

STRATEGIES TO HARNESS THE FULL HYDRO-ELECTRIC POTENTIAL IN SRI LANKA

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of Science



Department of Electrical Engineering

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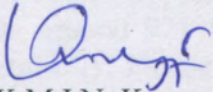
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Declaration

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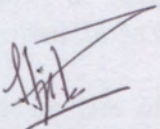
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Date: 25th June, 2012

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



Prof. H.Y.R. Perera

Date: 25th June, 2012

Abstract

The existing power generating system in Sri Lanka relies upon a mix of generation from renewable sources, predominantly hydropower, with the balance from fossil fuel sources. While the electricity demand continues to grow at an average rate of 6 ~7% per annum, it is projected that the majority of new electricity demand will be met by large centralized coal fired generation plants.

Sri Lanka's increasing dependence on imported fossil fuels put pressure on the national economy, and it also has caused a heavy burden on the operational costs of the Ceylon Electricity Board. Their impact on the environment is also a concern. Therefore, increasing the hydro electric generation of the country to the optimum possible level is extremely important.

Objectives of this research are to explore the remaining hydro electric potential in the country and to propose strategies to harness this potential on a fast-track basis. Subsequent to this, development of the remaining untapped hydro potential to the optimum possible level and improvement of the output from existing plants were investigated.

In this study, remaining hydro electric potential in the country has been estimated to be around 971 MW, and they have the potential of generating about 3,704 GWh, annually. Financial, information, institutional, technical and policy barriers have been identified as main barriers against their development. Introduction of a new institutional model for project financing and attracting private sector financing through different ownership structures have been identified as main strategies to overcome the financial barriers against large hydro development. Improvement of the public awareness and having a firm national policy on developing the remaining hydro potential have also been identified as feasible strategies to overcome the other barriers. Resolving of evacuation limitations, improvement of research & development capacity, introduction of creative project financing options and streamlining the approval process are among the strategies identified to overcome the main barriers against the small hydro development.

It has also been revealed that additions of about 355 MW of peaking capacity to the existing large hydro plants are feasible and after completing the ongoing renovation works at several power stations, the total hydro capacity would be increased by another 26 MW.

The results of the case study revealed that the generation from Canyon machines could be increased by about 5%, if the maximum efficient operation performance parameters of these machines were considered for their dispatch. Hence, it could be recognized as an effective measure of increasing the generation of existing hydro plants, especially from machines with Francis turbines.

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LIST OF ABBREVIATIONS

Abbreviation	Description
ADF	Average Daily Flow
BLT	Build Lease Transfer
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
BOT	Build Operate Transfer
CCGT	Combined Cycle Gas Turbine
CEB	Ceylon Electricity Board
CECB	Central Engineering Consultancy Bureau, Sri Lanka
CPS 01	Unit 01 Machine at Canyon Power Station
CPS 02	Unit 02 Machine at Canyon Power Station
EIRR	Economic Internal Rate of Return
FIRR	Financial Internal Rate of Return
FSL	Full Supply Level
ft asl	Feet above mean sea level
GSS	Grid Sub Station
GWh	Giga Watt Hours
IPP	Independent Power Producers
ITDG	Intermediate Technology Development Group
kWh	Kilo Watt Hours
LOI	Letter of Intent
m asl	Meters above mean sea level
MCM	Million Cubic Meters
MOL	Minimum Operating Level
MVA	Mega Volt Amperes
MW	Mega Watts
MWh	Mega Watt Hours
NCRE	Non Conventional Renewable Energy
N/LAX 01	Unit 01 Machine at New Laxapana Power Station
N/LAX 02	Unit 02 Machine at New Laxapana Power Station
OEM	Original Equipment Manufacturer



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Abbreviation	Description
O/LAX 01	Unit 01 Machine at Old Laxapana Power Station
O/LAX 02	Unit 02 Machine at Old Laxapana Power Station
O/LAX 03	Unit 03 Machine at Old Laxapana Power Station
O/LAX 04	Unit 04 Machine at Old Laxapana Power Station
O/LAX 05	Unit 05 Machine at Old Laxapana Power Station
R&D	Research & Development
R&M	Renovation & Modernization
RLT	Rehabilitation Lease Transfer
ROR	Run-of-River
SCC	System Control Center
SEA	Sustainable Energy Authority
SHP	Small Hydro Power
SPPA	Standardised Power Purchase Agreement
SPS 01	Unit 01 Machine at Samanala Power Station
SPS 02	Unit 02 Machine at Samanala Power Station
WPS 01	Unit 01 Machine at Wimalasurendra Power Station
WPS 02	Unit 02 Machine at Wimalasurendra Power Station



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