

Systems Analysis Group

Technological perspectives toward “Cool Earth 50” and analysis for mid-term targets

1. Introduction

The issue of climate change was discussed as a main theme at the G8 summit held in Toyako, Hokkaido, in July, 2008. The summit leaders have declared that “We seek to share with all Parties to the UNFCCC the vision of, and together with them to consider and adopt in the UNFCCC negotiations, the goal of achieving at least 50% reduction of global emissions by 2050.”

Meanwhile, the discussion has been held in the context of scientific insights into the global warming issue and progress in the implementation of measures against global warming at various places in Japan and abroad. For instance, the IPCC fourth assessment report was released in 2007, and the Kyoto Protocol entered into force in 2008. The global warming issues have been paid much attention by the public, and the related articles are frequently covered by the media.

Currently, discussions and negotiations at global level have proceeded, aiming at an achievement of agreement on a new international framework and targets with regard to global warming after 2013 at the 15th Conference of Parties (COP) to the UNFCCC to be held in Denmark, December, 2009.

The Systems Analysis Group has been conducting studies on the issue of climate change by using systematic approaches in order that the public can understand such a wide and complex issues and search for a better solution. In addition, our research activities play an important role in an international discussion on the post-Kyoto framework.

This article introduces some of our analysis on the mid-term (by the year 2020) and long-term (by the year 2050) targets for CO₂ emission reduction, on the total costs to achieve these targets, and on concrete measures for emission reduction.

2. Analysis and assessment of long-term target

A former Prime Minister, Shinzo Abe presented “Cool Earth 50” on May, 2007, which aimed to halve global GHG emissions by 2050 relative to the current level.

Moreover, a former Prime Minister, Yasuo Fukuda announced “Fukuda vision” on June, 2008, which proposed a target of halving global CO₂ emissions by 2050 relative to the current level, and Japan’s goal of reducing its emissions by 60 to 80 % relative to the current level.

The attempt of sharing the long-term vision for emission reductions on a global basis is of great significance, however, it will be hard to realize the vision

of halving global emissions by 2050.

Given the fact that current emissions of developing countries are the same level as those of developed countries, the vision can be interpreted that even if developed countries achieve no emissions, developing countries are required to limit their emissions to the current levels in 2050.

On the other hand, the emissions of developing countries have nearly doubled in less than the past 20 years since 1990, and it is understandable how hard it is to limit their emissions to the current levels in just over 40 years.

In fact, at COP14 held in Poznan, Poland, December, 2008, developed countries sought for sharing of the vision of halving global emissions, however, consensus from developing countries was not achieved.

On the other hand, it stands to reason that it is necessary to reduce a significant amount of global emissions in the long term. To achieve this, it is required to analyze what types of concrete measures should be taken and what kinds of R&D should be carried out.

Global CO₂ emissions are expected to continue to increase in the future, and there is a possibility that if there is no change in technologies for emission reduction and social structure compared to the current situation, the global emissions will reach more than 87Gton in 2050.

The global CO₂ emissions will reach 48 Gton even if we take all the measures such as energy conservation with high cost-effectiveness (coal-fired power generation with high energy efficiency, global diffusion of blast furnace (BF) and basic oxygen furnace (BOF) with higher energy efficiency in steel sector) and fuel conversion (further diffusion of biofuels in some regions).

Following the discussion above, Figure 1 shows an assessment of cost-effective measures for emission reduction in the case of halving global emissions by 2050 relative to the current level, which is equivalent to the case of limiting the emissions to 13 Gton. The results indicate that the power sector has the largest emission reduction potential, especially by CCS, nuclear power and solar power generation. Hydrogen-based iron making in iron and steel sector, and plug-in hybrid vehicles in transport sector are also recognized as substantial emission reduction measures.

On the other hand, it is estimated that marginal abatement costs will be over 300 US\$/ton CO₂ to

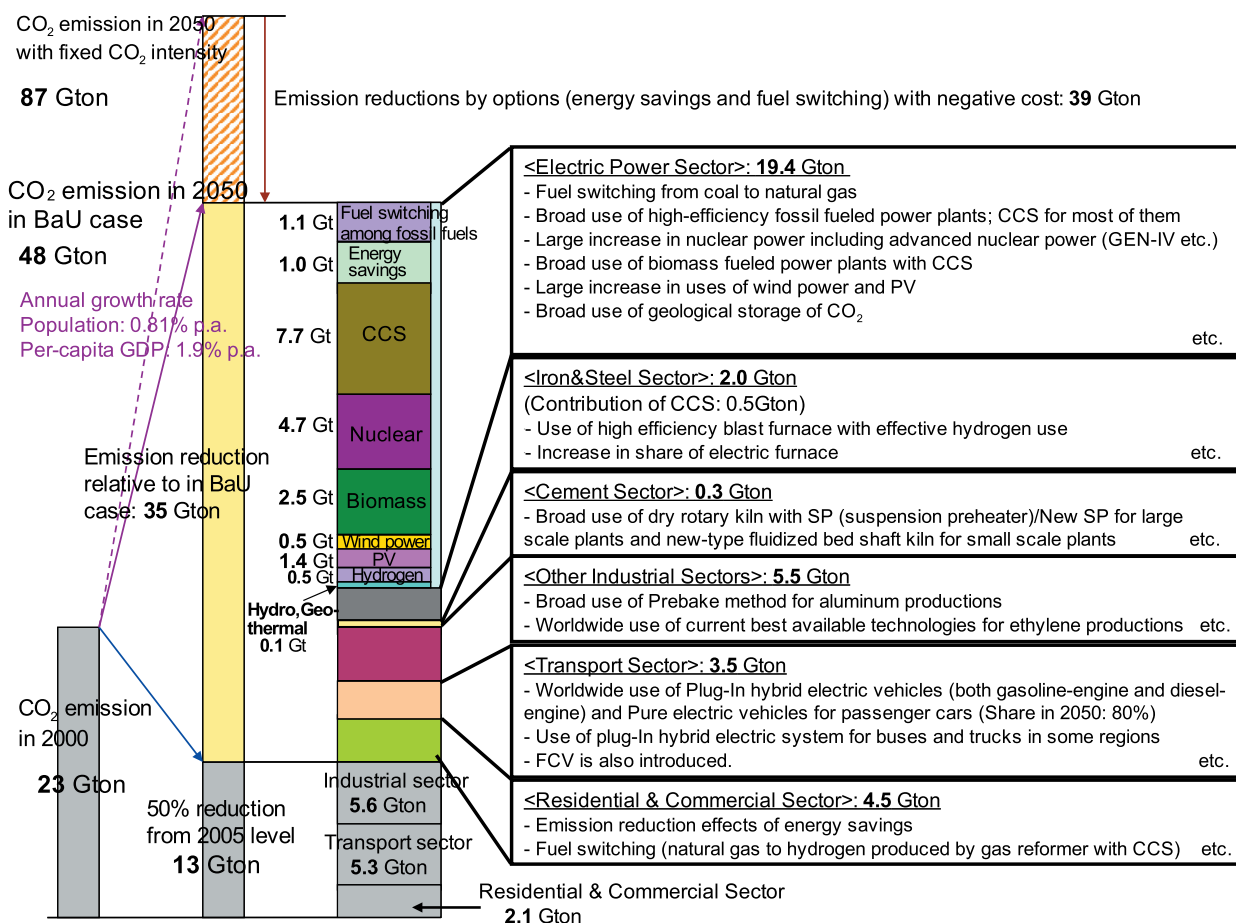


Figure.1 Technology portfolios and CO₂ emission reduction by sector to halve global CO₂ emissions by 2050

achieve the goal of halving global emissions by 2050. It will be difficult to pay such a high cost under global cooperation. Furthermore, it will be considerably hard to realize this goal unless new and currently unimaginable technology emerges. Therefore, it is important to take the burden of abatement costs into consideration, and to search for more realistic target for emission reduction which can be achievable for the entire world.

3. Analysis and assessment of mid-term targets

The greatest global concern in the context of climate change lies in how to establish a mid-term target for 2020 in the discussion on framework and target for post-Kyoto climate policy. EU leaders announced its mid-term target of reducing its emissions by 20 % (up to by 30% provided a global cooperation is achieved) relative to the 1990 levels. The Obama administration established its target of cutting U.S. emissions to 1990 levels by 2020. Moreover, the declared mid-term

target is 20% emission reduction compared to 2006 for Canada, and 5% reduction compared to 2000 for Australia. The Japanese government has examined its mid-term national reduction target by employing a sectoral and bottom-up approach. The examination led by a governmental body called “Mid-term target examination committee” has been progressing since November, 2008.

What is considered most important in an international discussion can be to establish a framework and target that lead to an effective reduction by all the major emitters, and to set up emission reduction levels for developed countries that reflect a regional effort required.

The sectoral approach has been widely acknowledged as one of the effective measures for emission reduction. For the realization of sectoral approach, our group has been contributing to a development of international discussion by doing related analysis and assessment with a high level of ability to conduct model analysis.

Figure 2 shows estimated marginal abatement costs of CO₂ by country when each country reduces its CO₂ emissions of the year 2020 in the range of 5% to 40% relative to 2005.

The results of our evaluation are estimated with a comprehensive emission reduction assessment model having high resolutions in region, sector and technology.

For instance, to reduce national emissions by 20% relative to 2005, a marginal abatement cost for Japan is estimated to be 200 US\$/tCO₂, which is the highest among other nations. The marginal abatement cost for EU is estimated to be around 50 US\$ and that of US is around 30 US\$. The results imply that the costs to be borne by Japan will be extremely high to carry out further measures as Japan has already achieved high energy efficiency.

On the other hand, EU, especially East Europe has a large potential for emission reduction. Likewise, it is estimated that U.S. also has a large potential for emission reduction due to many low- efficiency technologies and high dependency on coal.

Figure 3 shows results of our estimation on emission reduction potentials of 2020 (emission reduction potentials compared to the case where the level of energy technology is assumed to be unchanged from a current level) for major countries including developing countries by marginal abatement costs.

It can be found that on a global scale, there is a large amount of emission reduction potential at relatively lower marginal abatement costs, such as those amounting to less than zero US\$ (negative net costs) or to less than 25 US\$/tCO₂. Especially, China and U.S. have large emission reduction potentials at relatively lower costs.

The results of our evaluation indicate that it is important to achieve cooperation between developed countries and developing countries, and to reduce emissions by addressing potentials for emission reductions at lower costs that are largely found in developing countries.

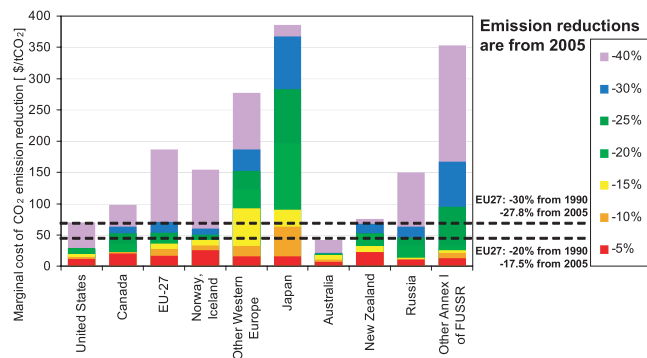


Figure.2 Marginal abatement costs of CO₂ for Annex I countries in 2020 by the rate of emission reduction relative to 2005
 Note: CO₂ from fuel combustion only. GHGs reduction of -20% from 1990 corresponds to -14% from 2005.

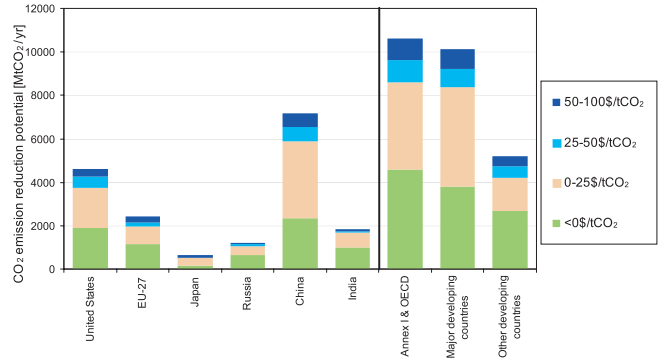


Figure.3 CO₂ emission reduction potential for major countries compared to Technology Frozen Case by marginal abatement cost of CO₂
 Note: emission reduction potentials of CCS excluded.

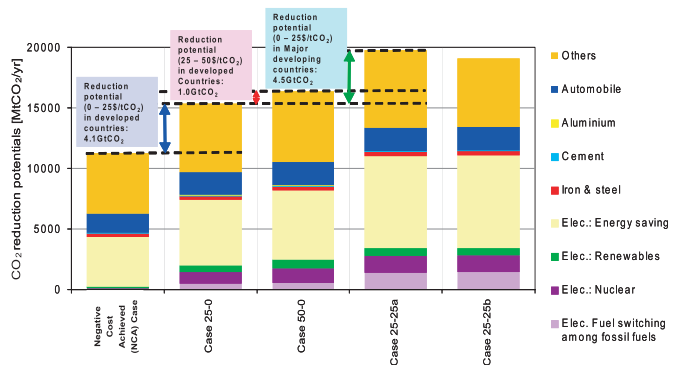


Figure.4 CO₂ emission reduction in the world by marginal abatement costs of CO₂ and by sector (compared to Technology Frozen Case)
 Note: emission reduction potentials of CCS excluded.

Baseline: the case in which measures at a marginal cost of less than 0\$/tCO₂ are taken by all countries in the world, Case 25-0: the case in which measures at a marginal cost of less than 25\$/tCO₂ are taken by only developed countries, Case 50-0: the case in which measures at a marginal cost of less than 50\$/tCO₂ are taken by only developed countries, Case 25-25a: the case in which developed countries take measures at a marginal cost of less than 25\$/tCO₂, and major developing countries take measures at a marginal cost of less than 25\$/tCO₂ as an intensity target, Case 25-25b: the case in which developed countries take measures at a marginal cost of less than 25\$/tCO₂, and major developing countries take measures at a marginal cost of 25\$/tCO₂ in major sectors as an intensity target.

Figure 4 provides our estimation on the emission reduction potential in the world by marginal abatement costs of CO₂ and by sector.

The analysis by RITE enables us to propose measures specifically not only by marginal abatement cost but also by sector and by technology as well as to estimate emission reduction potentials by country and by sector. Our analysis, therefore, has contributed to discussion on a numerical target with supportive evidence.

4. Conclusion

Global warming is a serious issue, extending over a long period of time and over the world. However, it is important for us to address climate change in a calm and determined manner, not being fueled by the risk. Furthermore, it is crucial to work on this issue globally and continuously.

Measures to tackle climate change should entail effectiveness and targets which can be shared by all over the world. The analysis and assessment based on data, which the Systems Analysis Group has been working on, is indispensable to a realization of the measures.

We will continue to send our research findings to industry, government and academia by conducting an analysis and assessment on measures for climate change in order that people can find a solution to address such a challenging issue of global warming.