

## Comparative Analysis of Medium Term Load Forecasting using Genetic Algorithm and Particle Swarm Optimization

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### Abstract

The forecasting of electrical energy provides the required information about future conditions of the network to the system engineers and helps to predict essential improving actions such as putting power plants at their maximum production, electricity purchasing, switching etc. It is essential for the booking of fuel supply and maintenance activities and making arrangements for utility power exchange. With the ongoing advancement of new numerical, mining and man-made reasoning devices, it is potentially feasible to enhance the result.

**Keywords:** Economic Dispatch, Emission, CEED, QPSO, MATLAB

### INTRODUCTION

Among the available form of energies, the electrical energy is the most essential and convenient form of energy due to its ease of conversion to other forms of energy such as sound, heat and light. It can be generated by means of energy conversion. The electrical energy is the one that is difficult to store with the present technology. The utilities as well the

government is responsible for providing adequate power supply to the consumers and finding difficult to supply the electrical energy demand.

Electrical energy forecasting can be generally classified into four categories based on the forecasting time, as shown in Table 1

**Table: 1.** Classification of Load forecast based on the forecasting time

| S.No | Load Forecast | Time Period          | Importance   |
|------|---------------|----------------------|--|
| 1    | Long          | 1-10 years           | <ol style="list-style-type: none"> <li>To calculate and allocate the required future capacity.</li> <li>To plan for new power stations to face customer requirements</li> <li>Plays an essential role to determine future budget</li> </ol>                  |
| 2    | Medium        | 1-week to few months | Fuel allocation and maintenance schedules.   |
| 3    | Short         | 1-hour to 1-week     | <ol style="list-style-type: none"> <li>Accurate for power system operation.</li> <li>To evaluate economic dispatch, hydrothermal coordination, unit commitment, transaction.</li> <li>To analysis system security among other mandatory function.</li> </ol> |
| 4    | Very Short    | 1-minute to 1-hour   | Energy Management Systems.   |

With the ongoing pattern of deregulation of power markets, momentary load anticipating has increased more significance and more noteworthy difficulties. In the market condition, exact estimating is the premise of electrical vitality exchange and spot value foundation for the framework to pick up the base power buying cost. In the continuous dispatch task, estimating blunder causes all the more acquiring power cost or breaking-contract penalty cost to keep the power supply and utilization balance.

Step by step instructions to assess the future load with the recorded information has remained a problem up to now, particularly for the load determining, days with outrageous climate and different irregular days. With the ongoing advancement of new scientific, information mining and man-made consciousness instruments, it is imaginably conceivable to enhance the guaging result. Long haul stack guaging is basic for evaluating the requirement for rebuilding or framework extension arranging with a perspective of blowing up the framework capacity so as to meet the long haul development sought after and monetary investigation. A few systems have been created for determining the future electrical vitality request in the ongoing decades.

The precise figure of electrical vitality isn't as simple as it looks, for example, climate, normal temperature, time, number of family units, number of forced air systems, measure of CO2 contamination, oil value, economy, populace, and so forth., that have effect on the interest may not be accessible. The principle targets of the theory are:

- Develop smart models dependent on Genetic Algorithm and Particle Swarm

Optimization for mid-term guaging of India's net electrical vitality application.

- Build perceptive models for foreseeing mid-term segment of electrical energy application
- To test the model to get the estimations of mean square error in the power framework.

### RELATED STUDY

The exploration methodologies of LF can be comprehensively isolated into two classifications: measurable techniques and computerized reasoning strategies [2], [3]. In measurable strategies, conditions can be acquired demonstrating the connection among load and its relative factors in the wake of preparing the verifiable information, while computerized reasoning techniques attempt to emulate people's state of mind and thinking to get learning from the past experience and imagine the future load.

The statistical category includes multiple linear regression, stochastic time series, etc. Normally factual strategies can foresee the load bend of conventional days exceptionally well, yet they come up short on the capacity to evaluate the load property of occasions and different strange days, because of the inflexibility of their structure. Master framework, ANN, fluffy induction, and transformative calculation have a place with the computational insight class. For the most part computational insight techniques are adaptable in finding the connection among load and its relative elements, particularly for the strange LF [4]. Some primary LF techniques are presented as pursues:

**Regression Method (RM)** is one of most broadly utilized factual methods. This are normally utilized for LF to display the relationship of load utilization and

different factors, for example, climate, day type and client class. Engle et al examined a few RM for the following day LF in [5].

**Time series methods** depend on the feeling that the information has an interior structure, for example, autocorrelation, pattern or regular variety. The techniques identify and investigate such a structure and are utilized for quite a long time in such fields as financial aspects, computerized flag handling, and also electric LF. Specifically, ARMA (autoregressive moving normal), ARIMA and ARIMAX (auto backward coordinated moving normal with exogenous factors) are the frequently utilized traditional time arrangement strategies [6].

**Artificial Neural Network (ANN):** it measure primarily non-linear circuits that posses the potential of non-linear curve fitting. The outputs of associate degree ANN square measure some linear or non-linear mathematical functions of its inputs.

**Fuzzy Logic:** Over the most recent three decades, various utilizations of fuzzy logic oriented to the building field, for example, LF, control framework stabilizer plan and responsive power control [8] in view of its convenience is diminishing the requirement for complex scientific models. For example the temperature of multi day might be "low", "medium" or "high". Fuzzy logic enables one to coherently derive yields from fuzzy sources of info, accordingly mapping contributions to yields. It ends up simpler to control and apparatus out arrangements, especially where the numerical model isn't unequivocally known or difficult to solve.

**The hybrid models** adding a couple of the current methodologies, for example, RM

method, ANNs, fuzzy logic and wavelet change have been famously connected in estimating issues with a perspective of misusing the advantages of the individual methodologies. Moreover, Evolutionary calculations like GA, PSO, and AIS, ACO have been utilized for preparing ANNs in LF applications. These calculations are superior to back-spread in intermingling and inquiry space capacity.

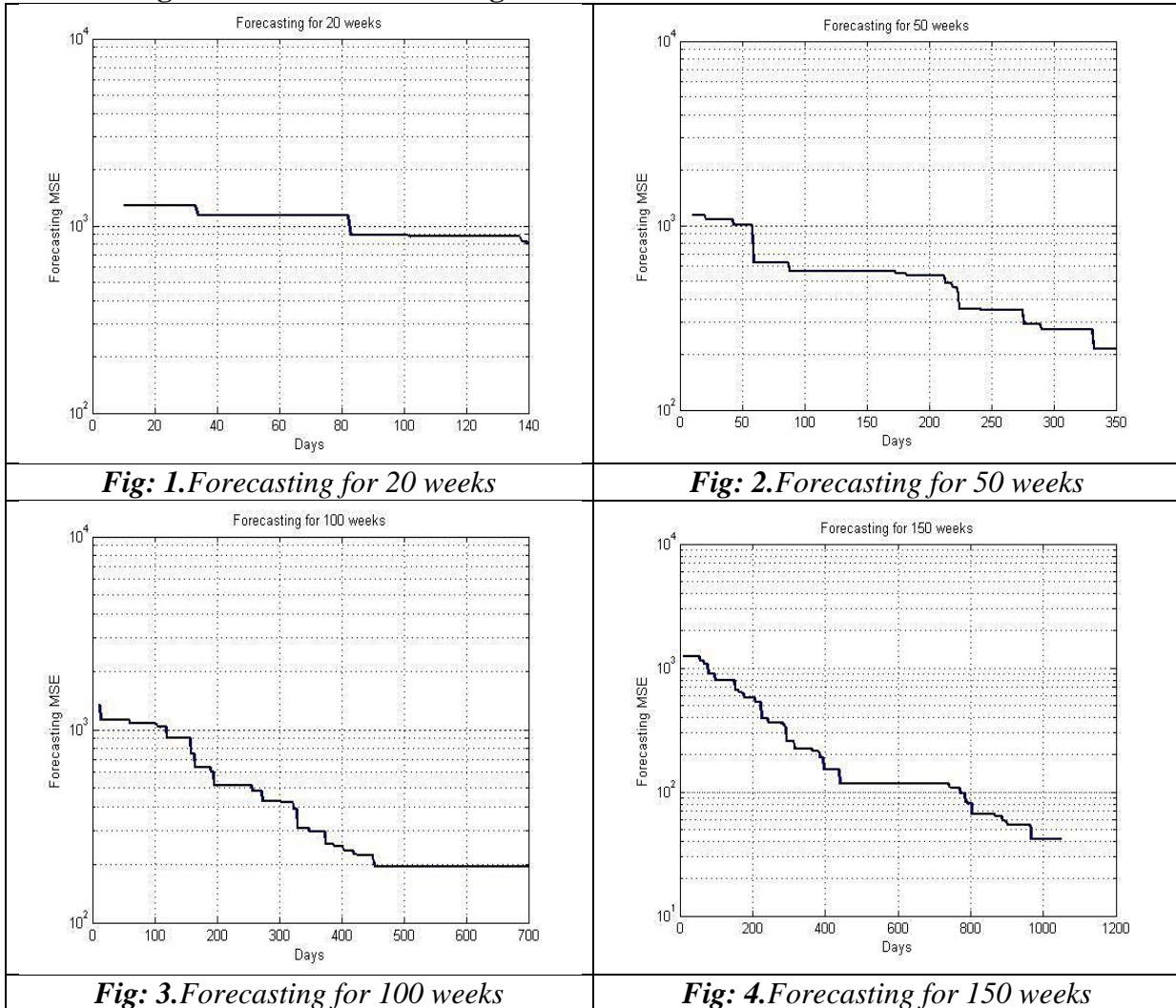
### LOAD FORECASTING

Load gauging investigation is the essential for accomplishing the objective of ideal arranging and activity of intensity framework. Precise models for electric load are fundamental for the activity and arranging of all the power utilities, as energy manufacturer, money related foundations, ISO's and different members in power era, transmission and dispersion markets. Specifically the medium term stack estimating (MTLF) is utilized both by energy makers to decide the activity arranging of the time (refueling of power stations, hydro assets the panel, repair, and so on.) and by transmission and circulation utilities to arranging the development of the limit of transmission and dispersion frameworks so as to guarantee the energy and request in medium term [9].

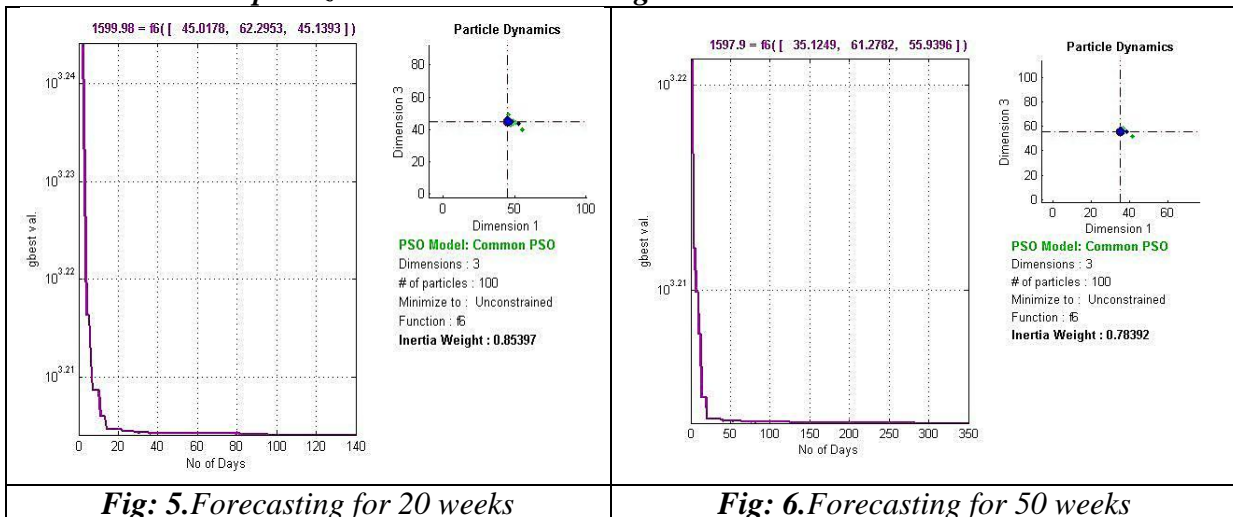
Among all the Heuristic techniques Swarm Intelligence (SI) based strategies have developed as a well known strategy for enhancement. Swarm Optimization (PSO) is one of the SI based technique, which is exceptionally easy to actualize and deliver similarly great outcomes. Since streamlining assumes an essential job in all logical and building applications, consequently there is consistently developing interest to create effective and powerful advancement methods.

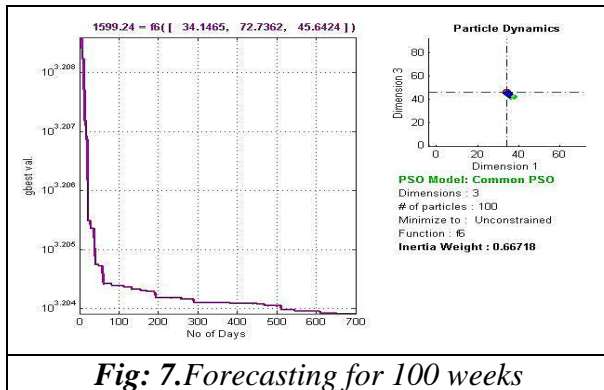
**RESULTS**

**Genetic Algorithm based Forecasting**

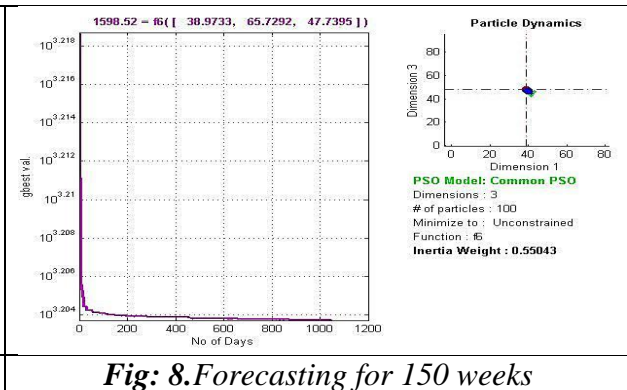


**Particle Swarm Optimization based Forecasting**





**Fig. 7.**Forecasting for 100 weeks



**Fig. 8.**Forecasting for 150 weeks

Both the algorithms are used to optimize mid-term load forecasting. In this work, Mean square error is considered as

performance criteria. Table 1 shows the MSE of forecasting for different weeks:

**Table.2.**Comparison of MSE for GA and PSO

| S.No | No of Weeks | MSE (GA) | MSE (PSO) |
|------|-------------|----------|-----------|
| 1    | 20          | 813.55   | 1599.98   |
| 2    | 50          | 308.93   | 1597.90   |
| 3    | 100         | 195.39   | 1599.24   |
| 4    | 150         | 41.13    | 1598.82   |

## CONCLUSION

Load anticipating is significant for the power framework arranging and security. The primary issue for the arranging is the assurance of load demand. Load estimating is essential for the precise savings. In this work Genetic calculation and molecule swarm advancement strategies are proposed to estimate the mid-term stack. Both the calculations (Refer Table 2) we have inferred that Particle Swarm Optimization is best over Genetic Algorithm since molecule and speed are stimulatingeternally as per wanted criteria which help it in showing signs of improvement results than hereditary calculation based guaging.

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