

MONITORING OF POWER SYSTEM QUALITY



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ABSTRACT

Power Quality can be defined as the characteristics of the electricity at a given point on an electrical system, evaluated against a set of reference technical parameters. These parameters might relate to the compatibility between electricity supplied on a network and the loads connected to that network.

The voltage waveform is normally distorted, and we have the so called Power Quality disturbances such as; voltage dips/swells, transients, harmonics and voltage unbalance amongst others. The study of Power Quality encompasses the Power Quality disturbances, as well as Power Quality standards, and Power Quality Monitoring.

This project will tackle the subject of Power Quality, Power Quality Disturbances, Power Quality Standards as well as Power Quality Monitoring. A general description of each of the disturbances will be given, and the basic techniques which are used to mitigate that disturbance so as to improve the quality of the supply are presented.

CHAPTER 1 INTRODUCTION

1.1 Introducing the research title

Power utilities in every country on the globe have a principal mandate of supplying electrical power to a diverse range of customers. By diverse we mean customers who demand power on varying standards; residential, commercial, as well as industrial. Residential customers normally have a different set of demands in as far as power supplied is concerned, as compared to industry. The common thing on these types of customers is that they call for a disturbance-free supply of electrical power.

Industrial customers can experience interruptions to important processes during momentary sags associated with remote faults on the utility system. Commercial customers are installing high efficiency and electronic office equipment resulting in higher harmonic levels in the buildings. These harmonic sources cause excessive neutral currents and transformer overheating. Even residential customers are concerned about surge protection for sensitive electronics in the house and the impact of momentary interruptions on their electronic equipment.

Noted on the previous paragraph are some of the factors that can disturb the power supplied to the customer. These factors are sags and harmonics. Factors that can cause disturbances to the supply of power are not limited to aforementioned two, but there are a few of them which need attention from power utilities.

As the utility industry undergoes restructuring and all customers find their service needs changing with increased use of equipment and processes more susceptible to power system disturbances, power suppliers and customers will find a solid background in Power Quality (Power Quality) not only useful, but also for continued productivity and competitiveness.

The subject of Power Quality therefore becomes a matter of utmost importance to every power utility that needs to supply an up to standard electrical power to its customers. Power Quality by definition is a set of electrical boundaries that allows equipment to function in its intended manner without significant loss of performance or life expectancy. Perfect Power Quality is characterized by a perfect sinusoidal voltage source without waveform distortion, variation in amplitude or variation in frequency. It is then mandatory for the utility to provide a perfectly sinusoidal voltage source, with constant frequency and amplitude.

There are however factors that can cause deviations from this perfectly sinusoidal voltage source and these are the factors that every power utility should be wary of from time to time. These factors distort the voltage waveform by changing the amplitude or cause deviation in the frequency. To fully comprehend the subject of Power Quality, these factors must be studied and monitored thoroughly, and measures to mitigate them be put in place.

The factors that are a threat to Power Quality are called Power Quality disturbances and are amongst others; voltage dips, voltage flicker, harmonics, frequency variations, voltage swells, over-voltages, under-voltages and transients. A system free from these Power Quality disturbances is what every power supplying utility should strive for in order to have a good quality of supply to its customers.

Swaziland Electricity Company (SEC) being the provider of electrical power in Swaziland is as well striving to supply a distortion-less voltage source to its customers, so she needs to give the subject of Power Quality some utmost attention.

1.2 Problem Statement

In her principal impetus of providing a distortion-less supply of electrical power to its customers, SEC needs to make sure that the Power Quality disturbances are

minimized on the network. So a study on Power Quality can go a long way into solving existing Power Quality disturbances as well as problems that may be experienced in the future. The company also needs to do some gap analysis on Power Quality. This gap analysis will help SEC to gauge her stand on Power Quality now, set some goals and find measures that need to be taken to attain those goals.

1.3 Research Objectives

This research has three major objectives:

- Study the subject of power quality and focus on power quality disturbances; their effects on the network, as well the basic techniques used to mitigate them and improve the quality of supply.
- Monitor the power quality disturbances on SEC's network.
- Compare what literature states on Power Quality with what actually happens on the network.

After the research I intend to come up with some recommendations that if implemented will go a long way in solving SEC's Power Quality problems now and in the future.

1.4 Hypothesis

An in-depth analysis of data collected from monitoring the network for power quality is vital in making decisions for preventive and corrective maintenance on the network.

1.5 Methodology

The following methodology was carried out for this project:

- Carried out a literature review on the subject of Power Quality, with emphasis on power utilities. The literature review made it possible to be abreast with Power Quality issues from the electrical distributor. This included studying international and local Power Quality standards documents.