

Program for Response Policy

Major Research Results

Formulating 100-year scenarios

The extent of global warming will be greatly affected by the directions taken in the development of human society. Estimating emission scenarios based on all available scientific data is, therefore, a fundamental element of global warming response policies. Japan is one of the world's leaders in research on emission scenarios. In the process of developing SRES scenarios, two teams from Japan, out of six in the world, prepared 100-year emission scenarios in IPCC. More than 400 non-IPCC emission scenarios have been entered into a database by a Japanese research team. Figure 11 shows the remarkably large range of these scenarios. Following this, Working Group III of IPCC worked on "post-SRES scenarios." Nine research teams throughout the world participated in their development, three of which were from Japan. The Japanese teams also coordinated the study program on projected concentration-stabilization scenarios.

Estimated Costs of the Kyoto Protocol

The IPCC TAR published in 2001 mentions cost study assessments to achieve the numerical target of the Kyoto protocol, including the Japanese studies. The costs of mitigation measures have conventionally been estimated by rough calculations using highly abstract economic models.

There is a need for more accurate cost estimations that consider the reductions in costs resulting from the progress of mitigation technologies. For this purpose, a "bottom-up" model that describes the processes and technologies of individual energy use in detail becomes necessary. The

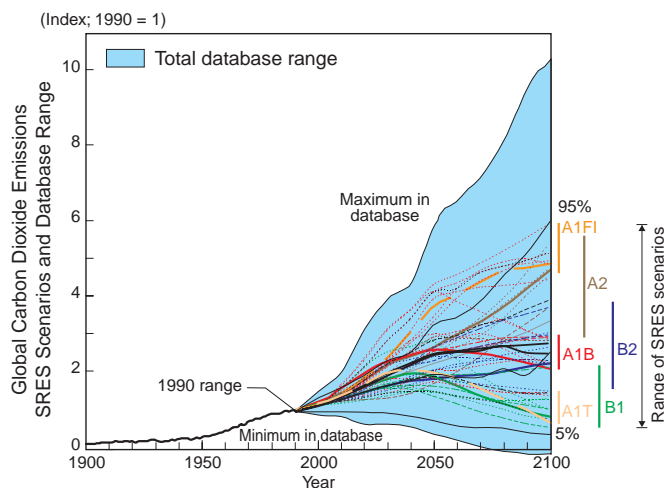


Fig. 11. Global CO₂ emissions from energy and industry, historical development from 1900 to 1990 and in 40 SRES scenarios from 1990 to 2100, shown as an index (1990 = 1) (IPCC WGIII, 2001).

Future Research Directions

- Response policy studies are entering into a new phase:
- ✓ An increasing necessity of studies in the social science and humanities.
- ✓ Bridging gaps in studies between developed and developing countries.
- ✓ Ratification of the Kyoto Protocol necessitates various urgent studies, such as the design and calculation of the effects of Emissions Trading, Joint Implementation, and Clean Development Mechanism.
- ✓ Moving rapidly to explore global warming response

development of such detailed models is progressing, such as a model named AIM (Asia-Pacific Integrated Model) by a Japanese team, which was applied not only in developed countries but in developing countries in Asia as well. This model estimates, without dependence on the Kyoto Mechanisms, that the marginal cost ranged from slightly more than 10,000 to about 35,000 yen/tC to achieve Japanese targets of the Kyoto Protocol. GDP loss estimates ranged from 0.1% to 0.8%, which was reported to the Global Environment Subcommittee, Central Environment Council, Japan, in 2001.

Technological Innovation Making Greater Progress Than Expected

Table 2 provides an overview of the technological potential for reducing greenhouse gas emissions in 2010 and 2020. The model introduced above, developed by Japanese research teams, is used exclusively to estimate the effects of the development and diffusion of such technologies. Investigations into the overall potential for emission reductions and the possibility of absorption by forests have also recently begun in Japan. Cost reductions have been estimated by detailing the processes and technologies of individual energy use and assuming relations between technological innovation and diffusion on one hand, and reduction in technology cost on the other. Various studies concerning individual technologies support these model studies. Japan is leading the world in research on energy-related technologies and carbon fixation technologies.

Table 2. Potential for emission reduction by 2020.

Category	Potential emission reduction in 2010 (million tons carbon, equiv./year)	Potential emission reduction in 2020 (million tons carbon, equiv./year)
Buildings	700 ~ 750	1000 ~ 1100
Transportation and Mobility	100 ~ 300	300 ~ 700
Industry		
- Energy efficiency improvement	300 ~ 500	700 ~ 900
- Material efficiency improvement	~ 200	~ 600
- Gases other than CO ₂	~ 100	~ 100
Agriculture	150 ~ 300	350 ~ 750
Waste	~ 200	~ 200
Use of alternatives under the Montreal Protocol	~ 100	n.a.
Energy supply and source switchover	50 ~ 150	350 ~ 700
Total	1900 ~ 2600	3600 ~ 5050

(Note) Reduction potentials calculated based on technologies to be introduced in the market with a direct cost of 100 US dollars or less per ton carbon equivalent. The unit "tons carbon, equiv." means that emissions such as methane and nitrous oxide have been converted into CO₂ emissions based on their degrees of contribution to global warming, and the total amount of greenhouse gas emissions is expressed by the weight of carbon (based on IPCC 2001).

- ✓ policies after 2010.
- ✓ Examination of the policy factors for achieving the targets of the Kyoto Protocol has almost been completed in Japan. Domestic policy consistent with an international framework needs to be developed.
- ✓ Verification studies concerning how to strengthen industrial competitiveness under the new world order.
- ✓ Promoting joint studies with the developing countries of Asia and the Pacific, and contributing to international cooperation and understanding.