International Comparison of Electric Service Tariffs

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1. Introduction

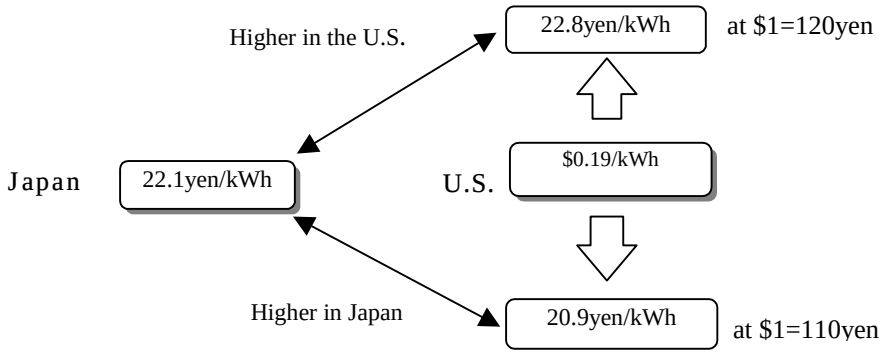
The Electric Utility Industry Subcommittee established within the Agency of Natural Resources and Energy in the Ministry of Economy, Trade and Industry has been engaged in discussions regarding the ideal form of electric service systems in Japan. In April 2002, the subcommittee began focusing on concrete subjects pertaining to a utility service system to be implemented in the near future. One of the topics of discussion is the notion that electric service charges in Japan are said to be higher than those in Europe and the United States, which are more advanced in the field of electric utility service. Due to the accelerating "hollowing out" of Japanese industry, a reduction in electricity rates is urgent and essential for revitalizing industry and increasing its competitiveness. The deregulation of electricity sales is expected to motivate new companies to participate in the power-supply business and to stimulate competition, thus leading to a reduction in electricity tariffs.

How high are the Japanese electricity tariffs compared to those in other countries? Unfortunately, such a comparison is difficult. There are a number of factors that make such a comparison difficult, including (1) fluctuations in currency exchange rates, (2) diverse systems (for fee calculations) adopted in different countries, and (3) varying conditions of typical electricity usage in different countries. The effect of exchange rates is particularly large when electric service charges in countries using different currencies are compared. For instance, when electricity charges in foreign countries are converted into Japanese yen for comparison purposes, the selection of the exchange rates used for calculation causes significant differences in the results of converted electricity charges, even if the billing systems are basically the same. To minimize the effect of exchange-rate fluctuations, the purchasing-power parity or the amount (kWh) of electricity that can be purchased with an hourly wage – which serve as indexes reflecting the standard of living and income level – are sometimes used for the sake of comparison. At any rate, international comparisons of electricity charges are not simple, and the results are affected by the comparison method

used.

This report introduces examples of international comparisons of electric service rates, and discusses the features and problems of each comparison method used. In view of the purpose of this report, evaluations of the electricity charges in different countries are avoided in this paper.

Fig. 1 Example of the effect of exchange rates in international comparisons of residential electric service charges



2. Deregulation of electricity sales and trends in electric service tariffs worldwide

2.1 The United States of America

In the United States, each state establishes and implements deregulation of electricity sales independently. As of March 2002, 24 states and Washington DC had adopted their own electric-industry restructuring plan. However, due to the recent power crisis in California, the deregulation trend has slowed somewhat overall. In the U.S., there are large differences in electric service rates among states. In states where the electric service charges are relatively low, people tend to have a negative attitude toward the deregulation of electricity sales. Although electricity rates dropped in many states that implemented deregulation, electric bills increased temporarily in some states due to a rise in the wholesale cost of electricity.

2.2 U.K.

Partial deregulation of electricity sales was initiated in the U.K. in 1990. When the market for residential electricity service was liberalized in 1999, the deregulation program was considered complete. More than 60% of commercial and industrial users and nearly 40% of general consumers switched power-supply

companies during the two-year period after deregulation, thus creating severe competition among electric utility companies operating in the country. In the beginning, the effect of the compulsory Pool system in the electricity wholesale market caused a slight increase in electricity bills for consumers. However, since the introduction of the New Electricity Trading Arrangement (NETA) in March 2001, replacing the compulsory Pool, electricity charges have been on the decline.

2.3 Germany

At the end of April 1998, full-fledged deregulation of electricity sales was implemented. Major power-supply companies such as RWE and Yello Strom (a subsidiary of EnBW) began supplying electricity to households outside their previous service areas, attracting a great deal of attention among general consumers. However, only approximately 7% of residences switched power-supply companies. Commercial-scale utility users, on the other hand, have been actively switching power suppliers. The most noticeable trend is that corporations with many offices and facilities scattered around the country that were receiving electricity from different local power companies are selecting one company for all their electricity needs. Though electric service rates for industrial service fell by approximately 30% after the deregulation, they have not decreased for residences; rather, they are rising slightly due to the increase in the environmental tax.

2.4 France

The partial deregulation implemented in 2000 for the electric power retail market in France has affected consumers using 16,000,000 kWh or more per year, accounting for approximately 30% of all consumers. Although more than 1,400 consumers are currently eligible, only 5% have switched power-supply companies. Customers who negotiated with newly launched companies received an 8% to 20% discount. As such, the deregulation has achieved a reduction in electric service charges.

3. Method of comparing electricity charges

The average cost per unit (unit price per kWh in the case of electricity) is used for comparison in many cases. However, depending on the method of calculating average unit price, the meaning or significance of the unit price and average unit price varies. The following section describes the features of different

methods used to calculate the average unit price.

3.1 Comparison based on average unit price calculated using statistical data

Publicized statistical data is often used to calculate average unit price. The most common method is to divide the power-supply company's total income from electricity sales by the quantity of electricity sold. Assuming that the electric service rates are based on the cost accounting concept of "total income equals total expenditure," the calculation result represents the average supply cost (prime cost) of electricity for residential and industrial applications, rather than the average electricity fee paid by consumers.

Because this calculation method provides results that represent supply costs, the obtained unit price is dependent upon the characteristics of the consumer group from which the statistical data was collected. When the percentage of consumers that use large amounts of electricity (or use electricity for many hours) is large, the unit price per fixed expenses becomes low, thus reducing the resulting average unit price. Conversely, when the majority of consumers use small amounts of electricity (or use electricity for a small number of hours), the fixed expenses make up a large portion of the unit price, thus raising the resulting average unit price. In other words, the average load factor of the consumer group determines the average supply cost. Therefore, when average unit prices of electricity for industrial applications in different countries and regions are compared, the main electricity-consuming industry in the countries and regions affects the calculated average unit prices. Furthermore, because actual data is used in calculations, the load factor in the specific period may also have an effect. The average unit price can be affected also by the operating rate of air-conditioning systems (in the case of residential electricity demand), and by economic trends (in the case of industrial electricity demand).

As an example, the following chart shows a comparison of electricity charges[1] in different countries based on OECD-country statistics on energy prices and taxes publicized in IEA Statistics "Energy Prices &

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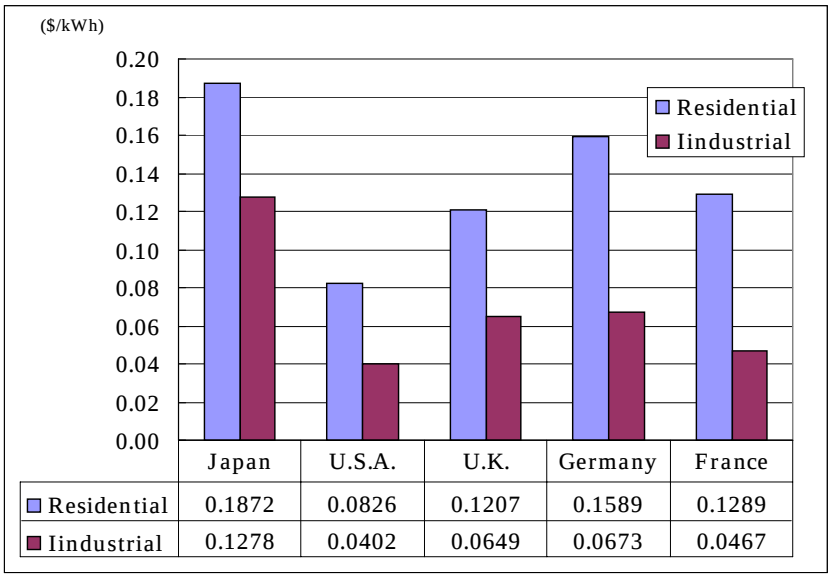
[1] Because statistical data is collected and compiled using different methods in individual countries, electric service charges for industrial applications also include charges for business (commercial) applications in the data of some countries. In Japan, electricity charges for industrial applications include charges for business applications, low-voltage electricity charges, and nighttime-discount charges.

Taxes." As these average unit prices are obtained using statistical data, they are normally used for country-based comparisons. However, when data is available, comparisons can be made by region or company.

Fig. 2 Comparison of electricity charges based on statistical average unit prices



	Japan	U.S.A.	U.K.	Germany	France
Residential	0.1872	0.0826	0.1207	0.1589	0.1289
Iindustrial	0.1278	0.0402	0.0649	0.0673	0.0467

(Source) IEA Statistics "Energy Prices & Taxes"

3.2 Comparison of tariffs based on a model case

While the average unit price was the basis of comparison in the method described above, this method uses actual electricity bills paid by users to compare electric service charges. In this method, a model with unified usage conditions (menu, contract demand, consumption, etc.) is established, and the tariffs of power companies are used to calculate electricity charges. Because it is necessary to obtain the tariffs from power companies to be compared and because details of actual fee calculation used by companies are not disclosed fully, calculations can be complex and time-consuming. In addition, there is another problem with this method. Depending on the model to be established, the resulting average unit price may vary significantly. Even when the same type of tariff is selected, the amount of electricity (hours of usage) consumed in the model case can have a significant influence on the result of the tariff comparison.

In the following, actual electric service charges of representative power utility companies in the United States, U.K., Germany, France, and Japan were calculated based on their tariffs.

Table 1 Power utility companies used for comparison

Country or region	Power utility company
New York, U.S.A.	Consolidated Edison
Illinois, U.S.A.	Commonwealth Edison
Texas, U.S.A.	Texas Utilities
U.K.	London Electricity
U.K.	British Gas
U.K.	Eastern Energy
U.K.	Power Gen
Germany	RWE
Germany	EnBW (Yello Strom for residential service)
France	EDF
Japan	Tokyo Electric Power Company

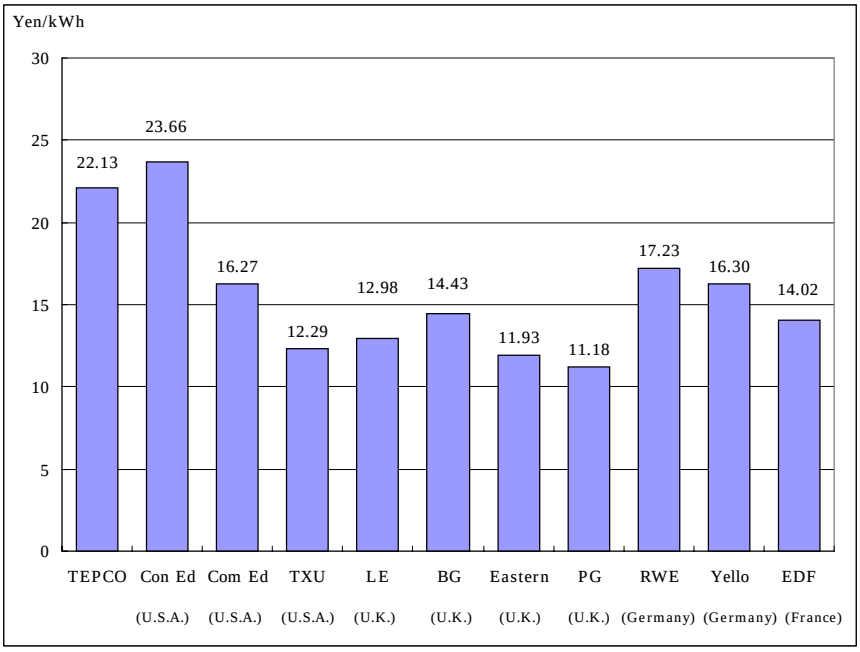
Table 2 Model customers and calculation conditions

	Residential customer	Large customer
Typical consumer	Ordinary households	Large factories, hotels, department stores, etc.
Received voltage	100 V or 200 V	20,000 V
Electricity demand scale (contract demand,etc)	30A	4,000kW
Comsumption	290 kWh (per month)	16,000,000 kWh (per year)
Computation Period	January to December 2001	As at left
Exchange rate	U.S.A.: 121.52 yen per $ U.K.: 174.95 yen per £ Germany: 55.615 yen per DM France: 108.77 yen per euro (Average annual rates in 2001)	As at left

(1) Comparison of average unit prices under constant power load

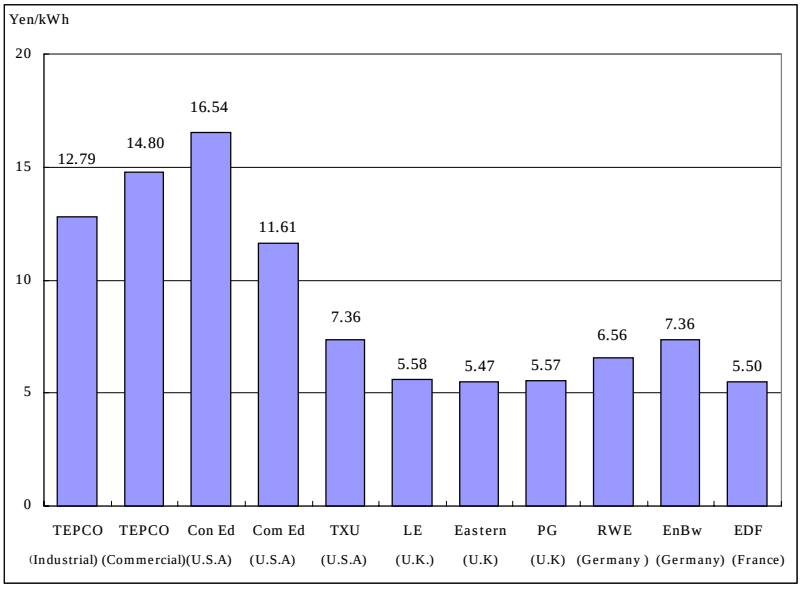
Because some power companies use tariffs with a monthly adjustable rate or summer/winter rates, monthly charges can vary even if the same amount of electricity is used every month. To eliminate any seasonal effect on electricity charges, a comparison was made with unit prices of the annual totals of electric service charges to model consumers shown in Table 2. The computation period is from January to December 2001, and various adjustable unit prices (fuel-cost adjustment unit price in the case of Japan) that were actually applied to monthly electricity bills were used in the calculations.

Fig. 3 Comparison of electric service charges in a model case (residential customer)



(Source) Produced by The Institute of Energy Economics, Japan using tariffs of power utility companies

Fig. 4 Comparison of electric service charges in a model case



(Source) Produced by The Institute of Energy Economics, Japan using tariffs of power utility companies
(Note) Abbreviations in the graph indicate the following:

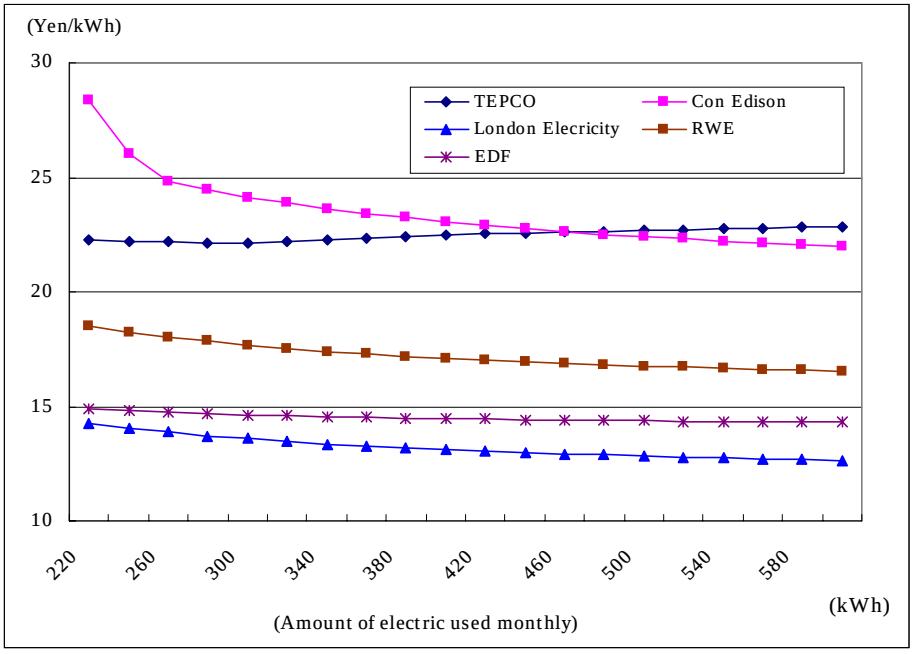
TEPCO: Tokyo Electric Power Company Con Ed: Consolidated Edison PG: Power Gen
Com Ed: Commonwealth Ediosn RWE: RWE TXU: Texas Utilities
Yello:Yello Strom LE: London Electricity EnBW: Energie Baden-Waürttemberg
BG: British Gas EDF: Electricité de France Eastern: Eeastern Energy

(2) Comparison of average unit prices in consideration of power load variations

To resolve the problem caused by the effect of usage conditions on the average unit price, the following graph – with the amount of electricity used (hours of usage) shown on the horizontal axis – was produced for the comparison of charges corresponding to changes in electricity usage.

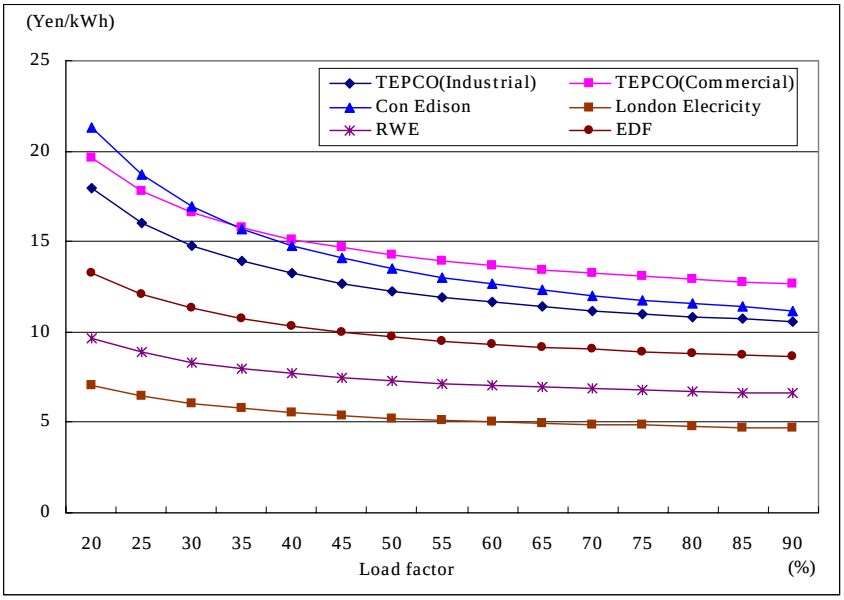
Due to the fixed base fee, the average unit price normally decreases as the amount of electricity used increases. However, because electricity fees for residences are charged at a metered rate in Japan and increase progressively with the amount used, the average unit price rises as the amount of electricity used increases, as shown in the graph below. (The electricity tariffs of different countries are described in the Appendixes.) Consequently, in a comparison based on usage of 290 kWh, Tokyo Electric Power Company's electricity charge for residences is lower than that of Consolidated Edison (U.S.A.); at a monthly usage of 460 kWh, however, Tokyo Electric Power Company's electricity charge becomes higher than that of Consolidated Edison, and the price differences from others grow larger.

Fig. 5 Comparison of electricity charges based on a model case with varied usage (residential customer)



(Source) Produced by The Institute of Energy Economics, Japan using tariffs of power utility companies

Fig. 6 Comparison of electricity charges based on a model with varied usage (large customer)



(Source) Produced by The Institute of Energy Economics, Japan using tariffs of power utility companies

(3) Tariff that reflects fluctuations in wholesale prices

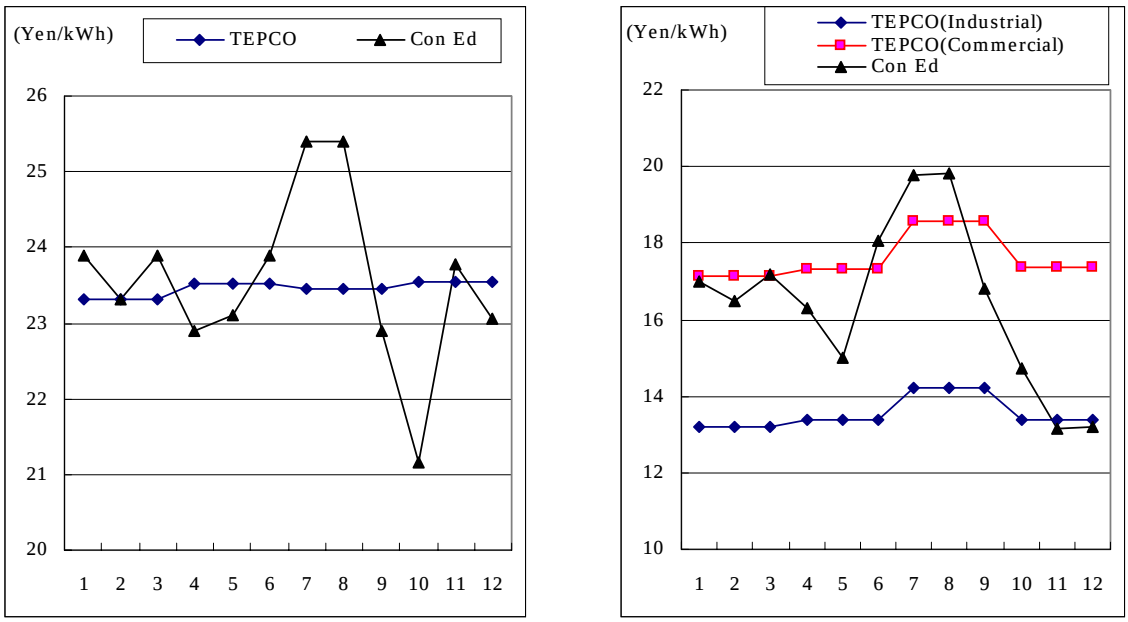
The deregulation of electricity sales has also resulted in a change in tariffs. Overseas, the use is spreading of a "real-time tariff," in which the price that power-supply companies pay to procure electricity in the wholesale market is reflected, partially due to a lowering of meter costs. Whether fluctuations in the wholesale price are reflected in the retail price has a major effect on the electricity bills paid by consumers. The following section discusses the advantages and disadvantages of both cases.

When wholesale price fluctuations are not reflected in the retail price, consumers can receive power supply at a stable rate. It is therefore beneficial to consumers. However, as seen in the electric power crisis that occurred in California, U.S.A., a sudden increase in the wholesale price to an unexpectedly high level can result in a back spread, and can put the power company at risk of bankruptcy.

What about reflecting wholesale price fluctuations in the retail price in some indirect way? It could reduce management risk, but it raises consumer concern that the rate may fluctuate significantly on a monthly basis. In the case of Consolidated Edison, based in New York, U.S.A., the company purchases 40% of

electricity demand in the New York ISO spot market, and meets the remaining demand with electricity generated by its own facilities, electricity obtained on long-term contracts, and electricity purchased from third parties. As electricity sales were deregulated in New York, electric utility companies negotiated with the public service commission in the state and formulated strategic plans, with or without the use of an adjustable accounting system. Consolidated Edison has established a wholesale purchase cost adjustment system to share the burden of increased wholesale cost. The company does not recover the entire price difference from the customers, however. The regulation authority compares the wholesale price with the New York ISO price during the relevant period, and the difference is divided between consumers and the company at a set ratio. In the summer of 2001, the ambient temperature was constantly higher than the latter part of July, and the power demand exceeded the maximum expected demand, causing the wholesale electricity cost to soar. This caused electricity rates to rise in New York.

Fig. 7 Comparison of the monthly average unit prices of Consolidated Edison and Tokyo Electric Power Company



(Note) Calculations based on actual monthly rates in 2001

4. Conclusion

It is not easy to compare Japanese electric service charges with those in foreign countries, as the tariffs and the use of electricity vary significantly in different countries. In addition, external factors such as exchange rates and price levels make fair comparisons even more difficult. However, it is obvious that electricity charges in Japan are not low. To respond to user demand for a lower rate, power utility companies must take a more advanced approach in analyzing the elements that have led to the high electricity cost in Japan. This requires more than just a comparison of tariffs, but a worldwide comparison of supply costs for electricity, to allow power utility companies to discover areas in which a focused effort could lead to cost reductions, rather than tackling the entire spectrum of operations to achieve cost cutting.

Since one goal of lowering electricity charges is to stop the “hollowing out” of Japanese industry, it is meaningful to conduct a comparative study of electricity charges not only with those of industrialized countries, but also with those of rapidly advancing Asian nations such as China and South Korea, where many Japanese companies have branched out in recent years.

At any rate, I hope that active discussions will be held regarding reforms of the electric power business, to create a more suitable electric utility service system in Japan through a competition-based market structure and streamlined business operations capable of further reducing electric service rates. In addition, these reforms should hopefully contribute to the recovery of Japanese industrial competitiveness.

Appendix 1 Tariffs for Model Cases (Residential Customers Services)

Country		Japan	U.S.A.		
Company		TEPCO	Consolidated Edison	Commonwealth Edison	Texas Utilities
City		Tokyo	New York, New York	Chicago, Illinois	Dallas, Texas
Tariff		Residential lighting B	Residential and religious (Seravice Classification 1)	Residential service (Rate 1)	Residential (Rate R)
Demand charge		Amperage-based system 260 yen/10A	Flat-rate system $8.57/month	Flat-rate system $7.13/month	Flat-rate system $6.00/month
Energy charge	Time-based classification	None	None	None	None
	Seasonal classification	None	Monthly adjustment	Summer (July – September) Others (October – June)	Peak (June – October) Off-peak (November – May)
	Incremental classification (kWh)	3-level incremental charge system (2nd level: 120; 3rd level: 300)	2-level decremental charge system (250)	2-level decremental charge system (400)	2-level decremental charge system (600) * Off-peak months only
Transmission charge		No separate charge	level decremental charge system)	No separate charge	No separate charge
Distribution charge		No separate charge	Monthly adjustment	No separate charge	No separate charge
Fuel-cost adjustment system		Yes (quarterly)	Discontinued from May 2000	None	Yes (monthly)
Other charge		None	Market supply charge (adjustable) System benefit charge (adjustable)	Infrastructure maintenance fee ($0.00.53/kWh) Renewable energy resources & coal technology development assistance charge ($0.05/month) Energy assistance charge for the supplemental low-income energy assistance fund. ($0.40/month) Instrumental funding charge ($0.01067/kWh) Decommission charge ($0.00102/kWh)	Residential Rate Reduction (5.4%) Fuel cost surcharge and fuel cost refund (adjustable)
Discount system		Direct Debit Discount	None	None	None
Tax		Consumption tax: 5% (tax excluded) Promotion of power development tax: 0.445 yen/kWh (tax included)	State tax (New York): 6.4395%	State and local taxes (Chicago): $0.00628/kWh (1st level) 10-level decremental system	Local tax (Dallas): 8.25%
Remarks				5% reduction in residential tariffs in October 2001	

Country		U.K.			
Company		London Electricity	British Gas	Eeastern Energy	Power Gen
City		LE Group Area	TXU Energi Area	TXU Energi Area	TXU Energi Area
Tariff		Residential (Direct debit tariff)	Residential (Direct debit tariff)	Residential Residential(Standard Tariff with Direct debit disucunt)	Residential (Direct debit tariff)
Demand charge		Flat-rate system £0.09/day	None None	Flat-rate system £2.21/month	Flat-rate system £1.27/month
Energy charge	Time-based classification	None	None	None	None
	Seasonal classification	None	None	None	None
	Incremental classification (kWh)	2-level decremental charge system (500)	2-level decremental charge system (225)	2-level decremental charge system (234)	None
Transmission charge		No separate charge	No separate charge	No separate charge	No separate charge
Distribution charge		No separate charge	No separate charge	No separate charge	No separate charge
Fuel-cost adjustment system		None	None	None	None
Other charge		None	None	None	None
Discount system		None	None	Direct Debit Discount	None
Tax		Value-added tax: 5%	Value-added tax: 5%	Value-added tax: 5%	Value-added tax: 5%
Remarks					

Country		Germany		France
Company		RWE	Yello Strom	EDF
City		Essen	Karlsruhe	Paris
Tariff		Avanza Classic	Yello Preis	Blue Base
Demand charge		Flat-rate system DM56.9/month	Flat-rate system DM12.908/month	Contract demand system 0.54 euro/kVA
Energy charge	Time-based classification	None	None	None
	Seasonal classification	None	None	None
	Incremental classification (kWh)	Rebate for an amount less than 167 kWh	None	None
Transmission charge		Metered rate	Metered rate	No separate charge
Distribution charge				No separate charge
Fuel-cost adjustment system		None	None	None
Other charge		Renewable Energy charge(3.67%) Meter rental (DM0.0015/kWh)	Renewable Energy charge(3.67%) Meter rental (DM3.830/month)	None
Discount system		None	None	None
Tax		Value-added tax: 16%	Value-added tax: 16%	Value-added tax: 5.5%
Remarks		CHP tax: DM0.0051/kWh Environmental tax: DM0.0300/kWh Concessions tax: DM0.0350/kWh Environmental tax increased to DM0.0500/kWh from January 2002	CHP tax: DM0.0037/kWh Environmental tax: DM0.0300/kWh Concessions tax: DM0.0350/kWh Demand charge increased and enegry charge decreased in November 2001	Local tax: 0.078 euro/kW

Appendix 2 Tariffs for Model Cases (Commercial-Scale Service)

Country		Japan	
Company		TEPCO	
City		Tokyo	
Tariff		Extra-high voltage B (for industrial customers)	Extra-high voltage A (for business and commercial customers)
Demand charge	Unit price	1,600 yen/kW	customers
	Seasonal classification	None	None
	Incremental classification (kWh)	None	None
Electricity usage charge	Time-based classification	None	None
	Seasonal classification	Summer(July – September) Other seasons(October – June)	Summer(July – September) Other seasons(October – June)
	Incremental classification (kWh)	None	None
Transmission charge		No separate charge	No separate charge
Distribution charge		-	-
Fuel-cost adjustment system		Yes (quarterly)	Yes (quarterly)
Other charge		Power-factor discount (surcharge)	Power-factor discount (surcharge)
Discount system		None	None
Tax		Consumption tax: 5% (tax excluded) Promotion of power resource development tax: 0.445 yen/kWh (tax included)	Consumption tax: 5% (tax excluded) Promotion of power resource development tax: 0.445 yen/kWh (tax included)

Country		U.S.A.		
Company		Consolidated Edison	Commonwealth Edison	Texas Utilities
City		New York, New York	Chicago, Illinois	Dallas, Texas
Tariff		General-Large (Seravice Classification 9)High tension service	Large general setvice (Rate 6L)	General service primary (Rate GP)
Demand charge	Unit price	Monthly adjustment	Summer (July – September): $16.41/kW Other (October – June): $12.85/kW	Flat rate ($15/month) + 1st level: $7.63/kW + 2nd level: $1.00/kW
	Seasonal classification	Monthly	Applicable	None
	Incremental classification (kWh)	3-level decremental charge system (2nd level: 5; 3rd level: 900)	2-level decremental charge system (2nd level: 10,000)	2-level decremental charge system (2nd level: 10)
Electricity usage charge	Time-based classification	None	Peak (Monday – Friday, 9:00 – 22:00) Off-peak (other days and other time zones)	None
	Seasonal classification	Monthly adjustment	Summer(July –September) Others(October – June)	None
	Incremental classification (kWh)	2 levels (same for 1st and 2nd levels) (15,000)	None	3-level decremental charge system (2nd level: 2,500; 3rd level: 6,000)
Transmission charge		Monthly adjustable (3-level decremental charge system)	No separate charge	No separate charge
Distribution charge		Monthly adjustment	No separate charge	No separate charge
Fuel-cost adjustment system		Discontinued from May 2000	None	Yes (monthly)
Other charge		Market supply charge (adjustable) System benefit charge (adjustable)	Infrastructure maintenance fee ($0.00.53/kWh) Renewable energy resources & coal technology development assistance charge ($0.05/month) Energy assistance charge for the supplemental low-income energy assistance fund. ($0.40/month) Instrumental funding charge ($0.01067/kWh) Decommission charge ($0.00102/kWh)	Rate Reduction (5.4%) Fuel surcharge factor and fuel refund factor (adjustable)
Discount system		None	None	None
Tax		State tax (New York): 6.4395%	State and local taxes (Chicago): $0.00628/kWh (1st level) 10-level decremental system	Local tax (Dallas): 8.25%

Country		U.K.		
Company		London Electricity	Eeastern Energy	Power Gen
City		LE Group Area	TXU Energi Area	TXU Energi Area
Tariff		High voltage	High voltage	High voltage
Demand charge	Unit price	Standing charge (£35.21/month) Capacity charge (£0.95/kVA)	Standing charge (£35.21/month) Capacity charge (£0.95/kVA)	Standing charge (£35.21/month) Capacity charge (£0.95/kVA)
	Seasonal classification	None	None	None
	Incremental classification (kWh)	None	None	None
Electricity usage charge	Time-based classification	None	None	None
	Seasonal classification	None	None	None
	Incremental classification (kWh)	None	None	None
Transmission charge		Annual fee per kW	Annual fee per kW	Annual fee per kW
Distribution charge		Separate fees for daytime and nighttime	Separate fees for daytime and nighttime	Separate fees for daytime and nighttime
Fuel-cost adjustment system		None	None	None
Other charge		Fossil-fuel (0.30%) climate change levy (£0.0043/kWh) Meter charge (£14.95/month) Pooling & settlement (£19.58/month)	Fossil-fuel (0.30%) climate change levy (£0.0043/kWh) Meter charge (£14.95/month) Pooling & settlement (£19.58/month)	Fossil-fuel (0.30%) climate change levy (£0.0043/kWh) Meter charge (£14.95/month) Pooling & settlement (£19.58/month)
Discount system		None	None	None
Tax		Value-added tax: 17.5%	Value-added tax: 17.5%	Value-added tax: 17.5%

Country		Germany		France
Company		RWE	Yello Strom	EDF
City		Essen	Karlsruhe	Paris
Tariff		Unknown	Unknown	Greena
Demand charge	Unit price	Monthly adjustment	Monthly adjustment	38.04 euro/kW (per year)
	Seasonal classification	Monthly	Monthly	None
	Incremental classification (kWh)	None	None	None
Electricity usage charge	Time-based classification	None	None	Peak (winter, 8:00 – 9:00, 20:00 –21:00) Daytime (7:00 –1:00) Nighttime (1:00 – 7:00)
	Seasonal classification	Monthly	Monthly	Summer (April – October) Winter(November – March)
	Incremental classification (kWh)	None	None	None
Transmission charge		Metered rate	Metered rate	No separate charge
Distribution charge				No separate charge
Fuel-cost adjustment system		None	None	None
Other charge		Renewable Energy charge (DM0.0057/kWh) Meter Rental (DM3100/year)	Renewable Energy charge (DM0.0046/kWh) Meter Rental (DM3100/year)	Meter maintenance fee (413 euro/month)
Discount system		None	None	None
Tax		Value-added tax: 16% CHP tax: DM0.0051/kWh Power tax: DM0.0060/kWh Concession tax: DM0.0022/kWh	Value-added tax: 16% CHP tax: DM0.0053/kWh Power tax: DM0.0060/kWh Concession tax: DM0.0022/kWh	Value-added tax: 5.5% Local tax: 0.078 euro/kW