Making a Saguaro H.A.W.T. (Horizontal Axis Wind Turbine)

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Saguaro cacti can withstand high desert winds, using pleats and spines to redirect wind toward the top of the plant. Wind turbine towers can be improved by imitating the saguaro cactus. It was hypothesized that a tower modelled after a saguaro would be more aerodynamically efficient and have greater load-bearing capability than the common tubular tower. Two wind turbine towers were constructed; one was a control modelled after a tubular tower, and the other was modelled after the structure of a saguaro. The towers first underwent a test of aerodynamic efficiency which discovered which tower could generate more turbine rotations. Then a load-bearing test was performed that discovered which tower could bear more weight without breaking. The results from the aerodynamic efficiency test showed that using a turbine on top of the saguaro tower generated up to 55% more turbine rotations than when using the control tower, especially at low wind speed. The results of the load-bearing test were inconclusive because neither tower broke or showed structural change or damage after bearing the maximum amount of weight. The hypothesis was both confirmed and not confirmed because the saguaro tower was more aerodynamically efficient than the control tower but was not proven to have greater load-bearing capacity. These results show that using a saguaro tower would produce more electricity than a tubular tower. Its efficiency at lower wind speed would make wind power a viable option for areas with lower wind speeds. Further research would explore materials and cost analysis.

Awards Won:
Arizona State University: Arizona State University ISEF Scholarship
University of Arizona: Renewal Tuition Scholarship