

Implementation of Demand Side Energy Monitoring on TOD Basis Using Lab view

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Abstract: -- Electricity is very essential for economic growth of country and growth is linked to the energy availability. The gap between demand and the supply is rapidly increasing. For Monitoring the quantity of energy used at specific times to reduce system peak demand, load leveling, balance system supply and demand, Energy efficiency, and to reduce overall system demand. This paper basically describes the demand-side energy monitoring on TOD basis using LabVIEW. In this paper, LabVIEW uses the concept of Time of Day (TOD) metering to check the usage of electricity and the time of use. Demand Side Energy Monitoring system measure which is used as a means of incentivizing consumers to shift a portion of their loads from peak times to off-peak times, thereby improving the system load factor by reducing the demand on the system during the peak period.

Keywords- TOD, LabVIEW, ZigBee, EEM, GUI.

I. INTRODUCTION

Time of Day (TOD) tariff, is recognized globally across electricity industries, as an important Demand Side Energy Monitoring measure which is used as a means of incentivizing consumers to shift a portion of their loads from peak times to off-peak times, thereby improving the system load factor by reducing the demand on the system during peak period. The main purpose of this project is to reduce the peak demand of the power plant. It promotes to avoid the need of creating new power plant by shifting the load to off-peak period. The demand of electricity is increasing every day. Also there is large variation in demand at different time periods of the day. The load curve of Indian utility normally has morning peak and evening peak. Differential between demand and supply is increasing day by day. In this scenario, in order to meet the peak demand, if generation capacity is increased, the cost of generation will also increase. In an existing shortage situation, the peak power available is significantly costlier than off peak power and availability of power during peak hours is also limited. For reducing the cost of generation, it is necessary to reduce burden on the system and hence steps are to be taken for flattening of the load curve i.e. to distribute the load (power demand) evenly throughout the time period of the day.

II. INCENTIVE PROGRAM CONDITIONS

In this program, consumers are charged at different tariff at different times of a day for their energy use[6]. Utilities should offer prices that motivates consumer to use electricity when there is a base load time. High unit rate during peak

load time, average rate per unit during base load time and discounted rate per unit if consuming energy during low demand period. This type of scheme should be employed. Steps required to implement this program are discussed below:

- Units of energy used during peak load should be charged highest rate, average rate per unit during base load period and discounted rate per unit during low demand period; hence there should be distinguishable difference between peak load, base load and low demand periods.
- However, some consumers are ready to pay high unit rate during peak load time but still they should not allowed to use energy more than predefined KW say as per their sanctioned limit.
- Time period for which consumers use energy.
- Sum up all the units consumed in a fixed time say one month.
- As Consumer's are the that ultimately use energy, hence he should be able to easy understand the load period i.e. whether peak load, base or discounted load time.

III. CONCEPT OF TOD METERING

Time of Day (TOD) metering is a concept which gives a pecuniary incentive to the consumers in deliberately shifting a part of their overall electricity use from the hours of peak demand to those of lean demand daily. As the consumer intentionally move a part of electricity usage to the hours of lean demand, the electricity requirement during the two peak times of a day – morning and evening can be reduced. Hence TOD metering concept is an exit for the consumers from frequent power outages. The TOD metering [1] involves

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dividing the day into tariff slots and assigning higher rates at peak load periods (hours of peak demand) and lower tariff rates at off-peak load periods (hours of lean demand). Hence LabVIEW based automated system to monitor demand side energy utilization will signal the consumers that the electricity is pricey during the two peak times of a day – morning and evening. During the peak times the consumers will have to pay more money for consuming more than required or will have to use it economically. Installing new power stations is not the only solution to reduce the gap between supply and demand. To cope with this problem demand side energy monitoring on TOD basis is the viable solution. It urges load management on consumer side with respect to time and amount of use so that there is overall reduction in the system peak. Proper monitoring provides great help in managing balance between demand and supply. The use of Time of day tariff is one of the programs under Demand side energy management that supports large commercial and industrial consumers to use electricity efficiently.

IV. LABVIEW BASED TOD METERING

LabVIEW based automated system facilitates centralized demand side energy meter data collection and energy utilization computation on TOD basis. This will enable remote monitoring and analysis of demand side energy utilization. This system comprises of a microcontroller based energy utilization recorder on TOD basis, LabVIEW based remote end demand side management system, ZigBee based transceiver and energy meter. Microcontroller based energy utilization recorder is a real time clock based system that performs electronic tracking of demand side energy utilization on TOD basis. During the end of each day, the electronically tracked information is transmitted to LabVIEW based remote end energy monitoring system. The electronically transmitted information comprises of meter ID, energy consumed during the hours of peak demand and the hours of lean demand. Since LabVIEW application is customized to monitor demand side energy utilization, it can be referred to as a Graphical User Interface (GUI) or Human Machine Interface (HMI). This application is designed with functionalities like data acquisition via wireless communication, graphical analysis of demand side energy utilization, auto-data collection of energy meter readings for billing purpose. As a HMI, this application enables the remote end operator to select the tariff per unit consumed during the hours of peak demand and the hours of lean

demand. Demand side energy utilization data acquired through wireless communication will be used by the LabVIEW application to perform automatic tariff calculation and report generation for monthly billing. ZigBee based wireless communication technology is used for the communication between the energy utilization recorder and the LabVIEW application. The above description implies that the mentioned LabVIEW application will circumvent the role of meter readers.

V. LABVIEW APPLICATION

The LabVIEW application for remote end demand side monitoring system is designed with following functionalities.

- Automatic wireless data acquisition for graphical analysis of energy utilization during the periods of peak demand and lean demand
- Energy utilization consumer details registration for billing purpose.
- Tariff selection for energy utilization billing.
- Automatic bill statement generation as Microsoft word document.

VI. BENEFITS OF DEMAND SIDE ENERGY MONITORING ON TOD BASIS

It results in lower peak demand and greater saving of electrical energy. Ultimate advantage to consumer, utility and societies are:

- Postpone the need for construction of new power plant.
- Less stress on power plant that in turn reduces local air pollution.
- Less stress on plant results in removal of harmful green gas emissions.
- Low cost of generation per unit.
- Network reliability is improved.
- Power plant requires less maintenance.
- Reduction in consumer's electricity bill.
- Enhances the national energy security by reducing the dependency on import of fuel.

VII. CONCLUSION

Demand side energy monitoring has changed the thinking of constructing a new power plant to meet the demand and now it is used to control electricity bills of various residential, industrial and commercial users. This will improve the power consumption efficiency but also reduce the energy

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demand. consumer can also monitor the load during peak hours. If the amount of load shifted to normal hours there by the peak demand will go down and hence power generation during peak hour can be reduced, this brings the production cost down. Since, the consumers get benefited for limiting the consumption during peak hours. This will increase system reliability, reduce energy prices, reduce dependency on imports of fuel and finally contributing to better environment.

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