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Design a Standalone PV Solar Umbrella

[Rajeev Kumar, Amit Verma, Paramjeet Singh Jamwal, Ajay Kumar, Rahul Birla]

Abstract— This paper presents a generalized idea of a solar application by an umbrella, which has powered by solar radiation. This umbrella used a solar panel which has a several advantages, and provide a ample surface for mounted the panels, its design to allow the exposure of sunlight and conveniently portable. The solar powered umbrella has** uses **of providing shades for the user making outdoor experience more enjoyable.

Keywords*—Component *Generalized umbrella structure, Solar panel

I. Introduction

Now a day's world has facing the major problem to end of the fossil fuel resources on earth. So to fulfill the energy demand in future, science and technology has developing the Green Energy. Tidal, wind and solar has the main aspect of green energy, among of them solar has a most important resources of renewable energy which are rapidly used to generate electrical energy. According to environmental aspects solar energy is a clean and non-pollutant resource of energy which can directly at anywhere. This paper present a new idea to utilized the solar energy is "The Solar Powered Umbrella". The solar powered umbrella designed to power of outdoor used the electronics equipments where there is no electricity. It is also used for domestic and commercial purpose likes as Home appliances, Restaurant and beach sides. To complete these premising ideas required constructional as well as technical skills

Rajeev Kuamr
Faculty of Technology, Uttarakhand Technical University
Dehradun, India

Amit Verma
Faculty of Technology, Uttarakhand Technical University
Dehradun, India

Paramjeet Singh Jamwal
Sant Longowal Institute of Engineering and Technology
Longowal, India

Ajay Kumar
Faculty of Technology, Uttarakhand Technical University
Dehradun, India

Rahul Birla
Sant Longowal Institute of Engineering and Technology
Longowal, India

II. Solar Panel

Solar cell has an example of renewable energy sources. It can be used to convert the sun radiation to electrical energy production. Its only limitation is geographical position of earth and intensity of sun radiation.
The output of individual solar cell is very low approx 0.5 volt so to get the high output voltage more numbers of solar cell are connected in series and this type of group of solar cell called the solar panel. The output of these panel approx 15volt
Different types of technology used in solar panel as their output voltages and efficiency.

A. *Monocrystalline*

Monocrystalline cells are made from a thin wafer cut from a single large crystal of silicon. The cells are then doped and the fine current collecting wires printed on the surface of the cell. Generally monocrystalline cells have the highest efficiency. This type of cell takes more energy to make than any other, and so has a greater energy payback period, though this is usually still within five years. A number of manufacturers make monocrystalline panels, including BP Solar and Sharp Solar

B. *Polycrystalline*

Polycrystalline cells are made from thin wafers of silicon cut from a large cast billet. The billet is not a large single crystal, but many crystals clumped together. Polycrystalline cells are usually slightly less efficient than monocrystalline cells, but because they are square, can be fitted into the rectangular frame of a solar panel with high space efficiency, although polycrystalline panels are still slightly larger than monocrystalline panels of the same rating. Polycrystalline cells must also have current Collecting grids printed onto them.

C. *Amorphous*

Amorphous thin film panels involve deposition of very thin films of silicon or other materials directly onto a substrate such as glass or stainless steel. This technique produces a cell with a lower efficiency than the cut wafer varieties, but has the advantage of eliminating the need for inter-cell connections. Uni-Solar makes triple-junction, nine-layer thin-film amorphous panels with a much higher efficiency than the older types. The layers of silicon are deposited directly onto a stainless steel substrate and are then coated in a flexible plastic protective layer. There are now a number of manufacturers of thin-film panels, including Uni-Solar, Kaneka and Schott Solar.

Silicon Composition	Efficiency Commercial Panels*	Known Max Efficiency*
Amorphous Silicon	6	12.5
Polycrystalline Silicon	9.5-15.3	20.4
Monocrystalline Silicon	13.3-15.9	25

*Efficiency (%) of Silicon Cells as measured at STC

III. Design

It is very simple to design structure of solar powered umbrella; it consists of 8 individual flaps which are connected from one side to a octagon center structure. The dimension of each flap approx 1100mm x 700mm and the solar panel has a dimension 1020mm x 670mm fixed on the upper side of flap. This solar cell contains 36 solar cell which has connected in series. These solar panel flaps are assembled in such a angle so which the panel can received more rays coming from sun.

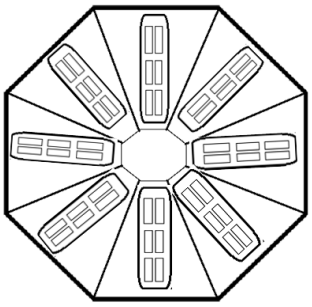

Fig I: Solar panels assembled in umbrella flaps upper view

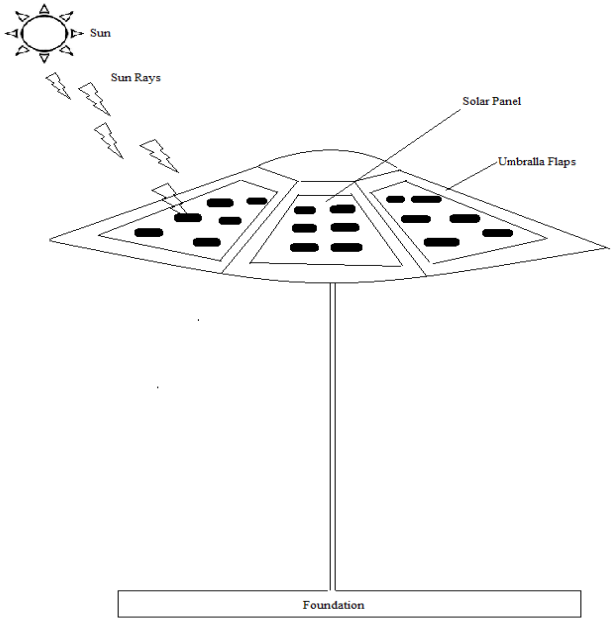

Fig II: Solar Powered Umbrella

IV. Specification

Electrical Specification of 100W Solar panel

Maximum Power	100 W
Voltage at maximum Power Point	18 V
Current at maximum Power Point	5.56A
Open circuit voltage Voc	21.9 V
Short circuit current Isc	6.13A

V. Load Calculation

TABLE I. APPLIANCES & THEIR WATTAGES

Appliances	Wattage(W)	Qty(Q)	Rated Wattage (W)
Refrigerator	140	1	140
Television	120	1	120
CFL	18	10	180
Laptop	75	1	75
Misc	400	1	400

TABLE II. LOAD CALACULATION

Appliances	Rated Wattage(W)	Hrs/Day	Energy/Day (W)
Refrigerator	140	8	1120
Television	120	4	480
CFL	180	6	1080
Laptop	75	2	150
Misc	400	1	400

Total Energy demand per day
= 1120+480+1080+150+400
= 3230 watts-hrs

Maximum DC powered required
=140+120+180+75+400
= 915 watt

Total watt hrs required for 3 days
= 3*3230
= 9690 watts-hrs

Battery Bank capacity (50% discharges)
= 2*9690
= 19380 watts-hrs

Battery bank capacity in Amp-hrs
= (Total battery bank capacity power)/ voltage rating of single battery
= 19380/12

=1615 Ah

Numbers of battery required for connection
= (Battery bank capacity in Amp-hrs)/ Current rating of single battery
=1615/105
=15.35
= approx. 16
With the help of solar power simulator to meet the load demand,
Required solar panel (100 W)
= 8
Required Battery (12 V, 105 Ah)
= 16
So, Total output power by solar panel
= 8*100
= 8000 watts (8kw)

Thus the voltage rating of battery bank required is 48V, 400Ah. The battery bank is designed as 4 group(s) of 4 batteries in series at 12 volts & 100 AH produce a 48 volt battery bank at 400 Amp Hours capacity.
This calculation has been done by online solar power simulator with different sun position and climate condition.

VI. Conclusion

We utilized the solar energy by using this design to supply the electrical power to meet the load demand. According to above online solar power simulator calculation the total load demand for 3 days is 9650 kwh which can be fulfilled by the 8 solar panel of 100 w and the 16 numbers of battery 12V, 105 Ah. These batteries have connected 4 group of a battery in series and then parallel to make the battery bank capacity 48 V 400 Ah.

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About Author (s):

Rajeev Kumar is a M.Tech Scholar in Power System Engineering and working in the area of Green Energy. I worked as a Lecturer at Roorkee College of Engineering, Roorkee for two years.

Amit Verma is working as a Assistant Professor at Faculty of Technology, Dehradun after completing M.Tech from Madan Mohan Malviya Institute of Technology, Gorakhpur. I have published two papers in the IEEE.

Paramjeet Singh Jamwal worked as a Lecturer at Guru Nanak Education Trust Group of Institution, Roorkee for two years after completing B.Tech from College of Engineering Roorkee. I am working on a Blog which you will find at info4eee.blogspot.com

Ajay Kumar is a M.Tech Scholar in Power System Engineering and working in the area of Power Engineering. I worked as a Lecturer at G.S.B.A., Roorkee for two years.

Rahul Birla worked as a Lecturer at RCP Universe, Roorkee for one year after completing B.Tech from College of Engineering Roorkee. Now I am a M.Tech Scholar and my area of interest is Embedded System