

**STUDY ON RELIABILITY IMPROVEMENTS OF  
LAKVIJAYA POWER STATION RELATED TO THE  
BALANCE OF PLANT SYSTEMS: A CASE STUDY**

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Department of Electrical Engineering

University of Moratuwa

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Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree Master  
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Department of Electrical Engineering

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Sri Lanka

July 2014

## DECLARATION

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

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Dr. Asanka Rodrigo.  
Faculty of Engineering  
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Date

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## ABSTRACT

Lakvijaya power station is the first coal fired power station in Sri Lanka having an installed capacity of 300MW. During 2012, it has supplied 18% of the Sri Lankan energy demand. The availability factor of this power station in 2012 was 68.8%. This is rather high compared with the average availability factor of coal powered power stations in countries in the region falls between 65% - 90%. According to the contract document, the availability factor of this plant has been expected as 85% [1].

However, there is a strong public opinion created by media that the plant is unreliable and prone to frequent failures. Therefore, any improvement in the availability of the power station will result in improving the public image as well as reducing overall costs spent on more expensive fuels. This research aims at critically analyzing the Auxiliary Systems of the power plant to identify their contribution to the reduction of plant availability and propose means of improving overall availability through increasing the reliability of auxiliary systems.

Data related to outages were collected from plant operational logs and defect reports from 22.12.2010 to 09.06.2012. Existing systems and layouts were studied referring to plant operation and maintenance manuals and by field observations. Analyzing the data, it was found that failures and unsatisfactory performance in the auxiliary systems have contributed to the low availability of the power plant by delaying re-starts after failures and reducing the plant capacity while in operation.

Failures and problems in auxiliary systems such as The Sea Water Pre-Treatment System, De-salination System, De-mineralization System, Chlorination System and the Hydrogen Production and Storage System were critically analyzed during this research and improvements to the designs are proposed based on the results.

The present availability factor of 21% of the De-salination System can be improved to 91% by carrying out the proposals made by this research. The availability factor of other systems too can be improved above 90% using the results.

Estimated total cost of the proposals is Rs. 543 Million. However, by implementing them Rs. 2.7 Billion is expected to be saved annually, by reducing the operating and maintenance costs of auxiliary systems and improving the availability of the power plant. Expected payback period is only 2 ½ months. Therefore, the proposed modifications are extremely desirable and cost effective. They will make a good financial contribution due to the expected savings while improving the reliability and the public image of the power plant.

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## LIST OF ABBREVIATIONS

Abbreviation	Description
$\mu$	Repair rate
$\mu\text{S}$	Micro Siemen
A	Availability
CEB	Ceylon Electricity Board
cm	Centimeter
CU	Copper
D	Pipe Diameter
DC	Direct Current
DI	Ductile Iron
DN	Nominal Diameter
FRP	Glass Reinforced Plastic Pipe
H	Head
h	Hour
H <sub>2</sub>	Hydrogen Gas
IEE	The Institution of Electrical Engineers
kW	Kilo Watt
LVPS	LakVijaya Power Station
$\bar{m}$	Mean running time
Mn	Million
MPa	Mega Pascal
MSL	Mean sea level
MW	Mega Watt
NaOCl	Sodium Hypochlorite
NWS&DB	National Water Supply and Drainage Board
PVC	Polyvinyl chloride
PLC	Programmable Logic Circuit
Q	Flow rate



$\bar{r}$	Mean failure time
RO	Reverse osmosis system
Rs.	Sri Lanka rupees
RWP	Raw Water Pump
SWA	Steel Wire Armoured
SYS	System
UF	Ultra Filtration
$v$	flow velocity
$V$	Voltage
VSD	Variable Speed Drive
XLPE	Cross-linked Polyethylene
$\lambda$	Failure rate
USD	United States Dollar



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