

Importance of street lighting construction essay



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INTRODUCTION

1. 1 Introduction

Street lighting ensures safety to literally every citizen in Sri Lanka by providing guidance and direction across the vast territories throughout the country. Citizens have grown accustomed to driving the streets, rural roads and busy urban thoroughfares, relying on improved visibility and safety afforded them by generous lighting conditions provided by several street light standards of the roadways. Similarly, the safety and ability to maneuver along walkways and sidewalks, in both congested and remote areas, is tremendously enhanced for pedestrians and cyclists. Street lights must be designed therefore to minimize glare and render enhanced colour recognition to meet people' s visual needs in observing objects.

1. 2 Importance of Street Lighting

Street lighting is an essential public service that provides a safer environment at nighttime to commuters as well as pedestrians. Proper use of

street lighting as an operative tool provides economic and social benefits to the public including: Reduction in night accidents and economic loss Aid to police protection and enhanced sense of personal security Facilitation of smooth traffic flow Promotion of business and the use of public facilities during the night hours. While this service is commonly available in developed countries, there is a shortage of proper street lighting facilities in many areas in developing countries due to lack of financial resources. The lack of adequate light at night has given rise to poor living conditions and as such, street crimes, and other mishaps are commonplace. Street lighting is perhaps more interesting topic for politicians to gain their supporters. It is the most conversable topic among people and essential activity of local authorities, Pradesheya Sabhas and municipalities where the electrical consumption can be considered as having a totally stable load pattern (kWh) during designated operating hours for each and every day. The number of lights and power requirements stay relatively steady over the nightly operating period. The only real variation is the quantity of operating hours each evening as determined by the time of the year. On the other hand, some degree of weather is varying where photo cell control systems exist during dark and misty time periods where areas like upcountry. As such, we have very predictable load patterns and energy values for street lighting that mostly operate including peak power extracting time periods considering the Ceylon Electricity Board (CEB) national grid. One opportunity to address the demand-side of this issue is to save electricity via technological upgrades of street lighting with the help of municipalities and local authorities. Electricity used for streetlights accounts for up to 1. 1% of electricity used by national grid stated in Statistical digest in 2011, published by CEB. It is worth noting <https://assignbuster.com/importance-of-street-lighting-construction-essay/>

that large amount of non-metered street lighting profiles exhibit a steady state operation on a month by month basis despite the fact that the new street lamp installations have been grown by 30% annually as revealed by street lamp census in 2010. This strategy will be worst during the election periods. Thus, the virtual billing value which is submitted by local authorities to the power and energy ministry, do not truly represent the actual load profiles. In response to the plotting of the billing information, both municipalities and local authorities have to be taken action to ensure true representation of load profiles with representing of CEB personnel to witness the actual requirements of the street lighting equipments. The electrical energy consumption of street lighting constitutes an important part of total energy consumption. Saving energy in street lamps is therefore important for total energy savings. It is known that street lighting levels are excessive in many cases. For instance, in the case of low traffic volumes, the lighting levels are excessive and could be reduced so that energy savings can be achieved. On the other hand, in specific situations and for traffic safety reasons, light levels should be increased even in the case of low traffic volume. Reductions in energy consumption through the installation of modern lighting equipment, control and management practices have a direct impact on the level of greenhouse gas emissions from street lighting. Reductions in greenhouse gas emissions are directly related to reductions in energy consumption; hence the potential savings are of the same order and vice versa.

1.3 Motivation

This research keeps the focus on energy efficiency measures in the street lighting sector. The street lighting situation in Sri Lanka is still largely dominated by inefficient technologies, most importantly standard incandescent, low efficiency fluorescent tube or mercury and sodium vapour lamps. Although cost-effective when regarded over the full lifespan of the lamp, more efficient options, such as light emitting diodes (LEDs), induction lamps and solar powered systems struggle to penetrate the market. Several promotion programs for energy efficient lighting can be found by the government in recent past (reference??). This research is concerned with possibilities to promote the approach of energy efficient street lighting technologies for grid-connected or off grid usage in Sri Lanka. This approach is initiated to evaluate the economic, technical, and operational feasibility of replacing the existing street lamps with LED light sources. Specifically, the following areas were evaluated as part of this research: Energy and maintenance cost savings of LED lamps over the existing street lamps Energy and maintenance cost savings of solar powered LED lamps over the existing street lamps Optimum luminance that should be maintained on various roads and streets in compliance with British and IESNA standards and comparable those to the streets lighted by the existing High Pressure Sodium (HPS) vapour lamps which were installed in most of the town and highly congested areas where more luminance is needed. Cost-effectiveness of deploying a photocell or timer switching for street lamp operation. The energy and maintenance cost savings are key inputs to the cost-effectiveness analysis of LED. The performance metrics in the economic analysis includes simple payback as well as the net present value of cost savings over the lifetime of

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the LED fixtures. This research findings point out the key market barriers for technology uptake in the street lighting sector and discusses the current state of technology promotional programs.

1. 4 Objectives of the research

The first objective of the research is to get an inventory verification of various kinds of street lamps connected in all over the country and secondly, to analyze the performance of existing lamps and its control systems. Road surface luminance is one of the control parameters in intelligent road lighting control systems. The third objective is to identify the optimized luminance intensity on the roads as part of assessment for efficient street lighting systems. The final objective is to find a best option for energy efficient street lighting. At present, in urban roadway lighting applications, High Pressure Sodium (HPS) and mercury vapour lamps which are the most widely used light sources. In semi – urban and rural area road lighting, fluorescent lamps and CFL is widely applied. LEDs are fast developing light sources and are considered as one promising light source for general lighting. However, LEDs are not used already for street lighting applications in Sri Lanka, since the initial cost of LED is very high as yet. Currently, HPS lamps are the dominant light source used in street lighting because of long lamp life time and high luminous efficacy. The research assessment is a comparative life cycle assessment including other economical analysis which was performed on Incandescent lamp, Fluorescent lamp, High Pressure Sodium (HPS) lamp, Mercury Vapour lamp, Induction lamp and Light Emitting Diode (LED) streetlight technologies. It also focused on the categories of energy efficiency, light quality, global warming affects ect. The majority of

streetlights are individually controlled by manual operation and some are by photocell and timer switch. It is revealed that some local authorities such as Colombo Municipal Council (CMC), have installed and upgraded a system that allow light levels to be controlled in certain time periods in addition to the photocell operation. Maintenance of streetlights consists almost entirely of replacing burnt bulbs or other defective components. Lights controlled by photocell are not monitored remotely in Sri Lanka and are replaced when reported by complaints of people or noticed during regular inspections. Bulb replacement is performed by relevant local authorities or municipalities.

1.5 Outline of this Report

This research conducted a detailed study of how to implement an energy efficient street lighting technologies in Sri Lanka. This study provides the data and analysis necessary to evaluate whether changing existing street lighting system is a worthwhile investment, not only economically but environmentally as well. The adoption of newer technologies could save the millions of rupees in each year by minimizing both energy and environmental costs while reserving them to invest in other infrastructure upgrades. This thesis consists of seven chapters including the literature review, methodology, case studies, economic analysis and results, and discussion. The literature review is the chapter 2 which explains the basics behind street lighting, the different types of lighting technologies, how they work, how they affect the environment, and how they meet current lighting requirements along with their advantages and disadvantages. The methodology chapter explains how the study was conducted with a detailed explanation of both methodologies and economic calculations. This chapter

presented a series of calculations to verify the data which are relevant to this study. How the data was applied to these methodologies will also be explained in chapter 3. This research thesis consists of three case studies. First one is the basic structure of this thesis, so that, the street lamp survey conducted to find out the total no of lamps in the country. It gives a basic understanding of the main end-use applications and target sectors of the different lamp types, control systems and an idea of the energy efficiency potential available in the street lighting sector. The second is illumination evaluation for HPS lamps connected in Galle road section. The auto operated street lighting system implemented in Balangoda town area and street lighting control system conducting in Sri Lanka also discussed as the case study 3 in this chapter. All these case studies are presented in chapter 4. The chapter 5 consists of economic analysis for all case studies and sets the insights gained throughout the research is enlightened by economic analysis. The economic performance was calculated as simple-payback for substitution of LED and solar powered LED solutions to the existing lamps that includes in accounting for lamp life-span, maintenance costs, and electrical costs. Conclusion chapter covers the results from the study to include their sensitivity to changes in costs associated with power production, maintenance costs, fixture costs, and service life. Environmental costs with carbon emissions savings and impacts were also calculated and discussed with regards to the different lighting technologies including solar powered stand along LED system. Finally, discussion chapter reviews the findings of this study and recommends the course of action that should be taken for implementation of energy efficient street lighting along with areas for future research.