Monitoring the Performance of a Solar Stirling Engine
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The Stirling engine was invented in the early 19th century as an alternative to the steam engine, which was primarily used at the time. The engine gains its power from a piston that moves back and forth repeatedly, creating power that can either be stored or used immediately. Stirling engines can be powered by solar power or heat, in the event solar power is not available. The rise in temperature from the heat or solar power causes the air in the piston to expand, also causing the area inside of the piston to expand as well. The air then escapes and the piston decompresses. This process occurring hundreds of times is what creates the power, which can then be ran to a battery for storage or straight to another device to power it.

Harnessing Solar Power

People have been using the sun’s rays for thousands of years. Whether it was to create fire with the use of mirrors or to dry out things such as animal skins, the sun has been a constant factor over time. In the past few decades, the sun’s energy has been harnessed for something else, electricity. Solar power can be harnessed through use of panels or mirrors. In places all over the world, there are giant “farms” of solar panels that are being used to gather the rays from the sun and convert them into electricity. This electricity will then power generators and supply power to places such as homes and other buildings. When mirrors are involved, such as with the Stirling engine, the mirrors concentrate the solar rays from the sun into one focal point where the solar rays are collected and turned into electricity.

Stirling Engine

An Arduino is a programmable single-board microcontroller. It’s open-source prototyping platform makes it very flexible and easy to use. It allows the user to create programs that can control sensors and other things that interact with the environment around it. The Arduino is connected to sensors by using an electronic breadboard.

Arduino

There are two sensors that are used in this Stirling Engine setup. The first sensor takes temperature readings from the environment around the sensor.

Sensors

The second sensor measures the amount of light in the surrounding environment. The voltage is also measured using the Arduino.

Photoresistor vs. Time

Voltage vs. Time

Temperature vs. Time

The photoresistor and voltage readings were all consistent with what was expected over time. The photoresistor values were constant, while voltage rose and dropped based on the amount of heat the sunlight created. The heat dropping and rising caused the piston to either slow down or speed up. The temperature readings however were inconsistent because the wind was affecting the sensor’s readings. If the sensor could have been encased in the glass tube with the steel wool, it would have had much more accurate readings.

Applications in the World

Solar power has great potential. The world is running on sources of fuel that will run out in the future. New sources of energy that are renewable must be eventually found. Stirling engines are just one of the ways the world can move to a renewable source of energy. Even if homes could be partially powered by solar energy, it would not only help the world, but also save people money. Instead of paying companies for all of their electricity, homes can generate some of their own power for free. They would have to pay for the engine but that is all. The energy gathered could also be used to power other things as well such as cars or electronics. The waste from the energy used would be less harmful to the environment too.

References


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