

Generation of Energy using Photovoltaic Night Lighting System

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Abstract—This paper stresses on the need of replacement of conventional night lamp by solar night lamp in every home for reducing the energy crisis at present. Increasing cost and import of conventional resources have bad effect on the economy of a country, also the next generation will face acute energy crisis if alternate resources of energy are not developed concurrently. The only cheaper solution is “unlimited power” from the sun. The use of solar energy is so far limited in household applications. In fact, if we harness only 0.0034 percent of the solar energy reaching the Earth’s surface. The propose development and optimization of a new generation of photovoltaic powered night lighting systems which integrate LEDs devices. The combination of high efficiency photovoltaic panels with whites LEDs of last generation allows the release of an autonomous and performing solar lighting system. The lighting system is composed to the battery, solar charger controller, lighting sensor control and PV solar panel.

1. INTRODUCTION

Energy-efficient lighting is an important factor for sustainable development and energy strategies. Indeed, Lighting consumes about 20 percent of the electricity for a nation. These considerations make solar energy the ultimate strategic choice as a source of world energy. As a result of current day satellite technology, designers now have a more or less clear picture about solar energy intensity distribution worldwide. Solar energy research emphasis over the past three decades was concentrated on two main aspects of this subject. The first is concerned with solar energy direct heat production and the second is involved with solar energy electricity production. Recent technological developments in thin-film photovoltaics, such as amorphous silicon and hybrid dye-sensitized/photovoltaic (PV) cells, are leading to new generations of consumer portable solar arrays. These new arrays are lightweight, durable, and flexible and have been reported to achieve power efficiencies of upto10%. The high power LEDs of last generation and technology offer a considerable alternative to a conventional street lighting with energy savings of up to 75 % and an important reduction in carbon emissions. The photometric properties of high power solar LED lights adding to their bright, natural light color, give a uniform rectangular beam pattern that is 50% brighter and 50% larger than the oval beam pattern produced by a

conventional lamp. There are many types of solar power lights that can be used to illuminate your home and surrounding and at the same time save the natural resources.[1] All the home lighting systems are powered by solar energy using solar cells that convert solar energy (sunlight) directly to electricity. The electricity is stored in batteries and used for the purpose of lighting when ever required. These systems are useful in non electrified rural areas and are liable emergency lighting systems for important domestic, commercial, and industrial applications. The present work demonstrates experimentally tested portable solar energy system for every home for saving the energy of the country.[2]

2. ENERGY TECHNOLOGY FOR PHOTOVOLTAIC SYSTEM

2.1 Photovoltaic Energy

Photovoltaic offer consumers the ability to generate electricity in a clean, quiet and reliable way. Photovoltaic systems are comprised of photovoltaic cells, devices that energy directly into electricity. Because the source of light is usually the sun, they are often called solar cells. The word photovoltaic comes from photo, meaning light, and voltaic, which refers to producing electricity. Therefore, the photovoltaic process is producing electricity directly from sunlight. Photovoltaic are often referred to as PV. [3] New technological approaches are always necessary to make low cost and high energy conversion efficiency cells so that photovoltaic energy from now until 2020 can cross the competitiveness threshold in comparison with other sources of electricity production.

Table 1: Parameters of Solar LED Light

S no.	Part name	Specification	Size	Cost in INR
1	Rechargeable battery 3V,	General	5cm×2cm	55.00
2	Solar panel(collector)	Photovoltaic (PV) cells	5cm× 4cm	50.00
3	LED	20MA & 3V (9numbers)	1.5cm× 0.5cm	45.00

4	Switch	Plastic,12V,0.5A	1.5cm×0.5cm	10.00
5	Glasson LED to form lamp	General thin glass	9cm×6cm	10.00
6	Aluminum and plastic box	Light flexible thermo-plastic and aluminum material	9cm× 5cm	55.00
7	Others:	Diode and connecting wires —	Negligible	15.00

3. SOLAR LED LIGHTING

Solar lights are the most advanced electrical light sources in the world. With 10000 hour rated life and the energy efficiency and color rendition of the best florescent lamps, there is no other light source that provides so many benefits while also minimizing heat and CO2 output. To maintain the highest level of international manufacturing and testing standards so that our products are durable and safe for the environment. Whatever aspect of lighting that it prioritizes, solar lights are superior in many categories. Energy efficiency, life, color rendition, lumen depreciation, waste/heat output, glare etc. Solar lights are truly the next generation of electric lights that is set to displace several existing forms of electric lighting.[4]



Fig. 1: Solar LED light for home and commercial purpose

4. MATERIALS AND METHOD

The system comprises solar panel, rechargeable battery, LED, glass, switch, resistance, and diode. The overall size of portable solar night lamp is 16cm×6cm, the total weight is 231gm, and the total manufacturing cost is Rs. 240.00. The LED, glass cover on LED, and solar panel are kept outside, while all other components are enclosed in a lustrous plastic box which is framed with iron material for unbreakable strength .The cost, specification, and size of various equipment are shown in Table. The system in diagram was designed to give a daily working time of 10-14 hours with the fully charged battery along with the concept of continuous

charging to get the lightning without any obstacle. The system provided for buffer storage for 4-5 non sunny/cloudy days. Electricity generated from thermal power station is an expensive source of electricity; solar energy has turned it into an economical power source in the long-run. The amount of electricity generated from solar energy depends upon the available sunlight.[5]

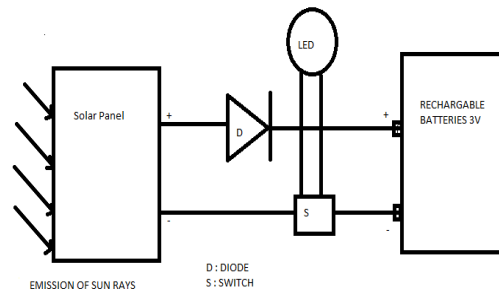


Fig. 2: Circuit diagram for solar power light

5. RESULTS

This paper analyses Conventional Electric Energy Consumption of LED Electric Lamp in a City (Energy Provided by Thermal Power Station). The energy consumption during night for two LED lamps of 10W each in a house is $2 \times 10 = 20W$.

Let us assume that the number of houses in a city stands 50000 nos. , the energy consumed by one house in a year is $(20 \times 12 \times 365)/1000=87.6KWh/Yr$.

The yearly electricity bill of one house is $87.6 \times 6.00 =Rs 525.60+$ cost of LED Lamp (Rs.200) = Rs.725.60

The energy consumed by 50000 houses in the city in a year will be $87.6 \times 50000=4380000KWh/Yr$, and the early electricity bill of 50000 houses is $4380000 \times 6 =Rs.26280000 =2.628crore$.

Cost of buying LED LAMP= $2 * Rs.100$ (one house) * 50000= Rs. 1.00cr

Total cost of electricity= $Rs2.628Cr + Rs. 1.00Cr = Rs. 3.628Cr$

Solar Energy Consumption of Solar LED Light in a City with the Same Light Intensity. The initial cost of one solar lamp is Rs.240; the commercial price of the solar equipment(including taxes, sales, and marketing cost)is Rs.350. Assuming that the life of solar equipment is one year (it is expected to be more), the cost of 50000 solar LED lamps (2 in each house) is $350 \times 2 \times 50000 = Rs. 24000000 = 3.50Cr$.

The operational unit cost of the electricity is nil.

4.1 Comparison

Saving in the energy consumed from conventional thermal power station, hence, by 50000 houses in the city in a year is equal to 4380000KWh/Yr, because these houses are getting energy from LED lamps; the yearly cost using solar LED lights for 50000 houses is = Rs. 3.50Cr; the yearly saving of cost using solar night bulb for one house is $Rs725.60 - 350 \times 2 = Rs.25.60$. The biggest advantage of using solar power is that it is an inexhaustible source of energy. Once you have installed the system, you do not have to worry that you would ever be without electricity, because the sun is always going to be there. The second advantage of using solar energy is that it does not cause any pollution into the environment. Solar panels do not release any emissions into the atmosphere while generating electricity. In the most remote locations, solar energy is the ideal source of electricity. A big advantage of solar energy systems is that a properly installed system free from the effect of maintenance.

6. CONCLUSION

It was established by testing the system during the last six months that if charged for 6-7hrs in summer sunlight, the battery is capable of supplying stored energy to solar night lamp for 4-5 nights. The developed solar system is costing Rs. 240 only, portable, user friendly, and free from maintenance. It is established that there is need for replacement of conventional night lamp by solar night lamp in every home for the cheaper unit cost as well as solution of energy crisis at present.

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