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RELIABILITY ANALYSIS AND IMPROVEMENT OF TURBINE SIDE OF LAKVIJAYA POWER STATION

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Thesis submitted in partial fulfillment of the requirements for the degree Master of Science

Department of Electrical Engineering

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Declaration

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The above candidate has carried out research for the Masters thesis under my supervision.

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Signature of the supervisor: Date: 28/01/2014.

Dedication

I dedicate this thesis to my beloved parents. I hope that this achievement will complete the dream that you had for me all those many years ago when you chose to give me the best education you could.

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Abstract

Analyzing the reliability of a newly built coal fired power station is important when the expected reliability is not proved by the power station. The guaranteed minimum availability of the Lakvijaya coal power station by the contractor is 85%. But the actual is far below than that during first two years.

Turbine side is the main contributor for poor reliability. It contributed to a 56% of forced outages and 57% of energy loss causes by forced outages. The major systems of the turbine side as well as related auxiliary systems contributed in various scales to the poor reliability of the power plant.

The study focuses on identifications and analysis the reliability issues of turbine side of Lakvijaya power station. Then find out the reasons behind the reliability issues and propose methods to improve the reliability.

The existing reliability is analyzed based on the historical data of failures. The reliability measures as MTBF, MTTR, FOR, availability and failure rate are used to analyze the reliability. The actual results obtained are compared with the standard values. It can be seen that design issues of systems, lack of attention given to commissioning, poor workmanship and lack of preventive maintenance causes poor reliability of turbine side. A minimum of 1.8 billion rupees could have been saved to CEB if the reliability issues in turbine side didn't arise.

The reliability improvement methods are proposed to improve the reliability. Design changes and improvements to the existing systems are proposed for improve lack of reliability. A minimum of 3.3 billion rupees can be saved within three years period by implementing these improvements.

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A short term reliability analysis is helpful to understand the behavior of generating unit. In short term, based on the state where the unit is operating when the fault occurs FOR, EENS and state probabilities are illustrated. It provides a guideline to decide the most reliable generating capacity among the available capacities after a fault. It is recommended updating the database of failures of the power plant and develops a more precise guideline for operating decision making.

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LIST OF ABBREVIATIONS

Abbreviation	Description
AC	Alternative Current
BFP	Boiler Feed water Pump
BOP	Balance of Plant
CCCW	Closed Cycle Cooling Water
CD	Capacity Deficiency
CEB	Ceylon Electricity Board
CMEC	China National Machinery and Equipment Import Export Corporation
CT	Current Transformer
CWS	Cooling Water System
DC	Direct Current
DCS	Distributed Control System
DSCT	Discrete State Continuous Time
DSH	De-Super Heater
ECD	Expected Capacity Deficiency
EENS	Expected Energy Not Supplied
FCB	Fast Cut Back
FOR	Forced Outage Rate
FRP	Fiber Reinforced Plastic
GDP	Gross Domestic Product
ID	Induced Draft
LP	Low Pressure
LVPS	Lakvijaya Power Station
MSS	Multi State System
MTBF	Mean Time Between Failures
MTTR	Mean Time to Repair
OCCW	Open Cycle Cooling Water
RB	Run Back

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RTR	Reliability Trial Run
SPP	Simple Payback Period
SST	Start-up and Standby Transformer
UAT	Unit Auxiliary Transformer
UPS	Uninterrupted Power Supply
VSD	Variable Speed Drive

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