

CAN THE FUSION POWER BE A VIBLE OPTION BY INCORPORATING THE EXTERNAL COST OF ELECTRIC POWER TECHNOLOGIES IN KOREA? - ANALYSIS WITH TIMES MODEL

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Overview

The TIMES (The Integrated MARKAL-EFOM System) model, a bottom-up model of the Korean electricity energy system, is used to examine the potentials of fusion power by internalisation of external costs from power generation. The TIMES model analysis imposes additional charges on electricity production, which reflect the socio-economic costs from climate change (carbon dioxide), decommission, risk of accidents, safety and policy costs. The model covers a 40-year period to 2050 and shows that the potential of fusion power alter dramatically by changing carbon dioxide goals and nuclear constraints.

Methods and Data

TIMES is an economic model generator for local, national or multi-regional energy systems; it provides a technology-rich basis for estimating energy dynamics over a long-term, multi-period time horizon. It is usually applied to the analysis of an entire energy sector, but may be also applied to study in detail single sectors (e.g. the electricity sector in Korea). Reference case estimates of end-use energy service demands (e.g., car road travel; residential lighting; steam heat requirements in the paper industry; etc.) are provided by the user for each region. In addition, the user provides estimates of the existing stock of energy related equipment in all sectors, and the characteristics of available future technologies, as well as present and future sources of primary energy supply and their potentials. Using these inputs, the TIMES model aims to supply energy services at minimum global cost (more accurately at minimum loss of surplus) by simultaneously making equipment investment and operating, primary energy supply, and energy trade decisions, by region (Loulou, et al., 2005).

External cost values used in this study have been derived from the calculated outcomes of Japanese government in December 2011 after Fukushima accident. For the purpose of internalisation of the external cost within the total electricity cost, the Japanese result was adjusted to reflect the Korean electricity sector level of aggregation. External costs are implemented in the TIMES model by multiplying the amount of electric power generated from each power plant during each time period with corresponding external cost.

Results and Conclusions

The TIMES model results indicate that substantial changes in the electricity generation system in favour of fusion power induced by incorporating external costs, carbon dioxide limits and constraints on the nuclear power. However, these changes lead increase of overall electricity energy system costs compare to the business as usual case.

This paper provides the insight that fusion power needs to be more economic technology alternative because it demands a lot of constraints and limitations on conventional energy system to penetrate into the market.

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