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# Solar-Thermal-Electric Stirling Engine-Powered System for Residential Units

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**Abstract :** This project is focused on designing a Stirling engine system for a solar-thermal-electrical system that can supply electric power to a single residential unit. Since Stirling engines are heat engines operating any available heat source, is notable for its ability to generate clean and reliable energy without emissions. Due to the need of finding alternative energy sources, the Stirling engines are making a comeback with the recent technologies, which include thermal energy conservation during the heat transfer process. Recent reviews show mounting evidence and positive test results that Stirling engines are able to produce constant energy supply that ranges from 5kW to 20kW. Solar Power source is one of the many uses for Stirling engines. Using solar energy to operate Stirling engines is an idea considered by many researchers, due to the ease of adaptability of the Stirling engine. In this project, the Stirling engine developed was designed and tested to operate from biomass source of energy, i.e., wood pellets stove, during low solar radiation, with good results. A 20% efficiency of the engine was estimated, and 18% efficiency was measured, making it suitable and appropriate for residential applications. The effort reported was aimed at exploring parameters necessary to design, build and test a 'Solar Powered Stirling Engine (SPSE)' using Water ($H_2O$) as the Heat Transfer medium, with Nitrogen as the working gas that can reach or exceed an efficiency of 20%. The main objectives of this work consisted in: converting a V-twin cylinder air compressor into an alpha-type Stirling engine, construct a Solar Water Heater, by using an automotive radiator as the high-temperature reservoir for the Stirling engine, and an array of fixed mirrors that concentrate the solar radiation on the automotive radiator/high-temperature reservoir. The low-temperature reservoir is the surrounding air at ambient temperature. This work has determined that a low-cost system is sufficiently efficient and reliable. Off-the-shelf components have been used and estimates of the ability of the Engine final design to meet the electricity needs of small residence have been determined.

**Keywords :** stirling engine, solar-thermal, power inverter, alternator
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