

**Interim Report of
the Clean Coal Cycle (C3) Study Group**

“Japan’s New Coal Policy Towards 2030”

**-C3 Initiative Towards the Establishment of
the Clean Coal Cycle-**

**June 16, 2004
Clean Coal Cycle (C3) Study Group**

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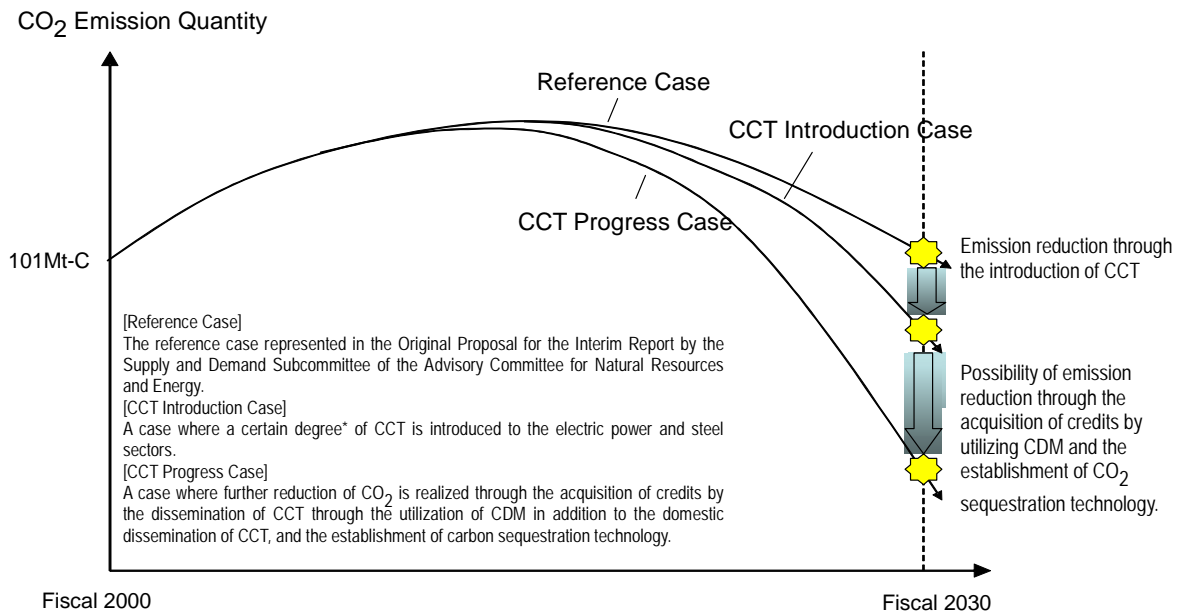
Introduction

Although a pillar of the world’s energy supply since the industrial revolution, coal is now facing an adverse wind. On the pretext that coal is deemed an “inferior” energy source that accelerates global warming because it has greater emissions of carbon dioxide (CO₂) per unit calorific value than other fossil fuels, the outcry to curb its utilization has been intensified. Under the circumstances where more consideration to environmental protection is being requested in the use of energy hereafter, should the utilization of coal be restricted, regardless of its inexpensiveness and supply stability.

This report has been compiled to answer this question and to indicate how to formulate a policy to promote the environmentally friendly use of coal from a medium- to long-term perspective. At present, the task of achieving environmental protection in coal use is surely significant, but not impossible. There exists the possibility that future technological innovation in the energy sector will drastically reduce the environmental load associated with coal use, and thus resolve the issues in terms of environmental protection in coal use compared to other fossil fuels and other fuels. Concerning this point, the Original Proposal for the Interim Report presently being compiled by the Supply and Demand Subcommittee of the Advisory Committee for Natural Resources and Energy, specifies the following in the energy supply and demand outlook for 2030: “In the event that clean coal technology such as high efficient coal-fired power generation technology, and innovative technology such as carbon sequestration are progressed, the restriction in terms of global warming issues will not pose any problems in comparison with other fossil fuels, and that on the contrary, there is the possibility that the demand for coal will be dramatically increased.”

Also in this report, coupled with countermeasures to the environmental issues, approaches are presented to combat the soaring price of coal, which has risen dramatically over the past year. The factors for the recent sharp price escalation can be divided into temporary factors (e.g. accidents and disasters) and structural factors (e.g. increase in coal demand in China), and this report mainly presents countermeasures to the structural issues. By steadfastly implementing the various measures shown herein, coal could be stably supplied over the medium- to long-term, though temporary fluctuations in price would be observed.

<Chart 1> Possibility of Coal-originated CO₂ Emission Reduction by Introducing Clean Coal Technology (Japan)



* Achievement of emission reduction in an amount of approx. 2 million tons-C would be made possible in the case where the introduction of CCT is progressed under the following assumptions, as compared with the case where such an introduction is not progressed:

Electric power sector:

Existing coal-fired power generation facilities after 40 years of operation should be gradually replaced with coal-fired power generation facilities of the same size, based on the assumption that an IGCC were to be introduced to the 40% of facilities to be replaced after fiscal 2015, and an IGFC were to be introduced to the 20% of facilities to be replaced after fiscal 2020;

Steel sector:

Assumed that the existing coke furnaces after 50 years of operation should be gradually replaced with the SCOPE21 furnaces of the same size.

1. Necessity of a new coal policy

(1) Changes in the domestic and international energy situation

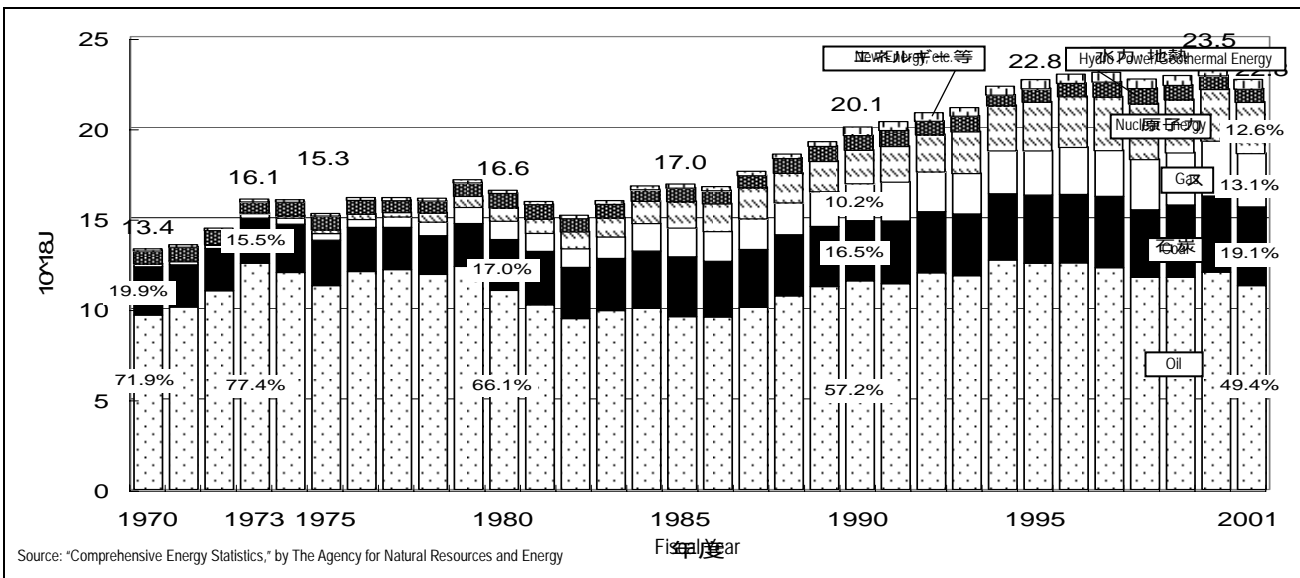
Structural changes in the domestic and international energy situation have recently emerged. First, the situation in the Middle East, on which Japan relies for the majority of its crude oil supply, remains unstable, while the increased demand for energy in Asian countries with China at the lead has had a substantial effect on the global energy market. Secondly, on the domestic front, changes in the socioeconomic environment have transpired including the onset of an aging society coupled with a declining birthrate, the changes in national consciousness and lifestyles, and the further development of market competition in the energy sector. Furthermore, based on the growing concern with global warming issues, environmental restriction is increasing in such a way that more decisive measures are being requested for global environmental issues.

(2) Position of coal in the energy policy and the history of coal policy

Though coal does exert a larger environmental load than other fossil fuels, it has been important in the energy policy of Japan as an energy source superior in its supply stability. Domestic coal, which held the central position in the energy supply of Japan for some time after the end of World War II, was soon replaced by oil; however, the ratio of coal in the primary energy supply has been maintained at slightly below 20% over the past 20 years by increasing imports of inexpensive overseas coal.

The domestic coal policy followed for more than 40 years after the end of World War II as the pillar of Japan's coal policy was basically completed at the end of March 2002, when the last coal policy (the so-called "Post 8th Coal Policy") that positioned the 1990s as the final stage of the structural adjustment of domestic coalmines was completed. The coal policy now in effect is focused on the stable supply of overseas coal along with the promotion of environmentally friendly use of coal, both which are being fully implemented based on the repositioning of coal in the energy policy after the two oil crises.

<Chart 2> Trend in Japan's Primary Energy Supply

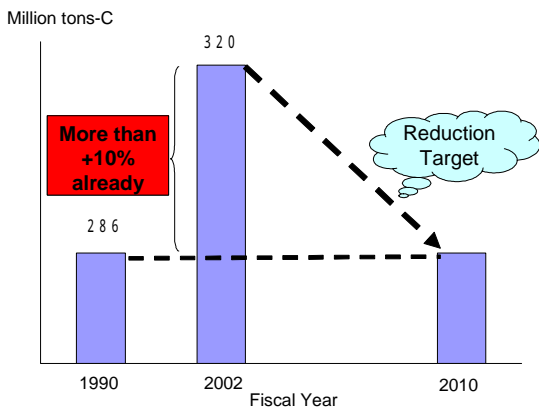


(3) Changes in coal-related situations and necessity of a new coal policy

Coal is an important energy source accounting for around 20% of Japan’s primary energy supply, and lately, various issues have been raised once again due to changes in the energy situation. First, derived from growing concern with global environmental issues, advancements in environmentally friendly use of coal are being requested for an energy resource that has a relatively larger emission of carbon dioxide (CO₂) per unit calorific value. In addition, as the price of coal has skyrocketed in an unprecedented manner in recent years, driven by both supply and demand side factors since the latter half of 2003, there is an ever-increasing need to establish an environment in which supply and demand coordination is rapidly secured corresponding to the increasing coal demand in Asian countries, especially in China.

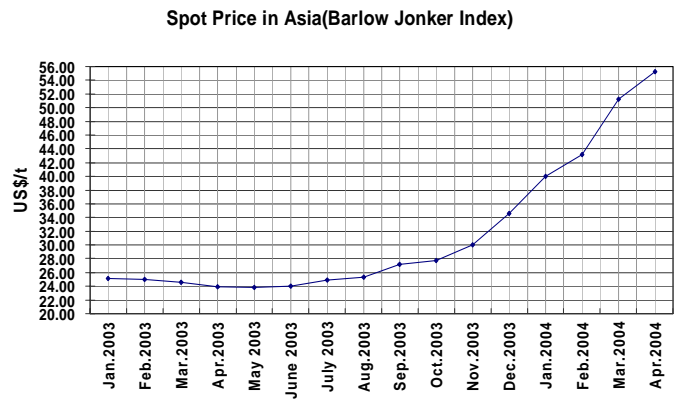
Considering the combination of these situational changes at a time when the domestic coal policy constituting the core of Japan’s coal policy for many years has been completed, a “new” coal policy is now required to address the issues confronting coal in the whole of Asia, with a long-term perspective extending to around 2030.

<Chart 3> CO₂ Emission Reduction Target Resulting from Energy Use as Specified in “the Guideline of Measures to Global Warming” by Japanese government



Source: Value of the Inventory Report for FY 2004

<Chart 4> Trend in Recent Coal Price



2. Basic concept of the new coal policy

(1) Study perspective

In investigating a guideline for Japan's medium- to long-term coal policy hereafter, the following three perspectives are considered to form the basic concept based on the recent structural changes in the energy situation.

Pan-Asian perspective for taking measures against energy and environmental issues

Since energy/environment issues are beyond the framework of any individual country, international cooperation is indispensable for taking any concrete measures to address these issues. In particular, for Japan that relies on imports to meet the majority of her energy demand, securing a stable energy supply through international trade is vitally important. It is anticipated that the demand for coal will steadfastly increase in Asian countries, while the majority of coal demand within Asia would be covered continuously by the coal-producing countries in Asia including Australia, and thus each country within Asia has great concerns about coal supply and demand stability as well as the efficient use of coal. Accordingly, it is essential to study measures to facilitate coal supply/demand stability and efficient, environmentally friendly use of coal, considering the two as common issues within Asia, a region that continues to deepen its interdependent economic relationships. Furthermore, when considering the whole of Asia as a unified economic zone where coal demand is increasing, regional coal supply/demand stability can contribute to the maintenance and improvement of energy self-sufficiency throughout the zone.

<Chart 5> Forecast of Coal Supply and Demand for Major Asian Countries

(Million tons)

		1999	2005	2010	2015	2020
Total, Major Asian Countries	Production	1144.3	1,349.7	1,512.2	1,700.8	1,950.8
	Consumption	1325.0	1,514.6	1,687.3	1,930.6	2,245.4
Supply Shortage in Asian Area		180.8	164.8	175.0	229.8	294.6
Australia	Production	252.2	312.6	328.7	348.4	370.9
	Consumption	77.8	82.1	85.0	91.1	99.2
	Balance	174.4	230.5	243.7	257.3	271.7
Ratio of coal exports from Australia to Asia in 2002						79.3%

Remarks:

1) Calculated on the assumption that 1 kg of coal has the calorific value of 6,000 kcal, and 1 ton of oil is equivalent to 1.645 tons of coal.

2) Major Asian Countries: Japan, China, Korea, Taiwan, Indonesia, Malaysia, Philippines, Thailand, and Vietnam (India is not included.)

Source: APERC, "APEC Energy Demand and Supply Outlook 2002," 2002.

Medium- to long-term perspective towards 2030

Whereas it is possible for technological innovation in the energy sector to remarkably alter the position of each energy source, a considerable amount of time is required from the development stage to the practical application stage. Since coal resources are abundant, there is also the possibility that the difference in the amount of reserves may alter the position of each fossil fuel through fluctuations in price and other factors from the medium- to long-term perspective. Therefore, in investigating a new coal policy, a medium- to long-term forecast is required, with a focus on 2030, in consideration of the possible effects on the future position of coal due to the abundance of coal resources and technological innovation in the energy sector.

All-round perspective from upstream(development) to downstream(use)

Thus far there has been a distinct tendency to independently adopt measures for each phase, from coal development through to coal use, based on the distinct tasks involved such as coalmine development, promotion of infrastructure construction, improvement of heat efficiency, and processing of coal ash. However, these individual tasks do not independently exist as evidenced by the fact that, for example, increasing supply capacity requires proportional investments in each phase, such as the coalmine development and the infrastructure construction phases, and the improvement of heat efficiency and the processing of coal ash requires measures downstream such as the upgrading of the technology and, simultaneously, measures in the upstream such as coal refinement and improved coal selection. Furthermore, situational changes have been witnessed recently such as increasing instances where power generation firms are locating at coalmine sites as well as stronger interest being

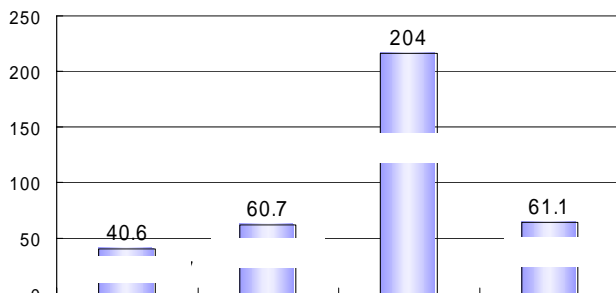
shown in coalmine development on the side of coal consumers. Therefore, in order to reach an optimal solution to a series of tasks from coal development to coal use, it is necessary to deploy a comprehensive measure covering the complete process from upstream to downstream.

(2) Characteristics of coal and position of coal in the energy resources policy

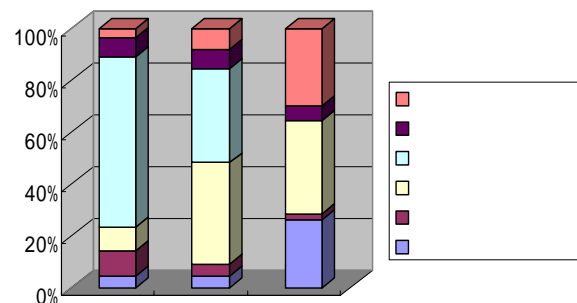
Coal as an energy resource has the advantage of stable, lower prices than other fossil fuels due to abundant resources and relatively wide distribution all over the world, but the disadvantage of imparting a larger environmental load when combusted due to its higher carbon, sulfur, and ash contents. In addition, coal is more inconvenient in terms of transportation and storage because of its solid status, but it has the benefit of reduced hazards of spillage, ignition, and explosion.

Since the position of coal having such characteristics in the energy resources policy is to be determined on the basis of its relative advantages and the relative disadvantages as compared with other energy sources, it would be important to preserve and intensify such advantages and to make efforts to overcome such disadvantages. Although coal has the advantage of superior supply stability at present, reducing its higher emission quantity of CO₂ per unit calorific value is the largest task faced; however, coal has remained one of the alternatives in the pursuit of a well-balanced energy supply structure to cope with various issues. In the future, with advances in innovative technological development, such as high-efficiency combustion technologies through coal gasification, CO₂ sequestration technologies, and other technologies anticipated towards 2030, coal is expected to become a promising alternative as a CO₂-free energy source in the pursuit of a well-balanced energy supply structure.

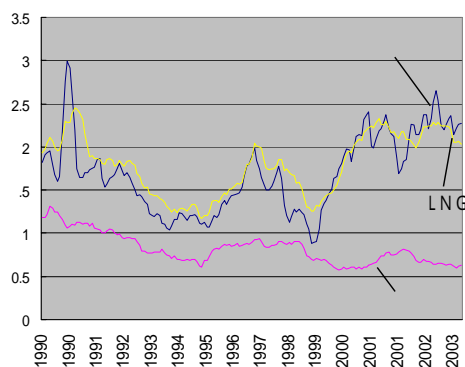
<Chart 6> Proved Reserves and Recoverable Years of Major Resources



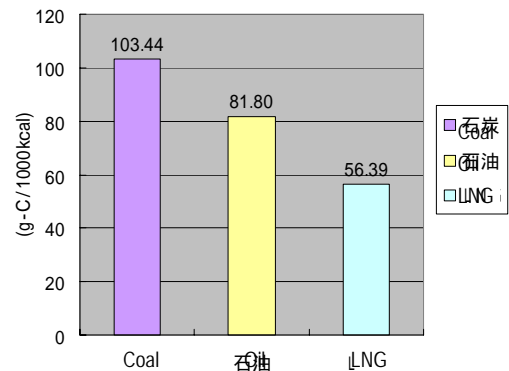
<Chart 7> Distribution of Proved Reserves of Resources



<Chart 8> Average Imported CIF Price by Energy Source



<Chart 9> Carbon Emission Coefficient by Energy Source



Source: Japanese Government's Report Based on the "United Nations Framework Convention on Climate Change"

(3) 3 policy targets and 5 basic directions of the new coal policy

Based on the above-mentioned characteristics of coal, a new coal policy towards 2030 should target the following:

- Firstly, to reduce the environmental load of CO₂ emission, etc. in connection with coal use (overcoming disadvantages);
- Secondly, to use coal from the perspective of diversifying energy sources to make it work as a leverage against other fossil fuels, (making the best use of advantages); and
- Thirdly, to secure a stable supply of coal (maintaining and strengthening advantages).

Moreover, the policy should be promoted along the following 5 basic directions:

Promote high-efficiency use

In order to secure stable supply at lower prices—the largest advantage of coal— as well as to reduce environmentally harmful emissions arising from coal use, the development and active dissemination of technology for high-efficiency use of coal in the power generation sector should be promoted. In particular, from the perspective of CO₂ reduction on a global basis and stimulation of Japan's economy, in order to promote the technology dissemination on a commercial basis to Asian countries where coal use is expected to increase, the establishment of concrete programs for the utilization of the Kyoto Mechanisms and the utilization of policy finance should be promoted. Furthermore, for projects in the demonstration stage, the short- and medium-term economics and the dissemination scenarios should be verified from time to time considering the price trends of other fossil fuels and the trend of international environmental regulations during the implementation of the concrete programs.

Reduce/utilize environmentally harmful byproducts

To reduce the environmental load—the largest disadvantage of coal—the development and dissemination of technologies such as CO₂ separation/sequestration technologies should be promoted to contribute to the reduction and utilization of environmentally harmful byproducts (CO₂, SO_x, NO_x, coal ash and others) associated with coal use. In particular, considering that such byproducts as coal ash and others can also be utilized overseas, taking measures on a pan-Asian scale should be promoted. Furthermore, for projects in the demonstration stage, the short- and medium-term economics and the dissemination scenarios should be verified from time to time considering the trends in domestic and international environmental regulations as the presumption for introduction during the implementation of the concrete programs.

Cultivate new possibilities

To make coal compete more with other energy sources and to secure stable energy supply as a whole through diversification of energy sources, expanding possibilities of coal use should be promoted. Furthermore, for projects in the research and development stage, emphasis should be placed on the pursuit of coal's potential based on a long-term perspective, while for projects in the demonstration stage, the short- and medium-term economics and the dissemination scenarios should be verified from time to time during the implementation of the concrete programs.

Expand supply potential

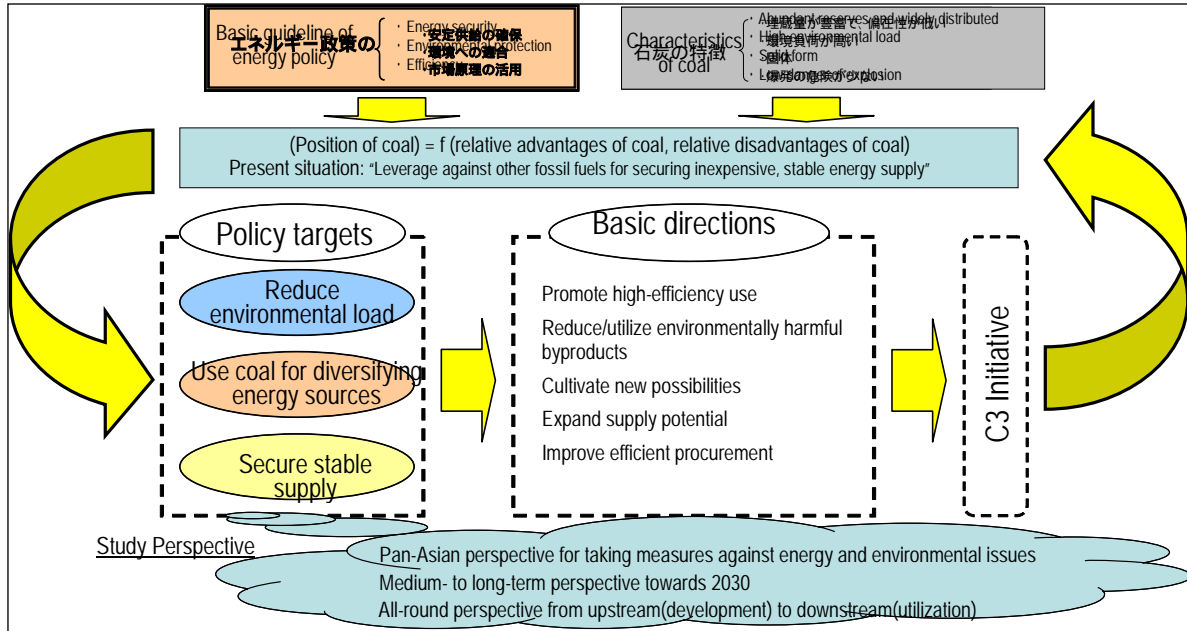
To maintain and strengthen coal's stable, low-cost advantage, and to ensure prompt supply/demand coordination (equal to price coordination) corresponding to increasing coal demand in the Asian region, infrastructure improvement should be promoted to accommodate the expansion of potential energy supplies through the utilization of policy finance. In the implementation of the concrete programs, after verifying the cost-effectiveness of each program anchored in full utilization of the market mechanism, emphasis should be placed on the program that targets the dissolution of any supply bottleneck. Based on the recognition that infrastructure establishment should be under the responsibility of the coal-producing countries, in principle, in selecting an individual project, its contribution to Japan is to be considered as well.

Improve efficient procurement

In order to maintain and strengthen coal's stable, low-cost advantage under the circumstances where coal demand in Asia increases hereafter, the establishment of an efficient coal-trading environment should be nurtured in such a way that a liquid coal-trading market is established through provision of transparent, fair price indices. In the implementation of the concrete programs, the formulation of a mechanism that is advantageous to both the

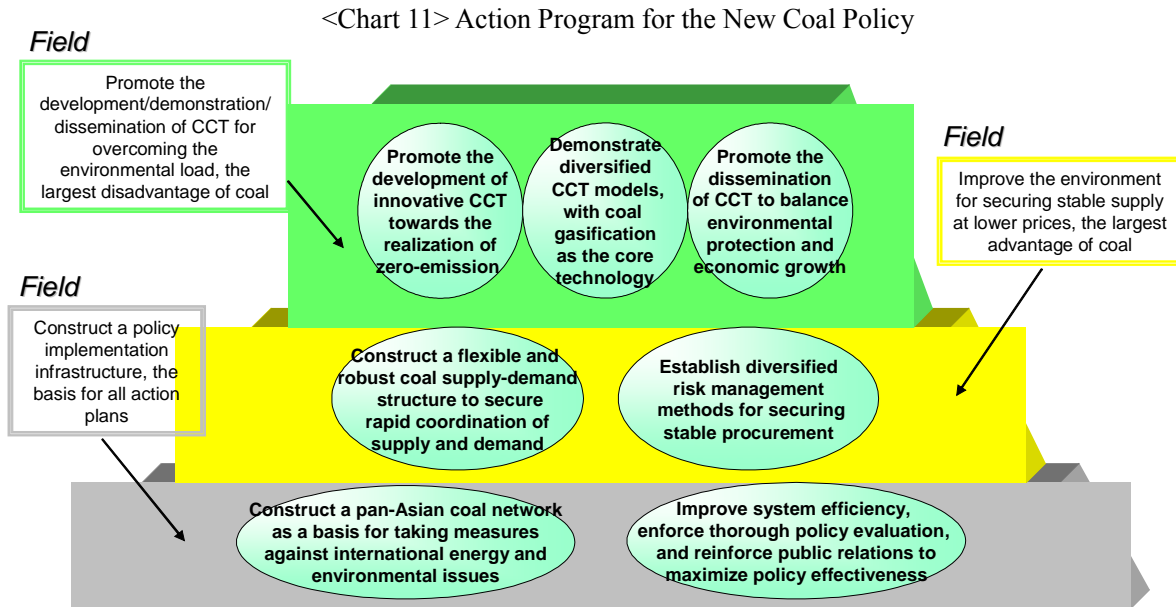
coal producers and the coal consumers should be pursued from the medium- to long-term perspective with a view to establishing an environment where individual coal consumers can select an efficient procurement method suitable to their respective needs.

<Chart 10> Basic Concept of the New Coal Policy



3. C3 Initiative towards the establishment of the Clean Coal Cycle

With a view to establishing **a virtuous cycle (Clean Coal Cycle) to position coal as more influential energy source by maintaining and strengthening its stable, low-cost supply advantage and enlarging environmentally friendly use** with a focus on 2030, it is important to promote the Clean Coal Cycle (C3) Initiative consisting of the following three emphasized fields and seven pillars (action plans).



(1) Promote the development/demonstration/dissemination of clean coal technology (CCT) for overcoming the environmental load, the largest disadvantage of coal

Promote the development of innovative CCT towards the realization of zero-emission utilization

With a view to positioning coal as a CO₂-free energy source in 2030 and clarifying the positioning and relationship of each technology over the entire interval, the development of innovative, environmentally friendly coal utilization technology (CCT) should be actively promoted in forms such as next-generation high-efficiency gasification technology or CO₂ sequestration technology towards the realization of zero-emission utilization. For the practical application of CO₂ sequestration technology and in order to materialize substantial cost reduction, measures such as the enhancement of crude oil production through the injection of CO₂ into oil fields or the recovery of methane gas through the injection of CO₂ into coal beds should be promoted Asianwide.

(Examples)

- *Implementation of F/S on next-generation coal gasification technology (This year on)*

A feasibility study should be conducted on a high-efficiency power generation system (A-IGCC, A-IGFC) drastically improving energy conversion efficiency (65% or more at the transmission end) through gasifying coal at the lowest possible temperature, and utilizing the waste heat of high-temperature gas turbines.

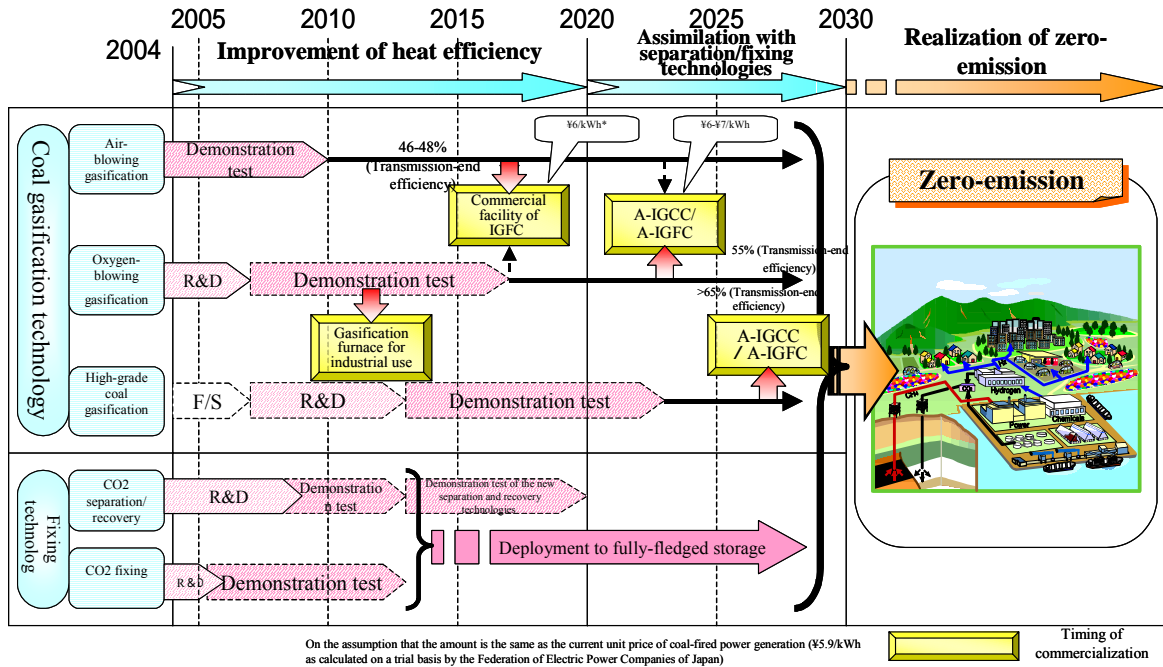
- *Implementation of F/S on the application of oxygen combustion technology to a pulverized coal-fired power generating facility (International cooperative research) (This year on)*

Feasibility study should be conducted for a system in which pulverized coal is combusted not with air but with oxygen at an existing coal-fired power plant, and most of the waste gas is converted to CO₂, thus facilitating the recovery and sequestration of CO₂. Cooperative research with Australia is scheduled.

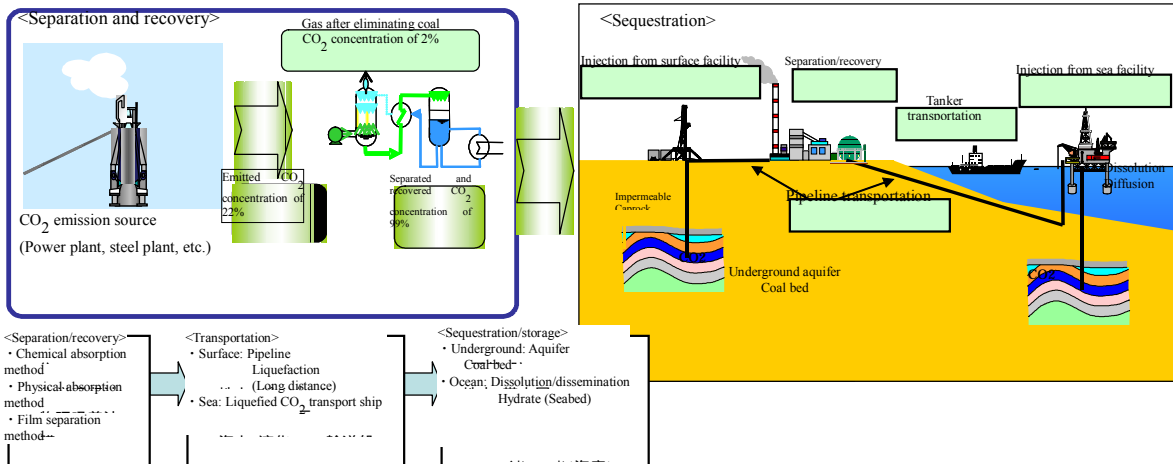
- *Implementation of demonstration test of integrated coal gasification combined-cycle (IGCC) (Continued)*
- *Implementation of research and development of integrated coal gasification fuel cells combined-cycle (IGFC) (Continued)*
- *Implementation of research and development of CO₂ recovery type hydrogen production by reaction integrated novel gasification process technology (HyPr-RING) (Continued)*

• Implementation of research and development of CO₂ separation/recovery/ sequestration technologies (Ocean /underground/coal bed sequestration) (Continued)

<Chart 12> Road Map for the Development of Innovative CCT for Realizing Zero-emission Utilization



<Chart 13> CO₂ Separation, Recovery, and Sequestration



<Column 1> Coal Gasification Technology to Realize Simultaneous Achievement
of Three Policy Targets

Coal gasification technology can reduce CO₂ emission—the largest task in coal utilization—and effect maximization of coal's potentiality (possibility of utilizing as a diversified raw material), which contributes to a stable supply of coal.

There are two approaches to the reduction of CO₂ emission, namely Reduction of CO₂ generation quantity by utilization efficiency improvement, and Recovery/sequestration of CO₂ contained in emission generated. Integrated coal gasification combined-cycle (IGCC), in which combined power generation is conducted with a gas turbine and steam turbine, and integrated coal gasification fuel cell combined-cycle (IGFC), in which superior efficiency improvement is conducted by combining IGCC with fuel cells, belong to the former approach, and efficiency improvement of 20% and 30% or more can be expected, respectively, as compared with conventional coal-fired power generation. Furthermore, next-generation coal gasification technology aims at efficiency improvement of more than 50% as compared with the conventional coal-fired power generation by dramatically improving the efficiency through conducting gasification under low temperatures by recycling the waste heat of gas turbines. Coal gasification technology can also play a significant role in the latter approach, namely in the recovery/sequestration of CO₂, and as a result of the process where separation and recovery of CO₂ can be achieved in a high concentration before combustion through gasification, a drastic reduction in the separation/recovery cost, which is considered a bottleneck for carbon sequestration, can be achieved.

Coal gasification technology is also a technique to broaden the possibility of utilizing coal as a diversified raw material. Synthetic gas obtained by gasification can be used not only as fuel for power generation, but also as raw material for chemicals, liquefied fuel such as DME and GTL, and further as a hydrogen source for fuel cells. Accordingly, for instance, it is possible to form a co-production system to realize an improvement in integrated energy utilization efficiency by co-producing electric power and chemical raw materials with coal gasification as the core. In addition, for biomass and waste, for which it is difficult to materialize cost reduction through economies of scale since a large amount cannot be secured at any one time, efficient utilization of such resources is enabled by being jointly utilized with coal, and thus such technologies can realize the reduction of CO₂ emission while simultaneously contributing to the formation of a recycling-oriented society.

The contribution to securing a stable coal supply, too, cannot be ignored as one of the roles that coal gasification technology can play. Thus far, for the majority of fuels for coal-fired power generation, Japan has relied on high-grade coal from overseas, but in order to realize alleviation in coal supply and demand stringency Asianwide, it will be crucial to proceed with the utilization of low-grade coal under high-efficiency conditions. In coal gasification, a wide range of coals, from high-grade bituminous coal to coal with a low degree of carbonization and high activity, such as lignite and sub-bituminous coal, can be utilized. Consequently, the development and dissemination of coal gasification technology would especially contribute to the alleviation of the supply and demand stringency of high-grade coal.

The United States of America, which does not intend to ratify the Kyoto Protocol and is proceeding with countermeasures against global warming independently, has been promoting the FutureGen Project in which zero-emission coal-fired power generation is realized by integrating a series of technologies starting from coal gasification and hydrogen production/utilization to separation/recovery/sequestration of CO₂. Regarding the individual technologies used in this project, Japan is considered to be at the same level as the United States, so it is likewise requested in Japan that the promotion of a zero-emission project be implemented by improving the efficiency of coal utilization and diversification of such utilization, and by integrating CO₂ separation/recovery/sequestration technologies with coal gasification technology as the core.

Demonstrate diversified CCT models, with coal gasification as the core technology

The demonstration of diversified CCT models, such as hybrid gasification with coal and biomass/waste plastics and others, co-production of electric power and chemical materials, and hydrogen production, should be implemented with the coal gasification technology—key to the technological development process targeting the realization of zero-emission utilization in 2030—as the core. In the dissemination of demonstration models, taking measures in accordance with the characteristics of the region is to be promoted for the realization of a recycling-oriented society/hydrogen economy society appropriate to each region.

(Examples)

- *Implementation of F/S on an integrated model of the hybrid gasification/hydrogen/CO₂ sequestration system*

(This year)

A feasibility study should be implemented on a demonstration model of the optimum system, in which coal/biomass/waste plastics and others are simultaneously gasified, CTL/hydrogen and others are manufactured with the thus obtained gas, and are then used for power generation and fuels for automobiles, and furthermore, CO₂ sequestration is conducted throughout.

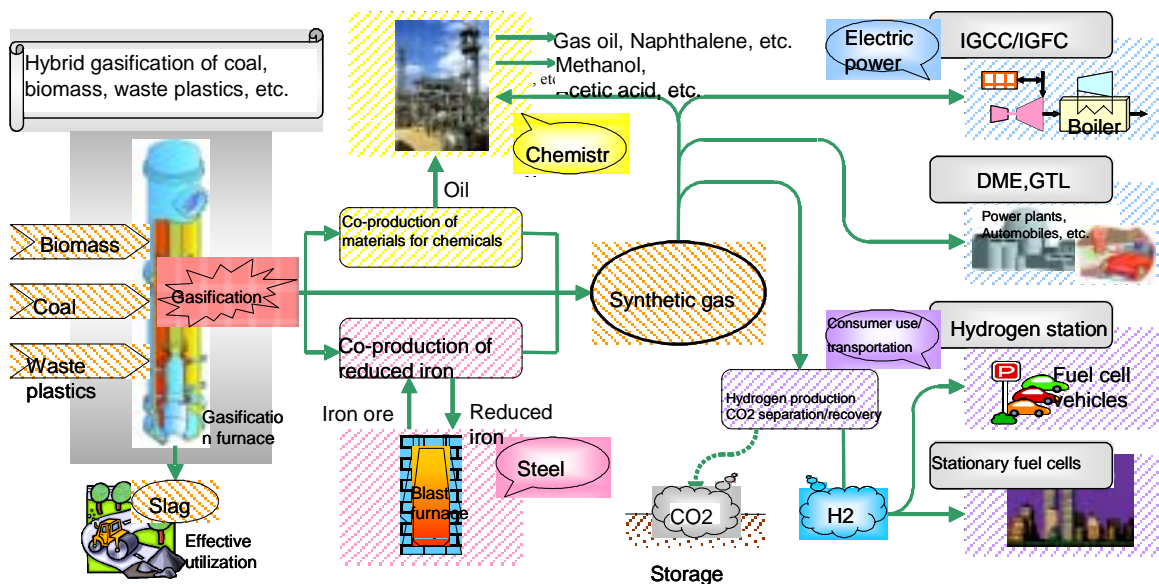
• Implementation of F/S co-production system with reduced iron (This year)

A feasibility study should be conducted on a demonstration model of the co-production process, in which iron ore is reduced in a shaft furnace by using gas obtained from coal gasification, and at the same time the gas is refined, and the semi-reduced iron thus obtained is sent into a blast furnace, and clean gas thus refined is utilized for power generation, hydrogen production, etc.

• Implementation of research and development of coal partial hydrogenation thermal cracking technology (Continued)

• Implementation of demonstration test of DME direct synthesis technology (Continued)

<Chart 14> Demonstration of Diversified CCT Models, with Coal Gasification as the Core



Promote the dissemination of CCT to balance environmental protection and economic growth

To promote CCT dissemination on a commercial basis to Asian countries where increased coal demand is hereafter anticipated, it is necessary to bring to fruition the first CDM-approved project at an earlier date in each CCT field, such as high-efficiency coal-fired power generation, a high-efficiency boiler for industrial use, and the effective use of coalmine methane gas, by establishing a crediting calculation method (greenhouse gas reduction effect) resulting from the introduction of CCT under CDM. Further, to promote the dissemination of Japan's CCT on a commercial basis in Asian countries where such dissemination has not been fully progressed because of comparatively lenient environmental regulations, even though certain CCT such as desulfurization/denitrization facilities have sufficient price competitiveness, it is necessary: to collaborate with other governments to enact stricter environmental regulations; to improve the investment environment in Asian countries through bilateral policy dialogue; and to promote the active utilization of policy finance to support the dissemination of CCT. To promote CCT dissemination domestically, the active utilization of a subsidy system for the introduction of facilities that realize a considerable energy-conservation effect should be promoted.

(Examples)

• Investigative excavation of CDM model projects utilizing CCT (This year)

With several Asian countries as the targets of these studies, where there is an actual record, such as becoming a host country for CDM-determined projects, and there is an advanced system for implementing CDM, investigations should be conducted on the possibility of the realization of CDM project activities based on CCT. Several proposals for model projects should be mapped out for each country, taking into consideration the various specific situations therein.

- *Implementation of feasibility study concerning effective utilization of coalmine methane gas (CMM) (This year)*

A feasibility study should be conducted on a possible CDM project activity in which CMM discharged from underground mining in China and others is effectively utilized for power generation, etc.

- *Implementation of policy dialogue with major countries (This year on)*

To promote the dissemination of CCT in Asian countries on a commercial basis, a positive approach should be taken to establishing appropriate environmental regulations and improving the investment environment through bilateral policy dialogue.

- *Research and development should be implemented on technology to effectively utilize coal ash (Continued)*

<Column 2> Diffusion of CCT through Utilization of CDM

The utilization of the Clean Development Mechanism (CDM) under Article 12 of the Kyoto Protocol is considered to contribute to the dissemination of CCT on a commercial basis as profitability increases are made possible through credit acquisition. However, one of the large tasks involved in utilizing CDM is establishing the baseline for calculation of credits to be issued corresponding to the quantity of greenhouse gas emission reduced. In particular, it is difficult to establish the baseline for a CDM project activity in which greenhouse gas emission reductions are achieved by efficiency improvement as compared with the conventional technology, and thus there has been no application submitted to date for the approval of a CDM project activity utilizing CCT with the CDM Executive Board, the body responsible for approving methodologies for establishing individual baselines.

Under such circumstances, so as to realize the first CDM-approved project at an earlier date in each CCT field, such as high-efficiency coal-fired power generation, a high-efficiency boiler for industrial use, and the effective utilization of coalmine methane gas, several feasibility studies are to be conducted within this fiscal year as the first step towards the possibility of realization of CDM project activities through CCT in Asian countries. Countries targeted for the studies should be those where the establishment of a system for the implementation of CDM is progressed, such as having actual results as a CDM host country. Considering various situations in the host country including its determination and desire, we intend to devise several (virtual) model project proposals with the high possibility of a CDM project activity being realized for each country. As the second step, after scrutinizing the concrete possibility for realization including the will of participation by the private sector for the individual model project proposals to be identified through the investigation this fiscal year, the project with the highest possibility of being realized is to be selected in and after next fiscal year. Lastly, as the third step, by actively approaching the host country through policy dialogue, and by obtaining policy support such as utilization of policy finance, the objective is for a private sector firm as the model project promotion organization to submit an application for project approval to the CDM Executive Board as soon as practical, thus bringing to fruition a CCT-based CDM project.

(2) Improve the environment for securing stable supply at lower prices, the largest advantage of coal

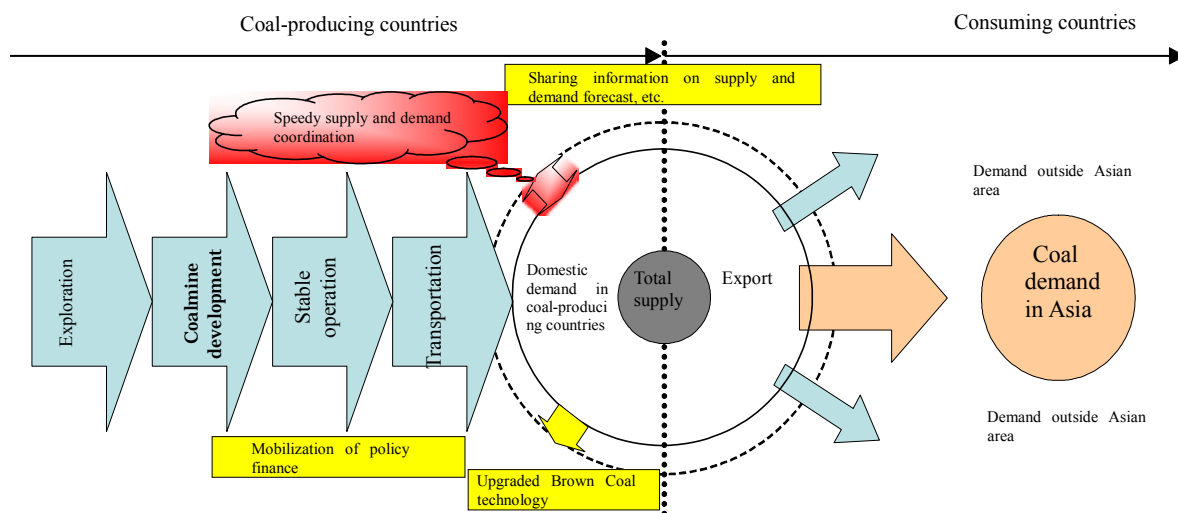
Construct a flexible and robust coal supply-demand structure to secure rapid coordination of supply and demand

To resolve bottlenecks to stable coal supplies in terms of infrastructure like railways/ports, we aim to expedite coalmine development and infrastructure improvement through enhanced investigation of infrastructure improvement and mobilization of policy finance, as well as adopt an active approach for improving trade/investment environments to facilitate financing through policy dialogue with coal-producing countries. Additionally, we intend to accelerate measures for the practical application of low-grade coal refinement technology that contributes mitigating the supply and demand stringency of high-grade coal, the major type of coal demanded in Japan. Furthermore, to expedite timely coalmine development based on an exact forecast of supply and demand, we aim to exchange coal supply and demand forecast information within the Asian region by utilizing multilateral organizations such as APEC and ASEAN+3 (Japan, China, and Korea).

(Examples)

- *Enhanced investigations of infrastructure improvement in coal-producing countries (This year)*
Starting with China and Russia, investigations are to be conducted with emphasis on the status and need for the maintenance and development of infrastructure, such as railways and ports, in coal-producing countries.
- *Exchanging information on the Asian coal supply and demand forecast within APEC (Winter, this year)*
We aim to exchange information on the current task of supply capacity expansion and the coal supply and demand forecast for the Asian region as well as investigate some concrete measures within APEC (Coal Policy Seminar).
- *Implementation of research and development of Upgraded Brown Coal technology (UBC) (Continued)*
We intend to implement research and development on the refining technology to heighten the calorific value of low-grade coal that exists in abundance in Indonesia and to enable it to be used as high-grade coal. Hereafter, an investigation should be conducted on the demonstration test intended for its practical application.
- *Implementation of geological surveys (Continued)*
- *Implementation of projects for coal mining technology transfer (Continued)*

<Chart 15> Assignment for Realization of Rapid Supply and Demand Coordination (Coal Supply Flow Chart)



<Column 3> Possibility of Innovative Uses of Coal Resulting from Coal Refining Technology

The steam coal used in Japan is represented by high-grade coal like bituminous coal, a stable coal with high carbonization. This phenomenon is based on the following background: Since coal must be transported via ship over long distances for procurement, buyers seek low-volatility coal with less danger of explosion, and also with larger calorific volume per unit weight from the perspective of reduction of transportation cost; and On the side of coal users starting with the electric power sector, high-quality coal with low water content is strongly sought after in order to realize maximum operational efficiency.

One of the characteristics of coal is that the proven reserves are large compared with other fossil fuels, but around 50% of such reserves are represented by low-grade coal of low carbonization having high water content, such as sub-bituminous coal and lignite. Such low-grade coal has seldom been traded beyond the country-of-origin's border due to the transportation issues mentioned above, and has been consumed mostly within the producing country. However, in the event that it is possible to upgrade the calorific value of such low-grade coal to the level equivalent to high-grade coal and to process such low-grade coal in a form for easier transportation and utilization with coal refining technology (for instance, UBC, or Upgraded Brown Coal technology), the alternative for low-grade coal utilization in coal-consuming countries would emerge, which

should contribute to the mitigation of global coal supply and demand stringency. In addition, since most low-grade coal features low sulfur and ash contents, its use would be desirable from the standpoint of environmental protection.

Furthermore, research and development of refining technology to reduce the ash of coal to the minimum possible is now in progress. The technique produces coal having almost no ash content (Hyper-coal) by extracting only the contents to be dissolved in oil. Hyper-coal enables direct combustion at gas turbines that has so far been impossible due to the existence of ash content, and thus CO₂ emission reduction is expected through high-efficiency fuel utilization through combined power generation with gas and steam turbines and with no need of a gasification furnace. Moreover, by using Hyper-coal at existing pulverized coal-fired power generation facilities and others, the problem of processing the ash can be avoided. Additionally, utilization in wider fields can be expected, for instance, in the steel and non-ferrous metals smelting industries.

Establish diversified risk management methods for securing stable procurement

In an attempt to establish an environment in which domestic coal consumers are able to properly manage risks in connection with changes in individual demand and securing the necessary quantities, and fluctuations in market prices, a study should be initiated immediately towards the establishment of a liquid spot market and a liquid futures market. Utilization of policy finance should be promoted to enhance the support for coal consumers who intend to minimize losses due to price fluctuations by gaining investment profit through securing concessions as one means to hedge the risk of coal price fluctuations.

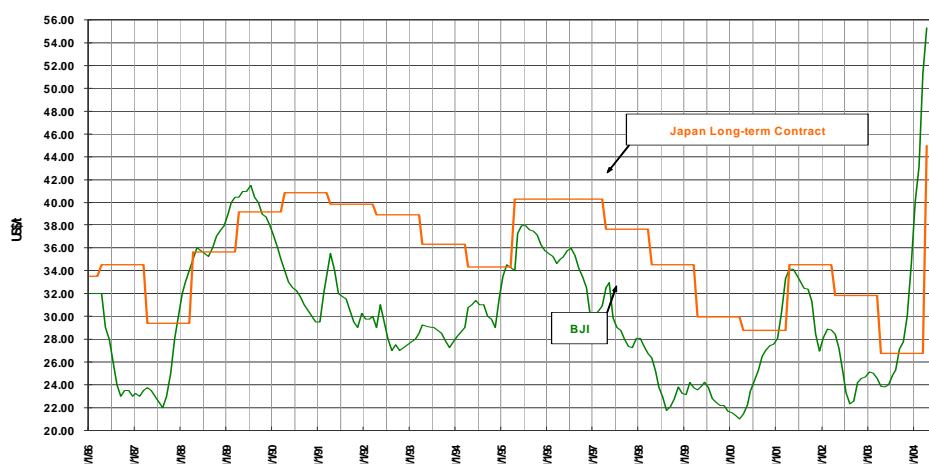
(Examples)

- Start of a study on the establishment of a liquid spot market and liquid futures market (Summer, this year)

Recognition should be shared among the persons concerned on the concept of establishing an environment to enable the many sellers and buyers concerned to participate in market trading on a spot basis with a sense of security, consisting of factors such as commodities to be traded, trading conditions, and clarification of rules, through hosting workshops and other means. In addition, concerning the futures market, an investigation should be conducted on how to determine the trading participation qualifications, market supervision/observation, etc.

- Promotion of the utilization of overseas investment loss reserve fund system (Continued)

<Chart 16> Japan's Long-term Contract Price & Asia's Spot Price



Remarks) BJI (Barlow Jonker Index) partly contains the prices for Europe.
Source: Barlow Jonker, "Coal 2002" & "Australian Coal Report".

However, the long-term contract price for 2004 is an estimated value.

<Column 4> Establishment of Liquid Spot Market and Liquid Futures Market

The majority of coal trading in Japan has been thus far based on long-term contracts of one year or more, and the trading quantity not based on such long-term contracts, but on so-called spot contracts has been limited. However, spot trading is increasing recently with the progress in electric power liberalization as a backdrop. Currently, spot trading is conducted bilaterally on a one-to-one basis, and a “market”, in which countless sellers and buyers trade simultaneously, has not fully evolved. This has been due to the lack of spot trading and the fact that bilateral trading was more suitable than market trading for those seeking a specific kind of coal.

However, to secure the rapid formation of prices precisely reflecting the supply and demand balance while hereafter users will seek wider varieties of coal, it is indispensable to utilize the price discovery function of the market by establishing a liquid spot market. In order to form a liquid spot market at an early date, it is important to deepen discussions among those concerned with regard to the tasks required for market formation, such as commodities to be traded, trading conditions, clarification of rules, etc.

With the increase in spot trading in recent years, the need for a futures market as the foundation, where the risk of price fluctuation is hedged, has been heightened. In actuality, in coal trading in the United States and Europe, with electric power deregulation and other changes in the latter half of the 1990s as a background, spot trading has increased, and simultaneously, future trading has been initiated as well. As the possibility exists in futures trading that participants may suffer unexpected losses depending on the commodities traded, a study should be made on the trading participation qualifications and appropriate means of market supervision/observation in addition to the clarification of commodities to be traded, trading conditions, and rules.

(3) Construct a policy implementation infrastructure, the basis for all action plans

Construct a pan-Asian coal network as a basis for taking measures against international energy and environmental issues

To promote environmentally friendly coal utilization while securing a stable coal supply and demand situation within the Asian area, efforts should be made to reinforce the relationship with Australia, China, Indonesia, Vietnam, etc. through bilateral policy dialogue. Concomitantly, information with each country should be sought on the coal supply and demand forecast within the Asian area and the tasks for the dissemination of CCT by utilizing multilateral organizations such as APEC and ASEAN+3. Furthermore, as a basis for the dissemination of a program for stabilizing coal supply and demand and the dissemination of CCT in a form suited to each country, construction of an international information network on coal should be implemented, and the training of coal professionals should be conducted.

(Examples)

- *Implementation of policy dialogue with major countries (This year on) (Re-listed)*

Aiming at benefiting both parties by comprehensively promoting the assurance of a stable supply of coal and the dissemination of CCT within the Asian area, bilateral policy dialogue should be implemented with major coal-producing countries such as Australia, China, Indonesia, Vietnam, etc.

- *Sharing of policy issues/information within ASEAN+3 (This year)*

Sharing should be promoted within ASEAN+3 with regard to each country's policy issues/information towards immediate supply capacity expansion and dissemination of CCT.

- *Implementation of F/S for the construction of a coal information network (This year)*

To make efforts towards promoting the dissemination of Japan's CCT in major Asian countries, a feasibility study should be implemented on the construction of a system enabling mutual transmission and receiving/sharing of information working in coordination with the existing local CCT-related organizations as a base.

Improve system efficiency, enforce thorough policy evaluation, and reinforce public relations to maximize policy effectiveness

To maximize policy effectiveness, the efficiency of the policy implementation system should be enhanced by clarifying the role of each policy implementation organization, and the thoroughness of the preliminary, interim, and final evaluations of policies should be assured by regularly conducting follow-up on the progress of each policy and also by performing quantitative evaluation to the extent possible. In addition, with a view to securing a stable supply of coal by transmitting precise information to the market continuously to enable the market to function efficiently, public relations activities should be reinforced.

(Examples)

- *Start of study toward enhancing the efficiency of a policy implementation system (Summer, this year)*
 To enhance the efficiency of Japan's coal policy, a study should be launched toward improving the policy implementation system, including the appropriate functions and construction of the policy implementation body.
- *Implementation of follow-up of C3 Initiative (Beginning of next year)*
 Follow-up should be conducted concerning the progress of the C3 Initiative, and simultaneously, the needs for each program of the Initiative should be reviewed as required based on economics and other considerations.
- *Reinforcement of public relations (Summer, this year on)*
 The contents of Clean Coal Day-related business should be expanded, and the contents of the website of the Coal Division should be augmented.

Conclusion –The aim of the C3 Initiative–

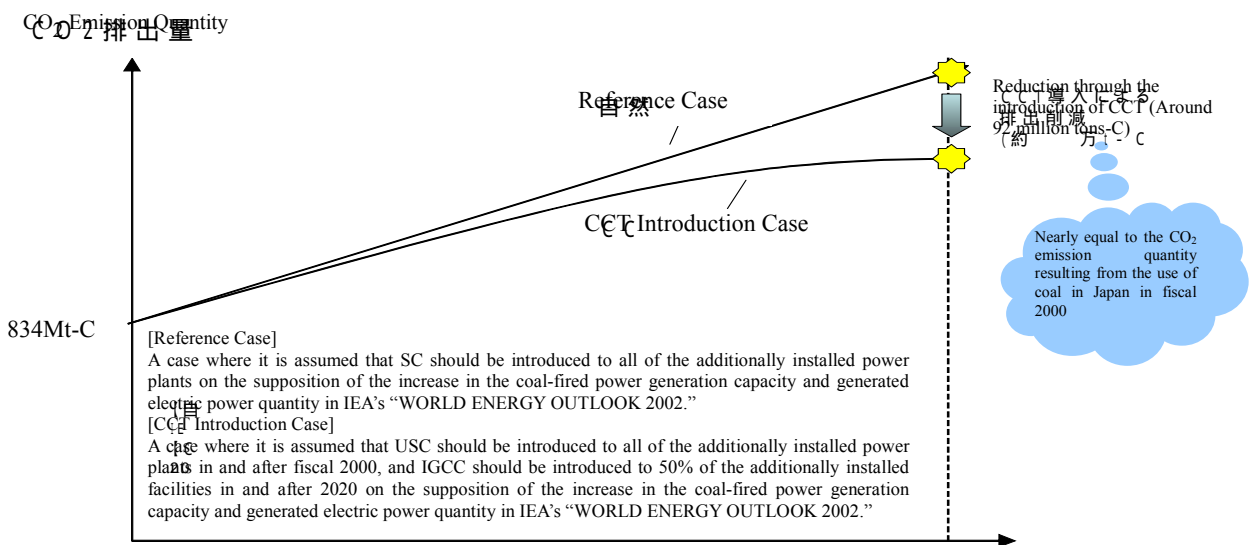
This Initiative is aimed at collating the strategies and concrete action plans for effectively utilizing coal in an economically reasonable and environmentally friendly manner over a medium- to long-term period in response to the contemporary needs for securing a further stable supply of energy and environmental protection when using energy.

Currently, coal's largest drawback is that its CO₂ emission quantity per unit calorific value is larger than other fossil fuels, and negative opinions against the expansion of coal utilization are commonly expressed. However, to meet the energy demand in Asian countries' steadfastly progressing economic development, increasing the use of coal that exists in abundance within the region is indispensable, while it is considered that the issue of CO₂ emission can be solved from a medium- to long-term basis through the development of innovative technologies. Therefore, giving a short-term response to the immediate tasks should be avoided from beginning to end without considering the possibility that coal can play a role in the short- and medium-term economic development of Asia as well as in the medium- to long-term stabilization of global energy supply and demand.

The intention of this Initiative compiled from such a perspective is that while Japan, the world's largest coal importing country, plays a leading role in the stability of coal supply and demand within the Asian region, the application of advanced environmentally friendly technologies developed in Japan will increase the compatibility of environmental protection and economics in the use of coal on both a regional and global scale. These strategies are suitable for Japan aiming at the realization of a society with high-efficiency energy utilization as a paradigm for the world, while the development and dissemination of innovative technology in the energy sector focusing on coal use may contribute to the enhancement of Japan's industrial competitiveness.

It is hereafter required, on the government side, to promptly put into practice the individual concrete programs based on this Initiative and to nurture the environment for effectively utilizing coal in an economically reasonable and environmentally friendly manner, while on the private sector side, to actively proceed with business development in each special field, with Asia—where a steadfast increase in coal demand is anticipated—as a major arena.

<Chart 17> Effect of CO₂ Emission Reduction through Asianwide CCT Diffusion (Excluding Japan)
(Electric Power Sector)



Fiscal 2000 年度 * The target of this trial calculation is 23 countries and areas, such as China (including Hong Kong), Korea, Indonesia, Thailand, Vietnam, Philippines, and others, excluding Japan. Fiscal 2030

List of responses on an Asian scale (for reference)

- Implementation of F/S on the application of oxygen combustion technology to a pulverized coal-fired power generation facility (International cooperative research) (This year)
- Investigative excavation of CDM model projects utilizing CCT (This year)
- Implementation of F/S concerning effective utilization of coalmine methane gas (CMM) (This year)
- Enhanced investigations of infrastructure improvement in coal-producing countries (This year)
- Exchanging information on the Asian coal supply and demand forecast within APEC (Winter, this year)
- Start of a study on the establishment of a liquid spot market and liquid futures market (Summer, this year)
- Implementation of policy dialogue with major countries (This year on)
- Sharing of policy assignment/information within ASEAN+3 (This year)
- Implementation of F/S for the construction of a coal information network (This year)

<Column 5> Economic Effect of Utilization of Inexpensive Coal (Trial Calculation)

Coal's biggest attraction is unquestionably its low price relative to other fossil fuels. Albeit the coal price has escalated since the latter half of last year due to the tightness between global supply and demand, the prices of crude oil and natural gas (LNG) have increased as well and the price difference per unit calorific value is still a factor of between two and three.

As there is an abundance of low-priced coal in the Asian region, coal demand in Asia is expected to increase steadfastly hereafter. For instance, according to an IEA forecast, coal demand in Asia (excluding India) in 2030 will increase to 3.4 billion tons, a quantity 1.8 times that of the 1.9 billion tons demanded in 2000. In the case where approximately 1.5 billion tons of coal equivalent to such an increase is to be substituted by natural gas (LNG), this would result in a fuel cost increase of over 11 trillion yen per year.*

On the other hand, the CO₂ emission reduction resulting from the above-mentioned energy substitution is around 450 million tons, which means investment of 25 thousand yen in order to reduce 1 ton of CO₂ emission.

Since no factors other than the fuel cost are considered here, straightforward comparisons cannot be made, but the utilization of inexpensive coal has a considerable economic effect (fuel cost reduction), and thus it can be said there would be a possibility that in order to reduce CO₂ emission, other means such as the promotion of CCT dissemination rather than fuel switching would entail less economic burden.

* On the assumption that the international cost of coal per ton is ¥5,000, and the international cost of natural gas (LNG) per unit calorific value is 2.5 times that of the coal price, while the transportation cost is ignored.

As of June 16th, 2004

List of Committee Members

Chairman

Suetsugu, Katsuhiko. Secretary General, Asia-Pacific Energy Forum

Members(Alphabetical)

Asano, Haruhiko. Executive Director, Chubu Electric Power Company
Ando, Katsuyoshi. President, Japan Coal Energy Center
Fujiwara, Shinichi. General Manager, Raw Materials Div.-1, Nippon Steel Corporation
Honjo, Kaoru. Executive Director, New Energy and Industrial Technology Development Organization (NEDO)
Horii, Hideyuki. Professor, Graduate School of Engineering, Tokyo University
Hosoda, Eiji. Professor, Faculty of Economics, Keio University
Kanekiyo, Kensuke. Managing Director, Institute of Energy Economics, Japan
Kashiwagi, Takao. Professor, Graduate School of Bio-Applications and Systems Engineering, Tokyo University of Agriculture and Technology
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Saito, Masato. Ex-President, Center for Coal Utilization, Japan
Sakanashi, Yoshihiko. General Manager, Business Planning Department, Electric Power Development Co., Ltd.
Suzuki, Hitoshi. General Manager, Fuel Department, Tokyo Electric Power Company
Urata, Shujiro. Professor, Social Science Faculty, Waseda University
Wakazono, Osamu. Executive Director, Mitsubishi Heavy Industries, Ltd.
Wake, Yoko. Professor, Faculty of Business and Commerce, Keio University
Watanabe, Hiroyuki. Executive Director, Toyoda Motor Corporation
Yamazaki, Aya. Director General, International Finance Department 2, Japan Bank for International Cooperation

Record of Meetings

- 1st: Jan.30 Position of coal in Japan's energy policy
- 2nd:Feb.27 Measures to develop and disseminate clean coal technologies
- 3rd:Mar.24 Measures to ensure stable supply of coal
- 4th:Apr.21 Basic concept of the new coal policy
- 5th:May24 Action program("Clean Coal Cycle Initiative")
- 6th:June11 Japan's new coal policy(Interim report)