FEASIBILITY STUDY ON COGENERATION FROM DIESEL ENGINE POWER PLANTS IN SRI LANKA

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Degree of Master of Science

Department of Electrical Engineering

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

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Declaration

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Abstract

Sri Lankan power system heavily depends on thermal oil plants and 58% of the annual energy demand is generated by such power plants as at year 2012. The installed capacity of diesel plants in Sri Lanaka is 540 MW. By 2012, all of them operated in open cycle. Exhaust gas temperatures ranging from 300-400 $^{\circ}$C emit to the environment without contributing to much of useful work. With the increase of fossil fuel prices, generation costs have increased significantly. Government is subsidizing the electricity to make electricity affordable to the general public. This results in substantial financial losses to Ceylon Electricity Board.

Exhaust gas can be directed through a heat recovery steam generator, which is able to produce super-heated steam. This superheated steam can be utilized to run a steam turbine in accordance as an application of Rankine Cycle. In this study, cogeneration potential of 100 MW "Heladhanavi" diesel engine power plant is considered. Furthermore, technical, environmental and economic feasibility is evaluated. There is a potential of 4MW power generation through cogeneration. The heat recovery reduces exhaust gas temperature to 230 $^{\circ}$C. Dispersion of flue gas is analyzed with the aid of USEPA Dispersion model and Pasquily Stability Criteria. The existing stack height is sufficient according to dispersion model results. The power generated from recovered heat is able to save six million fuel liters per year and reduce CO_2 emission amounting to 21,000 metric tons per year.

Extending the same methodology for all remaining diesel engine power plants operating in the country, it has been estimated that an overall capacity addition of around 19MW can be achieved through cogeneration.

Project Internal Rate of return has estimated and to be 21.6% at current tariff published by PUCSL, but there are several risks associated with the investment. Main issues to the investors are, remaining periods of power purchase agreements, which are not long enough and the reducing plant factors due to coal plant additions. Therefore, regulatory bodies should identify the potential cogeneration and they should encourage investments.

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TABLE OF CONTENTS Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

LIST OF APPENDICES

Appendix Description Page

LIST OF ABBREVIATIONS

CEB – Ceylon Electricity Board

IPP – Independent Power producer

CHP – Combined Heat and Power

LTL – Lanka Transformers Limited

LV – Low Voltage

MV – Medium Voltage

HV – High Voltage

US – United States of America

EPA – Environmental Protection Agency

CEA – Central Environmental Authority

USCPI – United States Consumer Price Index

PPA – Power Purchase Agreement

SPPA – Standard Power Purchase Agreement

IRR – Internal Rate of Return

Pvt – Private

Ltd – Limited

PUCSL – Public Utilities Commission

PUPRA -Public Utility Regulatory Policies Act

HFO – Heavy Furnace Oil