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The Liberalization of the Japanese Electric Power Industry

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1. INTRODUCTION

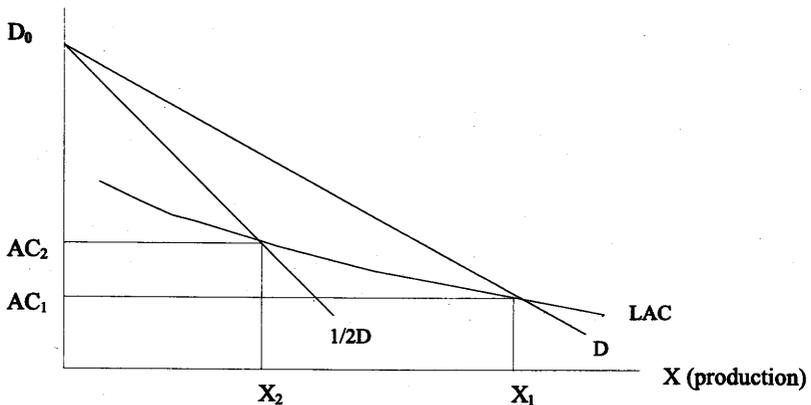
In this paper I will analyze the emergence of competition in the electricity industry and the logic underlying this process. The Japanese electricity industry has been undergoing radical structural change since 1996. The market structure of electricity in Japan used to be peculiar in the sense that nine local monopolies were maintained under the regulatory system of the Ministry of Trade and Industry (MITI).

Each local monopoly firm was huge in size in the regional economy and very often extremely influential politically as well as economically.¹ This constituted one reason why Japan was for so long so slow in liberalizing the electricity industry. Quite recently, however, criticism concerning the high electricity tariff compared with other major countries became fierce and the government decided to shake up the old regulatory system in a short period. Along with the introduction of a bidding system in 1996, the Electricity Industry Council started discussions on how to open up the electricity market and concluded a new agenda last year.

2. THE COST STRUCTURE OF ELECTRIC POWER GENERATION

The Japanese electric power industry has been dominated by nine local regional monopoly firms (ten including Okinawa) covering the country. Each company is vertically integrated from power generation to transmission and distribution. From the viewpoint of economics this type of monopoly has been rationalized by the theory of natural monopoly. The long-run average cost never ceases to decrease by increasing the amount of supply as shown in Figure 5.1. In this case dividing a market between more than two firms means a waste of resources because the average cost of supply is higher in the hands of such firms. This is clearly shown in Figure 5.1: the average cost of a monopoly firm is AC_1 whereas the average cost of a divided firm is AC_2 and AC_1 is always lower than AC_2 .

Figure 5.1: Natural Monopoly



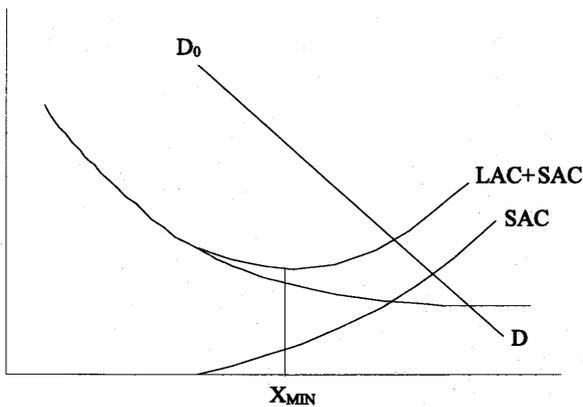
D_0D : Demand Curve

LAC : Long run Average Cost

This rationalization of natural monopoly had been valid until nuclear energy emerged as a source of more stable energy supply. Japan, which has always been dependent upon imports of foreign energy resources, has also to depend upon atomic power more heavily than other major countries.

Dependence upon atomic power, however, incurred additional costs in the process of the construction of power generating stations. Considerations of safety and the approval of local inhabitants required that powerhouses be built in remote locations. This increased the cost of power generation in several ways; Electricity companies had to pay large amounts of compensation to nearby inhabitants. The construction time necessary to complete a powerhouse increased. The cost of power cable installation dramatically increased because of the much longer transmission line requirements needed to feed customers in city areas. As a result the cost structure of power generation has changed in recent years as shown in Figure 5.2. The cost of generating power is the sum of LAC and SAC: SAC is the social cost incurred by building an atomic powerhouse in a remote area. It is the additional cost seen when electric power companies have to extend their maximum power limit. This shows that ever decreasing average cost has become a myth. Now the total cost of power production exhibits decreasing return to scale from the point of X_{MIN} . There exists a minimum cost as is seen by the production size of X_{MIN} .

Figure 5.2: The Change of Cost Structure



SAC: Social Average Cost

3. THE INITIAL LIBERALIZATION OF ELECTRIC POWER

In the face of the disappearance of the natural monopoly the Japanese regulatory regime of the electric power industry had to revise the old paradigm to tackle this problem. Furthermore, there also existed another major concern among Japanese politicians. It had long been pointed out that the country's tariff for electrical utilities was much higher than in other advanced countries.² And that was very problematic to the Japanese economy because high electric power prices could elevate the cost of production for major manufacturing industries. The higher cost of power generation discussed in the previous section may be one source of raising electricity prices. In response to the above MITI proposed a new regime in 1996. MITI introduced the so called 'bidding system' into the area of power generation. In the days of natural monopoly no firm could enter the power generating market and only the electricity company could produce and provide electricity to customers. By introducing a bidding system, however, MITI made it possible for other firms to enter the power generation market for the first time. This was seen as a device to liberalize the wholesale market for electric power. Some companies entered the market for the purpose of utilizing their capacity in electric power production as many of them had extensive experience of producing power for their own use. In 1996 the amount up for bidding was 3.04 GW and in 1997 — 3.12GW.

From the economic point of view, however, the bidding system itself has weaknesses in promoting competition against electric power companies. It is true that bidding firms give a stimulus to electric utilities in the sense that a comparison of costs of power generation has become possible — the electric power companies must compete with bidding firms because they must show that they are as efficient as new entrants — but there exists a basic flaw in this system. In the wholesale market it seems that electric utilities must compete with bidding firms but the same is not true in the retail market. Electricity companies are sole providers of electric power to customers whereas bidding firms cannot sell their products to general customers. In this sense bidding firms have the equivalent status of subcontractors in manufacturing. Subcontractors produce products for their parent company but the final product is only sold under the parent company's brand. The subcontractors therefore do not have their own market and cannot compete with their parent firm without refusing to

adhere to the subcontracting regime.

In the case of electricity supply, the transmission and distribution network is monopolized by the electric utilities. Therefore, wholesalers of electric power cannot find a way to enter into the retail market.

4. THE EMERGENCE OF IPP

MITI noticed the importance of creating competition in the retail market. In 1998, MITI reorganized the Electricity Industry Council (Denjishin) and started discussions for introducing competition in the retail market.

Here, it must also be pointed out that the environment for creating competition in the electric power market was well prepared. Firstly technological innovation that had emerged enabled some firms to realize lower costs in producing electricity by utilizing the economy of cogeneration. While the introduction of several other technologies made it possible for outside firms to some extent to supply electric power at a reasonable cost.

Secondly, some large industrial firms, located very close to their biggest customers in industrialized areas, have enough capacity to provide electric power at comparable cost to electric utilities. The most notable examples here are in the steel, chemical, and gas industries where a producer's plant is located in the center of an industrial complex surrounded by big customers who are themselves often related to the supplier through traditional tie-ups. Such a situation gives a formidable advantage to these firms because the cost of transmitting power is much less than that seen by electric power companies.

Thirdly the impetus to enter into the electricity supply market has become stronger since large firms noticed that the market may not be very profitable but is stable.

In the 1990s Japan experienced the longest recession since World War II. As a result many large firms went in search of lucrative markets to invest in and electricity emerged as one of the candidates. The electricity produced by a new entrant or Independent Power Producer (IPP) is sold in the market under the name of an electricity company, and therefore, as was pointed out above, the IPP serves as a kind of subcontractor to the electrical utility. The council wanted to liberalize the electricity market further by introducing competition into the retail market. The rate structure of electricity services has been strictly regulated by MITI and it is obvious that there exists several kinds of cross-subsidy among services.

The Council believed that the total liberalization of electrical services however would be harmful and too extreme. It was also clear that the demand for lower prices came from the largest customers that had to compete in the international market. It was therefore concluded that the process for liberalizing the electricity industry should be gradual in the sense that the market of small customers and households should not be directly opened to competition until the economic consequences of the liberalization to the largest customers was understood.

The idea of competition between IPPs and electric utilities can be analyzed by comparing the cost structure of the two parties. The following figure can be used to analyze the situation.

In Figure 5.3 we assume three IPPs (A, B and C) can produce electricity at the same cost as is shown ac . The IPP is going to provide electricity under a demand schedule like d_{ADA} . For simplicity it is assumed that the IPPs face identical demand curves and can supply electricity at the lowest cost of C_{MIN} . Although the size of demand is limited as dd , the total amount of supply can be summed up as shown in Figure 5.4.

It is clear that the supply cost of electricity is C_{MIN} which is common to all IPPs. As a result the possibility of entry into the retail market depends upon the comparison of C_{MIN} and the fee payable to electric utilities which made the access to customers possible.

We can compare the average cost between IPPs and electric utilities

Figure: 5.3: The Emergence of IPP

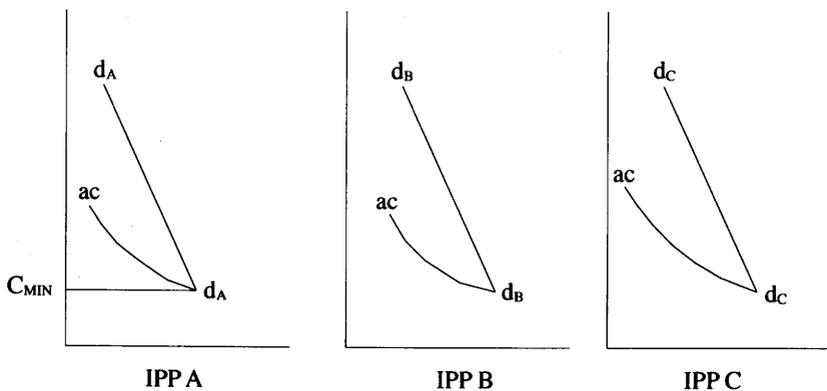


Figure 5.4: The Supply Curve of IPP's

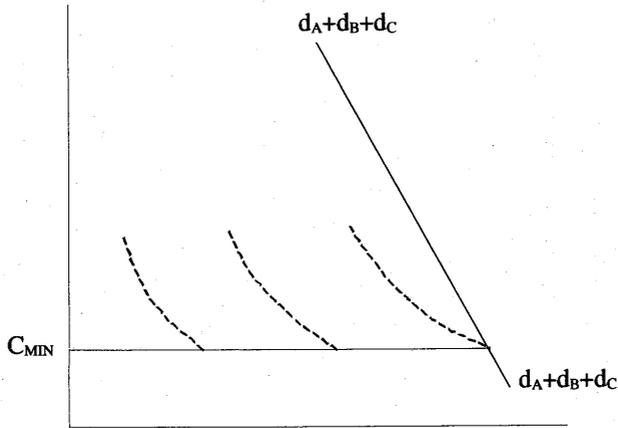
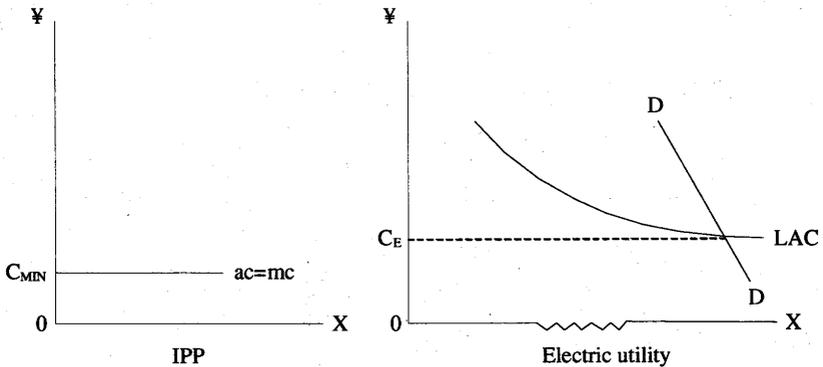


Figure 5.5: The Competition between IPP and Electric Utility



in Figure 5.5.

The supply curve of the IPP is depicted by the horizontal line $ac=mc$. It is assumed that the IPP can provide electricity at lower cost because of the cost advantage derived from good location of its powerhouse and possible technological innovation. There exists a certain difference between C_{MIN} and C_E . The disadvantage of the IPP is inherent to the network industry. Firms other than electric utilities do not have the access line to the customer. It is economically infeasible for new entrants to

construct transmission cable lines for their own use. In other words the transmission line is the essential facility or bottleneck without which no firm can successfully compete with the incumbent firm.

It is illegal for the incumbent firm to refuse interconnection between the incumbent network and the newly created network. But the problem is the fee that the incumbent can charge the newcomer. If the fee payable to the electric utility is denoted Z , the next condition to obtain must be to realize effective competition in the retail market.

$$C_E - C_{MIN} \geq Z$$

When

$$C_E = C_{MIN} + Z$$

the IPP is break-even and indifferent to entry. If the next condition to obtain is that the IPP will succeed with profitable entry.

$$C_E > C_{MIN} + Z$$

5. THE PROPOSAL OF THE ELECTRICITY INDUSTRY COUNCIL

One of the major tasks for the Electricity Industry Council was to find out the method of deciding on an appropriate rate for transmission. The Council adopted the new approach for network interconnection developed in the telecommunications industry. In the United States the Federal Communications Commission (FCC) introduced a concept to implement competition between local and long-distance carriers. This is called 'Forward Looking Cost' (or Forward Looking Economic Cost). This cost reflects incremental costs necessary to provide interconnection service to the entrant into the local loop. In other words Forward Looking Cost is not historical costs which reflect the previous investment of the incumbent firm.

By introducing this concept the FCC tried to enhance competition in the local market. This situation is akin to the electricity industry where regulators are anxious to promote competition in the retail market. MITI was quick to adopt this idea. There exists, however, a basic difference between telecommunications and electricity. In telecoms the speed of technological innovation is so rapid that no one can anticipate possible trends whereas in the electricity industry technological innovation is very slow at least for the moment. This difference necessitates a distinction of

the concept of Forward Looking Cost between telecoms and electricity. In the case of telecoms historical costs are higher than the current costs as far as technological innovation prevails. On the other hand historical costs may be lower than the current costs in electricity. The basic idea of the Council is dependent upon the concept of Forward Looking Cost but the calculation procedure pays considerable attention to the historical costs compared to the case of telecoms.

At the same time MITI tried to clarify the method of allocating common costs. It was often the case that the cost allocation was arbitrary and less transparent. In the new regime MITI introduced the so called ABC accounting method. ABC stands for Activity Based Costing and its aim is to pay more attention to find out a direct relationship between activity and cost.

The electric utilities are requested to provide a menu of transmission rates to MITI. The method of cost allocation employed by utilities are examined by MITI based on public comments from the general public.

6. HOW FAR LIBERALIZATION CAN BE REALIZED?

The Council decided to liberalize the market for the largest customers: the criteria for demarcation of customers is the degree of voltage at which electricity is sent to them. From March 2000, the market of over 20,000 volts will be totally liberalized: customers and electricity companies are free to negotiate prices. On top of that, customers will be free to buy electricity from any electric utility or IPP. The essential condition to realize this market is the level of transmission rate. As was discussed in the previous section, MITI prepared a new scheme for calculating transmission price based upon the Forward Looking Cost and ABC accounting rule.

With regard to the distribution of customers according to the size of purchase amount, the percentage of the largest customer is almost 30%. As for the other customers, it will not be determined which customers should be liberalized until 2003. The Council continues to discuss how far liberalization will be developed. In the UK total liberalization is already completed including households. MITI is still cautious to extend the boundary of liberalization to the smallest customers as electricity rates for smaller customers have been raised in many countries which have experienced total liberalization. The basic problem we are now facing is to examine the structure of cross-subsidy inherent in the Japanese

electricity industry. It is the factual problem whether electricity prices for small customers can be reduced or not. If there exists cross-subsidy from smaller customers to large customers, there will be room for reducing the present tariff for the household customer.

In the UK, competition in the retail market for the household customer was made possible by the emergence of 'aggregators' or a market brokerage function. It is uncertain in Japan whether this type of marketing can be realized in the near future.

Notes

- ¹ The nine local electricity companies are as follows (from North to South): Hokkaido, Tohoku, Hokuriku, Tokyo, Chubu, Kansai, Chugoku, Shikoku, and Kyusyu. The capacity and average price are shown in the Table 5.1.

Table 5.1: The Capacity of Electric Power Generation and Average Price (1997)

	Capacity (GW)	Price (¥/kw)
Hokkaido	6.41	20.34
Tohoku	17.52	19.47
Tokyo	67.87	19.27
Chubu	32.73	18.50
Hokuriku	7.46	17.53
Kansai	39.44	18.41
Chugoku	14.47	18.80
Shikoku	7.24	19.69
Kyushu	20.48	19.73

- ² Accounting to the Economic Planning Agency, these existed still price discrepancy between Japan and other countries in 1997 as in the Table 5.2.

Table 5.2: Price Discrepancy between Japan and Other Countries in 1997

Japan	US	UK	Germany	France
1.0	1.19	1.25	1.08	1.41

Notes: The comparison is based upon the monthly rate.

Foreign exchange rate is in 1997 (US\$1=¥121).

Source: EPA, "Price Report '98."

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