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GENERATION OF ELECTRICITY FROM SOLAR ENERGY

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ABSTRACT

India is blessed with rich solar energy and if oppressed well, the country has the potential of produce trillion-kilowatts of electricity. Sunlight is rehabilitated to electricity directly when complete to fall on solar photovoltaic (SPV) molecules. Systems/devices are made for various application based on SPV modules connected with correctly designed power conditioning units for meeting electricity necessities. These systems are designed to work in off-grid mode (usually support with batteries to permit use when sunlight is low or during night). In modern days, solar PV are set up on ground surface. Obtainable roof-top area on the buildings can also be used for fixing up solar PV power plants, and thus provision with the requirement of free land area. The electricity generate from SPV systems can also be fed to the allocation or transmission grid after habituation to suit grid integration. Currently, whole world is in the midst of an energy revolution that is necessarily changing the expectations of rural electrification.

Index Terms: *Solar Energy, Renewable Energy, Photovoltaic Panels.*

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1. INTRODUCTION

1.1 General

Energy is the necessary to the comfort of our homes, providing space and water heating and electricity. However, there are many ways in the design, construction and operation of our homes of reducing energy needs and meeting those needs with renewable sources, without compromise warmness and control. Currently, we all rely heavily on fossil fuels such as coal, oil, and gas to provide our energy needs. Fossil fuels are non-renewable, that is, they draw on finite resources that will eventually run out. In contrast, renewable energy resources, provided from the sun, wind and water are continuously replenish and will never run out. Fossil fuels are also destructive to the environment. They supply significantly too many of the environmental problems we face today such as greenhouse gases, air pollution and water and soil blotch while renewable energy technologies benefit from inferior running costs and are clean sources of energy that have a much lower environmental impact. Energy is available from a variety of renewable sources appropriate to our homes, including solar, geothermal, biomass, hydra and wind.

1.2 Solar Energy

The sun provides the widely held of the energy available on the Earth; wind power, hydro power, biomass and all fossil fuels can trace their energy source back to the sun. The light from the sun is a non-fading renewable source of energy which is free from environmental pollution and noise. Solar energy is necessary for the life on the Earth. Everyday sun sends out remarkable amount of energy in the form of heat and radiation called solar energy. Solar energy is a unlimited source of energy which is available at no cost. It can easily reimburse the energy drawn from the non-renewable sources of energy such as fossil fuels and petroleum deposit inside the earth. The major benefit of solar energy over other conservative power generators is that the sunlight can be directly harvest into solar energy with the use of small and tiny photovoltaic (PV) solar panels.

1.3 Photovoltaic (PV) Panels

The fabrication of solar panels has passed through a great number of solar panels development steps from one production to another. Silicon based solar panels were the first production solar panels grown on Si wafers, mainly single crystals. Further improvement to thin films, dye sensitized solar panels and natural solar panels enhanced the cell efficiency.

Photovoltaic (PV) panels which directly convert sunlight into electricity, are made of semiconducting materials, such as crystalline silicon. The power output of a PV cell depends on its efficiency and surface area, and is comparative to the force of sunlight striking the surface of the cell.

Group of PV panels are electrically configured into modules and arrays, which can be used to charge batteries, operate motors and to power electrical loads. With the suitable power exchange equipment, PV systems can produce irregular current (AC) compatible with any conservative appliances and activate in parallel with and inter-connected to the electricity grid network.

PV has the immense advantages of being silent in operation with a low visual impact making them mainly appropriate for urban areas.

Fig.1.3 (a) Photovoltaic Panels

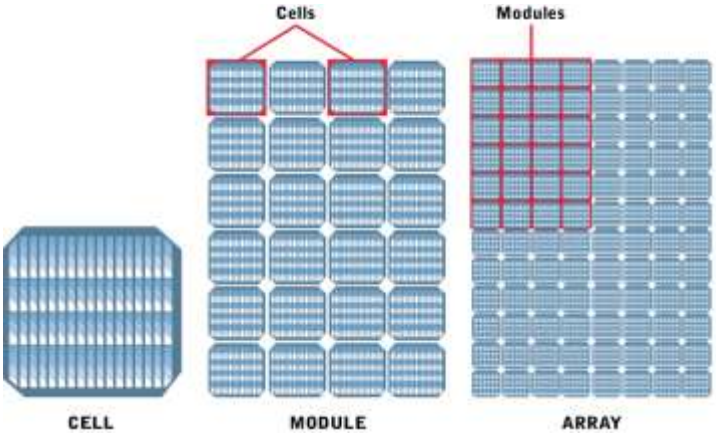

Fig.1.3 (b) PV cells placed inside the PV Panels

Rate of Solar Panels:

Table no.1 TATA Solar Panels Price List

Model (watt)	MRP (Rs.)
10W 12V	1069
40W 12V	3071
80W 12V	6142
100W 12V	7678
150W 12V	11516
200W 24V	13920
250W 24V	17400
300W 24 V	20880

2. TYPES OF SOLAR POWER SYSTEM

2.1 Off-Grid or Stand-Alone Solar (PV) System (SASS)

Stand-alone Solar (PV) System (SASS) create power separately of the electricity grid network. There are many locations on the earth where no source of electricity is obtainable. At this locations, SASS can be the ideal source of electricity. In such locations, SASS can be more cost effective than extend existing power lines. As it does not have any association with electricity grid network or other electric supply line, it is called as Off-Grid Photovoltaic System.

Depending upon the use and design there are different types of stand-alone solar system:-

1. Stand-Alone Solar (PV) System with only DC Load.
2. Stand-Alone Solar (PV) System with only AC/DC Load, Electronics Control Circuit and Battery.

2.2 Types of Stand-Alone Solar (PV) System

2.2.1 Stand-Alone Solar (PV) System with only DC Load

This system is the simplest among all the stand-alone solar system. Stand-alone solar (PV) system with only DC load requires only two main workings one the solar module array where electricity is generate and one or more DC loads where the electricity is constant. This system serve only during sunny day times. It is quite natural that the rate of production of the electricity. This structure varies throughout the day depending upon the intensity and occurrence angle of sunlight. This makes the application of stand-alone solar (PV) scheme with only DC loads is limited to some specific electrical appliances where the precise operation is not essential.

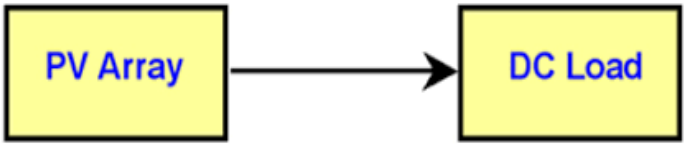

Fig.2.2.1 Block Diagram of Stand-Alone Solar (PV) System with only DC Load

2.2.2 Advantages of Stand-Alone Solar (PV) System with only DC Load

1. Simple construction.
2. Cost effective.
3. Eliminates Utility Dependency.
4. No requirement of electric grid network.

2.2.3 Stand-Alone Solar (PV) System with AC/DC Load, Electronics Control Circuit and Battery

So far we have discuss about the stand-alone solar (PV) system which can only be used for effective DC load but limit numbers of equipment we use in our daily life are AC operated so some means is necessary to attach with the solar energy system so that we can run AC apparatus as well with stand-alone solar system. Inverter is a device which converts DC to AC of specified voltage and incidence. Inverter is basically a DC to AC converter DC to AC converter whose input is DC and output is AC of desired voltage

and frequency. Also to improve the utilization of power generated by the solar module array we add an electronic control circuit. Now we connect an inverter across the DC output terminals of electronic control device along with the DC load then the system becomes able to run AC equipment's as well. As this system can operate both the DC and AC load, the system becomes most popular version of stand-alone solar energy system. Almost all kinds of DC and AC load can be operated by this system such as AC/DC fan, computer, TV, tube-lights, CFL, LED lamps, etc.

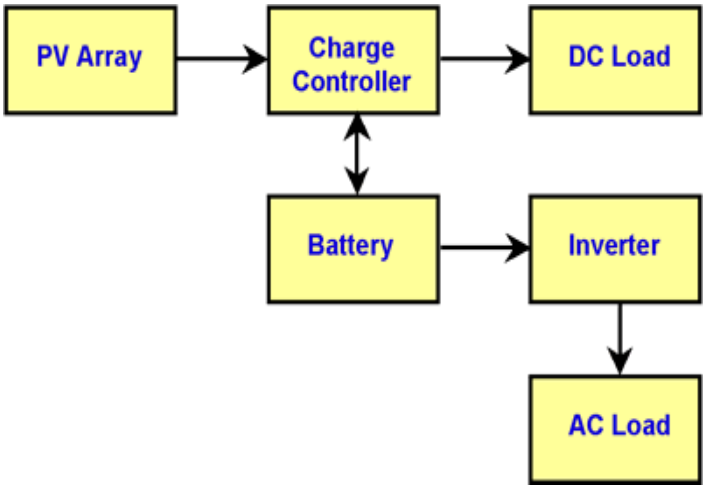

Fig.2.2.2 Block diagram of Stand-Alone Solar (PV) System with AC/DC Load, Electronics Control Circuit and Battery

2.2.2 Advantages of Stand-Alone Solar (PV) System with AC/DC Load, Electronics Control Circuit and Battery

1. Can provide power to home appliances.
2. Stores energy for use during an outage.
3. This is the most suitable as alternative of grid electric supply where limited grid supply is available.

2.3 Grid Connected System

Grid-connected photovoltaic systems, supply surplus power back onto the grid and electricity is haggard from the grid at periods when demand in the home exceeds the PV output. Grid-connected systems are generally integrated into the structure of buildings, but can also be ground mount. These systems eliminate the need for battery storeroom. In some cases, utility companies permit additional metering, which allows the owner to sell excess power back to the utility company.

2.3.1 Installation in the Home

A PV array produces power when exposed to sunlight. Based on available roof area solar PV panels will be install on the roof of the building. It is important that nothing casts a shadow over the area where the PV panels will be mount. PV panels produce more electricity on bright days but do not require direct sunlight, so normal daylight is adequate to produce electricity. The ideal orientation for PV panels is south facing, although they still manufacture around 80% of the optimum output when facing east or west. The output of the panels (DC electricity) connect to the power habituation unit / inverter which converts DC to AC. The inverter output will be connected to the control panel or distribution board of the building to make use of the power. The inverter synchronizes with grid and also with any backup power source to produce smooth power to power the loads with penchant of consuming solar power first. If the solar power is more than the load requirement, the excess power is automatically feed to the grid. For larger capacity systems connection through step up transformer and switch yard may be requisite to feed the power to grid.

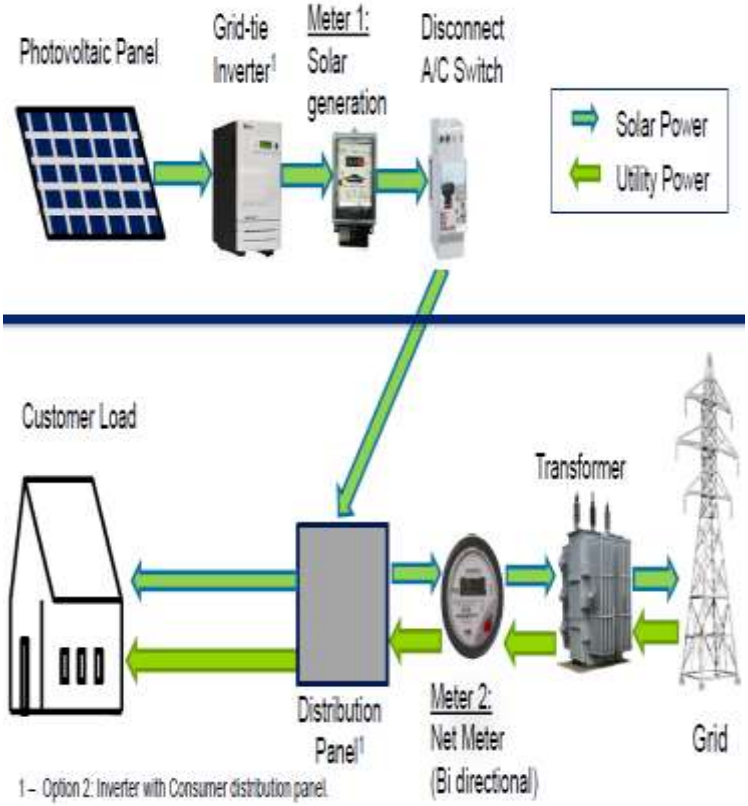

Fig.2.3.1 (a) Grossed Meter Roof Top Solar System

2.3.2 Approximate Estimate 2BHK House

2.3.2.1 Energy Required for the House

Table no. 2 Energy Consumed by 2BHK House in 1 Day

Sr. No.	Appliances	No. of Appliances	Watts Consumed	Total Watts	Unit Consumed per day
1	TV	1 (32")	125	125	0.125
2	Refrigerator	1	1411	1411	1.41
3	Fan	4	100	400	0.4
4	Water Purifier	1	48	48	0.048
5	CFL(5W)	5	40	40	0.04
6	CFL(75W)	5	75	375	0.375
7	Mobile Charger	Min. 3	2 to 4 (3)	9	0.009
8	Grinder	1	300	300	0.3
9	Washing	1	750	750	0.75

	Machine				
10	Water Heater	1	479	479	0.479
11	Computer	1	120	120	0.12
12	Iron	1	1100	1100	1.1
13	Pump	1	1000	1000	1
14	Oven	1	3000	3000	3
15	Cable Box	1	20	20	0.02
16	Home Theatre	1	150	150	0.15
	TOTAL			9327	9.327

2.3.2.2 Energy Generated by Solar Panels

Table no.3 Energy Generated by 1 Solar panel

Sr. No.	Model (watt)	Energy Generated by 1 panel = Panel Watt*hours (watts-hr.) (2)	Energy generated by 1 panel (unit/day)
1	150W 12V	1200	1.2
2	200W 24V	1600	1.6
3	250W 24V	2000	2
4	300W 24 V	2400	2.4

2.3.3 Payback and Maintenance

PV is expensive, but with new materials and ongoing product development, it is expected that the price of PV panels will become more competitive in the future. In fact, the price has abridged by one third in the last ten years. Stand-alone systems often give the most effective solution when grid electricity is not available. For installation in larger buildings, cost reserves are possible when PV panels are incorporated in the building design, where they can replacement for other construction materials providing the external skin of a building. Today's photovoltaic modules are extremely safe and dependable products, with minimal breakdown rates. Most major manufacturers promise the high efficiency operation of their PV modules for 20 or more years, with predictable service lifetimes in excess of this. PV panels have no moving parts and require least maintenance.

2.3.4 Advantages of Grid Connected System

The grid connected roof top solar PV system will accomplish the partial/full power needs of large scale buildings. Following are the benefits of roof top solar PV systems:

1. Production of environmentally clean energy.
2. Consumer becomes generator for THEIR own electricity requirements.
3. Reduction in electricity consumption from the grid.
4. Reduction in diesel consumption wherever DG backup is provided.
5. Feeding excess power to the grid.

3. CONCLUSION

Solar power production has been developed as one of the most demanding renewable sources of electricity. It has several advantages compare to other form of energy like fossils fuels and petroleum deposits. It is an alternative which is shows potential and consistent to meet the high energy demand. Though the methods of use solar energy are simple, yet need an efficient and durable solar material. Technology based on solar cell can theoretically convert more than sixty percent of the whole solar spectrum into electric power. The polymer base solar panels are also a viable option. However, their degradation over time is a serious concern. There are various challenges for this industry, including lowering the cost of production, public awareness and best infrastructure. Solar energy is the need of the day and research on the solar panels has a promising future worldwide.

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