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Review on Demand Controller

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***Abstract*— In today's decade, there is a large requirement of power. It is very essential to maintain power continuity and reliability. The best method is to decrease usage at customer side. Maximum demand controller is a device designed to meet different load conditions w.r.t power system. It continuously checks the load and if demand increases beyond a preset value it will be informed by an alarm and message to the registered user. If unattended, it automatically cuts off the low priority loads in a logical sequence as designed by user. In addition, voltage and current is measured and energy cost is predetermined.**

***Keywords*— Maximum demand, Maximum demand controller, Load management, Features, Working**

I. INTRODUCTION

Power is measured as work done in an instant, while energy is the integral of power over time. Demand is the maximum amount of power required for the consumer to meet his needs. The consumption could be greater or less than that demand. But as the sources of energy are limited and there is huge demand for power, its essential to keep usage below the demand.

Fixed charge relies on maximum demand of customer whiles running charges depends on no. of units consumed. Load management is a powerful method of efficiency improvement both for user as well as utility. As the demand charges constitute a considerable portion of the electricity bill, from user angle too there is a need for integrated demand controller.

II. DEMAND CONTROL SYSTEMS

The purpose of demand control system is to ensure that the maximum contracted power limit is not exceeded. The different units measure instantaneous power and automatically calculate the power used that is exceeding the contracted power through inbuilt program. Therefore, any load can be quickly and reliably disconnected with built-in relays and controller. The different methods for control strategy is as illustrated below:

A. Preventive Method

The preventive method is used when we do not wish to connect or disconnect loads automatically. The system prevents any value above the preset value of power with a system of visual or acoustic signals, so that an operator can manually disconnect determined no. of loads.

B. Predictive Method

The predictive method is the most common and efficient method. It makes the condition at the end of the period and optimizes loads, so that the maximum number of loads can be connected, ensuring that the peak limit preset is not exceeded.

C. Control of Loads

Its needed for control of a group of loads on priorities, to distinguish the loads with a lower priority, and which can be commonly disconnected, and the loads with the highest priority, that must only be disconnected when needed, in order to prevent exceeding the preset value. The control of loads is obtained through two systems as under: -

1. *Modular System*: Its adapted to the number of loads in any installation. It only keeps what is needed. It has a modular system that can connect /disconnect loads near the loads, to simplify the cabling layout, reduce distances, cost and improve the response time. It consists of circuit breakers, relays, isolators etc. They are controlled by a single PC.

2. *Software System*: Software is included to display the information in a PC and store the connections and disconnections of the power unit. Individual tables based on priority, are available not only to start and stop loads automatically, but also to guarantee the perfect control of power. The loads are defined, the disconnection system of the loads is assigned. The loads are unlimited. After creating the groups, the user must simply program the loads, for the relay that controls the loads to be activated.

III. METHODOLOGY

Maximum Demand Controller is a device designed to meet the need of electrical users conscious of the value of load management. Alarm is sounded when used power approaches a pre-set value. If corrective measures are not taken, the controller switches off nonessential loads in a logical sequence. For designing the Maximum Demand Controller there are three main strategies for calculation as:

A. Fixed Priority Strategy

A Fixed priority strategy sheds the least important loads first and the most important loads last . The fixed priority strategy has the advantage of keeping high priority areas supply "ON" while low priority areas will be "OFF" during peak demand periods.

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B. Rotating Strategy

In a rotating strategy, an equal distribution of power is provided to all controlled loads. This strategy is suitable when all areas or rooms require an equal share of power.

C. Combination Fixed/Rotate Strategy

It is the most versatile and powerful strategy because there are so many combinations possible. A combination load strategy helps groups of rotating loads to be programmed with or without fixed priority loads. This can result in maximum efficiency and energy cost savings. The conditions at which variation in frequency changes are a noted below:

1. Generation > demand + losses = frequency increases

2.. Generation = demand + losses = frequency same

3.. Generation < demand + losses = frequency decreases

IV. ELECTRICAL LOAD MANAGEMENT

A. Need for Electrical Load Management

A large demand for power is seen nowadays. As capacity addition is costly and only a long time prospect, better load management at user end helps to minimize peak demands on the utility infrastructure as well as better utilization of power plant capacities. Load management is a powerful means of efficiency improvement both for end user as well as utility.

B. Maximum Demand Control

Step by step approach for Maximum Demand Control in case of a substation are as follows:

1. Load Curve Generation: Presents the load demand of a consumer against time of the day is known as a 'load curve'. If it is plotted for the 24 hours, it is known as an 'hourly load curve' and if daily demands plotted in a month, it is called daily load curves. These types of curves are useful in predicting patterns of peaks and valleys.

2. Rescheduling of Loads: Rescheduling of electric loads and equipment operations, in different shifts can be planned and implemented to minimize the simultaneous maximum demand over a power system.

*3. Storage of Products/In Process Material/Process Utilities Like Refrigeratio*n: It is possible to decrease the maximum demand by building up storage capacity of products/materials, water, chilled water/hot water, using electricity during off peak periods.

4. Shedding of Non-Essential Loads: When the maximum demand tends to reach pre-set limit, shedding some of nonessential loads temporarily can help to reduce power demand on a system.

5. Operation of Captive Generation and Diesel Generation Sets: When diesel generation sets are used to aid the power supplied by the generating units , it is good to connect the DG sets for durations when demand reaches the peak value. This would reduce the demand to a useful extent and minimize the demand charges.

Active power is measured in kW (Kilo Watts). Reactive power is measured in kVAr (Kilo Volt-Amperes Reactive). The total power is the vector sum of the active power and reactive power. The vector sum of the active power and reactive power make up the total (or apparent) power used. Total Power is measured in KVA (Kilo Volts Amperes).

V. PROPOSED SYSTEM

The price of electricity and demand for power is predicted to increase exponentially in the coming several years. In fact, the world's demand for power is rising faster than the demand can be met. Consequently, industries, homes, and businesses are already taking power saving measures to save money and to become more environmentally friendly. Power saving techniques seems to have a small impact to each individual, but as the price and demand for electricity rises, the collective power saving actions of everyone will make a significant difference.

This paper gives an overview of building an electronic device which continuously monitor's one's power consumption and warns consumer if he/she is expected to increase beyond his/her pre-fixed demand. This monitoring is done on a regular basis, so that if consumer is at the brink of exceeding his/her specified consumption limits, they will be warned. this topic concentrates on two things,

1. Consumer's electricity bill.
2. Control on power consumption.

As mentioned above, by fixing one's consumption below a fixed slab rate category and continuously checking that the consumption has not exceeded this limit for a month, we can cut down the consumer's electricity bill as well as the load on the system, if we succeed in limiting the consumption below the slab rate. This constantly alerts consumer if their consumption has reached nearer to the pre-planned units using an audio signal and/or and S.M.S on a regular basis, so that the consumer is aware of his consumption and voluntarily controls his consumption.

A. Features

1. Automatic Load Shedding: As the power consumption reaches nearer to the pre-set value, the controller automatically sheds/shuts down the least priority loads through an electromagnetic relay and hence reduces the power consumption and slows down the rate of consumption.

2. Warning System: When the power consumed reaches to some value which is not the pre-set value but it is set forefront of the actual limit, it warns the consumer by constantly beeping an alarm and an SMS and hence makes the consumer cautious about his consumption and prompts him to slow down his consumption.

3. Messaging System: If in case no one is present in the home, this unit sends a text message via a GSM module present in this circuit. And hence intimates the user that the limit is about to cross. The keypad will enable the user to enter his own consumption and also the units at which he/she wants to get the warnings. This can be set twice, thrice or any number of times in a specific time. Also the user can control the loads externally through registered mobile number and GSM module.

C. Working

The working of the proposed system is explained as under. The current transformer calculates the amount of current utilized. The power is calculated by the program earlier saved by the user. The microcontroller continuously monitors the power consumed. This system will intimate the consumer about his usage rate. It will display the units he consumed and how much cost he would get at the end of

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month, in order to be in a minimum slab rate being fixed for a period of time by him/her.

This helps consumer taking care regarding his electrical energy consumption and protect him/her from the extra charges incurred due to minor changes in slab categories, even though these changes are small but they affect the consumer's bill severely. When the demand reaches the pre-set value it will be informed by using an alarm, and message to the registered user. If unattended it automatically cuts-off the low priority loads in a logical sequence.

This sequence is predetermined by the user and is programmed jointly by the user and the supplier of the device. The user can control the 'ON' and 'OFF' of loads externally through SMS from registered mobile number to the GSM module. Also voltage and current is measured and energy cost is predetermine based on consumption. The consumption along with measured voltage and current are displayed using an LCD.

VI. CONCLUSIONS

This paper represents a review on strategy of controlling the maximum demand over a time period. The control is made easy using a controller with Embedded C platform.

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