AN ENERGY CONSERVATION SCHEME BASED ON ENERGY CONSUMPTION PATTERN OF THE CONSUMER

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ABSTRACT: Based on the energy use patterns of the consumers in the commercial buildings they are classified by grouping them based on segmenting their consumption by human's workdays, non-workdays, work hours & non work hours for efficient classification of the building occupants by calculating their energy use efficiency, entropy and intensity. Building occupants with low energy use efficiency & high energy use intensity is targeted for reduction of overall energy consumption and upgrading the equipment which enables conservation of energy by reduction of losses and proper usage of electrical equipment.

Keywords: Energy conservation, efficiency, energy use intensity.

INTRODUCTION

Energy conservation campaigns aimed at groups are not efficient and energy conservation is more related to attitude and motivation that a consumer has as an individual [3][4][6]. So campaigns aimed at individual are to be developed. These campaigns not only affect the energy consumption profile of a consumer but also alter the generation and demand profile required for a utility [2]. With development in distributed generation; planning and dispatch play a crucial role in deciding the dynamics of a utility [17]. Building Management System eliminate the problems associated with the utility as demand could be forecasted accurately and scheduling becomes simpler as the present demand is known. Use of commercial sensor networks in control and automation of electrical equipments has grown on a drastic level in Building Management Systems [5][8]. Apart from advancement in BMS energy conservation schemes and programs are also developed in order to contribute to the technology [1][6][7]. Conservation schemes not only reduce the consumption of energy but also reduce the green house gas emissions.

In behavioral intervention energy use trends are to be monitored and the consumption pattern is intimated to the consumer in regular intervals. The intervention schemes not only concentrate on energy usage trends but also contribute towards the upgradation of equipment in a building thereby reducing the losses associated with the energy inefficient equipment. 40% of the total energy consumed in our country is through the buildings and account for 41% of the total CO_2 and they tend to increase at an enormous rate in recent years[19]. To overcome these issues sensing and automation technologies are evolving in a large scale and have also become economical to implement [7-15]. But these building management systems tend to engage the equipment and their control is based on the utilization profile of those equipment's.

But the utilization profile of equipment's is generally based on the behavior of the consumer. The consumption profile of the consumer entirely depends upon the utilization profile of the equipment's in the building. So altering the behavior of the consumer alters the utilization profile thereby altering the consumption profile [6]. Attributes such as energy efficiency and entropy has always been the key factors in deciding the consumption profile [20]. But for a country like India with a diversified community of users and consumption patterns incentive schemes and subsidy schemes tend to alter the consumption pattern on a larger scale than the technical factors. Technical factors could also be introduced to support the subsidy scheme.

BACKGROUND

Intervention schemes in late 80s and 90s concentrated more on setting goals by the utility for the consumer and also on educating the general public about conservation of energy. These campaigns aimed at individual failed as awareness about conservation couldn't alter the comfort level of most of the consumers.in case of the twin river scenario [6] the method of intervention through regular feedback and suggestions from consumer failed due to lack of participation from the consumers who cared more about their comfort than conserving the energy.

Other schemes of intervention of consumption pattern by regular updating pattern of the consumer and intimating them through feedback for control also failed as the consumption pattern is attributed to the attitudinal behavior of the consumer. Providing the user with consumption pattern through feedback and requesting the user to update the energy use equipment seemed to be un economical in most of the cases [6][20].

METHODOLOGY

The energy consumption profile of the consumer is collected and stored in the SCU (Segmentation & Control Unit). Based on the collected data they are classified into working and non-working day charts in each profile of a consumer. Further customers are segmented based on the energy use profile into lower energy consumer, medium energy consumer and higher energy consumer. The lower and medium energy consumers are provided with incentives. The higher energy consumers are notified to reduce the consumption and strategies to reduce the power consumption will also be detailed. The collected date is preprocessed and classified initially for segmentation and after segmentation the users are notified about their consumption pattern and energy conservation strategies are followed.

Based on data obtained from the EB Meter of each consumer the SCU unit help to segment and classify the user based on metrics taken for the evaluation done by utility. Monthly power consumption data for every consumer is collected and they are classified based on following criteria's. consumer with a lower consumption profile (lesser than or equal 300 units) should be given 10% reduction in their electricity bill and for consumers with Medium consumption profile (300 - 600 units) should be given 5% reduction.in their electrical bill Consumers with a heavy consumption profile (greater than 600 units) should not be given any incentive and they should be notified to upgrade their equipment for alter their consumption pattern. If upgradation does change their consumption pattern, then individual intervention can be done based entirely on explaining the various strategies to alter their consumption profile.

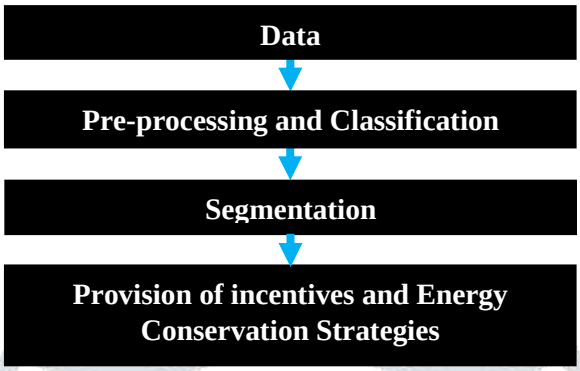

Fig 1. Workflow

DISCUSSION OF IMPACTS

Methodology based classification and segmentation helps only in building user profile and intervention of consumption by the user is aimed only at reducing their consumption and preventing the wastage of power. Schemes, incentives and algorithms cannot alter the consumption pattern of the consumer. The proposed method aims only at intervention of consumption pattern thereby making the consumer aware of the amount of energy he consumed. The percentage of reduction of power consumption depends entirely upon the consumers rather than the efficiency of the algorithm [3].proper calibration of sensors and entirely automated BMS could only effectively reduce the consumption pattern and prevent energy losses.

LIMITATIONS AND FUTURE RESEARCH

The power consumed by building occupant is limited yet major portion of the consumption is attributed to the buildings. Change in attitude of the customers towards the need for conservation alone can bring major changes in the implementation of these methodologies suggested. The future work could be extended to building up of a user profile for the consumer by the utility which maintains all the details about the consumers like consumption patterns, statistical analysis of the consumption on comparison with neighbors, list of the appliances used by the consumer in the building could bring about more improvement in behavioral intervention.

CONCLUSION

Building Management Systems (BMS) have improved drastically in recent years and their contribution to conservation of resources is substantial in this world yet contribution by Building Management Systems(BMS) in behavior intervention has to scale up in the upcoming years through IoT enabled equipment's and devices in building. The consumers should be allowed to know the consumption profile of other consumers in his building or in his locality to decide and plan on his consumption pattern. Intervention and conservation will be helpful for the utilities to economically plan the generation and dispatch and also will reduce the losses incurred by the utility which arise due to uniform provision of incentives to all the consumers.

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