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Power Quality Analysis of the Educational Institute – Guru Gobind Singh College of Engineering & Research Centre

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Abstract : *Power quality is very much significant when it comes to every place. The nature/quality of current always gets decided by the load connected at the terminal side. Every industry, utility companies as well equipment users and manufacturers are concerned about the power quality. The term power quality has become one of the most upcoming words in the power industry since the late 1980s. It is an umbrella concept for a multitude of individual types of power system disturbances. The engineers are now trying to deal with these issues using a systematic approach rather than handling them as individual problems. Through this paper we are discussing and focusing on the analysis & PQ audit report of college campus at Guru Gobind Singh college of engineering & Research Centre, Nashik.*

Key Words: Harmonics, Power Quality, power factor, THD for voltage and current, Power factor, Reactive, Active, Apparent Power, Harmonic Level. Energy Saving. PQ Audit and objectives.

1. INTRODUCTION

The quality of power will define the power quality. Any issues related to power exhibited in voltage, current, or frequency deviations that result in failure or misoperation of customer equipment. When any issue arises in equipment, the users at the end level starts to complain about the outage that has occurred. However, the records at the utility side don't show any issues in relation to feeding to customers.

We have different universal standards for power quality and other parameter in relation to technical that can be considered, but the real and final measure of power quality is seen by the performance of end-user equipment. If the electric power is not sufficient for such requirements, then there is bad power quality.Power quality involves monitoring of various parameters such as voltage, current, frequency deviations, harmonic indices, power factor, level of harmonics etc. When it comes to audit of a college premises, the consideration of load is very much important. The reason is the presence of sensitive equipments and customer loads, there is a need to define the quality of electricity provided in a common and concise manner that can be evaluated by the electricity supplier as well as by consumers or equipment. One of the basic principles of solving power quality issues is that disturbances in the electric power system are not bounded by legal boundaries. Power suppliers, power consumers, and equipment suppliers must work together to solve many problems. Before the discussion and coming together, they must understand the electrical atmosphere and environment in which their equipment is working.. This is necessary to reduce the long-term economic impact of inevitable power quality variations and to identify system improvements that can mitigate power quality problems.

PQ monitoring is the process of collecting, analyzing, and interpreting raw measurement data into useful information. By continuous measuring of current and voltage for the system is the gathering procedure for data. The process of analysis and interpretation has been traditionally performed manually, but recent advances in signal processing and artificial intelligence fields have made it possible to design and implement smart and intelligent systems to automatically analyze and interpret raw data into useful information with very less human involvement and intervention. Before embarking on any power quality monitoring effort, one should clearly define the monitoring objectives. The monitoring objectives often determine the choice of monitoring equipment, triggering thresholds, methods for data acquisition and storage, and analysis and interpretation requirements. One of the common objectives of power quality is to characterize system performance.

This is the most general requirement. Almost every power producer shall find this objective significant if it has the need to understand its system performance and then match that system performance with the actual needs of customers. System characterization is a driven approach to power quality monitoring. By understanding the normal power quality performance of a system, a provider can quickly identify problems and can offer information to its customers to help them match their sensitive equipment's characteristics with realistic power quality characteristics.

2. ELECTRICAL ENERGY CONSUMPTION PATTERN:

Guru Gobind Singh College of Engineering college & Research centre Nashik Consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities,

Present level of energy concussion:

Sr. No	Value	Maximum Demand in KVA	Energy Consumed in KVA	Power Factor	CO2 Emission MT
1	Max	78	16,466	0.994	10.459
2	Min	22	4,130	0.453	38.10
3	Avg	49	9,784	0.723	9.320

The various projects already implemented by the College are

- Maintenance of good Power Factor by APFC
- Usage of Electronic chokes for Tube light fittings
- Usage of LEDs at some locations.

The College has installed Roof Top Solar PV Plant of capacity 20 kWp. Due to this projects, the percentage of usage of Renewable Energy to the total Power demand works out to be 30 %. Based on regular analysis by using power analyser we identify load is unbalanced and more harmonics are present system due to nonlinear load such as 20 kva UPS and other electronics blast tube light.

2.1 STUDY OF ELECTRICAL ENERGY CONSUMPTION:

In this section we study last year electricity bills

Table no. 2 Electrical Bill Analysis -2020

No	Month	Energy Consumed, kWh	MD, kVA	Power Factor
1	Jan	16,466	78	0.993
2	Feb	15242	73	0.995
3	Mar	15184	73	0.994
4	Apr	4130	23	0.991
5	May	4680	22	0.994
6	Jun	7156	41	0.991
7	Jul	7850	44	0.993
8	Aug	8782	48	0.992
9	Sep	8973	51	0.995
10	Oct	11598	53	0.997
11	Nov	7102	35	0.993
12	Dec	10,249	47	0.992
13	Max	16466	78	0.995
14	Min	4130	22	0.991
15	Avg	9784	49	0.993

Graphically Representation of Monthly Electrical Energy Consumption

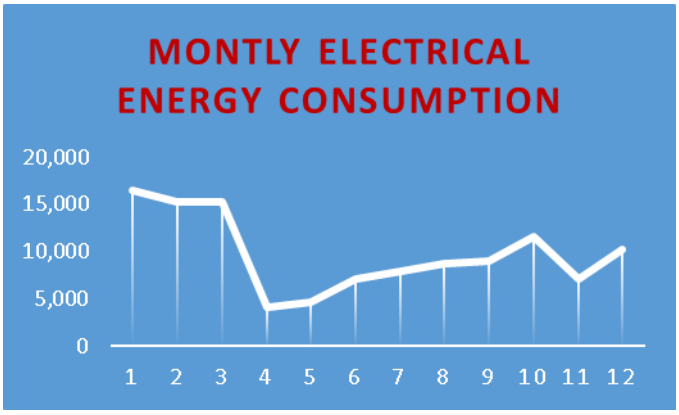

Fig 1 : Monthly energy Consumption

3. Use of renewable source of energy:

3.1 Roof Top Solar PV Plant:

The College is installing a 20 kWp Solar PV Plant. On installation of the same the details of the

Generation would be as per the following Table.

NO	Particulars	Value	Unit
1	Total Solar PV System Capacity	20	KW
2	Average generation per kWp per Day	4	kWh/kWp
3	Daily average generation	80	kWh/kWp
4	Annual generation days	300	Days/Annum
5	Total annual Electrical Energy Generation	24000	kWh/Annum

Fig 2 : Photograph of Solar Rooftop System

1.2 Results

The PQ analyzer helps in analyzing the profile of voltage, current, power factor, active power, reactive power, apparent power, THDs for voltage and current. The screenshots below are the real readings taken for college campus:

Fig. 3 Readings of Analyser when only School is "ON"

The readings of college campus were taken during the off peak hours as well as during peak hours The individual unit of building was made on and off and the readings were obtained. The purpose o making these building supply as "ON" and "OFF" were to understand the contribution of harmonics due to the separate building.

The figures 3, 4 and 5 and the photos shown here represents the readings of the analyzer taken during the off peak hours at the evening time. Similar readings were taken during the peak hours (probably taken at afternoon after 12 PM).The readings taken during the peak hours represents the actual condition of the power system harmonics as well as the power quality condition.

Fig. 4 Readings of Analyser when only Polytechnic is "ON"

Fig. 5 Readings of Analyser when only Degree is "ON

2. CONCLUSIONS

Conclusion of power quality analysis at MAIN INCOMER

The various conclusions of power quality analysis are:

- Average value of % Total voltage harmonic distortion is less than 5% limit recommended by IEEE 519-1992 Standard. Here in this PQ Analyzer meter the THDs value indicates total harmonic distortion.
- Average value of % Individual voltage harmonic distortion is less than 3% limit recommended by IEEE519-1992 Standard.
- Average value of % Total current harmonic distortion is more. Less than 5% limits recommended for by IEEE 519-1992 standard.
- Higher content of harmonics leads to increase in heating as well increased currents in all phases leading to overheating (I2R losses) and losses. Increased currents will increase financial losses too.
- Power factor is very low.(during peak hours).
- Generally in every sector lightning consists of 60% load. Moreover it's a college premises mostly load is lighting load and majority of load right now is consisting of lighting, Electronics load (CPs, UPS) and few HVAC load. There is requirement of balancing the lightning load and there is need of reduction of reducing the harmonics.
- Maintaining voltage profile is important.

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