Abstract

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Strategies for the Symbiotic Development of Renewable Power and Nuclear Power under the 'Renewable Energy 3020' Policy in South Korea: Technical Solutions for Expanding Renewable Power Generation

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Abstract

In recent years, the Korean government has implemented the 'Renewable Energy 3020' policy to substantially expand renewable energy without the inclusion of nuclear and coal-fired power plants. Korean government needs to consider the effects of technological innovation, changes in market, and the possibility of social consensus deduction. The Wien Automatic System Planning (WASP) model was used to verify the implementation of the long-term power development plan within specified constraints. The extension methodology of renewable power equipment was verified using the WASP model, which provides the basis for the application of scientific logic and suggestion to drive the national energy transition policy efficiently. Currently, technological and economic uncertainties related to nuclear and renewable power generation need to be investigated. Thereafter, energy transition needs to be examined to promote an alternative energy policy considering the technological innovation and the social consensus. The national energy transition policy will likely succeed, if based on the accurate technical planning and evaluation of the symbiotic strategies for nuclear and renewable power generation. In addition, to achieve the goal of expansion of renewable power generation to 20% of the total power by 2030, an additional cost of approximately 144 billion KRW will be incurred, according to WASP model simulations not considering transmission and distribution networks and backup generator installation costs [1]. In this study, it was found that the construction of a win-win structure for renewable and nuclear power generation has been driven by multiple angles of logic based on energy conversion plans related to the 'Renewable Energy 3020' policy; however, there is a limit to valid possibilities if existing research methodologies are used. This study is lacking in that it does not review humanities and social scientific logic with respect to the energy market and industrial structure. This study suggests a mutually beneficial role promotion through a new complex scientific logic that considers wider economic and social policies. To promote energy conversion centered on renewable energy using the existing methodology, one must be aware that there are limits to utilizing them to formulate long-term power supply plans. Particularly, in the case of a mid-term plan within 15 years, the need to develop a logic for improving upon and complementing existing methodologies, such as WASP, with the aim of minimizing costs by reducing the planning period, is urgent. Therefore, there is a need to review international joint research projects. The energy conversion policy in this paper recommends a long-term vision of at least 30 years. In the short- and mid-terms the second-best energy conversion policy should be accepted, considering execution efficiency. To do this, the best technologies in this field need to be reviewed because the substantial part of achieving the 'Renewable Energy 3020' policy goal involves building facility and capacity. Also, only a combination of energy saving and variable renewable energy (VRE) can achieve the goal; alternative plans may be reviewed.

Biography

Hyung-Man Kim is currently Chair Professor of Mechanical Engineering at INJE University and the Director of the National Leading Research Laboratory of regenerative fuel cell. His academic career started with a Bachelor's and a Master's degree, both in Mechanical Engineering from Seoul National University, Korea, followed by a Ph.D. degree at the University of Tokyo, Japan, in 1997. Professor Kim is an internationally renowned expert in energy engineering and is distinguished for his seminal contributions in the areas of fuel cells, multi-scale multiphase heat and mass transport with electrochemical reactions, computational modeling, integration and control of regenerative fuel cell with photovoltaic cell, renewable energy of ocean kinetic energy harvester, distributed generation, smart grid, and sustainable energy for global environment. He is an author/co-author of over 100 journal papers. His scientific research has been recognized by many recent awards, including ISE Fellow Award, the INJE Distinguished Scholar Award, and Academic Award for the Fuel Cell Research Achievement. In addition to his scholastic achievements with outstanding research credential, he has also received many teaching excellence awards, including the Award for the student mentoring at Teacher's day and Grand Prize of the Regional Brain-Korea 21 Directors. In the international community, Prof. Kim has served as reviewer and has been a member of the editorial board for more than 20 international journals.

