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Introduction to 1KW Solar Power Plant off Grid Systems

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Abstract: The exhaustion of conventional resources and its effect on climate requires an urgent call for the substitute power resources to convene up the current power requirement. Solar energy is an endless, unsoiled and prospective energy source among all other nonconventional energy options. As more concentration is being done on focal point for the development of renewable energy capital globally. To ascertain their viability it is necessary to do the economic and technical assessments of these resources. This paper presents designing aspects and assessments of solar PV system based on field and actual performance. The study is based on design of solar PV system and a case study based on cost analysis of 1.0 kW off-grid photovoltaic energy system installed at Jamia Millia Islamia, New Delhi (28.5616°N, 77.2802° E, and about 293 m above sea level) India.

Both monthly and weekly costs of energy produced by the 1kW PV system have been calculated. In addition, the solar PV 1kW system can give internal rate of return of about 1.714% on investment. Based on assumptions used in this study, solar 1kW PV system of Rs 0.9724/kW h is estimated for a project with profitable life of 25 years with no other financial support.

Keywords: Conventional resources, Solar energy, PV system, Combined Power Generation, Continuous Power Supply

I. INTRODUCTION

Alternative energy sources have become a popular renewable source of electrical energy , where the product of electricity by conventional means is unpractical. Now, electricity is the most requisite means for man. All the energy resources are depleting day by day. Consequently, we must move from traditional to non-traditional energy resources. In this state, a mix of two energy resources occurs. This operation excites sustainable energy exchequer without harming nature. We can give uninterrupted energy using a solar system of energy. This system consists of the integration of a dual-energy system that will provide stable power. Solar panels are used to convert solar energy, and wind turbines are used to convert wind energy into electricity. The article discusses the cases of power generation using two sources, which leads to the obstetrics of electricity at affordable prices without disrupting the natural balance. Introduction. The uses of energy have evolved as humans have changed patterns of energy consumption. Although renewable resources such as wind, water, and biomass were the first sources of energy tapped to provide heat, light, and usable power, it was the energy stored in fossil fuels and, more recently, nuclear power that fueled the tremendous expansion of the world industrial, residential, and transportation sectors during the 20th century. But as fossil-fuel consumption has increased, a result of population growth and growth in our standard of living, so have the concerns over energy security and the negative impacts of greenhouse gases on the environment

I.POWER GENERATION FROM SOLAR SYSTEM

Solar energy is the radiation from the Sun capable of producing heat, causing chemical reactions, or generating electricity. The total amount of solar energy received on Earth is vastly more than the world's current and anticipated energy requirements. Sun energy reaches the earth in different amounts at different places; it is because of geographical conditions of the earth. The major renewable energy resources are the solar energy that can be used for different applications. Like; Water heaters, solar lamps, etc.

A. Solar Panel's Working Principle

When light reaches the p-n junction, the light photons can easily enter in the junction, through very thin p-type layer. The light energy, in the form of photons, supplies sufficient energy to the junction to create a number of electron-hole pairs.

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The incident light breaks the thermal equilibrium condition of the junction. The free electrons in the depletion region can quickly come to the n-type side of the junction.

Similarly, the holes in the depletion can quickly come to the p-type side of the junction. Once, the newly created free electrons come to the n-type side, cannot further cross the junction because of barrier potential of the junction. Similarly, the newly created holes once come to the p-type side cannot further cross the junction became of same barrier potential of the junction. As the concentration of electrons becomes higher in one side, i.e. n-type side of the junction and concentration of holes becomes more in another side, i.e. the p-type side of the junction, the p-n junction will behave like a small battery cell. A voltage is set up which is known as photo voltage. If we connect a small load across the junction, there will be a tiny current flowing through it.

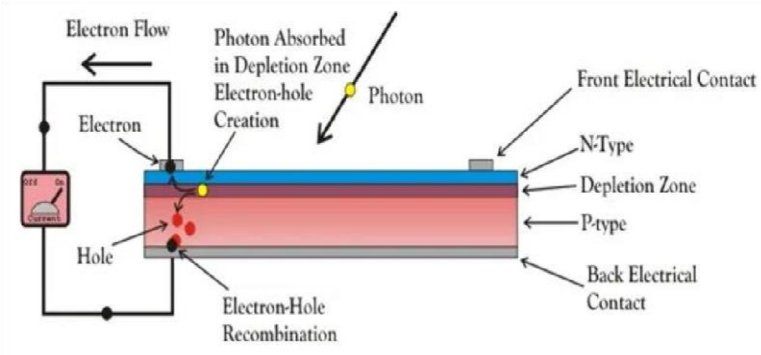

Fig 2.1 Solar Panel Working Principle

In the above fig 2.1 shows the working principle of the solar panel. It resembles the PN junction diode model. As the photon energy falls on the solar panel electrons gets energized. This moves towards the P- type channel. This constitutes the current to flow if the load is connected. Continuations of the electros flow in the closed path drive the load. The battery is connected for reliability of power. This stored energy can be used for DC operated devices. If the connected load is an AC load, to dive this Inverter is needed.

B. Solar Power System

Power from the PV panels is connected to the loads, in grid connected or standalone manner. Grid connected PV systems have more efficient as they can feed the loads continues by using grid power. Small power PV systems provides the cost effective power generation in remote places.

II.INVERTOFR

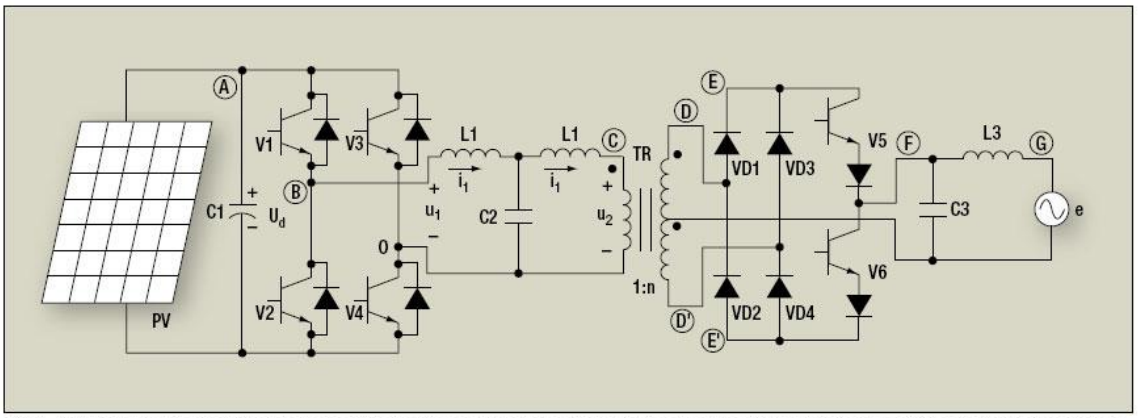

Fig. 1. *System topology of the proposed single-phase current-source grid-connected inverter that consists of a high-frequency, full-bridge inverter, immittance converter, center-tapped transformer, high-frequency bridge rectifier, power-frequency inverter and low-pass filter.*

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DC to AC power inverters, which aim to efficiently transform a DC power source to a high voltage AC source, similar to power that would be available at an electrical wall outlet. Inverters are used for many applications, as in situations where low voltage DC sources such as batteries, solar panels or fuel cells must be converted so that devices can run off of AC power. One example of such a situation would be converting electrical power from a car battery to run a laptop, TV or cell phone .The method in which the low voltage DC power is inverted, is completed in two steps. The first being the conversion of the low voltage DC power to a high voltage DC source, and the second step being the conversion of the high DC source to an AC waveform using pulse width modulation. Another method to complete the desired outcome would be to first convert the low voltage DC power to AC, and then use a transformer to boost the voltage to 120 volts. This project focused on the first method described and specifically the transformation of a high voltage DC source into an AC output. Of the different DCAC inverters on the market today there are essentially two different forms of AC output generated: modified sine wave, and pure sine wave1. A modified sine wave can be seen as more of a square wave than a sine wave; it passes the high DC voltage for specified amounts of time so that the average power and rms voltage are the same as if it were a sine wave. These types of inverters are much cheaper than pure sine wave inverters and therefore are attractive.

A. Solar Energy Conversion Formula

Globally a formula **E = A x r x H x PR** is followed to estimate the electricity generated in output of a photovoltaic system. Example the solar panel yield of a PV module of 250 Wp with an area of 1.6 m² is 15.6% .

B. Electric Power Generator

Electric power generator is connected to the wind turbine in WECS. In this we use Synchronous or induction generator depends on the requirement. Which generates the AC power, and it converts to DC by Rectifiers if required depending on the load.

C. Converters

In this proposed system of SWHES, the use of converter and inverter are needed. Generated AC power can be converted to DC to store the battery. Solar panel generates the DC Power, this power has to covert to AC Power if the connected load is AC Power operated device. DC power operated devices directly connected to the battery. In solar systems, power converters play important role. Load switching from solar to wind vice versa will be done by theses converters.

D. Energy Storage

Solar Wind Solar Wind Energy System uses the battery for storage of energy. Storage elements improve the system reliability. The rating of the battery depends on our load. All the DC power operated devices connected this battery directly.

III. SOLAR POWER GENERATION (SOLAR)

Thanks to the development of solar panels, we can harness the energy of an inexhaustible source of power–the sun. Solar panel systems work very simply:

- During the day, solar cells in your solar panels absorb the energy from sunlight;
- Circuits within the cells collect that energy and turn it into direct current (DC) energy;
- The DC electricity is passed through a device called an inverter to convert it to the usable alternating current (AC) electricity that comes out of your wall outlets;
- All of which means you can use that electricity in your home, store it with a solar battery, or send it back to the grid.

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Fig. Solar power Energy System

Energy conversion takes place from solar energy to electrical energy. Even with the modest sunlight batteries get charged which can store energy for longer time depending upon the battery ratings. Normally a 12V battery get used which get charge quickly and runs for longer durartion.

IV.APPLICATIONS

Industrial Application
Sun's thermal energy is used in office, warehouse and industry to supply power. Solar energy is used to power radio and TV stations. It is also used to supply power to lighthouse and warning light for aircraft.

Remote Application
Solar energy can be used for power generation in remotely situated places like schools, homes, clinics and buildings. Water pumps run on solar energy in remote areas. Large scale desalination plant also use power generated from solar energy instead of electricity.

Transportation
Solar energy is also used for public transportation such as trolleys, buses and light-rails.

Pool heating
Solar heating system can be used to heat up water in pool during cold seasons.

A. Grid connected and stand alone

- **Grid connected:** The large power rating of solar, where the access of sun irradiation is more, they can be connected to Grid. In these types of generation, if the system failed to generate power the Grid will supply the load.
- **Stand alone:** Almost all solar applications are stand - alone not connected to the grid.
- **Street lighting:** The foremost application of is solar street lighting. Use of this reduces the load from conventional power plants.
- **Household:** Residential appliances can use power generated through solar energy system. Solar are used to supply electricity to different offices or other parts of the building in reliable manner.
- **Remote Applications:** like military services where it is impossible to provide conventional power supply these solar systems are useful.
- **Ventilation system:** The proposed systems are also used for ventilation purposes, these helps in running Bath fans, floor fans and ceiling fans in buildings
- **Power Pump:** Solar can also help to pump the water to any building. DC power operated pump can circulate the water through your home.
- **Village Power:** The proposed system is very useful in villages which are in valley and on hills, where it is not possible to send electricity.

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V.CONCLUSION

The present worldwide trends concern energy security and sustainable development across the globe. The role of renewable energy has therefore become ever more significant. The developed world is already on the track for walking out from the fossil fuel era and involving mainly the areas of renewable energy technologies and energy efficiency. Utilizing solar and wind energy for electricity production will help in resolving the challenges such as climate change and greenhouse emissions and can emerge as the best solution for resolving the energy crisis. The solar energy system suggested in this paper has advantages such as continuity in power supply, high efficiency, low maintenance cost, optimized utilization of the resources, and load management. The results given in this paper show that the use of solar PV power generation units could save up to 10%–20% of the cost of current systems. This study encourages the use of solar systems in India and abroad in order to improve electricity production sustainability. Solar systems will provide a viable, secure power supply to rural areas while also providing a pool of funding for community grid maintenance and economic development. Ultimately, these systems will help to increase the usage of renewable energy for generating electricity globally and thereby contribute to resolving the environmental problems currently facing the world.

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- www.google.com

c) Magazines

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This are the books , sites and magazines that we referred for collecting the required data for our projects our guide also help us to make this project.