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HOURLY FORECASTING OF LONG TERM ELECTRIC ENERGY DEMAND USING NOVEL MATHEMATICAL MODELS AND NEURAL NETWORKS

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Abstract. *In this work, hourly forecasting of long term electric energy demand is achieved using mathematical models and Artificial Neural Network (ANN) approaches. Previous works regarding energy demand forecasting either treated the problem of long term prediction over yearly averages, or considered hourly prediction using a very short term time lag, such as a few hours. The methods proposed in this work produce predictions with hourly accuracy despite the time lag of "years", making the model suitable for long term prediction. Several functions for mathematical modeling and different ANN structures are applied and tested for achieving small forecasting errors. The proposed mathematical models of the load are compared with different ANN model outputs in the sense of Mean Absolute Percentage Error (MAPE) and Root Mean Square Error (RMSE). The mathematical models are observed to provide a simple, intuitive and more generalized form, whereas the ANN models provided specified models that are better fine-tuned for the available data. The suitability of these methods is illustrated and verified using 4-year-long real-life hourly load data taken from the Turkish Electric Power Company.*

Keywords: Energy demand, Hourly forecasting, Mathematical models, Artificial neural network structures

1. **Introduction.** For the secure operation of power systems and electric industry in the deregulated economy, importance of load forecasting is insatiable. Initial sample applications areas of load forecasting include energy purchasing and generation, load switching, contract evaluation and infrastructure development. According to the corresponding extent of prediction lag, there are three types of load forecasting: (i) short-term forecast in intervals ranging from one hour to one week, (ii) medium forecast, which are usually from a week to a year, and (iii) long-term forecast for long time horizons. The forecasts for different time horizons are useful for different operations within a utility company.

Short-term load forecasting is important for real time operation and control of power systems. Medium-term is mainly important for maintenance and scheduling programs. Long-term load forecasting represents the first step in developing future generation, transmission and distribution facilities.

Naturally, the shorter the forecasting term is, the better the time segment accuracy becomes. For example, short-term load forecasting reaches to hourly resolution whereas long-term methods deal with yearly data. It must be initially noted that this work provides