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PROMOTION OF TECHNICAL RESEARCH AND DEVELOPMENT FOR PREVENTION OF GLOBAL WARMING
An Overview

I. Purpose

Japan has made a commitment under the Kyoto Protocol to reduce its greenhouse gas emissions by 6% from base year (1990) levels during the first commitment period (2008–2012). In order to realize this commitment, studies will be implemented on the status of research and development in the various technologies specified in the Guideline of Measures to Prevent Global Warming (hereafter, the Guideline), the possibilities for further development of technologies for prevention of global warming during or following the first commitment period (2008–2012), human resource development, and other related matters of importance.

Although this matter will not be taken up in the present report, the expansion and construction of new nuclear power plants will be essential to the achievement of Japan's reduction target, and continued research and development for this purpose is necessary.

II. Main Elements of the Report

The main technologies considered effective in preventing global warming (energy conservation, new energy, etc.) will be analyzed in terms of their potential for reduction of greenhouse gases in light of their feasibility, the necessity for research and development, the necessity for measures to introduce them and promote their diffusion, and the impact of diffusion of measures to prevent global warming (see attached table). Those issues that are identified for priority or accelerated engagement will be organized in the form of a research and development promotion strategy.

1. Technologies Expected to be Realized During the First Commitment Period

○ Technologies listed in the Guideline that have reached the stage of diffusion for use (high-performance industrial furnaces, high-performance

boilers, high-performance lasers, etc.) will require steady efforts for adoption and diffusion.

○ For technologies listed in the Guideline that are in the course of research and development, the timeframe objectives for adoption and diffusion will be defined, the technologies will be established by systematic research and development, and their reduction impact will be evaluated quantitatively. It will also be crucial to conduct specific investigation of measures for their adoption and diffusion in society.

2. Technologies of Importance in the Medium to Long Term

○ Technical development will be assigned priority and expedited in the case of technical issues that have potential for a certain reduction of greenhouse gas emissions around 2010, which is within the first commitment period. It will also be crucial to conduct an associated investigation of measures for adoption and diffusion.

○ It will be necessary to assign clear priorities based on assessment for those technical issues that do not have a clear timeframe for practical application at their present stage, or that have not undergone adequate quantitative evaluation of their reduction impact following diffusion.

○ It will be necessary to create clear roadmaps leading to practical application and diffusion for each issue, taking into consideration the provision of related technologies required for diffusion, standardization, preparation of technical standards, and so on.

(1) Technologies considered to require particularly high-priority treatment because of their great potential for greenhouse gas reduction

・Development of technology for improved automobile fuel economy
・Development of energy-saving technology for carbon dioxide separation, recovery, and sequestration
・Development of technology for carbon dioxide storage
・Development of fuel cell technology
・High-efficiency coal gasification power generation
・Development of forest management technology for carbon dioxide fixation

(2) Technical development topics considered to require more expedited work on adoption and diffusion in particular, as well as on research and development

・Development of energy-saving housing and construction technology and promotion of their adoption

・Development of high-efficiency heat pumps
・Development of solar power generation technology
・Collaborative industrial-consumer resource recycling systems with effective energy utilization
・Development of biomass utilization
・Chlorofluorocarbon replacement technology

3. Critical Technology for the Future Construction of an Environmentally Harmonious Society

○ Research and development topics expected to yield significant greenhouse gas reduction as total systems in appropriate combination with other technologies
・Development of hydrogen manufacturing and supply systems for the hydrogen society
・Development of fixed, high-efficiency secondary batteries
・Technology for increased sophistication and recycling in waste treatment

4. Importance of Diffusion Measures

○ The formulation and adoption of measures for diffusion of energy-saving housing and other such technologies that are thought to have particularly great potential for carbon dioxide reduction is a crucial issue.
○ It is important to give specific, concrete form to measures and activities for cost reduction, operational trials, social infrastructure improvement, and the adoption of incentives for diffusion, for the reassessment of laws and regulations, for the provision of information to the public, and for other such activities that extend beyond the government agency framework.

5. Related Matters of Importance

○ Promotion of active engagement by all levels and sectors of society
It is hoped that every individual citizen will engage voluntarily in activities to prevent global warming. This requires study as an issue of environmental education, and particularly of elementary and secondary education.
○ Importance of life cycle assessment
It is necessary to evaluate and analyze the effectiveness of greenhouse gas reductions and the overall load on the environment caused by the diffusion of individual technologies.

○ Necessity for an international perspective

It is important to develop overseas markets strategically so that technologies from Japan will contribute to the worldwide reduction of greenhouse gas emissions. It will also be necessary to study measures for technology transfer while making use of the Kyoto mechanism.

○ Human resource development

It is crucial to plan on securing and developing the human resources to engage in research and development for the purpose of maintenance in such areas as technical infrastructure in the medium to long term. Engineering education must place emphasis on (1) comprehensive perspectives involved in energy and the environment, (2) environmental studies that include humanities and sociological aspects, and (3) sociological aspects involved in the formation of consensus among residents.

○ Importance of basic research

There are a number of fields that can be expected to yield dramatic reductions in greenhouse gases through the further creation of innovative technologies, and it will be important to actively promote basic research.

Memorandum for Reference

(The ◎ symbol marks items not covered in the overview.)

◎ Japan has made a commitment under the Kyoto Protocol to reduce greenhouse gas emissions by 6% over the base year (1990) during the first commitment period (around 2010). In the meantime, emissions increased by 8% in 2000, so that a reduction of 14% will be necessary. This is no simple matter.

◎ The Guideline of Measures to Prevent Global Warming calls for carbon dioxide emissions from energy sources to be held to the 1990 level by energy saving and a variety of other such measures. The objective is to achieve the promised reduction by a combination of these and other measures.

◎ Therefore, in order to clarify the extent to which research and development can contribute to this goal, studies will be made of the status of research and development in the various technologies applied to prevention, the technical issues for countermeasures that should be given priority, and other, related matters of importance.

○ Nuclear power is recognized to be essential in terms of both preventing global warming and assuring a stable energy supply. As such, it is not to be dealt with in the same category as other countermeasure technologies,

which is why it was not included within the scope of the present study.

◎ Information on separate research and development issues has been submitted by the government agencies concerned, private enterprises, and expert panels. That information has been organized and classified under 37 technical topics that are expected to yield effective measures to prevent global warming.

○ As shown in the attached table, the various research and development topics were analyzed in terms of their potential for greenhouse gas reduction, taking feasibility into consideration, the importance of measures for research and development, adoption, and diffusion, and so on.

○ The technical items listed in the Guideline of Measures to Prevent Global Warming include some, like the high-performance industrial furnace, that have already reached the stage of diffusion. Steady efforts must be made to adopt and disseminate such technologies. For technologies that are in the course of research and development, it is crucial to the clearly define the achievement targets, place the technologies on an established footing, and also conduct specific studies of measures for their adoption and diffusion in society.

○ Certain technologies are considered (1) to demand assignment of particularly high priority because of their great potential for reduction of greenhouse gases, or (2) to require particularly expedited effort toward adoption and diffusion as well as research and development. Such technologies are taken up in greater detail in the report.

◎ The attached table indicates the results of analysis by simple color coding for easier visibility. The table shows the greenhouse gas reduction potential of each development topic in or around the years 2010 and 2030, categorizing the reduction as less than 1 million tons, 1 million tons or more, or 10 million tons or more annually.

◎ The topics targeted for 2010 clearly require work toward adoption and diffusion as well as for research and development. The technologies listed here have the potential for annual reductions of up to 10 million tons or more when they reach practical application and enter widespread use.

◎ These technologies will be capable of even greater reductions by around

2030, contributing to annual reductions of up to 100 million tons or more. This is the equivalent of nearly 8% of total base year emissions.

○ The crucial point is to implement steady efforts for adoption and diffusion of the developed technologies in society at the same time that research and development are being carried on.

Q&A

Q1. Can the commitment for a 6% reduction during the first commitment period be achieved?
A1. It cannot be achieved by using just the kinds of scientific technology reported here. We intend to fulfill the commitment by a comprehensive program using additional energy-saving measures, solar power generation, and other such new energy technologies to reduce carbon dioxide emissions from energy sources, making certain of the volume of carbon dioxide absorbed by forests, and so on.

Please note, by the way, that stepped-up research and development of innovative environmental and energy technologies described in the Guideline of Measures to Prevent Global Warming is forecast to yield a reduction of approximately 0.6% (some 7.44 million tons) from base year (1990) levels.

Q2. Is no need seen to pursue any technical topics other than those identified as important here?
A2. That is not the case. What we have done here is to indicate the higher priorities.

Q3. Is nuclear power included among the subjects for study described here?
A3. It is not included among these technical topics for study. The expansion and construction of new nuclear power plants will be essential to the achievement of Japan's reduction target, and we also consider continued research and development in this area to be necessary in terms of assuring a stable energy supply.

Q4. Are fuel cells effective in reducing emissions of greenhouse gases?
A4. They are effective, and are expected to yield potential reductions of 1 million tons or more per year in or around 2010. Their fuel is hydrogen,

and fuel cells will become even more effective in the future if hydrogen manufacturing methods with lower carbon dioxide emissions can be found.

Q5. Is utilization of biomass and waste effective in reducing emissions of greenhouse gases?
A5. This is effective, and is expected to yield potential reductions of 1 million tons or more per year in or around 2010. It also looks promising beyond that time. It is important to work on adoption and diffusion as well as on research and development.

Major Global Warming Prevention Technologies and Greenhouse Gas Reduction Potential (Carbon Dioxide Equivalent)		2010		2030
Topics for which Research and Development Will Remain of Importance for Some Time		Under 1 million tons/year	1 million tons/year or more	10 million tons/year or more
Technical development for improved automobile fuel economy	Develop lightweight alloys and conduct research on engine control technology for improved fuel economy		○	◎
Development of energy-saving technology for carbon dioxide separation, recovery, and sequestration	Develop technology to separate and recover carbon dioxide directly from plant exhaust gases	△		◎
Development of technology for carbon dioxide storage	Demonstrate technology for sequestering recovered carbon dioxide in the ground or ocean and storing it for long periods of time	△		◎
Development of fuel cell technology	Develop high-performance fuel cell and conduct research on demonstration and practical application (vehicular, portable, fixed)		○	◎
Topics for Which Adoption and Diffusion Will be of Greater Importance for Some Time				
Development of energy-saving housing and construction technology and promotion of their adoption	Develop, evaluate, and promote adoption of residential insulating materials and other such technology		○	◎
Development of high-efficiency heat pumps	Develop technology for improved efficiency air conditioning and hot water heat pumps		○	◎
Development of solar power generation technology	Develop technologies for product cost reduction, recycling, reuse, and so on		○	◎
Collaborative industrial-consumer resource recycling systems with effective energy utilization	Develop technologies for waste energy utilization and waste recycling based on collaboration of industry and local communities		○	◎
Development of biomass utilization	Technical development of regional resource and energy systems utilizing biomass		○	◎
Chlorofluorocarbon replacement technology	Develop technologies for manufacture and utilization of chlorofluorocarbon replacements that have smaller global warming effect and do not damage to the ozone layer		○	◎