



## **Analysis of Factors Affecting Load Forecasting- A Case Study**

*S. Vasudevan<sup>1</sup> and K. Jothinathan<sup>2</sup>*

<sup>1</sup> Research Scholar, Department of Electrical Engineering, Annamalai University, Tamil Nadu, India

<sup>2</sup> Associate Professor, Department of Electrical Engineering, Annamalai University, Tamil Nadu, India

Email: [vasudevanaetneb@gmail.com](mailto:vasudevanaetneb@gmail.com); [jothi.eeau@yahoo.com](mailto:jothi.eeau@yahoo.com)

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### **ABSTRACT :**

Accurate electrical load forecasting is an essential tool for power system distribution company. It can result in quality of power supply to end user and cost saving to the distribution company. The main object of this paper is to analyze various factors affecting load forecasting. This paper considers the effect of these factors to highlight their contribution in load management. A good understanding of the influence of factors on the pattern of the load forecast helps to reduce the gap between the demand and generation.

Keywords : Load forecast, load management, metrological factors, Calendar features

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### **Introduction:**

The load modelling and forecasting is based on the knowledge of several factors. Which are influencing the load. There are different factors influencing the load that were identified and utilized by researchers. Usually electrical load is consumed by different varieties of consumers. In India the power consumed by the following category of consumers. 1. Domestic 2. Commercial 3. Industrial 4. Agricultural. The load pattern of industrial consumption is quite stable. Whereas the domestic and agricultural are varying based on the load pattern of usage. In spite of these various factors of weak days, special days holidays may affect the load consumption. In addition metrological factors may change the load shape due to variation in the usage of agricultural equipment and household appliances.

In the early morning bulk of load consumption is due to various activities in domestic, agriculture pump motor and local body water motor are working. Whereas in the evening most of electrical load is domestic and commercial lighting and air conditioning. In our country load pattern with respect to change in temperature depends on seasonal variation.

Usually the metrological factors of temperature and humidity are the most significant factors to be considered for load forecasting.

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### **Literature Review**

At present, many scholars have carried out research on power load forecasting, including medium and long-term power load forecasting and short-term power load forecasting. Li and Jiang (2012) studied the factors affecting medium and long-term power load and analyzed empirically medium and long-term power load forecasting in the northeast of China [1]. There are also many short-term load forecasting studies. Javed et al. (2021) gave a comprehensive overview of modern linear and nonlinear parameter modelling techniques for short-term power load prediction considering time and climate factors, ensuring stable and reliable power system operation by mitigating non-linearities in power load data, and *Energies* 2022, 15, 1236-3 of 23 proved the effectiveness of the model by case analysis [2]. Bin et al. (2014) established a short-term load forecasting model based on BP neural network theory taking full account of the relationship between the daily load and weather factors [3]. Muhammed Usman Fahad and Naeem Arbab evolved the various factors which influence the demand and their impact on consumption of power and their significance in short-term load forecasting (2014) [4]

Jichong Liu and Yu Yin construct a prediction model of power load forecasting considering climate factors based on a large amount of historical data and provide that prediction accuracy is related to both climate factors and load regularity. [5]

ZHANG 1,2, XIAOHAN ZHAO analyze the uncertainty of influence of policy factors on power load, in order to improve the accuracy of load forecasting under the influence of policy factors, and solve the problem the weighted fuzzy cluster analysis method combined with weights is used to predict load under the influence of policy factors [6]

ABDUL AZEEM explores state-of-art methods recently utilized for electrical load forecasting highlighting the common practices, recent advances, and exposure of areas available for improvement. The review investigates the methods, parameters, and respective sectors considered for load forecasting. It performs in-depth analysis and discusses the strengths, weaknesses, and error percentages of models. [9]

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Modelled the research paper, considering the influence of meteorological factors, in the follow-up research, we can take into account the plot type, week type, and cultural activities, and establish a joint model with multiple influencing factors to investigate the impact of comprehensive influencing factors on regional short-term power load. [10]

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### Factors classified on the time horizon

There are many factors that influence the power load. It is difficult to distinguish exactly the certain influence factors Xue and Carg (8) classified the power load influence factors in to three namely short term influence factors, middle term influence factors and long term influence factors.

A) The short term influence factors :

The short term influence factors often appear in certain forecasting period and nearly have not the characteristic of time duration for sudden changes of weather.

B) The middle term influence factor

The middle term influence factor often last some forecasting period and have certain characteristic of time duration. For example season climate change.

C) The long term influence factors

The long- term influence factors sustain for a long period. Usually many forecasting periods and have notably the characters of the duration, for example change of gross national product, population etc.

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### Factors affecting the electrical load

A power distribution company always observes various kind of consumers and accordingly various load consumption pattern. For example an intermittent process industrial consumer consume more power in during day hours. Where as a commercial consumer consume more in the evening peak hours. The important feature that should be taken into consideration for electrical load forecasting can be classified as follows [7]

Metrological factors : Weather, climate ,temperature, humidity etc.

Calender features : Hours of the day, day of the weak, festival days, and time of the year.

Random features : Local festival, sports activity and political events etc.

Customer factors : Type of consumption, Electrical appliances, No of employees etc.

I Time factor:

Time is the most important factor in the short term load forecasting because its impact on consumer load is high. From observing load curve of Villupuram distribution sub station in TNEB, tamilnadu state, India, it is found that load curve has “Time of the day” “day of the week” “special day” “month of the season“ property. This means that load curve is periodic in nature.

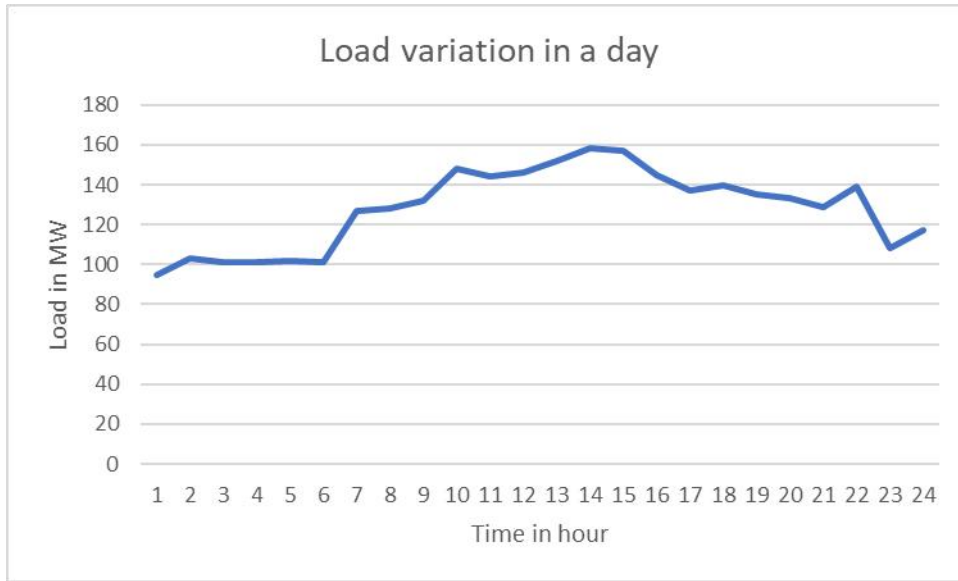


Fig 1. load variation during a day

Fig 1 shows the load curve of 3 Monday of may 2024 and 10 . As can be seen in fig above that although the average load differ because of difference in temperature during each day but the pattern of load is nearly same. In each curve morning peak @8,00 Hrs and evening peak is 18.00 Hrs. This shows periodically in terms of day of the week.

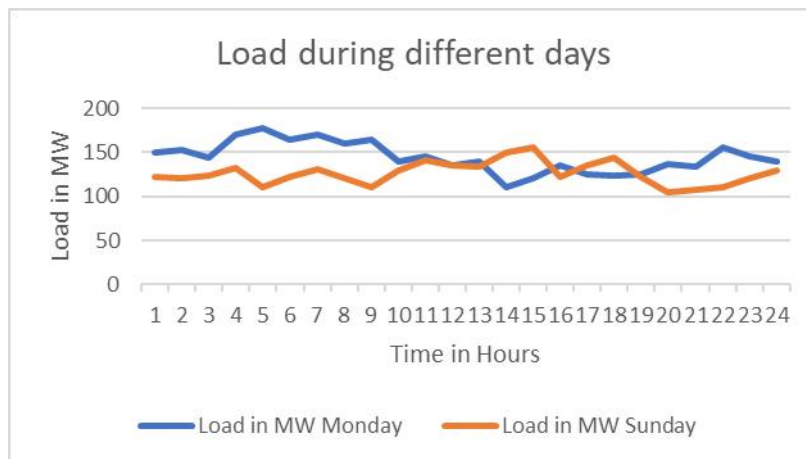


Fig 2 Load variation during Holyday and working day

Fig 2 shows the load variation on different days that is working day Tuesday and holiday Sunday. It is observe from the curve that the daily load pattern have a clear cut idea of daily activities of human life style i.e. working hours, leisure hours and resting hours. There are some specific patterns of load variations with time. Due to less activity and works in industries and offices, the weekend or holiday load is lesser than week days. The load variation with time reflects the arrangement of people’s daily life: working time, leisure time and sleeping time. There are some rules of load variation with time. The weekend or holiday load is lower than the week day, due to decrease of working load in industry and offices. The cyclic time dependency leads to analysing the load.

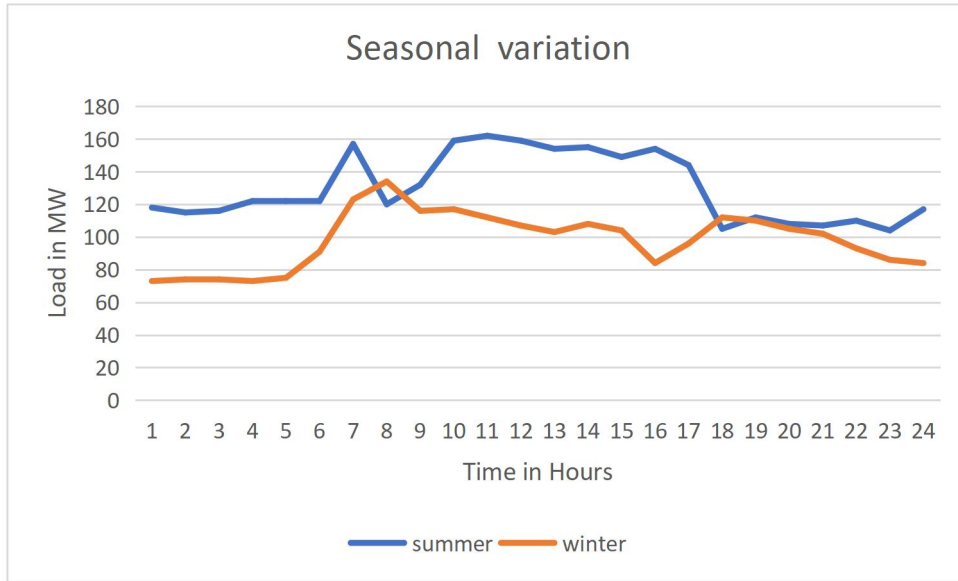


Fig 3 – Load variation during summer and winter

In fig 3 hourly load curved is shown for 24 Hrs of a day in winter and summer season The interval length is one hour that an 24 intervals in the fig. It can be seen in fig that load pattern and peaks is varies in the two season.

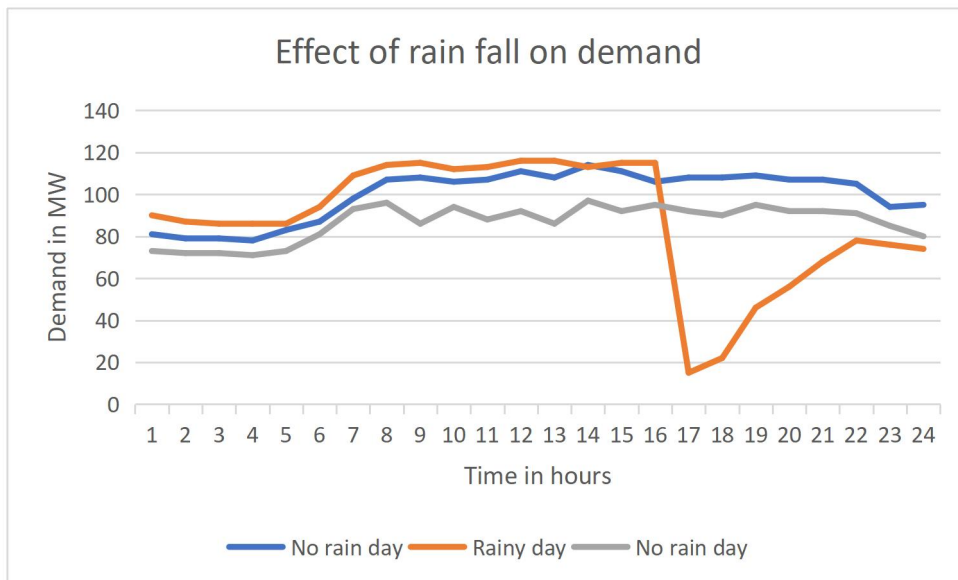


Fig 4 Load variation during rainy and non-rainy day

Fig 4 shows the change in load due to record of rain during the evening. The rain fall record at Villupuram district on 18.07.24 at 16.00 to 20.00 Hrs 120 mm. Due to breakdown of feeders and reduce of load in domestic and agriculture load the hourly load reduced deeply at evening onwards. The impact of rain fall shows in the succeeding day in the curve

**Temperature**

The increase in temperature will result in increase in load and decrease in temperature will result in decrease in average load and also in peak demand. This is because of increase in temperature affect people’s feeling of comfort and consumers will use electricity for cooling purpose and the agriculturist uses more power for cultivation purpose due to loss of precipitation in soil. Fig 3 shows load curve of temperature vs temperature. From this it is noted that the demand is high when temperature high.

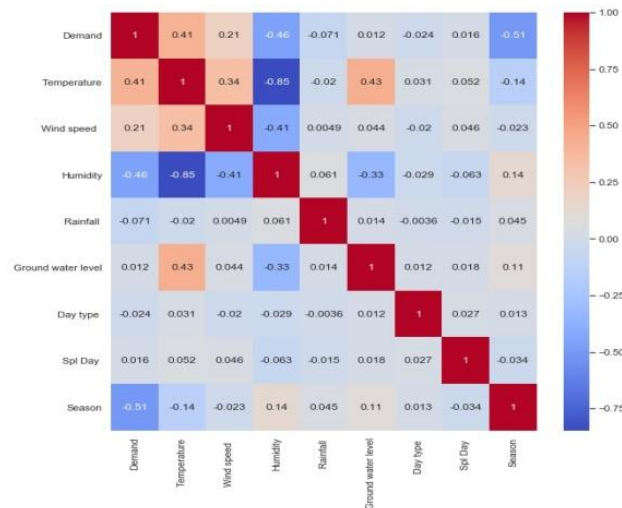


Fig 4 Correlation map of various factors with demand

This work has included eight different independent variables. These variables are temperature, wind speed, humidity, rainfall, ground water level, day type, special day and season of the corresponding year. The fig.1 shows the correlation map of the input variables with load demand. The correlation matrix shows the percentage of relation among variables, higher the correlation higher will be the effect on the dependent variable. However, positive and negative correlation both are important for taking the decision. Temperature has highest positive correlation and season has highest negative correlation of 51% which shows that in the rainy season demand of electricity will decrease. Ground water level has lowest correlation of 1.2% with the demand. However, it strongly relates with humidity, temperature and wind speed.

## Conclusion :

The research paper discusses the effectness of the different factors affecting the load forecasting. The case study of factors affecting the load forecasting with real time data set from 230 kV substation, Villupuram, Tamilnadu state, India were analysed. The correlation matrix shows the percentage of relation among the variables. This research uses in forecasting of load by incorporating the various factors, so as to increase the accuracy of result obtained. In this analysis it is learnt that depends on the site location and nature of load, some factors more dominant on load variation. Considering more variables in load forecasting more accuracy will be got.

## Reference:

- Li, J.; Jiang, Z.H. Study on Medium and Long Term Power Load Forecasting in Cold Regions. *Appl. Mech. Mater.* 2012, 170–173, 3472–3477
- Javed, U.; Ijaz, K.; Jawad, M.; Ansari, E.A.; Shabbir, N.; Kütt, L.; Husev, O. Exploratory Data Analysis Based Short-Term Electrical Load Forecasting: A Comprehensive Analysis. *Energies* 2021, 14, 5510. [CrossRef]
- Bin, H.; Zu, Y.X.; Zhang, C. A Forecasting Method of Short-Term Electric Power Load Based on BP Neural Network. *Appl. Mech. Mater.* 2014, 538, 247–250. [CrossRef]
- Muhammad Usman Fahad and Naem Arbab Factor Affecting Short Term Load Forecasting *Journal of Clean Energy Technologies*, Vol. 2, No. 4, October 2014 DOI: 10.7763/JOCET.2014.V2.145 305
- Jicheng Liu and Yu Yin \* Power Load Forecasting Considering Climate Factors Based on IPSO-Elman Method in China, MDPI <https://doi.org/10.3390/en15031236>
- ZHANG 1,2, XIAOHAN ZHAO3 , ZHENHAI DOU1 , AND LIANXIN LIU1 A New Medium and Long-Term Power Load Forecasting Method Considering Policy Factors BO Digital Object Identifier 10.1109/ACCESS.2021.3131237 IEEE access
- F. Cavallaro, "Electric load analysis using an artificial neural network," *Int. J. Energy Res.*, Volume 29, Issue 5, pp. 377–392, April 2005
- B. Xue, and J. Geng, "Dynamic transverse correction method of middle and long term energy forecasting based on statistic of forecasting errors," *Proceedings of Conference on Power & Energy IPEC*, 2012, pp. 253-256, Dec. 2012.
- ABDUL AZEEM 1 , IDRIS ISMAIL1 Electrical Load Forecasting Models for Different Generation Modalities: A Review IEEE ACCESS Digital Object Identifier 10.1109/ACCESS.2021.312073110 Kang Qian Xinyi Wang Yue Yuan Research on Regional Short-Term Power Load Forecasting Model and Case Analysis, *Processes* <https://doi.org/10.3390/pr9091617>