A study of using solar energy for stadium in Malaysia

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Laporan ini dikemukakan sebagai
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PENGAKUAN

"Saya akui laporan ini adalah hasil kerja saya sendiri kecuali ringkasan dan petikan yang tiap-tiap satunya saya telah jelaskan sumbernya"

Tandatangan:……………………..
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ABSTRACT

This project is regarding a study of using solar energy for stadium in Malaysia. The system is using the solar energy to the stadium as the main energy or additional energy backup. The case study need study whether this system can support the usage of the stadium or not, and it is compatible or need another research and development to operate in excellent condition. Throughout observation and study, solar energy is a suitable and available power source that could produce efficient output to the stadium without emission, but need the large scale of solar panel to ensure enough energy been collected to power the stadium. This system will replace the main electric power in the stadium, which is trying to save cost for electricity usage for the stadium and whether this system can powered the electricity off grid or without conventional electricity. In this study proved or not this system is relevant or not for the stadium. This case study is not mandatory to conclude this solar energy is the best way or not but can the solar energy been used efficiently to stadium.

ABSTRAK

Projek ini adalah berkaitan kajian mengenai penggunaan tenaga solar untuk stadium di Malaysia. Sistem yang hendak dibangunkan adalah menggunakan tenaga solar untuk membekalkan tenaga elektrik sebagai tenaga utama. Kajian ini menuntut untuk mengkaji samada sistem ini mampu untuk menampung penggunaan elektrik stadium ataupun tidak, dan adakah system ini sesuai atau memerlukan kajian dan pembangunan yang lain untuk beroperasi di dalam keadaan yang optimum. Melalui pemantauan dan kajian, saya memahami yang bahawasanya tenaga solar ini adalah sesuai dan tenaga keluarannya mampu untuk menampung kegunaan stadium tetapi memerlukan panel solar dalam skala dan saiz yang besar. Kajian ini juga mengkaji samada sistem ini relevan atau tidak untuk dibangunkan. Secara teori dan amalinya sistem ini sangat bersesuaian dengan negara seperti Malaysia yang berada di garisan Khatulistiwa dan mendapat sinaran cahaya matahari yang banyak di siang hari.

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CO2	**Carbon dioxide**
MW	**Mega Watt**
USA	**United State of America**
H2O	**Water**
K	**Unit of temperature,Kelvin**
PV	**Photovoltaic**
PC	**Photochemical**
PB	**Photobiological**
H	**Hydrogen**
MIT	**Massachusetts Institute of Technology**

CHAPTER 1

INTRODUCTION

1.1 Background

Solar energy is the utilization of the radiant energy from the sun. Solar power is used interchangeably with solar energy but refers more specifically to the conversion of sunlight into electricity by photovoltaic and concentrating solar thermal devices, or by one of several experimental technologies such as thermoelectric converters, solar chimneys and solar ponds. A study of using solar energy for stadium been introduced in this project to cut cost due to electricity cost that already rising up due to increment of fuel price and operational cost. Solar energy as we know are clean, no pollution and environmental friendly. Its also can be converted or manipulated into another type of energy. This idea is trying to conserve the solar energy into electricity and can be used anytime needed. But to realizing this must construct energy conserve or battery to reserve electricity generated. But to build the system required a lot of money but give many benefits for the long term. The system want to be develop also must have potential to been upgrade in the future if authority want to convert this system to the full scale solar power system, without electric power. This project also can be determined as a start of such projects that dual purpose, to cut cost and reduce of using electricity power. The stadium design also played as a main character. Stadium share a common to another, which is less roof and have a great area of pedestrian walk. This area can been used to install the solar panel depend on how many power that we want to generate.

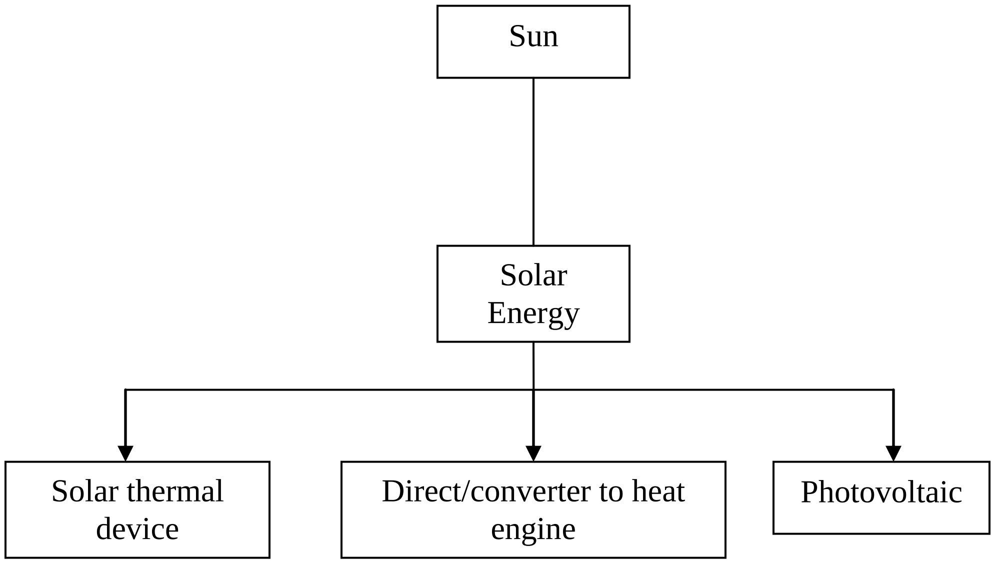

Figure 1: Application of solar Energy

1.2 Objective

The objectives of this research are:

1) Explaining type of solar energy can be converted.
2) Apply solar energy for application.
3) Considered the design of the solar panel

1.3 Scopes

The scopes of this study are:

1) To design solar energy system to generate electricity power for stadium usage

2) To study a cost of implementing the system

3) To fabricate a model of the design.

This project maybe not required any prototype but must developed model scale which is explain clearly about its concept and how does it work.

1.4 Problem Statement

Normally, the operational cost for stadium is very high due to electricity cost. Therefore, the alternative energy such as 'solar power' has been use as an option to save the energy consumption. But can this project been built with a tight budget and been functioning in superb condition and the solar panel is too expensive. Another problem is design of solar panel that wants to install to the stadium. The design must not to reducing the stadium design and esthetic value or to visible. Bad weather also must be considered before construct solar panel. Solar panels that want to be build must have durability, strong enough and can be use for a long period without maintenance it. Position of solar panel also must be considered which is to been install at the roof top or other area within stadium.

CHAPTER 2

LITERATURE REVIEW

2.1 Renewable Energy Alternative

Renewable energy sources are expected to become economically competitive as their costs already have fallen significantly compared with conventional energy sources in the medium term, especially if the massive subsidies to nuclear and fossil forms of energy are phased out. Finally, new renewable energy sources offer huge benefits to developing countries, especially in the provision of energy services to the people who currently lack them. Up to now, the renewable sources have been completely discriminated against for economic reasons. However, the trend in recent years favors the renewable sources in many cases over conventional sources. The advantages of renewable energy are that they are sustainable (non-depletable), ubiquitous (found everywhere across the world in contrast to fossil fuels and minerals), and essentially clean and environmentally friendly. The disadvantages of renewable energy are its variability, low density, and generally higher initial cost. For different forms of renewable energy, other disadvantages or perceived problems are pollution, odor from biomass, avian with wind plants, and brine from geothermal. In contrast, fossil fuels are stored solar energy from past geological ages. Even though the quantities of oil, natural gas, and coal are large, they are finite and for the long term of hundreds of years they are not sustainable. The world energy demand depends, mainly, on fossil fuels with respective shares of petroleum, coal, and natural gas at 38%, 30%, and 20%, respectively. The remaining 12% is filled by the non-conventional energy alternatives of hydropower

(7%) and nuclear energy (5%). It is expected that the world oil and natural gas reserves will last for several decades, but the coal reserves will sustain the energy requirements for a few centuries. This means that the fossil fuel amount is currently limited and even though new reserves might be found in the future, they will still remain limited and the rate of energy demand increase in the world will require exploitation of other renewable alternatives at ever increasing rates. The desire to use renewable energy sources is not only due to their availability in many parts of the world, but also, more empathetically, as a result of the fossil fuel damage to environmental and atmospheric cleanness issues. The search for new alternative energy systems has increased greatly in the last few decades for the following reasons:

1). The extra demand on energy within the next five decades will continue to increase in such a manner that the use of fossil fuels will not be sufficient, and therefore, the deficit in the energy supply will be covered by additional energy production and discoveries.

2). Fossil fuels are not available in every country because they are unevenly distributed over the world, but renewable energies, and especially solar radiation, are more evenly distributed and, consequently, each country will do its best to research and develop their own national energy harvest.

3). Fossil fuel combustion leads to some undesirable effects such as atmospheric pollution because of the CO2 emissions and environmental problems including air pollution, acid rain, greenhouse effect, climate changes, oil spills, etc. It is understood by now that even with refined precautions and technology, these undesirable effects can never be avoided completely but can be minimized. One way of such minimization is to substitute at least a significant part of the fossil fuel usage by solar energy.

4). To optimize and safe energy usage of conventional energy, to reduce cost for the long term usage. It is because conventional energy reactor, power plant or hydroelectric dam using so many man powers, a lot of maintenance and must been monitoring all the time compare to solar energy which is less maintenance.

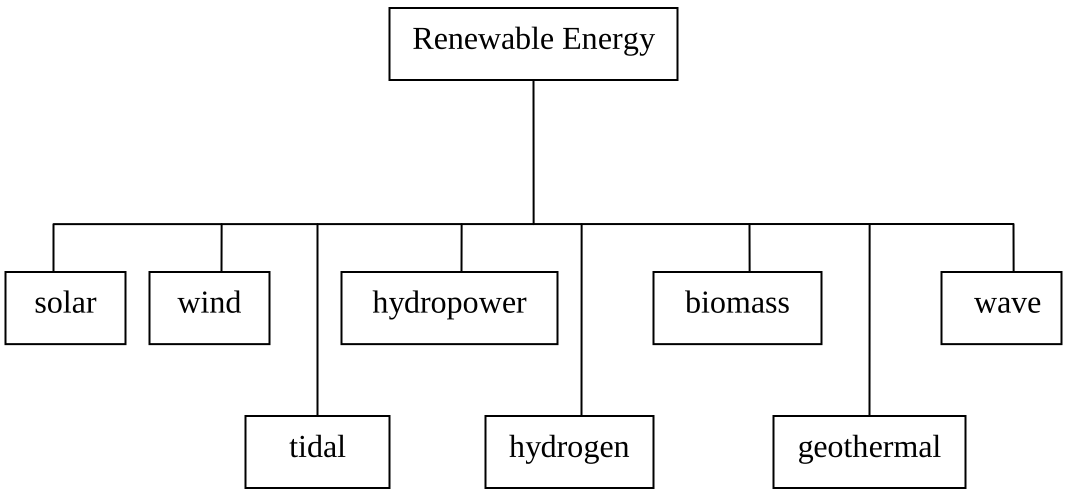

Figure 2.1: Classification of Renewable Energy

2.1.1 Solar Energy

In this context, solar energy refers to energy that is collected from sunlight. Solar energy can be applied in many ways, including to:

- Generate electricity using photovoltaic solar cells.
- Generate hydrogen using photo-electrochemical cells.
- Generate electricity using concentrated solar power.
- Generate electricity by heating trapped air which rotates turbines in a solar updraft tower.
- Heat buildings, directly, through passive solar building design.

- Heat foodstuffs, through solar ovens.
- Heat water or air for domestic hot water and space heating needs using solar-thermal panels.
- Heat and cool air through use of solar chimneys.
- Generate electricity in geosynchronous orbit using solar power satellites.
- Solar air conditioning

2.1.2 Wind Energy

Airflows can be used to run wind turbines. Modern wind turbines range from around 600 kW to 5 MW of rated power, although turbines with rated output of 1.5–3 MW have become the most common for commercial use; the power output of a turbine is a function of the cube of the wind speed, so as wind speed increases, power output increases dramatically. Areas where winds are stronger and more constant, such as offshore and high altitude sites are preferred locations for wind farms.

2.1.3 Hydropower

Energy in water (in the form of kinetic energy, temperature differences or salinity gradients) can be harnessed and used. Since water is about 800 times denser than air, even a slow flowing stream of water, or moderate sea swell, can yield considerable amounts of energy, (Wikimedia Foundation, Inc., 2008)

2.1.4 Biomass

Solid biomass is mostly commonly usually used directly as a combustible fuel, producing 10-20 MJ/kg of heat. Its forms and sources include wood fuel, the biogenic portion of municipal solid waste, or the unused portion of field crops. Field crops may or may not be grown intentionally as an energy crop, and the remaining plant byproduct used as a fuel. Most types of biomass contain energy. Even cow manure still contains two-thirds of the original energy consumed by the cow. Energy harvesting via a bioreactor is a cost-effective solution to the waste disposal issues faced by the dairy farmer, and can produce enough biogas to run a farm.

2.1.5 Wave

Wave power uses the energy in waves. Wave powers machines are usually take the form of floating or neutrally buoyant structures which move relative to one another or to a fixed point. Wave power has now reached commercialization. The possibility of extracting energy from ocean waves has intrigued people for centuries. Although there are a few concepts over 100 years old, it is only in the past two decades that viable schemes have been proposed. Wave power generation is not a widely employed technology, and no commercial wave farm has yet been established. In the basic studies as well as in the design stages of a wave energy plant, the knowledge of the statistical characteristics of the local wave climate is essential, no matter whether physical or theoretical/numerical modeling methods are to be employed. This information may result from wave measurements, more or less sophisticated forecast models, or a combination of both, and usually takes the form of a set of representative sea states, each characterized by its frequency of occurrence and by a spectral distribution. Assessment of how turbo-generator design and the production of electrical energy are affected by the wave climate is very important. However, this may have a major economic impact, since if the equipment design is very much dependent on the wave climate, a new design has to be developed for each new site. This introduces extra costs and significantly limits the use of serial construction and fabrication methods.

2.1.6 Tidal

Tidal energy is a form of hydropower that converts the energy of tides into electricity or other useful forms of power. Although not yet widely used, tidal power has potential for future electricity generation. Tides are more predictable than wind energy and solar power. Historically, tide mills have been used, both in Europe and on the Atlantic coast of the USA. The earliest occurrences date from the Middle Ages, or even from Roman times.

2.1.7 Hydrogen

Hydrogen is the most abundant element on earth, however, less than 1% is present as molecular hydrogen gas H2; the overwhelming part is chemically bound as H2O in water and some is bound to liquid or gaseous hydrocarbons. It is thought that the heavy elements were, and still are, being built from hydrogen and helium. It has been estimated that hydrogen makes up more than 90% of all the atoms or 75% of the mass of the universe (Weast 1976). Combined with oxygen it generates water, and with carbon it makes different compounds such as methane, coal, and petroleum. Hydrogen exhibits the highest heating value of all chemical fuels. Furthermore, it is regenerative and environment friendly, (Zekai Sen, 2008).

2.1.8 Geothermal

Geothermal power is energy generated by heat stored in the earth, or the collection of absorbed heat derived from underground, in the atmosphere and oceans. Prince Piero Ginori Conti tested the first geothermal generator on 4 July 1904, at the Larderello dry steam field in Italy.[1] The largest group of geothermal power plants in the world is located in The Geysers, a geothermal field in California. As of 2008, geothermal power supplies less than 1% of the world's energy. Geothermal can generally refer to any heat contained in the ground, (Wikimedia Foundation Inc., 2008).

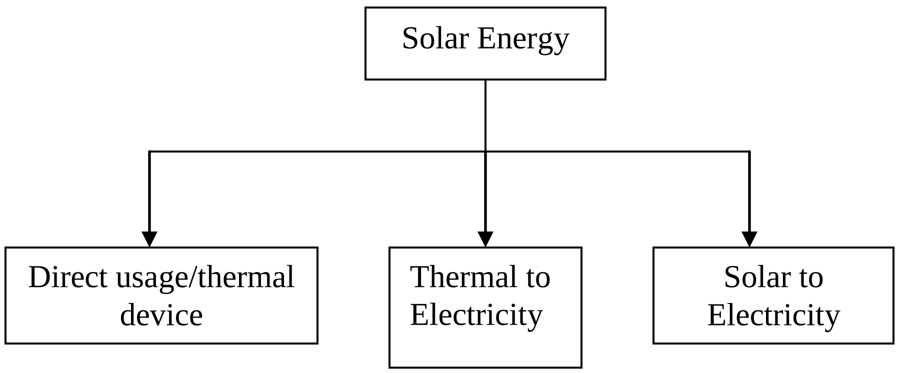

Figure 2.2: Application of Solar Energy

2.2 Sun as the Source of Solar Energy

Solar radiation and daylight are essential to all forms of life. Solar radiation is a fundamental energy for the survival and the development of living things. Daylight to humans is important in that it is necessary for visual comfort and providing psychological needs. Solar radiation is energy from the sun and daylight is part of the energy spectrum of electromagnetic radiation emitted by the sun within the visible wave-band that is received at the surface of the earth after absorption and scattering in the earth's atmosphere. Sunlight is the direct component of light while daylight is the total light from the sky dome. Solar radiation and daylight possess similar physical properties and modeling of one involves the other. Modeling solar and daylight availability requires slope irradiation and illuminance on a monthly averaged, daily or hourly basis, depending on the analysis. Daylight is also affected by attenuation due to absorption and scattering in the atmosphere and consists of direct (or beams); diffuse and ground-reflected components, (A. Zain-Ahmed, 2000).

The Sun is the star at the center of the Solar System. The Earth and other matter (including other planets, asteroids, meteoroids, comets, and dust) orbit the Sun, which by itself accounts for about 99.8% of the Solar System's mass,(Wikimedia Foundation, Inc.2008). Energy from the Sun, in the form of sunlight and heat, supports almost all life on Earth via photosynthesis, and drives the Earth's climate and weather. The surface of the Sun consists of hydrogen (about 74% of its mass, or 92% of its volume), helium (about 24% of mass, 7% of volume), and trace quantities of other elements, including iron, nickel, oxygen, silicon, sulfur, magnesium, carbon, neon, calcium, and chromium (Wikimedia Foundation, Inc.2008).

The Sun has a spectral class of G2V. G2 means that it has a surface temperature of approximately 5,780 K, giving it a white color that often, because of atmospheric scattering, appears yellow when seen from the surface of the Earth,(Wikimedia Foundation, Inc.2008). This is a subtractive effect, as the preferential scattering of shorter wavelength light removes enough violet and blue light, leaving a range of frequencies that is perceived by the human eye as yellow. It is this scattering of light at the blue end of the spectrum that gives the surrounding sky its color. When the Sun is low in the sky, even more light is scattered so that the Sun appears orange or even red. The Sun's spectrum contains lines of ionized and neutral metals as well as very weak hydrogen lines. The V (Roman five) in the spectral class indicates that the Sun, like most stars, is a main sequence star. This means that it generates its energy by nuclear fusion of hydrogen nuclei into helium.

There are more than 100 million G2 class stars in our galaxy. Once regarded as a small and relatively insignificant star, the Sun is now known to be brighter than 85% of the stars in the galaxy, most of which are red dwarfs. The Sun's current main sequence age, determined using computer models of stellar evolution and nucleocosmochronology, is thought to be about 4.57 billion years. The Sun is about halfway through its main-sequence evolution, during which nuclear fusion reactions in its core fuse hydrogen into helium. Each second, more than 4 million tonnes of matter are converted into energy within the Sun's core, producing neutrinos and solar radiation; at this rate, the Sun will have so far converted around 100 Earth-masses of matter into energy. The Sun will spend a total of approximately 10 billion years as a main sequence star. The diameter of the sun is R = 1.39×106 km. The sun is an internal energy generator and distributor for other planets such as the earth. It is estimated that 90% of the energy is generated in the region between 0 and 0.23R, which contains 40% of the sun's mass. The core temperature varies between 8×106 K and 40×106 K and the density is estimated at about 100 times that of water. At a distance 0.7R from the center the temperature drops to about 130,000K where the density is about 70 kg/m3, (Zekai Sen, 2008). The space from 0.7R to 1.0R is known as the convective zone with a temperature of about 5000K and the density is about 10−5 kg/m3.

The sun is a big ball of plasma composed primarily of H and He and small amounts of other atoms or elements. Plasma is a state of matter where the electrons are separated from the nuclei because the temperature is so high and accordingly the kinetic energies of nuclei and electrons are also high. Protons are converted into He nuclei plus energy by the process of fusion. This reaction is extremely exothermal and the free energy per He nuclei is 25.5 eV or 1.5×108 (kcal/g). The mass of four protons, 4×1.00723, is greater than the mass of the produced He nucleus 4.00151 by 0.02741 mass units. This small excess of matter is converted directly to electromagnetic radiation and is the unlimited source of solar energy. The source of almost all renewable energy is the enormous fusion reactor in the sun which converts H into He at the rate of 4×106 tonnes per second. The theoretical predictions show that the conversion of four H atoms (i. e., four protons) into He using carbon nuclei as a catalyst will last about 1011 years before the H is exhausted. The energy generated in the core of the sun must be transferred toward its surface for radiation into the space. Protons are converted into He nuclei and because the mass of the He nucleus is less than the mass of the four protons, the difference in mass (around 5×109 kg/second) is converted into energy, which is transferred to the surface where electromagnetic radiation and some particles are emitted into space; this is known as the solar wind.

Most of the developing countries lie within the tropical belt of the world where there are high solar power densities and, consequently, they want to exploit this source in the most beneficial ways. On the other hand, about 80% of the world's population lives between latitudes 35°N and 35° S. These regions receive the sun's radiation for almost 3000 – 4000 h/year. In solar power density terms, this is equivalent to around 2000kWh/year, which is 0.25 cet/year. Additionally, in these low latitude regions, seasonal sunlight hour changes are not significant. This means that these areas receive the sun's radiation almost uniformly throughout the whole year. Apart from the solar radiation, the sunlight also carries energy. It is possible to split the light into three overlapping groups:

1. Photovoltaic (PV) group: produces electricity directly from the sun's light

2. Photochemical (PC) group: produces electricity or light and gaseous fuels by means of non-living chemical processes

3. Photobiological (PB) group: produces food (animal and human fuel) and gaseousfuels by means of living organisms or plants

The last two groups also share the term "photosynthesis", which means literally the building (synthesizing) by light.

The proton-proton chain reaction is one of several fusion reactions by which stars convert hydrogen to helium, the primary alternative being the CNO cycle. The proton-proton chain dominates in stars the size of the Sun or smaller. Overcoming electrostatic repulsion between two hydrogen nuclei requires a large amount of energy, and this reaction takes an average of 10^9 years to complete at the temperature of the Sun's core.