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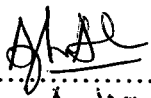
Energy efficiency enhancement at FKE administration block
/ Mohd Azrin Abdul Aziz.

**ENERGY EFFICIENCY ENHANCEMENT AT
FKE ADMINISTRATION BLOCK**

MOHD AZRIN BIN ABDUL AZIZ

MAY 2009

“I hereby declare that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Industrial Power)”

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
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*This Report Is Submitted In Partial Fulfillment of Requirements for The
Degree of Bachelor of Electrical Engineering (Industrial Power)*

**Fakulti Kejuruteraan Elektrik
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Thank you to Allah because with His blessing I have finished writing final year project report on time as stated the dateline. As all known, final year project is the criteria for student qualified to receive degree in Bachelor of Electrical Engineering.

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ABSTARCT

Energy efficiency enhancement is a case study to find out the best solution to make electrical energy be managing efficiently and enhance the electrical energy usage by the consumer. The research will be base on electrical energy consumption at FKE administration block. From the observation that have been done, electrical energy at FKE administration block have not managed properly. For example, the lobby lamps have been light up on the daylight and the lamp and the air conditioners at the certain room have been switch on although the room is empty. Unconsciously, these problems caused electrical energy have been waste. It also brings to the higher monthly electricity bill and a big amount of money will be needed to pay the electric bill. As the result, this research will be study on the electrical energy consumption by the consumer and the energy efficiency enhancement for FKE administration block. This research also determining the TNB statement that said ‘most of the consumer use electrical energy 30% more than actual usage daily’ either correct or not.

ABSTRAK

Peningkatan Kecekapan Tenaga Di Blok Pentadbiran FKE merupakan satu kajian kes untuk mendapatkan satu penyelesaian untuk meningkatkan pengurusan penggunaan tenaga secara efisien dan mempertingkatkan penggunaan tenaga oleh fakulti. Kajian kes ini adalah berdasarkan penggunaan tenaga elektrik di blok pentadbiran FKE. Berdasarkan tinjauan keseluruhan blok, didapati penggunaan tenaga elektrik tidak diuruskan dengan baik. Kebanyakan lampu di dalam blok telah dinyalakan pada waktu siang dan penggunaan alat penghawa dingin telah dibazirkan kebanyakan bilik telah dibiarkan begitu sahaja. Tanpa disedari, masalah ini telah mengundang kepada pembaziran tenaga elektrik. Hal ini turut mengundang kepada peningkatan bil elektrik bulanan yang tinggi dan kos bil bulanan yang tinggi bagi membayar bil. Di akhir kajian, dijangkakan penggunaan tenaga akan diuruskan lebih efisien dan bil elektrik bulanan dapat dikurangkan daripada jumlah bil – bil bulanan sebelumnya.

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CHAPTER I

INTRODUCTION

1.1 Problem Statement:

From the observations that have been done, we found that faculty has not used electrical energy efficiently. Most of staff and student love to take for granted the electric energy that has been used by them. They usually leave a room with lamp switch on and air conditioner still running. This bad attitude cause wasting energy and increasing of the monthly bill.

The electric energy has not been managed properly. For example, the lamps at the stairs have been light on the daylight. Actually, the lamp have been switch on to light up the ground floor stairs. However, because of the wiring have been set to light all lamp with one switch, all lamp will be turn on when the switch turn on. This inefficient wiring bring to the waste of electricity.

The air conditioners have been switch at minimum control. The buildings at the FKE use air conditioner type chiller, which it use central source to produce cool air in the building. From the central, the air has been distributed to the Air Handling Unit (AHU) floor by floor each block. And then the air has been distributed to the rooms. However the air conditioner has not been control efficiently. These problem cause the rooms temperature became very low. So that, there will be uncomfortable for people stay inside the building. There are also a few problems

Regarding to the statement from Tenaga Nasional Berhad (TNB), most of the consumer use electrical energy 30% more than actual usage. The statement can be approved by the study the energy consumption by the consumer. From this case study the statement could be approve.

1.2 Objective Project

Objectives of project is the basic criteria for doing the project. This is important to makesure the project will be running fluencely untill the end and the final result will be achieve in the end of the project. Below are the objectives of the project.

First, to study the electrical energy consumption by the faculty. Energy consumption must be study to see how the faculty uses the electrical energy daily. This is important so that we can see the polar of energy consume by the faculty. Furthermore, the study also helping to lookout how does faculty manage the electric energy overall building.

Second, to manage electrical energy usage in FKE administration block. In order to enhance the energy efficiency, one of the ways to do is manage the energy usage properly. The waste of energy does not happen to the whole building. But, there just a few rooms or parts of the building should be considered. For example, the lamps at the lobby have been switch on to light the entrance. However, not all lamps should be light up. Just a few lamps near the entrance must be light on.

Third, to find steps to enhance the electrical energy usage by the faculty. At the end of the project, we expect to have the best solution to helping faculty to enhance the electric energy consume by the faculty and helping faculty saving for monthly electricity bill.

CHAPTER II

LITERATURE REVIEW

2.1. Introduction

Literature review is to study for fulfill the objective. The literature review that have been study in connection with auditing energy and other instrumentation that related with energy efficiency. The study is focus on to analyze the electrical consumption in the building at block F which is include energy audit, loading, wiring plan, maximum power demand, lighting, air conditioning and all equipment that is involve in this study.

2.2. Energy audit

Energy audits are a systematic study, inspection or survey to identify how energy is being used in a building or a plant. It is provide an analysis of the amount of energy consumed during a given period in the form of electricity. Auditing energy also identify the potential for energy savings accurately. Energy audit is the first step in controlling the waste energy consumption. Using proper audit methods and equipments, an energy audit provides the energy manager with essential information on how much, where and how energy is used within building. This will indicate the performance at the overall plant or process level. The energy manager can compare these performances against past and future levels for a proper energy management. The main part of energy audit report is energy saving proposals comprising of technical and economic analysis of projects. Looking at the final output, an energy audit can also define as a systematic search for energy conservation opportunities.

2.2.1. Energy audit stages

Energy audit can be categorized into two types, namely walk-through or preliminary and detail audit.

2.2.1.1. Walk-through or preliminary audit

Walk-through or preliminary audit comprises one day or half-day visit to a plant and the output is a simple report based on observation and historical data provided during the visit. The findings will be a general comment based on rule-of-thumbs, energy best practices or the manufacturer's data.

2.2.1.2. Detail audit

Detail audit is carried out for the energy savings proposal recommend in walk-through or preliminary audit. It will provide technical solution options and economic analysis for the building management to decide project implementation or priority. A feasibility study will be required to determine the viability of each option.

Detailed energy audit is most comprehensive but also time-consuming energy audit type. Specifically, it includes use of instrument to measure energy use for whole building and some energy systems within.

2.3. Factor affecting energy use in building

The factors affecting energy use in buildings can be categorized into two groupings:

2.3.1. End-use

The amount of energy used in buildings depends firstly on what it is used for. Thus the initial and most important step in isolating the factors affecting

energy use is to determine its end-use. Include this end-use such as air conditioning, lighting and power and process.

2.3.2. Factors

a) Building factor

Building characteristic can play an important part in focusing attention on possible energy saving measures.

b) People factor

How the site operatives use the office space may have a significant impact on energy consumption. The local operation of space heating controls, air conditioning units, tutorial class lighting, computers, printers, and duration/nature of occupancy periods can all affect energy consumption.

c) Occupied period

The longer the site space is occupied, especially offices, the greater is the potential for energy use and waste.

2.4. Lighting

Lighting is the single largest consumer of electricity in commercial buildings. About 41 percent of electricity and 28 percent of total energy, consumed in the commercial sector is for lighting. In the residential sector, lighting energy use is small though not trivial, representing about 7 percent of residential energy use. The opportunities for improved lighting efficiency-delivering the same or better quality of light with less energy are considerable. Using technologies already on the market, electricity use for residential lighting could be cut by about one-third. Similarly, electricity use for commercial lighting could be reduced considerably with estimates of 39 to 83 percent using commercially available technologies. These energy savings come largely from the use of new, efficient lighting technologies. Lamps, ballasts,

reflectors, and lighting control technologies. Have all advanced considerably in recent years. This section reviews some of these recent technical advances and provides an indication of the costs and benefits of energy efficient lighting. The lighting technologies currently used in commercial buildings mirror the diversity of the sector itself: standard fluorescent lamps in offices, high-intensity lamps highlighting merchandise in retail stores, a mix of fluorescent and incandescent lamps in restaurants, and so on. This section provides basic information on widely used commercial lighting technologies, their alternatives, and their costs and other attributes.

2.4.1. Lamps

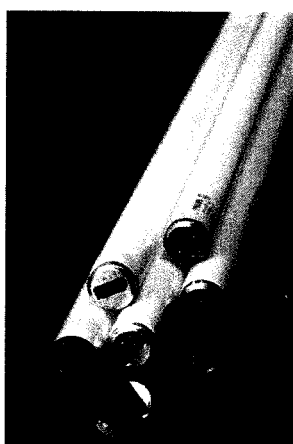


Figure 2.1: Florescent Lamp

Fluorescent lamps consume about 55 percent of lighting electricity in the commercial sector, fluorescent lamps vary widely, but many are the familiar 4-foot cylindrical-shaped units. These lamps typically consume 34 to 40 watts of electricity and supply about 3,000 lumens of light. Other popular fluorescent lamps are the 8-foot long cylinders, typically consuming 75 to 100 watts and producing 6,000 to 9,000 lumens; and the U-shaped lamp, typically at 40 watts and 3,000 lumens. Most fluorescent lamps found in commercial buildings are one of these three types. There are countless variations on the regular fluorescent technology. Color of light, starting technology, shape of electrical connector, diameter, length, and of course energy consumption can all vary, depending on

the specific model and manufacturer. The focus here is on those technologies that can influence energy consumption. Several fluorescent lamp technologies offer additional efficiency improvements. Smaller diameter lamps are somewhat more efficient, due to their greater surface to-volume ratio. Lamps with improved phosphors also offer efficiency gains.

2.4.2. Ballast

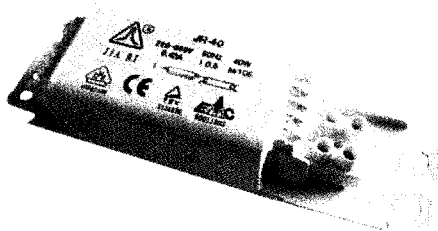


Figure 2.2 : Ballast

The fluorescent lamp requires ballast, which regulates the voltage and current received by the lamp. Ballasts consume energy internally and also affect the energy efficiency of the lamp through their voltage and current control. There are two major types of ballast technologies magnetic and electronic. For many years, ballasts used a simple iron core and aluminum core windings to regulate voltage and current. This magnetic technology was well-proven and in universal use but was relatively inefficient. The use of larger iron cores and copper rather than aluminum windings provides about a 10 percent improvement in energy efficiency, with no change in light output or quality. The use of electronic (solid-state) ballasts, which control voltage and current electronically, can both increase

the energy efficiency of the ballast itself and improve the operation of the lamp through improved current control. Efficiency levels set by this legislation will probably prevent the use of the very inefficient standard magnetic ballasts, but will allow for the use of improved magnetic ballasts and electronic ballasts.

2.4.3. Fixtures

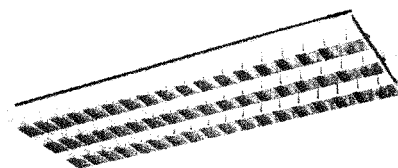


Figure 2.3: Lamp Fixture

The design of the entire lighting fixture can significantly influence performance. A poorly designed fixture will absorb light and reduce useful output. Conversely, a well-designed fixture will reflect light to where it is needed, thereby reducing wasted output. Fixtures consist of several parts: the lamp itself, the ballast, the reflector to direct the light in the desired direction, the lens or louver to reduce glare, and the housing. There are thousands of fixtures on the market, each with its own design and characteristics. The quality of light given off by a fixture is difficult to measure, making it difficult to quantify the effectiveness or value of various fixture designs. There are some general design features, however, that clearly contribute to energy efficiency. The addition of a specular reflector can increase the light output of a fixture. For example,

removing two lamps from a four-lamp fixture and then adding a specular reflector will yield about 60 to 80 percent of the initial light output with a 50 percent reduction in energy use, and a payback of usually less than 1 year. Locating fixtures nearer to areas needing light can reduce wasted output. Changing, cleaning, or removing the lens covering fixtures can increase light output. The potential savings from combining improved fixtures, lamps, and ballasts is significant. For example, an analysis by the Electric Power Research Institute (EPRI) found that the use of commercially available lighting technologies, including electronic ballasts, reflectors, and reduced wattage lamps, reduced energy consumption by 37 percent relative to a standard design with no reduction in light output and with a payback of less than 7 years. Actual installation of similar technologies in an office building in New York City yielded significant savings, with a payback of 6.2 years.

2.4.4. Controls

Lighting controls can reduce lighting energy use by ensuring that lights are used only when and where required. Options include manual or automatic dimming to reduce output when appropriate, manual switches to allow lights to be turned off when not needed, occupancy sensors to switch lights on automatically when a room is occupied, and scheduled switches to turn lights on and off on a prearranged schedule. The economic attractiveness of improved controls is building-specific, as they depend on hours of operation, occupant behavior, electricity prices, and other factors. Examples include the installation of occupancy sensors in a section of the World Trade Center, which reduced lighting energy use by 57 percent, and lighting control retrofits in eight commercial buildings that yielded an average 19 percent energy savings, with an average payback of 3.7 years. There are ways to improve lighting controller.