Office building energy savings engineering essay

Engineering

CHAPTER 1Office building energy saving is one of the ways to reduce loss of energy in building in Malaysia. To improve the energy efficiency of buildings needs to rational use of energy and improves energy efficiency in ensuring the conditions of building comfort. Building energy-saving specifically refers to that In the building planning, design construction, doing implementation of energy efficiency standards, materials and products, improving the performance of thermal insulation and heating, air conditioning refrigeration and heating system efficiency, using energy-saving technology technique equipment, strengthening the operation and management of energy systems, In ensuring the quality of the indoor thermal environment, reducing power consumption air conditioning and lighting. Office building energy-saving focused on the energy is the cost of electricity and create a lot of heat (cold) to achieve the environmental requirements of modern buildings. Intelligence technology Information technology as the main technology can effectively enhance the ‘ office building energy-saving’ technology level of the effect of office building energy-saving abroad, provides a new revelation for the construction industry to achieve higher energy efficiency target. Therefore, Intelligent Technology needs to Support technology development in construction projects which reflect to features of modern technology. Office Building energy-saving has been gradually applied in recent yearUsing intelligent technology for optimization of building energy systems integration design, building of strong and weak electrical equipment,. Energy consumption, personnel inputs and operational costs greatly reduced through the development of integrated optimization, saving investment to meet the construction side and the requirements of energy saving [10]. In this project, electricity usage in the office without control causing over

electricity consumption. The amount energy used in a building depends on the type of device used. Thus the important step with isolating the factors affect energy used [1]. Install energy saving equipment can minimize the energy usage in the office. Installation with better devices such as daylight detector, electronic ballast, low-emission glass and time switch will reduce electric consumption annually.

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PROBLEM STATEMENT

For recent years, the increase in world oil prices has risen dramatically and rising oil prices also have an impact on our country. Therefore, coal price in the world also increase. Gas and coal is one of the main fuel to generate electricity, if increase fuel price it also will affect to generate electricity. Use energy sources based on coal natural gas , and oil have verified to be highly effective to economic progress, but at the same time it can damage the environment and to human health. The main of productions non renewable-energy are producing a heavy toxic vapour and smoke it cause of unhealthy environment and lead the country to a critical global warming. Selection of electrical equipment is very important. Use electric equipment not suitable and low efficiency caused many power consumption to be produced. Therefore, the use of energy saving device such as daylight detector, electronic ballast, low-emission glass and time switch it can reduce power consumption and electricity generation also can be reduced.

OBJECTIVES

To minimize energy usage in a two story office building by using energy saving device.

To simulate the electricity consumption of an office building using e-Quest software.

To make comparisons between of electricity consumption using energy saving devices and standard device.

SCOPE OF THE PROJECT

The scope of the project is minimizing energy usage in the office by using energy saving device. This project is to reduce power consumption. Power consumption refers to electrical energy over time that must be supplied to electrical devices in order to maintain its operation. Reducing power consumption by cutting out any power or energy in the electrical devices used to maintain its operation without any interference. By reducing power consumption, the office can save more in cost. Reduction of cost and power consumption can be implemented in a similar manner. Other than that, cost can be saved on the monthly electricity bill.

THESIS OVERVIEW

This thesis consists of five chapters which each chapter discusses the details of the particular topic.

Chapter 1

In this chapter, discuss the introduction of energy efficiency in office buildings

Chapter 2

In this chapter, literature review and equipment using this project to reduce power consumption

Chapter 3

In this chapter, step to start this project and step using e-quest software

Chapter 4

In this chapter, discuss the results simulation obtained together with discussion of the results about of this project. The comparison was made between the office before improvement and after improvement.

Chapter 5

In this chapter, concludes the overall project that has been done upon the result obtained

Chapter 6

In this chapter, make future recommendation to improve this project

CHAPTER 2

LITERATURE REVIEW

INTRODUCTION

The main concept for of this project Minimizing Energy Usage in the Office is to reduce electric consumption in the office. By using energy saving device power consumption can be reduce and financial monthly office can save more cost. Beside that reducing power consumption can save pollution in the world. Environmental pollution causes of removal material or energy into water, land or air. Excessive electricity usage causes power plant should generate a lot of electricity to meet demand. Therefore a lot of pollution that occurs when electrical power is generated. Electric power plants that cause occurs pollution is hydro, steam and coal power plants.

Energy saving device can reduce power consumption and it also suitable concept to be energy safer, more efficient and more reliable. Better device energy saving using this project is: Daylight detectorElectronic ballastLow-emission glassTime switch

Daylight detector

Lighting in office especially in working areas is subject to regulations prescribed by 'Suruhanjaya Tenaga' such as it needs a enough luminance level which depend on the type device in the office. Power consumption can be reduced by using energy efficient equipment such as daylight detector [12]. By using daylight detector it used natural sunlight. During switch lighting ON it will be in automatic mode [10]. The system will operate depend on sunlight. When day the sensor detect sunlight automatic switch OFF. By

using natural sunlight power consumption can be reduced. Figure 2. 1 show circuit KNX lighting control to daylight detector. The device is from Schneider electric named KNX. The KNX-System is solutions for lighting control with respect to energy savings and reducing cost [13]. In time controlled switch (ON / OFF) of lighting in temporarily used in office defined occupancy times up to 10% energy savings. Time control can use as time switches and it can integrate a timer function of the touch panels. In a KNX installation the time controlled switching and dimming of any lighting can be realized without additional wiring to install. Using automatic daylight detection in office and in temporarily used rooms up to 20% energy savings. Switching lighting ON and OFF or sending values can also be controlled in combination to ambient light levels. Combining time control with daylight detection allows can be a guaranteed basic illumination for well-defined periods. Different lighting control scenarios according to the weather on a day such as sunlight dependant switching of the lighting for short periods at relatively low levels at certain times or higher light levels for longer periods, for example, during peak times. Additionally, increased the life time of the lamps can be increased by dimming down to a basic brightness instead of switching OFF completely during active periods [14]. http://knxforbms. files. wordpress. com/2011/09/untitled2. png? w= 500&h= 349Figure 2. 1 : KNX Lighting Control To Daylight Detector

Electronic Ballast

In recent years, user of incandescent lamps has been replaced to fluorescent lamps, especially in commercial spaces and industrial. However, fluorescent lamps require ballasts to provide the necessary high voltage for starting the

lamps and for regulating lamp current during operation [15]. Ballasts have been two categorized types such as electromagnetic ballasts and electronic ballastsElectronic ballasts are a one device energy saving have some advantage like absence of flicker, light weight, high efficiency and audible noise as compared to electromagnetic ballast [3]. By using electronic ballast energy efficiency will increase and power consumption will reduce [8]. Electronic ballast is one of the simplest and most cost effective suitable used fluorescent in office. With used electronic ballast power consumption can be reduces without reducing output light. Before office improvement used choke ballast. Figure 2. 2 shows improvements from choke ballast to electronic ballast. In circuit fluorescent lamp using choke ballast it should lamp starter. Electronic ballast can reduce power consumption with improved lamp power factor and efficiency. For using electronic ballast not need to change and rewiring in office [2]. C: UsersjohnDownloadschoke ballast to electronic ballast. jpgFigure 2. 2: Improvement from Choke Ballast to Electronic Ballast

Low-Emission Glass

Low-Emission glass (low-e glass) is improving the insulating value of the window to block sunlight through in building. A thin coating based on tin oxide is deposited on the glass and either silver . This coating sends to see the light, but reflects longer wavelength infrared light associated with radiating heat emitted by all warm objects. By reflecting this radiating heat back into the building and the coating reduces heat loss from the building. [16]

Low-emission glass is a type of window used in the office. Its use allows sunlight to pass through the glass into the building and keep cooling in office [4]. Before this office used to tint in the window it can allow heat from outside through the window and many heat leaving from the office. This causes a lot electric consumption using an office to keep cooling. With low-emission glass temperatures can stable and air conditioner can set energy saving mode. Figure 2. 3 shows how low-e glass work. http://stormwindows. com/wp-content/gallery/new-pictures/innerglass-low-e-illustrati. jpgFigure 2. 3: Low-E Glass Work

Time Switch

Controlling load time switch in a system to improve its function by reducing power consumption. Circuit it is possible to decide when the sunlight detected lighting will be switched OFF in an office based on the working hours based on the daylight level. Programming the control in time switch of electric loads according to the needs of each application obtains measurable advantages in terms of reduction of power wastage and comfort. The range of time switches includes several versions that guarantee the closing and

opening of electrical load circuits according to a scheduled program [17]. Time switch as Figure 2. 4 is a device energy saving by reducing light time of use through preprogrammed scheduling. It's a simple device designed to control a several lighting zone. This project used time control to reduce power consumption in the office. The time control will switch on during office hours after than that switch will off. http://image. made-in-china. com/2f0j00tvZTBguIJbhV/Time-Switch-TB35B-. jpgFigure 2. 4: Time Switch

CHAPTER 3

METHODOLOGY

INTRODUCTION

This research project " Minimizing Energy Usage in Office" is application of reducing power consumption using energy saving devices. The first step to start this project is studying the concept and operation about energy saving device use in office such as daylight detector, electronic ballast, low-emission glass and time switch. The next step is to study and understand the concept to reduce power consumption of energy use so that it can acquire the necessary knowledge before applying and using devices in this research.

In this project to compare power consumption in office before and after improvement is using e-Quest software to simulate energy in the building. e-Quest is a software building analysis to design building professional. It's designed to allow perform detailed to compare analysis building design. Overall building analysis a system to design a creative process of integrating the performance of the interacting system such as lighting and HVAC [7]. By using e-Quest version of DOE-2 it can be combined an energy efficiency

measure (EEM) wizard, building creation wizard and graphical report with simulation " engine".

Then, to complete the learning this project by applying the principle and application of the device. Obtain result such as the effect of power consumption of energy use and analyze. Figure 3. 1 shows the general flow of the project. The purpose of this methodology is to ensure the development of this project is efficiently completed.

Figure 3. 1: Flow Chat

SIMULATION

e-Quest is designed to create a building performance to analysis professional buildings. Whole building analysis recognizes that a building is a system of systems and that energy responsive design is a creative process of integrating the performance of interacting systems such as envelope, DHW, fenestration and lighting HVAC. Therefore, any analysis of the performance consequences of these building systems must consider the interactions between them in a manner that is both comprehensive and affordable such as simulation runtime, model preparation time, results reporting and results troubleshooting time. There are two main parts to e-Quest:-The Wizards(both for building creation and EEM analysis)The Detailed Interface (including Results Reporting).

3. 2. 1 Wizards (both for building creation and EEM analysis)

e-Quest Wizards are to speed up and simplify the process of preparing building models for simulation analysis. Combining Wizards limited input

user with intelligent dynamic defaults, e-Quest Wizards can be used either to conduct schematic such as preliminary screening analysis or to speed up the preparation of more detailed about models to be used for more detailed analysis. Currently, e-Quest comes with three Wizards the Design Development Wizard (‘ DD Wizard’), the Energy Efficiency Measures Wizard (‘ EEM Wizard’) and the Schematic Design Wizard (‘ SD Wizard’). The DD Wizard and SD Wizard are used to create building models. To evaluate building design alternatives is the EEM Wizard.

3. 2. 2 Detailed Interface

e-Quest Detailed Interface is a Windows-based on the interface to the DOE-2. 2 simulation ‘ engine’. The most widely recognized used and trusted building simulation tool available for today. Compared with the Wizards, it will be relying on the Wizards to quickly prepare a ‘ rough’ model of the building.

OFFICE DESIGN

This project design office building using e-Quest software. For equipment are set before and after improving and simulate using e-Quest. Type of building is a two story office building . Location for weather set at state California in Los Angeles city because use selected data in e-Quest software. In this project not use data whether in Malaysia because not have selected data for Malaysia in e-Quest. Total Area office building on the ground floor and top floor is 916. In three dimensions with high 9 ft office floor to ceiling the total volume is 4122 And with 12 ft office floor to floor the total volume is 5496 Table 1 Shows area in the office. Using Microsoft office Visio is designed layout office on top view. Figure 3. 2 shows Office layout ground floor and figure 3. 3 Office layout top floor. Office layout calculates every port area in

percent such as in table 1 and then Key in per cent area into e-Quest software.

3. 3. 1 Office Layout on Top View

Figure 3. 2: Office Layout Ground Floor

Figure 3. 3: Office Layout Top Floor

No.

Type area

Area

ft2

Percent

Area %

1Office (executive/private)417. 4445. 572Corridor241. 8726. 403Lobby (office reception/waiting)48. 2026. 364Restrooms74. 808. 165Conference room48. 205. 266Mechanical/electrical room37. 404. 087Copy room (photocopying equipment)48. 205. 26

TOTAL

916. 11

100. 00

Table 3. 1: Percent Area Office Before and After ImprovementBefore office improvement equipment in office standard device. For window using glass type single gray 1/8in (1204) and fluorescent lamp use choke ballast. After office improvement equipment in office use energy saving device. For window using glass type double low-e glass (e2=. 1), 1/8in, 1/2in argon

(2632) and fluorescent lamp use hiPres sodium: lowboy: Hi/low ballast (full: 26% of power). To control the operation of lighting install daylight detector and time switch. Daylight detectors the system will operate depend on sunlight. When day the sensor detect sunlight automatic switch OFF. Using Time Switch can control the operation of lighting during a day. The time switch can set light switch will ON from 7. 00am until 7. 00pm. Beside that to block sunlight through into office are installed shading. Figure 3. 4 shows design office before and after improving.

3. 3. 2 Three Dimensions Of Office

Before Installation

ShadingAfter InstallationFigure 3. 4: Installation of Office Design

SIMULATION E-QUEST

General Information

Figure 3. 5: General Information for office before improvement

Figure 3. 6: General information for office after improvement

Firstly, the design office layout on top view using Microsoft office Visio. For information data in design office layout it key in into e-Quest software. The building that has been used in this project is a two story office building. A size area in office for ground floor is 458 And the area top floor is 458. The total area in office is 916.

Type of the air-conditioner that has been used in office is chilled water coils. Chilled water has been a primary medium for the transfer of heat from office building coils in the refrigeration system since the beginning of ventilating, heating, and air-conditioning design [18]. Besides that, to reduce power consumption of lighting office has been installed daylight detector after office improvement. Using the daylight detector, light will automatically switch OFF when sensor detects sunlight.

Building Footprint

Figure 3. 7: Building footprint for office before and after improvement

Figure 3. 7 shows data building footprint for office before and after improvement is same. For footprint shape office design is a rectangle. The width offices are 21. 40 and the length 21. 4. The floor height office from floor to floor was 12 and the floor height office from floor to ceiling was 9. 0.

Building Envelope Construction

Figure 3. 8: Building Envelope Construction for office before and after improvement

Figure 3. 8 shows data building Envelope Construction for office before and after improvement are same data input. For roof surface the contraction used 8 inch concrete and above grade walls used 12 inch HW concrete. Beside ground floor the construction used 8 inch concrete.

Building Interior Constructions

Figure 3. 9: Building before and after improvement

Figure 3. 9 shows data building Interior Constructions for office before and after improvement are same data input. Ceiling in office use type lay-in acoustic tile.

Exterior Doors

Figure 3. 10: Exterior doors for office before and after improvement

Figure 3. 10 shows data exterior doors for office before and after improvement is same data input. Type of door before and after improvement is opaque one door at direction north and one at south. The dimension of door is 7 ft height and 3 ft width. The construction of door is steel hollow core w/o Brk.

Exterior Windows

Figure 3. 11: Exterior windows for office before improvement

Figure 3. 12: Exterior windows for office after improvement

Office before improvement used window glass category to single clear tinted and the glass type is single gray 1/8 inch and then the frame aluminum type with width 1. 3 inch. After office improvement used window glass category double low-e and the glass type are double low-e (e2=. 10) tint 1/8 inch, 1/2 inch argon and then the frame aluminum type with width 1. 3 inch. The position window at direction of north.

Exterior Window Shades and Blinds

Figure 3. 13: Exterior window shades and blinds for office

before improvement.

Figure 3. 14: Exterior window shades and blinds for office after improvement

Figure 3. 13 and 3. 14 show exterior window shades and blinds for office before and after improvement. Before office improvement not used any window shading. After office improvement used shading window at direction north with width 2 ft.

Roof Skylight

Figure 3. 16: Roof skylight for office before and after improvement

Ground Floor Daylight Zoning

Figure 3. 16: Ground floor daylight zoning for office after improvement

Top Floor Daylight Zoning

Figure 3. 17: Top floor daylight zoning for office after improvement

Figure 3. 16 and figure 3. 17 shows ground and Top floor daylight zoning for office before and after the improvement. The lighting level of 50 foot-candles might be chosen as a work environment which involved office. If the light is lower than 50 foot-candles, light controlled will be on until 70% of total light. Lighting control method by photo sensor with sensor Hi/low ballast (full: 26% of power).

Activity Areas Allocation

Figure 3. 18: Activity areas allocation for office before and after improvement

Figure 3. 18 shows data activity area allocation for office before and after improvement is same input data. The highest percent in office is 45. 57% which used Office executive and private. Second highest percent in office is 26. 40% used Corridor. Third highest percent in office is 26. 36% used Lobby office reception and waiting. The rest has been used by Restrooms 8. 16%, Conference room and Copy room (photocopying equipment) 5. 26% and Mechanical/electrical room 4. 08%

Occupied Load by Activity Area

Figure 3. 19: Occupied load by activity area for office before and after improvement.

Unoccupied Load by Activity Area

Figure 3. 20: Unoccupied load by activity area for office before and after improvement.

3. 3. 14 Main Schedule Information

Figure 3. 21: Main schedule information for office before and after improvement.

Figure 3. 21 shows data main schedule information for office before and after improvement is same data input. Monday until Friday have a power consumption schedule. Saturday, Sunday and public holiday no power consumption has been estimated.

HVAC System Definition

Figure 3. 22: HVAC system definition for office before and after improvement.

Figure 3. 22 shows the data HVAC system definition for office before and after improvement is same data input. HVAC system type used cooling source was chilled water coils. The system type is standard VAV.

HVAC Zone Temperature and Air Flows

Figure 3. 23: HVAC zone temperature and air flows for office before and after improvement.

Thermostat has been set point for cooling from 76. 0 °F until 82. 0 °F and set point heating from 70 °F until 64. 0 °F. Design temperatures used cooling design temp for indoor 75 °F and 55°F supply. For air flows used minimum design flow is 0. 5 cfm/ and VAV minimum flow is 40%.

3. 4. 17 HVAC System Fans

Figure 3. 24: HVAC System fans for office before and after improvement

Figure 3. 24 shows HVAC zone temperature and air flows for office before and after improvement is same data input. Supply fans used power up to 3. 5 inch. WG per fan and return fans around 1. 17 inch. WG.

3. 4. 18 HVAC System Fans Schedules

Figure 3. 25: HVAC system fans schedules for office before improvement.

Figure 3. 26: HVAC system fans schedules for office after improvement.

Before office improvement the operation HVAC form Monday until Friday 24hour from 1am to 11. 59 pm. After office improvement the operation HVAC form Monday until Friday 12hour from 7am to 7pm. On Saturday, Sunday and public holiday no power consumption schedules before and after office improvement.

3. 4. 19 HVAC zone heating vent and economizers

Figure 3. 27: HVAC zones heating vent and economizers for office before improvement.

Figure 3. 28: HVAC zones heating vent and economizers for office after improvement.

Before office improvement not used any economizer. After office improvement that used HVAC economizer with Dry bulb temperature type.

3. 4. 20 HVAC System Hot/Cold Deck Resets

Figure 3. 29: HVAC system hot/cold deck resets for office before and after improvement

Figure 3. 29 shows data HVAC system hot/cold deck resets for office before and after improvement is same data input. Cold deck resets used outside air reset type. The outside temperature from 80 °F to 60 °F. The supply zone temperature from 55 °F to 65°F.

3. 4. 21 Cooling Primary Equipment

Figure 3. 30: Cooling primary equipment for office before and after the improvement

Figure 3. 30 shows data cooling primary equipment for office before and after improvement is same data input. For chilled water system used single system pumps for pump configuration. Second chilled used electric reciprocating hermetic chiller type.

Water Side HVAC

Figure 3. 31: Cooling water side HVDC. Water side HVAC systems have been recognized as one of the most sustainable HVAC systems. The water side HVAC is compatible with water loop systems closed and open [20]. Figure 3. 31 shows cooling water side HVDC. The hot gas refrigerant is condensed by water flow over the condenser and tube evaporating . This ties the condensing temperature to ambient wet bulb such as water-cooled chiller. The pump, condenser and water sump are all integral to the chiller. Beside that a water cooled chiller will require a field erected piping, cooling tower and condenser pump. Evaporative cooled chillers offer the saving and ease of air-cooled chiller to install while providing performance same level to

water chillers cooled. Evaporative cooled chillers will need drain, water treatment and makeup water.

Air Side HVAC

Figure 3. 32: Air Side HVAC. Air side HVAC has been the choice for system designers who are focused on low cost and simplicity . A system based on an air side HVAC usually is less expensive to easier install to maintain than other types such as water cooled systems. Beside that, the advantages typically have come to use low efficiency [21]. Figure 3. 32 shows air side HVAC. The water chilled supply temperature is needed to supply air temperature. The water chilled temperature should be cold enough to provide a suitable temperature difference for a cooling coil to be selected. The resulted in a 10 °F approach which to subtract from 55 °F supply air temperature has until 44 °F or 45 °F water chilled temperature.

Chilled Water System Control and Schedule

Figure 3. 33: chilled water system control and schedule for office before and after improvement

Chilled Water System Control and Schedule is set point fixed and temperatures at 44. 0 °F

Non-Residential Domestic Water Heating

Figure 3. 34: Non-Residential domestic water heating for office before and after improvement

CHAPTER 4

RESULTS AND DISCUSSIONS

INTRODUCTION

This chapter will describe e-Quest software to find the result in this project. The objective of this project successfully achieves will approved in the result. This chapter shows the result office before and after improvement using energy saving device such as daylight detector, electronic ballast, low-emission glass and time switch to reduce power consumption in the office. In this simulation implementation using e-Quest software to design and simulate the SD wizard. The result displays in an EEM wizard program in the e-Quest software.

4. 2 OBJECTIVE OF SIMULATION

The simulation has been conducted to evaluate the performance of the office. The objectives of this project are: To minimize the energy usage in the office using energy saving device such as daylight detector, electronic ballast, low-emission glass and time switch. To reduce power consumption which mostly involves air conditioning and lighting

SIMULATION RESULT AND DISCUSSION

Figure 4. 1: Monthly Electricity Consumption in Office before Improvement

Figure 4. 2: Monthly Electricity Consumption in Office after Improvement

Figure 4. 3: Monthly Per Cent Electric Consumption in Office Before ImprovementFigure 4. 4: Monthly Per Cent Electric Consumption in Office after ImprovementC: UsersjohnDesktopwarna utk graf. jpgelectric consumption (kWh)JanFebMarAprMayJunJulAugSepOctNovDecTotalSpace Cool43. 541. 146. 665. 7110. 298. 9229. 9257. 7199123. 260. 855. 81, 332. 40Vent. Fans35. 632. 235. 637. 438. 634. 144. 244. 24137. 432. 235. 6448. 2Pumps & Aux. 59. 253. 559. 2626256. 3626256. 36253. 559. 2707. 2Misc. Equip. 226. 1204. 5226. 1230. 9233. 3216. 5233. 3233. 3216. 5233. 3209. 3226. 12, 689. 40Area Lights215. 4194. 8215. 4223. 8224. 5205. 4224. 5224. 5205. 4224. 5196. 3215. 42, 569. 90Total579. 8526. 1582. 9619. 9668. 6611. 3794821. 7718. 3680. 4552. 1592. 17, 747. 20Table 4. 1: Result for office before ImprovementElectric Consumption (kWh)JanFebMarAprMayJunJulAugSepOctNovDecTotalSpace Cool26. 224. 627. 139. 573. 762. 9152. 1185. 6136. 574. 44036. 2878. 90Vent. Fans17. 115. 417. 118. 119. 216. 324. 826. 126. 218. 015. 417. 1230. 80Pumps & Aux. 28. 425. 728. 429. 729. 727. 029. 729. 727. 029. 725. 728. 4339. 30Misc. Equip. 226. 1204. 5226. 1230. 9233. 3216. 5233. 3233. 3216. 5233. 3209. 3226. 12, 689. 40Area Lights172. 8143. 5144. 3131122. 6115. 3118. 5123. 3128. 1161. 6153. 8181. 21, 696. 10Total470. 6413. 8442. 9449. 2478. 6438. 1558. 5598. 1534. 5517. 1444. 3489. 05, 834. 70Table 4. 2: Result for office after ImprovementFigure 4. 5: Electric Consumption Vs Month Before and After ImprovementFigure 4. 1 and figure 4. 2 shows the electricity consumption in office based on twelve months. After simulation doing e-quest monthly electric consumption office after improvement in

figure 4. 2 is more improved than office before improvement in figure 4. 1. Initially in this office before improvement it doesn't use any energy saving device. For window only use tinted to block sunlight through into the office but heat from outside can through into the office and many heat leaving from office [4]. It caused temperature in office increase and ventilation fan need more power so that office can keep cooling. Figure 4. 1 shows totals monthly of ventilation fans electric consumption in office before improvement is 448. 20 kWh rather than total monthly electric consumption in office after is 230. 80 kWh as show in a figure 4. 2. After improvement in the office by using low-emission glass power consumption is reduced. Moreover install shading devices in an office building it important energy efficient building design. It can help reduce heat from outside through in building [9]. Besides that light also used much power consumption in the office. In Malaysia, in 2006 lighting used around 19% power consumption at public building and commercial [6]. Before the improvement fluorescent lamp used choke ballast and light switch not control always ON 24 hours. Figure 4. 1 shows monthly of area lighting electric consumption in office before improvement used lighting is 2, 569. 90 kWh and figure 3. 2 shows monthly of area lighting electric consumption in office after improvement is 1, 696. 10 kWh. After install electronic ballast, daylight detector and time control much power consumption in office reduce. For time switch set for the light switch ON a day from 7am-7pm and switch OFF during night. Moreover, figure 4. 3 show misc. Equipment was higher percent monthly electric consumption in office before and after improvement because it's not doing anything improvement by using energy saving device. Figure 4. 5 shows the total difference in monthly electric consumption in office before and after

improvement according to months. The total difference annual for electric consumption between before improvement and after improvement office is 1912. 5 kWh.

CHAPTER 5

CONCLUSIONS

In this project, the main objective is to minimize energy usage in a two story office building by using energy saving device. The project was successful. After installation energy saving device electric consumption has been reduce table 4. 1 and 4. 2 shows the monthly result electric consumption for office before and after the improvement. Simulate electricity consumption of an office building using e-Quest software electric consumption has been reduced Figure 4. 1 and 4. 2 shows monthly electric consumption in office before and after Improvement using e-Quest software. Comparison between of electricity consumption using energy saving devices and standard device shown in Figure 4. 5 using e-Quest software. Besides that, the benefit of energy saving devices in term of minimizing the operation cost and maintaining. It is important to reduce the usage of electricity. Thus, it will reduce the annual or monthly expenses for electricity bill. Conserve energy and minimizing energy usage in the office using energy saving device such as daylight detector, electronic ballast, low-emission glass and time switch is usually more economical and environmentally friendly. The majority of the energy use in this country to generate electricity comes from non-renewable sources such as natural gas, coal and petroleum. If not conserve energy and use it as efficiently as possible, it can needlessly future generations of the fuels they will need [19].

CHAPTER 6

FUTURE RECOMMENDATION

In further research work, the survey needs to be in a larger scope. The future recommendation for used energy saving device should be widely used :-To enhance opportunities for Malaysia construction industry to design a green energy building so it can reduce power consumption and reduce environmental pollution. Increasing energy efficiency in industry, transport and commercial sectors and in government buildingsMinistry of Energy, Green Technology & Water Malaysia should to developing a Master Plan for energy efficiency to accelerate the development of energy efficiency in the 11th Malaysian Plan and beyond

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