

# Chapter 16

## Electricity Demand Forecasting

**Fawwaz Elakrmi**  
Amman University, Jordan

**Nazih Abu Shikhah**  
Amman University, Jordan

### ABSTRACT

*Electricity demand forecasting has attracted the attention of many researchers and power company staff. It still does so because with better forecasting, power companies can approach exact plans with no over- or –under planning. This is reflected as being the right investment in terms of time, money, and performance. In essence a good demand forecast means the right investment plan and therefore, satisfied customers. In reality this is the objective of any business; to be able to estimate the demand as close to reality as possible. The number and extent of demand forecasting methodologies and models developed is tremendous, however, there exists no novel technique that can serve all situations. Basically forecasting models can be divided into statistically based and intelligence-based models. A description of forecasting models helps in identifying the characteristics, features, and strengths of each model. The selection of the most suitable forecasting algorithm is not an easy process. The time frame of the forecast, data availability, the accuracy and cost of the forecast, the application and purpose of the forecast are some of the important parameters in the selection process. A case study of two forecasting models used in Jordan is presented. The discussion of the case study shows that load forecasting in Jordan is based on an intelligence-based model for short term forecasting, and on a combination of traditional statistically-based models for long term forecasting.*

### 1. INTRODUCTION

Planning is one essential function in the design and operation of any process, procedure, operation, or

business. It is prudent business to properly plan before embarking on any activity in order to guarantee its success. One of the crucial tools of planning is to attempt to foretell or foresee the future.

The term forecast stands for predictions of future events and conditions. The process of making

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such predictions is called forecasting (Bowerman, O'Connell, & Koehler, 2005). The process of attempting to predict the future encompasses many business activities such as following up technological evolutions, estimating sales, knowing cost trends and competition, maintenance requirements, and replacement of major plant or equipment. Forecasting has evolved over the years into an exact science and many models and tools are presently available commercially. The main purpose of forecasting is to meet future requirements, reduce unexpected cost and provide a potential input to decision making (Montgomery, Johnson, & Gardiner, 1990).

Energy has always received great attention from countries and individuals since it represents a commodity essential for comfortable life. With the advent of increased civilization and economic development energy has become a life-sustaining commodity. No one can dare to imagine what would be the status of life without energy. However, conventional energy resources on earth are limited and will last for only a certain period of time. Therefore, it is of paramount importance that people look for new energy resources; especially environmentally benign and renewable ones. It is also essential that exact methodologies for predicting the future demand for energy be developed to meet future supply. This, in turn, will guarantee that energy is used rationally and that exploration and development efforts are not wasted.

Moreover, the precise knowledge of future energy demand will help countries to plan their development activities correctly, thus, avoiding under- or over-planning of future supply. Extreme deviations (under- or -over) predictions are considered to be waste of resources as the former leads to supply shortages, while the latter leads to unnecessary extra cost of supply.

In many societies electricity constitutes a major share of the total energy requirements and sometimes it is termed "clean energy", although some electricity generating plants are great envi-

ronmental pollutants. Nevertheless, electricity has the least pollution record compared to all other energy sources if one considers the transportation of energy from source to final destinations. Furthermore, electricity networks lend themselves to be utilized as sources of live or on-line information about electricity consumption. Therefore, electricity has earned the privilege of having this chapter devoted to forecasting its future demand, as part of this book.

In operating a power system the mission of the utility/company, from the forecasting point of view, is to match demand for electric energy with available supply, in addition to meet the expected peak demand of the power system. Electrical demand forecasting provides input to the planning of future resources. Here, the focus is on total annual consumption of electric energy that leads to predicting system requirements. The electrical energy requirements to be supplied by generating units and/or load imports/exports comprise the sales to consumers, and the associated generation, transmission, and distribution losses. In this chapter the terms demand and load are considered to provide the same meaning from the forecasting point of view, and they will be used interchangeably.

Since a major objective of any power company is to accurately predict future loads, then forecasting can be broadly classified, in the sense of time frames, as: a) long-term forecasting (1-20 years), b) medium-term (1-12 months), and c) short-term (1-4 weeks ahead), and d) very short term (1-7 days ahead).

Long-term load forecasting is intended for applications in capacity expansion, and long-term capital investment return studies. Medium-term forecasting is utilized in preparing maintenance scheduling, and to plan for outages and major works in the power system. Short-term forecasting is used in operation planning, unit commitment, and economic dispatching. The very-short term forecasting is devoted for load exchange and

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