

The Effects of Sectoral and Regional Partial Participation of Global Warming Mitigation Coalitions based on Multiregional and Multisectoral Dynamic Energy Economic Model THERESIA

Topic: Environmental Input-Output Modeling

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It is well known that the global warming mitigation policy agreement is still far from the international consensus while the scientific community such as IPCC report has cautioned the need for the action. Thus, the short-term policy actions for the global warming mitigation such as carbon emission trading or voluntary actions will not include all world regions or economic activity sectors.

When carbon control policy covers only limited countries, so called "carbon leakage" issue, where the high carbon intensity industries in these regions move to the countries with no carbon policy and export the products, would arise. Although this behavior is rational for the economic reasons, it could, however, increase the global GHG emission when the energy efficiency in the developing regions is lower than that in the developed countries. Therefore the demand-side based emission accounting has been focused on and assessed based on the international input-output tables.

However, this method still fails to represent the emission responsibility sharing of the electric power generation between producers and consumers. When the consumers are responsible for all of the GHG emission of electric power generation, the effort of power generators who implement the low carbon emission technology is not explicitly evaluated. Furthermore, the outcome of the above partial participation with respect to the sector and/or the region is not assessed.

This paper aims at the assessment of the sectoral/regional partial participation in the global warming coalition as well as the above responsibility sharing between consumers and generators. The author applies the multiregional and multisectoral dynamic energy economic model THERESIA for the assessment. This model developed by the author deals with 15 world regions, 12 non-energy industry sectors and 7 energy sectors to assess the middle-to-long term global warming policies based on GTAP and Energy Balance Tables.

This study consists of the following three steps: firstly, the carbon emission of power generation sector is distributed between the consumer and the generator according to the conversion efficiency, i.e. the generator is responsible for $(1.0 - \text{efficiency}) \times (\text{total carbon emission})$ and the consumer is for $\text{efficiency} \times (\text{total carbon emission})$. Secondly, the carbon emission is embodied in the products by industry sector. Thus indirect carbon trading embodied in the commodities can be calculated. Finally, THERESIA simulations compare the outcomes of regional/sectoral participation where (1) a case when only iron and steel industry, chemical industry and power generation industry participate in the warming coalition, (2) a case only ANNEX-I regions in Kyoto protocol participate in the warming coalition, and (3) other various participation scenarios. The comparison between the conventional accounting based on the primary energy consumption and the above accounting is also established under various carbon control policies and participation scenarios.

The simulation results suggest that (1) this method clearly shows the indirect carbon emission embodied in the production structure reflecting the difference in the energy supply structure, (2) the carbon emission accounting method influences the international industry structure and GDP losses under the global carbon emission policies, and (3) when carbon emission is embodied in the products, indirect "carbon export" often exceeds the "carbon import" embodied in the commodities in the OECD regions.