# Long-Term Peak Demand Forecasting by Using Radial Basis Function Neural Networks

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Abstract: Prediction of peak loads in Iran up to year 2011 is discussed using the Radial Basis Function Networks (RBFNs). In this study, total system load forecast reflecting the current and future trends is carried out for global grid of Iran. Predictions were done for target years 2007 to 2011 respectively. Unlike short-term load forecasting, long-term load forecasting is mainly affected by economy factors rather than weather conditions. This study focuses on economical data that seem to have influence on long-term electric load demand. The data used are: actual yearly, incremental growth rate from previous year, and blend (actual and incremental growth rate from previous years). As the results, the maximum demands for 2007 through 2011 are predicted and is shown to be elevated from 37138 MW to 45749 MW for Iran Global Grid. The annual average rate of load growth seen per five years until 2011 is about 5.35%.

Keywords: Long-term Load Forecasting, Radial Basis Function, Demand, Neural Network.

## 1 Introduction

A power system serves one function and that is to supply customers, both large and small, with electrical energy as economically and as reliability as possible. Another responsibility of power utilities is to recognize the needs of their customers (Demand) and supply the necessary energies. Limitations of energy resources in addition to environmental factors, requires the electric energy to be used more efficiently and more efficient power plants and transmission lines to be constructed [1]. Long-term demand forecasts span from five years ahead up to fifteen years. They have an important role in the context of generation, transmission and distribution network planning in a power system. The objective of power system planning is to determine an economical expansion of the equipment and facilities to meet the customers' future electric demand with an acceptable level of reliability and power quality [2].

Iran electric power demand has steadily increased and the load factor of total power system has decreased. This trend is certain to continue in future. Limitations of energy resources in addition to environmental factors, requires the electric energy to be used more efficiently and more efficient power plants and transmission lines to be constructed. Iran has 16 interconnected power companies, which are responsible for providing power to the entire country. In this paper, load predictions are done for the total network

The peak electric power demand of this total power network has been increasing at an average of 6% per year. These numbers suggest that 16 Iranian power utilities should produce about 195.86 GW power for the next 5 years. However, neither the accurate amount of needed power nor the preparation for such amounts of power is as easy as it looks, because: (1) long-term load forecasting is always inaccurate (2) peak demand is very much dependant on temperature. (at peak period, 1 degree Celsius increase in temperature causes about 450 MW increase in demand for electricity), (3) some of the necessary data for long-term forecasting including weather condition and economic data are not available, (4) it is very difficult to store electric power with the present technology, (5) it takes several years and requires a great amount of investment to construct new power generation stations and transmission facilities.

In this paper, we propose a long-term load forecasting method, Radial Basis Function Networks (RBFNs) that trains faster and leads to better decision boundaries than the previous two different ANNs, a Recurrent Neural Network (RNN) and a 3-layered feed-forward Back Propagation (BP).In short-term load forecasting, generally, weather conditions (particularly temperature) have significant influences on peak loads. However, in long-term load forecasting economic

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