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CONCEPT OF SMART SOLAR STREET LIGHT

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Abstract: The high energy demand and the constant depletion of the fossil fuels lead us to shift our focus to renewable energy sources which are not only the future unlimited source of energy, it is also eco-friendly and viable for the environment. The solar street light is a innovation taken for the sustainable growth. though many policies have been implemented but the failures issues was not been resolved. This paper focuses on the failure reason and try to project a new methodology for the smart solar street light.

Keywords: Solar, Street light, Smart light

I. INTRODUCTION:

Street lighting is one the most important – and expensive – responsibilities of a city: Lighting can account for 10–38% of the total energy bill in typical cities worldwide (NYCGP 2009). Street lighting is a particularly critical concern for public authorities in developing countries 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 cut street 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 populations in remote areas. These cost savings can also enable municipalities to expand street lighting to additional areas, increasing access to lighting in low-income and other underserved areas

Most solar panels turn on and turn off automatically by sensing outdoor light using a light source. Solar streetlights are designed to work throughout the night. Many can stay lit for more than one night if the sun is not available for a couple of days. Older models included lamps that were not fluorescent or LED. Solar lights installed in windy regions are generally equipped with flat panels to better cope with the winds.

Latest designs use wireless technology and fuzzy control theory for battery management. The street lights using this technology can operate as a network with each light having the capability of performing on or off the network.

II. Working Components: Solar Panel

Solar panel is one of the most important parts of solar street lights, as solar panel will convert solar energy into electricity. There are 2 types of solar panel: mono-crystalline and poly-crystalline. Conversion rate of mono-crystalline solar panel is much higher than poly-crystalline.

Lighting Fixture

LED is usually used as lighting source of modern solar street light, as the LED will provide much higher Lumens with lower energy consumption. The energy consumption of LED fixture is at least 50% lower than HPS fixture which is widely used as lighting source in Traditional street lights. LEDs lack of warm up time also allows for use of motion detectors for additional efficiency gains.

Rechargeable Battery

Battery will store the electricity from solar panel during the day and provide energy to the fixture during night. The life cycle of the battery is very important to the lifetime of the light and the capacity of the battery will affect the backup days of the lights. There are usually 2 types of batteries: Gel Cell Deep Cycle Battery and Lead Acid Battery and many more.

There are some guidance which must be followed for lighting streets

Guidance for lighting of public streets, roads, and highways is provided in the Indian Standard (BIS, 1981). Since these guidelines are not enforced by any regulatory authority, it is common for municipalities to be unaware of the standards, and many fail to comply.

The most common reasons for inefficient street lighting systems in municipalities are:

Selection of inefficient luminaires

• Poor design and installation

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• Poor power quality

• Poor operation and maintenance practice

• There is tremendous potential to improve lighting quality while reducing energy use, costs, and greenhouse gas emissions— through energy-efficient retrofits for street lighting and improved operation and maintenance (O&M) practices.

The purpose of these guidelines is to increase the awareness about the Bureau of Indian Standards (BIS) Code of Practice for lighting of public thoroughfares and to provide practical guidance on energy-efficient street lighting best practices. Since the Code has not been updated since 1981, these guidelines can also contribute to the development of future standard

Advantages:

- Solar street lights are independent of the utility grid Hence, the operation costs are minimized.
- Solar street lights require much less maintenance compared to conventional street lights.
- Since external wires are eliminated, risk of accidents is minimized.
- This is a non polluting source of electricity
- Separate parts of solar system can be easily carried to the remote areas

Disadvantage:

- Initial investment is higher compared to conventional street lights.
- Risk of theft is higher as equipment costs are comparatively higher.
- Snow or dust, combined with moisture can accumulate on horizontal PV-panels and reduce or even stop energy production.
- Rechargeable batteries will need to be replaced several times over the lifetime of the fixtures adding to the total lifetime cost of the light.
- The batteries have to be replaced from time to time

III. Policies For Solar Lighting:

To promote solar lighting there was a large number of policies that has been implemented by The Govt. Of India. Some of the Policies are Jawaharlal Nehru Solar Mission(JNSM) and Rajiv Gandhi Grameen Vidyutikaran Yojna(RGGVY). To promote the use of solar while reducing the load on the grid in residential, commercial establishment's upto 100KW, MNRE has provided for soft loans with an interest cap of 5% to be availed through Non-Banking Financial Companies and scheduled commercial banks through IREDA. Banks are also being provided with incentives for promotional activities as well as cash prizes for villages that have a minimum installed base of 75% of solar lighting.

IV. Failure Reasons:

Whether you purchase large off-grid commercial solar light systems or smaller off-grid home solar light systems, there are generally only a handful of reasons these lights will fail. Hopefully after reading this list you will be able safeguard your off-grid solar lights against failure thus ensuring many, many years of trouble-free operation.

1. Solar Panel is Located in the Shade

Shading is very bad for your solar panels. *Solar panels use sunlight* to gather energy that is stored in the battery to power the light fixture at night. Shade prevents maximum amounts of sunlight from going through to the solar panel which in turn severely inhibits the solar panel's power production capabilities which in turn has an adverse effect on your off-grid solar light system. Seems simple, but you would be amazed at how many off-grid solar lights we have seen installed under a bush, tree, or some other obstruction that shades the solar panel.

2. Light is Located Above the Solar Panel

The charge within the solar panel is what lets the system controller know when it is dusk and thus time to turn the light fixture on. If the light fixture is installed above the solar panel, the system controller will think it is daytime and shut off the light fixture. As such, the solar panel needs to be installed above the light source or in a remote location away from the light fixtures.

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3. Solar Panel Doesn't Face the Correct Direction

Since the sun moves from east to west in North America, the optimum amount of sun is collected when the panels are facing South. If solar panel is not facing South, its sunlight harvesting and power production capability will be severely inhibited—thus negatively impact off-grid solar light system performance.

4. Solar Light or Panel is Undersized for the Job

A high quality off-grid solar light system is designed using a meticulous combination of calculations revolving around light fixture power consumption, load, solar insolation (based on geographic location of project) and autonomous battery storage to name a few. If any of these calculations are not performed properly, the net result will be a poorly design system that is suspect to failure.

5. Lamps or Batteries Need to be Changed

The only scheduled maintenance required for a high quality off-grid solar lighting system is a) light fixture lamp change and b) battery change. The typical life expectancy of a CFL lamp is 20,000+ hours while high performance LED lamps are rated to last well beyond 100,000+ hours. The battery life expectancy within a properly designed off-grid solar lighting system is 5-7 years. If the system is not operating properly—and the solar panels are facing South and are not shaded and the system calculations/design are done properly, chances are high that its either time to replace the lamp of the batteries.

V. CONCLUSION:

One of the major issue of failure of solar street lighting system is theft of batteries. Thus the loop of battery can be removed by using smart solar street lights. The street lights can be directly integrated to the Grid and the energy generated by the solar panels connected to the street lights in the daytime can be exported directly to the grid. In the evening the same can be drawn from the grid to light up the street lights. This will not only ensure the low cost as the energy storage device battery is not required, it will also ensure the net zero consumption of street light electricity which will also curtail down a huge amount of electricity for the Government. The net zero consumption can be measured by using an import-export meter.

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