LOAD APPORTIONING AS ENERGY SAVING APPROACH FOR GOVERNMENT BUILDING

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ABSTRACT

The global electrical energy demands have been on constant rise due to its many desirable factors that makes its use suitable for both domestic and general production use in realizing a wide range of products and services. Due to electrical energy management, lacking on design and implementation of load will raise the energy consumption and monthly electrical bill. Therefore the aim of this study is to approach the load apportioning strategy to matching the with the equipment or individual use of energy and lastly to fully utilized space and reschedule the time of usage. Data was collected by measured at main switchboard at selected UniMAP building for only one week using Fluke Power Recorder. The strategy is check the current usage of load then after measurement, the load will be arrange into a group of same portion with same time of usage. The result shows clearly the energy consumption for every single day and indicates the highest and lowest peak. From this study the apportioning strategy implemented by rearrange the load following type of room application. After the arrangement, new measurement was taken and a very good result was established. This study also can be further apply for a huge load that can be save a lot of money for owner especially government by energy saving.

Keywords: Load Apportioning, Energy Management.

Introduction

The global electrical energy demands have been on constant rise due to its many desirable factors that makes its use suitable for both domestic and general production use in realizing a wide range of products and services. Concurrently most of the government buildings are trapped on daily wasting energy since the space usage is not well utilizes. For example in a same floor of building have two room, equipped with centralized air-conditioning system, but only one room is use that day. So there were a lot of wasting there. Due to this phenomenon, some drastic strategy must be specificly plan and implement. Load apportioning strategy is one of the best strategies for energy saving by matching the with the equipment or individual use of energy. Normally use to determine the payment scale, which an individual meet during each billing payment made. Unfortunately, many of these payments have not been matching with individual's use, an attribute of installations that are not efficient and individual preference based. To counter this, considerations need to be made on each consumption scenario with key interest focusing on individual's electricity demand and consequent billing method. One of the best strategies to cut down the wasteful use of electric energy is the implementation of load apportioning. This refers to considering all cost factors that come with energy distribution and equally distributing the total cost among its users. Load apportioning brings forth responsible power use as it embarks on the concept of" pay as you use". There exist several apportionment policies each with their unique characteristic that suit different scenarios well distributors [1]. Building that are designed to host various entities like business or for accommodating people use the policy that best suits them and the consumers they host. At an instance, apportioning policy may best suit an individual who uses power throughout the day while at another instance another policy fits best a consumer who only uses power a fraction of a day [2]. As this paper contains the detail on how the apportioning been applied and the measurement tools, equipments, illustrations of measurement, results of measurement, analysis and discussion of the overall results in term of energy saving approach for government buildings.

METHOD

This paper presented how the project was done, which is use a main equipment such as fluke 434 Series II power quality and energy analyzer was used to measure the power and energy in the blocks assigned for this project. This equipment is one of the best equipment in measuring the power and energy, as energy saving equipment becomes more and more common in facilities the need to explore where energy is being wasted has become more and more important. At the same time these important pieces of energy saving equipment like motor drives and electronic lighting have the potential to disrupt the electrical system due to power quality problems. The Fluke 434 Series II Power Quality and Energy Analyzer can monetize the cost of energy waste due to poor power quality and is ideal for characterizing power quality, conducting load studies and capturing hard-to-find voltage events over a user-defined period of time. The Fluke 434 II Energy Analyzer is the ideal tool for advanced energy logging and energy monetization, identifying the most energy-wasteful areas of your facility. After finding the main aim which is the highest building that consume the energy, the focus will be on that building to analyze the problem in order to come out with the best solutions for the problem to be solved. Apportion the load between all of the equipments to get the result of which of the equipment consume the highest energy in order to control that equipment in term of use to be able reduce the unnecessary use during and after the working hours which causes the waste of energy. In addition, giving suggestions that may help to be a better solution in the future.

The formula used for power and energy;
$$P = \sqrt{3} \times I \times V \times \cos\varnothing \quad (kW) \dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$
$$E = P \times t \ (kWh)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..(2)$$

RESULT ANALYSIS

Figure 1 shows the total maximum consumption of energy in a week. Energy follows the power in terms of consumption as it is shown similarly. The consumption of energy is almost same with the power during the working day and office hours (8 am – 5pm) in a day as there is running of classes, labs and other equipment such as air condition and lamps. In all the time duration shown the Figure 1 below, the peak of consumption usually occurs from 8am to 5:00 pm as the noon time with a 33 °C. which needs to use air conditions which leads to consume more energy as the air conditions consider as inductive load while the lamps, laptops and water heaters as the inductive load consume more energy than resistive load. On the other hand, the lamps don't consume more energy but still need to be controlled to avoid the waste of any amount of energy. At night, energy still being consumed, as the lights not switched off to manage the waste of energy, there will be no cost for electrical energy management once the lights switched off at the night time.
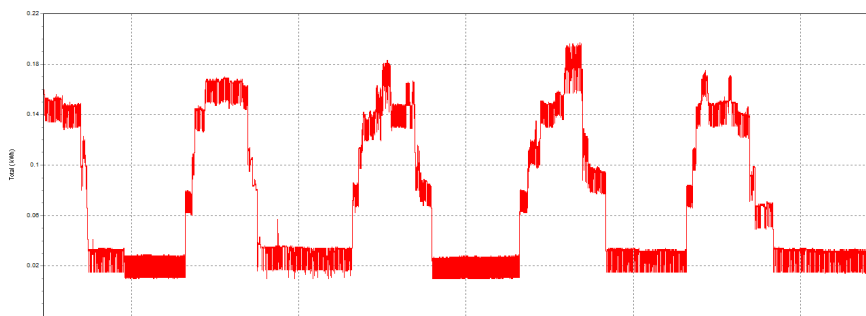

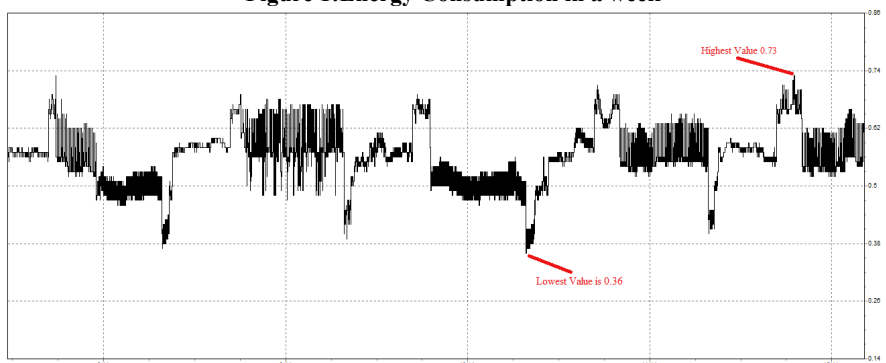**Figure 1:Energy Consumption in a week**

Figure 2: Power Factor measurement in a week.

Figure 2 shows the power factor in a week period as the highest value of power factor reached to be 0.73 only while the lowest value of power factor index was 0.36. It can be clearly seen that the power factor in not satisfied as it is not even approach to the value of 0.85, which is the standard for power factor, by TNB. It means that the load has a problem and needs power factor correction to solve the problem, as one way to do so is to add a capacitive bank to improve the power factor. As the low power factor, can cause large kVA rating of equipment of electrical machinery such as switch gear, transformers and alternators, as kVA rating is inversely proportional to power factor, the smaller the power factor, the larger is the kVA rating. Thus, at low power factor, making the equipment expensive and lager as the kVA rating has to be made more. Furthermore, the large current

conducted at low power factor, which causes larger copper losses in all the elements of the supply system. This results in very poor efficiency. From the diurnal electricity consumption patterns, fluctuations in the graphs are noticed in the hourly consumption. The consumption patterns of energy show several peaks and troughs throughout the day. Electrical energy consumption is different from one of weekday to another while closely same in weekends. It can be seen from the graph in Figure 3 that on Monday the energy consumption was approximately to be 74.02 kWh with a temperature of 30°C as the start of the week and meant to be all the staff are there

On Tuesday, the consumption turned to be 79.3 kWh which is higher than Monday as there was an increase in the temperature with to be 33°C. On Wednesday, the consumption was 73.66 kWh in a temperature of 33°C, on Thursday the consumption increased a bit to be 75.73 kWh under a temperature of 33°C, on Friday consumption was 74.71 kWh under the same degree of temperature while Saturday and Sunday with consumption of 14.09 kWh and 15.18 kWh respectively under temperature of 33°C.
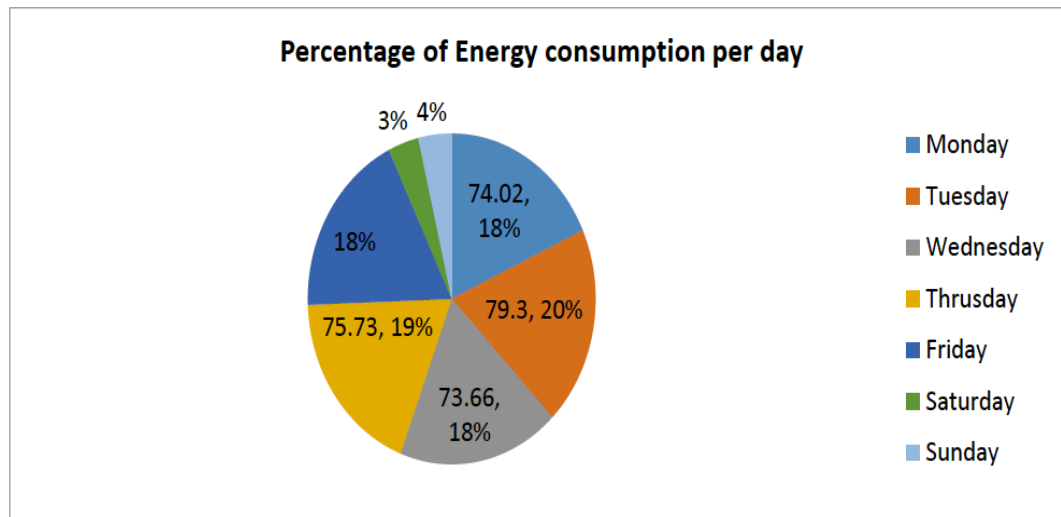

Figure 3: Percentage of Energy consumption per day

CONCLUSION

By referring to the findings, clearly shown that a wasting energy was there and some of the strategies must be applied in utilizing electricity wisely and effectively. Due to economics budget constraint now, the only way to start is with changing consumers' behavior and habit in utilizing appliances and equipments wisely and effectively. Thus, those appliances and equipments should only be operated when needed, otherwise those appliances and equipments need to be turned off. Secondly, consider high efficient appliances and equipments. Therefore, by taking those important parameters in consideration, behavior and technology, electricity consumption could be managed wisely and effectively. Due to limitation of the cost, a real result after implementing this approach cannot be done. Thus, it needs strong systematic and holistic approaches to be guided by government to consumers.

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