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Evaluation of Different Types of Solar Garden Lamps

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A B S T R A C T

Solar energy is the most important and cleanest energy source that can be used in almost every field. Almost 25% of produced electricity is being consumed for lighting in all over the world. Therefore, using alternative energy for lighting systems has become inevitable. Usage of alternative energy for lighting in the local parks, gardens and streets, long distance highways and roads have become widespread quickly. In addition to the money savings, solar-powered Led lighting offers substantial environmental and health benefits. Technological developments have allowed the use of LEDs technology in many general illumination applications, from houses to commercial or outdoor spaces. Different varieties of solar garden lamps were found to be manufactured in many countries like China, USA and Middle East but in India most of the solar garden lamps available in the market were imported from China. So, people used to buy through online and offline source. An attempt was made to analyse the features of different types of solar garden lamps available in the market. Secondary sources of data were used to analyse the features of the lamps.

Introduction

Garden lighting is a mostly concerning critically in performing regular human activities during night time because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources each year, and poor

lighting creates unsafe conditions. Energy efficient technologies and design can change garden lighting costs dramatically (often by 25-60%); these savings can eliminate or reduce the need for new generating plants and provide the capital for alternative energy solutions for people.

Solar garden lights are small lamps based on LED, a rechargeable battery and a small solar panel for recharging battery during sunlight. It conserves energy in a maximum amount. Solar lighting systems are one of the easiest to be maintained. Unlike most rechargeable products, however, solar lights can be exposed to sunlight during the day in order to provide lighting at night. Sunlight that shines on the solar panels generates electricity that is then stored into the solar light batteries, and is discharged once it is dark outside. The batteries in solar lights last about two years and replacement of batteries can be done by purchasing and be installed within solar lights to avoid purchasing new lights. But it also has the drawbacks which needs to charge and work properly only during the sunny days.

Many people were not aware of the different solar garden lamps available in the market with reference to the features, design, functionality, advantages and disadvantages. According to the size and design, the price of the lamp also varied.

Vinutharani *et al.,* (2016) conducted a study on sensor based smart lighting system and gave the idea for developing low cost, adaptable, easy to install, wireless sensor based smart lighting system that automatically adjust the intensity of light for energy saving and satisfied the user. The study illustrated a system that makes use of Pyroelectric InfraRed (PIR) sensor, CO_2 sensor & Light sensors (LDR). The dimming of light was achieved using PIR sensor. Intensity measurement and power consumption was measured by using Light sensors. A simple low cost multitasking hybrid solar emergency lamp has a motion detector with an additional feature of charging better by mains supply even though the weather is cloudy.

This is not only a simple solar emergency lamp having motion detector sensors which ensures the safety but also the system was designed using good materials at low cost. The components of the system provided better light in night and ensure the safety of nearby area. The whole system operates automatically. The system did not require any expert person to operate it (Prabhat *et al.,* 2016).

Hence, to know about the different solar garden lamps available in the market, the present study has been taken up with the following objectives.

To study the features of different solar garden lamps available

To analyse the energy efficiency of each of the lamps

Materials and Methods

Secondary sources of information were used to assess the features of garden lamps available in the market. Random market survey was conducted in the main city of Hyderabad to know the varieties of lights available in the lighting shops. A total of 13 different garden lamps available in the markets of Hyderabad and Secunderabad were selected for evaluation.

Solar garden lamps included in the study were ScrossBright waterproof solar wireless security motion sensor LED night light for outdoor/garden wall (Black), Crocon new solar powered rechargeable LED garden light auto on/off waterproof, Enjocho solar light

bulb, Quace solar garden light, Ozoy solar light, Ohuhu Stainless Steel Solar Garden Lights, Nekteck Solar Powered Garden Spotlight Set, URPOWER Wireless Solar Lights, SolarDuke Hanging Solar Light Lantern Gama Sonic Victorian Lamp Post Solar Light, Moonrays Payton solar LED plastic path light, SolarGlow stainless steel LED garden lights and Newhouse lighting solar flickering LED tiki torches.

The lamps used for the evaluation were bought from different market sources i.e. through online and offline.

The selected lamps were analyzed for features that were incorporated in the design and parameters evaluated for each lamp included lumens illuminated, charging time, working hours, life span and the price. A device known as Lux meter or illuminometer was used to measure the lumens given out by each lamp.

Results and Discussion

Results of the present study were presented below in detail

Lighting requirements in gardens

When designing or making changes in garden lighting, it is important to first understand the light requirements of the garden. Lighting requirements in gardens were presented in Table 1.

When existing/available solar lamps were evaluated, it was found that more or less all the lamps had similar features like having weather proof capacity, easy to install, highly durable, long lasting working hours etc.

However they were different from each other in terms of size, shape and pattern. Only few lamps had 360 degrees of display of light while some have upward or downward light.

When the specifications of the lamps were compared it was found that plastic and stainless steel were the commonly used materials for making the solar lamps.

The specifications required to be mentioned by the manufacturer for solar lamps are material used for the lamp, weight of the lamp, size, diameter, height, battery capacity, solar panel size and capacity.

However the many of the manufacturers have given only 70-75 per cent of the information. Unless the complete information given, consumer will not be able to take the right decision to choose the correct type of solar lamp.

The table 2 and 3 indicates that the features of all the solar garden lamps were different from each other but the majority of the lamps were found to use the same size of battery i.e. 1.2 V except the lamp namely Scross bright which has larger storage capacity.

The power output of each lamp also varied according to the size of the lamp. Similarly the lamp lumens emitted, working hours and price for all the lamps varied.

Crocon lamp found to work for more number of hours (11hrs) compared to other lamps. Quace brand has least operating hours i.e. 5 hrs. Cost of the lamp varied between Rs. 300 to Rs.400.

It can be concluded that different types of solar garden lamps available in the market were identified and their features, specifications and parameters were compared.

It would help the consumers to aware of advantages and disadvantages of solar garden lamps. It could make them in easy selection based on their purpose and preferences.

Table.1 Description of solar garden lamps

Name of solar garden lamps	Description	Salient features	Image
Scross Bright waterproof solar wireless security motion sensor LED night light for outdoor/garden wall (Black)	It has wireless motion sensor from scross runs on solar energy (even on weak sunlight) and comes with 20 LED lights. It is suitable for outdoor use and well suited to withstand all seasons.	➢ Weather resistance ➢ Easy to assemble ➢ Long lasting working hours ➢ Easy to install ➢ Easy to move ➢ Highly durable ➢ Ability to detect motion and illuminate the path automatically	
Crocon new solar powered rechargeable LED garden light auto on/off waterproof	LED garden light in any open space where direct sunlight falls on it during the day. It will charge during the day, and the sensor will automatically activate the lights at night.	➢ The LED light will light up in multiple colours. ➢ No external battery or power required. ➢ No wiring required. ➢ Easy to install ➢ Weather resistance ➢ Long lasting working hours	
Quace solar garden light	It is meant for ambient lighting only, does not solve the purpose of brightly illuminating the garden. It can be installed in the garden, flowerbed, and greensward or anywhere in direct sunlight during the day.	➢ Eco friendly ➢ Energy saving ➢ Waterproof ➢ Rechargeable ➢ Automatic light sensitive function ➢ No wiring required ➢ No need for extra maintenance ➢ ABS land inserted socket will never have corrosion rust.	
Ozoy solar light	It is ideal for lighting front doors, patios, decks, around the pool and outdoor seating areas. Solar panel is made of Polycrystalline silicon.	➢ Highly water resistant with 1P65 waterproof level, making it great during sun or rain. ➢ Auto light at night and auto charge in the day time without photo resistance. ➢ Easy to install and use ➢ No wiring required ➢ Highly durable ➢ Weather resistance	

Enjocho solar light bulb	Bulb dangles from a clip that easily attaches to a patio umbrella and adopts 5 stars LED as light source.	➢ Eco friendly ➢ Low power consumption ➢ Highly durable ➢ Easy to install and use ➢ No wiring is needed	
Ohuhu stainless steel solar garden lights	This super stylish set of six garden lights is made from high-quality stainless steel and with copper finish. While also creating a relaxing ambiance that will make the garden the envy of the neighbourhood, their soft white glow will provide gentle illumination for your driveway.	➢ Simple and easy to install ➢ No wiring and batteries required ➢ High quality weather resistant ➢ Long lasting working hours. ➢ Highly durable ➢ High quality material ➢ Easy to use and move ➢ Highly transparent	
Nekteck solar powered garden spotlight set	This bright warm light provides white light or party-style multi-colored lights. It can put into the ground or mount up on a wall. One of the highlights of the spotlight duo is that they can be adjusted to 180 degrees, (90 degrees for the solar panel and 90 degrees for the light's head). There is also a choice of two modes: high/bright light mode or dim light mode.	➢ Highly durable ➢ Highly transparent ➢ Highly resistant for all kinds of weather ➢ Long lasting working hours. ➢ Easy to use and place ➢ 2 in 1installation ➢ Fully adjustable light and solar panel ➢ Easily absorb the sunlight during the day and automatically turn the lights ➢ Automatic dusk-to-dawn operation with manual on/off ➢ Long working hours	
Urpower wireless solar lights	It combined infrared technology to bring a bright white light with a motion sensor that is ideal for lighting and security needs. It is used in garden, backyard, deck, porch, patio, pond, veggie patch, driveway, or any outdoor location that needs a light.	➢ Fully automated switch on/off ➢ Dual lighting modes available i.e., high light mode & dim light mode. ➢ Long working hours ➢ Super bright ➢ Weather resistance	

Solarduke hanging solar light lantern	This light will add a special magical soft warm light to the garden. The lantern can hang from a tree branch to create a magical ambiance among the foliage, place in on the ground alongside a pathway, or hang it in the entranceway.	➢ Weather resistance ➢ Long working hours ➢ Highly resistant for all kinds of weather ➢ Hang it anywhere ➢ Easy to use ➢ Simple to install ➢ Highly durable	
Gama sonic victorian lamp post solar light	It provides double hanging lamp heads which makes an elegant addition to the garden. It stands at 90 inches tall. Lamp heads contain a bulb that produces 200 lumens of power, which creates a soft white glow that shines through the stylish beveled glass panes.	➢ Rust resistance ➢ Easy to install ➢ No electrical wiring required ➢ Adjust the brightness ➢ Conserve battery life by switching the brightness mode from high to low ➢ Easy to clean ➢ Weather resistance	
Moonrayspayton solar led plastic path light	These path lights are made from sturdy plastic with a “hammered” lens that gives style and shape to the light. At nearly 16 inches in height, the light won’t be obstructed by grass or shrub. The solar panel is on top of the lamp, so it needs to be in direct sunlight during the day.	➢ Weather resistance ➢ Simple to install ➢ Fully automated switch on/off ➢ Long working hours ➢ Highly transparent ➢ 360 degree display of light ➢ Eco-friendly	
Solar glow stainless steel led garden lights	This light provides bright clear light shines from each LED light.	➢ Stainless steel ➢ Highly durable ➢ Weather resistant ➢ Easy and simple to install ➢ Long working hours ➢ Fully automated switch on/off ➢ 100% solor powered	

Newhouse lighting solar flickering LED tiki torches	This light consists of 3 internal LEDs enclosed behind a frosted lens. Of the 3 LEDs, one flickers creating the romantic feel of a flickering flame. With solar dusk-to-dawn functionality, the torches recharge its internal NI-Cd batteries during the day using the sun's rays, and automatically illuminate at night using its built-in photo cell, making these the perfect addition to poolside's, backyards, patios or any outdoor environment	➢ Highly durable ➢ No installation or wiring required ➢ Long lasting working hours ➢ Easy to install ➢	

Table.2 Specifications of different solar garden lamps

S. No	Name of the lamps	Weight	Product dimension	Battery capacity	Sensor	Solar panel capacity	Dimension of solar panel	Material
1.	Scross Bright waterproof solar wireless security motion sensor LED night light for outdoor/garden wall (Black)	198 gm	95 x 124 x 48 mm	3.7v lithium ion	Automatic sensor	0.55kw	-	Plastic
2.	Crocon new solar powered rechargeable LED garden light auto on/off waterproof	90gm	5.5 x38 cm	1.2 V/600 mAh Ni-Cd	Automatic sensor	0.18W	3 x4 cm	Stainless steel and plastic
3.	Enjocho solar light bulb	-	15x7.5 cm	40MAH	-	1.2 V/0.6 W	2 X 4cm	polypropylene
4.	Quace solar garden light	90.7gm	5.5 x 5.5 x 38 cm	1.2V/600 mAh AA Ni-Cd	-	2V/50mA(0.1W)	-	Plastic, stainless steel

5.	Ozoy solar light	-	9 x 5 x 13cm	1.2V/1200 mAh AA Ni-MH	-	2V/120m A (0.24 W)	-	-
6.	Ohuhu stainless steel solar garden lights	-	29 x 9.5 x 34 cm	600MA/2 V	-	2V / 60Ma	-	Glass, stainless steel poli-silicon
7.	Nekteck solar powered garden spotlight set	794 g	3.74”	3.7V 2200mAh	-	-	3.42” x5.66”	Plastic
8.	Urpower wireless solar lights	635g	13.2 x9.2 x7.7cm	3.7V900m Ah	-	-	-	Plastic
9.	Solarduke hanging solar light lantern	-	4” x 4”x 8”	1.2V /1200mAh AA Ni-MH	-	2.7 V 0.1 W	-	Metal
10.	Gama sonic victorian lamp post solar light	4.5kgs	9” x25” x90”	3.2V/3000 mAh Li-ion	-	-	-	Aluminu m
11.	Moonrayspay ton solar led plastic path light	1.3kgs	15.9” x4.7” x4.7”	400mAh Ni-cd	-	1.2V	-	Plastic
12.	Solarglow stainless steel led garden lights	-	15” x10.8 x4.9	0.01V	-	3W	10 x 25 x 101	Stainless steel
13.	Newhouse lighting solar flickering LED tiki torches	0.45kg	60” x 4” x60”	400 mAh Ni-cd	-	-	-	Plastic

Table.3 Features, parameters identified and price of the solar garden lamps

S. No	Types of solar lamps	Features			Parameters			Price (Rs)
		Solar panel (W)	Battery(V)	Size (cm)	Lumens emitted	Charging hours	Working hours	
1	Scross Bright waterproof solar wireless security	0.55	3.7	48x95x124	600	8	8	332

	motion sensor LED night light for outdoor/garden wall (Black)							
2	Crocon new solar powered rechargeable LED garden light auto on/off waterproof	0.18	1.2	5.5x38	90	8	11	319
3	Enjocho solar light bulb	0.6	1.2	7.5x15	30	8	6	305
4	Quace solar garden light	0.1	1.2	8x30	180	8	5	299
5	Ozoy solar light	0.24	1.2	5x9x13	100	8	9	399

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