A New Approach in Short-Term Prediction of the Electrical Charge with Regression Models A Case Study

Farhad Soleimanian Gharehchopogh, Urmia Branch, Islamic Azad University, West Azerbaijan, Iran
Freshte Dabaghchi Mokri, Computer Engineering Department, Science and Research Branch, Islamic Azad University, West Azerbaijan, Iran
Maryam Molany, Computer Engineering Department, Science and Research Branch, Islamic Azad University, West Azerbaijan, Iran

ABSTRACT

The accuracy of forecasting of electrical load for the electricity industry has a vital significance in the renewal of economic structure as well as various equations including: purchasing and producing energy, load fluctuation, and the development of infrastructures. Its short-term forecasting has a significant role in designing and utilizing power systems and in the distribution systems and having a variety of systems used to maintain security potentials for the system. In this paper, we attempted to carry out a short-term forecasting of electrical distribution company in west Azerbaijan state in Iran’s electricity in a few days on the basis of regression multi linear model. This forecasting which was done during a three-day period is and categorized weekdays into three groups including working days, weekends, and holidays was carried out in an hourly manner. This model regardless of parameters like humidity, wind velocity, daylight time, etc. by minimizing the forecasting error managed to maximize the reliability of the results as well as the safety potential of the system. In this model the only influential parameter on the forecasting was the reliance of the forecasting day on previous days. The main purpose of the present study was to maximize the accuracy and reliability of forecasting for certain days (religious holidays, national holidays ...). In this paper, the authors managed to decrease the error of forecasting for particular and regular off days to a great extent.

Keywords: Correlation, Particular Days, Regression Model, Short-Term Load Forecasting, Working Days

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1. INTRODUCTION

Nowadays the need for electricity has become so crucial that has casted shadow on every aspect of human life. Therefore, the forecast of electrical load for power systems has got significant importance in the last three decades, and for planning and designing power systems we should have precise and sufficient information about the amount of historical load, the alteration pattern of annual historical load, and the factors affecting it (Piers & Campbell, 2006; Tanaka, Uejima, & Asai, 1982). So to acquire such information as mentioned above the issue of electrical charge forecasting rises. Three groups will benefit from this kind of forecasting: regional power companies, power distribution companies, and electricity management companies. Therefore, we should minimize the error measurement as much as possible since by doing so the accuracy of forecasting increases and a greater harmony between power production and use is created. Producing either too much or too less electricity causes problems. If the amount of anticipated electrical load is less than the needed amount we’ll face lack of power, and therefore causes blackouts and decreased security of the system (Su & Lii, 2002), and if it is much than the amount needed will cause economic loss, since electricity cannot be stored in great amounts. Various papers in the literature have proposed different models for the forecasting of electrical charge including which are: neural Network (Lu, Wu, & Vemrui, 1993; Tee, Cardell, Gleen, & Ellis, 2009), Fuzzy model (Emami & T¨urksen, 1998), artificial neural system (Bunn & Sch, 2000), Linear-Fuzzy Regression (Song, Baek, Hong, & Jang, 2005) but Auto Regressive Integrated Moving Average model (ARIMA) and Multi-Linear Regression Model (Tanaka, Uejima, & Asai, 1982; Dubois & Prade, 1978; Tanaka, Uejima, & Asai, 1980) are two traditionally popular models.

The forecasting of west Azerbaijan’s electricity is done by a proficient person with quality experience in anticipating daily charge, and the effect of parameters and important occasions on the forecasting of historical charge. In this paper we tend to anticipate charge during the days of a week using Regression Multi-Linear model. Although this is an old model but since power consumption rate is not homogeneous during the days of the week, it must be anticipated by a proficient person. Therefore with the aid of a proficient person’s experiences and by categorization days of the week and creating a distinct model for forecasting of each category we managed to minimize the error of measurement as much as possible.

In this paper, we will implement the regression model through use of a software called (MATLAB 2011.a). For the reason of its capability of working with Excel data and ready-made functions, MATLAB software enabled us to easily analyze the province’s load data using Regression model and calculate the error of measurement. Also because of its remarkably high analysis ability and graphical capabilities, we managed to draw the historical charge and predicted charge graphs, and understand the advantages and disadvantages of the forecasting for the coming days.

In section (2), we will review a number of papers on the forecasting of charge using Regression Model. In section (3), we first will group days of the week based on the historical load, in order to increase the accuracy of the results. Then we will discuss different types of forecasting based on time. In section (4) a brief explanation about Regression is presented and then, using a flowchart for each of the days of the week, charge forecasting patterns are set, and various errors resulting from forecasting are discussed. Section (5) deals with the analysis of year-round days’ load and then the error of measurement for each group of days is calculated. Finally, three days randomly from among the three above-mentioned groups are selected and the anticipated and historical amounts are compared and shown in a diagram. In section (6) a conclusion will be presented.

2. PREVIOUS WORK

Reviewing literature you can find a number of works discussing and analyzing the forecasting of short-term load each of which has both
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