

Nam, Ilchong

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Questions about Article Nam, Il-Chong (82-2-3299-1183, icnam@kdischool.ac.kr)

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Causes of the Crisis in the Electricity Industry and Future Policy Directions

Nam, Il-Chong Professor at the
KDI School of Public Policy and
Management

- **In 2001, South Korea restructured its electric power industry and introduced competition to the industry, but it has failed to establish an effective system of competition.**
 - Since the restructuring took place in 2001, electric power is being produced and investment is being made in power generation facilities through competition between generation companies. However, due to structural problems in the market transaction system that determine the actual effectiveness of competition in the electric power industry, this competition is not taking place effectively.
 - Furthermore, the price regulation system for the transmission, distribution, and retailing of electricity, which remain under monopoly control, and the ownership structure of Korea Electric Power Corporation (KEPCO) and KEPCO's subsidiary generation companies remain stuck in the mindset of the government monopoly system that preceded the restructuring. As a result, KEPCO and its subsidiaries continue to experience internal inefficiency, and the distribution of resources within the power industry continues to be inefficient as well.

* This is translated version of *KDI Policy Forum* released on January 9, 2013.

** This article presents a summary of the major points of *Competition Policy for the Electricity Industry of Korea* by Nam, Il-Chong, a research monograph published in February 2012 by the Korea Development Institute.

- The chronic supply crisis, the unending inadequacy of facilities, the excessive consumption of power, KEPCO's large-scale accumulated deficit, the inefficient management of KEPCO and its subsidiary generation companies, and the frequent accidents that have occurred over the past few years are all caused by the failure of policies concerning management, regulation, and government-run companies in the power industry.
- **In order to normalize the power industry and increase its efficiency, it is necessary to strengthen policies governing competition in the power industry. It is also necessary to implement the kind of pricing and government-run company governance systems that are used in advanced countries, systems that are grounded in the profit motive and economic efficiency.**
 - In the wholesale power market, direct price competition should be permitted under a price cap, just as in the PJM market in the eastern US. In the capacity market, the current spot market format should be converted to a forward contract market that takes into account the time required for investment in facilities.
 - The system must be changed to eliminate excessive profit, which violates market principles, without hampering competition. Vesting contracts should be introduced to baseload plants and other power generation facilities that were constructed in the past; entrance limitations should be abolished for the construction of additional baseload plants; and business operators should be chosen through competitive bidding in cases where there is some kind of entrance barrier resulting from location or environmental issues.
 - After introducing optimal rate-of-return regulations in the respective categories of transmission, distribution, and retailing, these regulations should be converted to price cap regulations early on. In addition, the governance structure of KEPCO and its subsidiary utilities must be reoriented toward maximizing the profit motive and giving management more discretion so that these government-run companies can compete with companies in the private sector.
 - The power industry as it exists today has dealt with instability for the 10 years that have passed since 2003. The structure of the industry must also be reoriented to maximize competition.

1. Restructuring Background and the Situation in the South Korean Power Industry Since the Restructuring

Through restructuring in 2001, South Korea separated its power generation market from the other three vertical markets (transmission, distribution, and retailing) that make up the electricity industry and then introduced competition in the power generation market. Since 2001, the Korea Electric Power Corporation (KEPCO) has only handled transmission, distribution, and retailing and has not been involved with producing electricity. Generation of power and investment in power generation facilities, on the other hand, has taken place through competition between KEPCO's six

subsidiaries; generation companies that are affiliated with large business groups such as SK, GS, and POSCO; and a number of other small- and medium-sized utilities. This reflects trends in nearly all of the most advanced economies and in the majority of developed economies, which introduced competition into the generation and retailing markets after the mid-1990s and have been operating stable systems of competition since the mid-2000s.

The biggest difference between before and after competition was introduced in Korea lies in the decision-making process for investing in power generation facilities. Under the monopoly system that preceded the introduction of competition, the government and the monopoly company were responsible for estimating the scale of power generation facilities that the country needed, determining what scale and what kind of facilities were needed, and deciding when the facilities should be constructed and when they should be phased out. At the same time, consumers had to bear 100% of the risk of the investment failing due to excessive investment, insufficient facilities, or the selection of inefficient kinds of generators. However, under a competitive system, decisions about investment are left to competition between companies trying to maximize their profits, and the risk that accompanies the resulting investment is split between the consumers, the utilities, and the retailers.

When we assess the electricity industry today, 11 years since a competitive system was introduced, it is hard to find any evidence that the industry is being run any more efficiently than before. Since competition was introduced, the issue of insufficient numbers of power plants and baseload generators has not improved and, indeed, has gotten worse, and the supply and demand crisis has continued. Furthermore, we continue to see cases of market failure that no one had predicted at the time of the restructuring, including excessive consumption of electricity, massive accumulated deficit at KEPCO, and inefficient management and frequent accidents at KEPCO's subsidiary utilities.

Then there is the fact that, in other countries that have introduced competition into the electricity industry, the wholesale electricity price and the amount of power generated by each generator are determined by price competition between utilities in the wholesale electricity market. In the wholesale electricity market in Korea, however—even today, 11 years after competition was introduced—unnatural competition can be seen. Severe restrictions are placed on price competition, and the government is interfering in the determination of prices.

The situation in the Korean electricity market since its restructuring is very discouraging when it is compared with the situation in other countries that have introduced competition in their electricity markets. This suggests that there is a major flaw in the way that the Korean electricity market has been run since restructuring. The greatest problem that exists in the Korean electricity market is the fact that effective competition is not occurring in the wholesale electricity market, which is being run according to a competitive system.

As a general rule, the electricity industry exhibits a number of characteristics that are rarely

seen in other industries. These include the fact that power cannot be stored; that, if production and consumption do not take place at nearly the same time every moment, the system collapses, leading to a long-term suspension of the electricity supply; that, practically speaking, it is difficult for the retail price to change along with the situation of the market; and that vast sums of money must be invested in facilities that will be used for thirty years or more, involving high risks and uncertainty about the future.

Consequently, in every country, competition in the electricity market is managed through sophisticated market trading systems. Just like the eastern US, Australia, and Spain, South Korea operates a dual market divided into an electricity market and a capacity market. In addition to the revenue obtained through selling the electricity they have produced, generation companies also receive compensation for the very fact that they possess generators. Consequently, the real effectiveness of competition and the real efficiency of investment in the electricity market are determined by the way in which the electricity price and capacity price are determined. However, the market trading system currently used in Korea is fundamentally different from those used in advanced economies in terms of both the electricity price and capacity price, and this system has serious structural flaws.

The Korean system of regulation for the electricity transmission, distribution, and retailing sectors (which, unlike the wholesale electricity market, are not competitive but monopolistic) and the governance of public enterprises in the electricity industry are also considerably different from the systems of advanced economies. These systems violate market economy principles and still show traces of the framework that existed before restructuring occurred. A considerable portion of the market failure that has occurred in the Korean electricity market since it was restructured has been caused, first, by inefficiency in the way that the prices of electricity transmission, distribution, and retailing are regulated and in the governance structure of government-run companies in the electricity industry and, second, by a lack of consistency in the system of competition in the wholesale electricity market.

2. Characteristics of the Market Trading System in the Korean Wholesale Electricity Market and the Major Problems Thereof

Unlike other countries, the market trading system in the Korean whole electricity market forbids mid-and long-term bilateral contracts between generation companies and retailers, and electricity trading can only be conducted using the spot market, which opens at one-hour intervals. Also unlike other countries, direct price competition is forbidden in the electricity market, which is a spot market. Only indirect price competition is permitted, which is based on the accounting cost for each generator. Under this system, each generation company reports the variable costs of power generation for each generator in its possession to the trade exchange. The trade exchange,

after using these figures to calculate the marginal cost of power generation for each generator, has the utilities make bids at the price equivalent to the marginal cost calculated for each generator.

The SMP (system marginal price) that is determined through such indirect price competition is applied as the retail price of electricity for all utilities except for KEPCO's subsidiary utilities. Utility companies that are subsidiaries of KEPCO are allowed to use low prices that are calculated by applying discount rates differentiated by the generator type through a correction factor system. In other words, the price of the same product, that is, electricity, which is being traded inside the same market, varies depending upon who owns the generation company and what kind of generator is producing it.

The capacity market is also being operated as a spot market for capacity. Generation companies receive an amount of money from KEPCO for the capacity of each generator they own, in addition to the revenues from the sale of energy. The capacity payment KEPCO pays for the capacity of a generator is equal to the per kw capacity price multiplied by the maximum capacity of the generator. The same capacity unit price has been used since it was first calculated using a highly unusual method at the time that competition was introduced to the system in 2001. In the capacity pricing system that was introduced in 2001, a 30-year annuity plus the fixed operating cost was set up as the amount for the spot capacity market. This was what was needed to motivate utilities to construct gas turbine generators in 2001. Despite the fact that the construction cost of generators and the fixed operating cost have increased since then, this price is still being used today with hardly any adjustments. The system for bidding in the electricity market, which we briefly explained above, and the way of determining the wholesale electricity price and the capacity price are greatly different from the systems that are used in advanced economies, both in their content and effectiveness, and they are hampered by the following problems.

First of all, direct price competition between generation companies is forbidden, and the system which is currently in place requires that the estimated cost be used as the bidding price, limiting competition between generation companies in the electricity market.

Second, varying the wholesale electricity price according to the ownership structure of the generation company and the generator type severely distorts the incentive to invest in power stations. Varying the price according to the ownership structure of the utility means that the profitability of the same investment will differ depending on the company, and this fundamentally distorts the incentive to invest in power generation facilities. This not only makes it impossible to guarantee the effectiveness of investment, but it also brings about the collapse of the market system itself. Furthermore, varying the wholesale electricity price according to the generator type distorts the process by which utilities decide what generator type to construct, and it is also more likely to lead to an inefficient generation mix.

We can understand the significance of the modification factor system currently in use in the Korean electricity market by considering what would happen if it were applied to the gasoline

market. In this hypothetical scenario, the government would require that different amounts of money be charged for the same quality of gasoline, depending on which gas company is refining it and on what kind of refining equipment is being used. Such market interference by the government in regard to prices would result in some oil companies being more profitable than others, and it would distort the motivation of oil companies to invest in oil refining equipment. It can be easily predicted that, if the government continued to interfere in the market in such a fashion, the gasoline market would soon cease to be a competitive market.

Third, while the capacity price in the spot market is ostensibly calculated according to the concept of the opportunity cost of generators, the current capacity price is in reality completely unrelated to that cost, and indeed that opportunity cost is not accounted for at all in the spot market. The capacity price system that was introduced in 2001 was based on a special kind of contract that pays out the same amount each year during a 30-year contract in order to encourage utilities to build new gas turbine generators in 2001. Essentially, this has the same effect as making a one-time payment to induce generation companies to build gas turbine generators that were new in 2001. The capacity price that was calculated according to this method has no relation to the spot opportunity cost of capacity in 2001, and it is very likely that this amount was much higher than the opportunity cost of capacity in 2011. As a result, the capacity price has borne no relation to the opportunity cost of capacity for each year since 2002. Or in other words, the capacity price that is being used at the present bears no relation whatsoever to the opportunity cost of capacity. This is impossible to justify according to economic theory, and the possibility that this capacity price will offer an appropriate incentive for investment in power generation facilities is in fact zero.

In summary, since the market trading system used in the Korean wholesale electricity market prevents price competition between generation companies that is based on the true marginal cost, it is hampering the effectiveness of the electricity market in the short term. Additionally, the system has failed in its attempt to encourage generation companies to use the profit that they gain from the sale of electricity and capacity to make appropriate investments in power generation facilities. The growing shortage of power plants and baseload generators, the increase in the hours of operation of peaking generators resulting from this insufficiency, the increase in the time spent determining the SMP of peaking plants (65% in 2001 → 93% in 2010) and the resulting increase in the SMP, all of which have appeared since the introduction of competition—the ultimate import of these phenomena is that the market trading system that has been used since 2001 has failed to give companies the incentive to invest effectively in power generation facilities. Furthermore, though more than 11 years have passed since competition was introduced to the industry, the fact that the electricity price is not being determined in the market according to market principles and that the government keeps interfering in the market to vary the price according to the utility and the generator type means that, in reality, Korea's attempt to introduce an effective competitive system into the wholesale electricity market has failed.

Korean economic policy for the electricity market since 2001 has also not been successful in effectively resolving the problems that arise in the process of converting the vertical combined monopoly system that preceded restructuring into a competitive market. All countries that have discontinued a monopoly system and introduced competition into their electricity market have experienced the phenomenon in which excessive profit or loss is incurred in the generators that were built during the monopoly period, which causes either the companies or the consumers to suffer losses. To circumvent this, steps must be taken to control profitability during the transitional period while the competitive system is still taking root. Methods should be used that prevent the previously constructed generators from incurring excessive profit or loss without having a negative effect on competition. The modification factor system in Korea is partially intended to prevent baseload reactors constructed before the restructuring from accruing excessive profits.

However, the form that this system takes and the economic effect it has are completely different from the transitional measures that have been used in advanced economies. This can be seen by observing that: the modification factor system is applied not only to baseload generators built before the restructuring but also to those built afterward and those that will be built in the future; the system directly manipulates prices in the spot market; the system also applies to gas hybrid generators that are not baseload plants; and the factor is frequently changed. Indeed, the system bears a strong resemblance to arbitrary interference in the market and has distorted the incentive to invest in construction of power stations since the restructuring.

3. Problems with the Price Regulation System

After the restructuring in 2001, KEPCO's role was reduced to the businesses of electricity transmission, distribution, and retailing. A price regulation system that would both provide KEPCO with an incentive to reduce costs and keep its profits at a reasonable level should be applied in these areas in which KEPCO has a monopoly. However, the public utility pricing system that is currently in place neither provides KEPCO with an incentive for reducing prices nor ensures that profits stay at an optimal level. The current system for regulating the price of public utilities does compensate for variable expenses, financial costs, and depreciation expenses and is based on the principles of an optimal rate-of-return regulation system, which seeks to secure an appropriate rate of return for invested capital. However, it permits a number of exceptions, and in reality it is being operated in a manner that is in fact unrelated to an optimal rate-of-return regulation system.

Since the method of calculating the optimal rate of return for electricity prices is unclear, it is impossible to calculate reasonable profit for capital investment and consequently also impossible to calculate the revenue requirement and the optimal level of electricity prices. Further, since the government has no obligation to reflect the optimal rate of return in its calculation of the electricity price even if that rate were known, electricity prices are being determined very

arbitrarily. The current price regulation system for the services of electricity transmission, distribution, and retailing is incomplete and inefficient, and as such it is the cause of excessive consumption of electricity and the resulting waste of resources, distortions in the structure of the domestic electricity industry, and KEPCO's massive accumulated deficit and lack of competitiveness. Furthermore, while the price regulations on KEPCO since 2001 have naturally only applied to the services of electricity transmission, distribution, and retailing, the content of those regulations has tended to treat KEPCO, which is effectively a business dealing with transmission, distribution, and retailing, and KEPCO's subsidiary utilities, which are active in the competitive wholesale electricity market, as if they were one and the same. In other words, even after the restructuring, KEPCO and its subsidiary utilities have been linked together and treated as if they were a single company in a manner similar to the price regulation system that was used before the restructuring (when KEPCO had a monopoly in all four areas of power generation, transmission, distribution, and retailing), and the pricing regulations are being applied, as it were, to this imaginary company. These regulatory practices are not only unreasonable as a price regulation system for electricity transmission, distribution, and retailing, but they also lack consistency with the electricity market structure since restructuring, causing a distortion in competition in the wholesale electricity market. In addition, since the price regulation system that is currently in place does not provide KEPCO with an incentive to reduce its production cost, it results in an unnecessary increase in cost, which in turn leads to a rise in prices.

4. Problems with the Governance Structure of Government-Run Companies

The basic objective of the restructuring and the introduction of competition into the electricity industry was to delegate investment in power generation facilities to companies competing with each other according to the profit motive and to reduce costs in the electricity market across the board and lower prices accordingly by introducing a transparent and efficient regulatory regime in the sectors that remained under a monopoly. A necessary condition for competition in the wholesale electricity market to effectively take place is maximizing utilities' profits. Putting into place a governance structure that is based on the profit motive is particularly important for KEPCO and its subsidiary utilities, which account for more than 80% of the electricity market in terms of the scale of power generation facilities and the amount of electricity generated.

However, the current system responsible for the corporate governance of government-run companies does not recognize KEPCO and its subsidiaries as commercial entities, treating them instead as public organizations that are tools for achieving the policy goals of the government and thus severely limiting profit motive and independent management. Despite the fact that KEPCO is a publicly listed company and that private shareholders own nearly half of its shares, severe limitations are placed on KEPCO's ability to exercise ownership rights over its subsidiaries, which

have a considerable influence on the value for KEPCO's shareholders. The weak presence of the profit motive at KEPCO and its subsidiary utilities and the fact that the corporate governance of these companies are more akin to that of a government-run company not only reduce the internal efficiency in these organizations but also lower the effectiveness of competition in the wholesale electricity market. These are a cause of inefficiency in the transmission, distribution, and retailing sectors as well.

5. Measures Necessary to Normalize the Electricity Industry

Not only does the instability in the electricity industry's current system of competition lead to inefficiency, but furthermore the system cannot even be long maintained in its current state. Rather than continue with the current system, it would be a better idea to either restore the government monopoly system or introduce an actual competitive system. And indeed, it is now necessary to choose one of these two alternatives. When we consider the fact that there is a global trend toward introducing competition into the electricity industry and that the majority of advanced and developed economies have succeeded in introducing competition and are now running stable competitive systems, it is more desirable for South Korea to join these countries in moving in the direction of expanding competition than regress toward a government monopoly system. Even if the current structure of the electricity industry is maintained as is, there would need to be sweeping changes in the competitive system in the wholesale electricity market, the regulation system for monopoly pricing, and the governance structure of government-run companies.

It is also necessary to change the market trading system for the wholesale electricity market in the following manner. First, the rules governing competition in the spot wholesale electricity market must be altered to permit direct price bidding under a price cap and to allow electricity to be traded at a single price by abolishing the modification factor.

Second, trading electricity through mid- and long-term bilateral contracts outside of the spot market must be permitted. Enabling a substantial portion of the total amount of electricity trading to take place through mid- and long-term contracts between generation companies and retailers is a highly effective way of spreading out the risk of investment in generators, which require huge amounts of capital, and the risk associated with fluctuations in the future price of electricity.

Third, the capacity market should continue to be operated separately as it is at present. That said, the distorted capacity price system that is currently being used must be abolished, the capacity market must be converted to the kind of forward contract market that is used in PJM in the eastern US and certain parts of Australia, and the capacity pricing system must be changed so that capacity prices can be determined by the conditions of forward contracts made through competition between utilities. The forward contract market system is a system that makes it obligatory for retailing companies to secure access to electricity a certain amount of time in

advance. This electricity is the amount that projections suggest will be needed to meet future demand. Such a system motivates retailing companies to take advantage of competition between generation companies (whose objective is to profit on their investments) in order to negotiate the lowest possible price for the electricity that they are obliged to secure. Since it leads to comparatively more effective competition in the investment market for power generating facilities by giving generation companies and potential investors relatively sufficient time to invest in such facilities, it is superior to the spot capacity market system currently used in Korea.

Fourth, KEPCO and its utilities must be required to sign vesting contracts in order to prevent the generation companies that dominate the market from abusing their dominant position while simultaneously keeping the generators that were constructed in the past, and in particular baseload plants, from reaping excessive profits in a situation where there are an insufficient number of baseload plants. Vesting contracts are a kind of bilateral contract that do not hinder competition in the wholesale electricity market while also ensuring that the profits earned by generators that were constructed in the past do not exceed an appropriate level. Such contracts have been used in the United Kingdom and other countries during the transitional period after restructuring, and they are still being used today in Australia and Singapore.

Fifth, it may prove that there is an entrance barrier to investment in coal generators that makes it likely for excessive profits to be made by coal generators that are yet to be constructed. In this case, these excessive profits must be eliminated by selling permits for the construction of new coal generators through competitive bidding, thus reducing the unnecessary burden on consumers. It will also be necessary to review the options for using the pressure of competition to eliminate the excessive profits garnered by nuclear power plants that will be constructed in the future and to reduce the associated costs.

The price regulation system for the monopolistic sectors of electricity transmission, distribution, and retailing needs to be converted into a price-cap regulation system at the earliest possible opportunity, after first normalizing the rate-of-return regulations based on the principle of guaranteeing an optimal rate of return. The governance style of KEPCO and its subsidiaries must also be converted to that of a commercial company that pursues profits. In regard to the governance of KEPCO, it is also necessary to permit independent management with the aim of maximizing the financial value for KEPCO's stockholders within the bounds of competition policy and regulation policy. KEPCO should be given the authority to manage itself with the object of maximizing company value for its subsidiary generation companies and all other subsidiaries. At the same time, action must be taken to prevent KEPCO from abusing this authority by engaging in anti-competitive behavior such as collusion and price fixing. The solution is strict enforcement of the laws concerning competition and the addition of punitive clauses related to anti-competitive practices to the management contracts of the KEPCO management. By revising the laws concerning the regulation of public utility pricing and the governance of government-run companies, it is possible to achieve improvement in the areas of pricing regulations and

governance in a comparatively short period of time.

The structure of the electricity industry must also be reoriented toward promoting competition. Some necessary changes include dividing KEPCO in its current form into retailing companies and transmission and distribution companies; permitting retailing companies to enter the power generation stage and allowing them complete ownership and control of certain subsidiary generation companies while forcing them to sever the ownership relationship with the other subsidiary generation companies; and permitting competition in the retailing sector of the industry.

The questions of whether transmission and distribution services should be split into separate companies, whether distribution companies should be divided by region, and whether transmission services and system operations should be integrated can be decided at a later point after further review.