Black Silicon Inflatable Hybrid Solar Power, a 3rd Year Study

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The purpose of this experiment was to create a solar power apparatus with improved efficiency by pairing black silicon solar submerged in circulating water with an inflatable solar concentrator. The spherical inflatable solar concentrator was created out of silver mylar and clear mylar and mounted to an apparatus that contained the solar cell in a waterproof box. The black silicon solar cells are silicon solar cells that are chemically etched to reduce reflectivity by altering its surface on a submicroscopic level, which allows it to better absorb light at oblique angles. Each black silicon cell that was tested had a different etching time. Tests were run first with the inflatable concentrator and then the water circulation was added. During testing, a HOBO data logger and an ammeter collected data points that were transferred to the computer for analysis. The data shows that inflatable concentrated solar provided up to 24% improvement in power output compared to the same solar cells without concentrated collection. Concentrated solar causes the cells to become very hot, which would otherwise be inefficient. Cooling the solar cell with flowing distilled water improves the efficiency up to 13% over uncooled cells in a concentrator because solar cells are more efficient at lower temperatures. A black silicon solar cell with water circulation paired with an inflatable solar concentrator is over 40% more efficient than a silicon cell alone.