Faculty of Electrical Engineering

Universiti Teknikal Malaysia Melaka

Energy Consumption Analysis at Faculty of Electrical Engineering, UTeM

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Bachelor of Electrical Engineering with Honours

2021

I declare that this report entitled “Energy Consumption Analysis at Faculty of Electrical Engineering, UTeM” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 22 June 2021

ENERGY CONSUMPTION ANALYSIS AT THE FACULTY OF ELECTRICAL ENGINEERIN, UTEM

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A report submitted in partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering

Faculty of Electrical Engineering
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"I hereby declare that I have read through this report entitled "Energy Consumption Analysis at Faculty of Electrical Engineering, UTeM" and found that it complies the partial fulfilment for awarding the degree of Bachelor of Electrical Engineering"

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ABSTRACT

This report proposes to perform a energy consumption in Faculty of Electrical Engineering (FKE), UTeM. FKE building is one of the highest energy consumptions building at UTeM. Energy performs a critical position with the manufacturing and growth of each country's economy. Due to the high demand for for strength electricity recently, the utilities want to provide extra energy, because of this that that extra fossil gas reassets are burned to provide the energy and results in emission to the environment. The Malaysian Government has emphasized make sure adequate, reliable, healthy, and cost-powerful substances and green electricity sources while minimising bad environmental impacts. Therefore energy consumption analysis needs to be done to define how much energy consumed in this building. Thus, this report aims to analyse the energy consumption of one of the commercial buildings in Universiti Teknikal Malaysia Melaka, the Faculty of Electrical Engineering (FKE). The main objectives of this research is to analyze the room data survey of FKE building, identify the building energy index (BEI), determine load apportioning, analyze the factors of that contribute to higher energy consumption and find the solution to reduce energy consumption. All the methods for energy consumption analysis work, starting from desktop audit, analysis from the finding and reporting, has been implemented to analyse the total energy consumption at FKE's building. Finally, the suggestions on how FKE UTeM can save their energy consumption will be proposed and this will help FKE UTeM to reduce their monthly electric bill.

ABSTRAK

Laporan ini mencadangkan untuk melakukan penggunaan tenaga di Fakulti Kejuruteraan Elektrik (FKE), UTeM. Bangunan FKE adalah salah satu bangunan penggunaan tenaga tertinggi di UTeM. Tenaga melakukan kedudukan penting dengan pembuatan dan pertumbuhan ekonomi setiap negara. Kerana permintaan tinggi untuk kekuatan elektrik baru-baru ini, utiliti ingin memberikan tenaga tambahan, kerana ini bahawa reaset gas fosil tambahan dibakar untuk memberikan tenaga dan mengakibatkan pelepasan ke alam sekitar. Kerajaan Malaysia telah menekankan untuk memastikan bahan yang mencukupi, boleh dipercayai, sihat, dan menjimatkan kos serta sumber elektrik hijau sambil mengurangkan kesan buruk terhadap alam sekitar. Oleh itu analisis penggunaan tenaga perlu dilakukan untuk menentukan berapa banyak tenaga yang digunakan di bangunan ini. Oleh itu, laporan ini bertujuan untuk menganalisis penggunaan tenaga di salah satu bangunan komersial di Universiti Teknikal Malaysia Melaka, Fakulti Kejuruteraan Elektrik (FKE). Objektif utama penyelidikan ini adalah untuk menganalisis tinjauan data bilik bangunan FKE, mengenal pasti indeks tenaga bangunan (BEI), menentukan pembahagian beban, menganalisis faktor-faktor yang menyumbang kepada penggunaan tenaga yang lebih tinggi dan mencari jalan penyelesaian untuk mengurangkan penggunaan tenaga. Semua kaedah untuk analisis penggunaan tenaga kerja, mulai dari audit desktop, analisis dari penemuan dan pelaporan, telah dilaksanakan untuk menganalisis jumlah penggunaan tenaga di bangunan FKE. Akhirnya, cadangan bagaimana FKE UTeM dapat menjimatkan penggunaan tenaga mereka akan dikemukakan dan ini akan membantu FKE UTeM untuk mengurangkan bil elektrik bulanan mereka.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

The purpose of this project is to perform an energy consumption analysis in FKE's building. It is to instituting energy performance packages in an establishment. It is composed of sports that are looking for become aware of conservation opportunities initial to the improvement of power savings program. The role of an energy consumption analysis to institute the best power performance programs, need to recognise first which regions in status unnecessarily devour an excessive amount of power, e.g. which is the maximum cost-powerful to improve. An energy consumption analysis identifies in which power is being fed on and assesses power saving possibilities so that get to keep cash in which it counts the maximum.

Moreover, energy consumption analysis seeks to document matters that are sometimes omitted with inside the institution, which include the power being used on website online per year, which techniques use the power, and the possibilities for savings. In doing, it assesses the effectiveness of control shape for controlling power use and imposing changes. The analysis file establishes the wishes for plant metering and tracking, allowing the pinnacle of organization to institutionalize the exercise and hence, keep cash for the years to come. In addition, the movement plan lists the steps and units the initial price range for the power control program. After passing the cost advantage test, movement plan should be developed to make sure that the opportunities diagnosed are implemented. The movement plan must consist of all the foremost steps for imposing the possibility as well as the humans responsible. Furthermore, there must be a plan for tracking the results.

1.2 Motivation

This project incline with national spirit to conserve energy. Energy performance engineers discover possibilities to save energy and enhance performance in business, universities and homes are conducting energy consumption analysis wherein they inspect, survey, model, and examine the primary energy flows in homes-mechanical, electrical, and thermal. It charges much less to electricity a domestic that has been transformed to be more energy-efficient. It increases the consolation degree indoors. It reduces our effect on climate change. Many scientists now agree with that excessive energy intake contributes drastically to worldwide warming.

The National Energy Plan (NEP) aim to chart the manner ahead to satisfy the Government ambitious pursuits for Malaysia's energy region developments. This consists of offering get admission to power to all of the Census places with the aid of using 2018, and for widespread electrification to be achieved, with 24 hours power with the aid of using 2022. The Energy Plan version is a important version designed for energy structures analysis. General inputs are demands, renewable energy sources, energy station capacities, prices and some of non-compulsory exceptional law techniques emphasising import or export and extra power production.

1.3 Problem Statement

Nowadays, FKE is one of the highest energy consumption building in UTeM. As we know, energy wastage has an increasing number of long past excessive at alarming rates, for example FKE used 1773511.4kWh in year 2020. Electric electricity is being wasted because of leaving electronics and electric powered gargets going for walks for a completely lengthy time period even if they may be now no longer being applied which includes lights, air conditioning systems, computers, heavy machines amongst others. Environmental pollutants and waste deposition has additionally elevated which represents strength wastage. In addition the fee of strength is day via way of means of day growing which calls powerful utilization of strength or imposing use of renewable strength sources. However with green utilization and tracking of used strength the fee of the strength can be decreased to manageable ranges. Moreover, have to analyse the load profile, utility bill and load apportioning. In addition, energy ranges of strength are low for this reason making an energy crisis. The energy efficiency is of paramount significance in view of the crisis. Therefore, energy consumption analysis is mainly needed to conserve the electrical energy usage in FKE building.

1.4 Objectives

The main objectives of this research are :-

1. To analyse the energy consumption in the FKE's building.
2. To analyse the room data survey, load profile, utility bill, load apportioning and building energy index (BEI) at the FKE's building.
3. To identify the factors of higher energy consumption at the FKE's building.
4. To suggest energy saving measures for the FKE's building.

1.5 Scope and Limitations

The limitation of this research is as follows. Firstly, explain about FKE energy profile, load apportioning, air-conditioner, plugload and evaluation lighting fixtures necessities and don't forget sub-metering. Other than that, analyze room data survey, load profile, electric bill, load apportioning and building energy index. Compare intake with different locations, preceding length and budget. In addition, test statistics towards invoices and evaluate meter studying towards statistics and test capacities and efficiencies of gadget and test operating of controls. Then, broaden power use indices to evaluate overall performance or productivity. Finally, observe and reveal new power saving techniques and study FKE for one year energy consumption.

1.6 Proposal Outline

As we know, this proposal contains five chapters which is every chapter have its own purpose. Once reading the whole chapter in this project hopefully the reader can understand the entire system design for this project. Chapter 1 contains introduction of this project. Chapter 2 contains all the parts in literature review. This chapter will explain the information about the articles or books that related to the project design and the research on energy efficiency that is done by other research. This chapter also describes the journals and others important information regarding this project. Chapter 3 is mainly about methodology of this project. This chapter will explain about the detail of the project. It also contains the project progress that have block diagram, flow chart, gantt chart and also the explanation in detail about the project. The project explanation will be explained through block by block that refer to the block diagram. Chapter 4 discusses the result and the analysis that obtain from this project. This chapter will explain on the results and analysis of the project. The analysis contains the existing system and the improved on proposed system. Both values will be compared to justify the theory. Chapter 5 is mainly about Energy Saving Measures. Finally, chapter 6 will explain the conclusion of the project. It also includes the suggestions and the future recommendation of the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will explain the information about the articles or books that related to the project design and the research on energy efficiency that is done by other research. This chapter also describes the journals and others important information regarding this project. The cost of energy is a significant factor in economic activity, on major with factors of production such as land, capital and labour. The imperatives of energy shortage and wastage call for energy saving measures (ESM), which essentially mean using less energy for the same level of activity. In this chapter, we discuss the saving, efficiency, audit fundamentals, scope, short term, medium term and long term measures to be taken for saving.

2.2 Energy Management

The fee of electricity is a substantial thing in monetary activity, on essential with elements of manufacturing along with land, capital and labour. The imperatives of electricity and wastage of electricity saving measures, which basically imply the use of much less electricity for the equal stage of activity. In this chapter contained saving, efficiency, audit fundamentals, scope, time period, medium time period and long time measures to be taken for saving. The time period electricity control can be described as“ The powerful use of electricity to maximize profits (decrease costs) and decorate aggressive positions” as described in (Cape Hart, Turner and Kennedy, Guide to Energy Management Fairmont press inc. 1997). The essential aim of electricity control is to produce items and offer offerings with the least fee and least environmental effect. One of the techniques to lesser electricity losing and energy fee is through periodically reviewing schedules to ensure the gadget run best while needed, and through increasing the use of a control system to function of the gadget and structures in an electricity green way while keeping a safe constructing environment[1]:

2.3 Energy Audit

Energy audits are a important and scientific survey which perceive how power is being utilized in a building . It is a beneficial method to discover out the satisfactory alternatives for power conservation. Energy audits offer an evaluation of the quantity of power consumed at some stage in a given length with inside the shape of power, gas, gasoline, oil or steam. Using that information, it's also viable to listing how the power became used according to the diverse techniques in a plant or at the diverse retailers in a building. The subsequent step in a power audit then is to perceive the ability for power savings accurately. Energy audit, much like detectives investigating against the law scene will acquire quite a few information, expand a listing of suspects, prepare the information, and findings along with recommendations. Energy audit cannot be efficaciously accomplished without the dedication from the pinnacle control. Management need to be first off satisfied of the need of enforcing power control and for this reason power audit. The primary motives are[2]:

(i) Potential cash returns

a) The possibly power and hence the price saving after implementation.

(ii) Energy is expansive

a) Traditional power resources, e.g. fossil gasoline ,are diminishing,

b) There is an inclination of growing unit price for ingesting power or different shape of power;

(iii) Probable destruction to environment

a) Burning of fossil gasoline in strength era effects in growth of CO2, which contributes to global warming.

2.4 Site Surveys

Once acquiring the data or information on historical electricity use and how much we spent for the beyond few years on electricity, the following step is to installation an electricity audit software. This software need to be undertaken at the same time through the auditors and the constructing management. This software need to begin with site surveys. Site surveys are vital offer records on electricity use. They need to be done to take a look at the following files:-

(i) Energy sources

(ii) Energy usage or utilization

(iii) Energy control

2.4.1 Energy Sources

Different assets of strength providing to the building have to be recorded, whether they may be in the shape of electricity, gas, diesel oil, etc. Total strength fee of all inputs can be calculated in phrases of a not unusual place unit, so that their person efficiencies may be compared.

2.4.2 Energy Usage or Utilization

Site surveys on electricity usage are more complex and time-consuming. They may also consist of the following :

i) Running hours of aircond and duration of pre-cool period.

ii) Internal consolation conditions, e.g. temperature, humidity, lighting fixtures levels.

iii) Locations of pointless air-conditioning and lighting fixtures, e.g. unoccupied areas.

iv) Chillers/pumps scheduling and setting.

v.) Any electricity efficient mild fittings and control being used.

2.4.3 Energy Control

Energy control has deal with or managed the electricity use inside the building. Typical statistics required are the call of the man or woman liable for electricity control, how and when electricity intake is reviewed, how regularly meter readings are taken, whether or not extra sub- meters are required, any electricity forecast, evaluation

on electricity intake internally and/or externally, how properly is the system operated and maintained, any electricity performance development schemes in hand, whether or not personnel are conscious for electricity conservation.

2.5 Energy Efficiency

The harm inflicted with the aid of using international warming is taking place a long way quicker than any professionals have anticipated or anticipated. Since the Kyoto Protocol changed into signed in 1997 to combat international warming thru decreasing international greenhouse gases (GHGs) emission, the arena weather sample has worsened at an expanded price past expectation. While evolved nations sanctioned with the aid of using the protocol are dedicated to reap their GHG emission targets, growing countries play comparable roles on a voluntary basis. Since nearly all the GHGs emissions come from electricity sector, it's miles apparent that electricity coverage and associated regulatory frameworks play vital roles in knowing the Kyoto Protocol objectives. With carbon dioxide (CO_2) touted as the principle treatment within side the GHGs emissions, it's miles best affordable that carbon buying and selling turns into the critical detail within side the Protocol.

Recently a milestone is marked within side the Kyoto Protocol with the 2009 Climate Summit in Copenhagen, Denmark, with all collaborating nations in addition dedicated themselves in pleasing the protocol's duties earlier than the dedication duration due in 2012. It is profitable to check the numerous electricity performance efforts and carbon buying and selling capability in Malaysia, a rustic which even though does now no longer undergo any obligation, has ratified and lauded the purpose of the protocol. Malaysia as a growing kingdom is visible as a right away beneficiary from carbon buying and selling and on this paper, how the usa electricity rules have developed over time with concerted efforts from the authorities to decrease its carbon footprint through several electricity performance implementations are mentioned in length. The effect from the 2009 Climate Summit on Malaysia is likewise briefed[3]:

2.6 Efficient and Effective lighting

There are many selections in energy efficient lighting. Those are LEDs and compact fluorescent lamps, CFLs. Despite the strength saving bulbs, begin with cost greater than incandescent bulbs, over lifetime that prevent cash due to the fact that they use less electricity. Figure 2.1 to figure 2.3 shows that fluorescent lamp, LED lamp and CFL bulb.

Figure 2.1 : Fluorescent lamp

Figure 2.2: LED lamp