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A CLASS OF MODELS FOR LOAD MANAGEMENT APPLICATION AND EVALUATION REVISITED

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ABSTRACT

The problem of load modeling for Demand Side Management (DSM) purposes is addressed in this paper. The proposed load models rely on information about both the physical characteristics of elemental load devices at the distribution level, and usage statistics of these devices.

Although the class of models discussed here has been previously proposed in the literature, its suitability for DSM purposes is definitely established by showing how the models can be a tool for real DSM actions evaluation. Some results are shown.

1.- INTRODUCTION

The use of Demand-Side Management (DSM) alternatives is gaining adepts between utilities and distribution companies in order to achieve a better operation of the Electric Power System.

Two different approaches may be used to cope with the growth of the demand in an Electric Power System. The first one is to expand the Power System so that the new energy requirements can be met (Supply-Side policy). The second one is to try to influence the electric energy consumption so as to reduce the investment requirements (Demand-Side policies).

Demand-Side Management has been defined as those activities oriented to influence customer uses of electricity in ways that will produce the desired changes in the load shape [1]. We will refer to the Control actions directly performed upon the customer loads as Load Management (LM) actions.

The reason for considering the possibility of influencing the customer uses must be found in the continuous rise in the cost of electricity and equipment, the availability of the required technology, more severe environmental constraints on power system generation, transmission and expansion, and the necessity to offer new options to the customer.

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The consequences of DSM for the utility are a better use of its Power System, and hence a deferral of the need of new investments, whereas for the customer they represent the possibility of benefiting from reduced fares.

Typical DSM objectives include Peak Clipping, Valley Filling, load Shifting and Strategic Conservation and Growth.

Voltage reduction is a typical LM action that has been traditionally used by the utility for power peak consumption reduction.

Some other actions need to be considered as potential LM control actions, mainly those related to the possibility of end-user load shedding: load interruption and load cycling.

Obviously, the possibility of performing these kinds of actions upon the consumers must be attached to a flexible rates policy.

One of the most critical problems when considering the application of DSM by the utility is to be able to assess whether this policy is going to produce the desired effects or not. Thus, in order to evaluate the DSM policies, it is necessary to have load models that can fulfill at least two objectives: First they should provide the necessary information to evaluate the benefits obtained through the use of the DSM and, secondly, they must allow the evaluation of every control action from the end-customer side, for example, through the evaluation of some "comfort index".

These comfort indices, in conjunction with a proper rates structure, can become very important in securing a high level of acceptance of DSM policies among the customers.

The load models we are about to discuss in this paper have appeared earlier elsewhere in the literature [6], [7], [8], [9] and [12]. However, due to their relative mathematical sophistication, their potential practical usefulness has remained largely unsuspected. The main goal of this paper is an attempt at correcting the above situation.

These models are being tested by the authors with encouraging results. However we chose not to report them in this paper because lack of space.

The paper is organized as follows: constraints on the load modeling problem are analyzed in section 2. The model building approach to be used is reviewed and compared with other proposed methodologies in section 3. Section 4 is devoted to the application of the models in LM. Numerical results are shown in section 5. Finally, in section 6, conclusions are drawn and directions for further research proposed.

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