Analysis of Energy Consumption by Load Factor

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ABSTRACT: ***As business increasing day by day so industries also increasing which results in a large burden on a generation of electricity. To fulfill the demand of consumers, the efficiency of the generation, transmission and distribution should be high. To supply a sufficient amount of electricity to the consumer different factors have to measure, where the load factor plays an important role in supplying a sufficient amount of energy to the consumer. If the load factor is high, the utilization of electricity is maximum which will increase the smooth and sufficient electricity distribution to the consumer. Here in this research paper, data of loads have been collected from different sources. The collected data divided into two system, system 1 & 2. The load factor has been calculated for two systems, system 1 & 2. The system 1 load factor is 0.308, which is very less and the system 2 loaded factor is 0.833, which is a good load factor. After calculation for the load factors for both systems, analysis has been done for both the systems.***

KEYWORDS: ***Average load, Load factor, Maximum demand, Power demand, Electricity Consumption.***

INTRODUCTION

The load depends upon the electricity application. It takes power as input. The loads are of different types depends, where it is connected with the system [1]. The types of load factors are shown in Figure 1. Average load defines in three different periods. Daily average loads, monthly averages load & annually average loads. Where power consumed by the load on daily basis for 24hrs is called the daily average load [2][3]. The power consumption by the load for a month is called the monthly average load, similarly, the power consumed by the load for 12 months is called the annual average load.

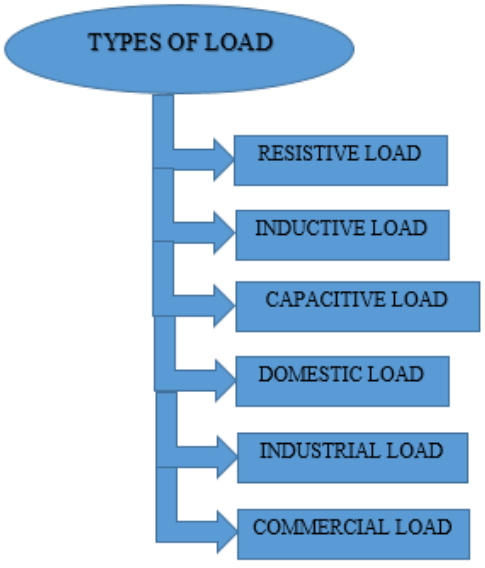

Figure 1: Types of load

1. *Uses of Monthly average load*

Monthly average load is the graph between the power demands to the duration of time in which power is supplied to the load. For monthly average load the duration of demand shows is of 30 days [4]. The monthly average demand is important for monthly bills of electricity and much more applications.

2. *Uses of Yearly load curve*

Yearly average load is the graph between the power demand to the duration of time in which power is supplied to the load [5]. For annual average load the duration of demand shows is of 12 months. The annually average demand is important for installation of power plant and much more applications.

3. *What is maximum demand?*

The peak demand is called the maximum demand. The load curve shows the power demand to the duration of demand. So the peak value of power demand to the load is called the maximum demand.

4. *What is the load factors?*

The load factors is ratio for an average powered to maximum demands of consumers. The load factors should be one or less than one. The value of load factor determines the utilization of electricity. As the value of load factor is nearly one, the utilization of electricity is more, which is beneficial for any industry.

5. *Benefits of load factors*

The load factors is directly proportional to efficiency to electricity. If value of load factor is high, the efficiency of that system will be high, because than the waste of electricity will be less and utilization of electricity will be more. Similarly, if the value of load factor is low, the efficiency of that system will be less, because then the waste of electricity will be more and utilization of electricity will be less.

Research Question

- Why improvement of load factor is important?
- What is the role of demand in improving load factor?

LITERATURE REVIEW

There are different researches related to "Analysis of energy consumption by load factor" in which the following are some description.

As in "The determination of the load factor into airline industry" author Sanjay L. Kurkute et.al analyzed the presentation of airlines by collecting some of its detail. The performance of airlines through its load factor and efficiency. It is also said that load factor is proportional to efficiency.

As in "Research on the surveys & the calculations of the loaded factors into urban public transportations" Author Kun yu et.al analysis has been done for urban area, basically public transport load factor for urban area. Load has been analyzed in three parts collection of power morning data, evening data and night data.

As in "Equipments power consumptions & the load factors profile to the building energy simulations" author Omer Sarfraz et.al analyzed the plug loads for building to identify full consumption of energy. The analysis has been done by simulation and recommendation to minimum numbers for the testing day necessary for obtaining equipments peaks heat gains that are made also.

As in "Load factors improvements onto the daily loaded curves utilizing pump storages for saving products costs" author Langlang Gumilar et.al presented the power plants with load fuel is cheaper to serve medium loads all day. Peak load selection is for particular time. Analysis of load factor has been done by data collection of pump storage power plant.

METHODOLOGY

1. *Design:*

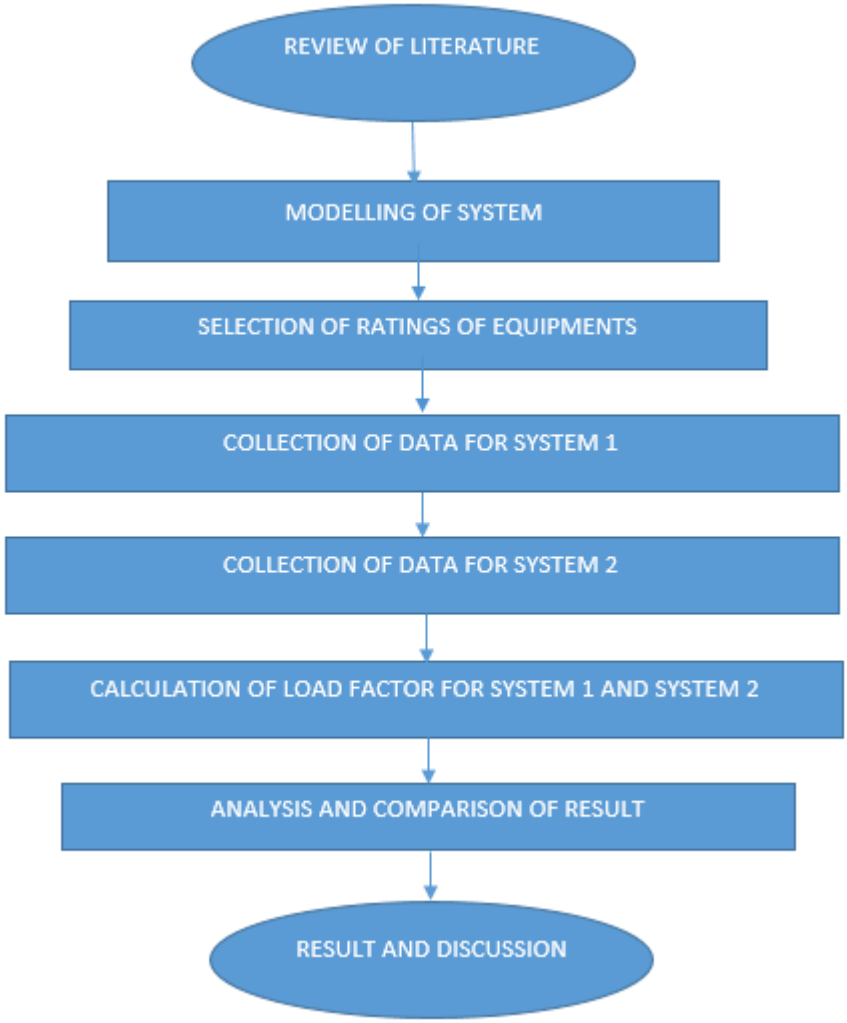

Figure 2: Design Methodology

The methodology of calculation and analysis of load factor is shown in Figure 2.

2. *Sample:*

The instruments used in this research are at rated calculated value, according to calculations for total load factors of system. Above which the equipment may burn. Some measuring instruments are also used for this experimental research. The data of a power plant has been collected to calculate the demand, according to the demand of energy, load factor has been calculated.

3. *Instrument:*

In this research, data has been collected by a survey of a power plant. Analysis has been done by calculation of average load, demand factor load factor.

4. Data Collection and Analysis:

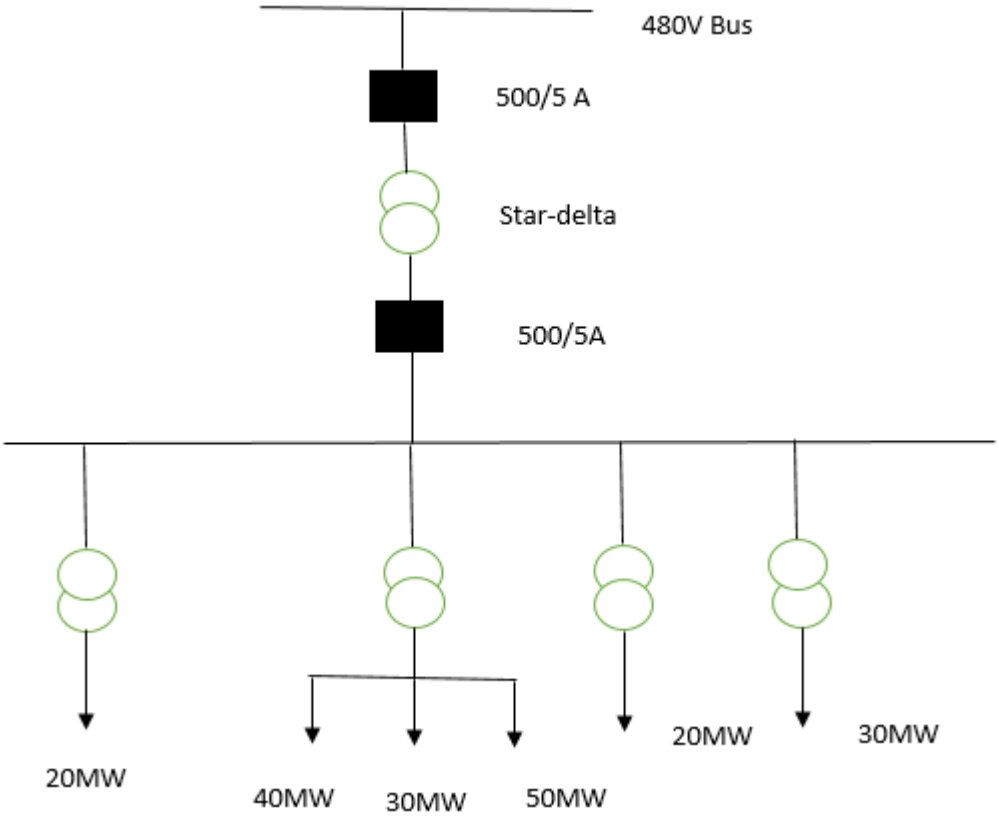

Figure 3: Single line diagram of system 1

Calculation of load factor for system 1.

Unit generated by system 1= $[(20\times6)+(40\times4)+(30\times2)+(50\times4)+(20\times4)+(30\times4)] \times 10^6 = 740\text{MW}$

$$\text{Average load} = \frac{Unit\ generated\ by\ system,}{Number\ of\ hours}\ \text{MW}$$

$$\text{Average load} = \frac{740}{24}\ \text{MW} = 30833\ \text{kW}$$

$$\text{Load factor} = \frac{Average\ load}{Maximum\ demand}$$

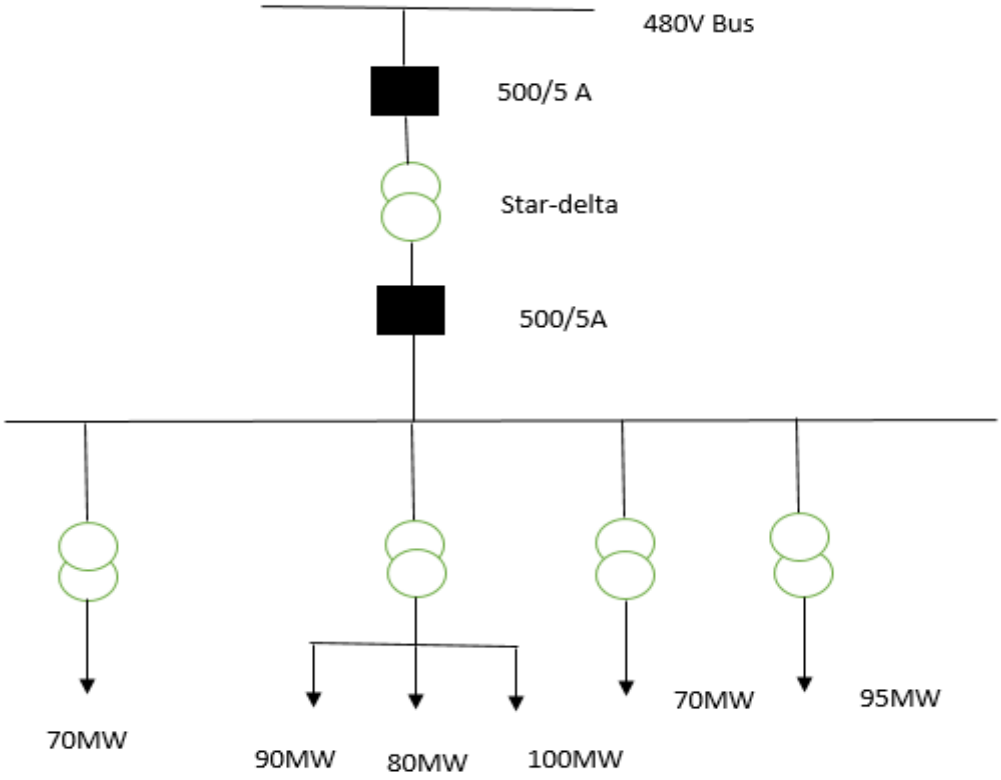

Figure 4: Single line diagram of system 2

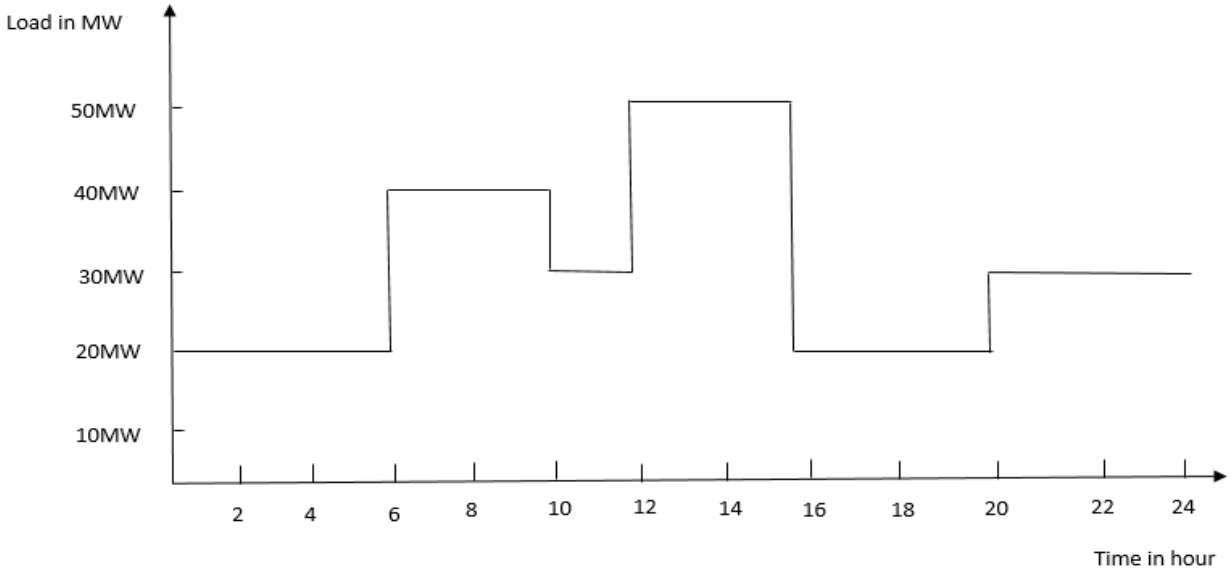

Figure 5: Data collection of system 1

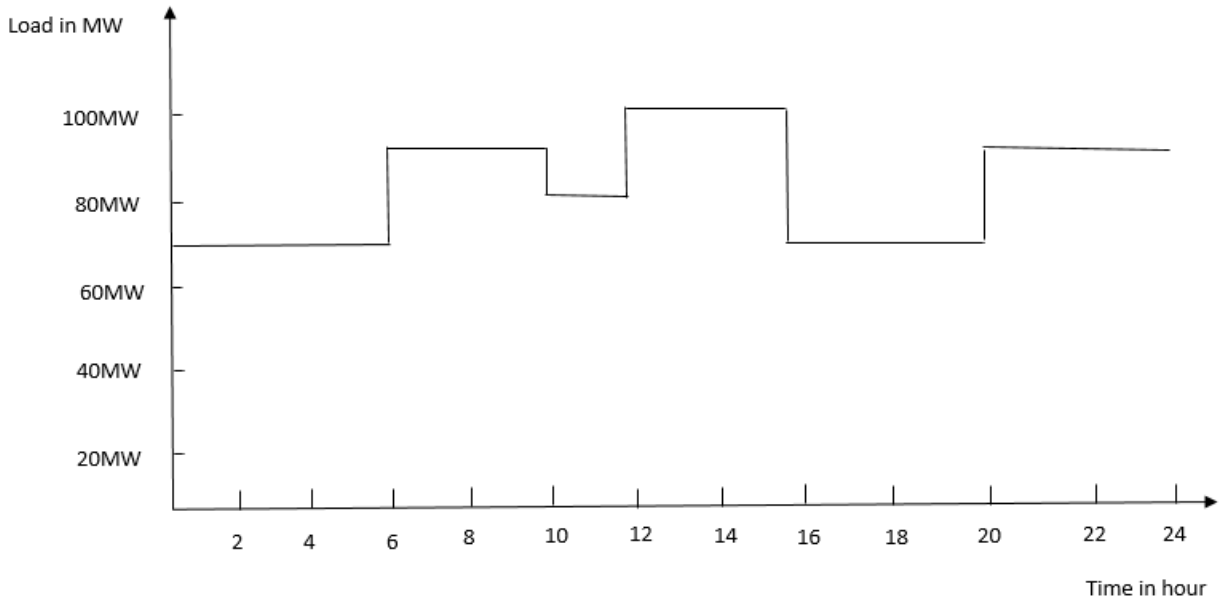

Figure 6: Data collection of system 2

Maximum demand for system 1 is 100MW

$$\text{Load factor} = \frac{Average\ load}{Maximum\ demand} = \frac{30833}{100000} = 0.308$$

Calculation of load factor for system 2

Unit generated by system 2 = $[(70\times6)+(90\times4)+(80\times2)+(100\times4)+(70\times4)+(95\times4)] \times 10^6$

Unit generated by system 2 = 2000MW

$$\text{Average load} = \frac{Unit\ generated\ by\ system,}{Number\ of\ hours}\ \text{MW}$$

$$\text{Average load} = \frac{2000}{24}\ \text{MW} = 83333\ \text{kW}$$

$$\text{Load factor} = \frac{Average\ load}{Maximum\ demand}$$

Maximum demand for system 2 is 100MW

$$\text{Load factor} = \frac{Average\ load}{Maximum\ demand} = \frac{83333}{100000} = 0.833$$

Here in this research paper system 1 and system 2 data has been collected. The system 1 and system 2 as show in Figure 3, 4, 5 & 6 where various equipments are connected for generation of electricity and load is connected which is working as sink for electricity. By taking maximum power according to the load used for both system 1 and system 2 the calculation of load factor has been done.

RESULT & DISCUSSION

The calculation and analysis of load factors for system 1 and system 2 have been done successfully. Where system 1 data shows the minimum utilization of electricity and system 2 data shows the maximum utilization of electricity. The result for system 1 & 2, the load factor for system 1 is 0.308 which is a very low load factor, due to less utilization of electricity. The load factor for system 2 is 0.833 which is a good load factor, as it is utilizing the maximum electricity.

CONCLUSION

This research was analyzed by the designing system and calculation approaches. From the above research, it is found that the calculation of load factor has been done for two systems, system 1 and system 2. Result of the calculation of load factor for both the systems, System 1 load factor is 0.308 and system 2 load factor is 0.833 which shows that system 2 is utilizing the maximum electricity because the load factor for system 2 is more than system 1. For future scope, the load factor for other systems can be analyzed and different factors which are beneficial for the efficient generation of electricity can be calculated and analyzed.

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