



SOLUTIONS TO POWER QUALITY PROBLEMS AT KANDANA WATER SUPPLY SCHEME

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Degree of Master of Science

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Abstract

Quality of the power supply becomes a key issue in plant automation. Especially, voltage sags appearing on the electricity supply cause voltage sensitive equipment to shut down and incur heavy financial losses to Industrial customers. -However, effects of voltage sags can be minimized or mitigated considerably if both utility and the plant are working with good cooperation. This thesis presents power quality issues and mitigating techniques of voltage sag problem at Kandana water treatment plant where sensitive equipment are used for different stage of water treatment and distribution process.

Kandana water treatment plant consists of five pumps having capacity of 500 kW and three pumps with 200 kW capacities. The pumps are controlled by several sensitive electronic devices which are vulnerable to voltage sags. By analyzing the past break down data at Horana Grid substation and plant disturbance recorded at treatment plant and measurement taken with a power quality analyzer it has been observed that the voltage sag appearing at the treatment plant are mainly caused by faults.

First, investigations were carried out to estimate the severity of voltage sag associated with different types of faults in the utility network and their impacts on the equipment installed in the water treatment plant. Then, the effects of voltage sags on the equipment vulnerable for water pumping and distribution process like large pumps with sensitive electronic controllers were investigated to find out a mitigating solution. Detail analysis with theoretical descriptions has been given to describe field observation.

In order to solve the power quality problem especially the voltage sag, several options system level and device level have been considered. It is noted most of the system level mitigating solutions have been implemented by the utility side. Then device level solutions have been introduced. In this sense, Dynamic Voltage Restorer



CDVR) was used to solve the voltage sag problem. Further, designing and controlling of the DVR have been with theoretical derivations and simulations results are given to justify the proposed solution. Remarkably good results have been gained by using this Dynamic Voltage Restorer.

Declaration

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

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Abbreviations

PQ	-	Power Quality
CEB	-	Ceylon Electricity Board
DVR	-	Dynamic Voltage Restorer
GSS	-	Grid Substation
kV	-	Kilo Volts
MVA	-	Mega Volt Ampere
RMS	-	Root Mean Square
SLG	-	Single line to Ground
IGBT	-	Insulated gate bipolar transistor
VSC	-	Voltage Source Converter
UPS	-	Uninterruptible Power Supply
GMD	-	Geometrical Mean Diameter
GSS	-	Grid Substation



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