

Report by the Subcommittee to Evaluate System Reforms

May 22, 2006

Subcommittee to Evaluate System Reforms

Electricity Industry Committee

Advisory Committee for Natural Resources and Energy

NOTE:

This is an English version of the “Report by the Subcommittee to Evaluate System Reforms”. It should be noted that the original Japanese text will prevail over the English in case of conflict.

Introduction

Chapter 1 Evaluation from the viewpoint of efficiency improvement

1. Retail market

- (1) Price reduction in Japan and international comparison
- (2) Reduction of retail prices in the liberalized sector
- (3) The effect of efficiency improvement over the restricted sector
- (4) Competition in the retail market
- (5) Options available to customers
- (6) Quantitative analysis on the impacts on the electricity price given by the institutional system reforms

2. Wholesale market

- (1) Structure of the power generation market
- (2) Institutional system reforms and the structural change of the wholesale power trade
- (3) Options of power procurement available to PPSs

Chapter 2 Evaluation from the viewpoint of stable supply

- (1) Capital investment
- (2) Interconnection lines
- (3) System operation
- (4) Preservation of security and restoration from disasters
- (5) Research and development

Chapter 3 Evaluation from the viewpoint of environmental protection

- (1) Trend of CO₂ emission
- (2) Customer needs for environmental adaptability

Chapter 4 Evaluation from the viewpoint of individual reform programs

- (1) Abolishment of the cross-area wheeling service charge (“rate-pancaking” system)
- (2) Imbalance charge system
- (3) Behavioral regulations
- (4) Neutral System Organization (organization to support transmission, distribution and other related operations)
- (5) Wholesale Power Exchange

Chapter 5 Evaluation on institutional system reforms of the electricity industries in foreign countries

- (1) Trend and evaluation of the system reform of the electricity industry in Europe

- (2) Trend and evaluation of the institutional system reform of the electricity industry in the U.S.

Chapter 6 Conclusion

1. Summary of evaluation

- (1) Efficiency improvement

- (2) Stable supply

- (3) Environmental protection

- (4) Individual reform programs

2. Measures to be implemented to solve current problems

- (1) Mitigating the burden of imbalance charges in the cross-area wheeling service

- (2) Improving interconnection facilities to eliminate market splitting

- (3) Reviewing the margin of interconnection lines

- (4) Introducing weekly products at the Wholesale Power Exchange

- (5) Revising the Guidelines for Fair Power Trade

3. Important subjects necessary to be addressed for discussion of future institutional system reform

- (1) Simultaneous pursuit of market liberalization and stable supply

- (2) Simultaneous pursuit of market liberalization and environmental protection

- (3) Appropriate power procurement of PPSs

Note

Introduction

In Japan, the institutional system reforms of the electricity industry have been promoted in three stages so far since fiscal 1995. It is planned that discussion on full liberalization of the electricity retail market will commence in 2007. For starting the discussion, it is necessary to evaluate the impacts made by the reforms so far, and to make careful deliberation based on the evaluation results. To this end, the Subcommittee to Evaluate System Reforms has been organized under the Electricity Industry Committee of the Advisory Committee for Natural Resources and Energy, and the Subcommittee made evaluation of the past reform achievements.

Evaluated points include: ① how policy targets have been attained from the macro viewpoints of efficiency, stable supply and environmental protection, and ② what impacts were made by the respective system reform programs including the abolition of the cross-area wheeling service charge system, the establishment of the Neutral System Organization (organization to support transmission, distribution and other related operations), the establishment of a wholesale power exchange, and the introduction of behavioral regulations.

For the purpose of making appropriate evaluation, we referred to EU and U.S. precedents of evaluation works on their system reform programs, and tried to ensure the objective assessment of data.

Chapter 1: Evaluation from the viewpoint of efficiency improvement

The institutional system reforms of the electricity industry in Japan have been introduced for the purpose of attaining internationally-competitive cost levels, establishing the foundation to enable the reduction of electricity costs in our country on a medium or long term basis, and promoting efficiency improvement by means of encouraging competition, taking into due consideration the “security of energy supply” and “harmonization with environment.”

In the retail segment, the government has liberalized the power supply service at extra-high voltage in March 2000, and also phased in the liberalization for high voltage power service in fiscal 2004 and 2005 respectively, for the purpose of promoting competition for large-lot customers who have strong bargaining power. The government also expects that efficiency improvement made by promoted competition in the liberalized sector would also benefit the regulated sector involving household customers.

In the wholesale segment, the wholesale power competitive bidding system was introduced in December 1995 to promote competition. From fiscal 2005, nationwide power trade started at Japan Electric Power Exchange (hereafter referred to as “JEPX”), where we expect to see the formation of a

reference index price, and the expansion of options of electricity sales and procurement.

1. Retail market

(1) Price reduction in Japan and international comparison

Since the introduction of institutional system reform of the electricity industry in 1995, the electricity price has been decreasing steadily in Japan. Despite the recent soaring fuel costs, the electricity price decreased by about 18% during the period between fiscal 1995 and 2005. Price disparity between foreign countries and Japan has been also steadily reducing. When comparing foreign and Japan's industrial electricity prices based on applicable foreign exchange rates relevant to international competitiveness, by referring to the latest data released by the International Energy Agency (IEA), the U.S. price, which was 0.27 in 1999 in terms of the ratio to Japan, became 0.40 in 2004. In the same comparison, Italy's price, which was 0.60 in 1999, reached 1.27 in 2004, which means that Italy's price has become higher than Japan's. When taking into consideration the latest trend of increasing electricity prices in Europe and the U.S. with the soaring prices of primary energy sources, it is expected that price disparity between Japan and foreign countries would be further reduced at the present.

(2) Reduction of retail price in the liberalized sector

Since the liberalization of the retail market in fiscal 2000, the electricity price in the liberalized sector has been steadily declining. In particular, the electricity price for commercial demand, which is relatively higher than that for industrial demand, has decreased substantially by about 30% during the period between the first half of fiscal 2000 and the first half of fiscal 2005 reflecting the entry of many new businesses other than general power utilities (GPUs) (those new entrants are referred to as "PPS: Power Producer and Supplier"). The industrial electricity price, on the other hand, has decreased by about 13% during the same period. Thus, promoted competition through market liberalization has resulted in further efficiency improvement and the reduction of electricity price.

(3) The effect of efficiency improvement over the regulated sector

The electricity price for household customers, where liberalization has not been introduced has also decreased by about 10% from fiscal 2000 to 2005 as a result of efficiency improvement, which overcame the impacts of the recent soaring fuel costs. Although the degree of decrease in the regulated sector is lower than in the liberalized sector, it is appropriate to confirm that the effect of efficiency improvement in the liberalized sectors has been benefiting even regulated household electricity charges, since competitive pressure in the liberalized sectors does not directly affect regulated sector.

The same tendency can be observed with regulated wheeling service charges. Wheeling service charges at extra-high voltage have decreased by about 21% on the average during the period between April 2000 and April 2006, and at high voltage, the charges have decreased by about 11.2% on the average during the period between April 2004 and April 2006. Change orders for wheeling service

charges, its criteria had clarified in the process of the latest institutional system reform, has not been issued until now.

It is planned that all GPUs will implement price cuts during fiscal 2006.

(4) Competition in the retail market

Since the start of partial liberalization in the retail segment, PPSs' share in terms of electricity sales (kWh) performance has been steadily increasing, but still remains at a low percentage of 2.11% of the entire specified-scale electricity demand as of March 2006. The PPSs' share largely varies according to the type of demand. The share is about 20% in commercial demand at extra-high voltage, while it is only 1% or slightly higher in industrial demand at extra-high voltage or in the whole demand at high voltage. When looking at the PPSs' share by region, it is relatively higher in urban areas such as Tokyo and Kansai and is extremely low in local areas such as Hokkaido, Tohoku and Hokuriku. The low share in the latter areas can be attributed to their extremely low commercial demand at extra-high voltage, usually needed in large-sized office buildings, etc. which are major customers of PPSs. However, since there are construction plans for large-scale power sources designed by PPSs, it is necessary to continue to pay close attention to the future market trend.

When evaluating the electricity market on the basis of the Herfindahl-Hirschman Index (HHI), given that the whole country is divided into market units covered by their respective GPUs, all market units show a 9,000 or higher level of HHI, which means almost a state of monopoly in terms of HHI. Given that the country is divided by frequency band into the eastern part and the western part of Japan, the former shows about 5,500 of HHI and the latter shows 2,200, which means that the western market is slightly more competitive than the eastern market. Given that the nationwide market is evaluated as a whole, HHI is 1,800, which implies a slightly concentrated state.

As a result of the abolishment of the cross-area wheeling service charge system, institutional restrictions on competition among GPUs should have been removed, but actually, there has been only one competitive move made so far, where Kyushu Electric Power Co., Inc. acquired one account in the market covered by The Chugoku Electric Power Co., Inc. However, it can be assumed that competitive pressure potentially influences the industry, judging from the fact that the electricity price disparity among GPUs has decreased by about 40% from fiscal 1994 to 2005, although there have been no substantial direct competition seen yet among GPUs.

At the same time, competition in the field of customer service also exists as observed in the introduction of various customer-conscious services including meticulously-designed rate menus to meet customers' needs or load curves, consultation on energy utilization to help customers optimize their consumption, leasing of electric appliances or facilities, a package billing system, etc.

(Note: HHI (Herfindahl-Hirschman Index): An HHI value of 10,000 implies a 100% monopoly, and closer to 0 (zero) means more competition. In the EU and the U.S., the range from 1,800 to 1,000 is regarded as implying a slightly concentrated market, and 1,000 or lower is regarded as implying a competitive market.)

(5) Options available to customers

According to the results of a survey using a questionnaire answered by customers, about 80% of all customer respondents are aware of the fact that GPUs are allowed to set their own charges freely, and about 70% are aware of the fact that GPUs are allowed to make cross-area power supply, and those results mean that customers' awareness about the liberalization of the electricity market is high. Also, about half of the respondents said that they are satisfied with the information provided by a local GPU in their area, while only a few respondents said that they are satisfied with the information provided by other GPUs outside their area or by PPSs, and more than 30% of the respondents said that they consider the information by GPUs outside their area or PPSs to be insufficient.

It is also found that about 17% of the respondents who have a service contract with a local GPU made comparative evaluation on the utility with other suppliers in the process of making a supplier selection, and that about 82% did not make such a comparison at all. Of those respondents who did make the comparative evaluation, about 41% chose PPSs for comparison with a local GPU and about 18% chose other GPUs outside their area. At the same time, as much as 35% of the total respondents said that they would make comparative evaluation on not only a local GPU but also other suppliers when they renew the current contract, and of those respondents who are positive for comparative evaluation for future contracts, 67% said that they would include PPSs in comparison and 54% said that they would pick up GPUs outside their area.

Those survey results show that customers hope to see power suppliers, including PPSs and GPUs within and outside their area, improve their business activities and information services that enhance customers' easy, costless comparison and evaluation of suppliers.

(6) Quantitative analysis on the impacts on the electricity price given by the institutional system reforms

Since the introduction of the institutional system reform of the electricity industry in 1995, the electricity price has been steadily decreasing. On the contrary, it is apparent that PPSs market shares still remain low, and that direct competition among GPUs is, up until now, scarcely observed. In an effort to analyze such circumstances, it is discussed what percentage of the attained reduction in electricity price can be attributed to efficiency improvement achieved as a result of the institutional system reforms, and what percentage is attributable to other factors such as declining interest rates not relevant to the institutional system reform.

Then, a quantitative analysis on the factors contributing to the reduction of supply costs was tried

under the assumption that the price reduction which can be attributed to the reforms is that other than the reduction which can be attributed to the previously specified exogenous factors such as declining interest rates. As a result, it is found that, of all the reductions of supply costs until fiscal 2003, about 60% are attributed to other factors than the institutional system reform, with 40% being the declining payment of interests as a result of lowering interest rates, about 16% being the slowed increase of demand, and about 7% being the structural change of fuels variety. Therefore, it is determined that the remaining 40% at maximum are attributable mainly to the institutional system reform, which corresponds to the reduction of 1.3 yen/kWh (or about 1.2 trillion yen). Thus, it can be considered that the institutional system reform has promoted the efforts of electricity industry utilities to improve efficiency.

The electricity price has been declining interlinked with supply costs. Since the time around the introduction of the institutional system reform, consumer surplus has been continuing to expand.

2. Wholesale market

(1) Structure of the power generation market

In terms of power generation capacity, the market share structure as of 1995 consisted of 76.4% for GPUs, 12.9% for wholesale electric utilities, and 10.6% for self-generating facilities. In fiscal 2005, the share of GPUs decreased to 73.5% and self-generating facilities occupied 14.2% after the steady increase of its share, while wholesale electric utilities remained at 11.9%. The share of PPSs in terms of power generation capacity remained as low as 0.3% in 2005.

Thus, owners of self-generating facilities, many of which are considered to have distributed generations that can be installed easily, have been steadily increasing their share as a practical rival of GPUs, while on the other hand, PPS did not increase its capacity much. Note that PPSs are planning to launch the operation of a large-scale power plant.

(2) Institutional system reforms and the structural change of the wholesale power trade

① Reforms concerning the wholesale power trade

Before the 1995 introduction of the institutional system reform of the electricity industry, a rate for wholesale supply to be used for general electricity industry used to be calculated by the “cost of service” rate-making regulation under which all necessary costs were added up, and the government was to give the approval for the rate. As for the price to be paid by GPUs for surplus electricity purchased from self-generating facilities, for which the cost of service rate-making regulation is not suitable, there had been no restrictions and free pricing had been allowed.

The 1995 reform introduced the IPP (Independent Power Producer) system applicable to the case that a GPU purchased wholesale power through competitive bidding, where a wholesale supply price should be based on a contract price, not on the cost of service rate-making regulation. The reform also introduced a rule that no pricing restrictions shall be imposed on any wholesale supply price of small-scale

or short-term trade below the specified terms and conditions of supply (above the amount of 1,000 kw for ten years or 100,000 kw for five years).

The 2000 reform changed the way of determining wholesale supply prices, from the system requiring government approval to the notification system. The 2000 reform also introduced the liberalization of the retail market which allowed the entry of PPSs to purchase wholesale power from wholesale suppliers such as self-generating facilities. The price regulation on wholesale supply is applied only to the supply for a GPU under the specified terms and conditions.

The 2005 reform introduced the establishment of a wholesale power exchange, where spot transactions in 30 minute units available the next day, as well as the forward transactions of monthly products have started.

② Structural change of the wholesale power trade

Although no significant change has been seen in the structure of the wholesale power market where long-term bilateral contracts by GPUs occupy the majority of activities, diversified wholesale power trade patterns and increasing liquidity of transactions can be seen as a result of promoted liberalization.

During the period of fiscal 1995 to 2005, there has been no significant change in the structure of the supply capacity of GPUs, whose annual power generation by their own plants usually ranges from 700 to 800 billion kWh, and annual procurement ranges from 100 to 160 billion kWh from IPP and wholesale electric utilities through a long-term contract, and about 10 billion kWh as surplus electricity from self-generating facilities. Thus, GPUs have been securing their supply capacity by depending on their own power sources for the large part, while acquiring long-term contracts with IPP, wholesale electric utilities and self-generating facilities.

PPSs procurement has been increasing with the increase of PPSs share since the liberalization of the retail segment in March 2000. During fiscal 2005, PPSs' generation from their own sources totaled to about 5 billion kWh including the amount consumed by themselves, their procurement of surplus electricity from self-generating facilities registered about 7 billion kWh, and the so called "all-time backup" from GPUs was about 4 billion kWh. Since it takes a long time to construct a new power plant, PPSs, who are new entrants to the market, probably depend much on procurement through the wholesale power trade.

Before the introduction of the institutional system reform, owners of self-generating facilities used to sell all of their surplus electricity to GPUs. But in fiscal 2007, they also sold it to PPSs, with about 13 billion kWh going to general electric utilities and about 7 billion kWh to PPSs. This means that the institutional system reform led to the diversification of customers of owners of self-generating facilities.

Since it has not been very long since the establishment of the wholesale power exchange, the transaction volume there is still limited. However, the wholesale power exchange, in which any businesses engaged in the wholesale power trade can participate, is expected to play an important role in the future.

(3) Options of power procurement available to PPSs

Unlike GPUs who can afford to secure the retail supply primarily through one's own power sources, PPSs depend much on the wholesale power trade. Options available to PPSs include their own power sources, procurement from self-generating facilities, IPP or wholesale electric utilities, all-time backup from GPUs, or utilization of the wholesale power exchange. However:

- It takes a long time to construct a new power plant of one's own.
- The owners of self-generation facilities cannot easily increase their sale of surplus electricity to PPSs because they always prioritize their self-consumption.
- IPP or wholesale electric utilities, that enter into long-term contracts with GPUs, cannot trade with PPSs without changing their existing contracts.

Because of the above circumstances and restrictions, it seems that PPSs need to depend on the all-time backup from GPUs for the time being, while utilizing the wholesale power exchange. In the meanwhile, there is a consensus that all-time backup should be converted into trade at the wholesale power exchange. Here, it would be necessary to ensure that transactions at the Exchange allow for sufficient options and that thorough market monitoring of the exercise of market power is sufficiently implemented.

Chapter 2: Evaluation from the viewpoint of stable supply

(1) Capital investment

① Decreasing capital investment and sufficient facility capacity

The total amount of capital investment made by ten GPUs as of 1993 was about 4.7 trillion yen, registering a record high. However, the amount has started to decrease since the introduction of the institutional system reform of the electricity industry in 1995, reaching about 1.2 trillion yen in fiscal 2005. When looking at the presumed growth rate of the peak load, which would influence a great deal the capital investment to be made by GPUs, the fiscal 1996 supply plan presumed a yearly growth rate of 2.3% while the fiscal 2006 plan presumes 0.8%. Two aspects can be considered concerning the decreasing capital investment: one is a part of strategy for cost reduction to materialize a price cut amid intensifying price competitions after the introduction of market liberalization and the other is the outcome of a lowered presumed growth of demand.

As for facility capacity as a stock, it seems that overall utilities manage to be maintained, judging from their supply margin or extended circuits of transmission lines, and that they have been enhanced to meet increasing peak load. It is also noticeable that the decreasing trend of capital investment seems to have bottomed out.

② System reliability

As for system reliability, any degradation of the power quality cannot be seen from the perspective of power failure, frequency and voltage. In England and the United States, for instance, they register an average of a 100-minute accidental blackout annually per customer, while Japan enjoys an

average of only 10 minutes before and after the reform introduction, except for special years having many disasters, etc.

Generally, the electricity industry has a long facility-construction/depreciation cycle, and tends to retain large facility capacity accumulated by the past investment, and therefore the impact of decreasing investment to the system reliability is not easily exposed on a short-term basis. It is also true that large social and economical damage is expected in case of a supply trouble such as a large-scale blackout, as seen from precedents in foreign countries. Therefore, it is necessary to continue to pay close attention to any influential elements on system reliability.

③ Future estimates on supply margin based on a supply plan

When presuming that facility construction is realized as set by a supply plan, an appropriate supply margin will be secured, and the transmission lines will also be improved for ten years from now.

Specifically, supply margin is expected to be 10% or more for ten years from now while an appropriate reserve margin is usually regarded as 8 to 10 %. However, the supply plan does not cover the demand of PPSs. If it is assumed that all PPSs' demand will be covered solely by the supply of GPUs, the estimated supply margin for ten years from now will be 7.1% at the least.

(2) Interconnection lines

① Additional function of interconnection lines

In the past, inter-regional interconnection lines connecting areas covered by the respective GPUs (hereinafter referred to as “interconnection lines”) used to be utilized primarily for the purpose of securing a stable supply of electricity, such as maintaining power system stability in emergency or wide-area power sources development. As a result of the institutional system reforms, including the retail market liberalization and the establishment of the wholesale power exchange, positioning of the interconnection lines has altered, additional roles expected on the lines. Specifically, not only GPUs, but also PPSs came to use the lines and their new role as an infrastructure for wide-area power trade is strongly expected. In this light, the neutral system organization (hereinafter referred to as “the NSO”) makes rules on the facility construction and operation of interconnection lines and discloses information on power systems for the purpose of ensuring fairness and transparency.

② Status of operation

The NSO rules prescribe that the operation capacity of the interconnection lines shall be preferentially allotted to existing wide-area contracts of GPUs such as wide-area power interchange, after a certain margin is reserved in advance for the purpose of ensuring system stability at the time of emergency (3% of the system capacity in principle under the current rule), and that the remaining capacity shall be allotted to contracts of PPSs and transactions at the Power Exchange.

So far, there has been no unfavorable state of operation possibly affecting the stable supply of

electricity. However, restrictions can be seen at the frequency converter (FC) connecting the eastern part of Japan applying 50Hz and the western part of Japan applying 60Hz, due to its limited remaining capacity on both Tokyo-to-Chubu and Chubu-to-Tokyo currents. As for the current from Tohoku to Tokyo at the Soma Futama Trunk Line and on the current from Kyushu to Chugoku at the Kanmon Connection Line, the state of temporary low capacity or congestion can be seen.

(3) System operation

The short-term supply-demand balance of electricity is maintained through system operation by GPUs. Their daily operation ensure that any instantaneous balance between supply and demand is always well-coordinated in the course of their daily operation, and to this end, they first make the annual supply-demand coordination plan as well as the annual system operation plan, and then make the monthly, weekly and daily plans respectively through necessary revisions.

After the introduction of the institutional system reforms, the system operation became more complicated since the establishment of the wholesale power exchange as well as the abolishment of the rate-pancaking system for cross-area wheeling service. These reform programs expanded utilization of interconnection lines, increased the number of wheeling services and notification changes to the wheeling segment, and brought the necessity to make a comprehensive area management of supply and demand by taking care of not only their own activities but also PPSs activities.

In response to such circumstances, the central dispatching offices, which are engaged in dispatch scheduling for the respective GPUs, have increased their work force, and there have not been any major troubles so far. However, it would be necessary to improve the business protocol on wheeling service and also improve the NSO's liaison system for dispatching scheduling in order to enhance the security of supply-demand coordination and system operation.

(4) Preservation of security and restoration from disasters

① System for maintenance and security preservation

After the introduction of the institutional system reform, no significant increase of accidents or failure of electric power facilities can be seen, except for special years having many natural disasters. The cost of repairs borne by GPUs decreased from 2.8 yen/kWh in 1993 to 1.6 yen/kWh in 2005. However, this decrease is considered to be partially attributed to the improvement of cost performance as a result of revised maintenance methods and the automation of power distribution, and tends to have bottomed out in recent years.

Security-related regulations under the Electricity Utilities Industry Law remain unchanged, despite the liberalization or deregulation as a result of the institutional system reform, and the security preservation scheme encouraging voluntary efforts of the businesses continues to work properly as represented by the notification system on in-house security rules. Therefore the liberalization of the power market will not cause any sudden deterioration of maintenance or security preservation of electric

power facilities.

② Prevention of and restoration from disasters

GPUs have their own scheme for prevention of and restoration from disasters in accordance with the relevant laws or ordinances to address disasters. Also, as part of the wide-area operation of electricity industry, they have established a wide-area restoration/assistance scheme through measures to make any necessary materials or resources available to the damaged in a time of emergency.

Even facing the destructive Typhoon No.18 and the Niigata Chuetsu Earthquake in 2004 after the reforms, the swift, effective implementation of wide-area restoration/assistance measures could be seen, which were equivalent to those implemented at the time of the Typhoon No.19 of 1991 and the Great Hanshin-Awaji Earthquake in 1995 before the reform introduction. Therefore, it seems that our current systems for restoration from disasters are effective and have no problems.

(5) Research and development

Before the reform, research and development costs of GPUs used to be fully reflected in the electricity charges under the “cost of service” rate-making regulation. After the reform, the costs have been decreasing from about 200 billion yen in 1994 (actual performance) to about 120 billion yen in 2005 (estimates), as a result of improved efficiency and the completion of most projects for the development of advanced light-water reactors.

In the electricity industry, R&D projects tend to require an enormous amount of cost over a long period of time, especially in nuclear power generation. In order to continue to secure sufficient R&D budgets under the current liberalization-promoted environment, it would be necessary to steadily promote R&D activities, clarifying the respective responsibilities of the government and the industry based on the government’s high-order plans such as the Basic Energy Plan, the Science and Technology Basic Plan and the Framework for Nuclear Energy Policy.

Chapter 3: Evaluation from the viewpoint of environmental protection

In the current framework of the electricity industry system, GPUs who play the central role in the industry are expected to promote the development of long-term fixed power sources, which are less environmentally harmful while requiring a heavy initial investment and long time to recover investment, such as nuclear and hydroelectric power plants. In order to secure the running of such power sources under the circumstances of promoted market liberalization, various measures were taken including the priority dispatching rule in light load hours and preferential reservation of the transmission capacity of interconnection lines.

(1) Trend of CO2 emission

Since the retail liberalization in 2000, CO2 emission has been increasing from 330 million tons in 2001 to 390 million tons in 2005, and emission intensity has been also increasing. However, excluding the impact from the nuclear power plant shutdown, the incremental emission is not so conspicuous. Although it is possible that liberalization led market players to put more emphasis on economic efficiency than on environment-friendliness when constructing new power plants, the influence of the liberalization is not clear in the form of CO2 emission increase at present due to the long construction time of power plant.. As for power sources of PPSs, the majority of them are thermal power plants that are relatively easy to be constructed, but the PPS' dependence on their own power sources is still quite low. Note that it is planned that large-scale thermal power plants will be constructed by PPSs.

As an effort to reduce CO2 emission, a total of twelve companies including GPUs, Electric Power Development, Co., Ltd., and the Japan Atomic Power Company established and released the "Environmental Action Plan in the Japanese Electricity Industry," where they voluntarily set the target of reducing the CO2 emission intensity at the customer end by about 20% from 1990 to 2010.

(2) Customer needs for environmental adaptability

Liberalization of the electricity market sometimes functions as an incentive to increase low-cost but high-CO2-emitting power sources. However, customer needs for low-CO2-emitting power sources, which are getting stronger with the increasing level of their interest in environmental protection, has been increasing, functioning as a disincentive to the construction of high-CO2-emitting power sources.

At the government level, partial amendment to the Law Concerning the Promotion of Measures to Cope with Global Warming was implemented, to oblige those businesses whose emission of greenhouse gas exceeds a certain designated level to report to the government on the amount of their emission and also require the government to tally all reported amounts and release the results to the public. As the amended Law also requires the businesses to report on the amount of CO2 emissions from the consumption of the electricity supplied, environment-conscious consumers tend to seek low-CO2-emitting power sources. As the CO2 emission coefficient to be used for calculating the amount of CO2 emission, either ① the "default" value (of 0.555) prescribed in the ministerial ordinance or ② the observed value can be used. It is ruled that in the case of using the latter, any coefficient below the default is supposed to be released to the public by the Minister of Economy, Trade and Industry or the Minister of the Environment. Thus, it is expected that such government measures will facilitate voluntarily efforts of electricity industry utilities to reduce CO2 emission. At the same time, it is necessary to pay attention to any possible influence made by the CO2 emission coefficients of electricity utilities on their competition.

Chapter 4: Evaluation from the viewpoint of individual reform programs

Abolishment of the cross-area wheeling service charge (“rate-pancaking” system)

① Background of the reform

From April 2005, the cross-area wheeling service charge system, so-called “rate-pancaking” system, where power trade is charged each time it crosses franchise areas, was abolished, and the uniform transmission system utilization charges have been introduced in each utility’s service area, which do not reflect the status of whether cross-area transactions took place or not. Specifically, it has been determined that the necessary financial settlements shall be made among GPUs in accordance with predetermined rules to clear up any disparity generated as a result of abolishing conventional cross-area wheeling service charges, and that power generation adjustment for any cross-area wheeling loss shall be made by a GPU who covers the area in which the customer is located. Advantages expectable from the abolishment of the “rate-pancaking” system include a lowering electricity price as a result of the effective utilization of efficient power sources and efficiency improvement through competition, while disadvantages include the increase of cross-area wheeling loss and of distribution costs as a result of the construction of transmission lines for remote power sources. The Basic Energy Plan gives the following three requisites: a) a fair and complete collection of the construction costs for transmission lines, b) an appropriate settlement of transmission costs, and c) the restriction of the construction of remote power sources that would harm the efficiency of the entire power supply system. It has been determined that the outcome and impact from the said system abolishment will be reviewed from the viewpoint of those three requirements, so that any necessary countermeasures can be implemented without delay if any problem is found, where such countermeasure could include the revision of the abolishment of the cross-area wheeling service charge.

② Vitalization of wide-area distribution

The level of utilization of interconnection lines remains at 7 to 10 billion kWh from fiscal 2003 to fiscal 2005. Since the introduction of the reform, there has not been a significant change in the volume of cross-area wheeling transactions among GPUs, who are the major users of interconnection lines, but the utilization of interconnection lines by PPSs has significantly increased, from about 100 million kWh in fiscal 2004 before the abolishment of the “rate-pancaking” system to about 250 million kWh in fiscal 2005. As of fiscal 2004, the total electricity sales of PPSs was about 7.2 billion kWh, which increased to 10.0 billion kWh by fiscal 2005. Thus, the PPSs’ utilization of interconnection lines has been rapidly increasing, exceeding the increase rate of their electricity sales. The abolishment of the “rate-pancaking” system has made it possible to make nationwide spot transactions, and actually, the wide-area utilization of interconnection lines by spot transactions is observed, where cross-area utilization of interconnection lines is made at an average of 1.4 times per transaction. It can be judged that the abolishment of the “rate-pancaking” system facilitates the vitalization of wide-area distribution of electricity.

③ Adverse influence from the abolishment of the “rate-pancaking” system

Although the abolishment of the “rate-pancaking” system seems to have large influence on the construction of PPSs’ power sources, after the reform, PPSs have not yet announced any additional plans of new power plant construction. The current construction plan targets neighboring areas of heavy urban consumers, and therefore, no adverse influences arising from the proliferation of power sources are observed at this moment.

Increased wide-area electricity distribution as a result of the abolishment of the “rate-pancaking” system tends to raise distribution costs including cross-area wheeling loss and would eventually increase the burden on customers in the regulated sector. However, the cost estimation shows that the increment would be as slight as 0.0000 to 0.0017 yen/kWh, meaning that there would be no significant adverse influence on customers in the regulated sector. As the electricity price has been steadily decreasing since the introduction of competitions through market liberalization, it can be judged that the effect of efficiency improvement including abolishment of the “rate-pancaking” system overwhelmed any adverse influences.

(1) Imbalance charge system

① Background of the system reform

In supplying electricity, it is essential to ensure that any instantaneous balance between supply and demand is always balanced at any moment. As for PPSs, they only have to ensure such supply-demand balance for each collective 30-minute volume, and they do not have to ensure instantaneous balance at every moment. This disparity between the collective demand and the collective power generated within the 30 minutes is referred to as “imbalance.” PPSs are supposed to pay imbalance charges to a GPU as system operator, where imbalance charges would be determined according to the volume and proportion of imbalance.

In the previous stage of the institutional system reform, the so-called emergency backup charge, which is a part of the imbalance charge in the wheeling service and consists of a two-part charge (base charge and metered charge) was abolished, and was replaced by the charge for imbalance outside the scope of fluctuation ranges consisting solely of a metered charge. The structure of the imbalance charge in the cross-area wheeling service basically conforms to that in the wheeling service, except for the nonexistence of the selectable fluctuation ranges.

② Change in the actual burden of imbalance charge payment

After the reform of the imbalance charge system, the purchased volume of PPSs for imbalance has doubled from about 50 million kWh in fiscal 2004 to about 110 million kWh in fiscal 2005. However, the payment of PPSs for imbalance electricity has scarcely increased, with about 1.3 billion yen in fiscal 2004 and about 1.4 billion yen in fiscal 2005. This inconsistency between the purchased volume and the payment is attributable to the fact that most of the imbalance charges derived from the wheeling service, where the base charge of the emergency backup charge was abolished. Actually, the unit payment price decreased from 25.8 yen/kWh in fiscal 2004 to 12.8 yen/kWh in fiscal 2005.

On the other hand, the unit payment price of imbalance charges in the cross-area wheeling service has increased from 11.5 yen/kWh in fiscal 2004 to 20.6 yen/kWh in fiscal 2005, after the system reform, because of the charge raising. This increase of the unit payment price contributes to the increase of the imbalance charge payment in the cross-area wheeling service, although the volume of imbalance in the cross-area wheeling service is smaller than that in the wheeling service. In order to avoid any arbitrage between the wheeling service and the cross-area wheeling service, there should be an equality in imbalance charges between the two services. However, it would be necessary to implement measures for controlling imbalance outside the scope of fluctuation ranges, because further vitalization of wide-area electricity distribution in the future, and the resulting increase of PPSs' cross-area supply would possibly invite more imbalance in the cross-area wheeling service, making a large impact on the sales cost of PPSs.

(3) Behavioral regulations

① Introduction of behavioral regulations

In order for the transmission/distribution segment to fully perform their coordination function to maintain system reliability, it is necessary to assure fairness and transparency of the segment itself, which is directly responsible for the transmission/distribution activities including individual system operation and wheeling service, and to ensure reliance from all market players.

Specifically, it is necessary to guarantee the following three points: a) an information firewall between the transmission/distribution segment and the power generation or retail segments, b) prohibition of cross-subsidization, and c) prohibition of discriminatory treatment. To this end, it has been determined that behavioral regulations should be largely introduced and that the administrative functions of ex post checking should be improved to secure fairness and transparency of the transmission/distribution segment.

The Amended Electricity Utilities Industry Law enforced from April 2005 added the following new provisions as behavioral regulations:

(a) Prohibition of the use of information for purposes other than the intended purpose in the wheeling service

The transmission/distribution segments should not use information on any other supplier or their customer which has come to their knowledge through wheeling service for purposes other than the intended purpose in the service.

(b) Accounting separation

The transmission/distribution segments should prepare and publish their accounting statements on their wheeling service and transmission/distribution activities, so that their accounting can be supervised and that their profits from the transmission/distribution segment will not be used by other segments.

(c) Prohibition of discriminatory treatment

Transmission/distribution segments are prohibited from treating any specific supplier in a discriminatory manner in wheeling service.

Also, on March 31, 2005, the Market Monitoring Subcommittee was organized under the

Electricity Industry Committee for the purpose of improving the administrative function of ex post checking.

② Status of implementation of the behavioral regulations

Stipulations concerning behavioral regulations and market monitoring have been improving. So far, there has not been seen any material problems concerning fairness and transparency of the transmission/distribution segment of GPUs.

(a) Establishment of ministerial ordinance and guidelines

For the purpose of implementing behavioral regulations prescribed in the Electricity Utilities Industry Law, the following establishment or improvement of ministerial ordinance and guidelines has been made:

- Establishment of “the accounting rules for revenues and expenditures in wheeling service or other related services” (enforced on January 31, 2006)
- Revision of “the guidelines for fair power trade” (enacted on May 20, 2005)
- Revision of “the guidelines for the dispute settlement on electricity/gas trade” (enacted on May 20, 2005)

(b) Implementation of market monitoring

An optional survey was conducted to evaluate GPUs’ observation of “desirable behavior” in pursuing their wheeling service. As for disputes concerning behavioral regulations, one case was reported during the period between April 2005 and the end of February 2006, and this case, together with other disputes, is to be reported to the Market Monitoring Subcommittee. As for accounting separation, it is to be applied to the settlement for the fiscal year 2005. Also, the inspection on GPUs’ observation of behavioral regulations is to be enforced from fiscal 2006 in accordance with Article 105 of the Electricity Utilities Industry Law.

(4) Neutral System Organization (organization to support transmission, distribution and other related operations)

① Establishment

In the report “Framework of the Desirable Future Electricity Industry System” issued on February 15, 2003 by the Electricity Industry Committee, it was suggested that a neutral system organization (NSO) should be established as an intermediate corporation to improve fairness and transparency in relation to network access, facility construction, system operation, information disclosure of the transmission/distribution segment of GPUs, under the supervision of the government on their decision-making procedure, etc.

In response to this suggestion, the Electric Power System Council of Japan (ESCJ) was established on February 10, 2004, and was officially designated by the Minister of Economy, Trade and Industry, on June 15, 2004, as the only organization authorized to support transmission, distribution and other related operations to be engaged to make rules concerning facility construction, network access, etc.

② Major responsibilities

During fiscal 2004, the NSO established “general provisions,” “rules on facility construction,” “rules on network access,” “rules on system operation,” “rules on information disclosure,” “rules on the evaluation of system reliability” and “provisional operation” in accordance with the suggestions of the Committee’s report. Those “ESCJ rules” have been revised seven times, as necessary, up until April 2006.

ESCJ is also working on dispute settlement, dispatching liaison, provision of system information, etc.

③ Addresses for enhanced convenience for network users

(a) Reevaluation of the margin of interconnection lines

In accordance with the suggestions of the Committee’s report, the NSO re-evaluated the capacity of interconnection lines reserved for emergency situations (the margin of interconnection lines).

(b) Improvement of the utilization of FC (Frequency Converter)

Before the liberalization of the retail market, FC was well prepared to cope with large-lot currents among GPUs at the time of emergency. However, the establishment of the wholesale power exchange and other changes has exposed constraint on the utilization of FC, and then the NSO examined improvement of the utilization of FC.

④ Other activities of the NSO

As for the construction of transmission/distribution facilities including interconnection lines, the NSO established the rules on facility constructions in which coordination procedures are prescribed for the improvement plans of interconnection lines. It is desired that the NSO will further promote examinations on how they should positively commit to problems arising from interconnection lines, including examinations on the establishment of objective criteria needed for starting coordination.

The NSO is also expected to actively promote addresses for ensuring the stable supply of electricity, including long-term projection of the presumed supply and demand, evaluation of system reliability through establishment of system interconnection models, etc.

(5) Wholesale Power Exchange

① Establishment of the Japan Electric Power Exchange

The report, “Framework of the Desirable Future Electricity Industry System” issued on February 15, 2003 by the Electricity Industry Committee, proposed the establishment of a wholesale power exchange, which would be contributive to the enhancement of utilities’ risk management functions such as the formation of reference index price as one of the criteria for the judgment of investment risk, and the expansion of options of electricity sales and procurement at the time of unbalanced supply and demand. In response to those institutional requests, the Japan Electric Power Exchange was organized on November 28, 2003 as a privately-established limited liability intermediate corporation, and transactions at the

Exchange started on April 1, 2005.

② Volume of transactions

(a) Trend of the volume of spot transactions

Spot transactions at JEPX had been relatively slow until July 2005 when the daily average of spot transactions was below one million kWh. However, spot transactions have started to increase gradually after August 2005, and nearly 10 million kWh of transactions could be seen on a winter day. However, there was a sudden decrease of spot transactions after March 2006, dropping to a range between 1 and 2 million kWh. The accumulated volume of spot transactions during fiscal 2005 was about 938 million kWh, which is far beyond the original target (about 360 million kWh for spot and forward transactions collectively) at the time of the establishment of the Exchange.

(b) Trend of the volume of forward transactions

The accumulated volume of forward trading during fiscal 2005 was about 150 million kWh, which is slightly lower than 20% of the volume of spot transactions. Thus, the market of forward transactions seems to still be slow. This slow market can be attributed to immaturity of the Exchange, where it would be risky for traders to make high-volume forward transactions without certain prospects for the future trend as well as an inconvenience for traders in terms of the specification of products for forward transaction.

(c) Relation with “economic power interchange”

Through the establishment of the wholesale power exchange, the practice of “economical power interchange” has been abolished. However, the volume of spot transactions during fiscal 2005 (938 million kWh) exceeded the record-high yearly volume of “economical power interchange” transactions after fiscal 1995 (757 million kWh in fiscal 1999), and therefore it can be considered that spot transactions at the Exchange effectively took over the function of “economical power interchange” transactions.

③ Verification on the function of indicating reference index price

(a) Price trend

Although the daily (24-hour) average of prices of spot transactions (hereinafter referred to as “system price”) was relatively high during the summer, registering a summer record high of 10.8 yen/kWh in the latter half of June, the system price during the period between April and the middle of November, excluding those summer days, ranged from 7 to 9 yen/kWh. During the record-breaking cold winter in 2005, the price continued to be above 10 yen/kWh from the end of November to February, registering a yearly record high of 17.5 yen/kWh in January. After March, the price decreased again to a range between 7 and 9 yen/kWh.

Comparing the daily average to the peak-time average (price between 13:00 and 16:00), the price disparity tends to be larger on summer weekdays, registering the maximum disparity of about 7 yen/kWh. The disparity tends to be smaller after September.

(b) Simulation based on optimum power source composition model

It is still about one year since the opening of the wholesale power exchange, and thus it is difficult to determine its ability of indicating reference index price due to the lack of sufficient transaction data. Therefore, instead, the verification of the existence of market power was attempted, although such verification could not be a sufficient condition for the verification of the function of indicating reference index price. Because of the data restrictions concerning the marginal costs of utilities, the optimum power source composition model was applied to simulate the market to verify the market power. The verification results show that there seems to be no material constant market power at this moment.

(c) Market monitoring at the wholesale power exchange

The committee for monitoring market transactions of JEPX is supposed to monitor the market to identify any players who intentionally try to force up prices under a tight supply-demand condition by taking advantage of their relatively large market share in the power generation market.

Meanwhile, the special committee for verification of market transactions is responsible for verifying the appropriateness of the input by GPUs into the Exchange in terms of consistency with their declaration to the Electricity Industry Committee.

Both committees hold meetings almost every month, to monitor and verify all transaction data. There have been no penalty precedents so far. It is desired that further improvement of quantitative analysis concerning market monitoring will be made and that more transaction data will be released to the public, as such data could be a convenient reference for traders.

④ Market splitting

Most cases of market splitting have been initiated at the Frequency Converter (FC) that interconnects the Tokyo area and the Chubu area. Market splitting is scarcely observed in other interconnection points, or even if any, there are too few split transactions to be observed.

After July, the market splitting initiated at FC was observed for 90% of hours on the average. Up to August, the factor of market splitting was principally attributed to lower constraint. However, as the volume of transactions increased, the proportion of splitting due to lower constraint declined, dropping to lower than 20% in December or afterwards.

On the other hand, upper constraint is to be applied as a result of the increasing transaction volume to exceed the capacity at FC, and up to November 2005, any splitting due to upper constraint could not be seen, which however came to occupy more than 20% of all the splittings after December. In January, when transactions rapidly increased, about 50% were upper limits-applied transactions, which decreased again to 20% after February when transactions started to decline. As for stride constraints, splitting due to it usually ranges from 20% to 50%.

Chapter 5: Evaluation on institutional system reforms of the electricity industries in foreign countries

(1) Trend and evaluation of the system reform of the electricity industry in Europe

The EU is planning to complete a legal unbandling of the transmission/distribution segment as well as full liberalization of the retail market by July 2007, with the aim to form a uniform market within the EU territory in accordance with the EU Electricity Directive of 2003. Any EU nations who lag behind in implementing the Directive are strictly treated, where an official warning is to be sent to those nations on their inappropriate observation of the Directive, or some cases will be brought to the European Court of Justice.

① Increasing prices and competition policy

After the introduction of liberalization, the electricity price (nominal) applied to industrial customers had been declining until 2000, when the price bottomed out at 86.9 in comparison with the 1995 level of 100. However, recently the price has started to rise radically, reaching 99.8 in 2004, which is almost the same level as that prior to the liberalization. As for the price applied to household customers, on the other hand, after the 1995 introduction of liberalization, the price had been declining until 1999, when the price bottomed out at 97.4 in comparison with the 1995 level of 100, and then started to rise to 100.1 in 2004. This means that the price has been relatively flat in the market for household customers.

According to European regulatory authorities and electric utilities, they consider the recent upward tendency of the electricity price to be the outcome of soaring fuel costs such as crude oil and a resulting effect of the market mechanism. They consider that the responsibility of the regulatory authorities is to ensure, through constant market monitoring, that any rising electricity price is not due to some exercise of market power. In an effort to prevent any exercise of market power, they take measures based on competition policy to correct market distortions through thorough implementation of the EU Directive or strengthening the function of international connection lines.

② Stable supply

In response to the large-scale blackouts in 2003 in England, Italy and Scandinavian countries, the EU has been strengthening measures to secure the stable supply of electricity. In December 2005, the Security of Supply and Infrastructure Directive was adopted. Specifically, the directive suggests that TSO (transmission system operator) should take the responsibility of maintaining the supply-demand balance, and that sufficient investments in power generation should be secured through the improvement of the wholesale electricity market which provides "price signal". The directive also aims at the improvement of the network facilities through establishing a framework of regulations that would function as an incentive for investing in TSO.

According to the UCTE report on reliability evaluation (UCTE: Union for the Co-ordination of Transmission of Electricity), it is judged that the EU can secure a stable supply for the next three years and that it is possible to face the inability to secure a stable supply in 2012 or later, when additional investment

for power generations of 30 million kW would be required to maintain stable supply.

③ International connection lines

Market unification is still insufficient under the circumstances that wholesale prices tend to be converged among neighboring EU nations while retail price disparity among markets is still large and international transactions are not active yet. This insufficiency of market unification is considered to be principally owing to the state of congestion at international connection lines due to the lack of their capacity. Although some projects for the improvement of international connection lines made certain progress, the EU gave up the plan of establishing its legislative framework originally proposed by the draft version of the Security of Supply and Infrastructure Directive, and instead, the EU intends to focus on the improvement of rules on congestion management for the time being.

(2) Trend and evaluation of the institutional system reform of the electricity industry in the U.S.

The U.S. changed its hard line that aimed at the nationwide expansion of the liberalization model as successfully achieved by PJM Interconnection (a regional transmission organization covering three states, Pennsylvania, New Jersey and Maryland). Instead, the U.S. federal government focuses on measures to prevent market manipulation and to secure a stable supply.

① Market design

In an effort to promote the reform of the wholesale power market, the Federal Energy Regulatory Commission (FERC) had promoted the Standard Market Design (SMD) which principally aimed at the legal unbandling of the transmission/distribution segment, and the establishment of the Regional Transmission Organization (RTO). However, FERC gave up the implementation of the SMD as a result of strong opposition from Northwestern and Southeastern states against the SMD. However, the Energy Policy Act enacted in August 2005 reflects some elements of SMD, including desirable factors from the viewpoint of a fair market design (security of market transparency, etc.)

② Stable supply and nuclear energy

For securing stable supply of energy, the Electric Reliability Organization (ERO) was established under the Energy Policy Act, and has designed the reliability criteria and penal regulations for those who fail to meet the criteria. Also, for promoting the construction of transmission lines, it is planned to designate those transmission routes contributive to state interests, to involve regional authorities in the construction of transmission lines and provide an incentive for the construction of transmission lines.

Also, as part of the support programs for nuclear power generation, the government provides compensation for delayed construction of new nuclear power plants as well as financial incentive with advanced nuclear power plants such as guaranteed financing or tax deduction.

③ Liberalization of the retail market

In the U.S., state-initiated liberalization of the retail market has been promoted, and a total of 18 states have introduced full liberalization so far. However, the overall trend can be characterized by decreasing new entrants to the market as well as a declining switching rate of customers for suppliers. Also, California encountered a power crisis resulting in frozen liberalization, and some states abolished or postponed industrial reconstitution because of concern over possible soaring electricity prices. Thus, liberalization is stagnant as a whole.

Chapter 6: Conclusion

1. Summary of evaluation

(1) Efficiency improvement

It can be judged that efficiency improvement with the utilization of the competition principle has been making steady progress, producing good results such as lowering electricity price in the liberalized sectors and its positive influence also benefiting the regulated sector. As for the target of securing options available to customers, a competitive pressure seems to be potentially influencing the industry, where price disparity among GPUs has been substantially reduced, although the share of PPSs is still small, and direct competitions among GPUs for the acquisition of customers are scarcely observed yet. It is also apparent that customers desire suppliers to be more active in sales activities and provide more information on their services.

There has been no large structural change in the wholesale market, where long-term bilateral contracts by GPUs still occupy the majority. However, promoted liberalization and the establishment of the wholesale power exchange led to the increasing liquidity of transactions as well as diversification of buyers from self-generating facilities or sellers to PPSs. In this light, it is required that effective competitions in wholesale trade will be secured under the new system.

(2) Stable supply

The amount of capital investment has been declining to a level equivalent to 30% of the record-high amount in the past, partially due to improved management efficiency. At the same time, the estimated growth rate of peak load tends to decline. The facility capacity as a stock is being maintained while the increase of the demand for electricity tends to be decelerating. There is no sign of deteriorating system reliability at this moment, judging from reliability indices such as power failure hours, frequency, voltage, etc. Also, the scheme for security preservation and necessary inspections are appropriately carried out, as the failure rate did not increase. As for the future construction of facilities, it is estimated that a sufficient supply margin can be secured for the next ten years, and that construction of necessary transmission lines will be smoothly promoted when assuming that constructions will be implemented as planned in accordance with the supply plan. However, it is important to take into consideration such

uncertainty elements as the current supply plan does not cover demand of PPSs, and as there might be a risk of the nonfulfillment of the construction plans,. It probably takes a long time to confirm certain effects of the institutional system reforms on stable supply, and therefore it is necessary to continue to pay close attention to reform-causing outcomes on a long term basis.

(3) Environmental protection

The current electricity industry system has a scheme of coping with liberalization and environmental protection integrally, where the stable operation of environment-friendly nuclear and hydroelectric power generation (excluding pumping-up hydroelectric power generation) is secured through measures like the priority dispatching. Also, GPUs and wholesale electric utilities established their own action plan for promoting voluntary efforts to reduce CO₂ emission.

Although CO₂ emission and emission intensity has been on an upward trend after the introduction of the institutional system reforms, the incremental emission is not so conspicuous when excluding the impacts from the long-time shutdown of nuclear power plants. As for PPSs, although their own power sources are quite few at this moment, and they do not have any voluntary action plan as GPUs do, there are plans for construction of large-scale power plants by PPSs. In addition, the amendment to the Law Concerning the Promotion of the Measures to Cope with Global Warming is expected to encourage customers to seek those utilities whose reported emission coefficient of CO₂ is low.

(4) Individual reform programs

Individual reform programs include the abolishment of the cross-area wheeling service charge system, the establishment of the wholesale power exchange, and the revision of the imbalance charge system, which have been introduced from the viewpoint of vitalization of wide-area distribution, and the establishment of the neutral system organization (NSO) and the introduction of behavioral regulations which have been implemented from the viewpoint of securing fairness and transparency of the transmission/distribution segment. Each of those reform programs is considered to be successfully performing their expected functions, judging from the facts that:

- the substantial increase of PPSs' use of interconnection lines did not significantly affect burden on customers in the regulated sector;
- the original target of the volume of transactions at JEPX has been achieved;
- actual payment of imbalance charges by PPSs has scarcely increased as a whole; and
- no material problems occurred concerning fairness and transparency of the transmission/distribution segments of GPUs.

However, since these reform programs are evaluated only one year after their introduction, it is necessary to continue to pay close attention to the effects to be produced by the reforms. In addition, as the issue of market splitting in the wholesale power trade and stagnant forward transactions have become obvious, it is necessary to take measures against those issues.

2. Measures to be implemented to solve current problems

(1) Mitigating the burden of imbalance charges in the cross-area wheeling service

Under the current system, the cross-area wheeling service contract between PPSs and GPUs is supposed to be applied for each power plant, and therefore it is currently difficult to prevent “imbalance” by means of complemented multiple power plants at the same time. As a result, unit payment price of imbalance charges has been increasing in the cross-area wheeling service, although the entire volume of “imbalance” in the cross-area wheeling service is relatively small at the present. In light of such circumstances, it is planned that GPUs will revise their wheeling service clauses during fiscal 2006, in order to allow cross-area wheeling service contracts to be concluded for multiple power plants collectively, like in wheeling service contracts.

(2) Improving interconnection facilities to eliminate market splitting

The market of spot transactions at JEPX suffers constant market splitting conditions into the western market and the eastern market because of transmission congestion due to physical constraints at the FC. To address this problem, the provisional utilization of the Higashi Shimizu FC started in March 2006. It is also planned that the No. 2 Substation of Shin-shinano FC will be improved during fiscal 2006 and that the No. 1 Substation will be renovated by 2009.

The Kitahon Direct Current Interconnection Line that interconnects the Hokkaido and Tohoku areas also causes market splitting attributed to lower constraints, although the transaction volume at the Line is not so high. Therefore, improvement is to be made in 2008 to solve the problem.

(3) Reviewing the margin of interconnection lines

In preparation for an emergency situation, every interconnection line reserves a margin of 3% of the entire system capacity or any margin enough to ensure system stability at the time of the drop of the largest power source unit. The NSO reevaluated the adequacy of this margin by referring to the latest data, and concluded that the 3% margin is appropriate. However, they are going to continue to examine whether the current criteria to support the 3% margin are adequate. It has also been determined that the reserved margin should be reduced when there is a sufficient reserve for the regional supply, as far as system stability is secured. Specifically, it has been determined that the margin was allowed to be opened two months ahead of actual transaction, in order to enhance convenience for system users, while it had been allowed to be opened only day-ahead for the spot market transactions. Accordingly, the NSO revised the rules on system utilization in March 2006.

(4) Introducing weekly products at JEPX

At JEPX, which opened in April 2005, spot transactions have attained a certain volume, while forward transactions are still stagnant. It has been determined that weekly products will be introduced to the forward products in addition to the monthly products from July 2006, in response to the opinion suggesting that monthly products are inadaptable to the periodical inspection of power plants.

(5) Revising the Guidelines for Fair Power Trade

In light of diversified trade patterns of wholesale power as a result of the institutional system reforms, including the establishment of the wholesale power exchange, the Guidelines for Fair Power Trade will be revised by the end of fiscal 2006, by reviewing the guidelines for trades at the wholesale power exchange and contracts of “all-time backup.”

3. Important subjects necessary to be addressed for discussion of future institutional system reform

The Basic Energy Plan finalized during the Cabinet meeting in October 2003 suggests that the scope of retail choice should be expanded step-by-step and the discussion for full liberalization should be started during 2007. The Plan also suggests that sufficient deliberations on the following items should be made throughout the discussion taking into consideration the condition of options available to customers:

- security of system reliability;
- simultaneous pursuit of energy security and environmental protection;
- security of last resort service and universal services;
- risk elements of long-term investments or long-term contracts; and
- other practical and technical problems.

Although the discussion on the reforms of the electricity industry system is outside the scope of the Subcommittee’s objectives, some important subjects considered necessary to be addressed for the discussion of future institutional reform have been identified in the course of this evaluation on the past reforms. It is considered to be meaningful to report these subjects to the Electricity Industry Committee together with the evaluation results.

(1) Simultaneous pursuit of market liberalization and stable supply

Under the current electricity industry system, GPUs are supposed to be responsible for securing stable supply of electricity, as they have sufficient supply margin in their own franchised area. However, it is possible that such sufficient supply margin could not be maintained in the case of severe competition with PPSs, etc. Therefore, it is necessary to discuss the appropriate mechanism to secure stable supply supported by not only GPUs but also PPSs, etc.. Also, when assuming that such mechanism ensuring stable supply could be established, any possible improvement concerning the current “imbalance” system supported by the GPU should be within the scope of discussion.

(2) Simultaneous pursuit of market liberalization and environmental protection

Under the current electricity industry system, GPUs, who play the central role in the system, are expected to promote nuclear or hydroelectric power generation that makes low environmental impact. GPUs are also playing the central role in designing the voluntary action plan for the reduction of CO2 emission.

When taking into consideration the construction plans of PPSs' own power plants, it is necessary to discuss the appropriate addresses of electricity industry utilities including PPSs to reduce CO2 emission from the viewpoint of the simultaneous pursuit of market liberalization and environmental protection. It is also necessary to pay attention to the influence of measures for environmental protection on competitions among electricity industry utilities.

(3) Appropriate power procurement of PPSs

Options of power procurement available to PPSs have been diversified. Currently, the options include the utilization of their own power sources, contracts with owners of self-generating facilities, "all-time backup" procured from GPUs, trade at the wholesale power exchange and trade with IPPs or wholesale electric utilities. However, because of various restraints, PPSs seem to continue to depend on "all-time backup" from GPUs to some extent for the time being.

Under such circumstance, it is necessary to discuss the appropriate power procurement of PPSs, in light of the necessity to simultaneously pursue the security of stable supply and environmental protection.

Note

As the electricity industry is an apparatus industry, it takes a long time to identify the effects of the system reforms. This evaluation on the institutional system reforms of the electricity industry has been made by all possible addresses under the circumstances that available data for reference was quite limited and that only one year has passed since the full-scale introduction of the third reform in April 2005.

It is required to establish a scheme of constant verification on the system reforms, through continuous efforts to comprehend the outcome of reform programs, for example, such representative indices as the market trend of the electricity price and share in the liberalized sector, influence on the stable supply involving capital investment, maintenance and safety assurance of facilities and system reliability, impacts of the abolishment of the cross-area wheeling service charge system, etc.

Past discussions made by the Subcommittee to Evaluate System Reforms of the Electricity Industry Committee, Advisory Committee for Natural Resources and Energy

1st Meeting: October 24, 2005

- Establishment of the Subcommittee to Evaluate System Reforms
- Items to be evaluated or verified concerning the institutional system reforms of the

electricity industry

2nd Meeting: October 31, 2005

- Hearing from customers in the liberalized sector and owners of self-generating facilities
- Summary of quantitative analysis on the influence of the system reforms on electricity price

3rd Meeting: November 21, 2005

- Evaluation from the viewpoint of stable supply and environmental protection

4th Meeting: December 12, 2005

- The Effects and evaluations of the institutional system reforms in EU and US

5th Meeting: February 7, 2006

- Evaluation from the viewpoint of efficiency improvement

6th Meeting: February 24, 2006

- Hearing from GPUs and PPSs

7th Meeting: March 23, 2006

- Evaluation on individual reform programs

8th Meeting: April 24, 2006

- Main points of this Report (draft)

9th Meeting: May 22, 006

- Details of the Report (draft)

List of members of the Subcommittee to Evaluate System Reforms

Chairperson:

Yoshitsugu Kanemoto, professor of the Graduate School of Economics, University of Tokyo

Members:

Tsutomu Oyama, professor of the Graduate School of Engineering, Yokohama National University

Makoto Tanaka, assistant professor of the National Graduate Institute for Policy Studies

Toshihiro Matsumura, assistant professor of the Institute of Social Science, University of Tokyo

Noriyuki Yanagisawa, assistant professor of the Graduate School of Economics, University of Tokyo

Akihiko Yokoyama, professor of the Graduate School of Engineering, University of Tokyo

(Members are listed in order of the Japanese syllabary for family name)