UNIVERSITI TEKNOLOGI MARA

EXPERIMENTAL STUDY ON THE PERFORMANCE OF SOLAR THERMOELECTRIC GENERATOR

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MSc

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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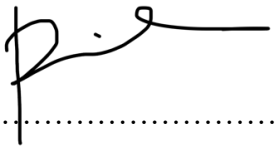
Signature of Student	:	 ……..
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ABSTRACT

An increasing demand on energy over years as well as the CO_2 emission of fossil fuels have led toward exploration on alternative energy sources mainly renewable energy. Solar, one of renewable energy sources, has proven to be beneficial as it is not only pollution-free, but can also be used to produce electricity and thermal energy. Two main solar technologies are used to harness the solar energy namely Solar Photovoltaic (PV) and Solar Thermal system. The former converts solar energy to electricity whereas the latter produces useful thermal energy from the solar energy. Nevertheless, solar thermal collector can also be combined with a heat-to-electricity-direct-conversion technology called Thermoelectric Generator (TEG) to produce both electrical and thermal energy. The combination of these two technologies is known as Solar Thermoelectric Generator (STEG). The advantage of STEG is not only it can produce two different outputs, but also harness low grade heat such as solar energy by converting directly into electricity without the need of installing the moving parts or components. The absence of moving parts on power generation shows TEG is a maintenance-free and noise-free technology. Despite having the great advantages as mentioned earlier, STEG has also its drawbacks. Low power output has always been a major obstacle for this technology to become mature. Therefore, this research aims to evaluate STEG performance under different operating parameters as well as investigating the impact of different TEG array configuration. The impacts of operating parameters which are water flowrate and tilt angle and two TEG array configurations (TEG Series and TEG Parallel) were evaluated through an outdoor experimental work. Prior to this, a theoretical model was developed to predict and compare STEG performance with experimental result. The comparison of maximum power output resulted in a good correlation between the theoretical and the experimental data. A maximum deviation obtained is 19%. From the findings, STEG produced the highest electrical output with the highest water flowrate. With a maximum water flowrate of 33 ml/s, the average open-circuit voltage recorded is 518 mV. As for tilt angle, STEG electrical output increased from 100 mV/day to 401 mV/day when tilt angle increased from 3°to 20°. However, STEG electrical output decreased from 401 mV/day to 300 mV/day when tilt angle increased from 20° to 30°. This study shows the tilt angle plays a significant impact on the STEG performance. In term of TEG array configuration, TEG Series always produced higher power output than TEG Parallel.

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