



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN A BILLING ESTIMATION FOR DOMESTIC USAGE

This report submitted in accordance with requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree of Electrical Engineering
Technology (Industrial Power) (with Honour.)

by

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ABSTRACT

Most consumers are usually lack of awareness about the trend of energy utilization in their residential house. This project focuses on the improvement of efficiency in electricity energy used in a house. Wise and efficient use of electricity can conserve energy, save money and assist in protecting the environment. The primary step is to analyse the electricity usage and using the energy more efficiently and comfortably controlled. Next, it will follow by analysing the data to get the estimated energy usage and bill charges. This paper proposes on the implementation of billing estimation to overcome the problem for the consumer to manage their electrical energy usage and the trend prediction.

The issue of increasing tariff in electricity starting on early year of 2014 has burden the customer. The current rate of domestic tariff must be concerned by the users in order to avoid excessive energy consumption. It can be done by controlling the usage of electrical energy for domestic users throughout the load behaviour analysis based on the lifestyle of human. When the consumers lower electricity usage, the power plant companies gain more advantages as providing them some useful load profile data for the load balancing. This ensures a healthier reserve margin that eliminates any possibilities of nationwide power outages.

ABSTRAK

Kebanyakan pengguna biasanya kurang mempunyai kesedaran tentang trend penggunaan tenaga di rumah kediaman mereka. Projek ini jelas sekali memberi tumpuan kepada peningkatan kecekapan tenaga elektrik yang digunakan di rumah. Penggunaan tenaga yang bijak dan cekap boleh menjimatkan tenaga elektrik, menjimatkan wang dan membantu melindungi alam sekitar. Langkah utama adalah dengan menganalisis penggunaan elektrik dan menggunakan tenaga dengan lebih cekap dan di bawah kawalan. Seterusnya, kaedah analisis akan dibuat untuk mendapatkan anggaran penggunaan tenaga dan bayaran bil. Kertas kerja ini mencadangkan mengenai pelaksanaan anggaran bil untuk mengatasi masalah bagi pengguna untuk menguruskan dan membuat ramalan trend penggunaan tenaga elektrik .

Isu kenaikan tarif elektrik bermula pada tahun awal 2014 membebaskan pengguna. Kadar semasa tarif domestik perlu diambil kira oleh pengguna untuk mengelakkan penggunaan tenaga yang berlebihan. Ia boleh dilakukan dengan mengawal penggunaan tenaga elektrik bagi pengguna domestik melalui analisis beban berdasarkan gaya hidup manusia. Apabila penggunaan elektrik lebih rendah, syarikat-syarikat tenaga kuasa mendapat lebih banyak kelebihan hasil daripada beberapa data profil beban yang berguna untuk pengimbangan beban. Ini memastikan margin rizab yang lebih sihat dan menghapuskan sebarang kemungkinan gangguan bekalan kuasa di seluruh negara.

DEDICATIONS

“Dedicated especially to my beloved father, mother and my family, my faithful housemates and friends who had supported me in completing this project.

May Allah bless us and give us guidance.

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LIST OF SYMBOLS AND ABBREVIATIONS

ST	=	Suruhanjaya Tenaga
TNB	=	Tenaga Nasional Berhad
Wh	=	Watt per hour
EMD	=	Electricity Monitoring Device
LCD	=	Liquid Crystal Display
LED	=	Light Emitter Diode
AC	=	Alternating Current
DC	=	Direct Current
ADC	=	Analogue to Digital Converter

CHAPTER 1

INTRODUCTION

1.0 Introduction

Energy use is crucial to human survival and development. Improvement in lifestyle has been associated with the increasing of energy consumption. The access for optimum energy service has always been as a necessary precondition for development. Efficient energy use, sometimes simply called energy efficiency. It means that by using less energy to provide the same level of energy service. Energy efficiency is important for the power consumption of any building. Energy efficiency will be more important due to the increment of electrical energy demand.

1.1 Background

The term of power trending might be irrelevant for those who are do not concern about the electricity usage. By analysing the consumption of electricity, there are various ways to do some changes for energy saving based on the efforts taken by the users. One of the common problem happens to the user is the usage of energy seems to be unexpectedly higher without a relevant reason. The total kilowatt hour should be examined by the user in order to avoid it. Thus, it is essential to manage the uses of energy in daily life by an observation to avoid excessive energy usage as well as getting economic benefits.

1.2 Energy Consumption

It can be defines as the form of uses from electricity usage. Electric energy consumption is the actual energy demand made on existing electricity supply. In a developing nation like Malaysia, the numerous growing of technology influences an increment of electricity demand from the residential, commercial, industrial and others.

According to the statistical data from the Suruhanjaya Tenaga (ST), which is known as energy balance record, the trend for the electricity consumption is always having a rise number of wattage per hour (Wh). For instance, the following tables show the comparison of peak consumption between the year of 2012 and 2013.

REGION	ELECTRICITY GROSS GENERATION		ELECTRICITY CONSUMPTION		AVAILABLE CAPACITY**	PEAK DEMAND	RESERVE MARGIN
	GWh	%	GWh	%	MW	MW	%
PENINSULAR MALAYSIA	117,797	87.7	102,174	87.8	21,044	15,826	33.0
SARAWAK	10,824	8.0	9,237	7.9	2,265	1,161	95.1
SABAH*	5,754	4.3	4,943	4.3	1,091	828	31.8
TOTAL	134,375	100.0	116,354	100.0	24,400		

2012

REGION	ELECTRICITY GROSS GENERATION		ELECTRICITY CONSUMPTION		AVAILABLE CAPACITY**	PEAK DEMAND	RESERVE MARGIN
	GWh	%	GWh	%	MW	MW	%
PENINSULAR MALAYSIA	120,893	84.2	105,861	86.0	21,753	16,562	31.3
SABAH*	7,433	5.2	5,097	4.1	1,172	874	34.1
SARAWAK	15,171	10.6	12,118	9.8	2,045	1,783	14.7
TOTAL	143,497	100.0	123,076	100.0	24,970		

2013

Figure 1.1: Gross generation, Consumption, Available capacity, Peak consumption and Reserve margin for electricity in Malaysia (Source: National Energy Balance 2013)

1.3 Increment of Electrical Energy

The electricity bill calculation is based on the current rate of domestic tariff. Electricity consumption usually increases due to the following reasons:

1. Additional electrical appliances as the family member grow
2. Electrical loading or size of the appliances
3. Replacement of smaller appliances to bigger capacity
4. Modern life style leads to using more electrical appliances
5. Longer usage of appliances
6. Capacity of appliances which can be adjusted at maximum, result on high load factor. For instance, air condition, fan, water heater and others.
7. Faulty appliance will result in appliance operating longer hour and wasting electricity. For example, refrigerator with faulty thermostat, shortage of refrigerant, or defective door gasket.

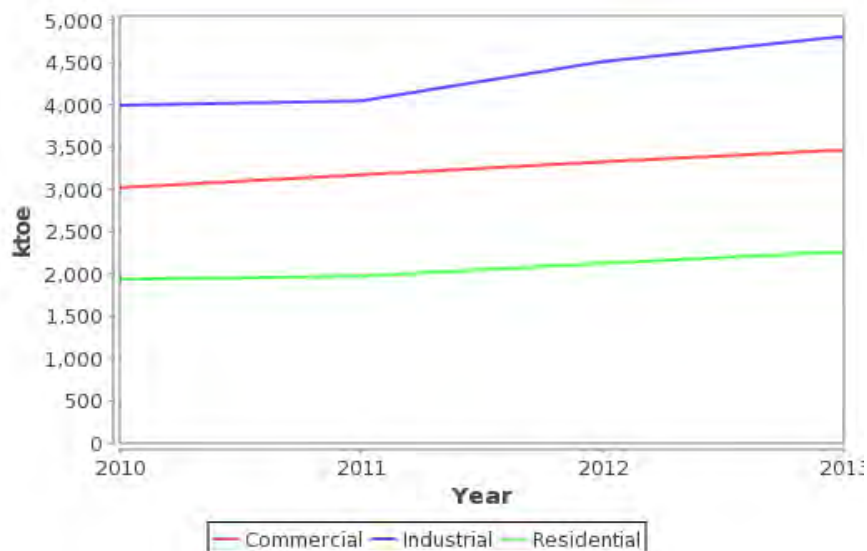


Figure 1.2: Total of energy for electricity in kilotonne at Malaysia
(Source: <http://meih.st.gov.my/statistics>, Suruhanjaya Tenaga Commission 2013)

1.4 Domestic Usage

The electricity consumption cost per household depends on family size, living habits, number and age of electrical appliances and hours of usage. The calculation for the estimation of electricity cost for different appliances is shown as the following:

1. Power rating of the electrical appliance and its efficiency
2. Number of hours appliances being used
3. The domestic tariff rate per kilowatt hour (kWh)

$$\text{Electricity consumption (kWh)} = \text{Power (watts)} \times \text{hour of operation} \times \frac{30 \text{ days}}{1000}$$

1.5 Problem Statement

When the monthly bill for electricity is too high cause of the high energy consumption, there is no way turning back. In the other word, the energy utilization is exceeding the necessity. So, the total cost of the electricity bill definitely must be paid to obtain the next service from the supplier.

1.6 Objectives of Research

There are four main objectives need to be done for this project:

1. Encourage the consumers to concern about their expenditure in electricity bills.
2. Convince the consumers to reduce the consumption of energy by an observation.
3. To inform the consumer about the previous units of data for saving purpose.

1.7 Contributions of Research

The contributions in this research are obviously to minimise the rate of energy used for domestic area by notifying them about the current and previous units of kilowatt hour data.

1.8 Scope of Research

This project is all about the management of energy consumption. It is such of reminder to the domestic consumers in planning their budget for electricity bills by referring to the amount of energy that has been used. Moreover, it will make them realize on the important of electrical energy conservation in spite of pleasure for the next generation.

This project is conducted for a residential house in order to get information, knowledge, data and the other important things to make it useful for other important purpose.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The purpose of this section is mentioned for the research or thesis of this project. This review contained of the other exist project which using the same concept of this project. The point of view to relate the other project is to recognize the advantages, disadvantages and data research for this project. It can generate the ideas and improvement for this project.

2.1 EMD: Electricity Monitoring Device for User Awareness

This research is propose on the about EMD research methodology and process development of a device to monitoring real-time electricity utilization. It is relates to the monitoring system for indirectly help for the users to estimate their budget for the usage of electrical energy. The idea is developed based on the objective which is wants to create consciousness among the electricity user regarding the energy consumption.

Electricity Monitoring Device (EMD) is actually a simple device that can inform electricity consumption for the domestic user. This device will help the home and factory users to monitor their daily electricity consumption. In addition, this device will ensure the user to check on their monthly billing cost in terms of the power calculation and costing. It is an alternate way to reduce the energy usage during a certain period.

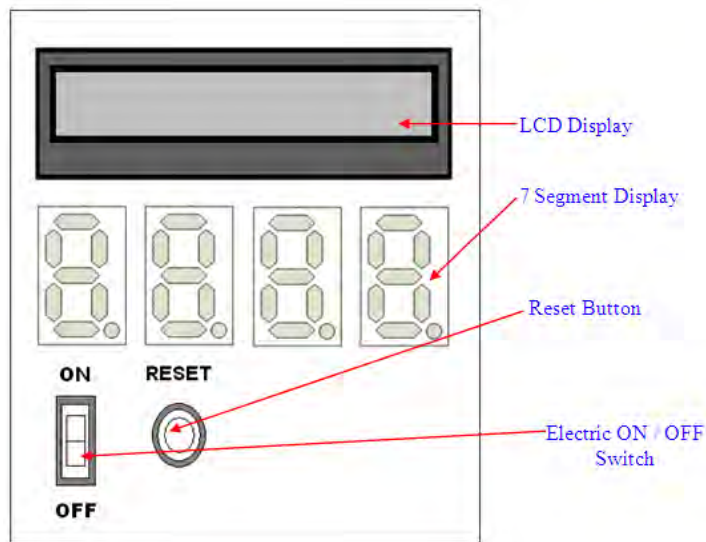


Figure 2.1: Illustration for Electrical monitoring device (EMD) (S. S. S. Ranjit, S. E. Loo and S. Zulkifli, 2011)

This device is basically design by using the common electronic components which consists of 4 bits digital flip-flop circuit that is used as a counter. It will be used LCD and seven segment display, switches, push buttons and others to develop the device. The 4 bits digital flip flop counter display up count value during utilization of electricity

In general, the Electricity Monitoring Device will improve on the way of thinking for the user about the important of energy. This device also uses the simple circuit integration so that it is compatible at any installation especially for domestic usage.

2.2 Development of Energy Management and Warning System for Resident: An Energy Saving Solution

In this content, it is disclosed about the household energy management and warning system for energy saving solution. Then, it is focused on four elements and they are air conditioner inverter control, fluorescence brightness control, power switching control and household energy usage warning system.

This whole system could declare the power usage and display it through a LCD monitor. Besides, it can warn the user through LED bulbs when the power usage is getting close to the monthly prescribed energy usage levels.



Figure 2.2: Main Controller box (Sittisak Rojchaya and Mongkol Konghirun, 2009)

2.2.1 Air- Conditioner Inverter

This microcontroller will obtain the temperature analogue signal from temperature sensor. Then, it would control the on/off state of the air-conditioner in accordance with the real temperature of the room by using the hysteresis control type.

In the operation, if the desired temperature was set at 25°C, then the air-conditioner would stop when the measured temperature is lower than the desired temperature by 2°C. For energy saving, during start up, the other microcontroller will operate the inverter for soft starting compressor.