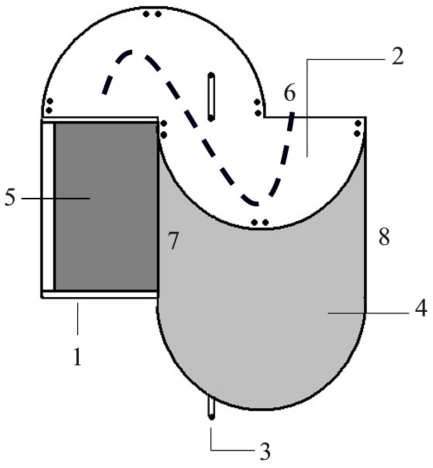
Well, not really. The scientific literature has many evaluations of the Savonius type of drag vertical axis turbine, characterized by two overlapping circles, in its traditional design can vary widely, from 5 to 25%. Previous researchers found that one of the important parameters that caused these wide variations in performance was something called the tip speed ratio. Very simply, for wind to pass efficiently through a turbine, each type of turbine of each size at each wind speed has an ideal relationship with how fast the tips of the blade move.

This literature was generally ignored, and most people, including experts, just accepted the incorrect idea that vertical axis turbines could not be efficient.

In general, the different types of turbines have these efficiency ranges:

Drag vertical axis	7-10%
Lift vertical axis	15-25%
Horizontal axis	30%
Large horizontal axis	30-40%

In our bid to revolutionize the small wind industry, we decided to start with the Savonius turbine and make it better. Below is a picture of such a turbine. It has covers on bottom (1) and top (2) that are parallel and similar in size. Sometimes (1) and (2) are complete circles. The blades (4) are perpendicular to the covers and are circular in shape, usually forming an empty half cylinder. They all spin around a central axis (3). The shaft (3) is not for support, since the two covers (1 and 2) provide that. There is not usually not an overlap of the blades around the shaft. There are two blades, each with an inner edge (7) and an outer edge (8). The wind enters the space (5) between the inner edge of one blade and the outer edge of the other and circulates through the turbine following the path (6).



We hear lots of times, "I've seen this turbine before," or "I could put two half barrels together and do the same thing." Part of the reason for the supposed poor performance of these turbines is, to start with, most of the designers never paid attention to the scientific literature.

One of the reasons a Savonius works is that drag type turbines suffer from resistance to the wind when the cupped blade faces the wind from the outside. The Savonius turbine redirects that wind from resistance to directing it into the other blade.

We made the Savonius type turbine better in the following ways:

1. We paid attention to a series of relationships and ratios in the air space of the inside of the turbine. By doing this alone, and while paying attention to the tip speed ratio, our simulations show an efficiency of 34%--higher than that of even most small horizontal axis turbines! These are patent pending.
2. Our investigations of computational fluid dynamics (CFD) suggested to us that, after the wind hit the back of the blades, it created turbulence that degraded the performance of the turbine. By placing horizontal ribs according to a patented formula, we broke up the areas of turbulence. This adds 20% to whatever the efficiency of the turbine was before. So, if a turbine has an efficiency of 34%, the ribbed turbine has an efficiency of 34 + (34*0.2) = 40.8%. This alone is game-changing efficiency and explains why our turbines start producing electricity at slightly over 1 meter per second.
3. We streamlined it with a double curve shape.
4. We tapered it so it is more open at the top and able to pick up wind better as it shifts direction.
5. We added a change in angle at the top to decrease edge effects, like the upturned edge of modern airplane wings.

So here is a comparison of Flower Turbines with other technologies.

Type	Efficiency	Noise	Birds	Starting Speed
Horizontal axis	30%+	High	Dangerous	3 meters per second
Vertical axis lift	15-25%	High	Dangerous	3 meters per second
Vertical axis helix	5-10%	Medium	Dangerous	5 meters per second
Vertical axis drag	7-10%	Low	Safe	2-3 meters per second
Flower Turbines	Over 40% alone; when including the cluster effect, the performance increases so that it performs 20-50% better; technically, that is not "efficiency"	Low	Safe	1.2 meters per second

The cluster effect, explained on the web page, adds 20-50% beyond the efficiency of the turbine alone.

The above information showed that we decreased turbulence within the turbine and from turbine to turbine.

The next step is reducing turbulence from environment to turbine. Buildings can interfere with rooftop wind.

We have a patent pending on how to deflect or redirect turbulent wind away from a rooftop turbine. The basic idea is to use aerodynamic spoilers.