DEVELOPMENT OF CONDITION-BASED MAINTENANCE (CBM) MODEL FOR POWER SUBSTATIONS CRITICAL EQUIPMENT TO ENHANCE RELIABILITY: The Case Study of 132/33 kV, 45 MVA Transformer at Makumbusho Substation.

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ABSTRACT

Makumbusho is located along New Bagamoyo Road in the South East of Dar es Salaam city. This is a primary substation receiving power from a 132Kv transmission line from the Ubongo substation. The substation is critical for power distribution within the city hence the maintenance of critical substation equipment needs to be taken as a great concern. Critical equipment has been affected by failure while awaiting their planned maintenance schedule hence causing unreliability power supply. This dissertation has focused on the deployment of a CBM strategy for critical substation equipment.

The study was done at the Makumbusho substation with the 45 MVA, 132/33 kV transformer as the case study with three specific objectives. The dissertation aimed at developing a framework for the identification of critical equipment. Identifying factors which cause the failure of critical equipment and developing a Condition Based Maintenance (CBM) model for maintenance management of critical equipment at Makumbusho substation.

To achieve the stated objectives, the researcher conducted a comprehensive literature review of the substation equipment, maintenance strategies and mathematical modelling in maintenance management. The researcher then collected data using a questionnaire and conducted a document review of monthly substation reports.

Based on the study findings, the significant factors which caused the failure of critical equipment at the Makumbusho substation were identified as are shortage of enough budget to support maintenance, unavailability of a maintenance management information system, scheduled maintenance period of equipment being not realistic, ignoring of maintenance plan due to high concern of power outage, delay of approval of maintenance activities and unavailability of spare parts. A framework for the identification of critical equipment at the Makumbusho substation was developed using a programming flow chart.

The Condition Based Maintenance (CBM) model was developed using the Artificial Neuron Network (ANN). The development of the CBM model was the main objective of this study. The outputs of CBM – ANN are used for guiding on decision making on maintenance action while practicing CBM strategy for critical equipment.

To improve reliability of power to the customer, maintenance of critical equipment for Makumbusho substation to be done by adopting CBM maintenance strategy with the use of CBM – ANN model. The adoption of N-1 Contingency criterion during design of substation can be useful to reduce the factors which cause to failure of equipment.

 M.Eng.(Maintenance Management) Dissertation.