

**ENERGY ANALYSIS OF MINI HYDRO SCHEMES
USING PLANT PERFORMANCE DATA**

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Degree of Master of Engineering in Energy Technology

Department of Mechanical Engineering

University of Moratuwa

Sri Lanka

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Thesis submitted in partial fulfillment of the requirements for the degree
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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or institute of higher learning and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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ABSTRACT

In this research project, characteristics of mini hydro power schemes which affect to the performance of the scheme were analyzed. The main objective of the project was to develop an analytical criterion to estimate the variations of the energy associated with small hydropower schemes which plays a major role in feasibility of the mini hydro scheme while fulfilling the other objectives of defining site specific efficiency factors associated with each mini hydro power scheme. For the present model of forecasting annual energy variations, the factors being used for computing anticipated energy losses in and during the sections of weir entrance, head race canal, forebay tank, penstock line, hydraulic turbines and electricity generator are not site-specific and technology specific. Therefore an experimental approach was used in combination with statistical data analysis to develop a relationship between stream flows with scheme characteristics. Electrical power generation, rainfall of the nearby meteorological data measuring stations, plant maintenance records were analyzed and several catchment runoff calculation methods were studied. Four consecutive operational mini hydro schemes were selected and relationships among their operational characteristics were studied during the analysis.

The results of the study show that performance data of adjacent operational power schemes can be used to predict energy potential of a downstream scheme which is situated within 5 km distance from the operational plant. By the proposed model energy potential of a selected mini hydro scheme can be estimated very accurately for the first five months of the year with a slight deviation varies in the range 2% to 11%. But this model cannot be recommended to estimate energy potentials of upstream to the considered operational scheme. This can be used as a simple hydrological resource as this model can forecast energy potentials without using current hydrological data as it associates only performance data of mini hydro power plants.

Key words: mini hydro power scheme, flow duration curve, performance characteristics, turbine efficiency

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TABLE OF CONTENTS

DECLARATION	i
ABSTRACT.....	ii
ACKNOWLEDGEMENT	iii
TABLE OF CONTENTS.....	iv
LIST OF FIGURES	v
LIST OF TABLES	vi
LIST OF ABBREVIATIONS	vii
1. INTRODUCTION	1
1.1. Background	1
1.2. Motivation.....	2
1.3. Aim and objectives of the research	5
2. LITERATURE REVIEW.....	6
2.1. Performance of a mini hydro power scheme.....	6
2.2. Basic definitions regarding energy potential of a mini hydro power plant.....	6
2.3. Hydrological assessment of a mini hydro catchment.....	12
2.4. Energy potential of mini hydro power scheme	18
3. METHODOLOGY.....	21
3.1. Introduction	21
3.2. Procedure for data analysis	22
4. ANALYSIS	23
4.1. Introduction	23
4.2. Forecasting energy generation of downstream scheme by performance data of upstream schemes.....	24
4.3. Forecasting energy generation of upstream scheme by performance data of downstream scheme	29
4.4. Head flow product of the scheme.....	32
5. RESULTS AND DISCUSSION	34
5.1. Present energy estimation criteria	34
5.2. Forecasted river flows	34
5.3. Actual vs forecasted energy	39
6. CONCLUSION AND RECOMMENDATIONS.....	50
REFERENCES.....	52

LIST OF FIGURES

Figure 1.1: Electricity generation in Sri Lanka.....	1
Figure 1.2: Small hydro power capacities in Sri Lanka	2
Figure 1.3: Forecasted Vs actual annual energy generations of mini hydro power plants in Sri Lanka	4
Figure 2.1: Schematic of a mini hydro scheme	7
Figure 2.2: Typical efficiency as a function of percentage of the rated discharge for several types of turbines	10
Figure 2.3: Example of hydro turbine range applications.....	10
Figure 2.4: Typical power conversion scheme of hydro power plant	12
Figure 3.1: Selected mini hydro power plants	21
Figure 4.1: Actual energy generation and predicted energy generation by current model for MH1.....	24
Figure 4.2: Actual energy generation and predicted energy generation by current model for MH2.....	24
Figure 4.3: Actual energy generation and predicted energy generation by current model for MH3.....	25
Figure 4.4: Actual energy generation and predicted energy generation by current model for MH4.....	25
Figure 4.5: predicted energy generation for MH2	26
Figure 4.6: cumulative energy generation for MH2	26
Figure 4.7: predicted energy generation for MH3	27
Figure 4.8: cumulative energy generation of MH3.....	27
Figure 4.9: predicted energy generation for MH4	28
Figure 4.10: cumulative energy generation of MH4.....	28
Figure 4.11: predicted energy generation for MH3	29
Figure 4.12: cumulative energy generation for MH3.....	30
Figure 4.13: predicted energy generation for MH2	30
Figure 4.14: Cumulative energy generation of MH2.....	31
Figure 4.15: Predicted energy generation for MH1	31
Figure 4.16: Cumulative energy generation of MH1	32
Figure 4.17: Head flow product of the schemes	33
Figure 5.1: Flow duration curve and design power curves of MH1 catchment.....	35
Figure 5.2: Design flow vs design power of MH1	36
Figure 5.3: Flow duration curve and design power curves of MH2 catchment.....	36
Figure 5.4: Design flow vs design power of MH2.....	37
Figure 5.5: Flow duration curve and design power curves of MH3 catchment.....	37
Figure 5.6: Design flow vs design power of MH3.....	38
Figure 5.7: Flow duration curve and design power curves of MH4 catchment.....	38
Figure 5.8: Design flow vs design power of MH4.....	39

LIST OF TABLES

Table 2.1: Application range of turbines.....	9
Table 4.1: Project characteristics	23
Table 5.1: Energy comparison of MH1 with criteria-1	39
Table 5.2: Energy comparison of MH1 with criteria-2.....	40
Table 5.3: Energy comparison of MH1 with criteria-3.....	41
Table 5.4: Energy comparison of MH1 with criteria-4.....	41
Table 5.5: Energy comparison of MH2 with criteria-1	42
Table 5.6: Energy comparison of MH2 with criteria-2.....	42
Table 5.7: Energy comparison of MH2 with criteria-3.....	43
Table 5.8: Energy comparison of MH2 with criteria-4.....	44
Table 5.9: Energy comparison of MH3 with criteria-1	44
Table 5.10: Energy comparison of MH3 with criteria-2.....	45
Table 5.11: Energy comparison of MH3 with criteria-3.....	46
Table 5.12: Energy comparison of MH3 with criteria-4.....	46
Table 5.13: Energy comparison of MH4 with criteria-1	47
Table 5.14; Energy comparison of MH4 with criteria-2.....	48
Table 5.15: Energy comparison of MH4 with criteria-3.....	48
Table 5.16: Energy comparison of MH4 with criteria-4.....	49

LIST OF ABBREVIATIONS

Abbreviation	Description
PPP	Private Power Producers
NRE	New Renewable Energy
SLSEA	Sri Lanka Sustainable Energy Authority
MHPP	Mini Hydro Power Project
GIS	Geographical Information System
MH	Mini Hydro