

# The reform of the electric power industry in Taiwan

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**The purpose of this paper is to investigate the reform of the electricity industry in Taiwan. We first outline the current situation in Taiwan. Second, we analyze the government policy for promotion of cogeneration, the opening of the market for power generation to independent power producers and the revision of the Electricity Act. Third, some implications of the government deregulation policy and difficulties in relation to future regulatory reform of the electricity industry in Taiwan are discussed. Finally, a brief conclusion and several recommendations are presented** © 1997 Published by Elsevier Science Ltd. All rights reserved.

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## Introduction

After years of ideological contest and new breakthroughs in technology, the world has now embarked on the path of market-driven economic development. Many industries in industrialized countries have shifted from a conventional regulated system to a more liberalized one. The electricity industry is one which is rapidly evolving toward a more competitive market. For example, the electricity industries in the United Kingdom, New Zealand, and Norway have faced drastic changes over the past few years. This international trend in the electricity industry has inevitably influenced Taiwan's electricity industry, currently monopolized by the vertically integrated Taiwan Power Company (Taipower), which is run by the government, to move gradually toward a more open and liberalized market system.

Taiwan, unlike many other countries, has an isolated power system with a lack of power capacity in the summer peak load period. The causes of such shortages are mainly the NIMBY (not in my backyard) complex of people who are actively against new power development projects. In Taiwan, there has been a power shortage problem since 1988 and the current government policy for the power industry is to accelerate the power supply. Since the reform of the power industry can encourage various private investors (including the investor from other countries) to develop new power plants, the power shortage problem could be possibly mitigated.

Note that the investor-owned utilities or IPPs tend to develop combined-cycle gas-turbine unit or a gas-fired power plant which has a shorter lead time, less-capital intensive, and less environmental impacts to the local residents. In addition, the descending trend of primary energy prices, and rapid economic and load growth in Taiwan have worsened the power shortage situation. The strategy adopted by the government to ease the tensions caused by the power shortages has been to introduce deregulation to the power market with several measures. All these are contributing to the reform of the electricity industry in Taiwan, and in particular importance is the revision of the Electricity Act, now under review by the Legislative Yuan.

The purpose of this paper is to investigate some of the issues involved in the reform of the electric power industry in Taiwan. In order to achieve this objective, we first outline the current situation in Taiwan. The government's policy for promotion of cogeneration, the opening of the market for power generation to IPPs and the revision of the Electricity Act are then analyzed. Third, some implications of the government deregulation policy and difficulties in relation to future regulatory reform of the electricity industry in Taiwan are discussed. Finally, a brief conclusion and recommendations are presented.

## The current electricity industry in Taiwan

By the end of 1996, the total number of power plants in Taiwan was 60, of which 39 were hydroelectric, 18 were

thermal, and 3 were nuclear plants. The total installed capacity was 23 763 MW, of which 18% was hydroelectric, 32% coal-fired, 20% oil-fired, 9% gas-fired, and 22% nuclear. The peak load was 21 762 MW in 1996, a 9.2% increase over that in 1995, and the average load was 14 227 MW, an 5.7% increase over 1995. Power generation totaled 124.9 TWh in 1996, an 6.0% increase over the previous year. Of this 1996 total, 7% came from hydroelectric, 40% from coal-fired, 19% from oil-fired, 5% from gas-fired, and 29% from nuclear plants. The installed capacity of self-generation systems, mainly cogeneration, reached 4296 MW, with power generation at 10.5 TWh. Total installed capacity of power generation, including self-generation, reached 28 059 MW, with power generation at 135.5 TWh. On the other hand, total electricity consumption in 1996 amounted to 121.7 TWh, of which 64% was for industrial use, 2% for agriculture and transportation, 22% for residential use, and 12% for commercial uses. Power generation growth is behind that of GDP and is even lower than that of power demand in Taiwan in the last decade. From 1985 to 1996, average growth of GDP was 7.5% and the growth of power demand was 8.1%, while the growth of power supply was only 5.4%. If shown in real numbers, the net total peak capability in July 1985 was 13 519 MW and peak load was 8716 MW, which gave a percent reserve margin of 55.1%. On the other hand, the net total peak capability was up to 22 981 MW in 1996, however, peak load boomed at the same period of time up to 21 762 MW. That is, the system percent reserve margin had declined to 5.6% in July of 1996 from 55.1% in July 1985. Such figures clearly indicate the serious power shortage in Taiwan, as shown in Table 1.

Furthermore, the outlook for 1997 and 1998 is not optimistic. The peak load of 1996 was 21 762 MW while peak loads of 22 964 MW for 1997 and 24 250 MW for 1998 have been predicted. The percent reserve margin will be up to 10% in 1997 and 1998. Only if there is no breakdown in any power plant can a power shortage be avoided.

## The reform of the electricity industry

Power industry reform in Taiwan is mainly motivated by two factors: the aforementioned power shortage and deregulation of overall economic policy. Since the early 1980s, the Taiwan government has promulgated a series of deregulation policies, dealing, for example, with interest rates, foreign currency exchange rates, international trade, aviation, and so forth. Accordingly, the government is promoting deregula-

tion of the electricity industry through three means: promotion of cogeneration, the introduction of private power producers, and vertical disintegration of Taipower. These changes have led to a revision of the Electricity Act. Hence, this section first describes the government's policy and measures regarding cogeneration development. Second, the introduction of private power producers is explained. Third, discussion of the disintegration of Taipower will illustrate its potential difficulties. Finally, important points of the proposed Electricity Act revision are summarized.

### *Development of cogeneration*

The initial step in the reform of the electricity industry in Taiwan could be said to have been taken in 1988 when the Ministry of Economic Affairs first promulgated the Measures for Promoting Cogeneration Applications in 1988, based on the Energy Management Law and Electricity Act. The highlights are:

- The measures apply to 'qualified cogeneration systems' only. These are cogeneration systems with compliance to certain conditions: the operating standard for thermal output has to be no less than 20% of the total energy output of the facility; and the efficiency standard has to be no less than 50%.
- Natural gas is the fuel given highest priority for cogeneration systems.
- Consumers are encouraged to invest in cogenerators by installing qualified cogeneration systems to meet their own needs, including steam and electricity. Taipower is obligated to purchase any surplus electricity from the cogenerators.
- Third-party investments are encouraged to install qualified cogeneration systems for selling produced heat and electricity to either users or electric utilities.
- Purchase prices of surplus electricity can be based on either Taipower's avoided cost or the time-of-use rate which Taipower uses for generation, transmission, and distribution. Qualified cogeneration system owners have the right to select the more favorable from the two above.
- Taipower has to serve as the back-up and supplementary power for the maintenance of qualified cogeneration systems.

Other than the above-mentioned regulations, the government also provides financial and tax incentives for setting up cogeneration systems as below: (1) Loans with low interest

**Table 1** Power supply in Taiwan: 1985-1996

	Unit: MW; %						
Year	85	86	88	90	92	94	96
Net total peak Capability	13 519	14 682	15 007	15 585	17 823	19 503	22 981
Peak load	8716	9900	12 331	14 511	16 704	18 610	21 762
Percent capability margin	55.1	48.3	21.7	7.4	6.7	4.8	5.6

Source: Annual Statistical Report of Taiwan Power Company.

**Table 2** Existing and estimated installed capacity of cogeneration in Taiwan  
(a) Existing

Year Industry	1986		1990		1992		1994		1996	
	Quantity	Percent	Quantity	Percent	Quantity	Percent	Quantity	Percent	Quantity	Percent
Petrochemicals	116	24.0	278	30.0	505	29.2	630	31.8	751	28.3
Oil	90	19.0	100	11.0	130	7.5	142	7.2	142	5.4
Refineries										
Metals	80	17.0	236	25.0	355	20.5	374	18.9	386	14.5
Paper	67	14.0	143	15.0	205	11.9	205	10.4	209	11.6
Textiles	59	13.0	110	12.0	413	23.9	425	21.4	778	29.3
Food	56	12.0	60	6.0	60	3.5	66	3.3	76	2.9
Cement	6	1.0	6	1.0	60	3.5	87	4.4	96	3.6
Others							51	2.6	117	4.4
Total	475	100.0	933	100.0	1728	100.0	1980	100.0	2654	100.0

rates. Chiao Tung Bank<sup>1</sup> will provide loans with regular interest minus 2.125 to 2.25 percent. (2) Accelerated depreciation. Cogeneration facilities may apply for two-year accelerated depreciation. (3) Profit-oriented enterprises may receive a credit of 5 to 15% of the income tax payable in the current year. Such credit may accumulate for the following four years once the deductible amount is more than the income tax payable in the current year. (4) Qualified cogeneration systems may set their prices to favor natural gas use, with 2.5% off for industrial use.

In 1996, the total installed capacity of cogeneration systems was 2356 MW, which represents 9.91% of Taipower's installed capacity (23 763 MW). Table 2 and Table 3 shows the allocation of cogeneration facilities among various major industrial sectors (Huang, 1995).

Industries are expected to implement about 2654 MW more in cogeneration facilities in the next 4 years. The total installed capacity will sum up to 4015 MW in 2000. Table 2 summarizes the outlook for such growth in the 4 years following 1996. This increase in cogeneration will promote energy efficiency in terms of the total energy consumed. Additionally, cogeneration can ease the problems of power shortages for energy users. The most common size of cogeneration units is currently from 10 to 30 MW in Taiwan, accounting for roughly 47% of overall installed cogeneration unit capacity. Oil is the dominant fuel, which powers about 62% of all new facilities. Among all the facilities installed, steam turbines are the most common type. Note that there is a power shortage problem in Taiwan in the late 1980s. Taiwan's government then has explicitly promoted cogeneration since 1989, to provide extra capacity in the existing power system by the following measures. First, Energy Commission has proclaimed a cogeneration promotion decree in 1988, and has established a cogeneration task-force to assist the potential factories to install their cogeneration facility. Second, the central utilities (Taipower) has been asked by the government's decree to purchase the surplus electricity produced by cogenerators with a favorable rate based on the 'avoided cost' of Taipower. From 1989 to 1991, Taipower has also adjusted and increased the purchase rates three times in order to

encourage the cogenerators to sale their electricity (Hsu, 1991). The purchase rates are: Taipower must purchase the power by 100% of his own electricity price for the first 20% of cogenerator's installed capacity. As to the remaining 80% of the installed capacity, Taipower should pay with the 81% of Taipower's electricity price. The current purchase rate of Taipower is much higher than that of other countries such as US. and Japan.

#### *Introduction of private power producers*

Private power producers in Taiwan are somewhat different from independent power producers as they are generally known. In some advanced countries, say the United Kingdom, there is no explicit planning framework for the establishment of a power plant. A generator should only have a license from the regulator and decides whether its power plant should be constructed or not. It does not require or planning process reviewed by the government. However, according to the Taiwan government's regulations, these private power producers are also defined as 'public utilities' and require the Ministry of Economic Affairs' permission with a franchise. Therefore we call these power producers 'private' instead of 'independent', although in this paper we refer to them as IPPs, in conformity with international practice. England and Wales (the only part of UK with competitive system), all generators are independent in the sense that they must all compete on overtly equal terms through the Pool and are given non-discriminatory access to the network. The daughter generation companies of the CEGB are sometimes not categorized as independent and new entrants are known as IPPs. It can be argued this is precisely wrong. The three daughter companies of CEGB own no other part of the system, they own no transmission, distribution or supply companies (although they can supply direct to large consumers). They are thus independent. The new entrants are nearly all owned by distribution and supply companies which therefore have captive consumers and own network infrastructure. These are the dependent companies and they have a market share of no more than 20–30%.

The history of private power producers is very short in Taiwan. If we date their existence from the time they were

<sup>1</sup>A government-owned bank that mainly helps provide investment loans to the commercial and industrial sectors in Taiwan.

**Table 3 Existing and estimated installed capacity of cogeneration in Taiwan**  
(b) Estimated

Unit: MW;%

Year	1996	1997	1998	2000
Additional capacity (quantity)	392	940	254	113
Total (percent)	2708	3648	3902	4015
Cogen/Taipower system	10.8	13.8	14.6	14.9

Source: Liang (1995); Energy Commission (1995).

approved by the government, it's just about half a year.<sup>2</sup> The first group contains 7 companies that were selected through a bidding process out of 22 applicants at the end of June 1995, representing generation capacity of 7050 MW. The second group contains 4 companies out of 20 competitive bidders at the end of 1995, representing 3250 MW generating capacity.

There are several points which should be considered by the government regarding its policy on the introduction of private power producers. One is that such an introduction should be phase-oriented.

The first step to liberalize the generation sector is the establishment of new private power producers which should be defined as IPPs and not public utilities, while Taipower on the other hand should remain a public utility, responsible for the reliability of the power supply, i.e., obligated to serve. Second, the authorities should divide up the generating sector of Taipower to form several power-generating companies in order to further enhance competition for power generation.

#### *Restructuring the Taiwan power company*

The power industry in Taiwan has been vertically integrated and monopolized by a single company (Taipower) for over fifty years. In this moment of deregulation, the key issue is whether the vertical integration of the existing power company should be dismantled. The argument in support of disintegration of the power industry in Taiwan can be summarized as follows.

Monopoly is subject to regulation, which is difficult to conduct perfectly. According to regulations set by the Taiwan government in 1969, the allowed rate of return for Taipower ranges from 9.5% to 12%. Costs and proposed rates for Taipower are first reviewed and approved by the Ministry of Economic Affairs and then by the Council for Economic Planning and Development, the Public Utility Regulatory Committee, and DGBAS (Directorate-General of Budget, Accounting and Statistics) of the Executive Yuan. After Taipower's costs and rates are approved, they must be confirmed by the Legislative Yuan before the new rates can be implemented. Note that most of the US prudence reviews only refer to investor-owned utilities which most utilities in the United States are. The regulator, i.e., Public Utilities Commission (PUC), focuses on the cost auditing on the regulated investor-owned utilities. However, public owned

utilities such as TVA (Tennessee Valley Authority), municipalities etc. are not subject to this economic regulation, presumable on the grounds there any incentive to make excessive profits will be controlled by democratic means and that any extra profits will be returned to the public. Compared with the procedure of regulation in the US, where the public utility commissions use 'prudence reviews' and 'used and useful' tests (i.e., are capital expenditure actually 'used and useful' in the company's production effort?) before allowing a capital investment to enter the rate base, the Taiwan case is different in at least two aspects. One is that the members of Taiwan's Public Utility Regulatory Committee are primarily government officials: there are no consumer representatives and no public hearings. The other is that 'used and useful tests' are not applied with regard to the determination of rate base (Hsu and Chuang, 1995).

According to Averch and Johnson (1962), under a constrained rate of return on capital, such as the above-mentioned case in Taiwan, a utility tends to over-utilize capital in maximizing its profit. This is termed the 'A-J effect.' Indeed, the neoclassical theory of the optimal regulation of natural monopolies, as developed in Hotelling (1938) and Dupuit (1952), is based on the assumption that the regulator is in possession of perfect information on the regulated entity. However, the assumption is unrealistic in real life, since the regulatory agency obtains a good deal of the information it gets on the regulated entity from the entity itself. And, given the possibility of conflicts of interest, the obtained information could lead to the manipulation or misrepresentation of the facts. Therefore, the more realistic assumption of asymmetric information between the regulator and the regulated entity should be made.<sup>3</sup> If the vertical integration of Taiwan's power industry remains, the government will have to make strenuous efforts to regulate and monitor such a monopoly. If disintegration is pursued, much of such administration cost will be saved in the power generation market.

In addition, cross-subsidies among various sectors can be prevented and operation efficiency can be improved by competition. Without disintegration, the operation and management performance in each sector will be difficult to assess realistically. Moreover, a vertically integrated power company may act against other power generation suppliers when the former is the sole buyer of power generated by the latter. This kind of potential unfair competition is another reason for dismantling the vertical power company.

<sup>2</sup>The first batch of 7 private power producers was announced by the Ministry of Economic Affairs on Aug. 17, 1995.

<sup>3</sup>See Hsu and Chen (1991a), Hsu and Chen (1991b), Vickers and Yarrow (1988).

Some argue that disintegration will hamper synthetic management efforts, known as 'management synergy.' Classic works by Hotelling, Dupuit etc. are marshalled to support the virtues of the market. This may be true to some extent for old days when smart-meter and electronic trading system are not available and the transaction cost among electricity companies of generation, transmission and distribution are relatively high. However, with the breakthrough of modern technologies today applied in electricity power industry, the cost of uncertainty and risk involved in power transaction between generation and transmission/distribution can be reduced significantly and let the most capable party manage the risk better with a lower cost (Wan and Adelman, 1995). Thus, the overall cost of power supply could be brought down through external competitive pressure. However, without much competition from the market, a vertical integrated power company's synthetic efficiency might be quite limited. Furthermore, according to Gilsdorf (1994), integration will not essentially reduce the aggregate cost of operation. That is, from the viewpoint of efficiency and power supply cost, it is not necessary to maintain vertical integration of the power industry.

#### *Revision of the Electricity Act*

It is clear that the Electricity Act, first passed in 1947, with minor modification in 1965, can no longer meet the current needs of Taiwan's power market. For example, the roles of cogenerators and independent power producers have not been fully clarified, the rules for monitoring the electricity industry and related regulations are not well-considered, and the franchises for power generation, transmission, and distribution are also not clearly defined. All of the above-mentioned issues should be addressed in a revision of the Electricity Act in the near future so as to meet the needs of a healthy power market. The new draft of the Electricity Act revision, which was approved in the Executive Yuan in August 1995 and has been submitted to the Legislative Yuan for passage, contains most of the points described above. Important aspects of this revision are listed below:

- (1) The power industry is classified into three categories: generation companies (gencos), transmission companies (transcos), and distribution companies (discos).
- (2) One company can operate in no more than 2 of these 3 categories of the power industry.
- (3) Licensing permission from the government is required for company establishment in any category.
- (4) Transmission and distribution business is territory-specified. Only one firm is allowed in a given region.
- (5) Licensing permission will expire after 20 years. A 10-year extension is allowable, subject to the government's review.
- (6) Non-utility generators (NUGs) are defined to include independent power plants, cogenerators, renewable energy suppliers, and others, such as back-up generators owned by electricity consumers.
- (7) Power generated from a company's cogeneration system can be sold to electricity users in the same industrial park or building; power generators using renewable energy

sources can supply electricity to electricity users directly. The above conditions are all subject to the permission of the government.

- (8) Power generated by independent power plants, cogeneration, renewable energy, and other self-generators can be transmitted and distributed by transcos and discos.

In short, this new revision tries to introduce deregulation and disintegration to the current electricity industry. Legal definition of NUGs will have a positive effect on the development of these generators and will reinforce the progress of deregulation in the electricity industry in Taiwan. One point worthwhile noting in the Electricity Act, there should be a requirement of the distinction between power distributor and supplier. Because it is the avenue by which consumer can exert choice. In the case of any consumers to be given choice or, as is generally the case, large consumers are, one must design an operating mechanism to avoid 'cherry-picking' and to protect the 'captive customers'. This can be solved by two means. One is to set up an appropriate power wheeling rate between grid utilities and the generators. Or the power transmission should change to be a common carrier and always try the best to make its transmission-line open access to the public. The second is to allow several small customers pool together to a certain scale to bargain with the generating utilities directly.

## **Policy implications and discussion**

### *Deregulation of the generation sector is a priority*

Deregulation mainly focuses on relaxing or removing regulations to stimulate competition, while privatization seeks to transfer ownership and rights of management and operation from the government to the private sector in order to promulgate entrepreneurship and promote operation efficiency. In other words, deregulation concentrates on market competition, while privatization is centralized on the control of the management mechanism. Usually deregulation is a necessary condition for privatization if the power industry is publicly owned originally. Hence, not every country begins from similar conditions and, for Taiwan, we recommend that deregulation of the power market should precede the privatization of Taipower (Hsu, 1995).

In terms of the deregulation or reform policy planned for Taiwan's electricity industry, the generation sector will be the first part to be deregulated. This policy is quite appropriate because the generation sector, in contrast to the transmission and distribution sectors, represents the largest fraction of total power supply cost. If the generation cost can be effectively reduced through the mechanism of competition, the overall electric rate can be expected to be reduced significantly.

However, it should be noted that IPPs in Taiwan currently have been given approval by the government to install generation facilities of 7050 MW. An additional 3000 MW will be allowed for bidding by the end of 1995, installation of which is expected to be completed by the year 2000. All together, this will represent roughly a quarter of the power

generation market, a proportion which is relatively higher than those of the US. Given these circumstances, it is important to ensure the reliability of IPP operations. The current Electricity Act revision proposed by the government allows IPPs to be taken over by others in case of bankruptcy or poor performance. In addition, the vulnerability of the Taipower transmission system should be recognized, i.e. the northern region has a serious shortage of power supply in peak periods and needs to have long-range power transmitted from the southern power plants' generators. This is because land for power plants is scarce, and northern Taiwan consumes more than 50% of the load demand of Taiwan due to intensive economic activities in the northern area. This situation will be exacerbated by having IPPs sited in southern Taiwan. Therefore, for the security of the power system, regional balancing is a critical issue in Taiwan. These problems could be mitigated by strengthening and expanding the power transmission system in Taiwan. However, the problem of obtaining the rights-of-way for establishing or expanding transmission has become more and more difficult to deal with. Citizens who live along the proposed transmission routes tend to obstruct such engineering work. As a result, the cost of rebalancing among different regions and achieving a reserve margin for the whole electricity supply system should be allocated between IPPs and Taipower in an equitable manner. In terms of cogeneration and renewable energy, the deregulation policy should continue to promote both types of power generation because they are comparatively more beneficial to the society than conventional steam-turbine power generation.

#### *Relaxing the limitations on foreign capital investment*

According to the current regulations, foreign capital investment is not allowed to exceed 30% of the total amount in any IPP project. This restriction should be lifted for three reasons. First, Taiwan, being a small island, should encourage more foreign capital to flow in and more domestic capital to flow out for investment so as to increase the total amount of international trade of capital. This can enhance the influence of Taiwan in the world economy. Second, owing to Taiwan's ongoing diplomatic difficulties, having more foreign investors will improve the ties between Taiwan and other countries. Also, in case of any political entanglement or confrontation with other countries, more support from abroad could be expected because those investors will try to protect their local investment with the help of their home countries. Third, by owning and operating the IPPs, foreign investors will enthusiastically transplant relevant technology and management skills to improve the performance of local IPPs.

#### *Relaxing the limitations on IPP participation*

It should be noted that the current process for installing IPP capacity is controlled by the government and non-periodically open to potential entrants. So far, generation of 7050 MW has been opened in the first round of bidding (in June 1995) to 7 IPPs, and permission to generate another 3250 MW was bid on by 4 IPPs at the end of December 1995. However, it is believed that a more liberal policy should be implemented

because having more suppliers will stimulate competition through entrepreneurship which will in turn lower the power supply cost and thus benefit the end consumers. Furthermore, many other advanced countries do not have this kind of limitation.

Compared with the problems encountered by IPPs in other countries, the acquisition of land is much more difficult in Taiwan mainly because Taiwan is densely populated and land resources are scarce. Although creating reclaimed land along the west coast is an alternative for sites for IPPs, it normally takes more time to complete the necessary tasks than to simply buy land. Moreover, it is extremely difficult to establish the connections between IPPs and the Taipower transmission grid. The rights-of-way for these connections are difficult to obtain because local citizens frequently obstruct the necessary engineering work and even seek court injunctions to halt the work. A solution to this problem needs to be found as soon as possible.

Another controversial issue is that wheeling is not allowed and Taipower is the sole buyer of the power generated by IPPs. The contract price between the two parties (Taipower and IPPs) is to be based on bidding with a ceiling of Taipower's 'avoided cost.' However, Taipower's 'avoided cost' is confidential according to the current regulations. In contrast, the 'avoided cost' for the contract price in many other countries such as the US is deemed public information, and available to all IPPs in advance of bidding. Currently, many IPPs have complained that the price for bidding the contract is too low. Actually, if a reasonably free market is being sought, no planning process of bidding procedures for IPPs is possible and reasonable. However, one should not consider Taiwan's electricity market with current bidding process 'a free market'. Rather, it is a new capacity competitive bidding process which a regulatory control are involved. That is it may be called a quasi-free market or a transition towards the free market. As far as we know, Japan, Korea and some of the states of US are also adopting the similar method. This problem deserves the attention of the government, because pricing signals are indicators for optimal resource allocation.

## **Conclusion and recommendations**

Taiwan's thriving economy has been clamoring for internationalization and deregulation since the early 1980s. This paper has discussed the reform of the electricity industry in Taiwan. After more than 50 years of Taipower monopoly, the current power market in Taiwan is heading toward more deregulation and competition. There are at least three aspects of deregulation which will benefit Taiwan's economy. First, opening the market for power generation can be expected to solve the power shortage problem effectively in Taiwan. Introducing IPPs and promoting distributed generation systems such as cogeneration and renewable energy sources could also help alleviate urban power shortages caused by metropolitan development, where large peak load demand derives from high-rise commercial buildings and where there

are difficulties with installing and expanding the distribution network and electric transformers. Second, the level of competition will be essentially improved by a more liberalized market mechanism. Accordingly, the efficiency of operation as well as management will be enhanced and necessary cost will then be reduced. All these will contribute to a reduction in the electricity rate charged to end users. Third, as the electricity market becomes more and more liberalized and diversified, it is expected that new schemes for electricity rates will be developed and introduced to customers, such as priority service rates i.e., higher reliability sources can charge higher rates while lower reliability sources can charge less (Hsu et al, 1994; Hsu and Chen, 1993). Future and spot markets for electricity sales will also be realized. Customers can utilize the above to hedge their risks in market transactions and to maximize their benefit. In other words, the market will become more customer-oriented and profit-driven.

Private power producers and cogenerators have been encouraged by the government so as to create more competition in the power generating sector. For the past few years, the Taiwan government has promoted the installation of cogeneration facilities. This strategy seems like it will be the most successful among all the strategies for solving the power shortage problem because of the attractive nature of the cogeneration system: short lead time, better energy efficiency and the possibility for on-site construction. Yet, related regulations and laws are quite incomplete, and the existing legal system which regulates the power market has many deficiencies. The Electricity Act has not been revised for more than thirty years, so revision is essential. The new draft of the Electricity Act was approved by the Executive Yuan in August 1995 and submitted to the Legislative Yuan for final legislation. However, the length of time necessary for review and debate by the Legislative Yuan is quite uncertain.

Finally, it should be emphasized that the deregulation of power generation is just the first step in liberalizing the power market in Taiwan. The deregulation of power transmission and distribution are equally important. In many advanced countries, power wheeling is implemented and transmission and distribution companies are required by law to comply. Therefore, the government should officially announce a plan for the reform of the electricity industry and set up a timetable for the subsequent measures for future deregulation. Of course, in order to carry out all those measures effectively, the education of the public is necessary and communication between related parties, such as government officials, IPPs,

utility managers, cogenerators, and electricity users, should be strengthened so as to construct the consensus to successfully complete the overall reform of the electricity industry in Taiwan.

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