

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 BACKGROUND OF STUDY**

Ground Source Heat Pump (GSHP) system uses the ground temperature as a heat source in a heating mode and a heat sink in a cooling mode, respectively. In the cooling mode, GSHP system absorbs heat from the conditioned space and discharges it to the ground through a ground heat exchanger while air source heat pump (ASHP) system discharges heat to outdoor air. Therefore, the coefficient of performance (COP) of ASHP system is generally confined to the limited value strongly dependent to the outdoor temperature.

However, the water circulated through the ground heat exchanger is used as the heat sink of the condenser, in which the temperature is lower than outdoor air, in spite of that it can be possible for GSHP system to have higher COP than ASHP system. In this study, the coils length and hole depth during GSHP installation process will be focus. Besides, the effect of soil moisture to the coils length and hole depth will be discuss. This system mainly consists of three separate circuits: (a) the ground heat exchanger circuit, (b) the refrigerant circuit and (c) the fan-coil circuit or air circuit.

#### **1.2 STATEMENT OF THE PROBLEMS**

Nowadays, the temperature in Malaysia is increasing day by day. Many of the owners use air-conditioners in order to decrease the temperature in their houses. But, the usage of the air-conditioners may increase their electricity bill. So, the cooling systems that user friendly and cheaper must be created. In this project, the Ground Source Heat

Pump systems that can replace the conventional systems will be discovering. Since Ground Source Heat Pump are the one of the fastest growing applications of renewable energy in USA and Europe, so it's would possible to apply these systems in Malaysia and see whether it is suitable for use in hot country like Malaysia and Asia region. The usage of Ground Source Heat Pump systems as cooling systems will help people to decrease their monthly electric's bill and to avoid global warming become more serious.

### **1.3 OBJECTIVES OF THE STUDY**

- i. To study and analysis of vapor compression heat pump to be used as heat sink.
- ii. To study about vapor compression heat pump in order to build a circuit that suitable for cooling system.
- iii. Finding the best type of Ground Source Heat Pump to be used as a cooling system.
- iv. Finding the suitable coils length and hole depth according to the soil moisture.

### **1.4 SCOPE OF STUDY**

- i. Research appropriate heat pump circuit that suitable for cooling system with ground as heat sink.
- ii. The types of Ground Source Heat Pump that will be discuss are open loop systems and close loop systems. The closed loop can be dividing into four types, which are horizontal loop, vertical loop, slinky loop and pond loop. The capability of the each system is determine base on their advantages and disadvantages. The best system will picking as the cooling system in this study.
- iii. The soils that are use in this project are sand soil, which is a main soil in Pekan. The side effects that can cause by soil are neglect.
- iv. The coils length and hole depth base on the soil moisture (5%, 10% and 15% soil moisture) will be determined by the equation that will be discuss in chapter 3.