

**DETERMINATION OF OPTIMUM UNIT CAPACITIES
OF FUTURE COAL POWER PLANTS IN SRI LANKA**

Angage Pubudu Asanka Perera

(128880D)

Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

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Declaration

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Abstract

In Sri Lanka, future generation plan includes number of coal power plants according to Long Term Generation Expansion Plan (LTGEP) prepared by Ceylon Electricity Board. Proportion of coal power generation is significant and hence their technology and unit size are important parameters when planning future coal power plants. Therefore, this study focuses on a methodology to determine optimum unit size of future coal power plants in accordance with LTGEP.

System stability constraint is identified as the limiting factor for larger units over conventional 300 MW size. In order to determine the constraint, off peak demand forecasting has been performed for next 20 years. Out of two forecasting methods, multiple regression analysis method is selected and based on off peak demand forecast, stability constraint is determined.

Technologies used for coal power generation are studied along with their advantages and limitations. High efficient supercritical technology is more focused and alternative options have been considered for proposed coal power units in LTGEP considering determined constraint. Accordingly, two cases are selected for financial analysis.

Discounted cash flow analysis is carried out for each case in order to compare supercritical single unit instead of two equal sized advanced subcritical units. Due to long project life time, constant cost basis is used to minimize error of financial forecast. NPV, IRR and LOCE figures were calculated and sensitivity is analysed against fuel price and selling price. Results show that high efficient supercritical unit is more economical than smaller units even under partial load operation condition at off peak period.

Therefore, high efficient supercritical plant is recommended considering other driving factors such as reduction in hazardous emissions, ash products and environmental factors. Furthermore, findings of this study can be used for other technologies as well.

Key words: unit size, regression analysis, supercritical, off peak demand forecasting

Dedication

I dedicate this thesis to my loving parents, who dedicate their life to raise me in higher level and to my ever loving wife.

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2.3.2.3	Setting up Initial values and Forecasting	9
2.3.2.4	Results of Forecasting using Triple Exponential Smoothing	9
2.3.3	Regression Analysis	11
2.3.3.1	Introduction to Regression Analysis	11
2.3.3.2	Theoretical equations of Multiple Linear Regression Analysis	12
2.3.3.3	Coefficient of Correlation	13
2.3.3.4	P- Value	14
2.3.3.5	F- Test of Overall Significance	15
2.3.3.6	Methodology	15
2.3.3.7	Results of Regression Analysis	16
2.3.4	Validation of Results	18
2.3.5	Sensitivity Analysis	20
2.3.6	Comparison with alternative method: off peak Approximation using peak demand	21
3.	Unit Capacity and Technology Options	23
3.1	Technological Options	23
3.1.1	Subcritical Technology	24
3.1.2	Supercritical Technology	25
3.1.3	Advanced Subcritical Technology	26
3.1.4	Ultra supercritical Technology	26
3.1.5	Circulation Fluidizing Bed Technology	27
3.2	Comparison of Technological Options	28
3.2.1	Design aspects	28
3.2.2	Operational aspects	29
3.2.3	Fuel Flexibility	30
3.2.4	Heat rate and Emissions	30

3.2.5	Cost comparison	33
3.3	Unit Capacity Options	34
3.3.1	Feasibility Options for Unit Capacities	34
4.	Financial Analysis	37
4.1	Scenarios for Financial Analysis	37
4.2	Project Appraisal Techniques used	38
4.2.1	Levelised Cost of Energy	38
4.2.2	Discounted Cash Flow Analysis	39
4.2.3	Net Present Value	39
4.2.4	Internal Rate of Return	40
4.3	Assumptions and Data used	40
4.3.1	Plant related assumptions	40
4.3.2	Assumptions for Financial analysis	40
4.3.3	Other data used	41
4.4	Methodology	42
4.5	Results of the Study	43
4.5.1	Base Scenario	43
4.5.2	Carbon Taxation Scenario	44
4.5.3	Scenario of Pump Storage Plant addition	45
4.6	Sensitivity Analysis	46
4.6.1	Sensitivity with Fuel price	46
4.6.2	Sensitivity with unit Selling price	46
5.	Conclusion and Recommendations	48
	Reference List	50
	Appendix A:Cash flow analysis for case –A, 600 MW SC unit (2030-2059)	52
	Appendix B: Cash flow analysis for case –B, 600 MW SC unit (2032-2061)	53

Appendix C: Cash flow analysis for case –A, 2X 300 MW units (2030-2059)	54
Appendix D: Cash flow analysis for case –A with carbon taxation	55
Appendix E: Cash flow analysis for case –B with carbon taxation	56
Appendix F: Cash flow analysis with pump storage plant addition	57
Appendix G: Loan schedule for case –A, 600 MW SC unit	58
Appendix H: Loan schedule for case –A, 2X 300 MW units	59
Appendix I: Adjusted stability constraint forecast considering addition of pump storage power plants	60

LIST OF FIGURES

Figure	Description	Page
Figure 2.1	Past monthly average off peak demand	8
Figure 2.2	Past annual average off peak demand	9
Figure 2.3	Annual off peak demand forecast with stability constraint	20
Figure 2.4	Off peak demand with sensitivity	21
Figure 2.5	Off peak demand using peak demand Vs regression analysis	21
Figure 3.1	Schematic diagram of subcritical boiler	25
Figure 3.2	Schematic of CFB coal plant	28

LIST OF TABLES

Table	Description	Page
Table 1.1	Future coal power plant additions	2
Table 2.1	Off peak demand forecast using time series method	11
Table 2.2	Step 1- analysis of individual variables	16
Table 2.3	Step 2- two variable analysis	17
Table 2.4	Off peak demand forecast	18
Table 2.5	Evaluation of forecasting results	19
Table 2.6	Comparison of results- regression Vs alternative method	22
Table 3.1	Summary of different technologies	23
Table 3.2	Comparison of different technologies	32
Table 3.3	Financial aspect of technological options	33
Table 3.4	Summary of feasible unit capacity/technology options	35
Table 4.1	Options for financial analysis	37
Table 4.2	Plant data for financial analysis	42
Table 4.3	Results of financial analysis- case A (2030)	43
Table 4.4	Results of financial analysis- case B (2032)	43
Table 4.5	Case A- 600 MW supercritical unit with carbon taxation	44
Table 4.6	Case B- 600 MW supercritical unit with carbon taxation	45
Table 4.7	Base scenarios Vs pump storage plant scenario	45
Table 4.8	Coal price sensitivity- case A	46
Table 4.9	Sensitivity with unit selling price- case A	46

LIST OF ABBREVIATIONS

Abbreviation	Description
ASUB	Advanced Sub critical
BFBC	Bubbling Fluidizing Bed Combustion
CEB	Ceylon Electricity Board
CFB(C)	Circulating Fluidizing Bed (Combustion)
DCF	Discounted Cash Flow
GDP	Gross Domestic Production
GHG	Green House Gas
HHV	Higher Heating Value
HP	High Pressure
ID	Industrial Demand
IEA	International Energy Authority
IRR	Internal Rate of Return
LHV	Lower Heating Value
LNG	Liquid Natural Gas
LCOE	Levelised Cost of Electricity
LTGEP	Long Term Generation Expansion Plan
MAD	Mean Absolute Deviation
MAPE	Mean Absolute Percentage Error
MS	Microsoft
MSE	Mean Square Error
NPV	Net Present Value
O & M	Operation and Maintenance
PV	Present Value
SC	Supercritical
USD	United State Dollar
WASP	Wien Automatic System Planning Package