CHAPTER 1

TRANSITION INTO RENEWABLE ENERGY UTILISATION

Mohd Faizal Hasan

1.1 INTRODUCTION

Sustainable energy technology is very important for creating a better future, in which could secure a safe life for our generation. Sustainable energy basically is known with two pillars; renewable energy technology and energy efficiency improvement. It is closely related to Sustainable Development Goals (SDG) that emphasises affordable and clean energy. Sustainable energy is meant to address the fossil fuels related issues as well as to preserve our ecosystems.

As the world population and energy demand are continuously growing, the increment in conventional fossil fuels usage is unavoidable to happen, and this negatively affects our environment especially in terms of global warming effect. These fossil fuels are non-renewable and need hundreds or thousands of years to replenish them. Therefore, the significant increment in fossil fuels demand causes difficulty in balancing between the available reserves and demand (Singh et al., 2013). In this case, a transformation from sole dependence on non-renewable resources to expansion in renewable energy usage is very crucial to cope with this scenario.

The main renewable energy sources in the world currently are solar, wind, hydropower, biofuels and others. In year 2023, the renewable shares in electricity generation were around 30%, and it is expected to increase to

around 42% in year 2028 (International Energy Agency [IEA], 2023), thus indicating a significant effort for energy transformation from non-renewable to renewable energy sources. In addition, the depletion of fossil fuels could be potentially replaced by these various types of renewable energy sources.

Meanwhile, in Malaysia, the shares of non-renewables such as natural gas, coal and petroleum as well as other liquids is considered still high. Based on Figure 1.1, for year 2019, percentage of non-renewable shares is around 94%, therefore the measures to stimulate the usage of non-renewable energy sources need to be implemented. Malaysia is enriched with abundant agricultural residues such as empty fruit bunch, mesocarp fibre, palm kernel shell, petiole and palm oil mill effluent (POME) that are produced at palm oil mill and plantation area. Rice husk that is produced at paddy farm also has potential to be utilised as a biomass energy source.

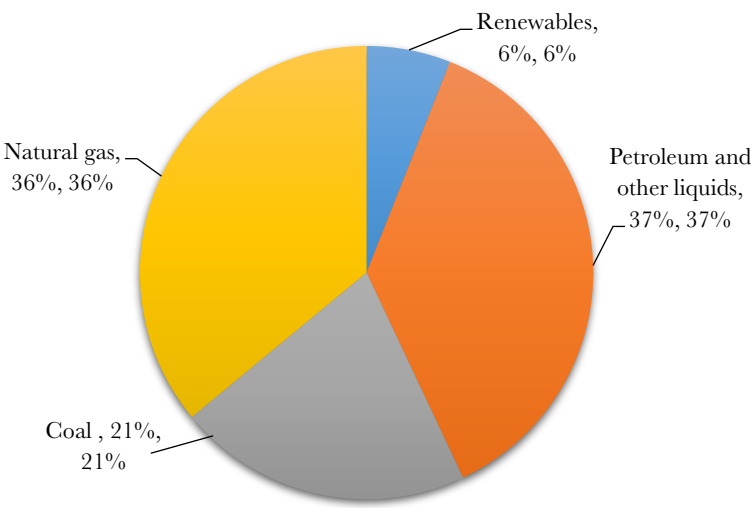

Figure 1.1 Primary energy consumption in Malaysia for year 2019 (Source: International Energy Agency [IEA], 2021)

One of the pillars for sustainable energy is energy efficiency improvement, which means energy usage becomes less to produce the same work output. For instance, the utilisation of thermal energy contained in combustion gases exhausted from a gas plant for electricity generation in a steam power plant. This is called heat recovery technique. The other example is the utilisation of thermal energy contained in gases produced from biomass combustion for various biomass pretreatments such as drying, torrefaction and pyrolysis. Besides, the modification of combustion techniques also could contribute to the improvement in energy efficiency, that is in terms of combustion performance. An example of this modification is the implementation of dual-fuel combustion strategy to enhance the combustion of less volatile biofuels.

The major benefits could be obtained from energy efficiency improvement in terms of several aspects. In terms of the environment, one of the benefits is lowering greenhouse gas (GHG) emissions, and other pollutants as well. Based on Figure 1.1, it can be clearly observed that in year 2019, the use of fossil fuels still dominates the Malaysia energy consumption share. In this case, when the consumption of fossil fuels can be reduced to produce the same amount of work, the GHG emissions also can be reduced directly. Alternatively, switching partially the use of fossil fuels to renewable energy sources also can contribute to the reduction of GHG emissions. For instance, the utilisation of biomass-based fuels instead of fossil fuels in combustion can reduce the net GHG emission due to the carbon neutral characteristics, whereby the carbon dioxide released during combustion is consumed back by plants during their growth. In short, two important measures were found to have potential for solving the climate change issues: (1) Energy efficiency improvement, and (2) The development and the use of renewable energy sources (Adua et al., 2021).

In terms of economical aspect, it can stabilize the price and volatility of electricity, thus contributing to the reduction in individual utility bills. Until now, Malaysia still depends strongly on imported coal and other fossil fuels for power generation (Rashidi et al., 2022). Therefore, the global increment in coal prices put pressure on the power