CHAPTER 1
INTRODUCTION

1.1 Background

Human desires energy to do their activities. They built machines for helping them in many field. Machines converts an amount of energy into other energy which usable for human works. In 17's century, James Watt found the steam engine which works with vapor energy from heated water. It also need combustion to produce vapor with high pressure, so that the engine can drive heavy tasks. This invention triggers industrial revolutionary where people built other machines based on steam engine.

In the 18's century, many researchers built the fuel combustion machines. Those machines need fuel which in form gas or liquid as its resource. Fuel which stored in a tank, is sprayed in a high pressure chamber. In a point at which fuel blasted, it produces mechanical energy for driving motor. Motor fuel leaves heat and pollution as its waste. It also consumes fuel energy from fossil fuel which might be exhausted some day.

Fuel motor became very popular at those ages. But it has drawbacks as mentioned in above. People start researching the other motor. In middle 1750, Benjamin Franklin did a research which detects electrons flowing in a conductor. Researchers continue the study of the electron flow. In 1821, Michael Faraday complete his research about the law of electromagnetic (EM) induction, and invented induction motor after that.

Electrical energy has flexibility conversion from or into some kinds of other energy, like motion, heat, light, pressure, etc. Because of that, electric devices are more popular. Source of electricity is coming from generator. Conventional generator needs fossil fuel for its sources. As people raise the use of electrical devices, fossil fuel are decreasing. It needs more than a thousand years to produce fossil fuel.

Researchers has been studying for using other kinds of energy which clean, safe, available in future. These sources are used to generate electricity and going back to its nature. Two kinds of the renewable source are sun light and hydrogen. Sun light, which is available every day, produces electricity by using photovoltaic (PV). While hydrogen, which is abundant in air, generate electricity using hydrogen generator. Combining these two devices in a system and adding electric motor, battery, and control circuit on it, able to make new system called solar hydrogen generation [Baby Pooja, 2013].

Solar-hydrogen generator is very useful to supply electricity for electric motor to drive wheels. Sun light converted into electricity which is used to separate hydrogen and oxygen

in an electrolyte. Hydrogen is used for generates electricity through fuel cell before it turning back into water and heat as disposal. Waste of solar-hydrogen motor is cleaner than waste of combustion motor [Balat, 2008].

The structure of hydrogen is the most simplest comparing from others. In this world, large number of hydrogen are available. But they merge with other atoms and make chemical compound. Water, air, hydrocarbon are kinds of compound that contain hydrogen. Only pure hydrogen extracted from its compound is the source of hydrogen generator. Number of hydrogen production affects produced electricity.

Hydrogen can be produced through water electrolysis which electricity is supplied from PV. PV arrays placed in open place where sun light reach it. Generated electricity flows to electrolyte water through two electrodes, anode and cathode. If the PV place is separated by wall or roof, then long wire should be connected from PV output to electrodes. Long wire is hard to arrange. While it is broken, the supplied power from PV is stopped.

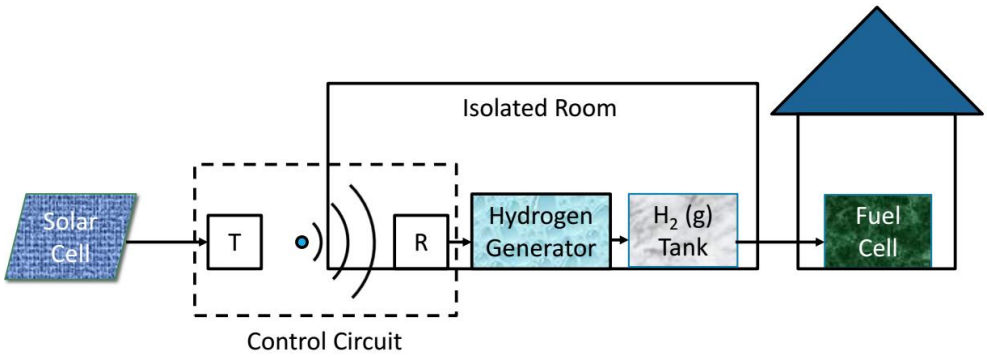

Figure 1. 1 Solar-hydrogen generation via wpt

This research provides the methods sending electric power via EM field. Since the wire has drawbacks in above, the electric power from PV should be delivered without wire. This methods is called Wireless Power Transfer (WPT) [K. Yamaguchi, 2014]. EM can penetrate the solid things like wall or roof as shown in Figure 1.1. Hydrogen is dangerous because it might explode under specific circumstance. It is more safe separating hydrogen generation from PV. Another reason is suitable for the electrolysis process inside house while PV array is placed outside.

1.2 Objectives

This thesis objective is simulating WPT, which is transmitting electric power from PV to electrodes, by using mathematical software and circuit simulator. This WPT helps PV wirelessly sending electric power to the electrodes for generating hydrogen process.

1.3 Problem Statement

The problems stated in this thesis are:

1. How much power output should be delivered from WPT for electrolysis process?
2. How much power input should be supplied from PV to WPT?
3. How much the efficiency of the WPT system?
4. How is the relation power output and efficiency in WPT frequency?

1.4 Scope of Research

This thesis concerns about WPT as control circuit in solar-hydrogen generation system. WPT uses alternating current wave for its input. It generates EM field which sending power wirelessly.