

A REVIEW ON GENERATION OF ELECTRICAL ENERGY BY USING SOLAR ENERGY

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ABSTRACT

The paper aims at developing a system which makes use of solar energy for rural electrification solar energy is treated as renewable source of energy. solar energy has been used since the earliest civilization to grind grain. The level of demand for electricity in any one area is so variable that it is more efficient to combine demand from many sites into an overall regional load. This regional electric load is then met by the output of a fleet of generators that can be controlled and managed for optimal performance. In part, the grid was developed to allow generators to provide backup to each other and share load. The grid also allows generators to be located closer to resources (e.g., fuel supply, water, available land) and ship electricity over the transmission and distribution network to different load centers. Utility-scale solar and wind power plants are conceptually similar to conventional generators—they generate electricity where the necessary resources are located, typically in remote areas where the fuel (sunlight or wind) is most abundant. These attributes—consolidating variable individual loads into more predictable regional loads, siting plants near their resource base, and extensive transmission lines—help the grid provide electric power with good reliability and low cost.

Keywords- Solar power, electricity, generation, , Renewable energu

1. INTRODUCTION

Because we are running out of gas and oil, we must prepare quickly for a third change, to strict conservation and to the use of...permanent renewable sources, like solar power". Solar energy has stood the test of time with its use dating as far as the history of humans. Every hour, the sun strikes the earth with over 430 quintillion joules of energy. The power is enough to sustain all the activities that require electricity for a whole year. But what have we done to tap the enormous energy from the sun? The sun is a source of an electric and thermal form of usable energy known as solar power. There are different ways to tap it. One of them is the use of photovoltaic solar panels. It is the most common method of capturing this energy. It converts rays from the sun to electricity. Additionally, solar power is crucial in indoor regulation of temperature. You can install hot water heating systems on your residential and commercial properties. When designing your house, you should consider how you can utilize solar energy.

Solar photovoltaic (PV)

uses electronic devices, also called solar cells, to convert sunlight directly into electricity. It is one of the fastest-growing renewable energy technologies and is playing an increasingly important role in the global energy transformation. The total installed capacity of solar PV reached 710 GW globally at the end of 2020. About 125 GW of new solar PV capacity was added in 2020, the largest capacity addition of any renewable energy source. Solar PV is highly modular and ranges in size from small solar home kits and rooftop installations of 3-20 kW capacity, right up to systems with capacity in the hundreds of megawatts. It has democratised electricity production. The cost of manufacturing solar panels has plummeted dramatically in the past decade, making them not only affordable, but also often the cheapest form of electricity. Solar module prices fell by up to 93% between 2010 and 2020. During the same period, the global weighted-average levelised cost of electricity (LCOE) for utility-scale solar PV projects fell by 85%.

Concentrated solar power (CSP)

uses mirrors to concentrate solar rays. These rays heat fluid, which creates steam to drive a turbine and generate electricity. CSP is used to generate electricity in large-scale power plants. By the end of 2020, the global installed capacity of CSP was approaching 7 GW, a fivefold increase between 2010 and 2020. It is likely that some 150 MW was commissioned in 2020, although official statistics only captured 100 MW. It is possible to classify CSP systems according to the mechanism by which the solar collectors concentrate solar irradiation: either "linear concentrating" or "point concentrating" varieties. Most existing systems use linear concentrating systems called parabolic trough collectors. Solar towers, sometimes also known as power towers, are the most widely deployed point concentrating CSP technology, but represented only around a fifth of all systems deployed at the end of 2020. One of the main advantages of a CSP power plant over a solar PV power plant is that it can be equipped with molten salts in which heat can be stored, allowing electricity to be generated after the sun has set. As the market has matured, the cost of thermal energy storage has declined, making storage duration of 12 hours economic. This has resulted in an increase in the storage duration in CSP systems. CSP with low-cost thermal energy storage has the ability to integrate higher

shares of variable solar and wind power, meaning that while often underappreciated, CSP could play an increasingly important role in the future. The increasing demand for energy, the continuous reduction in existing sources of fossil fuels and the growing concern regarding environment pollution, have pushed mankind to explore new technologies for the production of electrical energy using clean, renewable sources, such as solar energy, wind energy, etc. Among the nonconventional, renewable energy sources, solar energy affords great potential for conversion into electric power, able to ensure an important part of the electrical energy needs of the planet. Solar energy is free, practically inexhaustible and involves no polluting residues or green gases emissions. Energy is the primary and most universal measure of all kinds of work by human beings and nature. Primarily, it is the gift of the nature to the mankind in various forms. The consumption of the energy is directly proportional to the progress of the mankind. With ever growing population, improvement in the living standard of the humanity, industrialization of the developing countries, the global demand for energy increases day by day. The primary source of energy is fossil fuel, however the finiteness of fossil fuel resources and large scale environmental degradation caused by their widespread use, particularly global warming, urban air pollution and acid rain, strongly suggests that harnessing of non-conventional, renewal and environmental friendly. Solar energy is the most abundant stream of energy. It is available directly as solar isolation and indirectly as wind energy. Sun sends out energy in the form of electromagnetic radiation. Its potential is 178 Billion MW, which is about 20,000 times the world's demand. Some of the Solar Energy causes evaporation of water, leading to rains and creation of rivers etc. Some of it is utilized in photosynthesis which is essential for sustenance of life on earth.

2. GENERATION SCHEME OF SOLAR POWER PLANT

The crucial role of solar Panels Solar panels are responsible for generating electricity and in most cases they are located on the roof of any building. Hence it is through these solar panels where the real story begins and solar energy gets converted into electricity. These solar panels also known as the modules are usually southern faced for maximum potential and electricity production. Each of these solar panels is made up of a special layer of silicon cells, a metal frame, a glassed casing which is further surrounded by special film and wiring. For maximum electricity production, the solar panels are arranged together into "arrays". This through these solar cells also known as photovoltaic cells, where the sunlight is absorbed during the daylight hours.

Conversion of absorbed solar energy into electrical energy.

- Photovoltaic meaning light and electricity and hence installing these solar cells or photovoltaic cells is the first initial step to convert solar energy.
- Each Solar cell has a thin semiconductor wafer which is made up of two layers of silicon. Now silicon is a naturally occurring chemical element, one of the greatest semiconductors. Silicon semiconductors can act as both conductors as well as insulators.
- One silicon layer is positively charged known as the N-type and the other silicon layer is negatively charged known as the P-type. N-type gives away electrons easily while on the other side P-side semiconductor receives the extra electrons in the electric field. This positive and negative layer hence compliments the formation of an electric field on the solar panel.
- We all know that energy from the sun comes on the earth in the form of little packets called photons When the sunlight strikes these photovoltaic cells already forming an electric field, the photons of sunlight startle the electrons inside these cells activating them to start flowing.
- These loose electrons that start flowing on the electric field further create the electric current.

How electrical energy gets converted for usage.

The electrical energy which we get from the solar energy through the photovoltaic cells is normally known as the Direct current (DC) electricity. But this direct current electricity cannot be used to power homes and buildings, therefore to utilize this generated electrical energy, we need to convert it into Alternating current (AC) electricity. Further to convert Direct current into alternating current special solar inverters need to be installed. In modern solar systems, these inverters can be configured as one of the inverters for the entire system, or micro-mini inverters need to be attached behind the panels. The inverter turns DC electricity to 120 volts AC that can be further put into immediate use for the home appliances. The power produced by solar energy initially passes through the electrical panel in your home and then passes out into the electric grid. When in the case your solar plant is generating more electricity than your immediate consumption, your utility meter will turn backward.

Once your DC gets converted to AC, the current then runs through your electrical panel installed in your home and hence supplies power to all the home appliances. The electricity generated in the solar power system is the

same power generated through the grid by your electric utility company; therefore no changes in the home are required to get power from solar energy.

3. SYSTEM DESIGN

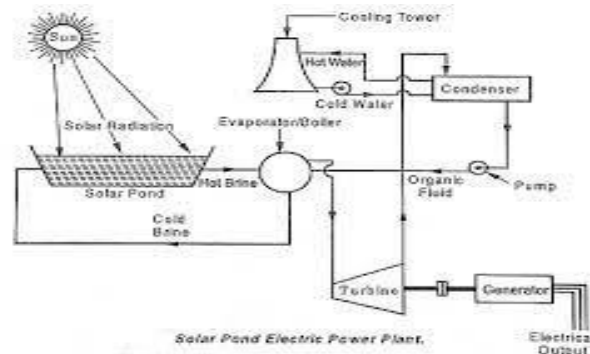


Fig1. System design.

Solar cells are systems that are composed of semiconductor materials and which convert solar energy directly into current. The amount of electrical energy which will be obtained is directly proportional to the intensity of sun light that falls on the photovoltaic (PV) panel. When light falls on the device the light photons are absorbed by semiconducting material and electric charge carriers are generated. Power Supply: We need the regulated 5 V output for the most of the IC's used in our system. In this paper power generated by sun light is used for IC's operation so does not need of external power supply. Stepper Motor and Motor Driver: Stepper motor is a digital actuator whose input is in the form of programmed energization of the stator windings and whose output is in the form of discrete angular rotation. In this project two stepper motors are used for the mounting the solar panel. Two stepper motors are mounting below the two ends of solar panel at the opposite site. Microcontroller cannot compatible with stepper motor so stepper motor driver used for compatibility. The stepper motor is used to rotate the solar panel accordingly where we obtain maximum voltage. Two stepper motors are used to put the panel at correct position. LCD: In this paper 16*2 LCD is used for displaying status of load, battery health etc. RTC: This paper tracks sun continuously by sensing panel voltage and real time clock. IC PCF 8583 used for real time clocking. The PCF8583 is a clock and calendar chip, based on a 2048 bit static CMOS RAM organized as 256 words by 8 bits. Addresses and data are transferred serially via the two-line bidirectional I2C-bus. The built-in word address register is incremented automatically after each written or read data byte. Address pin A0 is used for programming the hardware address, allowing the connection of two devices to the bus without additional hardware. Charging control module: Charging module used to charge a battery and Panel control unit used to connect and disconnect solar panel. The charge controller's function is to regulate the power flowing from a photovoltaic panel into a rechargeable battery. It features is an equalize function for periodic overcharging, and automatic temperature compensation for better charging over a range of temperatures. The goal of the design was to make a charge controller with analog simplicity, high efficiency, and reliability. A medium power solar system can be built with a 12V solar panel up to 10 amps, the circuit, and a rechargeable battery. It works with lead acid, NiCD and NiMH batteries with ratings from less than one to several hundred amp-hours. Day/night sensor: Light detector sensor i.e LDR is used as day/night sensor. It consists of two cadmium sulphide (cds) photoconductive cells. The cell resistance falls with increasing light intensity. In this paper, it was desired for the output voltage to increase as the light intensity increases, so the photocell was placed in the top position. Relay: A relay is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. Because a relay is able to control an output circuit of higher power than the input circuit, it can be considered to be, in a broad sense, a form of an electrical amplifier. Microcontroller: It is the major part of the system. The microcontroller controls all the operations. The solar panel is aligned according to the intensity of sunlight under the control of the microcontroller. A solar cell (also known as a photovoltaic cell or PV cell) is defined as an electrical device that converts light energy into electrical energy through the photovoltaic effect. A solar cell is basically a p-n junction diode. Solar cells are a form of photoelectric cell, defined as a device whose electrical characteristics – such as current, voltage, or resistance – vary when exposed to light. Individual solar cells can be combined to form modules commonly known as solar panels. The common single junction silicon solar cell can produce a maximum open-circuit voltage of approximately 0.5 to 0.6 volts. By itself this isn't much – but remember these solar cells are tiny. When combined into a large solar panel, considerable amounts of renewable energy can be generated.

4. ADVANTAGES

1. The energy and heat from the sun is free and unlimited.
2. Solar power is non-polluting. Solar power usage does not emit any greenhouse gases or harmful waste.
3. Solar power is perfect and saving for power generation in remote areas or where the cost of expansion utility grid is high.
4. Solar power is versatile. It can be used for low-power purpose as well as larger ones - from hand-held calculators, watches, and solar powered garden lights to water heaters, cars, buildings and satellites.
5. Solar power system requires very little maintenance and last for many years.

5. CONCLUSION

The electric grid is a complex network that is an integral part of our society. Running the grid in the presence of increasing fuel costs and growing environmental concerns will require new technologies and ways to use them. While renewable power technologies will be an essential part of our energy future, no one technology can provide all of the energy and services we need. Careful integration of distributed generation and careful deployment of utility-scale generation will be needed to provide the mix of power and reliability that we require for a healthy electric supply as renewables contribute an increasingly larger share of our energy needs.

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