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Scanning the Issue

Network Synchronization (*Invited Paper*), *Lindsey, Ghazvinian, Hagmann, and Dessouky,* page 1445.

The area of network synchronization has attracted a considerable amount of interest over the past thirty years. The starting point for a mathematical treatment of the subject was the timing problems arising in Pulse Code Modulation systems in the 1960s, and the development of the first all-digital communication system. Since that time, network synchronization has played an important role in many diverse applications like navigation and position determination, ranging, computer communication, database management, data gathering, control and command systems, and phased-array antennas.

This paper gives an overview of various network synchronization techniques which have been proposed in the literature. It is shown how they can be classified in an easy and straightforward manner, and how they fit into a general framework that enables a fair comparison between the different techniques. The generic features, advantages, and disadvantages of the basic techniques are discussed, and an extensive reference list is given.

The Special Section on Demand-Side Management for Electric Utilities

Although electric utility needs and characteristics vary widely within the industry, virtually every utility should examine demand-side management alternatives. Demand-side management (DSM) can offer a utility a broad range of alternatives for reducing *or* adding load during a particular time of the day, during a certain season, or annually. Changing load through DSM allows the utility to more closely match its supply or generation with its load and thereby reduce overall customer costs. The exact benefits vary between programs and across utilities. Not all utilities will find DSM appropriate.

Customers and utilities can act independently to alter the pattern of demand. The concept of demand-side management imposes a utility/customer relationship that produces mutually beneficial results. To achieve these mutual benefits, a utility must carefully consider such factors as the manner in which the activity will affect the utility's load shape, the methods available for obtaining customer participation, and the likely magnitudes of costs and benefits to both utility and customer prior to attempting implementation. In this special section, the first paper, by the Guest Editor, on "The Concept of Demand-Side Management for Electric Utility" describes these basic principles and outlines the objectives of demand-side management as well as its relationship to load management and conservation.

Because there are so many demand-side alternatives, the process of identifying potential candidates is a difficult one. This process can be facilitated by categorizing demand-side activities in four steps:

- Establish load shape objectives.
- Determine the end use which should be affected.
- Review technology alternatives.
- Consider market implementation methods.

R. M. Delgado's paper on "Demand-Side Management Alternatives" highlights the major technological alternatives for demand-side management.

Selection of the most appropriate demand-side management alternatives is perhaps the most crucial question a utility faces. The question is difficult since the number of demand-side alternatives from which to select is so large. In addition, because the relative attractiveness of alternatives depends upon specific utility characteristics, such as load shape, summer and winter peaks, generation mix, customer mix, and load growth, transfer of results from one service area to another may not be appropriate. In other words, what is attractive to one utility may not be attractive to another. Completing detailed evaluations of demand-side programs can be complex and may even appear overwhelming. These evaluations typically require a great deal of data

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and a computer model for processing. In their paper, titled "Evaluation of Demand-Side Management," J. E. Runnels and M. D. Whyte discuss the attributes of DSM evaluation.

As outlined earlier, demand-side management focuses on deliberately changing the load shape so the consumer's demand for electricity can be met more efficiently. This focus may give the impression that the only load shape changes that occur are those induced by demand-side management. Certainly this is not the case. System load shape changes can occur naturally due to fluctuations in customer mix, the entry of new industries into the marketplace, the introduction of new processes, and the growth of end-use stock in the residential and commercial sectors. Thus to examine the impact of demand-side alternatives, it is important to differentiate between naturally occurring changes in the load shape and changes resulting from demand-side alternatives.

Customers purchase electricity to satisfy a need for energy, not to meet utility demand growth. The residential load shapes are influenced by the customer's decision to purchase an appliance, as well as the resulting level of use of that appliance. Similarly, in the commercial and industrial sectors, installation of equipment and its utilization affect the load shape. Projections of the purchase of appliances and the behavior of customers combine to produce a forecast of the load shape. In the paper titled "Issues in Forecasting Demand-Side Management Program Impacts," B. A. Smith, M. R. McRae, and E. L. Tabakin discuss the difficulties in forecasting demand-side management activities.

For many years, utility marketing departments successfully stimulated growth in electricity sales by directing numerous advertising and sales efforts such as the "Live Better Electrically" program. But, as electricity costs accelerated and national targets for utility use of petroleum and natural gas were set, supply-side issues took on a greater importance. During the 1970s, many of the utility marketing efforts were dismantled and the marketing staff dispersed to other departments. It has only recently been recognized nationally that marketing can be used to shape load as well as to stimulate it. Marketing departments can make valuable contributions to developing demand-side solutions to load problems *and* to taking advantage of load opportunities. Thus one of the first and most fundamental issues to be addressed in the development of marketing programs is to locate and pull together the expertise and tools necessary to identify, evaluate, and implement successful marketing programs.

It is an old adage that "nothing happens until someone sells something." In the demand-side management context, this means that even if the best analysis techniques have been applied, data collected, and technology developed, the success of demand-side management often hinges on the ability to persuade customers to actively participate in the program. It is important for utilities to understand how these decisions are reached. Customers do not purchase energy for the sake of consuming it *per se*, but instead are interested in the service it provides. That service brings warmth, cooling, artificial illumination, motive power, and/or other conveniences.

In his paper titled "Implementation of Demand-Side Management Programs," D. R. Limaye discusses the means utilities can employ to market demand-side management and in the paper titled "Pricing and Incentives," J. H. Chamberlin elaborates on the most important motivator—price.

All of these issues encompass an important and unique challenge to the utility industry. Those who stand ready to meet it will help shape the structure of our industry in the years to come.

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He has taught numerous courses on Utility Planning and Marketing for the New Jersey Institute of Technology, The University of California at Berkeley, the Center for Professional Advancement, and others. He spent fourteen years with Public Service Electric and Gas Company. Starting in 1968 as a Sales Engineer, he moved through various positions including Applications Engineer in 1972 and Assistant Manager, Load Management, in 1977. Within these positions he has played key roles in market planning, end-use forecasting, load research, rate design, cogeneration, load management and conservation, and as a witness in related regulatory proceedings. He joined the Electric Power Research Institute, Palo Alto, CA, in 1982, as a Program Manager. Presently, he is a Senior Program Manager and Manager of the Demand and Conservation Program. He is responsible for managing EPRI's research in the areas of Demand-Side Planning and Forecasting. This includes load research, rate design, market research, end-use marketing, planning and analysis of load management, conservation, cogeneration, and electrification. He is the author of over 80 texts and publications, primarily on the subject of demand-side management, energy utilization, and utility marketing.

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