

King Saud University
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**Advanced Analysis of Load Management and Energy
Conservation Strategies in Electric Power Systems**

By

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Abstract

Electric power utilities around the world are attempting to keep secure energy supply to its customers while minimizing their capital and operating costs. One effective way of offsetting the effect of load growth under constant or limited system generation resources and transmission capacities is to increase the margin between system generation and load during as much operating time as possible. This could be achieved by well-designed load management and energy conservation strategies, which serve both the consumer and the power company. The introductions of deregulation of power pools and restructuring of competitive electricity markets have placed significant emphasis on consumer reaction to utility decisions, which often involves changes in electricity rates, as well as levels of quality of service provided to consumers.

Consequently, effective load management and energy conservation strategies should take into account the global trends of non-monopolistic electricity supply systems in which consumers have more choices.

In this thesis, an advanced formulation of the general load management and energy conservation problem is used in order to include as many customer and utility parameters as possible and to attain high degree of results accuracy. Unlike previous formulations, which are mainly based on linear relationships, the present work uses quadratic-based relationships in order to accurately model interactions between various utility decision variables and consumer reaction parameters. In addition, a more advanced simulation program was acquired and adapted for analyzing non-monopoly and free-market scenarios of load management and energy conservation in which the consumer has more choices on electricity supply alternatives. The simulation program was applied to several demonstrative scenarios in the Saudi electricity system, which involves both monopolistic and non-monopolistic electricity supply environments.