Systems Analysis Group

Studies that aim to contribute to international discussions and negotiations on climate change policy

1. Overview of research activities

Systems Analysis Group conducts policy-related studies of global warming mitigation. The current major subjects are 1) quantitative determination of the atmospheric concentration stabilization level of GHGs that is stipulated qualitatively in Article 2 of UNFCCC in order not to interfere with the climate system, and Post Kyoto Protocol that will stipulate the international regime of emission reductions after 2012. The latter is rather urgent and its official discussion has now started. The former is an essential issue of great importance that influences the latter. In addition to these issues under UNFCC, APP (Asia Pacific Partnership on Clean Development and Climate) one of whose aims is emission reductions through diffusion of energy efficiency technologies has been launched. This is a regional agreement based on a so-called action-oriented approach. The figure shows these issues and the objectives of the two research projects of RITE, "PHOENIX" and "Beyond 2010" with respect to the related international trends.

2. "Beyond 2010"

In last year's RITE Today booklet, we introduced an analysis of emission reduction measures and reduction costs required to achieve top-down emission reductions which are imposed on each country (top-down targets) according to various by employing a world energy model having a high regional resolution, which is intended to contribute to international discussions on Post Kyoto Protocol. Expanding this energy model, we have conducted a study to evaluate emission reduction effects and costs of imposing energy efficiency targets or specific emission targets on each industry sector (bottom-up target). The proposal of bottom-up targets is being made because economic growth and CO_2 emissions have a strong correlation with each other and such international regimes as imposing a cap on emissions by country like KP are considered difficult to fall into agreement, especially developing countries that aim at large economic growth and are unwilling to participate in such regimes as imposing emission caps on each country and may interfere with their economic growth. In order to achieve both economic growth and emission reductions, introduction of high-energy efficiency technologies is inevitable and therefore energy efficiency targets are expected to be more easily accepted by many countries. It is well known that Japan's energy efficiency is high and we have made an evaluation of the effects of introduction of energy efficiency targets using Japanese efficiency levels as a reference by use of the expanded world energy model. APP, which was launched in January 2006 aims at technology cooperation involving developing countries of large emissions such as China and India which are not obligated to reducing emissions under KP. We also evaluated the effects of energy efficiency target introductions for the six participating countries of APP and determined that approximately the same amount of emission reductions are possible at a much smaller cost through introductions of these targets at current Japanese levels with regard to the power, steel and cement sectors for the six countries to that of the KP case. This result is valuable in showing the effectiveness of the APP regime in terms of emission reductions.

3. "PHOENIX"

PHOENIX stands for Pathways toward Harmony of Environment, Natural Resources and Industry Complex and attempts to determine a desirable target for long-term emission reductions considering both warming impacts and emission reduction costs. In the past, the approach by use of integrated assessment models has been known for the above objectives. The integrated assessment model typically evaluates the warming impacts in monetary terms, expresses them as functions of temperature rise, and explores such temperature rise as minimizes the sum of mitigation costs and damage costs, while also exploring the corresponding concentration stabilization levels of GHGs.

However, the warming impacts range over various areas and the cost minimization approach is not free from personal value judgments in monetary evaluation of such impacts as on biodiversity, human health etc. In addition to the above problem, the approach veils the regional distribution of impacts when summing up impacts throughout the world and also inevitably makes some value judgments on equity between future generations in obtaining the total sum of time series impacts. Thus, the PHOENIX project certainly intends to make quantitative evaluations of warming impacts by region and by time point but not necessarily in monetary terms during the evaluation process,

but it is at the final stage that value judgments are made on impacts together with mitigation costs to seek the desirable level of concentration stabilization. The detailed procedure on this approach is as follows; the future reference scenario of emissions is generated based on the IPCC SRES scenario, emission paths of 650, 550 and 450 ppm stabilization are set up based on the IPCC WG1 stabilization paths; then the climate change is calculated for each of the paths and various kinds of impacts are evaluated for the calculated climate changes; the mitigation costs are calculated in order to achieve the stabilization down from the reference path. Quantitative evaluations were possible only for sea level rise, agriculture products, human health, terrestrial biodiversity, water resources and ocean acidification as continuous events and ocean thermohaline circulation as abrupt and catastrophic events. In addition to these impacts, those on forestry, fishery, livestock, other industries, extreme weather, west Antarctic ice-sheets and Greenland ice are being studied around the world and their impacts are expected to become large as a result of climate change but the quantitative evaluations for the above emission paths were hardly possible. As for the thermohaline circulation, the impact of the circulation collapse is not very clear but it is not unreasonable to assume extremely large impacts on ocean ecology and related areas. Catastrophic events like this should be evaluated in terms of occurrence probability rather than the damage size from the viewpoint of precautionary measures and we calculated the probability of the circulation collapse for each of the stabilization emission paths and the reference path, by use of the evaluation result of the collapse by Stocker et al and the probability density function of climate sensitivity. Here it should be noted that it is between 2150 and 2200 when the collapse takes place. Other kinds of impacts than the theromohaline circulation were evaluated by region and at the time points of 2050, 2100, and 2150.

The final step is to obtain expert judgments on the desirable level of stabilization by providing all these evaluation results of impacts and mitigation costs. However, the results spread over wide areas and amount to a large volume, and we asked for preliminary judgments of experts on the relative importance of alleviations for five kinds of impacts which result from stabilizing at different levels. From the judgment results, we inferred the desirable level that each of the experts suggest, and finally provided to each of the experts all the important results of our study together with the desirable level which each of the experts is considered to suggest from the preliminary judgment, and obtained the final judgment of the experts on the desirable level of stabilization. For the final judgment, we prepared tables, graphs and geographic figures to help them understand easily the full evaluation results on impacts and mitigation. We also inquired as to how much importance the expert placed on each of the impacts, mitigation costs, regional differences and temporal differences in their judgment of a desirable stabilization level. We are now analyzing the expert judgment results and will publicize the results, which can be expected to offer significant contributions to climate policy making.

As described in the above, the Systems Analysis Group endeavors to incorporate new methodologies and tools into the accumulated expertise of the past and is carrying out research to help solve current important issues regarding climate policy.

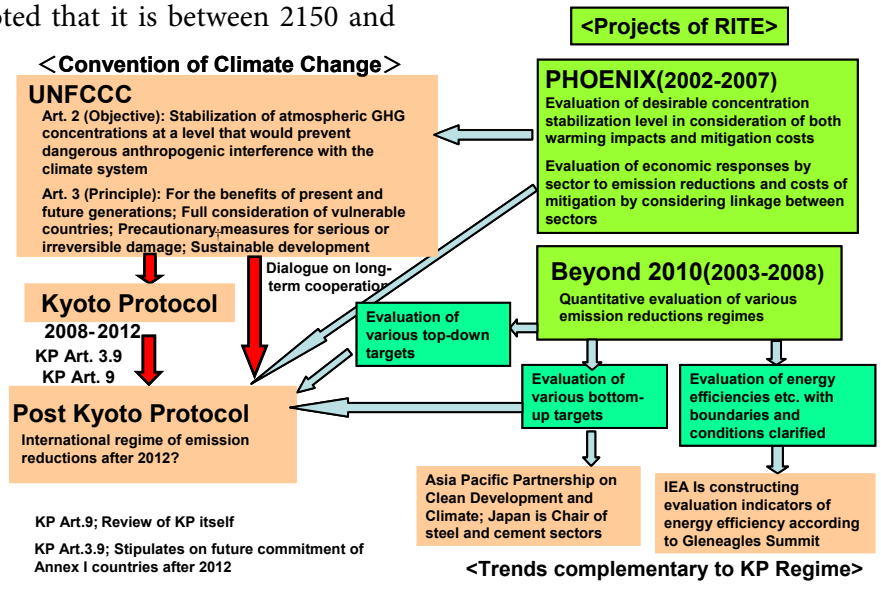

Fig. International Trends concerning Climate Policy and Aim of RITE Research