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FORECASTING ENERGY CONSUMPTION USING ARIMA MODELS

Dr.M.Aravind kumar Professor, Department of ECE, West Godavari Institute of Science and Engineering,Affliated to Jntuk, Andhra Pradesh, India. drmaravindkumar@gmail.com
Mrs.P.Sheela, Associate Professor, Department of CSE, West Godavari Institute of Science and Engineering,Affliated to Jntuk, Andhra Pradesh, India. sheelapitta@gmail.com
Mrs.Karishma Mehaboob, Assistant Professor, Department of CSE, West Godavari Institute of Science and Engineering,Affliated to Jntuk, Andhra Pradesh, India. mehaboob.karishma@gmail.com
Mrs.G.Phani Madhuri, Assistant Professor, Department of CSE, West Godavari Institute of Science and Engineering, Affliated to Jntuk, Andhra Pradesh, India. phani.madhuri@gmail.com
P. J.N.Deepika, Student of CSE Department, 19PD1A0535,West Godavari Institute of Science and Engineering, Affliated to Jntuk, Andhra Pradesh, India. perumalladeepika23@gmail.com
N.Ratna Chaitanya, Student of CSE Department, 19PD1A0528, West Godavari Institute of Science and Engineering, Affliated to Jntuk, Andhra Pradesh, India. ratnanaraharisetti@gmail.com

Abstract
The paper is aimed at contributing to the body of knowledge that exist in the area of energy forecasting by reviewing relevant empirical works on energy forecasting using ARIMA models. This paper is relevant in the face of frequent power outage and the dependence on external economies for energy supply. The study is based on secondary data obtained from electronic journals through archival studies. In all 10 articles were selected through purposive sampling method and were analysis using content analysis method. The results indicate that future energy consumption is expected to increase in economies in which these forecasts have been done. Hence, energy use must be efficient to avoid energy crisis in future. Future research should look at review of works on forecasting in a comparative manner comparing other models that have been used in forecasting energy demand. The paper is limited by the use of only secondary data.

Keywords: Forecasting, ARIMA model, Energy consumption, Disaggregate energy consumption

1. INTRODUCTION

Forecasting of energy consumption for both domestic and non-domestic purposes is of national interest for short run and long run economic policies.
The intractable energy crisis in many economies including Ghana has made the forecasting of energy consumption relevant and as such the need to get appropriate forecasting model is very crucial (Mohamed and Bodger[2], 2005).The consumption of energy has been increasing over the years due to factors such as population growth and technology development which aim at improving the wellbeing of citizens. Ghana like other developing economies over the years has been faced with energy crisis at the domestics and industrial levels with cases of total blackout in the country.

2. RELATED WORK

Many models have been used to forecast energy consumption empirically. In some economies energy consumptions has been increasing while in other economies energy consumption has been going done. According to Ajith and Baikunth (2001)[1] if energy consumption is more than production energy crisis may occur. This means to prevent future energy crisis production should not lag behind energy consumption.
Wang and Meng (2012) [3] predicted energy consumption of Hebei province from 2009 to 2013. The results demonstrate that the energy consumption in Hebei province will continue to increase for the next 5 years.

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The writers reported that in 2013 the energy consumption will increase to28856.26 million tons of standard coal, at the average annual growth rate of nearly 2.8% during the period of 2009 to 2013. They recommended policies measures, such as energy taxes, investments in improved energy efficiency, or changes in output composition must be considered explicitly.

3. PROPOSED FRAMEWORK

The forecasting of energy consumption can be done based on Autoregressive Integrated Moving Average (ARIMA) models. There are other models uses in forecasting energy consumption in economies. Some of the other models are multiple regression models, and artificial neural network models.

There are four steps involved in this model and these steps have been explained by Ajith and Baikunth (2001)[1] as model identification, parameter estimation, model diagnostics, and forecast verification and reasonableness.

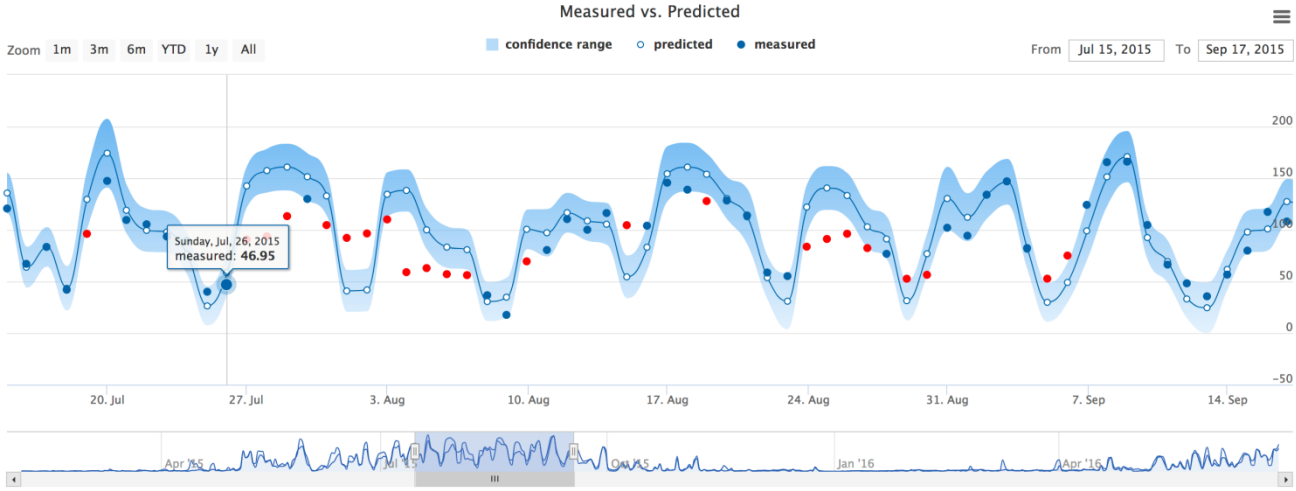
The steps are discussed by Ajith and Baikunth (2001)[1] as;

- Model identification: "Using graphs, statistics, autocorrelation function, partial autocorrelation functions, transformations, etc. achieve stationary and tentatively identify patterns and model components".
- Parameter estimation: "Determine the model coefficients through the method of least squares, maximum likelihood methods and other techniques".

4. EXPERIMENTAL RESULTS

This paper presented a review of ARIMA models used in forecasting energy consumption. Based on these findings and the review of the empirical works the conclusion is that ARIMA models are efficient and robust in forecasting energy consumption and must be used in developed and developing economies in forecasting energy consumption and other macroeconomic variables. Energy consumption will increase as population, temperature and income increase. Improvement in stock index will also increase energy consumption. Decrease in energy prices and taxes will also increase energy consumption.

Based on the review, findings and conclusions it is recommended that population, price of energy, income/output, and temperature should all be incorporated when modeling energy demand and they should arguably be considered in future energy policy decisions in economies.



5. CONCLUSION AND FUTURE WORK

This the introduction to the basic knowledge and classification of power systems' load forecasting. It focuses on classifying some load forecasting methods, the advantages, and disadvantages, into traditional and modern smart forecasting methods. In today's world, renewable energy is

integrated with nonrenewable energy to empower electric grids, which introduces new challenges because of its interference and volatility. Energy forecasting using soft computing technologies plays an essential role in solving these challenges. When predicting electricity consumption, it is necessary to determine an appropriate prediction method according to the expected forecasting results and characteristics of the prediction model. Besides, individual forecasting models have some limitations to overcome. Therefore, combinations of prediction methods are receiving increasing attention .We performed exploratory data analysis, pre-processing, and train- test split before training the model. We used various metrics to test the advantages of the proposed model: mean absolute error, mean squared error, and root mean squared error. In future Modeling of energy consumption prediction in residential buildings is a challenging task, because of randomness and noisy disturbance .To obtain better performance metrics. we have proposed a model for energy consumption prediction in residential buildings .By these we can predict the future energy it is so helpful to grid to make accurate energy for the grid by updating with smart meters we can know the people who are using more energy in what appliances. so, it is immensely helpful in which time we need more energy and less energy. In future work, there will be a study of the effectiveness of using other DL methods such as GRU (Gated Recurrent Unit) and CNN (Convolution Neural Network) which are not implemented in this study due to the high computational complexity.

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