Thermoelectric Generator's Effect on Photovoltaic System's Output

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As fossil fuel depletion drives the shift to alternative energy sources, this project aims to enhance efficiency and sustainability by combining a thermoelectric generator (TEG) with a photovoltaic (PV) system to create a hybrid energy solution. The TEG converts waste heat from the PV cell—such as infrared and ultraviolet energy—into additional electrical energy, reducing the risk of overheating and prolonging the lifespan of the PV system. The hypothesis is that if a TEG was attached to a PV, then the electricity output would be greater because of the additional use of waste heat to produce electricity. The independent variable is the PV system with the TEG (PV-TEG), while the dependent variable is the combined electricity output. The control group consists of the PV system without the TEG. Constants include the experiment duration, buck converter, aluminum heat sinks, Arduino, soldering materials, and solar panel model. To implement the system, start by 3D printing the housing for the solar panels. Then, solder the panels in series and connect them to a buck converter linked to a solar power module. Attach a battery and connect Arduino’s analog pins for voltage measurement. Secure the components and program the Arduino to read battery voltage. For the PV-TEG system, repeat the previous steps, attach aluminum heat sinks, solder four TEGs in series, and install cooling fans. Connect the fans to a breadboard for power and wire the Arduino, including additional analog pins to the buck and boost converters, linking the TEG output to the power module.

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