Title: Cost Effectiveness Study of An Existing Combined Cycle Power Plant Improvement

Name of Student: Kanyarat Tankong **Student ID**: 52910416

Name of Supervisor: Dr. Athikom Bangviwat

ABSTRACT

The degradation of an existing combined cycle plant was investigated, and possible modifications for performance improvement were explored. The case study of Bangpakong Combined Cycle Power Plant was analyzed regarding plant performance, cost effectiveness and economic benefit using the Gate cycle model. The degradation of the power plant was analysed and compared with GE's guaranteed performance guide, and found that net output improvement and net heat rate improvement of gas turbines were negative, where net heat rate improvement was approximately -12.7%. It is therefore implied that an improvement in the performance of the gas turbine would be most effective. For applications where significant power demand occurs during the high ambient temperature, a useful option for increasing output is a gas turbine air inlet cooling system. Different types of air inlet cooling systems, such as evaporative system, mechanical chiller system and absorption chiller system were considered. The inlet temperature, parasitic load and flue gas temperature were the key factors that contributed to the improvement of the combined cycle plant's performance. The evaporative system was found to provide the greatest heat rate improvement, while the absorption chiller system was found to generate the greatest power augmentation at 2.5%. The cost effectiveness analysis showed that the evaporative cooling system was the best alternative option for performance improvement for the BPK combined cycle power plant with the net present value of US$ 730,001 in 8 years of useful life, while the primary energy saving dropped by 0.58%.

Keywords: Combined Cycle Power Plant, Primary Energy Saving(PES), Feasibility, Gas turbine air inlet cooling system