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Design and Fabrication of Solar Tree

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Abstract: *Flat or roof top mountings of PV systems require large area or land. Scarcity of land is greatest problem in cities and even in villages in India. Solar Power Tree provides better alternative to flat mounting of PV systems. For domestic lighting and other applications use of Solar Tree is more relevant when PV system is to be used. In this work, a new product called, 'solar tree' has been designed to increase the power output by many folds by consuming solar energy. It can be installed on the sides of heavy traffic roadways and on roof top buildings. The tree consists of numerous solar panels connected to one another in series and parallel connections. The solar tree consists of number of branches welded to a stem and each stem has a solar panel mounted on it. It adds up voltage in series and current in parallel connection*

Keywords: Solar Collectors, Solar Photovoltaic, Solar Panel.

INTRODUCTION

Energy consumption in the world particularly in the industrialized countries has been growing at an alarm rate. Fossil fuels which today meet major part of the energy demand are being depleted quickly. World has started running out of oil and it is estimated that 80% of the world's supply will be consumed in our lifetimes. Coal supplies may appear to be large but even this stock may not last longer than a few decades. Nuclear power has posed a number of problems and nuclear fusion is still a speculative technology. Thus we are forced to look for unconventional energy sources such as geothermal, ocean tides, wind and sun. It is also hoped that these alternative energy sources will be able to meet considerable part of the energy demand in coming future. Among all these solar energy seems to hold out the greatest promise for the mankind. It is free, inexhaustible, nonpolluting and devoid of political control. Solar water heaters, space heaters are already on the market and seem to be economically viable. Solar photovoltaic cells, solar refrigerators, solar thermal plants will be technically and economically viable in a short time. It is optimistically estimated. With depleting conventional sources of energy, the world is looking towards renewable energy sources via solar, wind, tidal etc. Sun, a star, radiates lot of solar energy onto earth surface and is a perennial source of energy.

DESIGN METHODOLOGY

In this work, we have presented our thought that Solar Tree concept for domestic electrification is big step to reduce electricity bills and dependence on grid power which is unreliable nowadays in India. It also provides clean energy source to reduce the global warming. Energy demand (load) of the small family is considered and taken for determining the capacity of proposed system and system component sizes.

- *Component:*

1. Long tower
2. Stems
3. Sheet leaves
4. Solar panels
5. battery
6. Wiring
7. LED bulb

A. Load estimation:

The average load profiles are considered depending on daily usage duration in a day. Following electrical appliances are for total load estimation.

Appliance	Rated Power	Qty	Hrs/day	Amh	KWh/day
LED Bulb	18	2	12	2.2	52.8

B. Total load of The System :

Number of light = *2*

Total load = load of light × no. of load
= 18 × 2
=36 watt

C. Selection of Battery:

- Determining The Size of battery

Total load= 36watt
The total DC load requirement = 4.4 x 12 Ah
=52.8 Ah
Considering battery autonomy for 12 hours total requirement = 2.2 x 2 = 4.4 Ah
= 4.4 x1 2 = 52.8 Ah
Considering battery efficiency and depth of discharge (DOD) equal to 80 %.
Battery Capacity = 52.8/ (0.8x0.8)
=82.5 Ah.
As our requirement is of 52.8 = 53Ah
We have selected the battery of 65 Ah

D. Calculations for solar panel:

According to the requirement, the calculation of solar panel
Current from the single solar panel we have to calculate first
Power = voltage*current
Current = power/voltage
Current = 20/17
Current = 1.17 Amp
The current from the single solar panel is 1.17Amp
In order to charge the battery the of 65 Amp
We have to find no of solar panel required.

E. Calculations for number of solar panel:

As by considering 7 hrs of sunshine per day
The current produce by a solar panel in a day
I=1.17×7
I=8.19 Ah
The current produce by single 20W solar panel in a day is 8.9 Ah
In order to fulfill the load as per requirement
To charge the battery minimum up to 55 Amp.
No of solar panel required =total load/ panel output
=55/8.9
= 6.17 = 7
The no of solar panel required for charging battery up to 55amp is 7
As we are connecting the panel in series so suitable no of panels are 8
And the power coming from the 8 panel
=8*8.9
= 71.2 Ah by considering the sunshine 7 hrs per day
=56.6 Ah by considering 6 hrs of sunshine per day

F. Selection of battery:

The selection of battery is by considering the total load requirement and the power generate by the solar panel or
We can also determine the no and specification of solar panel after the selection of battery choose as suitable on the basis of calculation
As the total load requirement is of 52.8 Amh
The power produce by the solar panel is 56.6 by considering 6hrs of sunshine
By evaluating this and checking the battery sizes available in the market
We have selected the size as 65 Amp

G. Selection of Standard wires:

The size of wires are standard is of 2.2 sq. mm.

WORKING

One of the big challenges in the solar industry is to maximize solar electricity output while keeping down the installation cost. Solar photovoltaic (PV), which uses photovoltaic cells to convert the sun's rays directly into electricity. Photo Voltaic is now very popular. During the period of 2000-2011, PV constituted the fastest growing renewable energy source. Solar energy emits far less emissions than do fossil fuel energy sources. Solar cells create electricity by converting photons of light into electrons. Solar cell producing direct current, this DC current is converted to alternating current, by using inverter.

Fig: Solar Tree

Solar PV modules will be fixed throughout the tall pole having a pattern of spiraling phyllotaxy with the adjustment of load distribution over the pillar for its balancing. At the same time the pattern is so adjusted that the top panels wouldn't hinder the bottom panel from getting the maximum sun light in a day time. The panels will be facing towards the sun at an angle as required so that they can get maximum solar energy for whole day. The Solar Power Tree consists of mainly five component. Solar panels, Long Pole, LDEs, Batteries and Stems for connecting the panels mounts mechanically move the PV panels over the course of a day so that they directly face

the sun at all times. The solar cell is composed of a p-type semiconductor and an n-type semiconductor. Solar light hitting the cell produces two types of electrons, negatively and positively charged electrons in the semi-conductors. Negatively charged (-) electrons gather around the n-type semiconductor while positively charged (+) electrons gather around the p-type semiconductor. When you connect loads such as a light bulb, electric current flows between the two electrodes. The first thing to know is that panels rely on light from the sun, not heat. In fact, most solar panels become less efficient in extremely hot conditions. Solar panels convert sunlight into DC electricity. When photons from sunlight strike the silicon cell in the solar panel, electrons are released. The freed electrons race around and, with the help of an electric field, create energy in the process. The electrons flow through the panel and string (which connects each of the panels on your Tree in a traditional set-up) eventually making their way to the solar inverter or battery.

CONCLUSION

The present study increases the solar power output by the number of solar panels installed on a pole in comparison to a single panel pole system. The structure of solar panel system is given a tree shape. The panels are put on the structure in a spiral fashion. It proves to be a useful system to meet the energy demands of the world and to use a given space more efficiently. The present system of roof top solar systems can be replaced by solar tree and the roof top space can be utilized for recreation purposes. The solar tree can be installed on ground also in addition to roof top spaces. So, this solar tree proves to be advantageous in saving space and increasing the power output by many folds. It saves a lot of energy over the years to come. The number of solar trees that could be installed in a given space depends on the wattage needed.

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