Comparing Economic between LED and Sodium Lighting Systems at Highway Amman-Zarqa

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***Abstract*—**The study deals with lighting highway Amman- zarqa by traditional kind of lighting use sodium lighting unit and replaced by LED unit, and compare the difference between them in the financial and technical systems. The study is calculated the overall loads of lighting units used along the way and annual financial savings through which replace the lighting units.

Road lighting is widely recognized as an efficient traffic safety measure. However, we know too little about the effect of road lighting on accidents in a given situation and we do not know what kind of lighting that is optimal for the situation. today has a demand for energy savings, locally and globally, and we should not use more energy for road lighting than is necessary.

Lighting units used and work on replacing it by LED lighting units, It is what we aim to achieve in this study the lowest cost, that is proved through the annual savings in consumption bill , and be able to buy lighting units to be replaced. This study has achieved savings in electrical energy consumption in order to save on your monthly bill and the amount of lighting acceptable and the replacement of old units and new lighting quality.

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***Keywords*—** LED, High Pressure Sodium (HPS) Lamps, Luminous Intensity, Street Light Standards.

I. Introduction

STREET Street lighting are used for the lighting of public thorough fares and roadways, contributing to road safety as well as public safety. The reliability and safety of this luminance have a direct impact on levels of customer satisfaction as well as quality of supply.

Outdoor lighting is an essential part of our life and is designed to improve visibility of pedestrians and vehicle drivers. Electrical street lighting began with Edison's incandescent light bulb late in the 19th century. However, streets had been lit before that with gas or arc lamps since in the early 15th century. Much has changed since Edison introduced the incandescent light bulb. When lighting installations are designed, they usually need to fulfill certain lighting requirements. During the last decade, energy savings strategies applied in street lighting throughout the world have taken a vast interest initiated by the replacement of the inefficient lamps such as high pressure mercury (HPM) lamps with more efficient high pressure sodium (HPS) lamps. LED provides on average 50-60% reduction to annual consumption when compared to traditional lighting and have an extended life of 20 years as opposed to the standard 3 to 6 years for a traditional lamp.

In Jordan energy consumption is extremely difficult challenge because Jordan imports more than 95% of the total energy consumed. The proportion of energy consumption for street lighting is about 3% of the total electrical power consumed. The purpose of this thesis was to use street LED lighting instead of high pressure sodium (HPS) lamps at Jordanian streets in Amman and zarqa. The new system will improve safety were used to reduce the power consumed in street lighting in Jordan. [4].

Fig. 1 The road linking Amman with zarqa, Lighting is 25-kilometre highway

This project will connect approximately 50% of Jordan's population to each other. The project is designed to alleviate traffic congestion on the main highway between the two cities;

LED Roadway Lighting Ltd. (LRL) is pleased to announce that the NXT-M luminaries has been recognized in the 2015 Next Generation Luminaires™ (NGL) Outdoor Lighting Competition (www.ngldc.org). The announcement was made on May 5, 2015 at Lightfair International in New York City. [1]

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The NGL Solid-State Lighting Design Competition is sponsored by the U.S. Department of Energy, the Illuminating Engineering Society and the International Association of Lighting Designers and "seeks to encourage technical innovation and recognize and promote excellence in the design of energy-efficient LED luminaires." The judging panel selects luminaires on the basis of appropriate illuminance; light distribution; backlight, uplight and glare (BUG) ratings; glare control; serviceability and replacement; energy efficiency; lumen maintenance, and other factors.

1) *Continuous Lighting Classified as Safety Lighting:* Studies on the effectiveness of roadway lighting have mixed results. It is generally accepted that, overall, continuous lighting reduces crashes by about 30 percent. The precise mechanism for the reduction of those crashes is not known. Currently it is not possible to translate surrogate measures, driver performance with targets, or other measures directly into a safety change.

General Estimates System (GES) show that 90 percent of fatal and injury crashes that occur on the roadway, where lighting guidelines specify that light be placed, are multiple vehicle crashes. .

2) *Considerations Before Implementation:* Special events, weather, and other local considerations should be included in the decision to implement lighting curfews. Implementation of curfews should occur through traffic management centers and should be monitored to gain experience as to the best operational, Over 50 percent of all motor vehicle fatalities occur in darkness even though only 25 percent of all travel occurs at night. This over representation has been used as a justification for installing fixed roadway lighting on many highways. However, research that has attempted to determine the effect of such fixed lighting on frequency and severity of night accidents appears to be mixed, such frequencies and severities being dependent on a host of geometric and traffic factors including the volume of traffic utilizing the road, how such volume is related to the road's capacity, and the complexity of the driver's visual search task. During the past decade, several highway agencies have switched off roadway lighting during periods of energy shortages to reduce maintenance and operating costs. However, quite often such lighting was restored when nighttime accidents increased. One fundamental problem with these light reduction techniques was that lighting was reduced or eliminated during the entire.

II. Lighting Equipment

This study contains definitions and explanations of the equipment used in highway illumination. Multiple types of lighting units used in street lighting some of the in figure below.

Fig. 2 two kind of street lighting unit

Continuous lighting requires the financial cooperation of the city, because the benefits derived extend beyond enhanced safety for motorists. Some of these benefits are improved aesthetics, lower crime rates, and a more conspicuous appearance for the city.

Circuit Design

Once the service type is determined, the circuits can be designed. This section covers the major considerations in the designing of roadway lighting circuits. Designers should refer to the *National Electrical Code (NEC) Handbook* for additional information.

Voltage Drop

The primary limitation on the length of circuits is the voltage drop. Calculating Voltage Drop, is important to be considered.

Conductors and Conduit Size

Another consideration is the number of conductors that can be installed in the various sizes of conduits. shows the maximum number of conductors allowed in each conduit based on the capability of the wire to dissipate heat. However, with conduit runs of any substantial length, it is usually not practical to install the maximum number of conductors allowed in the conduit.

Electrical Service Equipment Sizes

Electrical service equipment sizes are based on the branch circuit load and the number of branch circuits. Note that all electrical equipment on the standard electrical service, except the lighting contactor, must be reduced to 80 percent of its rating (For example, only 40 design amperes is allowed on a 50 amp breaker.) The lighting contactors are rated for operation at full current rating.

Safety Lighting and Traffic Signal Installation

When safety lighting is installed by the state in an incorporated city as part of a traffic signal installation, a separate electrical service is not required. The safety lighting is considered incidental to the traffic signal installation and is covered by the traffic signal agreement or municipal maintenance agreement.

Illumination Levels

Illumination levels should be higher than normal, where practicable, in detour areas, gore areas, and other construction zone obstacles. Illumination levels and uniformity may be lower than normally required in areas where the motorist has no special navigational decisions to make. Lighting systems should not create excessive glare, a potential problem with low mounting heights.

Data sheet

100W LED Streetlight Datasheet with 5,000K Color Temperature: Table below the specification of LED unit and the element of contain.

Voltage/Frequency	100 - 277V
Consumption	100W
Lamp Luminous Flux(lm):	11000 lm
Colour temperature	3000K - 6000K
Output colour index	> 80 WW > 70 CW
Light beam	30° - 60° optional
Use temperature	-20°C ~ 40°C
Duration*	35.000 hrs
Protection index	IP65

Figure(3) shows the LED lighting system components lamp body , LED chips, lamp housing and power supply, Which form the basic elements of the system.

Fig. 4 LED lighting system components

Data sheet: High Pressure Sodium Lamp 250w

That old unit is Lighting systems used in lighting road Amman Zarqa about 20 years ago.

Fig. 5 high pressure lighting unit

Nominal wattage	250 W
Rated wattage	250.00 W
Lamp current	3.0 A
Nominal voltage	100 V
Ignition voltage	3.3 / 5.0 kVp
Rated luminous flux	18000 lm
Color rendering index Ra	≤25
Color temperature	2000 K

III. CALCULATIONS

We have calculated year total cost for traditional lighting type of highway and LED type and costly compare between them as seen in table below. We found that we can safe 108000jd a year. This annual savings in consumption bill, we can replace the traditional lighting unit's modern lighting units with high technical and economic characteristics. Characterized by lighting units and the amount of Flex high and also more operational life and high efficiency.

Replaced 2000pcs of LED unit is costly 2000x 80JD=160000JD, this value can safer one and half year in monthly bill

25km HPS type	40pole/ km	1000 pole	2000x250 unit	500kw	500x10h	5000kw	500jd/day	15000 jd/ month	180000 jd/year
25km LED type	40pole/ km	1000 pole	2000x100	200kw	200x10h	2000kw	200jd/day	6000 jd/ month	72000 jd/year

IV. Conclusion

1- The study and calculation showed savings in annual consumption bill.

2- Annual financial savings through which replace the lighting units.

3- The use of lighting LED units contribute to raising the efficiency of lighting and the resulting.

4- Work on replacing the lighting units ago on the operation for over 20 years.

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