



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**GENERATE CURRENT FROM WASTE HEAT CALLED
SEEBECK GENERATOR USING PELTIER MODULE**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Mechanical Engineering Technology (Refrigeration and Air-Conditioning Systems).

by

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TAJUK: Generate Current From Waste Heat Called Seebeck Generator Using Peltier Module

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DECLARATION

I hereby, declared this report entitled “Generate Current From Waste Heat Called Seebeck Generator Using Peltier Module” is the result of my own research except as cited in references.

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Date :

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Refrigeration and Air-Conditioning System). The member of the supervisory is as follow:

.....
(En. Amir Abdullah Bin Damanhuri)

ABSTRACT

Thermo-electric generators (TEG) are based on completion of basic electronic of Seebeck which the devices that convert heat into usable electricity. TEGs require heat and cool as an energy source and TEGs can generate power as long as there is a heat source. 1.5 horse power air conditioning condenser units are used to investigate where most temperature differences occur during the operation of the condenser. For this purpose, several thermometers are placed inside the condenser unit to conduct the measurements. Measurements have been done during day and night time considering outdoor temperature to compare temperature variations inside the condenser unit based on outside temperature. I will install a thermo-electric generator inside an air conditioning condenser unit. This research is on efficiency, power generation capability/capacity, cost, size, potential consumer applications, and system installation, system circuit design to generate power.

ABSTRAK

Penjana Thermo-elektrik (TEG) adalah berdasarkan konsep elektronik Seebeck dimana peranti ini mampu menukar haba kepada tenaga elektrik yang boleh diaplikasi dan digunakan. TEGs memerlukan sumber daripada haba dan sejuk sebagai sumber tenaga. 1.5 unit kuasa kuda penyaman udara condenser digunakan sebagai sumber utama bagi mendapatkan suhu panas di mana kebanyakan perbezaan suhu berlaku semasa operasi pemeluwap. Untuk tujuan ini, beberapa sensor suhu diletakkan di dalam unit pemeluwap untuk membuat ukuran. Pengambilan data telah dilakukan pada siang hari untuk membandingkan variasi suhu di dalam unit pemeluwap. Peranti ini akan dipasang penjana termo-elektrik di dalam unit penyaman udara kondenser. Kajian ini adalah mengenai kecekapan, keupayaan penjanaan kuasa / kapasiti, kos, saiz, aplikasi pengguna yang berpotensi, dan pemasangan sistem, sistem reka bentuk litar untuk menjana kuasa.

DEDICATIONS

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LIST OF SYMBOLS AND ABBREVIATIONS

AIST	-	National Institute of Industrial Science and Technology
HVAC	-	Heating, Ventilating and Air-conditioning
IAQ	-	Indoor Air Quality
A	-	Area
C_v	-	Specific heat capacity with constant volume
EU	-	European Union
g	-	Gravity
h	-	Height
m	-	Mass
\dot{m}	-	Mass Flow Rate
P	-	Pressure
ΔP	-	Difference in Pressure
\dot{Q}	-	The amount of heat / heat radiation
R	-	Radius
S	-	Irradiance
T	-	Temperature
ΔT	-	Difference in temperature
\dot{V}	-	Volume Flow Rate
W	-	Weight
ε	-	Emmissivity
σ	-	Stefan BoltzmannConstant

INTRODUCTION

1.0 Introduction

In this chapter, introduction of the most important topics that involve background, problems statement, objectives, scope of the project are provided and the thesis organization of the overall chapters is provided within the same chapter.

1.1 Background of Research

The background of the study describes the most important subtopics such as energy saving, waste heat, air conditioning, principle of thermoelectric and heat transfer.

1.1.1 Energy

In science field, energy is a property of which can be exchanged to different objects or changed over into various structures. The "capability to perform work" is a typical depiction, yet it is hard to give one single far reaching meaning of as a result of its numerous energy (Mcgregor & Spring).

1.1.2 Air-conditioning System

Generally, the purpose of air-conditioning system is to maintain the indoor air quality and to provide thermal comfort inside the conditioned space. Maintaining a good IAQ is a very important measure to prevent the spreading of diseases throughout a building. Besides that, air-conditioning provides thermal comfort to conditioned space to the occupants. Generally, the application of air-conditioning system in daily life makes residences or occupants to be more comfortable especially in a warm climate country like in Malaysia.

Commonly, air-conditioning system can be divided into two categories, which are unitary refrigerant system, and the other one is centralised system (Norain, 2014). Both of these systems are known as conventional air-conditioning system, which depending on the vapour compression cycle. In the other means, if the area to be cooled is larger, the energy consumption will be higher as the compressor has to be worked more to overcome the heat. However, conventional air-conditioning system is not fit for the economic due to high energy intensive and takes about 60% of overall electrical consumption.

1.1.3 Heat Transfer

Heat transfer process is the most important approach that is more focused on the current experiments. The hydronic radiant cooling system used to transfer the heat generation inside the car to the circulated chilled water. The transfer can be defined as the exchange of thermal energy between physical system that depends on the temperature and pressure. Commonly there are three modes of heat transfer. The modes are conduction, convection and radiation. In hydronic radiant cooling system, convection and radiation are the associated heat transfer modes. This is because the exchange of heat occurs between the warm air indoors and the circulated chilled water in the copper tubes.

1.1.4 Thermoelectric Generator

Thermo-electric generators are all strong state gadgets that change over warmth into power. Dissimilar to conventional element heat motors, thermo-electric generators contain no moving parts and are totally noiseless. Such generators have been utilized dependably for more than 30 years of support free operation in profound space tests. Compared to vast, conventional warmth motors, thermo-electric generators have lower proficiency. Be that as it may, for little applications, thermo-electric can get to be aggressive on the grounds that they are conservative, straightforward (reasonable) and versatile. Thermo-electric frameworks can be effectively intended to work with little warmth sources and little temperature contrasts. Such little generators could be mass delivered for use in condenser waste warmth recuperation or home co-era of warmth and power (Allen, Haugeto, Kajor, & Namazian, 2002).

1.1.5 Heat Sink

In numerous electronic applications, temperature turns into an essential element when planning a framework. Exchanging and conduction misfortunes can warm up the silicon of the gadget over, it's maximum Junction Temperature (T_{jmax}) and cause performance failure, breakdown and most pessimistic scenario, fire. In this manner the temperature of the gadget must be computed not to surpass the T_{jmax} . To outline a decent Thermal Management arrangement, the tag ought to dependably be kept at the most reduced working temperature. Heat exchange happens when two surfaces have distinctive temperatures, in this manner bringing on warmth vitality to exchange from the hot surface to the colder surface. For instance, voltage is the main impetus that causes current to stream. By similarity, temperature is the power that causes warmth to stream. In the event that the temperature distinction is expanded, the measure of warmth stream will be expanded.

1.2 Problem Statement

In today's world, electricity would cost a lot of energy and resources and cause natural resources increasingly disturbed. To reduce energy consumption, recycling energy would be another alternative reaching green environment technology. Waste heat from the condenser outdoor unit is not used and cause global warming. From the web Results of study National Institute of Technology and Science (AIST) and the EU conference, the fact that a growing number of extraction of natural resources.

The main objectives of this project are:

- a) To develop a device that could collect waste heat from split unit condenser that could generate electricity.
- b) To study on electricity produce by using Peltier Generator.

1.3 Scope of Work

The scope of work under consideration for this current project is an testing to outdoor unit 1.5 hp Panasonic. The device (peltier module) install in condenser to absorb the source of heat. Moreover the scope includes the designing and installing of the copper tubes and inside the outdoor unit. In that device, copper plate is use for the trap the heat and the measurement copper plate is (12cm x 6cm x 0.2cm). The type of refrigerant use in the cycle is R22.

1.4 Organization of the Thesis

Chapter 1 explains the introduction of the project, which includes the background, problem statements, objectives and the work scope of the study. In chapter 2, the chapter briefly explains the review of theories, experimental works and some findings that had been done during the past research that is related to the current project. In chapter 3,

methodology and strategy to achieve the objectives is explained in detail. The working procedure, materials and apparatus are well explained.

LITERATURE REVIEW

2.0 Introduction

Our dependence on energy resources have created how to replace the original source to other alternative sources. Therefore, existing sources of energy will decrease. since oil is a limited asset. Throughout the years, the expense of power has ascended to exceptional levels due the restricted supply of oil and monetary and political elements. Along these lines, renewable energy is a more appealing other option to electricity generation, as it will likewise give a cleaner environment to future eras. in the today, there are numerous incredible answers for renewable energy, but some are unfeasible. In this project, a gadget will be made to acquaint a route for people with make renewable enrgy utilizing thermoelectric gadgets.

Renewable energy can be made by numerous strategies; for example, solar energy, wind energy, hydro energy, nuclear energy, and many more. For each of these diverse types of making power, there are sure impediments. solar energy is the most generally type of renewable energy that is utilized as a part of utilizations running from source energy to shuttle electrical frameworks. Notwithstanding, solar energy must be made when there is daylight, requiring the utilization of substitute energy sources, or a strategy for putting away energy for later utilize. Wind energy and hydro energy have their own particular confinements, making them deficient for more extensive utilization. Atomic energy is utilized as a part of utilizations, for example, power plants and military vehicles. Atomic sources can supply sufficient measures of energy, yet creates unsafe waste that is hurtful to the earth. This anticipate expects to give a wellspring of renewable energy that beats the restrictions of current strategies.

A thermoelectric gadget changes over heat sources to electrical energy by utilizing a variety of thermocouples. This gadget is a dependable wellspring of force for satellites, space tests, and even unmanned offices. Thermoelectric gadgets for profound space missions utilize a radioactive material, similar to plutonium, to produce warmth, and thermocouples to change over the warmth to power. Since a thermoelectric gadget has no moving parts, it is dependable and can produce power for a long time (Yildiz, Houston, Coogler, & Houston, 2014). Considerations have been done on enhancing the effectiveness of thermoelectric generator by fusing different advancements, similar to nanotechnology. By accomplishing a superior productivity, thermoelectric gadgets would require less radioactive material to create the same measure of force, making the force era framework lighter. Less radioactive material will likewise diminish the expense of spaceflight dispatches. Despite the fact that these gadgets are utilized for the most part as a part of rocket innovations, they can be additionally connected to advances on earth, which may assist add to the headway of innovation. A few utilizations of this innovation incorporate autos, computers, household appliances, etc. For instance, thermoelectric gadgets can improve the energy creation of cross breed cars by delivering power utilizing the wasteheat of the motor. On the off chance that a domain has a difference heat, thermoelectric gadgets can be connected, since they require little upkeep, and give power to numerous years.

2.1 Energy Savings

Energy investment funds are broadly perceived as a way to spare cash. In the meantime they add to the security of energy supply, nursery gas (GHG) discharges decreases, the quick and shoddy accomplishment of a maintainable energy supply, and to wrap things up, critical employment creation. In its late report Roadmap 2050: a useful manual for a prosperous, low-carbon Europe, the European Climate Foundation (ECF) perceives goal-oriented vitality investment funds as one of the requirements for a low carbon economy in Europe. The European Union (EU) perceives the significance of

energy reserve funds and has set an approach focus of accomplishing 20% energy investment funds by 2020, when contrasted with the same old thing energy use. This objective interprets into a flat out lessening of essential vitality use from 1800 Million tons oil comparable (Mtoe) in 2005 to around 1600 Mtoe in 2020. The EU, nonetheless, stays conflicted regarding this objective. For instance, the Presidency finishes of the European Council (25 and 26 March 2010) re-plan the objective as "moving towards a 20% expansion in energy proficiency".

2.1.2 Energy Recycle

Energy recycling is a from waste energy, which principally comes as overabundance warmth, is a characteristic by-result of force plants, and assembling forms that prepare, bake, boil, cook, burn, dry, distil, melt or otherwise heat things mechanical procedures. Boundless measures of waste energy are tossed out or vented into the environment, prompting smokestack after smokestack of undiscovered energy. Energy reusing catches this waste energy and delivers it into force as spotless as wind or sun blazed, slicing energy costs and an unnatural weather change contamination in the meantime.

2.2 Air Conditioning

Air-conditioning is procedure that ventilates the air, appropriates it consolidated with the outside air to the adapted space and in the meantime controls and keeps up the required space's temperature, stickiness, air development, air cleanliness, sound level, and weight differential inside foreordained points of confinement for the wellbeing and solace of the inhabitants, for item preparing, or both. The acronym HVAC&R remains for heating, ventilating, cooling, and refrigerating. The blend of these strategies is proportionate to the limits performed aerating and cooling (Kreith, Raton, Press, & Wang, 1999).

2.2.1 Air Conditioning System

An aerating and cooling or HVAC&R framework comprises of parts and hardware organized in successive request to warmth or cool, humidify or dehumidify, clean and sanitize, constrict frightful gear commotion, transport the adapted open air and recycle air to the moulded space, and control and keep up an indoor or encased environment at ideal vitality use.

2.2.2 Types of Air Conditioning System

In institutional, business, and private structures, cooling frameworks are fundamentally for the occupants' health and comfort. In assembling structures, ventilating frameworks are accommodated item handling or for the health and comfort of specialists too a preparing, and are called preparing aerating and cooling frameworks. Based on their size room or building , development, and working attributes, air-conditioning systems can be classified as the following.

a) Split unit

A split air conditioner consists of two main parts: the outdoor unit and the indoor unit. The outdoor unit is installed on or near the wall outside of the room or space that you wish to cool. The unit houses the compressor, condenser coil and the expansion coil or capillary tubing. The sleek-looking indoor unit contains the cooling coil, a long blower and an air filter.

2.2.3 Basic Refrigerant Cycle and Component

Principles of Refrigeration are:

- a) Liquids retain heat when changed from fluid to gas.
- b) Gases emit heat when changed from gas to fluid.

For an aerating and cooling framework to work with economy, the refrigerant must be utilized over and over again. Consequently, all aeration and cooling systems utilize the same cycle of compression, condensation, expansion, and evaporation in a closed circuit. The same refrigerant is utilized to move the warmth from one region, to call this zone, and to remove this warmth in another region.

- a) The refrigerant comes into the compressor as a low pressure gas, it is packed and after that moves out of the compressor as a high pressure gas.
- b) The gas then streams to the condenser. Here the gas gathers to a fluid, and radiates its warmth to the outside air.
- c) The fluid then moves to the development valve under high pressure. This valve limits the stream of the liquid, and brings down its weight as it leaves the extension valve.
- d) The low pressure fluid, then moves to the evaporator, where heat from within air is retained and transforms it from a fluid to a gas.
- e) As a hot low pressure gas, the refrigerant moves to the compressor where the whole cycle is repeated.

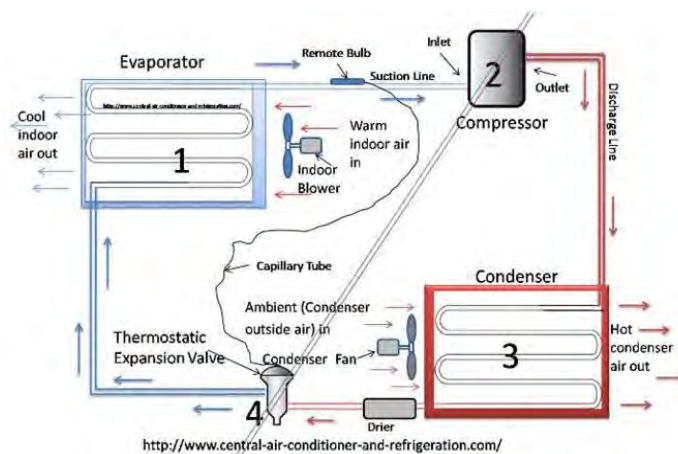


Figure 2. 1: Basic refrigerant cycle