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ENERGY EFFICIENCY FRAMEWORK FOR A COMMERCIAL BUILDING

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ABSTRACT

Energy conservation is a very important concept to the world. All the energy sources are reduced due to day to day uses. Because of that this concept should be implementing in the local industrial environment. According to the bank management one of the main problems was the electricity consumption of the Tower. Although as a bank the usage of electrical equipment are somewhat low, the electricity bill was considerably high with respect to the demand. At the same time it required high maintenance and repair cost. Thus the Seylan bank uses high quality and new technological equipment the electricity consumption of such equipment seems to be high. To address this problem the research was conducted to develop an energy efficiency model for the Seylan Towers which can be used in any building similar to the Seylan Building. In this research the designed model was partially installed in the Bank premises in order to reduce power consumption ratio. From the research out comes it has identified three components such as Chillers, motors and lighting which are having high power consumption ratio and by replacing these components it can be reduce 30% from total power consumption with 3.3year payback period Applying the energy efficiency concept is the most beneficial way to save not only the energy but also cost and time.

Keywords: Energy efficiency, Energy conservation, Low power consumption

1. INTRODUCTION

There are many motivations to improve energy efficiency. Reducing energy use reduces energy costs and may result in a financial cost saving to the user if the energy savings offset any additional costs of implementing an energy efficient technology. Reducing energy use is also seen as a solution to the problem of reducing greenhouse gas emissions. According to the International Energy Agency, improved energy efficiency in buildings, industrial processes

and transportation could reduce the world's energy needs in 2050 by one third, and help control global emissions of greenhouse gases[1].

The purpose of advancing Power efficiency is to found characteristic parameter which can estimate how much building energy could be used for people, and to obtain the relationship between people and used energy. So the control and manage of wasted energy by people in buildings according to energy efficiency can be done. Though the present advanced power efficiency has certain inaccuracy and needs further research to found out how to ensure effective energy and wasted energy, it has laid the foundation of further compute for building's based energy consumption[2].

Colombo is an area which has high energy usage. Since the Head Office of Seylan bank located in Colombo city, and energy efficient system will be a good chance to contribute to reduce energy consumption within Colombo city as well as to reduce the production cost on national electricity board. At the same time as the Seylan Bank is a commercial building with 17 floors with 76081.20 sq.feet floor area, this building consume much energy than normal buildings. These factors lead to high electricity bills on the Seylan Bank. Implementing an energy efficiency system for the Seylan Bank will be very helpful for them to reduce their electricity bill.

2. EXPERIMENTAL

Seylan Tower was analyzed for the identification of locations to be place power consumption meters. Power consumption meters were installed in the places of electrical equipment was located. An energy audit has been conducted to identify the power consumption of the each electrical components installed in Seylan Tower such as chiller, motors, lights. Meter readings were taken and recorded. The total consumption of each component was recorded for 4 months. The total of meter readings were calculated by adding up all the readings of the meters and the results were compared with the electricity bills. The audit report was analyzed and suitable actions were taken to reduce the electricity consumption.

2.1. Modifications

- Chiller was replaced with magnetic bearing chiller
- VSD system was installed to the motors
- Florescent bulb were replaced with LED bulbs

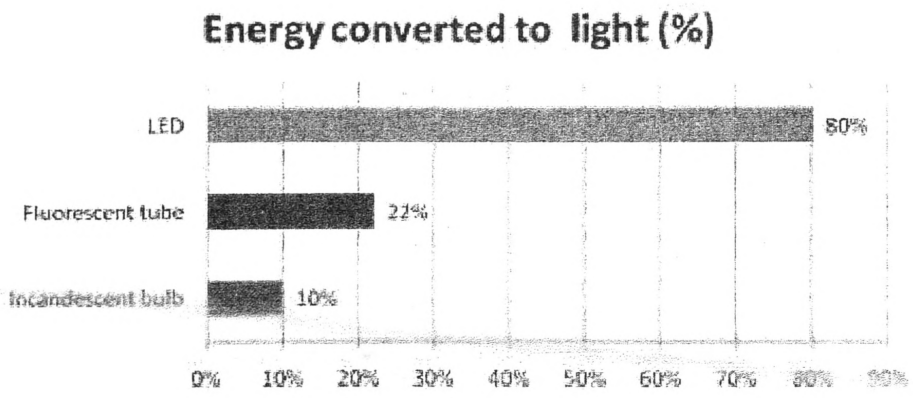

Figure 1: Percentage of converting energy

3. RESULTS AND DISCUSSION

Table 1 shows the electricity consumption of 5 components which were measured with the aid of meter readings.

Table 1 : Power consumption of Seylan tower

No	Equipment	Old Units, kWh	Electricity consumption	Old Cost, LKR
1	Chilled Water Pump	521,661	11%	13,860,177
2	Cooling Water Pump	509,835	11%	13,545,968
3	Chiller	1,247,606	27%	33,148,054
4	Lighting	364,203	8%	9,676,632
5	Air Handling Unit (AHU) and Fans	827,951	18%	21,998,711
6	Other	1,128,471,24	25%	29,982,711
	Sub-Total	**4,599,728**	**100**	**122,211,637**

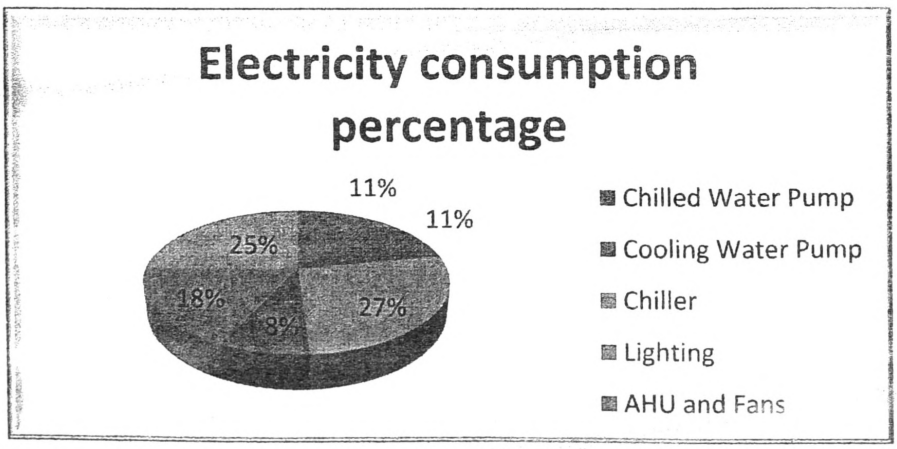

Figure 2: Electricity Consumption Percentage

Above Table 1 and Figure 2 indicates the percentage of the electricity usage with in the building. The maximum energy consumption is for the air conditioning plant and associated equipment account for 68% of the total energy usage. The cost of Air Conditioning plant per annum is Rs. 82,552,293.

- Power consumption of the VSD system and existing

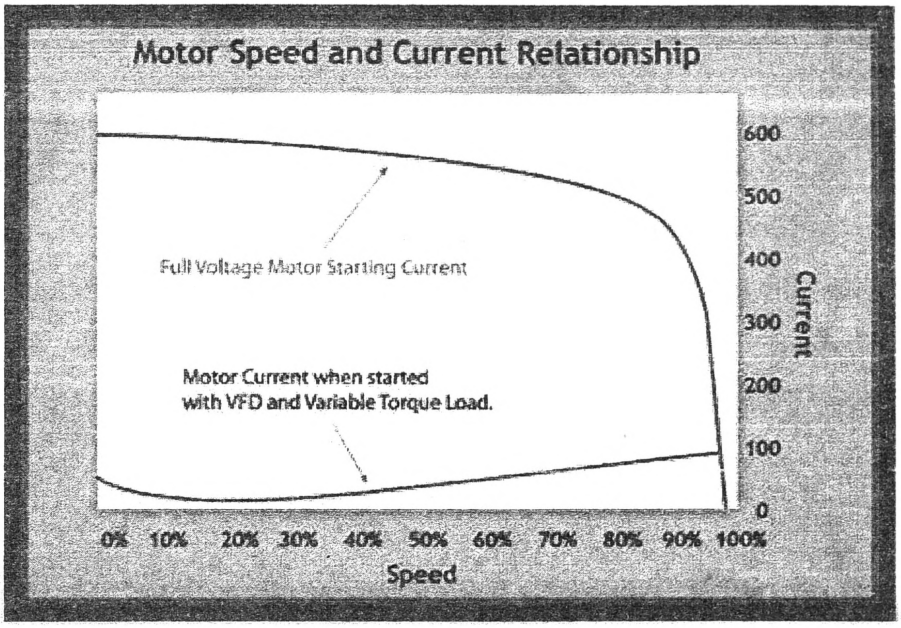

Figure 3: Motor Speed and Current Relationship

3.1. Replacement of 3060xT8 with LED lighting instead of T12 fluorescents

Energy consumption of LED tubes over Fluorescent tube was analyzed and the information about the energy consumption of two types of light tubes ware shown below. The consumption details of modified components were calculated and it shows that the payback period is 3.3 year only.

4. CONCLUSION

Thus the Seylan bank uses high quality and new technological equipment the electricity consumption of such equipment seems to be high. By implementing a framework to reduce power consumption of the Seylan tower the power consumption as well as the maintenance and repair cost can be reduced. The developed energy efficiency model for the Seylan Towers also can be used in any building similar to the Seylan Building. From the research out comes it has identified three components such as Chillers, motors and lighting which are having high power consumption ratio. The maximum energy consumption was for the air conditioning plant and associated equipment account for 68% of the total energy usage and by replacing these components it can be reduce 30% from total power consumption with 3.3year payback period.

Applying the energy efficiency concept is the most beneficial way to save not only the energy but also cost and time.

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