Title: Analysis of Asian Long-Term Climate Change Mitigation in Power Generation Sector

Authors: Fuminori Sano*, Keigo Akimoto, Takashi Homma, Jyunichiro Oda, Kenichi Wada

* corresponding author

Address: 9-2 Kizugawadai, Kizugawa-shi, Kyoto 619-0292 JAPAN

Phone: +81-774-75-2304 **Fax**: +81-774-75-2317

E-mail: sanofumi@rite.or.jp

Overview:

Recent Asian share of total primary energy supply in the world is about one third. It is expected that this share will grow further in foreseeable future because of the current rapid economic growth of Asia including China and India. On the other hand, climate change is one of the important global issues and CO_2 emission reduction will be required. From this perspective, energy efficiency improvement and low carbonization in Asia will be a key factor for combating climate change.

In power generation sector which is a large CO_2 emitter, nuclear power generation, CO_2 capture and storage, and renewable energies such as wind power and PV are expected as effective technologies for reducing CO_2 emission. However, future cost, social acceptance and etc. of these technologies have uncertainty. In this paper, Asian climate change mitigations in power generation sector with considering uncertainty of the above three technologies will be quantitatively analyzed by using DNE21+ model which is a world energy systems model.

Methods:

DNE21+ model[1)] which is a world energy systems model is used for quantitative analysis. This model is an optimization type linear programming model, minimizing the total worldwide energy system costs over all the assessment period (up to 2050).

The salient features of DNE21+ Model are as follows.

(1) The world is divided into 54 regions in country level in this model. Asia is divided into 15 regions (e.g., Japan, Korea, China, India, Indonesia, Thailand). This regional segregation enables to analyze with regional differences in consideration (e.g.,

potentials of renewable energy).

(2) The energy supply sectors including power generation sector are connected to the energy end-use sectors, energy export/import are considered, and the lifetimes of facilities are taken into account, so that assessments are made while maintaining complete consistency across the energy supply and demand sides. Furthermore, around 300 specific technologies are modeled and it enables to assess climate change mitigation measures in detail.

Baseline scenario (scenario without CO_2 mitigation policy) and some CO_2 constraint scenarios (e.g., Halving global CO_2 emission by 2050 relative to 2005) are calculated by using DNE21+ model. Climate change mitigation in power generation sector for Asian countries is analyzed through comparisons among the scenarios.

About the uncertainty of the technologies, some cases (e.g., no CO_2 capture and storage scenario) are set-up and their impacts will be analyzed.

Expected Results:

(1) The impacts of the above three technologies on climate change mitigation measures are large and energy supply and demand will be changed drastically. For example, if CO_2 capture and storage cannot be used until 2050, fossil fuel consumptions should be substantially reduced for achieving CO_2 emission reduction. The economical impacts (CO_2 marginal abatement cost and total CO_2 abatement cost) are also discussed quantitatively based on model analysis.

(2) The impacts of Asian climate change mitigation on global climate change mitigation are large, because Asian CO_2 emission in Baseline scenario will grow largely according with energy demand increase, especially coal. In other words, ambitious global CO_2 emission reduction will not be achieved without contributions of Asian countries to CO_2 emission reduction.

References:

1) K. Akimoto, F. Sano, T. Homma, J. Oda, M. Nagashima and M. Kii, “Estimates of GHG emission reduction potential by country, sector, and cost”, Energy Policy, Vol.38, Issue 7, pp.3384-3393 (2010)