

HYBRID LIGHTING SYSTEM IN A BUILDING

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ABSTRACT

Hybrid lighting is the combination of solar and artificial lighting which is used to illuminate the interior where there are no windows and skylights. In this paper there is focus on the study of many ways to protect and conserve energy in public or private buildings. And to learn how Hybrid Lighting systems work and indentify the key components for an efficient operation. It also describes the goal for future hybrid solar lighting system. There is also the cost analysis regarding hybrid lighting installation and labor cost. This paper is just the overview of designing of hybrid lighting system in a building.

Key words: Hybrid, Light guides, optical fiber, solar collector.

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1. INTRODUCTION

Hybrid solar lighting is the combination of solar and hybrid lighting which is used to illuminate the interior where there are no windows and skylights. This hybrid solar lighting technology provides high-quality lighting for facilities and reduces waste heat to lower energy loads. Hybrid lighting has the potential to significantly reduce energy consumption meanwhile it also maintains or exceeds lighting quality requirements. This technology is one of the most functional and productive which ensures the good payback period. Hybrid solar lighting can significantly reduce artificial lighting requirements and energy costs in many commercial, industrial buildings and in institutional facilities such as schools, libraries, and hospitals. The hybrid solar lighting technology has many benefits of natural lighting with many advantages of an electric lighting system flexibility, convenience, reliability, and control.

2. PRINCIPLES OF OPERATION

Hybrid lighting systems are produced by a combination of four technologies:

- Collecting natural light
- Generating artificial light
- Transporting and distributing light to where it is needed and,
- Controlling the amounts of both natural and artificial light continuously during usage.



Figure 1 Hybrid lighting systems in a Building

- Tubular daylight guidance system collectors
- Output devices;
- Light guides

The hybrid solar lighting system uses a solar collector which is mounted on the roof) to concentrate visible sunlight into a bundle of plastic optical fibers. The optical fibers penetrate the roof and distribute the sunlight to multiple “hybrid” luminaires within the building. The hybrid luminaires blend the natural light with artificial light (of variable intensity) to maintain a constant level of room lighting. One collector powers about eight fluorescent hybrid light fixtures, which can illuminate about 1000 square feet.

The lighting through optical fibers is illuminated when there is plenty of sunlight and if there is little or no sunshine then to maintain a desired illumination level, sensor controls the artificial lamps intensity.

The current optimal length of optical fibers is maximum 50 feet. As the length increases intensity of light decreases. So we can use this hybrid lighting technology on the upper storeys or in maximum 5 storey building.

3. THE GOAL FOR FUTURE HYBRID SOLAR LIGHTING SYSTEMS

The hybrid solar lighting technology is the systematic and logical pathway for achieving the following goals as this hybrid lighting technology uses small, flexible optical fibers to deliver the sunlight directly to the places in the building where it is required. Hybrid solar lighting is applicable to different building types and can be used for a variety of services like lighting and heating applications.

As a result, the potential near-term energy savings of this technology could be remarkable.

- It is compatible with various electric lamps, light fixtures, hot water heaters, photovoltaic, etc., and usable for various applications in a building.
- It is easily modified as space needs change.
- It is connected to standard power sources to ensure that disruptions in service do not occur on cloudy days or at night.
- It is affordable.

4. ADVANTAGES OF HYBRID SOLAR LIGHTING

- It is considered as high-efficiency light source because solar lighting has no infrared component.
- Conservation of electricity can be done with the use of hybrid lighting in proportion to the sunlight available in an amount
- Potential for leaks are reduced by roof penetrations.
- Heating, ventilation, and air-conditioning loads are reduced by 5 to 10%.

- Hybrid solar lighting can be used both for direct lighting and for indirect lighting, task lighting, and accent lighting.

5. COST CONSIDERATIONS

- The glass-based system of hybrid solar lighting costs about \$40,000 to illuminate 1000 square feet area of the building. The plastic based system cost about \$3000 to illuminate 1000 square feet.
- Payback period for hybrid lighting depends upon the efficiency of the electric lamps which is used with the combination of distributed sunlight.
- The system cost in 2006 was Rs 13.5 lakhs. In 2007, it was Rs 10.8 lakhs and in 2012, it was Rs 2 lakhs (Per 1000 square feet).
- The installation cost for hybrid lighting system in 2006, 2007, 2012, it was Rs 2.7 lakhs, Rs 2 lakhs, Rs 65000 respectively (per 1000 square feet).
- The cost of H.S.L. system inclusive of installation and labor (2016) is Rs.27000 per 1000 sq. feet.

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