Title: "Development of a Methodology for clustering electricity-price series to improve customer response initiatives"
Journal: IET Generation, Transmisión and Distribution. Vol.: 4, nº6, Pág. 706 -715
June 2010
www.ietdl.org

Published in IET Generation, Transmission & Distribution
Received on 3rd March 2009
Revised on 23rd December 2009
doi: 10.1049/iet-gtd.2009.0112

ISSN 1751-8687

Development of a methodology for clustering electricity-price series to improve customer response initiatives

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Abstract: The aim of this study is to propose a methodology in order to obtain a better support management decisions in terms of planning of bids and energy offers in real-time energy markets. Specifically, the authors use self-organising maps and statistical Ward's linkage to classify electricity market prices into different clusters (high homogeneity inside each cluster). In the second stage, the authors use non-parametric estimation to extract some price patterns in the above mentioned clusters. The knowledge contained within these patterns supplies customers with market-based information on which to focus its energy use decisions. The methodology proposed has been applied to New England (USA) market.

1 Introduction

The participation of customers in electricity markets is a basic concern for achieving a better market operation. The market will not be complete until demand and supply sides could compete on an equal footing and have 'similar' possibilities and products to participate in energy and ancillary markets [1].

US Department of Energy reported [2] that 'the most important benefit of demand response (DR) is improved resource efficiency of electricity generation and transmission due to closer alignment between customer electricity prices and the value they place on electricity'. This increased efficiency should create a variety of benefits: participant benefits (the bill savings and costs earned by customers that respond to prices), market-wide financial benefits (to mitigate the ability to exercise market power) and reliability benefits.

Unfortunately, small and medium-sized customers face serious barriers to participate in electricity markets: the lack of real price information which makes difficult for any investment or change in energy patterns [3], the minimum size of demand for DR eligibility (hundreds of kW), the requirements for metering and communication resources, the complexity of market rules and finally how and why to change their demand if the price varies. In this way, the role of 'energy aggregators' becomes a necessity in markets to help the customer response.

This situation promotes the need for 'simple' tools that allow 'aggregators' to identify customer groups in the market and determine the products that best suit each customer segment. From an economic point of view, this can be carried out by the use of elemental data, such as daily demand profiles [4], load simulation [5] and the results of market prices in the past. Moreover, the DR portfolio should be easy to understand and can be applied with the help of enabling technology [6]. Therefore the first step before applying the method proposed in this paper is to classify customers according to the demand and response. The bibliography presents several methodologies to perform this task [7, 8].

doi: 10.1049/iet-gtd.2009.0112