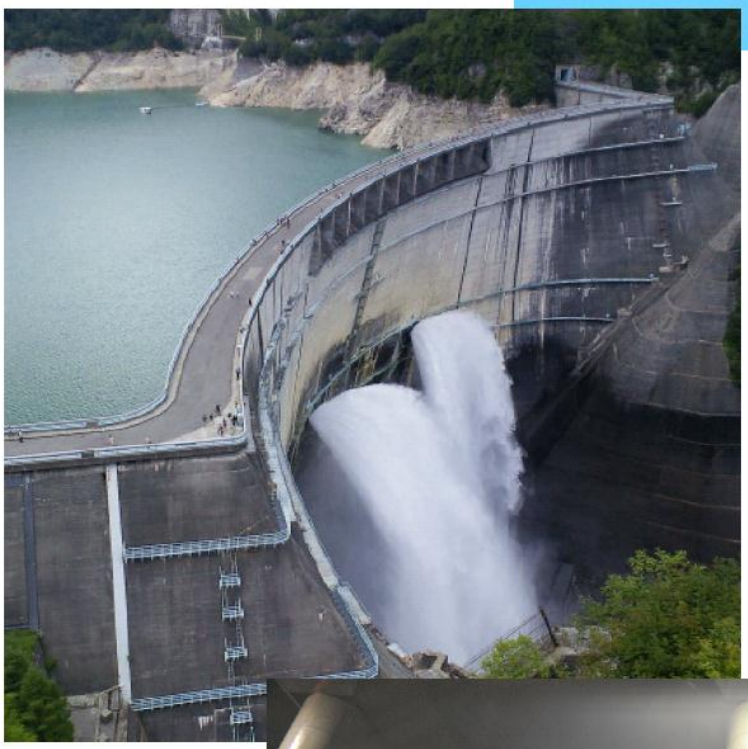
Sectoral Approach
in the Cement Industry

Japan Cement Association



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Outline of Cement Working Group of the Global Superior Energy Performance Partnership

October 2012

Japan Cement Association

1. Background

The Global Superior Energy Performance Partnership (GSEP) is an initiative of the Clean Energy Ministerial (CEM) and the International Partnership for Energy Efficiency Cooperation (IPEEC). It is the successor of the APP (Asia Pacific Partnership on Clean Development and Climate) indicated in APPENDIX.

The GSEP cement working group (Cement WG) aims to reduce global energy use in industrial facilities and commercial buildings in order to improve energy security and to reduce global greenhouse gas emissions (GHG) by:

- Encouraging industrial facilities and commercial buildings to pursue continuous improvements in energy efficiency, and
- Promoting public-private partnerships for cooperation on specific technologies or in individual energy-intensive sectors.

On September 12th and 13th, 2011, in Washington D.C., the governments of the United States, Japan and Finland organized the GSEP workshop to bring together for the first time the participants of the sectoral working groups including Power, Steel and Cement and the other three groups under the GSEP.

This report describes outcomes of the GSEP workshop including the breakout session, and the proposed framework and work plans of the Cement WG.

2. GSEP workshop

Approximately 140 public and private sector representatives from 14 countries came together to define collective strategic objectives and discuss work plans for each working group. Plenary sessions allowed participants to better understand the activities of the other working groups and to identify possible opportunities for collaboration.

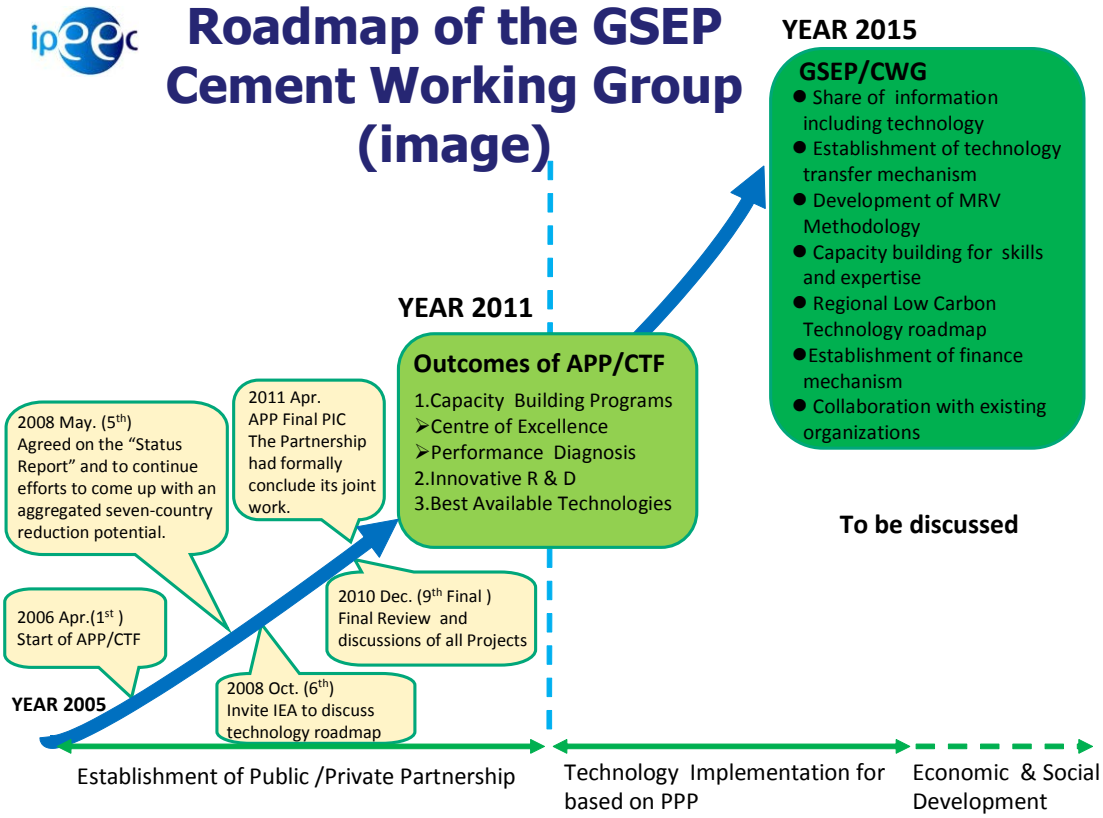
In order to establish the Cement WG under GSEP, government officials from the United States and Japan, and private representatives such as national trade associations and cement companies, participated in a breakout session of the cement sector. In the breakout session participants shared the view that APP left significant outcomes and discussed how to make further progress under the GSEP framework.

It was decided the 1st Cement WG meeting should be held to confirm goals, member countries and an operational guideline. The chair of the session also suggested to adopt the roadmap illustrated below, based on the APP Roadmap, for the GSEP WG.

All participants agreed the concept that the Cement WG creates a voluntary framework for international cooperation on the basis of public and private partnership. The following goals were then proposed:

- Collaboration on policies, programs and projects geared toward further enhancing the energy efficiency and reducing the GHG emissions of the cement manufacturing process.
- Promotion of sustainable applications of cement and concrete products as tools to enhance energy efficiency and avoid GHG footprints across the built environment.

The participants identified that securing participation of the governments of major economies, especially China and India, is indispensable for the continuation of GSEP.



3. Proposed Structures of the Cement WG

The Japan Cement Association (JCA) proposed the following structures of the Cement WG to the government through experiences of APP activities and also outcomes of the workshop:

3.1. Public private partnership as the significant framework

In order for the private sector to develop and transfer technologies based on a bottom-up approach, it is requested to share updated information on the status of climate initiatives, policies, technology, materials availability etc in member countries and have continuing dialogue with governments taking into consideration supporting policy measures. The JCA considerably expects the opportunity to discuss relevant policies with decision makers at the Cement WG as the succeeding initiative of APP.

3.2. Linking with finance organizations to facilitate effective technology diffusion.

The experience of the APP was that funding shortages result in difficulties in the continuation of projects. Therefore, a mechanism for financial support should be considered for each project of the Cement WG. At first, in order to encourage private funding of projects, the Cement WG should discuss project candidate criteria such as the kind of energy conservation or clean technologies and the required level of public financial support. This approach will link to the private sector engagement of the Green Climate Fund under the Durban agreement.

3.3. Collaboration with existing organizations and networks

Candidate organizations for the GSEP Cement WG to cooperate with are the Cement Sustainable Initiative (CSI), International Energy Agency (IEA) and European Cement Research Academy (ECRA).

The CSI is one of the international sector networks under the World Business Council for Sustainable Development (WBCSD), a global organization working towards sustainable development with many international company members. The CSI, consisting of global major and local cement companies, together with many trade associations, including JCA, as communication partners, has established a GHG data base incorporating data from all member companies and a few cement associations. The CSI has also developed tools and guidelines for environmental protection. Therefore, the Cement WG proposes to invite the CSI to collaborate and share its activities.

The IEA, having experienced the development of "The Cement Technology Roadmap 2009" and currently the India roadmap, shall be invited since the JCA thinks that the development of regional/country roadmaps for cement technologies is required in order to support the diffusion of clean technologies to developing countries and for the consideration of financial support.

The Cement WG should also invite ECRA to discuss innovative technologies including CCS as one of the key mitigation measures in the cement industry.

4. Proposed Working Plans

After consultation with the government, the JCA concluded the following working plans to be submitted to the partners:

- Enhancement and enlargement of the Center of Excellence in order to develop a methodology for technology transfer and capacity building
- Development of energy performance indicators
- Development of a positive list of the best available technologies in cement manufacturing
- Facilitate breakthrough technologies in energy conservation
- Develop a methodology for the Measurement, Reporting and Verification (MRV) of energy conservation and CO2 emissions
- Study funding methods

Main projects shall be considered as follows:

4.1. Sharing and diffusing good practices of production technologies

Since cement production involves a large consumption of heat energy and power, consideration of energy conservation is particularly important in view of energy security as well as climate change.

Key energy conservation technologies and their diffusion rates in Japan are shown in following table.
The JCA believes that Japanese clean technologies should not simply be offered to developing countries, but subject to a strategy for technology transfer and diffusion taking into account economic criteria, weather and national policies in the developing country. For example, developing countries in which power prices are relatively low should also consider the utilization of waste heat and drying of raw materials. Waste heat recovery facilities are usually not applied to rainy countries since the waste heat has to be utilized for drying of the raw materials.
When legal barriers to technology development and diffusion are identified in developing countries, all national institutional information on clean technology diffusion and environmental registration should be shared among government officials from the Cement WG members.
In addition to the installation of energy efficient facilities, it would be necessary to provide software such as operational know-how and energy management.

4.2. Methodology of MRV

There already exists the CSI Cement CO2 and Energy Protocol, a "CO2 and Energy Accounting and Reporting Standard for the Cement Industry," as the de facto global standard for cement CO2 emissions and energy consumption. Also, the European Committee for Standardization (CEN) is now developing a European standard on GHG emissions for energy intensive industries based on this protocol. Meanwhile, China has developed its national standard on CO2 emissions for the cement industry, also aligned with the CSI's protocol. Therefore, the JCA deeply considers that the CSI's Cement CO2 and Energy Protocol should be adopted by the Cement WG"

In future, for transparency and effectiveness, any GSEP energy conservation project shall be assured using the protocol. An improvement in the transparency of projects is required for both financial and technical support. Furthermore the JCA shall propose a new energy performance indicator for reporting.

Technology	Diffusion rate as of 2010	Energy conservation [per technical unit]
Waste heat recovery for power generation	60%	Approximately 35～40kWh/t-cli. power conserved
High performance vertical mill to grind blast furnace slag	73%	Maximum 40kWh/t-cem. power conserved
Roller mill system to pre-grind clinker	46%	10～20% improved of specific power consumption during finishing process
Air beam type cooler for clinker	50%	42～167kJ/kg-cli. of energy conservation 0.5～1.5kWh/t-cli. of power saving
High performance separator	53%	10%～20% improved of specific power consumption
Vertical coal mill	90%	20～25% improved of specific power consumption
Vertical roller mill to grind raw materials	46%	Approximately 30% improved of specific power consumption during raw material preparation process

4.3. Performance Diagnosis

Developing countries such as China and India request that a capacity building program for local experts be implemented in order to enable performance diagnosis at cement plants.

However, such a program should be carefully addressed since the JCA has serious concerns about the protection of know-how and proprietary information. Also, since the implementation of such a program would require a large budget, the Cement WG has to discuss a mechanism for linking to financial aid.

5. Conclusions

Participating in GSEP on the basis of a public private partnership provides a sectoral approach to technology transfer and diffusion based on a bottom-up approach and the sharing of environmental information. Furthermore, if discussions on climate protection are well integrated with the establishment of recycling based societies, the cement industry can make a huge contribution towards sustainable society.

Experiences of cement sector action through the Asia Pacific Partnership on Clean Development and Climate

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Figure 2: APP Cement task force meeting in Tokyo

The seven countries of the Asia-Pacific Partnership on Clean Development and Climate (APP) — Australia, Canada, China, India, Japan, the Republic of Korea and the United States of America — have been cooperating since 2006 to meet both their increased energy needs and associated challenges, including those related to air pollution, energy security and greenhouse gas intensities.

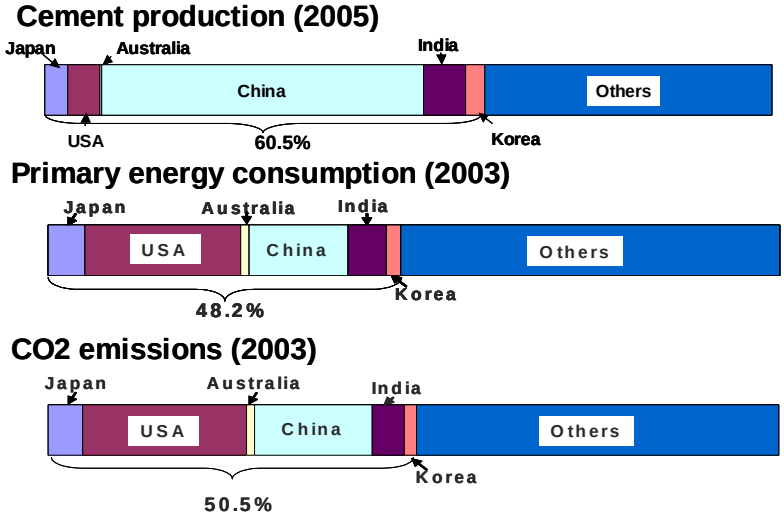
The Partnership established public-private task forces in eight key sectors: (1) cleaner fossil energy; (2) renewable energy and distributed generation; (3) power generation and transmission; (4) steel; (5) aluminum; (6) cement; (7) coal mining; and (8) buildings and appliances. The task forces are designed to meet Partnership goals through international cooperation to facilitate the development, diffusion, deployment and transfer of existing, emerging and longer term cost-effective, cleaner, more efficient technologies and practices among the Partners through substantial cooperation leading to concrete action so as to achieve practical results. This paper describes cement sector program and progress.

1 Cement Task Force

1.1 Background of cement sector

Partners in the sector account for 61 percent of global cement production (refer to Figure 1). The cement task force therefore has significant potential to reduce CO_2 emissions and conserve energy by sharing information on clean technologies and by cooperating further to diffuse such technologies. In addition, the Partnership's emphasis on public-private partnership will catalyze a sectoral approach (see Figure 2).

Figure 1: Cement Production and Energy & CO2 emissions in APP Partners



Currently, Partners individually challenge voluntary initiatives or national programs. For example, the Australian cement industry was one of the first to voluntarily monitor, measure and manage CO_2 and other emissions, resulting in a 24% reduction of CO_2 per ton of cement. The Chinese government is funding cement projects through national bonds for projects that utilize waste and other by-products, reduce energy consumption and promote environmental protection. The Indian cement sector has in recent years increased the use of alternative fuels and raw materials (AFR) for co-processing of wastes, which have resulted in reductions in greenhouse gas emissions and yielded other environmental benefits. In Japan, while the industry has achieved one of the world's most efficient production systems by using SP and NSP kilns, it is further working through Keidanren voluntary initiatives to reduce its energy intensity per ton of cement

by 3.8% from 1990 levels by 2010. The Korean cement industry is implementing ways to reduce air pollutants such as SOx and NOx, and have installed monitoring equipment for this purpose. The U.S. cement industry has committed to reducing its greenhouse gas intensity and, through the Climate Vision program, has adopted a voluntary goal of a 10% reduction in CO_2 emissions per ton of product from a 1990 baseline by 2020.

1.2 Objectives

The task force's objectives are to conduct surveys on the current situation, develop performance indicators, share information and experiences on clean technologies in order to conserve energy, manage emissions of greenhouse gases and air pollutions, promote use of AFR, and thereby diffuse and deploy such clean technologies in the cement industry of each Partner. Ways to diffuse and deploy clean technologies are explored at task force meetings.

1.3 Key Actions

The task force meetings have already been held in 7 locations as shown in Table 1.

One of the key components of the cement task force's effort is to collect reliable data. Another important element of this group's work is to share information on good/best practices so that these

Figure 4: CSI CO2 Protocol training seminar in China

may be replicated where appropriate in this very de-centralized sector (Figure3).

Addressing barriers to the utilization of clean technologies could assist Partners to more effectively address their greenhouse gas emissions whilst recognizing that differing national circumstances may influence the potential for energy conservation in domestic cement industries. In addition, concerted efforts to reduce SOx, NOx and dust are essential to the global efforts to reduce air pollutants.

2 Major Projects and Outcomes

2.1 Survey of the industry's current situation

A questionnaire survey of the current cement industry of each Partner was carried out to collect useful basic information. The results, published as an interim report in October 2007, can be viewed on the APP website. With the addition of new data from Canada the report was updated in the fall of 2008. [1]

Furthermore, adoption of the CSI CO_2 Protocol, developed by the WBCSD CSI, was agreed as the first calculation tool for the collection of plant data. Japan has improved the calculation sheet to provide additional data such as energy-efficiency indicators and air pollutants. Since China has not yet used the CSI CO_2 Protocol for the

Figure 3 : Key Major Streams of Cement Sector Activity

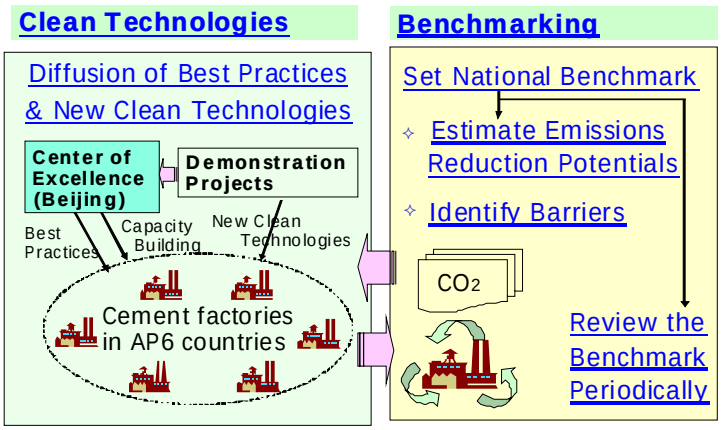


Table 1: The task force meetings

1st	April 18-21,	2006 Berkley, California, USA
2nd	September 20-21,	2006, XIAN, China
3rd	April 18-19,	2007, Delhi, India
4th	September 12-13,	2007, Melbourne, Australia
5th	May 13–14,	2008, Charleston, SC, USA
6th	Oct 24,	2008, Tokyo, Japan
7th	July 15–16,	2009, Seoul, Korea (plan)

calculation of CO_2 emissions, Australia, Japan and the USA provided support to China through training seminars held jointly with the WBCSD CSI in Beijing and Zhuhai during 2008. Further seminars will be held in China during 2009 as part of the capacity building program that helps trainees from every region of China understand the needs for implementing climate protection measures. During the training seminars (Figure 4), actual reference data is input into the calculation sheets of the Protocol.

A further survey was carried out by each Partner to identify barriers to achieving the maximum potential energy efficiency improvements and to the implementation of the good/best practices. The following are some examples. In Australia, permitting requirements necessitated by multiple-levels of government create challenges to the development, expansion and movement of cement-related products. China's large size and the diversity of local circumstances have created challenges in generating meaningful benchmarks and other measurement tools. In India, further increased use of AFR is hindered by insufficient regulatory measures and a lack of availability of the relevant foreign good/best practices. In Japan, existing high rates of efficiency in the cement sector mean that further increases are extremely challenging.

Table 2: Example of Best Practices

Raw materials	Vertical roller mill for raw materials
Preheater /Kiln	SP/NSP kiln system
	5-stage suspension preheater
	Vertical coal mill
	Air beam type clinker coolers
Finish Grinding	Improved separator
	Pre-grinding using roller mill system
	Vertical roller mill for blast-furnace slag grinding
Use of waste heat	Power generation utilizing waste heat

For Korea, the use of alternative fuels for reducing net CO_2 emissions is very limited because the current regulatory structure does not permit it and the supply of appropriate alternative fuels are inadequate to meet demand. In the United States stringent permitting requirements, limited market acceptance of blended cements and resistance to AFR use hinder advances in the sector.

A collection of the clean technologies used by each Partner was compiled into a booklet and published on the APP website in March 2009[2]. The APP booklet is not only shared with the Partners but also utilized for external reference such as for cement technology papers and the technology roadmaps developed by the IEA and CSI.

2.2 Benchmarking

For this project, the development of performance indicators and an estimation of reduction potentials were discussed in April 2007 and Partners agreed to select a cement-based emissions intensity of CO_2 (net) [kg-CO_2/ t-cement] as a common indicator and total energy intensity for clinker production (net) [MJ/ t-clinker] as a voluntary indicator.

Each Partner has been estimating the CO_2 reduction potential using the common indicator. Japan estimated the reduction potential by a bottom-up calculation of best practices at each plant as shown in Table 2. Aggregated results of all Partners will be reported.

Figure 6: Locations of Cement Plant performance diagnosis in China

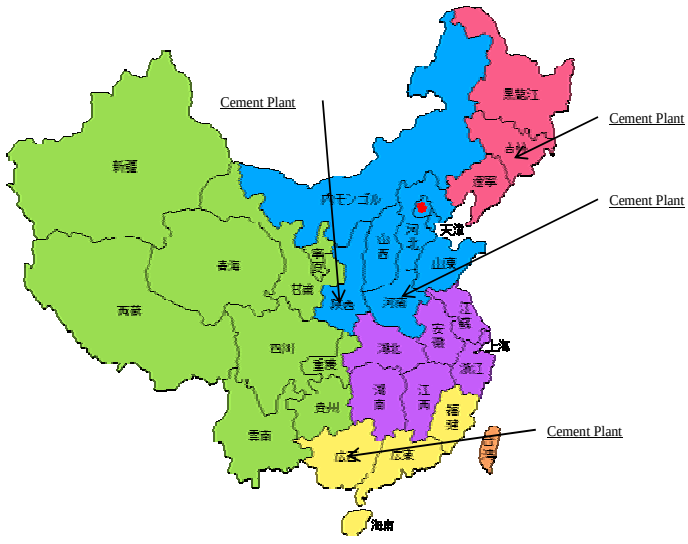


Figure 7: Locations of Cement Plant performance diagnosis in India

2.3 Performance Diagnosis

Experts in energy conservation, environmental management and ement production in the Japanese cement industry have visited cement plants in China (Figure 6) and India (Figure 7) for certain periods since 2008.

The experts carried out performance diagnosis, primarily for energy conservation and environmental management, and provided short-term and medium-to-long term recommendations on how, where appropriate, plants can optimize technologies and operational approaches. Japan will follow-up their actions after receiving the recommendations from the experts in 2009.

3 Findings

3.1 Enhancing Private Public Partnership

Each government and cement industry of the seven APP members play their own roles in the Partnership. Together they also represent public-private sector actions that are based on the transfer and deployment of existing clean technologies through mutual understanding of differentiated viewpoints and economic backgrounds of individual Partners.

3.2 Defining a Sectoral Approach

Through the Partnership the JCA and PCA, together with CEMBUREAU, developed a position paper on a sectoral approach to greenhouse gas management in March 2009. This position paper can be viewed on each association's website[3]. The next task force meeting in July will invite non-Partnership members, including CEMBUREAU, to discuss technology transfer and development of new clean technologies.

3.3 Removing Regulatory Barriers

Through the Partnership the JCA and PCA, together with respect to regulatory barriers preventing deployment of co-processing technologies for the utilization of wastes which will lead to CO_2 emissions reduction, the circumstances of each Partner have been identified and best/good practices will be further shared with the governments to remove such barriers through the APP activities.

3.4 Developing Incentivized Mechanism

It is necessary to create incentive mechanisms to drive investment and adoption of new technologies and to help overcome policy and financial barriers that today prevent the adoption of many cost-effective efficiency measures in developing countries.

4 Next Steps

Since 2006, through participation in the APP, Japan has presented its numerous activities on clean development and climate both domestically and internationally so as to introduce Japanese advanced energy conservation technologies. Japan has been collating national environment data from each Partner, and working eagerly to share the information so as to increase the understanding of project activities and the environment in Partner countries. In order to collect further reliable data and encourage the transfer of clean technologies, Japan will continue efforts to support monitoring, reporting and the implementation of verifiable actions in developing countries.

A future framework on climate change, which is currently under discussion, should require the participation of "all major emitting countries". Therefore, if the cement task force of the APP, which is one of the most practical sector actions in a sectoral approach, further cooperates with non-APP members, an international framework based on the transfer of clean technologies would be established among the cement associations of participant countries.

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