The Impact of Reflective Parabolic Wing Position to Concentrating Solar Energy in a CAD Designed Automated Arduino Controlled Solar Tracking Absorption Device

Abstract

The purpose of this study was to identify the impact of parabolic wing angle on a solar energy absorption unit's ability to harness energy from the sun as measured by the unit's internal temperature. Four units were designed, first in CAD, then 3D printed, and finally fully prototyped for study. The top of the units was at 55 degrees from horizontal which is the average position of the sun for all seasons in my location. The first unit served as a control with no parabolic wings. The second unit had a wing angle of 90 degrees to the unit's top surface. The third unit had a wing angle of 60 degrees to the unit's top surface. The fourth unit had a wing angle of 45 degrees to the unit's top surface. The four units were placed outside on five mostly sunny to sunny days to measure how hot each unit got. Measurements were taken every thirty minutes for a total of three hours and six measurements. Units were all placed on Arduino controlled 360-degree rotating tables. Sensors in the back of each unit directed the table to position the unit for optional sun absorption. Results indicated that the angle of the parabolic wings did impact energy absorption with the unit with 60-degree wings outperforming the other three units 64% of the time. Another finding was that the height of the sun also impacted energy absorption with the 60-degree wings consistently outperforming when the height of the sun was greater than 30 degrees from the horizon. The 45-degree wings outperformed the other three units 26% of the time. The 90-degree unit consistently performed the worst during the test as shadows from the wings block solar radiation. The control performed better than the 90-degree unit, but significantly worse than the 60- and 45-degree units, indicating that parabolic wings did, in fact, increase energy absorption from the sun.