SUPPLY SECURITY IMPROVEMENT OF ELECTRICITY EXPANSION PLANNING AND CO₂ MITIGATION IN INDONESIA

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A THESIS SUBMITTED AS A PART OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ENERGY TECHNOLOGY

THE JOINT GRADUATE SCHOOL OF ENERGY AND ENVIRONMENT AT KING MONGKUT’S UNIVERSITY OF TECHNOLOGY THONBURI

1ST SEMESTER 2009

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Thesis Title
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ACKNOWLEDGEMENTS

I would like to acknowledge The Joint Graduate School of Energy and Environment (JGSEE) at King Mongkut’s University of Technology Thonburi (KMUTT) for providing scholarships and the Sirindhorn International Institute of Technology (SIIT) at Thammasart University for providing the facilities for my study.

I would like to express my gratitude to Assoc. Prof. Dr. Bundit Limmeechokchhai, my advisor, for his invaluable supervision and contribution provided during my study. I also would like to thank my thesis committee members: Asst. Prof. Dr. Chumnong Sorapipatana, and Dr. Athikom Bangviwat for guiding me and sharing their knowledge with me. Importantly, I would like to convey my gratitude to my external thesis examiner, Assoc. Prof. Dr. Supachart Chungpaibulpatana, for his helpful advice.

I am especially thankful to my parents and my family for their love, care and support to pursue my studies and my interest throughout my life. Finally, I would like to express my deep appreciation to all the people on 5th floor of Mechanical Engineering Laboratory, SIIT for their kindness and hospitality during my research.
Electricity, as one of the final energy forms, plays a very important role in supporting various economic activities to increase people’s welfare. Most developing countries urgently need electricity for their economic development; on the other hand, economic prosperity brings a strong growth of electricity demand. Indonesia, as one of the developing countries, needs to expand its electricity generation in order to fulfill electricity demand in the future as well as to support economic development. Currently, the Indonesian government’s policy aims to promote coal utilization for power generation. This effort is to help reduce oil utilization as well as to increase energy source diversification. However, one of the major concerns of electricity generation using coal is its environmental emissions. This issue has become of wide interest to the public and it is likely to remain an influential hurdle for electricity capacity expansion in the future. Indonesia’s electricity sector has two challenges: on one side, it needs to improve electricity security supply, and, on the other side, concern for environmental protection.

Indonesia needs to expand its electricity generation in order to fulfill electricity demand in the future as well as to support economic development. The expansion needs to consider clean and abundant energy sources to achieve affordable energy prices, system reliability, and environmental impact. Furthermore, the effort to conduct energy efficiency and promote energy saving behavior by the Indonesian people is one of several ways to support energy security improvement.

The Long-range Energy Alternatives Planning (LEAP) model is used in this research as the analytical tool. The results show that using geothermal energy as an electricity supply source, together with reducing T&D loss and demand side management (DSM) options through implementing energy efficiency in the household sector, would save more generation capacity as well as mitigate CO₂ emissions from the power sector. However, in terms of total
system cost, it is not going to be the lowest total system cost since it uses geothermal energy. This is due to the fact that geothermal energy investment is more expensive compared to other energy sources. In Indonesia, the electricity supply must be secured to meet future demand, but also a clean electricity supply must be developed as well as renewable energy utilization, particularly from geothermal energy resources.

In the worst case analysis, due to the government’s plan, various Indonesian coal types have been analyzed in order to determine what type would be the most suitable for electricity generation fuel. The economic value of this fuel as well as its CO₂ emissions must also be considered. Furthermore, Indonesia needs to develop its clean coal technology to answer those challenges. The steps to decrease environmental impact and electricity production cost are by considering several aspects, such as pre-combustion, ongoing combustion and post-combustion. Combinations of affordable energy sources, in terms of price by using abundant domestic resources and advanced technologies, would help Indonesia to increase its energy security in the long term as well as the sustainability of the environment.

**Keywords:** Electricity supply security in Indonesia, LEAP model, Indonesian coal, geothermal energy, demand side management, CO₂ emissions mitigation.