TOWARD A NEW CLIMATE REGIME ESTABLISHMENT (6) ECONOMIC ASSESSMENT OF EMISSION PATHWAY

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Overview

In order to benefit the establishment of a new international agreement against global warming under the Durban Platform, a new global emission pathway named Z650 was proposed based on the schemes of zero-emission and overshoot[1), 2)]. Examinations of climate science indicated that the Z650 could avoil long-term risks while meeting the short-term need of relative large emissions. Global energy system optimization suggested an economically rational and technologically feasible long-term global energy mix could be achieved based on the current and foreseeable technologies to realize the Z650. However, it is necessary to make sure that the emission pathway is advisable or favourable for the actual use in the actual world. Therefore, this paper investigates the comprehensive impacts of the Z650 to the economy as a whole.

Methods

The Dynamic Integrated Model of Climate and the Economy (DICE) and its regional version (RICE) were employed to carry out long term projections in this paper after several modifications.

Three global emission pathways were analyzed. Besides the assessment target, Z650, two GHG concentration stabilization pathways of 450ppm (C450) and 500ppm (C500) were selected to be comparison cases. A business as usual (BAU) case was also projected to be the analyzing reference.

Numerical projections were executed in a period of 600 years for DICE and a period of 300 years for Rice, both starting from the year of 2005 and with a 10 years interval. The time series cost, climate damage, and marginal abatement cost were examined, and the total economic performance during the 21st century of the three pathways were analyzed and compared.

Results

1) Global assessment results

The mitigation costs in the case of C450 will be highest especially during the 21st century, with a peak in the mid-century of about 1% of toal GDP. The same costs in the other two cases derease the peak to about 0.7% of GDP. All the three cases will converge beyond the 21st century.

Increasing climate damages will occur in all the three cases. During the all period, the damage will be higher in the case of C500 than in the case of C450. The damage in the case of Z650 will be the same level with the case of C500 during the early stage till 2080, then decrease to the same level of C450.

The marginal abatement cost in the case of C450 increases rapidly during the 21st century till $800 per tone of CO2, but will stabilizes there after. The same cost in the case of C500 will be quite lower during the first half of the century, but will catch up guradualy with the case of C450. In the case of Z650, almost the same cost with the one in the case of C500 till 2070's, but will increase constantly due to the zero emission in the mid-22nd century.

The total economic performance during the 21st century were evaluated through summing up the cumulative mitigation cost and damage reduction. The results in all of the three cases show negative performance. That means that the mitigation actions will cause economic loss even though the climate damage reduction was taken into account. However, the same performance beyond the century show passive results, means future benefits could be expected. Among the three cases, Z650 show a relative best performance in the all period, especially after 2050.

2) Regional assessment results

A relative large differences were projected among regions. Compared to the case of BAU, lager GDP losses occur in China, Russia and Eurasia with the peak of over 3% in 2050's, while the loss in EU is about 1%, in the case of C450. In the case of Z650, the losses in China, Russia and Eurasia could be reduced significantly, the peak will be delayed to 2070's, and the peak value will also be decreased to less than 2.4%. At the meanwhile, the decrease of loss in EU is not significant. On the other hand, the differences of climate damage between the cases of C450 and Z650 were very small.

National comparison show that the total economic performance could be largely improved in China, United States and Japan in the case of Z650 compared with the case of C450. However the improvements in EU, India and other Asian countries were not significant.

Conclusions

The comprehensive economic performance of the proposed global emission pathway, Z650, was evaluated together with GHG concentration stabilization pathways, C450 and C500, using integrated assessment models.

Both global and regional analysis show a better performance of Z650 than the other two cases.

Regional investigation suggests benefit of Z650 than C450 occurs in an unequitable way.

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