CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

In Malaysia, the demand for electricity in Malaysia is growing in tandem with its Gross Domestic Product (GDP) growth. It received a welcomed boost from the rollout of projects under the rolling 5-year Malaysia Plans and the on-going Economic Transformation Programme (ETP). The forecasted growth for electricity has shown an increase of 3.7% in 2012 compared to 3.1% in 2011. This growth has been driven by strong demand from the commercial and domestic sectors. For the period till 2020, the average projected demand for electricity is expected to grow at 3.1%. Based on this forecast, the country is going to need even more energy as it strives to grow towards a high-income economy. An estimated 10.8 GW of new generation capacity will be needed by 2020 given that 7.7 GW of existing capacity are due for retirement.

By 2020, the total installed capacity will see an increase of 16% over the total installed capacity in 2012. Of this new capacity, gas and coal will continue to feature strongly in the Peninsular energy mix for power sector, with coal probably taking up a bigger share on the basis of rising gas prices. The Government had approved The National Renewable Energy (RE) Policy and Action Plan on 2nd April 2010. One of the main elements of this policy was the introduction of the Renewable Energy Act which entails the implementation of the Feed-In Tariff (FiT) system. The FiT is a premium in which the RE

power is sold according to each RE sources. The introduction of the RE Act also provide a mandatory requirement for the utility to accept and buy RE power. Both the RE Act and the FiT System was enforced on 1st December 2011. On 1st September 2011, the Sustainable Energy Development Authority of Malaysia (SEDA Malaysia) was officially established to undertake the role of a one stop centre to promote sustainable energy and to help facilitate the RE industry (Chin, 2012).

Hybrid energy has become an alternative source of energy nowadays. Higher energy demand and decrease in supply of fossil fuels and coals for energy enhance the research on the hybrid energy since it plays the important role in our live. Basically, hybrid energy usually consists of two or more renewable energy sources used together to increase system efficiency as well as greater balance in energy balance. Several types of renewable energy are solar, wind, biomass, geothermal and hydropower.

For this project, it will emphasize more on solar and wind energy as the combination for hybrid energy system. The reason on choosing this combination is because solar energy is one of the best renewable energy sources as it also suitable to use in Malaysia due to the high solar radiation received per year. Figure 1.1 shows the annual average daily solar irradiation in Malaysia where Malaysia receives about 4.96 kWh/m^2 of solar radiation in a year. The maximum solar radiation receive is 5.56 kWh/m^2 mostly in Northern region of Peninsular Malaysia and Southern region of East Malaysia. The Southern and Northeast region of Peninsular Malaysia as well as most parts in Sabah receives the lowest solar radiation (Azhari et al., 2007).

The Earth receives 174 petawatts (PW) of incoming solar radiation (insulation) at the upper atmosphere. Approximately 30% is reflected back to space while the rest is absorbed by clouds, oceans and land masses. The spectrum of solar light at the Earth's surface is mostly spread across the visible and near-infrared ranges with a small part in the near-ultraviolet. Earth's land surface, oceans and atmosphere absorb solar radiation, and this raises their temperature. Warm air containing evaporated water from the oceans rises, causing atmospheric circulation or convection. When the air reaches a high altitude, where

the temperature is low, water vapor condenses into clouds, which rain onto the Earth's surface, completing the water cycle.

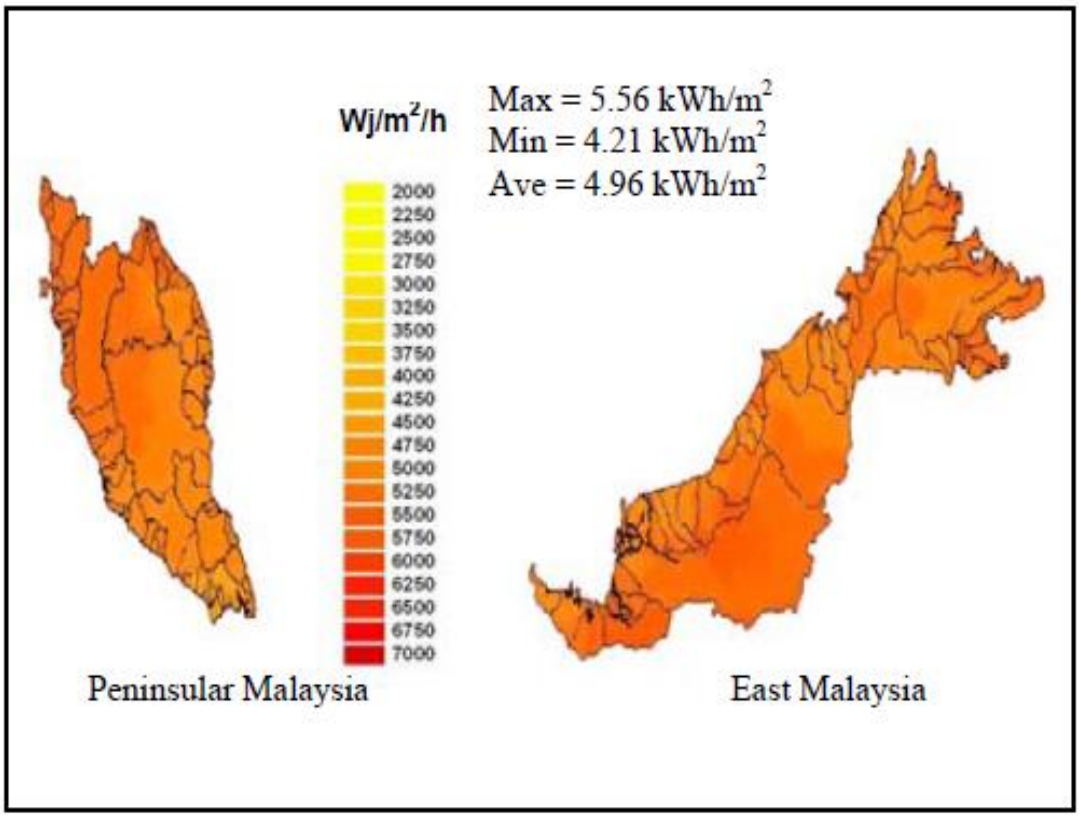

Figure 1.1: Annual average daily solar irradiation of Malaysia

Source: Azhari et al., 2007

The latent heat of water condensation amplifies convection, producing atmospheric phenomena such as wind, cyclones and anti-cyclones. Sunlight absorbed by the oceans and land masses keeps the surface at an average temperature of 14 °C. By photosynthesis green plants convert solar energy into chemical energy, which produces food, wood and the biomass from which fossil fuels are derived (Noor et al., 2011).

Next, wind energy growth in Asia is on the rise. Both India and China are leading the switch to wind energy with more installed capacity and manufacturing facilities. India rank fourth with 4.4 GW production and China in eighth with 1.26 GW. The Asian region is set to be the most dynamic geographical zone with a growth rate of 48 % (Darus et al.,