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Demand Side Management Techniques for Peak Reduction

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Abstract: ***Industrial growth is the back bone for the development of any nation. Industries are mainly dependent on electrical energy. But from the various studies, the sources for electrical energy are decreasing gradually, and in turn, the gap is increasing between the supplier and the load. The solution for this scenario is optimal utilization of resources. To overcome this problem , the concept Demand Side Management (DSM) has emerged in Power System Planning and Management. The principle objective of DSM is mutual understanding between the supplier and the consumer for maximizing benefits and minimizing inconvenience. The aim of this research work is selection and application of appropriate DSM techniques to industrial and domestic loads for peak load management and energy conservation, that is to control the maximum demand during the peak hours and saving the energy by using the energy efficient and intelligent appliances like air conditioners and water heaters. DSM includes techniques like the End Use Equipment Control, the Load Priority Technique, he Peak Clipping & Valley filling, the Differential Tariff and Resizing of the equipment. Depending upon the application, all the techniques may be applied sequentially, or only a few of them can be applied. There is a lot of ambiguity in the selection of DSM techniques, because the application of each DSM technique depends on the case study and the problem associated with the respective case study. After comprehensive understanding of a particular case, a thorough investigation and subsequent data analysis pave the way for the selection of appropriate DSM technique/techniques***

I. INTRODUCTION

Demand Side Management programs consist of the planning, implementing, and monitoring of the activities of electric utilities which are designed to encourage consumers to modify their level and pattern of electricity usage. In the past, the primary objective of most DSM programs was to provide cost-effective energy and capacity resources to help defer the need for new sources of power, including generating facilities, power purchases, transmission and distribution capacity additions. However, due to inherent changes that are occurring within the industry, electric utilities are also using DSM as a way to enhance customer service. DSM refers to only energy and load shape modifying activities that are undertaken in response to utility administered programs. It does not refer to energy and load - shape changes arising from the normal operation of the market place or from government mandated energy-efficiency standards.

II. LITERATURE SURVEY

At present, the demand for electrical energy is continuously increasing while the generation capacity is not increasing at the same rate because of so many restrictions. Hence, the demand on electric power system has to be managed in a very efficient manner. To meet this problem, DSM technology has come into existence.

Reynolds M. Delgado presented an over view of DSM alternatives. It covers the general state of art, projected for development and application of DSM alternatives. It starts with a background discussion of DSM, which provides reader with a historical reference, and an understanding of the types of DSM needs. R. Arunachalam represented the implementation of some DSM alternative techniques like End Use Equipment Control (EUEC), Load Priority Technique (LPT), Peak Clipping & Valley Filling and Differential Tariff (DT) in a milk industry. For this purpose, a local major industrial consumer having various categories of loads has been considered. Existing power consuming pattern has been recorded prior to the application of DSM techniques. The consumer also gets savings based on Differential Tariff technique by lowering of MD during peak hours and connecting more loads during off-peak hours. Calculations have established for economic analysis. Which shows how much MD has been reduced during peak hours and energy efficiency of the system has been improved by increase in Load Factor by connecting loads during off-peak hours. Demand Side Management programs are strategies designed to alter the shape of the load curve.

Increasing in the cost of new generating plants, unexpected load growth, increasing in critical fuel cost price constraints etc., have led to increasing interest by utilities in load management programs. The object of the work is reducing the electrical power consumption and shifting some loads from peak hours to off-peak hours.

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III. NECESSITY OFDSM

The concept of Demand Side Management in Power Systems is gaining worldwide and presently it is developing very rapidly. The causes for this are ; The rate of generation of electric power is not at all meeting the present day requirements due to the following reasons.

A. The continuous rise in the cost of electricity.
B. Activities by consumers to gain more control of their electricity bills.
C. Environmental barriers to site new generating plants.
D. Huge capital investment for building new generating plants.

Since the demand for electricity is expanding and as well as DSM concept is gaining momentum, it is expected that in near future, both supplier and consumer will make better use of DSM techniques to dealwith these factors

IV. VARIOUS DSMTECHNIQUES

A brief summary of the various DSM techniques is described in this section. However, it is equally important to note that there are many variations of DSM alternatives. This is because most of the suppliers/consumers design their own DSM programs to meet their specific working schedule.

A. End Use Equipment Control

This is one of the most active areas of DSM technology development. The majority of the work is in the industrial sector, although the commercial and residential consumers are showing interest in DSM. This is because some of the industrial loads exhibit the poorest load shapes so that there is more scope for improvement for most of the suppliers to obtain larger blocks of load control. These reasons have forced suppliers to look at industrial loads first for improvement through DSM Techniques .

1) EUEC Methods

The consumer end use appliance control is achieved through the following ways:
a) Deciding the priorities of the loads without affecting the production schedule
b) Availing the benefits of Differential Tariff; and.
c) Using proper automatic demand controllers for the bulk loads.

B. Load Priority Technique

In this technique, depending on the load priority it is for the production to keep the peak demand below a pre-set limit. This DSM alternative creates opportunity for industries to reduce peak and fill out the valleys in their load shape and improve the load factor of the consumer. In this DSM alternative, non-interruptible loads are classified as high priority Loads and the interruptible loads are classified as low priority loads. Under any normal working condition, there occurs maximum demand on the systems beyond the permitted limits when the priority loads are turned on, in order to maintain the demand well within the preset limit, then power supply to the low priority loads are cutoff. However, when the high priority loads are turned off, power is restored to the interruptible loads

From the supplier's point of view, this technique gives a highly desirable pattern of load consumption. Moreover, the load curve will be a flat one compared to load curve with peaks and valleys without the application of the technique.

C. Peak Clipping and Valley Filling

Reduction of peak demands reduces the demand charges of the consumer. Peak clipping is achieved by direct control of equipment, which is responsible for the peaks. Peak clipping is used to reduce capital investment charges, operating charges and dependence on high cost critical fuels. The main objective of peak clipping is to match the available generating capacity with the demand without going in for additional generation, which means cost. The principle involved in valley filling is to build up load or consume power during the light load periods of the supply system. This results in a more flat load curve as seen from the supply system; hence, the supplier's equipments like generators, transformers, transmission lines etc. are loaded to the tone of 80% to 0% of their rating instead of 15 to 20% during light loads. Thus, it results in high efficiency and lower cost of operation because of improved load factor or energy efficiency of the system.

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D. Differential Tariff

This technique has been introduced because of variable load on the supplier's equipment. Usually, the load curve of an industrial consumer will have some peaks and valleys depending upon his production schedule. Hence, the supplier must install his equipment) that will be capable of supplying peak load of the consumer. With this high capacity equipment, there is no doubt that he will be able to supply the consumer's peak; but, during the consumer's valley period, the equipment will be very much underutilized, thereby, highly reducing the energy efficiency of the equipment. Hence, the supplier will insist or will try by all possible means that his equipment is utilized to its rated capacity for the entire duration, whenever it is in the commissioned state. This step involves a dialogue with the consumer and suggests to him to reschedule his production schedule so that the supplier will see as flat a load curve as possible.

V. LIMITATIONS OFDSM

Limitation with DSM programmes is the ability of markets to capture cost-effective energy efficiency opportunities. Technology-based evaluations suggests that many cost-effective energy efficiency improvements are not rapidly adopted into market place. It appears that consumers acting on their own do not adopt many commercially available and cost effective efficiency measures. Other studies indicate that residential consumers act as if they severely discount the value of future energy savings when making energy efficiency investments.

VI. CONCLUSION

Electrical energy is inseparable from economic development and social transformation particularly for developing country like India. Therefore, in general the conservation measures to be accepted and implemented, requires intensive efforts by many groups in the country. The electrical energy end users require adoption , implementation, decisions and proceedings for energy conservation. The proposed DSM program is user friendly and it allows dealing the constraints of the customers with lots of mutual benefits between supplier and customers and also it does not demand expertise to deal with it, thereby allow ordinary customers to adopt it to their needs.

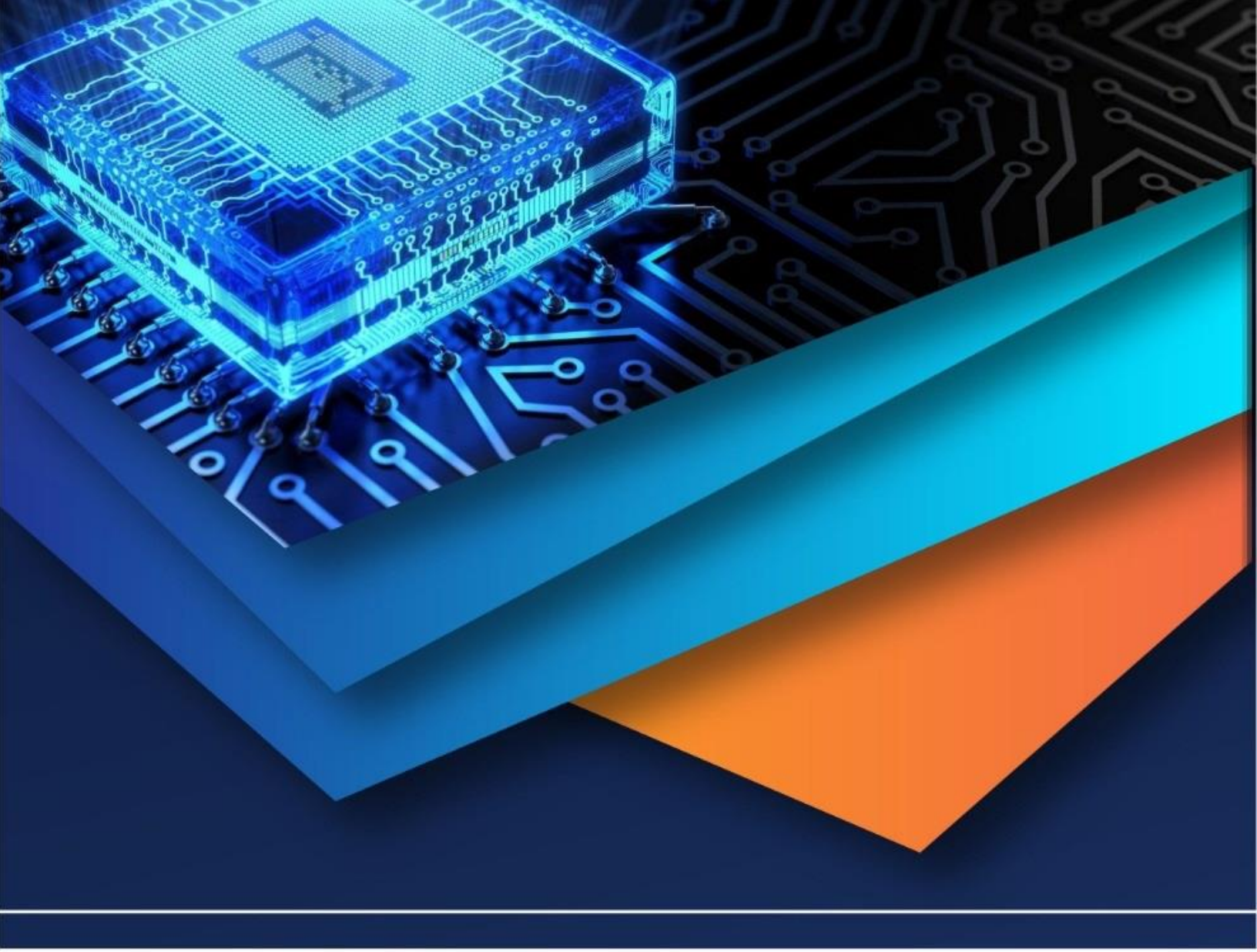
VII. FUTURE SCOPEOF DSM

The topic of DSM is gaining immense importance day by day. The field of DSM technology is widely spread and a large number of DSM alternatives are available. The application of these new innovative techniques to various case studies is wide open area of research. For more quality results and efficient load management. These techniques can be extended towards large scale industry.

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