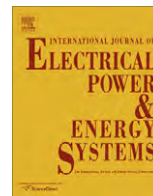




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A database system for power systems customers and energy efficiency programs

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ABSTRACT

In this paper the design and development of a database for the registration of power utilities' customers and their energy behavior are described. The database also includes the customers' devices and buildings, their demand curves, their tariffs, their connection with power and gas networks, as well as the measures of demand side management and energy saving, which can be implemented. The main purpose of this database is to support end-use models and load forecasting algorithms for individual customers or their respective clusters, to study the effects of energy efficiency programs and to evaluate the last ones financially. It can be a useful tool for retailers, distribution electricity companies or regulatory authorities of energy.

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1. Introduction

In an open electricity market it is essential to be familiar with the behavior of customers of the power system for retailers or distribution companies. This behavior is basically expressed through customer's chronological load diagrams, population and energy consumption of their appliances. Their future evolution defines the load changes both in distribution and system levels. Nowadays the energy characteristics of a customer are also influenced by fuel substitution or energy efficiency programs, especially if the latter are financially beneficial. This information requires an enormous data volume organized in a database.

The power utilities – as a result of their structure and organization – have systematically used the databases within the last twenty years. Most common applications employ relational and object oriented database management systems (DBMS) interfaced by windows. In [1] the hierarchical, the network, the relational and the object oriented database structures have been compared and SQL has been preferred, because of its standardization. Moreover, the requirements of an open – architecture systems have been described in [2] and the need of various databases collaboration has been analyzed [3]. These databases are often linked with application programs, like load flow [4–7], dynamic analysis [6,8], unit commitment and economic dispatch [6,9], transient analysis [10], emergency control [11] etc. Distribution companies

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have been lead to the development of databases, usually in collaboration with GIS, in order to determine the best cable tracing [12], to register their customers' and their networks elements' positions [13–15], to manage the load of their transformers, according to the customers who are supplied [16,17] or to select and register the data that describe a substation, such as feeders, switches, capacitors and transformers. [18–20]. Moreover specialized databases have been created, concerning energy efficiency measures and indices, such as MURE and UDYSEE [21,22], and building energy prediction [23]. In summary, the existing databases for power systems cover efficiently the needs of the systems they serve. The corresponding databases of energy efficiency measures provide information mainly about the measures, using data from end users, without taking into consideration the related systems of energy supply (electricity, gas or other fuels).

In this paper a new database is described that emphasizes in the registration of sample and typical customers, in order to change the power system's approach on load and energy forecasting, all the way from the customer's to the system's level. The recording of load patterns of customers or of their devices, the respective population and their energy behavior form the input data for the end-use models and load forecasting algorithms. Taking into consideration that the customers can change the kind of fuel or energy they use or their energy behavior through energy efficiency programs, the description of energy saving, fuel substitution and demand side management programs is necessary. Meanwhile the respective economical elements and tariffs are registered in order to perform the programs' financial evaluation.

The paper basically presents the requirements and the description of this database called *LADY* (from the initial letters of the phrase: “A database system for Load forecasting, Application for