Generating Renewable Power by Harvesting Energy in Rainfall

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The world is transitioning from fossil fuels to renewable alternatives such as wind and solar power. This research introduces a new type of renewable power from rain, through the piezoelectric effect. The piezoelectric effect occurs when a mechanical force is applied to a crystal, which generates a small voltage. In this research, rain acted as the mechanical force on a constructed device that included a piezoelectric crystal. Three different angles (orientation of the device with respect to the ground onto which the rain falls) were tested -- 0°, 20° and 30°. It was hypothesized that as the angle increased, a greater output would be observed. To test this, a piezoelectric crystal, mounted on a substrate, was connected to an Arduino, which measured the output (voltage). Each trial recorded 200 voltage measurements at 0.25s intervals. Forty-seven such trials were recorded for each angle. The data for each trial were integrated to produce a measure comparable to energy produced. A statistical t-test was conducted to compare each dataset. As demonstrated by the t-test, the findings from the research supported the research hypothesis; there was a direct relationship observed between angle and output. This likely occurred for two reasons. Splashing of water and the pooled accumulation of water atop the flat piezoelectric device compared to the angled devices would have each resulted in a lower force on the piezo. Future studies could include scaling the device design and material improvements to increase the inherent efficiency of piezoelectric crystals to produce larger energy output.

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