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Portfolio Optimization for a Long-term
Electric Energy Supply Planning
-A Case Study of Thailand-

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SUMMARY OF MASTER'S DISSERTATION

Student Identification Number	81433288	Name	Thampibul Siwanon
Title Portfolio Optimization for a Long-term Electric Energy Supply Planning – A Case Study of Thailand –			
Abstract As a result of high gas dependence, Thailand's gas reserves was estimated to deplete in the very near future. There was an evidence that the gas price volatility is the most critical factor affecting the country's energy vulnerability. Consequently, the issues have caused the country's energy security to reduce continuously. Although most of the previous studies regarding electricity supply planning have attempted to mitigate the energy security and environmental issues, the conventional studies have employed a least-cost approach based on a constant cost-per-megawatt model without considering the economies of scale effect, whereby costs decrease with an increase in plant size. Moreover, the conventional studies have neglected to consider fuel prices in a dynamic manner. As a result, using the conventional approach, which neglect the effects of economies of scale and dynamic fuel price, may lead to improper decision making. This paper introduces a revised least-cost optimization approach considering the economies of scale effect and dynamic fuel prices to provide a more precise and more optimal decision support for a long-term electricity supply planning in Thailand. The costs of electricity generation considered in this paper are estimated according to the technology level to precisely reflect the actual costs needed to construct and operate new plants. The paper considers 20 generation technologies, including conventional, renewable, and emerging technologies such as carbon capture and storage and integrated gasification combined cycle. The results from analyses show that the total system cost with the economies of scale effect is much lower than that without the effect. Additionally, the optimal generation mix obtained from the proposed framework is reasonably robust against changes in fuel prices, heat rate, plant capital investment and operation and maintenance cost. Also, it is observed that Nuclear and Wind are potential options for the carbon capture and storage technology as the key technologies to build a low-emission society in Thailand.			
Key Words: Electricity supply planning; Dynamic models; Economies of scale; Energy security			