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ANALYSIS OF TECHNIQUES USED IN DEMAND SIDE LOAD MANAGEMENT

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Abstract

The demand of electric power is goes on increasing. With the development of new technologies and manufacturing techniques the consumption of energy is rising. To meet the rising demand of electric energy there is need of new generating plants and transmission and distribution facilities. But limited resources restrict the further expansion in the infrastructure. So there are new techniques required from traditional ones. Some solutions are provided by researchers like use of renewable energy, reduction in line losses, energy efficient equipments or energy management. In this work, the analysis of different power system techniques is presented which are used to optimize the performance. Different techniques and model are presented in this paper for energy management.

Keywords: Power System, Energy Management, Demand Side load management.

Introduction:

As the electricity demand increases day by day and with the use of renewable energy resources, power distribution system facing the more stress conditions. This will cause increase in the individuals customers load above their base load which further causes the overload condition at the distribution transformer. This may also cause undue circuit failures. For example the uncertainty in Electric Vehicles drive behavior is one of the main problem. The proper scheduling of charging of the electric vehicles is important that ruminate the financial and environmental issues of the distribution systems. This will helpful in reducing the peak load demand, uniform load profile and minimizing the aging effect. To avoid the ill effects of the peak load, load scheduling draw considerable attention from researchers. Load scheduling helpful in avoiding hassle conditions by load management. By using load scheduling, improvement in the utility load factor is possible which restricts the commissioning of large generating stations and transmission lines. The proper planning of the peak load scheduling of residential customer including EVs is important for utilities.

Demand side management is a developing technique in the smart grid technology which uses advance communication technology. In many developed countries, coal and nuclear plants are base plants and peak load demands are meet by energy exchange among the power grids. The increased power demand, reduction in fossil fuels and greenhouse effect has changed the directions towards the renewable resources. But the challenges with renewable energy limited their use in grid. The scientists and industries try to face these challenges by upgrading electrical infrastructure and developing new technologies.

Literature Review:

As the power system becomes complex to meet the energy consumption requirements. There is a challenge to the suppliers to provide quantity and quality of electric power. To face this challenge majority of the countries goes under the electricity reforms. These electricity reforms [1-4] give good results and customer satisfactions [8] and improved service quality [9-11]. Due to infrastructural change in distribution there is improvement in service quality [12-14] and the case of line loss due to electricity theft [5-7] are reduced.

Authors in [15], proposed a model based technique to minimizing the customer's electricity bill using demand side management by optimizing the household smart equipments for day-ahead pricing. The proposed model has been developed in MATLAB/ SIMULINK. A comparison between Real Time Pricing (RTP) and the Fixed Time Tariff (FTT) has been made to show the effect of optimal scheduling on cost. A Home Energy Management System is presented by the authors for residential load. This system provides real time energy usage, controlling and power optimization of the equipments. An algorithm has been developed for power control of the loads which optimize the operation of load and simulated in MATLAB [16].

Yimin Zhou [17], developed a real time technique based on binary particle swarm optimization to optimize the home appliances. Authors include energy supplier and consumer with renewable resources in this study. On the basis of least tariff a time table for the use of load is prepared with the different time of use. In case of too high/low power demand supplier send a signal to stop/use of the equipment for peak load shifting. A simulation of smart home energy management system (SHEMS) is presented in [18]. The proposed technique is implemented on electric water heating and EV charging station. The results show that a customer saves a good amount by implementing SHEMS.

A variable set point approach has been presented to lower down the cost of energy consumed by residential users. By analyzing HVAC system of the society, authors calculate the peak shifting capability as these are intensive load in summer. A programmable communicating

thermostat is used for optimizing the electricity bill [19]. Authors in [20], proposed a HEM model using MATLAB to observ the power consumed and time of use of different electrical equipments. A demand shift algorithm has been developed to reduce peak demand without affecting the comfort level of user. Different input conditions are simulated and effect on customer is studied.

An integration of EV charging station with distribution grid has been presented by the authors in [21]. Master control has been employed for AC and DC bus power exchange. Three different modes of interconnection i.e., vehicle to grid (discharging), grid to vehicle (charging) and combination of both has been studied. Edris Pouresmaeil [22], proposed a smart residential load simulator for energy management in smart grids. The simulator is developed in MATLAB/SIMULINK with graphical interface, which helps in modeling of all the residential loads including power generating sources. Impact of solar irradiation, temperature etc. are considered for the energy consumption. This model is very helpful to understand energy load demand, consumption rate and energy management and the optimization process.

Authors presented a survey of demand side management techniques for controlling the household load [23]. The electricity cost and peak to average ratio and peak demand can be lowered by optimal scheduling. A wireless sensor network based approach has been presented to shaving the electrical energy [24]. The proposed system make use of renewable resources and whether forecasting and automatic motion sensors to control the power consumptions.

Mustafa Baysal [25], presented a HEM algorithm for the energy management with the renewable energy resources installed in house. This algorithm considers the battery state of charge, power available from grid and the tariff rate to reduce the bill. Authors in [26] presented a simulation model of EV to study motoring and regeneration action. Performance of the drive for specified speed and torque has been studied.

In addition with demand load side management in the power system and with the stress on renewable energy in the grid the quality of power is an important factor. A plenty of work has been done in this field till now. Distribution network mainly affected with poor power quality [27-31]. To detect the PQ disturbances different signal processing [40,43] approaches like wavelet, modified potential function [34], multiwavelet [35,44-46], fraclets [36], HHT [37], demodulation concepts [39], time-time transform [41], Legendre wavelets [42], fuzzy logic [38] etc. are used by the researchers. These techniques help in analysis of the power quality problems of the complex power system.

Conclusion:

In the current scenario, the optimum use of energy is becoming necessary. It not only helps in reduction in electricity bill but also save the resources. The unnecessary use of electrical equipments, increase the load demand especially in peak hours. This will results in high tariff of energy consumption. House energy management and use of smart techniques with integration of renewable energy supply quality as well as quantity to the society. Demand side load management techniques are helpful in economic, financial and social considerations.

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