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Optimization of Solar EnergyFor AC and DC Appliances

[1]Dinesh V Kala [2]Sanjay Lalla

1. Associate Professor G.N.Khalsa College, Matunga, Mumbai, India

2. Associate Professor R.K. Talreja College, Ulhasnagar-3, Maharashtra, India

Abstract: From photosynthesis to photovoltaic, sun is the ultimate source of energy. Surprisingly, the amount of solar energy reaches on earth's surface per hour is greater than the total demand of the human kind for the whole year. The challenge & innovation is how to harness this energy. Moreover, no fuel cost, no noise, no emissions, no pollution etc. Per unit cost of electricity is almost 25% of the conventional electricity just because the fuel is free under sun. The wide spread
application of solar based electricity applications are now plenty. The core concept of this research paper is, most of the devices and appliances runs on 12 Volt DC batteries of appropriate capacity.

Usually, 220 volts alternating utility is reduced to lower value of alternating voltage using transformer which in turn is converted to regulated direct voltage. In this paper we have entirely different approach, we store the energy from the photovoltaic panels to a 12 V 26Ah battery and in turn run all devices & appliances. All these were made as standalone PV systems.

Key words –dc, ac battery and solar energy

Introduction: Sun has its own significant and magnificent role and has its own signature in the existence of the whole humanity. Even fossil fuels also trace their energy source back to the sun.

Energy from solar panels is DC. A planned analysis and sizing was done in detail and which dc loads and ac loads need to be run in laboratory. The entire equipment in laboratory is running on solar based electricity. Irrefutably DC is the future of electricity. All the above innovative ideas will be instrumental in our bid to attain highest levels of environment-

friendly technologies.

For this purpose, installation of 640 watts solar panels for four different purposes was done. The idea was to have a typical green zone in the department of physics.

DC electric power is an emerging disruptive technological area that has the potential to stimulate economic growth, inspire innovation. DC based devices & appliances are 75% more efficient. Moreover, most energy storage technologies are DC-based. The project is selected with all the above intentions & inclinations into consideration. The innovation across the project is that all loads are DC loads, their consumption of wattage is much less than an AC load.

With the facilities below:

1. **Multiple point mobile charging station.**
2. **7 LED based illumination.**
3. **5 DC fans.**
4. **DC supply for electronic circuits.**

<u>Experimentation:</u>

<u>Part 1 (staff room)</u>: 200 watts of solar power dedicated for physics department staff room. The two panels each of 100W (V_{oc} = 18.00V and I_{sc} = 5.5A) are connected in parallel to enhance the current value resulting into V_{oc} = 18.00 V and I_{sc} = 11.00 A). This combination is used to charge battery through charge controller and battery voltage is used to run DC loads namely DC Fans, DC LED illuminations installed in heads cabin and staff room.

Device	Power rating	No.	Total power
DC LED Illumination	12W	4	48 W
DC Fans	18 W	2	36 W
		Total	84 W
Remaining 116 W is available to run many more DC loads			

<u>Part 2 (DC Lab)</u>: The 200 watts solar power was dedicated for DC Lab, DC loads for DC Power Supplies for any lab circuit to function (TTL based, transistorized based, Op-Amps based) Fans & LED lamps. For DC lab two panels each of 100W (V_{oc} =18V and I_{sc} = 5.5A) are connected in parallel to obtain 18V and 11.00 A. This combination is used to charge 12V, 26Ah battery through charge controller and battery voltage is used to run following devices/loads like power supplies and experiments in lab.

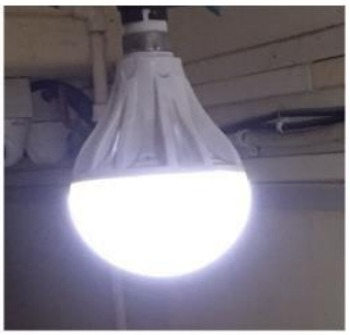
Device in DC lab	Power rating	No.	Total power
DC LED Illumination	10W	3	30 W
DC Fans	18W	3	54 W
DC LED Illumination	20W	1	20 W
		Total	104 W
Remaining 96 W is used for Experimentation			

Part 3 (AC LAB): The 200 watts of power is dedicated for AC based loads. An inverter is employed to convert DC battery voltage into AC to run AC loads like CRO, signal generators and so on. For this AC lab two panels each of 100W (V_{oc} =18V and I_{sc}=5.5A) are connected in parallel to obtain 18V and 11A.

Part 4 (MSc experimentation room): Two panels each of 25W (V_{oc} = 18V and I_{sc}= 1.25A) is used in to illuminate lamp of 20W from dusk to dawn. The embedded lithium battery gets charged throughout the day & discharges throughout the night.

PHOTOVOLTAIC PANEL

SOLAR DC SUPPLY



DC LOADS

SOLAR BASED MOBILE CHARGING SYSTEM

Research labs which face power cuts can use the solar energy in our country, since India falls in tropical zone with lots of sunshine. Moreover, solar based electricity can run water pumps for drinking water and washing purposes. Even ovens can be run for heating purposes and refrigerators for cooling. Hence the above methodology is scalable to run high powered devices also.

Everybody loves uninterrupted electric supply for one reason or other, may be a professional, a teacher, a student, a researcher and so on. In the recent time of pandemic, the significance of electricity and its availability always has realized to altogether at different level. Moreover, solar based standalone systems are very useful without any choice even for the areas which are deprived from utility till this date. As solar panels generate DC power, it could be more efficient to use DC power, so you wouldn't need an inverter to turn DC into AC power in turn back to DC. One can simply store solar based DC power in the appropriate size batteries and then use power DC to run DC based loads and appliances

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