

論文 / 著書情報
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論文審査の要旨及び審査員

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論文審査の要旨（2000 字程度）

Title: Scientific evaluation of energy policies: electricity mix decision-making in Japan and international electricity prices in developed countries.

Chapter 1: “Introduction”, explains nature of energy policy and research motivation and general overview of world energy outlook, and introduces two main themes in thesis. Achieving energy policy goals requires balancing different and often competing policies related to 3Es (economic growth, energy security, environmental protection) and renewed importance of public safety. As reaching agreement among various stakeholders whose interests sometimes conflict sharply with each other, it is essential that scientific approaches be applied to organize, analyze and propose rational solutions to controversial, mixed energy policy issues. Key trends of the world energy outlook are that continuous growth of world energy demand, transition to reduced CO₂ emissions, growing introduction of renewable energy and electrification. As the world final energy consumption shifts more to the electricity, energy policy on electricity has become more important. The first theme is about one of the toughest challenges in the recent energy policy of Japan’s choice of future electricity mix after the Fukushima accident by using Analytical Hierarchy Process (AHP), discussed in Chapter 2. Consequently, the second theme deals with panel data model focusing on the electricity prices and possible determinants of electricity prices such as progress of electricity market reforms and introduction of renewable energy in Chapter 3. Both themes are typical in energy policy to deal with trade-offs of multiple policy objectives.

Chapter 2: “Influence of Safety Risk Perception on Post-Fukushima Generation Mix and its Policy Implications in Japan”, reviewed the discussion on the post Fukushima Japanese energy policy to assess the historical role of nuclear energy in achieving the traditional 3Es policy goals and renewed importance on safety. A three-layer AHP model with the 3Es and two opposing views on safety – nuclear free view and scientific measurement of safety - was introduced to examine three electricity generation mix scenarios in 2030 proposed by the Japanese Government. Results of the model show that the highest nuclear power proportion scenario of 20% nuclear in the generation mix is the most appropriate when safety is measured with human fatalities as a scientific

measurement of risk. Although this may appear contradictory to the public preference of eliminating nuclear energy in Japan, the statistically low human fatalities, when scaled to unit electrical power generated, indicates that it is the safest electricity generation mix. Sensitivity analysis on changing safety weights also revealed that opposing views on safety result in choosing different electricity generation mixes in higher safety weights. The AHP model showed the effectiveness of scientific approach to policy decision-making.

Chapter 3: “Renewable energy’s impact on international household electricity price in liberalized electricity markets – panel data analysis on selected developed countries”, introduces historical energy policy development of electricity market reform and introduction of renewable energy that would affect electricity prices. The following three main research questions are examined in this Chapter. 1) Whether electricity market reforms achieved lower household electricity prices, 2) whether introduction of renewable energy increased household electricity price, and 3) how to measure or model the different effect of market reforms and introduction of renewable energy on household electricity prices in the model. By constructing two novel panel data models, impacts and significance of multiple explanatory variables such as level of electricity market reforms, percentage of renewable energy are examined using internationally comparable data from 1991 to 2014 for seven selected OECD countries. The analysis suggests that lower household electricity prices are associated with the evolution of regulatory reform on the electricity market. It also concludes that the share of renewable energy in electricity generation is not statistically significant. Notable implication to energy policy is that, in theory, increasing renewable energy with low marginal generation costs can potentially lower electricity prices in the future in a deregulated electricity market that has a spot or dynamic electricity exchange market.

Chapter 4: “General Conclusion”, summarizes overall conclusion and achievements made. Future works include application of the AHP model to a variety of scenarios such as evaluation of ambitious renewable energy introduction scenarios and further development of panel data model with more countries for better application of Generalized Method of Moments. Implications of this research on Japanese energy policy are also explored based upon these two research themes.

Based upon the thesis chapter summaries above, which describes novel research conducted on international energy policy, this thesis meets the conditions for conferment of the degree of Doctor of Engineering as agreed upon by the committee.

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