



## COUNTRY STUDIES

# Korea - Regulatory Reform in Electricity 2000

### Introduction

The Review is one of a series of country reports carried out under the OECD's Regulatory Reform Programme, in response to the 1997 mandate by OECD Ministers. This report on regulatory reform in electricity in Korea was principally prepared by Mr. Peter Fraser for the OECD.

### Overview

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### Related Topics

# Regulatory Reform in Korea

Regulatory Reform in the Electricity Sector



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**LA RÉFORME DE LA RÉGLEMENTATION DANS LE SECTEUR DE L'ÉLECTRICITÉ**

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## FOREWORD

Regulatory reform has emerged as an important policy area in OECD and non-OECD countries. For regulatory reforms to be beneficial, the regulatory regimes need to be transparent, coherent, and comprehensive, spanning from establishing the appropriate institutional framework to liberalising network industries, advocating and enforcing competition policy and law and opening external and internal markets to trade and investment.

This report on *Regulatory Reform in the Electricity Sector* analyses the institutional set-up and use of policy instruments in Korea. It also includes the country-specific policy recommendations developed by the OECD during the review process.

The report was prepared for *The OECD Review of Regulatory Reform in Korea* published in 2000. The Review is one of a series of country reports carried out under the OECD's Regulatory Reform Programme, in response to the 1997 mandate by OECD Ministers.

Since then, the OECD has assessed regulatory policies in 16 member countries as part of its Regulatory Reform programme. The Programme aims at assisting governments to improve regulatory quality — that is, to reform regulations to foster competition, innovation, economic growth and important social objectives. It assesses country's progresses relative to the principles endorsed by member countries in the 1997 *OECD Report on Regulatory Reform*.

The country reviews follow a multi-disciplinary approach and focus on the government's capacity to manage regulatory reform, on competition policy and enforcement, on market openness, specific sectors such as electricity and telecommunications, and on the domestic macroeconomic context.

This report was principally prepared by Peter Fraser of the International Energy Agency with the participation of Sally Van Sichen, Principal Administrator, of the OECD's Division for Competition Law and Policy, Bernard J. Phillips, Head of Division for the OECD's Division for Competition Law and Policy. It benefited from extensive comments provided by colleagues throughout the OECD Secretariat, as well as close consultations with a wide range of government officials, parliamentarians, business and trade union representatives, consumer groups, and academic experts in Korea. The report was peer-reviewed by the 30 member countries of the OECD. It is published under the authority of the OECD Secretary-General.

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## 1. HIGHLIGHTS

The Korean electricity sector is distinguished from those of other OECD countries by its rapid expansion. Electricity demand in Korea tripled over the period 1987-97. While demand for electricity dropped in 1998 due to the recession, it has rebounded above pre-recession levels in 1999 and is expected to continue rising at a somewhat lower pace in the future.

The Korean government has relied on the government-controlled utility Korea Electric Power Corporation (KEPCO) to meet this rapid growth in demand. KEPCO produces 94.5% of all electricity generated and is the only licensed transmission and distribution business in Korea. As a result, KEPCO is now the fourth largest OECD electric utility, with over 42% of its electricity generated by nuclear power.

A lack of competition and government influence over KEPCO's tariffs and commercial decisionmaking have resulted in inefficiencies. The government retains the right to appoint all board members, including the chief executive. Prices, which are among the lowest in the OECD (in exchange rate terms) despite increases in 1997 and 1998, reflect low regulated profits. Rates, set by the Ministry of Commerce, Industry and Energy, have been held down by a low regulated return on equity and even smaller dividend payouts to the government than to private shareholders. Electricity prices for the agricultural sector are heavily subsidised. On the other hand, costs have been increased by obligations to support government fuel policies by purchasing relatively high cost fuels such as domestic coal and LNG.

As part of its general regulatory reform policy to increase economic efficiency through the introduction of competition, and to increase foreign investment, the Korean government released in January 1999 the Basic Plan for Restructuring the Electricity Industry in Korea. The Basic Plan proposes to restructure the electricity sector and introduce competition in the generation and retail supply of electricity in four phases, while increasing customer choice and the reliability and quality of electric supply. The highlights of the plan are:

- KEPCO non-nuclear generation to be broken up into 5 wholly-owned generating subsidiaries, with the intention of privatising one of them (at least partially) by 2002 and the rest (at least partially) beginning in 2002.
- KEPCO nuclear capacity will be separated into a new wholly owned nuclear generating subsidiary.
- Distribution assets of KEPCO will be divided up into a number of wholly-owned subsidiaries by 2001 and privatised (at least partially) beginning in 2002.
- An independent regulator for network pricing and market monitoring is to be created within two years
- A generators' pool with dispatch based on fuel costs will be created by 2000. This will evolve into a bid-based electricity market by 2002.
- A multi-phase programme to introduce customer choice with the largest customers to go first, beginning in 2001, and most other customers following beginning in the year 2009.

This report reviews the Basic Plan and concludes that plan's main elements provide a sound framework to guide the development of a reliable, competitive and more efficient electricity sector. But many basic aspects greatly influential to the reform's success should be elaborated. The timetable for

liberalisation of consumer choice is very vague but appears to offer choice to most consumers a decade after the reforms have begun. The degree of privatisation of generating subsidiaries, crucial for the success of the structural reform, is yet to be decided. The design of the regulatory institutions will not be finalised for at least another year. By April 2000, the regulation that will be applied for captive consumers' tariffs had not been announced. The government's first priority must be to implement, as quickly as practical, concrete legal reforms that follow through on both the plan's stated aims of creating a reliable, competitive electricity sector and those basic points.

This report discusses the key issues that need to be addressed for Korea to achieve a competitive electricity sector. Recommendations of this report address:

- Defining a more ambitious timetable for full retail liberalisation of electricity consumers;
- Separating KEPCO's transmission business from the generation companies;
- Improving the corporate performance of KEPCO and successor companies by reforming their relationship with the government and private shareholders;
- Ensuring that regulatory institutions can play their appropriate roles in the new environment;
- Helping the market work effectively to ensure adequate levels of investment in generation;
- Pricing to improve economic efficiency and to eliminate hidden cross-subsidies;
- Creating a structure and regulatory design to ensure that distribution-supply companies promote economic efficiency;
- Ensuring that long-term contracts do not delay or diminish competition;
- Ensuring that environmental quality targets for emissions and renewable energy are achieved at lower cost using market-based mechanisms.

The report also discusses principles for dealing with potential stranded costs as well as the use of market-compatible environmental regulation to limit greenhouse gas emissions from the electricity sector.

This chapter is structured as follows. Section 5.2 outlines the current features of the electricity sector, including infrastructure, industry structure, prices and costs. Section 5.3 describes the legal, regulatory and governance framework. Section 5.4 describes the proposed reforms and identifies the main issues. Section 5.5 is a detailed critique of these issues. Section 5.6 states the conclusions and specific recommendations.

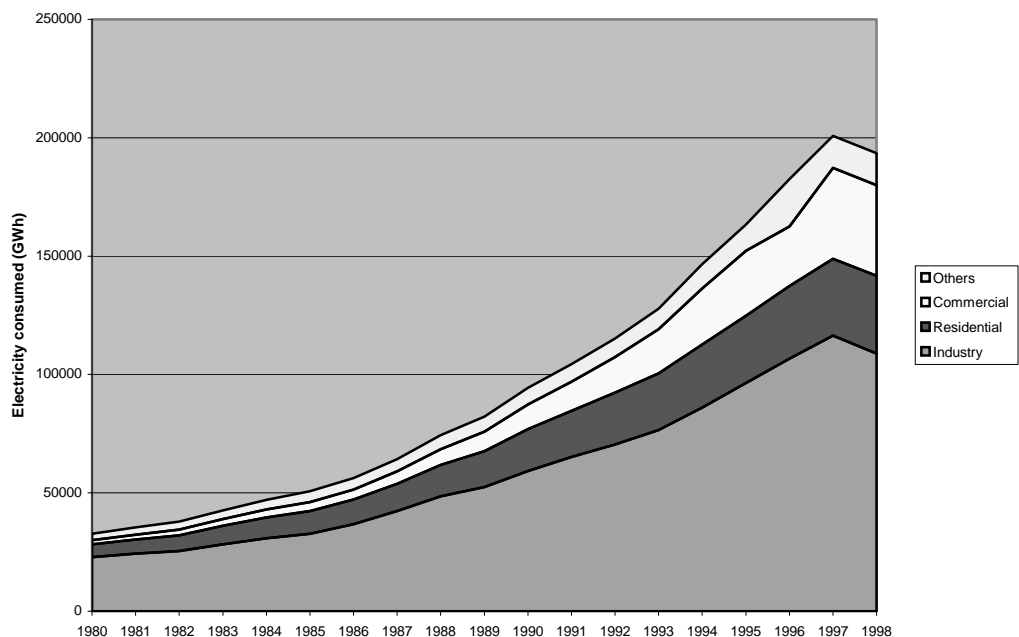
## **2. CURRENT FEATURES OF THE ELECTRICITY SECTOR**

### ***2.1. Capacity and generation***

Korea's electricity demand has grown much more quickly than the OECD average, in line with its higher economic growth. Korea's peak electricity demand in 1998 of 33 GW and electricity sales of 193TWh ranks it the seventh among OECD countries. Growth in demand for electricity has been the highest in the OECD, averaging 12.8% per annum in the period 1973-96 *vs.* 3% for the OECD average. Demand fell in 1998 due to the economic recession but has rebounded to prerecession levels by mid-1999.

Korea's demand for electricity is also distinguished from other OECD countries by relatively low residential demand and a relatively large share of industrial demand. Residential consumption of approximately 700 kWh per person per annum is a third of the OECD average. Industry accounts for 56% of electricity demand in Korea, versus an OECD average of 38%. This accounts for the relatively large electricity intensity of Korea, approximately one third larger than the OECD average.

Figure 1. Electricity consumption in Korea



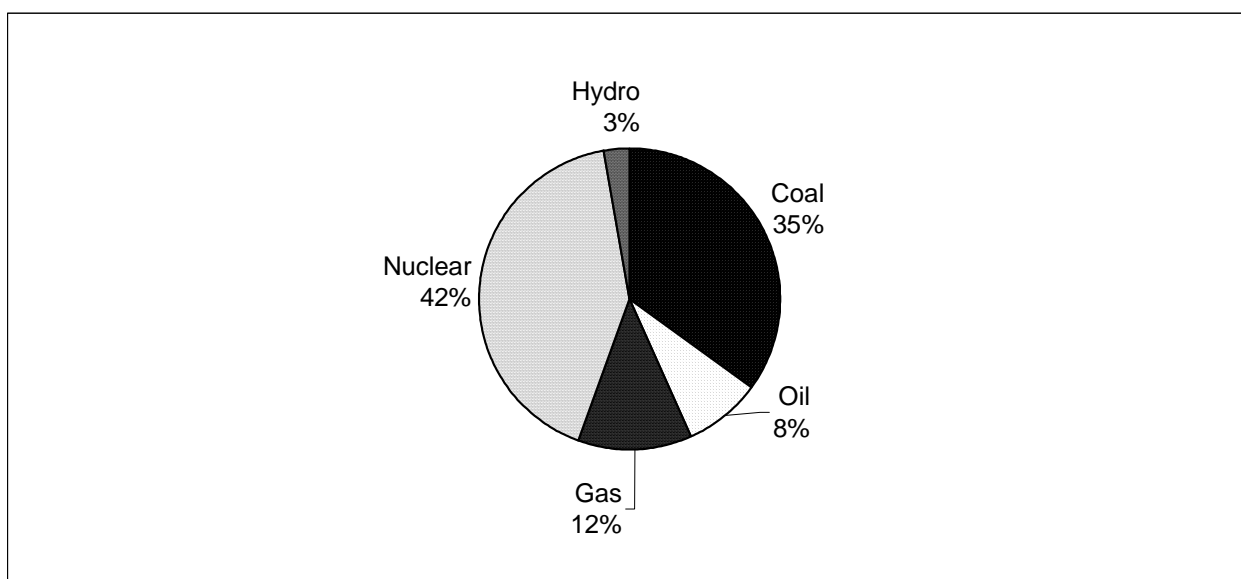
Source: Ministry of Commerce, Industry and Energy.

The capacity available in 1998 to meet this peak demand was 43 GW. Generating capacity barely kept pace with the expansion of demand up to 1997, leading to low capability reserve margins of between 3 and 10% during the period 1990-1997 and relatively high load factors of 70% or greater. However, the addition of 15 GW of new generating capacity over the period 1998-2002 is expected to create a large reserve margin for the next few years. The load factor, which has also been favourably affected by the large proportion of industrial demand, will also be depressed by the expected increase in air conditioning.

Fuel mix for domestic electricity generation in 1998 shows a mix of nuclear (42%), coal (35%), gas (12%), oil (8%), and hydroelectric power (3%) (see Figure 2).



Figure 2. 1998 fuel shares in Korean power generation



Source: KEPCO.

Nuclear power, with relatively low fuel costs, is used for baseload power generation. The government has supported the development of nuclear power to enhance energy security through decreased dependence on fossil fuels, which must be almost entirely imported. Korean nuclear power uses three different reactor types, the Westinghouse pressurised water reactor (PWR), the Combustion Engineering PWR, and the Canadian-designed CANDU pressurised heavy water reactor (PHWR). Despite the extra operational complexity, the Korean programme has been very successful, with a 1998 capacity factor of 90%. The share of nuclear generation exceeded 40% of total electricity production for the first time in 1998. New plants coming into service should keep this share above 40% for the next few years. The Korean government intends to build a further 10 reactors over the next 15 years.

Coal-fired generation, mostly with imported bituminous coal, is also relatively low cost and is used for baseload and midload operation. However, a small portion of coal-fired generation uses domestic anthracite coal, which KEPCO is obliged by the government to purchase at a cost nearly twice as much per tonne. In order to meet its anticipated continuing obligation to burn anthracite, KEPCO is constructing new power plants using advanced coal-burning technology (circulating fluidised bed) to burn domestic anthracite.

Gas-fired power generation provides power during the summer months to help meet peak load, reduce the environmental impact of electricity production and to reduce seasonal variations in the demand for natural gas. Its relatively high cost (see Table 1), despite the use of efficient combined cycle power plants, implies that its share of power production is larger than economically optimal. However, KEPCO is obliged to purchase a minimum amount of natural gas under a “take or pay” arrangement with the government-owned gas monopoly KOGAS until 2006, although the precise minimum can be changed through negotiation.

Of the other types of power generation, oil-fired generation facilities are largely older plants that are used for meeting peak demands. Its contribution has dropped dramatically as new nuclear and gas-fired generation has increased. Hydroelectric power is also used for meeting peak demand. About half of all hydro capacity is pumped storage hydro, meaning that water is pumped into reservoirs during off-peak hours to be used to generate electricity during peak hours. Table 1 summarises the total capacity, capacity factor and fuel cost for different types of power generation.

Table 1. Power production in Korea 1998

Type	Capacity (MW)	Gross Production (TWh)	Capacity Factor (%)	Fuel Cost (Won/kWh)	Average Unit Cost (Won/kWh)
Nuclear	12016	89.7	90	3.7	33.7
Imported Coal	10240	70.9	77	18.9	37.8
Domestic Coal	1091	4.6	75	35.7	62.7
Gas	9518	26.3	28	50.2	75.4
Oil	7410	17.7	26	38.6	59.8
Hydro	1531	4.3	32	0	42.0
Pumped Storage Hydro	1600	1.8	13	17.8	61.0
Total (or average)	43406	215.3	55	18	45.3

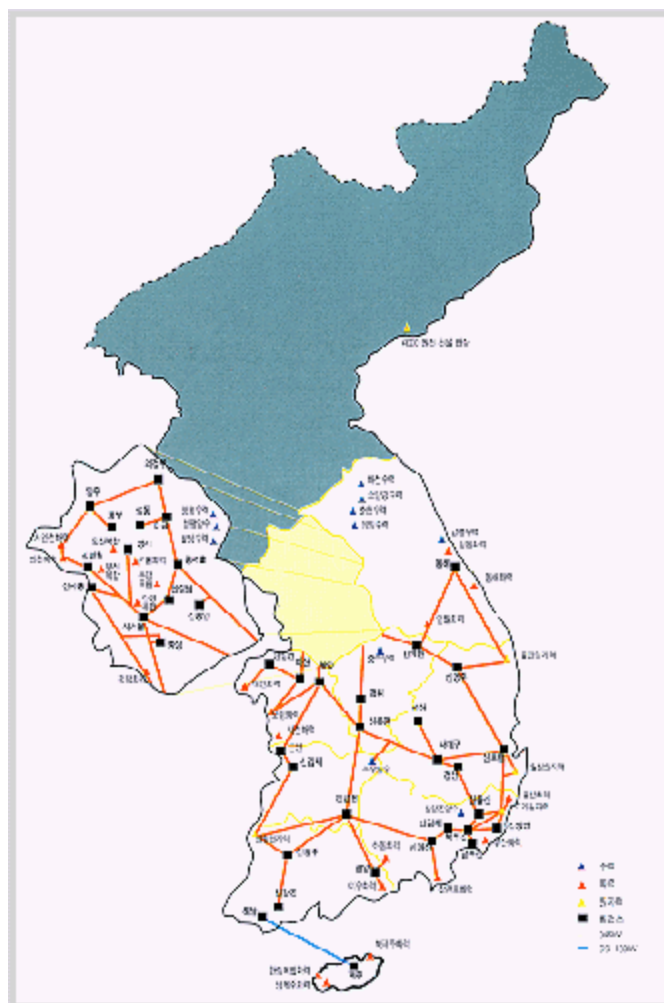
Note: Capacity factors and costs refer to KEPCO plants only.

Source: Ministry of Commerce, Industry and Energy and KEPCO.

## 2.2. Transmission and international trade

The high voltage transmission network consists of a well-developed 345 kV/154 kV system. There is also a high voltage direct current (HVDC) link with Cheju Island in the south (Figure 2). As much of the network is relatively new, transmission and distribution losses at 4.9% of total electricity supplied are better than the OECD average of 7.2%. KEPCO has begun to develop a 765 kV system that will reduce transmission losses further (Table 2). There is a pronounced flow of power towards Seoul from power plants in southern and eastern parts of the country.

Figure 3. Korean high voltage network



Source: KEPCO.

Table 2. High voltage transmission network expansion (in circuit km)

	1998	2000	2005	2010	2015
765 kV	54	676	956	1 678	2 158
345 kV	6 491	7 472	9 866	9 398	9 868
154 kV	15 821	17 648	21 468	24 408	26 732
<b>Total</b>	<b>22 296</b>	<b>25 796</b>	<b>31 390</b>	<b>35 484</b>	<b>38 758</b>

There are no interconnections with other countries. Interconnections formerly existed with North Korea but these were severed by North Korea in 1948. KEPCO and the Japanese utility Kyushu Electric have been exploring the feasibility of an undersea link with Japan.

### 2.3. *Industry structure*

Korea Electric Power Corporation (KEPCO) completely dominates the electricity system in Korea. It is a majority (52.6%) state-owned company that owns 94% of the generating capacity and 100% of the transmission and distribution system in Korea. Its 41 GW of generating capacity make it the 4<sup>th</sup> largest power generating company in the OECD. In addition, KEPCO has under construction or in advanced planning a further 19 GW of capacity (including 8 GW of coal, 6 GW of nuclear and 5 GW of LNG) to come into service by 2005.

There are a small number of independent producers that supply power to KEPCO under long-term arrangements (Table 3). The Hanwha arrangement and price was based on a long-term contract reached in 1972. The Korea Water Resource Corporation uses water surplus to its needs to sell hydropower to KEPCO. Cogeneration facilities have been encouraged by changes in legislation that set favourable prices for sale of power under contract to KEPCO.

Table 3. **Independent power production 1998**

Companies	Capacity (MW)	Sales to KEPCO (TWh)	Average revenue (W/kWh)
Hanwha Energy	1500 (Gas)	2.6	100.5
Korea Water Resource	980 (hydro)	2.4	64.8
Small Hydro (21 sites)	35	0.093	54.8
Cogenerators (26 sites)	2 824	3.4	43.3
Total	5 338	8.49	66

Source: Ministry of Commerce, Industry and Energy.

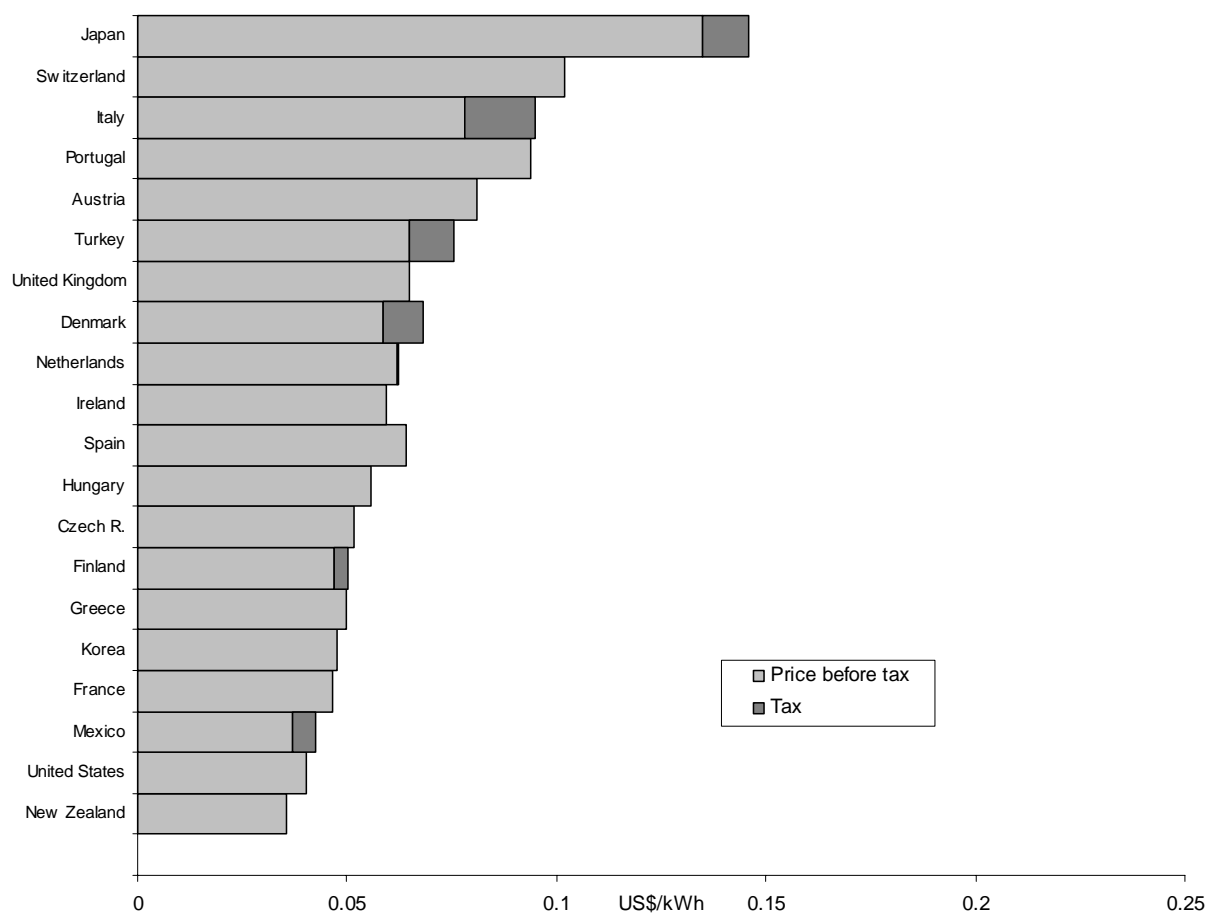
KEPCO has agreed to additional contracts with four producers, to come into service by 2005. This approximately 3 GW of additional capacity is about 10% of what KEPCO has been planning to construct during this period. Contract durations range from 20-26 years. Three out of four proposed projects are for LNG-fired power plants. The fourth is for a 1 GW coal-fired power plant.

Two generating plants, the CHP plants at Anyang and Buchon, have not been sold despite the plan to sell them in 1999. While a tender was held, and three firms or consortia submitted bids, the government rejected the bids due to lower-than-expected bidding prices and “difficult” changes in the existing arrangements with KEPCO regarding long-term contracts, fuel purchases, retaining existing workers and profit rates. (Korea Herald, 15 December 1999) Another tender, perhaps for the two plants separately, is expected in 2000.

### 2.4. *Electricity prices and costs*

Industrial and household electricity prices in Korea<sup>1</sup> are among the lowest in OECD countries when measured in simple exchange rate terms (Figures 4 and 5). In terms of purchasing power parities (PPP), however, Korean electricity prices are above the OECD average. The PPP exchange rate is higher than the current exchange rate because the prices of non-tradeable goods in Korea tend to be low. The relatively high price of electricity measured by the PPP exchange rate suggests scope for increased efficiency in this sector.

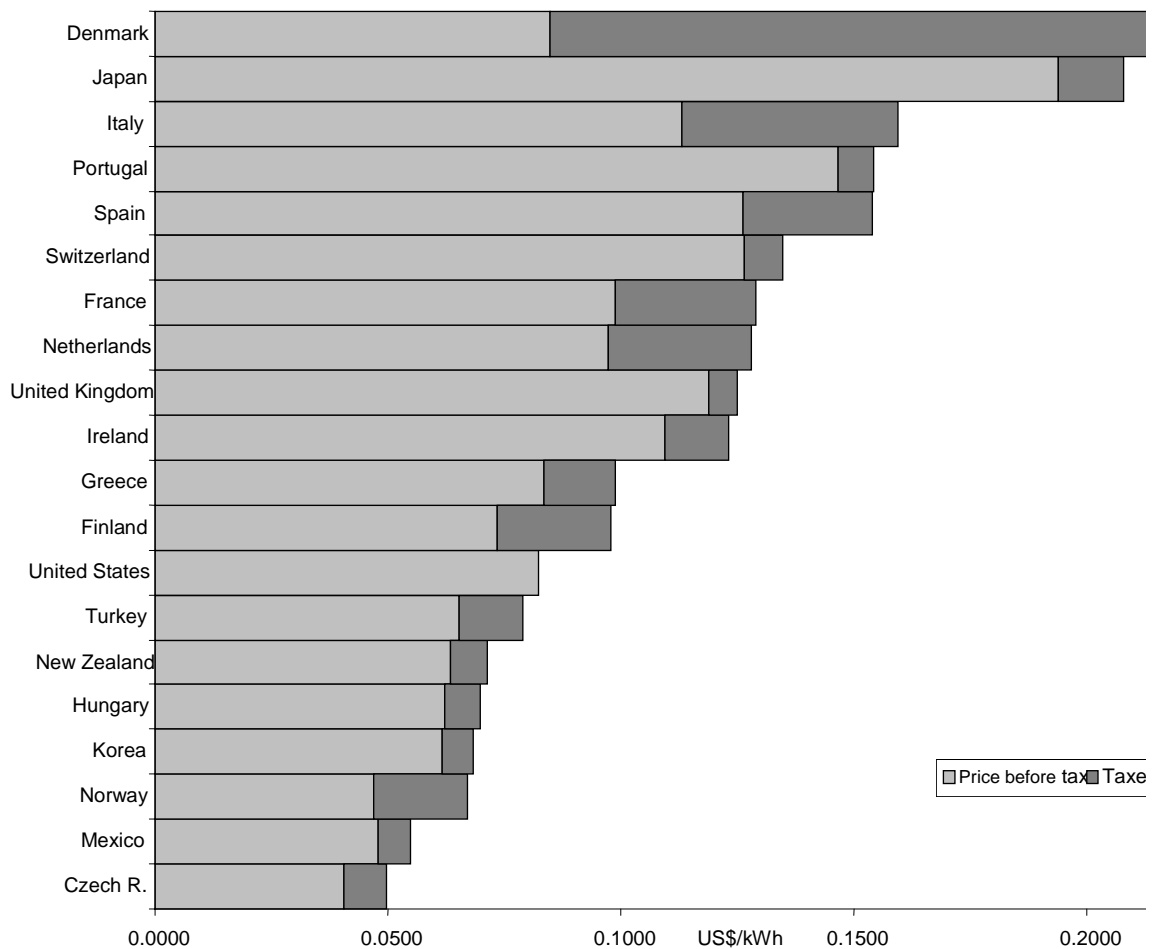
Figure 4. Industrial electricity prices in selected OECD countries 1998



Note: Comparison based on prevailing exchange rates.

Source: *Energy Prices and Taxes*, IEA/OECD (1999), Paris.

Figure 5. Household electricity prices in selected OECD countries 1998

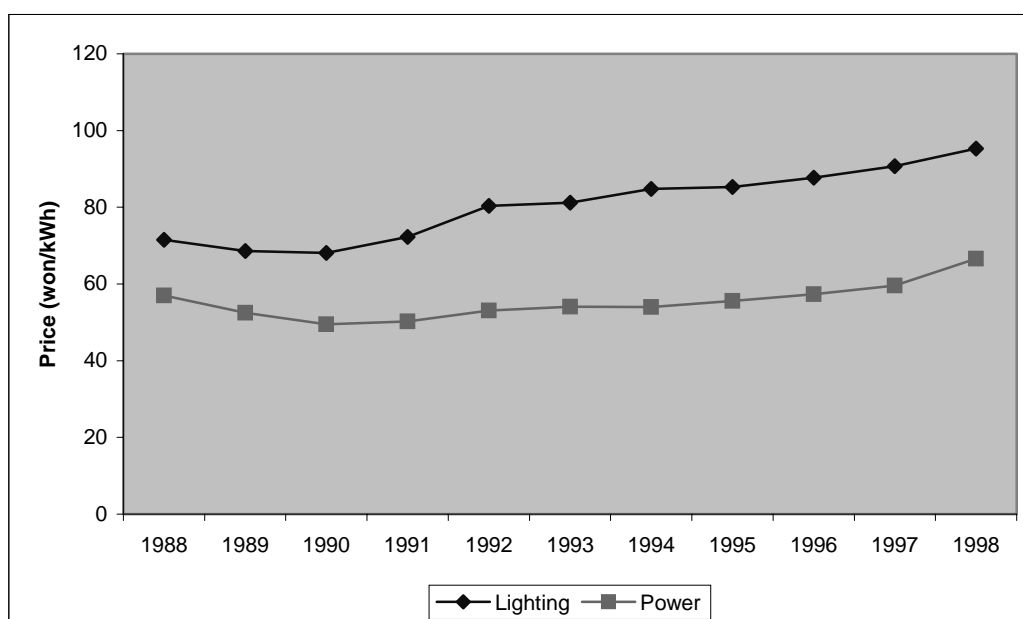


Note: Comparison based on prevailing exchange rates.

Source: *Energy Prices and Taxes*, IEA/OECD (1999), Paris.

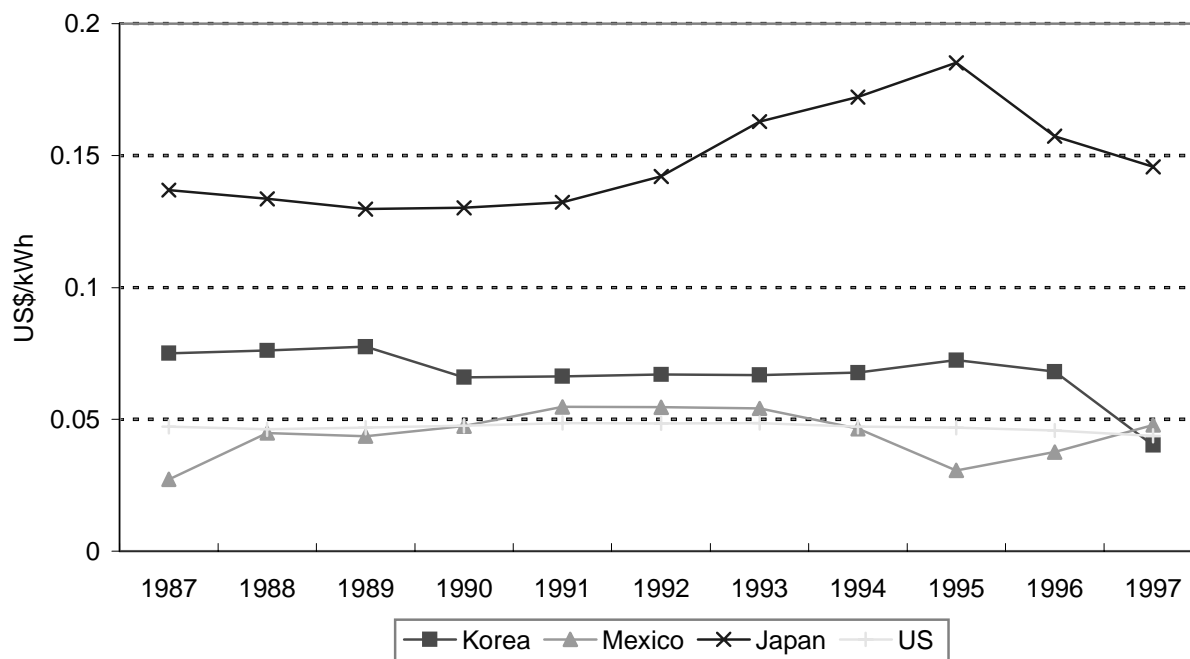
Price rises over the past decade have been necessary to cover costs of the rapid expansion of KEPCO as the company has tripled in size over 10 years (Figure 6). The devaluation of the won in late 1997, while it led to rate increases (5.9% in July 1997 and 6.5% in January 1998) because of increases in costs of fuel and foreign-denominated interest payments, has also made the electricity price highly competitive compared with other countries, using exchange rates (Figure 7). Prices are also lower because of government policies that lead to low rates of return on equity and lower dividends for the government's shares.

Figure 6. Electricity prices 1988-1998



Source: Korean Energy Economics Institute (data for average revenue/kWh).

Figure 7. Industrial electricity prices in selected OECD countries 1987-1997



Note: Comparison based on prevailing exchange rates.

Source: Energy Prices and Taxes, IEA/OECD, Paris, 1998.

Tariffs do not vary on the basis of location, but do vary by the voltage at which the customer receives electricity. The basic tariff structure is a two-part tariff where customers pay for capacity (in kW) and for energy (kWh). Commercial, educational and industrial tariffs also vary by season. Optional time of use tariffs exist for industrial customers and commercial customers at high voltage but only account for approximately 2% of sales. Discounts are also available to these customers in return for being available to be interrupted.

Tariffs contain significant price distortions (Table 4). According to Ministry estimates, tariffs for farmers recovered only 40% of the cost of electricity sold to them. Similarly, tariffs for streetlighting paid by municipalities recovered only 83% of the cost while industrial tariffs, which constituted 59% of the sales in 1998, recovered 91% of the cost. To offset the revenue lost from underpricing electricity to these customers, tariffs to households, educational and commercial users of electricity are significantly higher than the cost of production. In November 1999, the government raised industrial rates 8% while holding household rates steady to address partially this imbalance.

Table 4. **Prices vs. costs for different customer categories in 1998**

	Household	Commercial	Education	Industry	Agriculture	Street Lighting	Total
Average revenue (won/kWh)	97.0	105.55	87.91	55.11	43.0	62.91	72.53
Ratio to cost of service (%)	109	124	118	92	40	83	102
Share of total sales (%)	18	19	1	59	2	1	100

A breakdown of components of 1999 estimated electricity costs is shown in Table 4.

Table 5. **Components of projected 1999 electricity costs for Korea**

a) By business segment

Items	Unit Cost (won/kWh)	Share (%)
Generation	45.30	72
Transmission and related	7.01	11
Distribution and related	7.89	13
Retailing/supply	2.46	4
Total	62.66	100

Source: Ministry of Commerce, Industry and Energy.



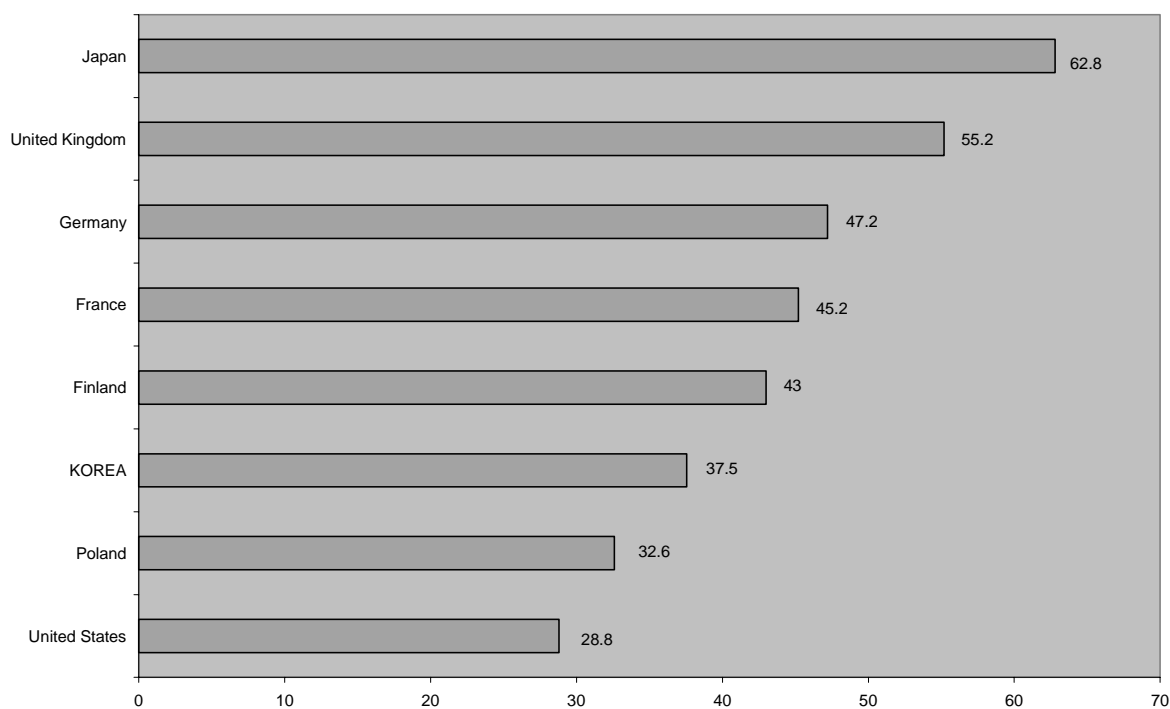
b) By cost component

	Cost (billions of won)	Share of costs (%)
Fuel	3493	28
Depreciation	3449	28
Operation, Maintenance and Administration	2805	22
Financial expenses	642	5
Power purchases	535	4
Decommissioning	357	3
Research and development	219	2
Other	1007	8
<b>Total</b>	<b>12535</b>	<b>100</b>

Source: KEPCO.

Fuel costs make up the largest share of total costs. As fuels are imported under contracts in foreign currency, power costs are quite sensitive to fluctuations in the exchange rate. In 1998, fuel costs for coal, oil and LNG were \$37.50/tonne \$120/tonne and \$176/per tonne of oil equivalent (toe)<sup>2</sup> respectively, (using the 1998 exchange rate averaging approximately 1400 won/\$). While prices for imported coal and oil are relatively competitive as compared with other countries, natural gas prices are the highest among OECD countries (Figures 8-10). The use of relatively costly LNG is the primary reason for the high cost of natural gas, although it is interesting to note that the price in 1997 was higher than that of Japan, the only other OECD country that relies on natural gas in the form of LNG. Two other factors for the relatively high cost are the relatively high price that KOGAS charges KEPCO for LNG, and the fact that import duties and taxes on natural gas in Korea are higher than in other countries. Japanese utilities' LNG costs are also reduced by their direct importation of LNG to their own facilities rather than relying on the gas utility. Competition between fuels in Korea is also affected by higher taxes on LNG and oil than for coal. Excise taxes are highest for LNG and lowest for coal. Oil is subject to an additional \$1.70 per barrel tax payable into a Petroleum Business Fund (Table 6).

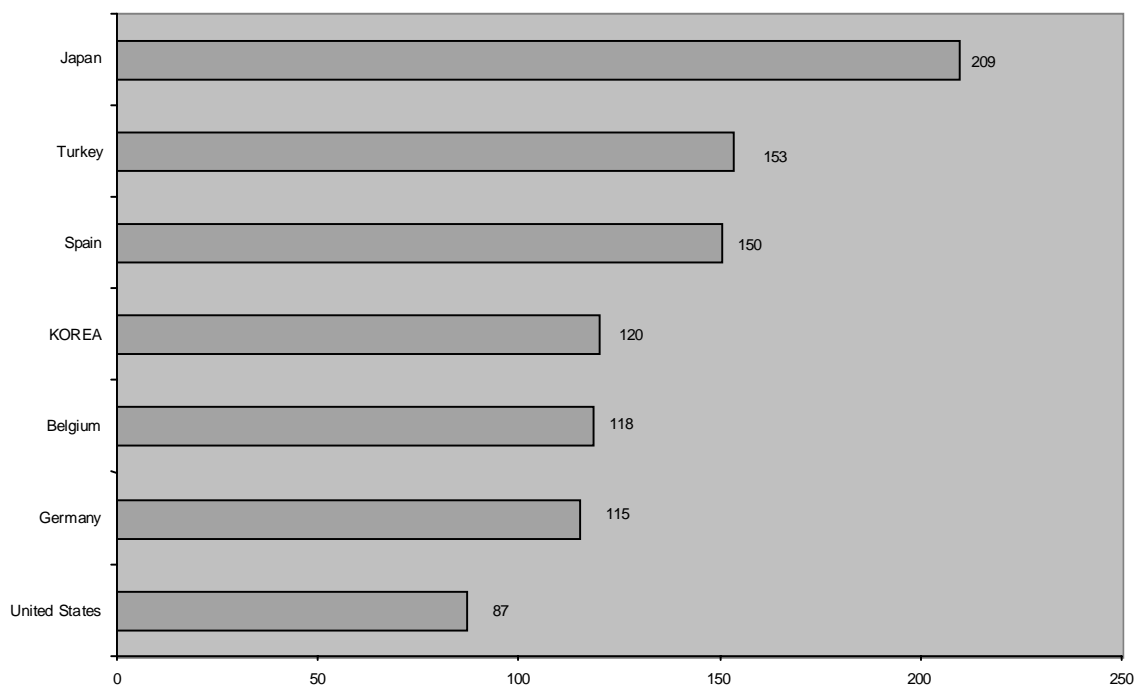
Figure 8. Coal prices for power generation in selected OECD countries, 1998 (\$/tonne)



Note: 1997 data for France, Japan and United Kingdom.

Source: Energy Prices and Taxes, IEA/OECD Paris and KEPCO.

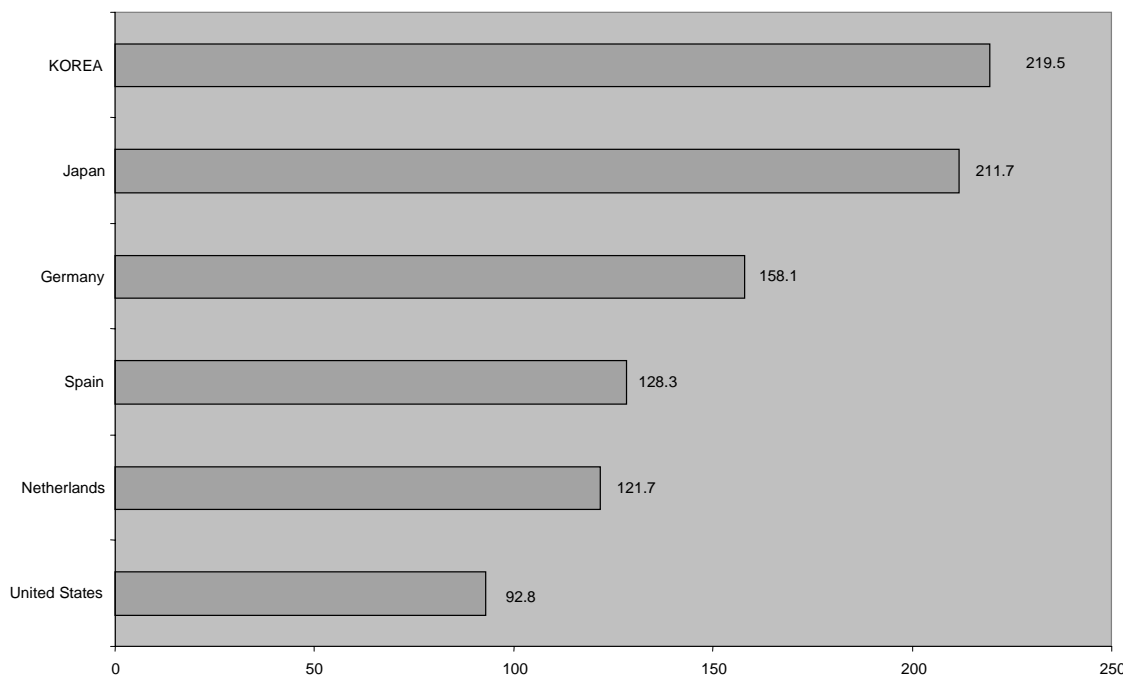
Figure 9: Heavy fuel oil prices for power generation in selected OECD countries 1998 (\$/tonne)



Note: 1997 data for Japan..

Source: Energy Prices and Taxes, IEA/OECD Paris and KEPCO.

Figure 10. Natural gas prices for power generation in selected OECD countries 1998 (\$/toe)



Note:

1997 data for Korea, Japan and United Kingdom. 1998 figure for Korea is \$176/tonne.

Source: Energy Prices and Taxes, IEA/OECD Paris and KEPCO.

Table 6. Taxes on imported fossil fuels

Fuel	Excise tax (%)	VAT (%)	Other	Total (%)
Coal	1	10		11
Heavy Fuel Oil	5	10	\$1.70/barrel crude	24
LNG	11	10		21

Note: Total tax % on oil assumes \$20/barrel of crude.

Source: IEA (1994), *Energy Policies of the Republic of Korea*.

KEPCO's costs are sensitive to changes in the value of the won. The two main sources of this sensitivity are fuel costs, mentioned above, and foreign currency denominated liabilities. Fuel costs represent almost 30% of revenues from the sale of electric power. Substantially all fuel material is sourced from abroad, and its prices are denominated in foreign currencies. As regards liabilities, at the end of 1998 50.6% of long-term debt and 10.5% of short-term borrowings were denominated in foreign currencies. By contrast, essentially all KEPCO's revenues are denominated in won. In response to the adverse economic developments in Korea, KEPCO reduced capital expenditures by 9% in 1998. (KEPCO, 1999a)

Reform of the natural gas sector is also planned, as laid out in "The restructuring plan for the national gas industry" released by the Korean government in November 1999. KOGAS, the state-owned gas monopoly, 24.5% by KEPCO, will be restructured into one company responsible for construction and operation of the facilities (LNG terminals and pipelines – distribution is already unbundled and is privately owned) and 3 LNG import/supply companies. The 7 LNG purchasing agreements will be transferred to these 3 companies, who are to compete against each other to sell to distributors and power companies. Third party access to these LNG facilities will be permitted as of 2002. However, open access to the distribution network will not be permitted at least in the near future. Privatisation of KOGAS by public share offering has already begun. The government will retain a majority holding in the facilities company and in one of the supply companies.

Costs to electricity consumers are increased because KEPCO fulfils several non-commercial functions such as:

- Supplying electricity to agricultural and fishing consumers and to remote areas below cost. This amounts to a subsidy of about won 150 billion.
- Purchasing domestic coal at a premium over imported coal amounts to a subsidy of won 78 billion;
- Supplying heat to Korea District Heating Corporation below cost amounts to won 50 billion;
- Purchasing electricity from small hydropower amounts to won 8 billion;
- Purchasing natural gas for power generation at peak prices although it is required to burn the fuel during the time of the year when gas should be less expensive. KEPCO's annual gas bill of won 1.3 trillion could easily be cut by 10% or won 130 billion;
- Support for job creation programmes while going through a restructuring intended to improve efficiency by cutting 3 765 jobs.

The above subsidies do not include price distortions that favour industrial customers at the expense of commercial and residential customers that have now been largely eliminated by an 8% increase to industrial consumers in November 1999. Nevertheless, the above list implies that a total of at least 4% of all electric bills are being used for these subsidies. In addition, a substantial fraction of the total nuclear power research and development budget is paid by KEPCO, amounting to won 219 billion.

## **2.5. Environmental protection**

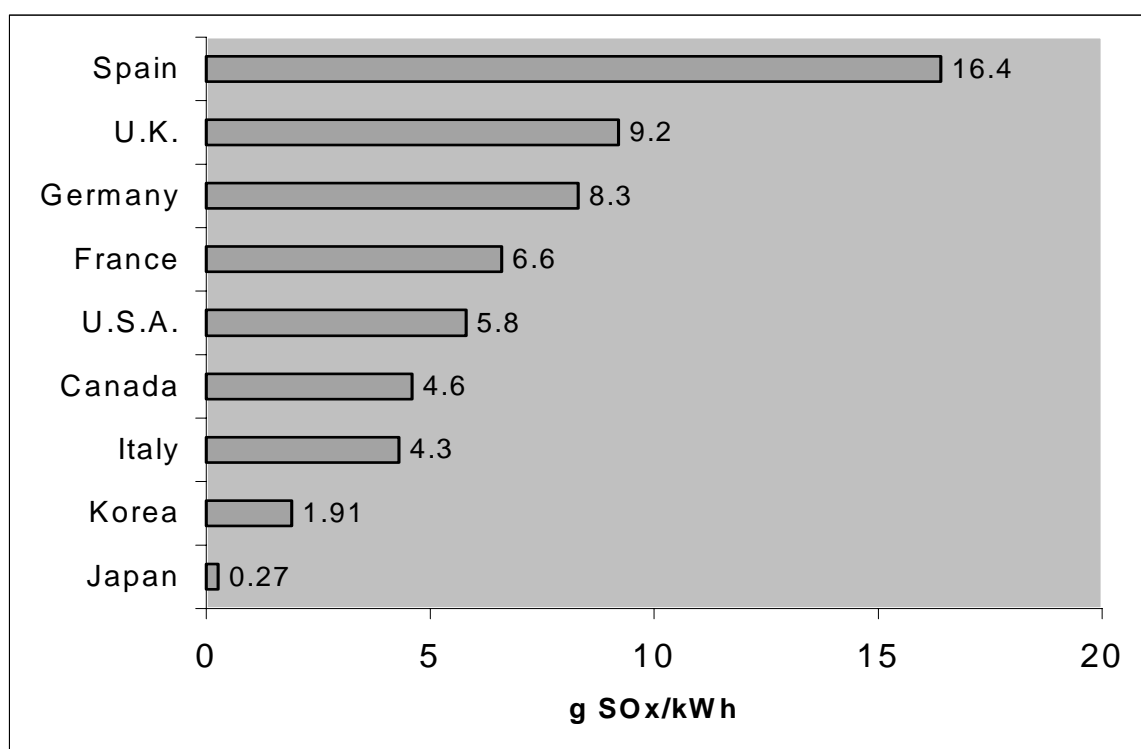
### *Acid gas emissions*

The 1990 Air Quality Preservation Act and associated presidential decrees form the basis for regulation of emissions from power plants. Electricity production accounts for about 26% of SO<sub>2</sub> and 16% of NO<sub>2</sub> emissions in Korea. As a result of progressive tightening air emissions regulations, emission limits are now comparable to regulations in other OECD countries.

A polluter found to be emitting in excess of a regulated limit will pay a fine equivalent to the treatment expenses for the pollutants emitted. The size of the fine per kilogram of pollutant increases as the excess increases and also varies by region, with the fines tripling in the areas of greatest concern. For example, for SO<sub>2</sub>, the basic fine is won 500 per kg of excess emissions up to a 20% excess. This increases to won 650 per kg for the excess emissions between 20 and 40%, 800 won per kg for 40 to 80% up to won 2250 per kg for amounts more than 400% above the limit. These fines triple in areas designated as sensitive, *i.e.* from won 1500 per kg to won 6750 per kg. For comparison, the basic fine is equivalent to approximately \$400/tonne of SO<sub>2</sub>, much higher than recent cost of SO<sub>2</sub> permits in the U.S. of approximately \$200/tonne.

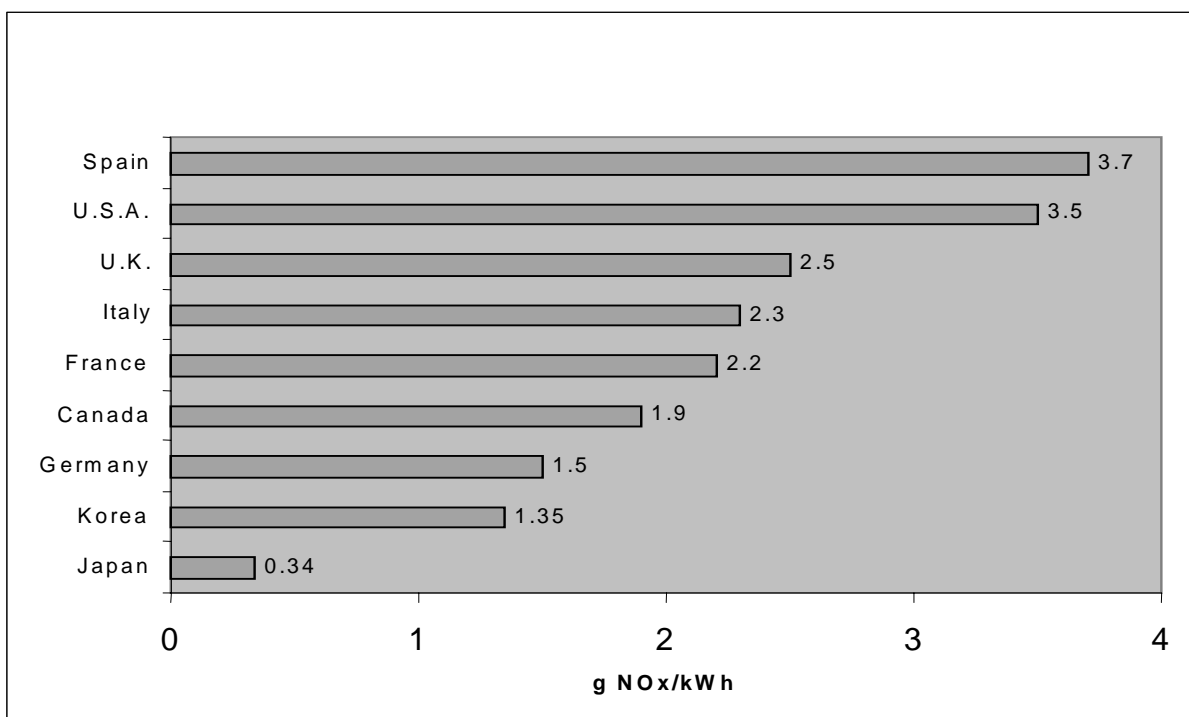
Emissions of SO<sub>2</sub> and NO<sub>x</sub> per kilowatt-hour of thermal power produced are lower than many other OECD countries (see Figures 11 and 12). The main reason for this is substantial investment in emissions control equipment. KEPCO has invested in flue gas desulphurisation equipment at its coal-fired power plants and installed low-NO<sub>x</sub> burners. Government standards will make flue gas desulphurisation a requirement on future coal plants. A new anthracite-burning power plant at Donghae uses fluidised bed combustion technology that also lowers emissions.

Figure 11. Average SO<sub>2</sub> emissions per kWh thermal power generation in selected OECD countries



Source: OECD/IEA, Ministry of Commerce and Energy.

Figure 12. Average NO<sub>x</sub> emissions per kWh thermal power generation in selected OECD countries

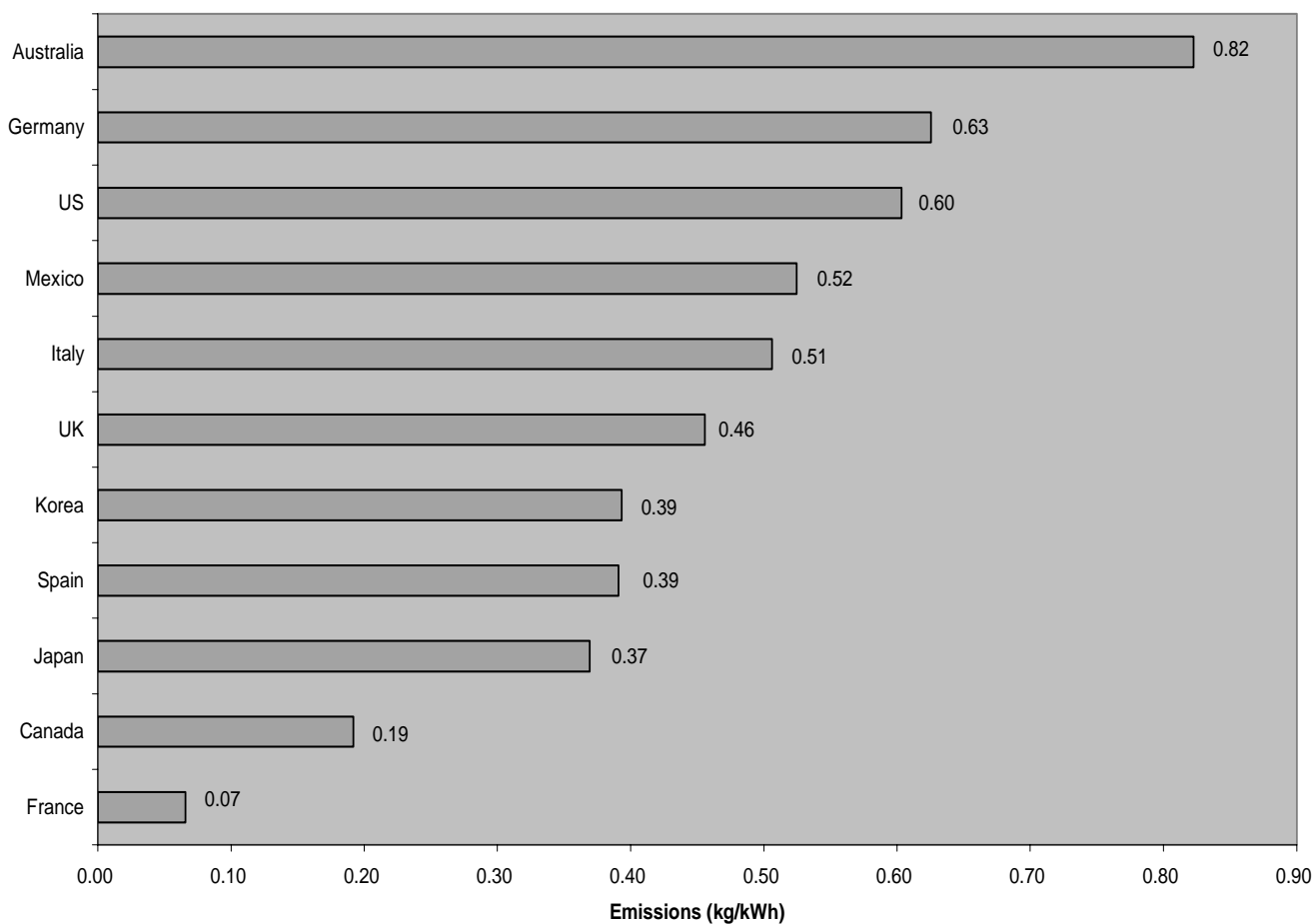


Source: OECD/IEA, Ministry of Commerce, Industry and Energy.

### Greenhouse gas emissions

Korea, although a signatory of the Kyoto Protocol, does not have a specific obligation to reduce its greenhouse gas emissions under this protocol. Rapid economic growth and a relatively energy-intensive economy have led to an 81% increase in CO<sub>2</sub> emissions from fuel combustion over the period 1990-97, compared to the OECD average of 9.5%. Average CO<sub>2</sub> emissions per kilowatt-hour of electricity production of 0.39 kg/kWh are 20% below the OECD average of 0.49 kg/kWh (Figure 13).

Figure 13. Average CO<sub>2</sub> emissions per kilowatt-hour of power production in selected OECD countries (1997)



Note: Data include emissions and power generated from power plants, combined heat and power production and autoproduction.

Source: IEA/OECD, *CO<sub>2</sub> Emissions from Fuel Combustion 1971-1997*, Electricity Information 1998.

Nevertheless, the government has announced its intentions to reduce greenhouse gas emissions on a voluntary and non-binding basis. The government has established an inter-agency committee led by the Prime Minister to combat climate change and is implementing a National Action Plan to reduce greenhouse gases. This Plan emphasises voluntary agreements with businesses, supplying alternative fuel vehicles, and developing energy efficient technologies. The Comprehensive National Energy Conservation Plan contains a wide range of measures to improve energy efficiency including energy audits, information and tax incentives. In 1997, the non-profit governmental agency Korea Energy Management Corporation provided financial support of won 278 billion, of which over half was for district heating or combined heat and power projects.

Fuel policies have also limited the growth in emissions. While nuclear power development has been favoured for energy security reasons, it also contributes to limiting the increases in emissions from the electricity sector. Similarly, government policies that have required KEPCO to develop LNG-fired facilities have limited emissions increases. Partly as a result, electric power generation and heat production, contribute about 19% of carbon dioxide emissions from fuel combustion in Korea compared to an OECD average of 31%.

The government is currently examining the use of a carbon tax or other economic instruments to control carbon dioxide emissions.

### *Renewable energy*

Renewable energy including hydropower supplied 1.1% of total primary energy in Korea in 1998. The Korean government has an objective to increase this to 2.0% by 2006. The current five-year plan (1997-2001) to develop renewable energy calls for research and development spending of won 203 billion. Subsidies and loans to new renewable energy developments totalled won 25.4 billion in 1996.

KEPCO's development plans consist of 101 MW of additional hydroelectric capacity to go into service by 2001 and 915 MW of other renewable energy projects to be built between 2001-2011. If there are no other developments, the share of renewable energy in total electricity production would decline over the next decade.

## **3. LEGAL, REGULATORY AND GOVERNANCE FRAMEWORK**

### **3.1. *Legislation***

There are seven pieces of legislation that are currently important to the Korean electric power sector. These are summarised in Table 7. Legislation related to economic regulation of the electricity sector and governance of KEPCO and plant are discussed further in sections 5.3.2, 5.3.3 and 5.3.4 respectively.

Table 6. Main legislation affecting Korea's electric power sector

Legislation	Main Provisions	Other Provisions and Notes
Economic Regulation: Electricity Business Act (Wholly amended 1990, last amended 1999)	MOCIE regulates entry to and exit from electricity business through licenses. Requires KEPCO to file development plan for MOCIE approval. MOCIE approval is also required for construction of facilities. MOCIE approve rates for customers and IPP contracts.	Obligation to supply on licensed utility Special suppliers permitted whereby new company can be established to generate and distribute electricity to nearby customers with the possibility of using KEPCO's transmission system. KEPCO has obligation to purchase from renewable energy sources
Monopoly Regulation and Fair Trade Act (1980, last amended 1999)	Gives Fair Trade Commission (FTC) authority to prosecute unfair competition practices (abuse of dominance, unfair business practices etc.)	FTC recently investigated and fined KEPCO for preferential treatment of subsidiaries.
Atomic Energy Act	Makes Atomic Energy Commission responsible for regulation of nuclear power safety. Science and technology ministry manages nuclear research	MOCIE retains planning role with respect to nuclear power and management of non-fuel wastes.
Governance of KEPCO: Korea Electric Power Corporation Act (1989, last amended 1998).	Defines KEPCO as a statutory juridical corporation Defines business of the corporation	Describes general provisions for control of KEPCO by government (mainly MOCIE)
The Basic Act on the Management of Government Invested Enterprises (1983, last amended 1999)	Defines organisation, management, and appointment of officers and directors by government, procurement and audit. Guarantees autonomy of operation of the enterprises	Details are described in KEPCO's articles of incorporation (amended 1999), which also specify shareholders rights, annual general meeting etc. Requires Ministry of Planning and Budget to carry out annual performance review.
Plant siting: Act on Special Cases Concerning Electricity Source Development (1978, last amended 1996)	Special provisions to expedite the regulatory approvals required for construction.	Applies equally to both KEPCO and private power developers.
Act on Assistance to Electric Power Plants – Neighbouring Areas (1989, last amended 1997)	Requires KEPCO to support regional development around power plants.	Currently set at 1.12% of KEPCO's annual turnover.
Local Authority Act (1996)	Gives local authorities the right of refusal to the construction of power plants.	Applies to KEPCO and private developments.



### 3.2. *Regulation of the electricity sector*

#### *Entry and exit*

The Electricity Business Act limits entry to and exit from the electricity business. The Ministry of Commerce, Industry and Energy (MOCIE) controls entry and exit through a licensing process.

Independent generation was allowed exceptionally in the 1960s when Korea was facing power shortages but since then no new independent generators were permitted until 1993. In all cases, generators have only been permitted to sell their power generated to KEPCO. New amendments in February 1999 will allow generators to supply power directly to customers such as a neighbouring factory and have eased entry requirements for firms.

KEPCO has the only license to transmit and distribute electricity in Korea. The amendments to the Electricity Business Act in early 1999 also created a license for specialised electricity business operators who will be permitted to develop a distribution and retail business and to have open access to KEPCO's transmission and distribution system.

#### *Access*

Until 1999, only KEPCO was legally able to use KEPCO's transmission lines. The 1999 amendments to the Electricity Business Act permit a specialised electricity business operator to transmit energy it generates to the retail customers it serves using KEPCO's transmission system and the operator's own distribution lines. None have yet been established.

KEPCO has an obligation to supply electricity to consumers. Generators selling power to KEPCO also have an obligation to supply KEPCO *i.e.*, they cannot refuse to supply KEPCO without just cause. Specialised electricity business operators also have an obligation to supply, which in practice would mean they would require a contract with KEPCO for backup power.

#### *Economic regulation*

The Electricity Business Act makes the Ministry of Commerce, Industry and Energy (MOCIE) primarily responsible for the economic regulation of the electricity sector. The Act requires that KEPCO submit its rate recommendations to MOCIE who will, after consultation with the Ministry of Finance and Economy (and if necessary the Cabinet and President), determine the final rate change to be allowed. The Act specifies that the rates must cover costs and allow a fair rate of return on capital. This cost is divided into a debt component and an equity component. The fair rate on debt is defined as the anticipated cost of KEPCO's long-term debt<sup>3</sup>, which was 11.0% in January 1999. The fair rate of return on equity is defined as equal to the interest rate payable banks in Korea on one-year time deposits, which in turn is set by Korean banking law and regulation, which was 8.8% in January 1999. Other factors also enter into setting overall rate levels, including consumer welfare, projected capital requirements, the effect of electricity prices on inflation, and the effect of rates on demand for electricity. The low rate of return on equity is reflected lower dividends paid to government shares in KEPCO rather than privately owned shares.

Unlike some jurisdictions, rate regulation does not take into account the reasonableness of operating expenses. However, the KEPCO Act states that the Minister of MOCIE "shall instruct and supervise the business of the corporation" in effect giving the Minister control over KEPCO's budget and operating decisions. In effect, the reasonableness of the expenditures is determined directly by the government through its instruction and supervision, and through its annual performance review which is published by the government.

KEPCO is also responsible for the long-term power development plan, which sets out facilities to be developed by KEPCO and the amount of capacity and energy to be procured from independent power producers. MOCIE also approves the terms and conditions of contracts between KEPCO and independent power producers.

### *Role of the competition authority*

The Fair Trade Commission has jurisdiction to apply the Monopoly Regulation and Fair Trade Act to activities in electricity sector. Competition legislation makes abuse of market dominant position, unfair trade practices and other unfair business practises are illegal in the electricity sector, as in other sectors. The competition law does not apply to conduct that is authorised by other regulation; thus, the application of competition law is limited because the Ministry of Commerce, Industry and Energy regulates KEPCO. Nevertheless, other unregulated aspects of KEPCO's business activities do fall under the competition law. For example, the Fair Trade Commission fined KEPCO in early 1999 for unfairly favouring its own subsidiaries in awarding contracts by tender. Furthermore, the Monopoly Regulation and Fair Practices Act requires that government agencies, including regulatory bodies, consult with the FTC on policies affecting competition.

### **3.3. Governance of KEPCO**

The relationship between the government and KEPCO is articulated through the KEPCO Act, the Government-Invested Enterprises Management Basic Act, the Electricity Business Act and KEPCO's articles of incorporation. The KEPCO Act requires the government to hold at least 51% of KEPCO's shares. The government is therefore able to control KEPCO using several instruments including the following:

- Appointment of the President of the Corporation (by the President, on the advice of an independent committee).
- Appointment of all members of the board of directors (by the MOCIE Minister and the Minister of the Planning and Budget Ministry).
- Budget directives for KEPCO with which KEPCO management must comply.
- Guidelines for accounting and procurement contracts.
- Approval of rates.
- Approval of investment plans and construction plans.

Government control over KEPCO continues to have an impact on how KEPCO conducts its business. Examples include:

- **Support for job creation programmes:** KEPCO has provided both financial and policy support for the government's job creation programmes. As part of the government's policy measures for job creation, KEPCO increased its capital spending by won 1 trillion in 1999 and has hired more workers, even though it has just gone through a restructuring intended to improve efficiency by cutting 3 765 jobs. In addition KEPCO contributed won 46.5 billion to the government's unemployment fund.

- **Relationship with North Korea:** KEPCO plays an active role in developing economic co-operation between the Korean government and North Korea. The KEDO nuclear power project, in which North Korea will be given two 1000 MW nuclear power plants under favourable financing terms, will have KEPCO as the chief contractor. KEPCO has also been involved in discussions on the possible development of coal-fired power plants in North Korea. KEPCO has stated it will be upgrading transmission capability near the North Korean border in order to facilitate reconnection of the power systems for possible future sales of electricity to North Korea.
- **Favourable rates for certain customer groups:** Electricity rates for agricultural customers are kept well below costs of service by a cross subsidy. According to KEPCO, electricity rates for industry have been made lower to encourage growth in the industry sector, whereas those in the commercial sector have been increased “to dampen the growth of the commercial sector”.
- **Low rates of return on equity:** KEPCO’s actual returns on equity have been below the cost of debt, and well below the return on equity of unregulated firms. Furthermore, rate increases in recent years had been insufficient to generate actual returns on invested capital as high as the rate of return assumed for the purpose of rate approvals.
- **Lower dividends:** The government takes a lower dividend payment or no payment at all than the common shareholders. KEPCO is, however, fully subject to corporate income taxes and other corporate taxes.

KEPCO’s performance is rated by the government against other government-invested enterprises in an annual performance review, which is published. KEPCO has been the top-rated government enterprise overall in this review, which takes into account such factors as financial standing, productivity improvements and compliance with government policy.

While KEPCO is majority government-owned, it has had private sector shareholders since 1989. Private investment in KEPCO has been very important both for it and for the Korean financial markets. As of April 1999, KEPCO shares accounted for 13% of the Korean stock exchange market capitalisation. KEPCO’s shares are distributed among the government (57.2% including the Korea Development Bank), 5% each for two Korean banks, and approximately 31% held by the public. No public shareholder is allowed to control more than 3% of shares.

Private shareholders have not had a significant role to play in the oversight of KEPCO despite the size of their shareholding. They have no representatives on the KEPCO board. Their scope for intervention at the annual general meeting of shareholders is limited, as they are not able to bring forward any resolutions except for those on the agenda, for which they are not consulted.

The government has been making efforts to improve corporate governance of the government-invested enterprises through recent amendments to the Basic Act on the Management of Government-Invested Enterprises. The amendments have taken steps to ensure greater transparency in both the selection of senior executive officers of the corporation, and in making publicly available financial information from both current and previous years. Investigation by the Board of Audit and Inspection has also served to identify areas of oversight (Korea Herald, 5 November 1999).

### 3.4. Siting

There is substantial legislation related to the siting of power plants. The Act on Special Cases Concerning Electricity Source Development (ASCESD) and the Act on Assistance to Electric Power Plants – Neighbouring Areas (AAEPPNA) were enacted to try and expedite the approval of new power plants. The concern about expediting construction is understandable given the rate of growth of demand and the time required developing new power plants (see Table 8).

Table 8. **Timelines for approvals and construction of power plants in Korea (months)**

Type	Feasibility	Approvals	Preparation for construction*	Pre-construction Total	Construction	TOTAL
Nuclear (LWR)	12	20	57	89	66	155
Coal (800 MW)	12	20	46	78	44	122
Pumped Storage	12	20	49	81	52	133
LNG	12	20	40	72	30	102

\* Includes tendering of main contracts and site preparation.

Source: Ministry of Commerce and Energy.

The ASCCESD streamlines the approval process by having MOCIE act as co-ordinator to consult with 11 other ministries of the government. The AAEPPNA is designed to promote acceptance of new KEPCO power plants by creating a fund that is used for various types of assistance in the area within 5 kilometres from the power plant. Eligible uses of the funds include public facilities, aid in paying electricity bills, welfare assistance, and business development. KEPCO must contribute to the fund at a level equal to 1.12% of its annual turnover.

The contribution assistance may well become even more important as local authorities have now been given the ability to block new plant construction under the Local Authority Act. One local authority recently blocked a coal-fired independent power project proposed by the steel maker POSCO. Independent power projects do not contribute or have access to the fund to promote acceptance of new power plants.

The need for local approval of power plants might also appear to be a barrier to the long-term development of nuclear power, over which there is a great deal of public concern. However, of the 10 nuclear plants currently under development, 9 have obtained local government approval.

## 4. PROPOSED REFORMS

### 4.1. *The basic plan for restructuring of the electricity supply industry*

Korea proposes to reform its electricity sector to increase economic efficiency through the introduction of effective competition, while increasing customer choice and quality of service and ensuring a reliable electricity supply. government opted for a phased approach. The government plans to restructure KEPCO, so as to create an industry structure more favourable for the development of effective competition, and to further privatise KEPCO, in phases. Transmission and distribution will be regulated, according to the plan, by an independent regulator. Tariffs for captive consumers will not be regulated. Entry into generation is expected to be liberalised. In June 1997, the government formed the Electricity Industry Restructuring Committee of industry representatives and experts to draw up a plan for restructuring the electricity supply industry. This commitment to restructure before complete privatisation was reiterated in the government's announcement in July 1998 of its plan to privatise state-owned enterprises, including KEPCO.

The Basic Plan for Restructuring of the Electricity Supply Industry was adopted by the government and published in early 1999. The plan is now in the early part of the implementation of Phase 1, and the government and KEPCO have jointly hired consultants to assist them in designing the detailed legal, regulatory, financial and technical changes required. Legislation was introduced in September 1999 but has not yet been considered by the full Assembly. The legislation proposes to revise the Electricity Business Act to set up a power exchange, establish an electricity commission within MOCIE and deal with “public purpose programmes” as well a special law to create the new firms, including five new non-nuclear generating firms, and deal with the transfer of assets, license and contracts (including labour agreements). KEPCO has already completed an internal reorganisation in accordance with the government’s plan. A Privatisation Research team of 18 experts from universities, research institutes, business and citizens groups has been organised to review various privatisation-related issues including the governance of the new corporations, methods of sale of the firms, impact of the restructuring and privatisation on employment. The team is also examining whether there should be any restrictions on ownership by foreign investors or by existing domestic conglomerates (*chaebol*). It is scheduled to report in May 2000.

The process will proceed in four phases. Phase 1 (Current System) goes to the end of 1999. Phase 2 (Power Generation Competition) goes to the end of 2002. Phase 3 (Wholesale Competition Phase) goes to 2009. Phase 4 (Retail Competition) is for beyond 2009. The highlights of the plan are:

- KEPCO non-nuclear generation will be broken up into 5 wholly-owned generating subsidiaries. The intention had been to privatise one of them in late 1999, which did not take place, and the rest by the end of Phase 2 (2002). The government has not decided whether the companies will be privatised entirely or partially. Two combined heat and power plants that provide district heating in Anyang and Buchon had been planned to be privatised in 1999, but this did not take place.
- KEPCO nuclear capacity will be separated from KEPCO into a new wholly owned nuclear generating subsidiary.
- Distribution assets of KEPCO will be divided up into a number of wholly-owned subsidiaries by 2001 and privatised, at least partially, by 2002.
- An independent regulator to monitor the market and regulate transmission and distribution pricing, a component of tariffs paid by users, is to be created within two years.
- A generators' pool with dispatch based on fuel costs will be created by 2000. This will be succeeded by a bid-based electricity market by mid 2001.
- A multi-phase programme to introduce customer choice with the largest customers to go first, beginning in 2001, and most other customers following beginning in the year 2009.

An issue by issue summary of the plan is described in Table 9 and is detailed in the following sections.

Table 9. Planned evolution of Korean electricity sector

Issue	Status mid-1999	Phase 2 (2000-2002)	Phase 3 (2003-2009) /Phase 4 (2009-)
Separation and structural reform	KEPCO as a vertically integrated utility (generation, transmission, distribution) with 5.5% of power purchased from IPPs.	KEPCO generation restructured into:  5 nonnuclear generating subsidiaries and then partially or entirely sold off.  Separate public nuclear company  Distribution subsidiaries created to distribute power to captive customers.	Distribution subsidiaries privatised.  KEPCO is principally transmission and nuclear power business (depending on the scale of the sale of the generating and distribution subsidiaries).
Liberalisation of retail supply	All customers supplied by KEPCO.	Large customers (to be defined) liberalised in 2001. Captive customer supplied by distribution subsidiaries.	Independent brokers of electricity will be permitted in Phase 3. In Phase 4, retail supply to be gradually liberalised to all customers.
Network access and entry/exit.	No third party access in practice. Entry and exit controlled by license.	Regulated non-discriminatory terms of access to the grid to generators and eligible consumers based on postage-stamp tariffs. Entry and exit controlled by license.	As in phase 2.
Electricity market	Dispatch by KEPCO based on fuelling cost, transmission constraints, take-or-pay IPP contracts and obligation to use LNG and domestic coal. Some interruptible power contracts.	Cost-based dispatch by electricity market operator independent of KEPCO based on fuel cost take-or-pay IPP contracts and obligation to use LNG and domestic coal. Generators receive marginal fuel cost plus capacity payment based on capacity value of proxy peaking plant.	Bid-based generator pool commences in step 3. Expected to be based on UK/Australia "mandatory" pool design.
Competition in generation	IPP sells power to KEPCO. Favourable rates for autoproducers. New contracts for about 10% of new capacity required.	IPP under contract remain a KEPCO obligation but have option to forego contract and sell directly to pool. (Durations of IPP contracts are 20-26 years.) New IPP compete with generation companies to sell power to liberalised customers.	New IPP compete with generation companies to sell power to liberalised customers under contract or through market.
Economic regulation	MOCIE regulation of retail prices through rate of return regulation	"Electricity Commission" within MOCIE to act as interim regulator and help design independent regulator and review need for legislative changes. MOCIE	Electricity Supervisory Board is established as regulator of network prices and terms and

		<p>continues to approve prices. Possible moves to price cap regulation are, in April 2000, under study.</p> <p>FTC continues to have role in policing unfair business practises in electricity sector.</p>	conditions of access.
Security of supply/diversity	KEPCO has obligation to serve customers and plan new supply. Government policies require use of domestic coal, LNG, combined heat and power (CHP) and support for nuclear power.	Distribution subsidiaries have obligation to serve their customers. Generation companies must file expansion plan with government who will co-ordinate. Nuclear power objectives met through public nuclear company. LNG and domestic coal obligations remain. Public purpose programme levy on electricity consumers will cover costs associated with domestic coal, LNG, CHP, and renewables.	LNG purchased on market once contract obligation expires in 2006.
Renewable energy	Government support for renewable energy through subsidies, low-interest loans and tax reductions. KEPCO has obligation to purchase.	<p>Government funding continues.</p> <p>KEPCO plans to construct new renewable power sources. Renewables are “must run” generators in pool. Consumer support for renewables through public purpose programme levy.</p>	As in Phase 2.
Public service obligations	Postage stamp pricing. Agricultural and industrial customers benefit from prices below costs.	Eligible industry customers purchase power under contract from generators or from the market. Agriculture subsidy support by electricity customers.	<p>Regional distributors will charge different prices.</p> <p>Government takes over responsibility for agriculture subsidy.</p>
Stranded cost recovery	Not applicable.	Sale of generation assets will help quantify stranded costs from non-nuclear generation. KEPCO continues to recover excess IPP costs from customers.	Not defined.

#### 4.2. Restructuring of KEPCO

KEPCO's non-nuclear generating assets are being divided into 5 wholly owned subsidiaries (Figure 14). The current plan is to divide the companies relatively equally with each company having a similar mix of generating capacity by fuel type and by location. The number of companies was determined in part by the need for minimum efficient scale of each company balanced against risks of possible collusion if too few companies are created. The government has stated it will sell one company shortly after the subsidiaries are created and the rest by the end of 2002. However, the government has not stated how great a share of the subsidiaries will be sold.

Figure 14. Restructuring of KEPCO (Phase 2)

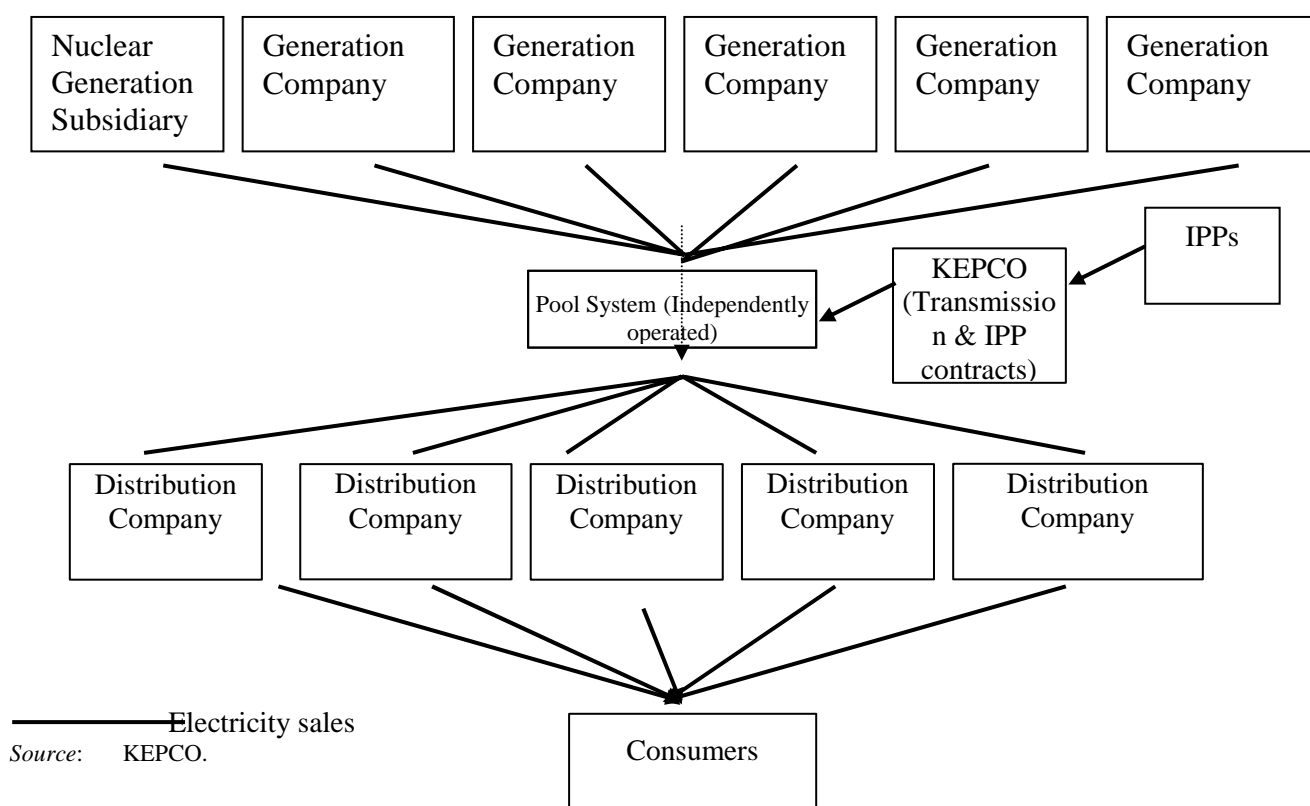


Table 10. Electricity sales

	Company 1	Company 2	Company 3	Company 4	Company 5	Nuclear
Capacity (MW)	7 700	7 738	7 946	7 710	7 500	17 716
# of plants	7	7	8	8	8	7

Note: These figures include plants to be constructed by 2006. These figures are preliminary and subject to confirmation.  
Source: Ministry of Commerce and Energy.



The nuclear company will be, according to the Plan, government-owned and a separate wholly-owned subsidiary of KEPCO. There are no plans for privatisation of this subsidiary.

Within the next two years, the distribution subsidiaries are to be created, under the Plan. The number of companies has not been determined. Factors that will determine the number of companies will include, the objective of creating a sufficient number of retail suppliers to compete with one another once the market is opened, and providing a sufficient number of distributors to form the basis for a comparative assessment of the efficiency of companies that remain regulated. The government has also identified a potential difficulty with the new distribution companies having very different costs leading to different tariffs and will consider creating companies with similar costs so as to minimise changes. The distribution companies will be gradually privatised during Phase 3, but by April 2000 a decision on the extent of privatisation had not been announced. Distribution companies will not be permitted to own generating assets.

KEPCO itself is planned to be a transmission company (nuclear generation will be separated from KEPCO as a subsidiary), and will also retain responsibility for honouring the IPP contracts. Depending on the degree of privatisation of the generating and distribution subsidiaries, it may retain interests in those activities, as well.

The interests of both current shareholders and bondholders in KEPCO will influence these structural reforms. One concern, that certain of KEPCO's bonds are callable if a significant portion of the company is privatised, has been resolved. The government has announced that KEPCO will retain responsibility from all borrowing for offshore creditors, with a certain proportion of KEPCO's domestic borrowing being allocated to the subsidiaries. Proceeds from asset sales will go toward debt reduction. Furthermore, private shareholders will be concerned that the liberalisation of the electricity sector, the separation of the nuclear assets into a new company, and the sale of the non-nuclear generating assets is appropriately compensated. This may influence to what degree the generating assets become separated from KEPCO. Further, Korean law requires that shareholders can require KEPCO to repurchase shares from dissatisfied minority shareholders.

#### **4.3. *Liberalisation of retail supply***

The Basic Plan states that some large consumers, yet to be defined, will be able to purchase electricity directly from the generators at the end of the year 2000. All captive customers will be served by their monopoly distributor. There will be an enlargement of the number of eligible consumers to an unspecified degree in Phase 3. All customers will become eligible during Phase 4, which begins in 2009. At that stage, the supply businesses of the distributors can, according to the Plan, compete with each other, with new independent retail electricity agents, brokers or marketers, or with consumer co-operatives to sell electricity to retail customers.

#### **4.4. *Access and entry***

##### *Access to Networks*

A regulated third-party access system for transmission will be put in place, according to the Basic Plan, to facilitate electricity trade between generators and eligible consumers beginning in 2001. Terms and conditions of access are to be nondiscriminatory. The opening of the distribution systems will not take place until phase 4.

## Entry

Legal requirements for entry into generation will be eased so that companies wishing to invest in generation and able to comply with the technical and environmental requirements will be able to do so, provided they are able to obtain local permission to build power plants. The design of the power market may impose additional technical or financial requirements on new entrants.

Entry into the distribution of electricity is already permitted by amendments passed early in 1999, although none have entered. However, the government intends to retain KEPCO as the only transmission company in Korea. Entry into retail supply business will be possible in Phase 3 (*i.e.*, 2003). Liberalised consumers will have the option to purchase directly from generators, the market or the independent brokers.

### 4.5. Regulatory institutions

The Basic Plan calls for the creation of an independent regulator, the Electricity Supervisory Board (ESB), to be in charge of the regulation of the transmission and distribution networks, and to monitor the contestable parts of the electricity sector by 2002.

The Basic Plan calls for the new body to be set up on a more gradual schedule than the restructuring of KEPCO. An Electricity Commission within MOCIE will be established immediately after passage of the bill that approves the privatisation plan to act as an interim regulator. The Electricity Commission will have 9 commissioners and a secretariat of approximately 50 staff. It will be responsible for regulating unfair practises, protecting consumers and resolving disputes among generators, distributors, consumers etc. It will also identify changes to laws and regulations that need to be made to create the independent network regulator, the ESB, to be in place by the time the price-based bidding pool starts (by 2002).

The government is planning to introduce the legislation to create the independent network regulator in 2000. It is envisaged that the regulator's powers and duties will include regulating network tariffs, and making recommendations to the Minister of Commerce, Industry and Energy on price and access regulation of monopoly network activities, and the monitoring of the contestable parts of the electricity sector, including the operation of the electricity market. The ESB, according to current plans, is expected to carry out its business in a transparent manner so as be accountable to electricity market participants and to consumers for its decisions. It is also to have a consumer advocacy role. To ensure its independence and transparency of operation, a model for the ESB similar to that of the Fair Trade Commission is being considered (see Box 1). A key issue is whether the electricity institution would report through MOCIE or directly to the Prime Minister's Office.

#### Box 1. Independence and transparency of the Fair Trade Commission

The Monopoly Regulation and Fair Trade Act outlines several measures to assure the independence and transparency of the Fair Trade Commission (FTC):

- The FTC reports directly to the Prime Minister's Office.
- The FTC Commissioners are appointed by the President for fixed terms and cannot easily be removed.
- The FTC conducts its hearings in public.
- All decisions of the FTC must be published.

There is a potential for overlap between the duties of the sector regulator and that of the FTC. This problem has been recognised and the current intent is to give the sector regulator the lead role in policing anticompetitive behaviour in the electricity sector, with the possibility of referring particular cases for review by the FTC. The competition law currently requires administrative agencies (such as the telecoms regulator) to consult in advance with the FTC when they wish to enact laws or measures which have a restriction on competition. Thus the sector regulator would be obliged to consult in advance on such issues as decision of tariffs and terms of transaction, limitation on market entry or business activities. It also should consult with the FTC before deciding whether to grant an approval or take any measures in connection with anti-competitive practices of businesses or their associations.

The regulatory approach for setting tariffs has not been disclosed. The regulator should look at incentive-based regulation, such as price caps. This regulatory approach, increasingly common in other countries, is being considered by Korea's telecommunications regulator. Regulation of distribution will be aided by the creation of multiple distribution companies. The regulator will be able to compare the performance of the different companies and use the performance of the more efficient firms as a yardstick.

#### **4.6. *Development of the market and competition in generation***

##### *Market Operation*

Once the generating subsidiaries have been created, the government intends to commence with a cost-based power market in order to create a degree of competition between the generating companies. A power exchange, not yet in operation in April 2000, is intended to be independent of KEPCO and act as market and system operator, and will also manage metering and settlements. It is a "mandatory" pool, *i.e.*, all units over 20 MW must be centrally dispatched. Renewable energy generators will have the status of "must run" facilities. Prices in the market will be based on costs, with a capacity payment based on a proxy peaking plant.

##### **Box 2. The Chilean power market**

The Chilean Central Interconnected System (SIC) uses a system operator that dispatches power plants in order of verified variable (principally fuel) cost balanced against transmission constraints. Liberalised customers are free to negotiate their power prices directly with generators. The price paid by distributors for electricity includes the marginal energy price, a capacity charge based on the cost of proxy peaking power plant, transmission losses and the cost of reserve power. The regulated price must be within 10% of the prices freely agreed by liberalised customers.

The government's latest plan is to introduce the price-bidding pool by 2002. The design of the pool is currently under development, but appears to be following the "mandatory" pool model originally established in the UK and now used in Australia. The current intention is for administration and oversight of the pool to be done through a pool management committee involving the market participants and the regulator. The sector regulator will be involved in ensuring the rules for operation of the market are consistent with fair competition.

##### *Competition in Generation*

During Phase 2, the generating subsidiaries will engage in cost-based bidding system that will feed into dispatch decisions. IPPs will have the option of ending their long-term contracts, which have durations ranging from 20 to 26 years, with KEPCO and selling power directly on the market. However, few IPPs are actually expected to take up this offer because long-term contract prices are expected to be higher than market prices.

During Phase 3, the privatised generating companies and new entrants will supply liberalised customers, the distribution subsidiaries of KEPCO, independent brokers or the bid-based market directly. Existing IPPs are expected to continue under their existing long-term supply contracts to KEPCO.

#### **4.7. Public service obligations**

The government notes that KEPCO fulfils several non-commercial functions such as supplying electricity to agricultural and fishing consumers and to remote areas below cost. The government has stated that these subsidised rates will continue. The subsidy for “public purpose programmes” will be funded by other electricity consumers, while other subsidies will be paid by the government out of general tax revenue.

The government also acknowledges the role of KEPCO in providing a support subsidy for LNG, domestic coal, renewables and nuclear power (the latter through required support for research and development), and states that support from the power sector will be needed for some time until these industries can operate without such support. The government has proposed revisions to the electricity business law to create a “public purpose programme” levy on consumers to support the domestic coal, renewables, demand management programmes and the stranded costs arising from LNG contracts and contracts for combined heat and power plants.

### **5. CRITIQUE**

Korea is planning a radical reform of its electricity sector. The primary purpose of the reform is to improve economic efficiency of the sector by introducing competition. This will also improve Korea’s international competitiveness. Other purposes are to offer greater consumer choice and a higher quality of service and to ensure a long-term, inexpensive and stable electricity supply. Many aspects of the plan, if carried out, would greatly boost Korea towards these goals.

A fundamental element of an effective reform is putting into place a competitive structure of the industry before privatisation. A second fundamental element of reform is the establishment of a regulator, independent of the industry and of day-to-day political pressures, but sufficiently endowed with technical resources, transparent procedures, and requirements for accountability to the public, industry, and government. The third element is the basic regulation of the sector, in terms of environment, economics, safety, and security of supply. Korea has a strong competition law and enforcement agency, but there remains substantial work to be done in designing electricity regulation both to protect consumers and independent generators from abusively high prices or unfair terms and to provide incentives for monopolies to behave efficiently. Similarly, reform of the sector opens up new ways to use regulation to efficiently achieve environmental and safety objectives. The last main element is facilitating the transition to competition, for example providing for KEPCO employees made redundant as successor companies pay greater attention to costs, clarifying the role of long-term contracts, and educating consumers about their new rights and duties.

Few irreversible decisions or actions have been made to date, so it is inappropriate to try to predict the outcome of the reform. Some key design features, *e.g.*, the timetable for liberalisation of consumers, the degree of privatisation of generating and distribution subsidiaries, and the design of the independent regulator, are still being debated within government. Two key milestones, the privatisation of the Anyang and Buchon plants, and the privatisation of the first KEPCO generation subsidiary, both scheduled for 1999, have been missed. It is important that the reform be made as concrete as possible, thus limiting discretion in the implementation of the policy, so that the stated policy goals formulated by policymakers are more closely met.

### **5.1. Structural reform of KEPCO**

The Basic Plan recognises the importance of structural reform of the Korean electricity sector in order to create conditions for workable competition, non-discrimination, and the attraction of new private investment in the power sector. The Plan proposes to divide KEPCO's generation and distribution assets, and to privatise them at least partly. If full privatisation of the several non-nuclear generation and distribution/supply companies to distinct owners were carried out, then this should create workable competition and reduce the ability as well as the incentive for KEPCO to discriminate in favour of its own businesses. The reduction of the threat of discrimination increases the attractiveness of private investment in the sector.

Further attention is needed to three aspects of the structural reform. The first is to ensure that KEPCO's structural reform ensures workable competition. The second is that the structural separation will be effective in preventing discrimination in the use of the transmission system. Creation of a market and system operator independent of KEPCO would be a positive step in this regard. The third is the size of the nuclear company and the constraints it places on market design.

The creation of a structure to enable workable competition is an important part of reform. In generation, this means that there must be an adequate number of independent competitive firms. At the same time, each daughter firm should exceed minimum efficient scale. Since generating firms repeatedly face each other, thus deepening their information about each others' strategies, the number of independent companies needed to reach workable competition would, in principle, be greater than the number required for other markets where contact is less frequent. Such has been the experience in the England and Wales pool. Further, since electricity is differentiated both as regards physical location and "location" on the load curve, where feasible the allocation of generating assets should seek to create competition at all locations and along the load curve. While the government's plan to create five non-nuclear generating firms of at least 7 GW each may meet these criteria, there may need to be further structural solutions if generators engage in collusive behaviour.

The possible incompleteness of separation of the non-nuclear generating companies and of the distribution companies is cause for concern. In order to provide incentives for the generators to compete, they must have different owners. This implies, in particular, that if KEPCO, through its holding company, continues to own more than the nuclear generator, then these jointly owned generators would not compete. Their common owner, KEPCO, would find it more valuable to co-ordinate their strategies in the marketplace. Electricity buyers would face a monopoly seller. A similar argument holds for the distribution companies: If they do not have independent and separate ownership and management, then they would not have incentives to seek lower cost electricity supply.

The existing IPPs could immediately transform into additional competitors to the KEPCO successor generating companies, but are prevented from doing so by long-term contracts to supply KEPCO. Similar transition issues have been faced in other countries. Some jurisdictions have arranged that some part of the value of the contracts would be paid by all electricity consumers and that the contracts would end.

If KEPCO retained common ownership of generation, transmission and distribution, then it would have incentives to discriminate against competitors such as IPPs and independent suppliers that are not vertically integrated. Creating a separate independent market and system operator, as called for in the Basic Plan, would help reduce the ability of KEPCO to discriminate in favour of its own facilities. Governance of this entity would be very important and should include the market participants. To facilitate this, the design of the bid-based electricity market should be done with the participation of all major market participants, including large and small users as well as KEPCO and its successors. This design approach should lead to an improved market design and better-educated market users. This in turn would increase confidence and reduce investor uncertainty regarding the fairness of the operation of the market.

KEPCO's generation assets may also have financial advantages that could discourage competition. One concern that these assets, which are intended to compete, may be cross-subsidised by KEPCO's transmission business, which will be subject to rate of return regulation. Cross-subsidy would discourage entry and competition. Careful oversight of the operation of KEPCO's transmission business by the regulator will be necessary to ensure this does not occur.

For the nonnuclear generating businesses, the simplest way to avoid the problems of dampened competition, discrimination, and cross-subsidy is for KEPCO to sell all shares, in all the subsidiaries, in such a way that companies that will compete will not have significant common owners. The disposal of all its shareholding of each of the generating and distribution companies would remove the incentive for KEPCO to discriminate in their favour. The government should require KEPCO to dispose of the remaining shares in a fixed timeframe. The same economic argument follows for the nuclear generating business, albeit less strongly due to the "must-run" nature of the technology, but the government has decided that nuclear generation will remain state-owned.

When attention is turned to the creation of distribution/supply companies, minimum efficient scale, future competition and ease of regulation should be foremost in the design considerations. Other countries, such as Denmark, have viable distribution/supply companies at quite small scale. Firms created at this earlier stage of reform would have a several year head start on other competitors in establishing brand names and reputations with consumers. Hence, it is important to not unduly limit their number. The greater constraint is likely to be creating a sufficient number of comparable firms that the chosen form of regulation works well. For example, if too few distribution/supply companies are created, then yardstick regulation cannot be used. The objective of geographically uniform prices does not require large distribution/supply firms but can be achieved through explicit cross-subsidy.

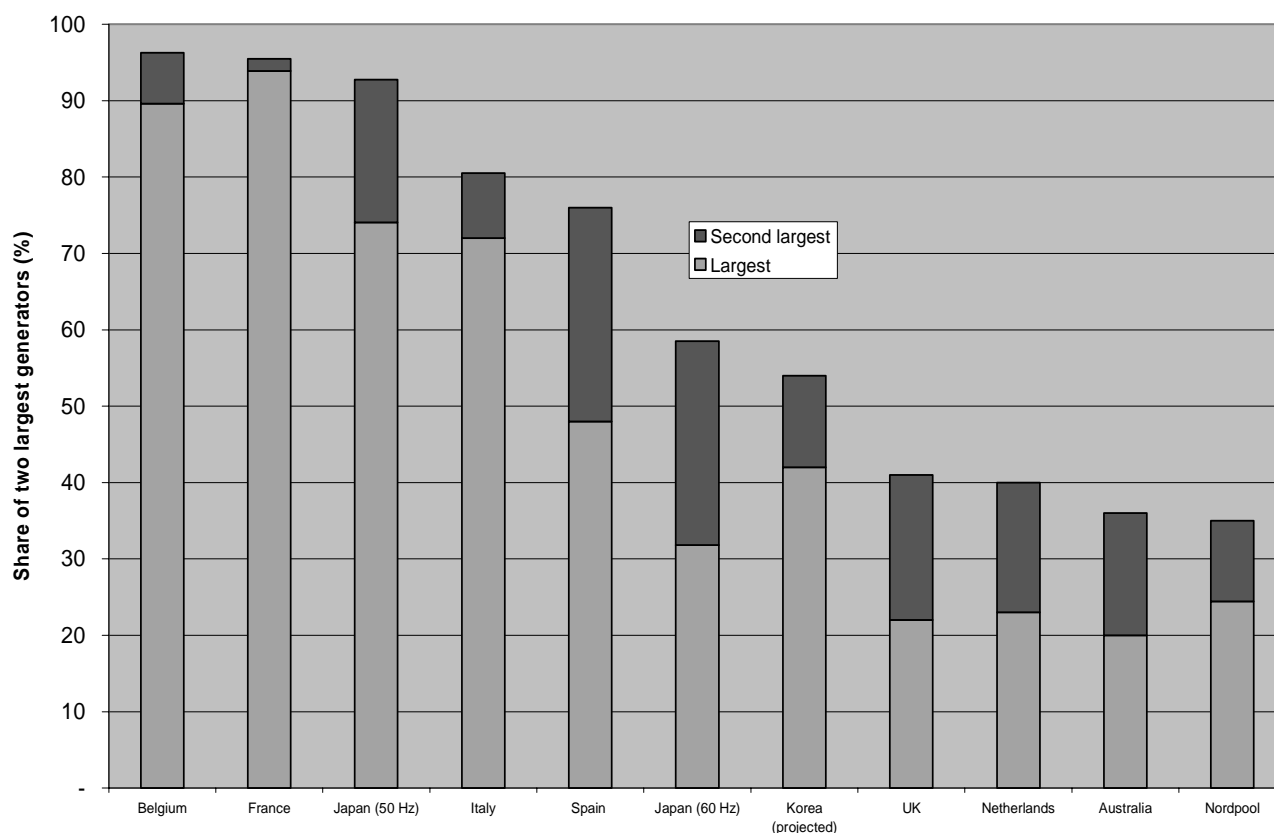
The vagueness in the privatisation plans remains a concern. The political resistance to the privatisation plans and the resulting delays in the passage of necessary legislation, the delay in the privatisation of the first generating company, and the difference of view between the government and the highest bidders as to the value of the Anyang and Buchon CHP plants, suggest that carrying through on the privatisation plans may be difficult.

Competitive neutrality is also a concern. Where competing privately owned and state owned companies receive different treatment, due to the difference in ownership, that results in different costs, then there is competitive non-neutrality and higher overall cost to the economy. There are at least three ways in which competitive neutrality can be undermined. First, KEPCO, by providing below-market returns on equity to the state, has lowered its cost of capital below that of private companies. KEPCO, as a publicly owned firm, may continue to operate generating assets at lower rate of profit than its private competitors. This will of course be a concern for private generators wishing to compete for baseload capacity against the nuclear generation subsidiary. However, if privatisation of all non-nuclear generators does not proceed, it will also be a concern for competition in meeting mid and peak demand. Second, there is a conflict in the roles of regulator and owner. Where the government is a regulator then it seeks its regulatory objective, in this case economic efficiency through competition, and where it is an owner it seeks a different goal of maximising the profits of its own assets, which can come at the expense of private competitors. Third, and operating to the benefit of private firms, state-owned firms may come under greater pressure to take non-commercial actions to support other government policies. Thus, it will be important that all potential sources of unequal treatment between state-owned and privately-owned competing firms be reviewed to ensure competitive neutrality.

The relationship between KEPCO and its nuclear power business will require special attention. The government's decision, under the Basic Plan, to create a single nuclear company providing 42% of the electricity in Korea could prove operationally advantageous, but means that the market will be more

concentrated than some other OECD countries (Figure 15). As the predominant baseload power generator, there is less concern that the nuclear business will be able to manipulate prices in the market during peak hours despite its large market share, provided that the company remains only in nuclear generation and its market share is does not get much greater. However, in off-peak hours, when the nuclear generator will be contributing the largest share of energy generated, it may be in a position to set prices. One possible solution is for the nuclear generator and distributors to enter into a contract to cover some portion of the nuclear company's production so as to reduce the incentive for the company to try and influence prices. Such an arrangement should be designed to provide incentives for the nuclear subsidiary to improve its efficiency.

Figure 15. Market share of two largest generators in selected OECD countries



Notes: 1998 data. UK market England and Wales only. Japanese markets divided according to frequency at which power is transmitted. Australia includes Victoria, New South Wales, ACT, and South Australia.  
Source: IEA and company annual reports.

There is also a potential concern that the presence of this single large baseload generator may constrain the electricity market design. Given that nuclear power will provide much of the baseload electricity for at least the next several years, the nonnuclear companies will be competing mainly for midload and peakload sales. As a result, no generator will have the full portfolio of assets needed to compete effectively along all parts of the load curve. This will necessarily influence the type of market that is likely to be successful for Korea.

Over time, this constraint could become less binding as the privatised generators and new entrants construct their own baseload capacity. However, this will depend on the cost-competitiveness of nuclear power and other government policies with respect to nuclear power.

Overall, Korea is to be commended for facing the difficult decision to provide the electricity sector with a structure that promotes competition. The details remain to be worked out, and irreversible actions have yet to be taken. It will be important for the success of the reforms that the Korean government follow-through promptly with these needed structural changes.

## **5.2. *Corporate governance of KEPCO and successor companies***

The government has used its control over KEPCO to use KEPCO as a policy tool to achieve government policy objectives in such diverse areas as job creation, support for fuel diversification, the relationship with North Korea and maintaining low prices to certain customer groups.

While the Basic Plan recognises the need to eliminate some parts of KEPCO's policy mandate, little has been said on how the governance of KEPCO will change as a result. The issue is being investigated by the government's Privatisation Research team. The government's control over KEPCO is extensive and needs to be reformed to reflect the company's commercial mandate and the commercial mandates of any successor companies remaining under KEPCO's ownership.

A basic reform would to give the minority shareholders of KEPCO a greater role in the oversight of the company. At present, even though non-governmental shareholders own 43% of the equity, they have virtually no say in the operation of the company and appoint no board members. The corporate governance of KEPCO must be changed so that its relationship with the state becomes more arms length. In particular, applying the new private sector corporate governance principles to KEPCO in such a way that minority shareholders have significant say in the operation of the company and appoint some board members and outside directors, should lead to better corporate performance.

A second basic reform is to ensure that KEPCO's board of directors make major commercial decisions without direct government intervention. Thus, KEPCO board of directors should be free to decide the appropriate investment strategy and be able manage the size of its workforce without direction from the government, and should not be required to support government initiatives in this regard any more than a private firm.

Finally, corporate governance must ensure that generation and transmission subsidiaries of KEPCO operate as independently as possible of each other to limit the ability of KEPCO to favour its own generating assets. Its generation and transmission subsidiaries should have separate boards of directors with no overlap of directors between the two boards and with each board having a large representation of independent directors.

## **5.3. *Regulatory institutions***

While Korea has a strong competition law and enforcement agency, substantial work remains to be done in designing electricity regulation both to protect consumers and independent generators from abusively high prices or unfair terms and to provide incentives for monopolies to behave efficiently. The government plans to create the Electricity Supervisory Board as an electricity sector regulator, charged with regulated transmission and distribution tariffs and access conditions, and modelling its independence on that of the Fair Trade Commission. This new institution is a welcome recognition that changing the structure of the electricity sector from monopoly to competitive markets requires a more sophisticated regulatory structure.

Changing the structure of a network-based industry such as electricity from monopoly to competitive markets requires a sophisticated regulatory structure. A market environment requires regulatory institutions whose decisions are competitively neutral, transparent, and not subject to day-to-day



political pressures. The new environment will increase the responsibilities of the regulator, particularly to ensure non-discriminatory access and economically rational pricing for system services. The competition authority and the regulator will need to prevent anti-competitive behaviour.

Other OECD countries have independent regulators, including Australia, Finland, Italy, the United Kingdom and the United States. Germany and New Zealand rely on the competition authority to regulate the electricity sector. While specific arrangements differ in each country, the main features of independent regulation are: complete independence from the regulated companies, a legal mandate that provides for separating the regulatory body from political control, a degree of organisational autonomy, and well defined obligations for transparency (*e.g.*, publishing decisions) and accountability (*e.g.*, appealable decisions, public scrutiny of expenditures).

In order to have fair and reasonably predictable decisions, the regulator must have analytical expertise and not rely on the expertise of the regulated utilities. The regulator must also be functionally separate from policy-making and electricity industry promotion functions in order to maintain a competitively neutral regulatory regime. To be seen to be fair, the regulator should have well-defined obligations for transparency, notably with respect to its decision-making processes and information on which the decisions are made. Further, the objectives of the regulator must be clearly stated, more specifically than, for example, “the public interest” and progress towards these objectives should be monitored. Finally, the powers of the regulator should be clearly stated. The combination of transparencies--of objectives, powers, processes, decisions, and information--gives the public clear performance criteria to evaluate the extent to which the regulator is fulfilling its role.

Independent regulation will help build the confidence of participants and potential investors in the Korean electricity sector that regulatory decisions will be fair, nondiscriminatory, reasonably predictable and not subject to day-to-day political pressures. Over time, the regulatory decisions made in this way can help build the credibility and legitimacy of the regulatory regime, encourage investment, and help reforms to progress.

One concern about sector-specific regulation in Korea is whether the sector ministry might have too large a role. This is a concern about the regulation of the telecommunications sector, as both the Ministry of Information and Communications (who is also the shareholder ministry for Korea Telecom) and the Korean Communications Commission are responsible. Given MOCIE’s policy and industry promotion responsibilities in the electricity sector, and its role as “owner” in voting the government’s shares in KEPCO, it will be important that MOCIE play no direct regulatory role. Under the present plan, the ESB will regulate only transmission and distribution tariffs, representing about one-quarter of total cost. The regulation, for captive consumers, of the other three-quarters of total cost, has not been specified. The creation of an independent regulator with broad authority, by divesting regulatory authority over tariffs charged captive consumers to the ESB, would improve the effectiveness of regulation and help eliminate the conflict between industry promotion functions and regulatory functions. In turn, this would also help eliminate regulatory inefficiencies due to a heavy-handed regulatory approach. In this context, it is important to define clearly the policy functions that will be retained by MOCIE from the regulatory functions of the new regulator.

The FTC or the Electricity Supervisory Board or both will need to prevent anticompetitive behaviour. The Electricity Supervisory Board must ensure consistency in its approach to competition issues to that of the FTC. The Monopoly Regulation and Fair Trade Act will require the sector regulator to consult with the FTC on competition issues in the electricity sector.

#### 5.4. *Economic regulation*

Establishing economic regulation that provides incentives to electricity companies to discover more efficient processes is a key part of reform in any country. This is especially true in Korea, where there is no tradition of independent regulation of this sector. But a second aspect is also important in light of the privatisation of at least some of the non-nuclear generating and distribution assets: The economic regulation, market rules and regulator must be established and be perceived to be stable by investors. Otherwise, the uncertainty would reduce the price received by the government for the assets.

##### Entry and exit

A key factor in the evolution of the electricity sector will be the entry of new companies. New generators would be able to constrain anticompetitive behaviour by the KEPCO successor companies. For example, in the United Kingdom it is believed that the threat of entry by gas-fired plants has limited the market price. In view of the importance of entry in competition, it will be important that the licensing and permitting regime for new generators be clear and impose neither excessive cost nor delays, while nevertheless meeting public policy objectives. Entry into the business of independent brokers and electricity retailer should, similarly, have a licensing and permitting regime that is not unnecessarily restrictive.

##### *Transmission access and pricing*

Access to the transmission system is planned to be regulated using postage-stamp pricing, where all customers pay the same rate regardless of differences in cost by location. This is a practice adopted in some countries during the transitional period of their reform. In the case of Korea, postage stamp pricing would mean that a company deciding where to locate a new factory will not consider the higher cost to the electricity system of locating that factory in the Seoul area rather than near large generation facilities. This loss of efficiency can be mitigated to a degree by charging prices for the use of the transmission system that vary by location to reflect differences in cost. In Korea, this would likely mean lower transmission rates for generators to locate in the Seoul region. Thus there would be an incentive to build more generating capacity in the Seoul region, reducing the need for new transmission.

However, in the longer term over which investment decisions--by generators, transmission companies, and users-- are implemented, it will become increasingly important that congestion be taken into account in the pricing regime by reflecting the different costs of service in congested and non-congested regions. Such pricing will ultimately influence consumer decision on where to locate as well as encourage consumers in congested areas to manage their electricity use to minimise the costs of congestion. Electricity markets in California and the PJM Interconnection in the mid-Atlantic states in the United States offer two different approaches to pricing congestion. California applies a zonal pricing regime under which, at times when there is congestion, a different price is determined in each zone where zones are separated by points of congestion. Over time, new zones are hived off from existing zones when intra-zonal congestion occurs sufficiently frequently. Nodal pricing, combined with tradeable transmission rights, is applied in the PJM Interconnection in the mid-Atlantic states in the United States. Under this regime, electricity prices are discovered at each of the about 2000 nodes, where the price at each node would be system marginal cost and price differences would reflect congestion, under conditions of effective competition. In both of these examples, a fixed component to the price must be added to provide sufficient revenue to cover total cost of the transmission system, which is a necessary feature of sustainable transmission pricing.

## *Regulation of distributors*

Economic regulation of the distribution business will have two key aspects: regulation of distribution network and regulation of the retail supply business to their captive customers. The government's intention to move away from cost of service regulation to an incentive system such as price caps to regulate the networks is a good one. While Korea has a strong competition law and enforcement agency, substantial work remains to be done in designing electricity regulation to provide incentives for distribution-supply monopolies to behave efficiently. There may also be opportunities to benchmark the performance of the distribution-supply firms against one another or against comparable distributors in other countries. Other countries have used incentive regulation to encourage distributors to reduce costs (see Box 3).

### **Box 3. Incentive regulation**

Regulation so that revenue equals cost does not provide incentives for a firm to reduce its costs, nor to seek profitable new customers. If a firm did reduce its costs, then it could not keep the resulting profits, but rather would have to pass the cost savings onto consumers as reduced revenues. If a firm did find a profitable new customer, then it could not retain those additional profits, but would have to reduce its revenues from the existing customers. Similarly, losing a profitable customer would not entail a profit loss, but rather increasing revenues from remaining customers.

Some countries use so-called incentive regulation, which provides profit-seeking firms with incentives to reduce costs. For example, price caps set maximum prices that a firm can charge for one or several products. (This is often referred to as "RPI minus x" regulation, after the British formulation.) The firm bears the profit risk, making more profits if it reduces costs or increases revenues, and losing money if it fails. Hence, it has incentives to seek innovative ways to reduce costs and to increase the value of its products for customers.

Another form of incentive regulation of profit-seeking firms is yardstick competition or "benchmarking." Under this form of regulation, the price a firm can charge is a function of the costs other firms incur, as well as its own costs. The more homogeneous the firms are, the more the price depends on the other firms' costs. Here, too, the firm bears much of the profit risk, making more profits if it can reduce costs more than the firms used for comparison.

Clearly, incentive regulation does not necessarily enhance economic efficiency if the firms are not profit-seeking.

For the vast majority of customers, however, the more important regulatory role will be to ensure that the distributor purchases electricity for their customers in a cost-effective manner. If the government is successful in creating a competitive generation market, market prices for generated electricity will be a good indicator to compare the cost of electricity purchased by the firms.

As these retail supply businesses begin to compete with one another for liberalised customers, avoiding discrimination by the supply-distribution business in favour of affiliated generation business, or cross-subsidy from the an affiliated regulated supply-distribution business will become important regulatory issues. While experience in the regulation of this area is limited in the electricity sector, it does suggest that operating distribution and supply as completely separate businesses will increase confidence in the fairness of the operation of the market, and that this benefit outweighs the increased administrative costs of separation.

## **5.5. Cost reflective pricing**

The government has acknowledged that prices for electricity do not reflect costs in a number of ways. For all consumers, the relatively low dividends taken by the government mean that prices have been artificially low. Second, price distortions in electricity favour agricultural and industrial customers at the expense of commercial and residential customers. The government has already raised rates to industrial

users in an attempt to redress this particular distortion, although commercial consumers still appear to be paying a larger share than others (industrial users' rates were raised 8% in the November 1999 increase, and commercial users' rates by 6%). The government has also indicated its intention to have postage-stamp transmission pricing for consumers, even though there is a pronounced difference in supplying the Seoul area and other regions of the country. Finally, greater use of time-of-use pricing would reduce the need for expensive peak-load generation.

The dividend policy of KEPCO should not distinguish between public and private shareholders. In fact, the privatisation of a significant proportion of KEPCO over the next few years will reduce the distortion.

With respect to price distortions favouring agricultural customers, the government has already stated that it will be reforming subsidies for agricultural electricity use through a separate fund. The most straightforward solution is to remove responsibility for the subsidy from electricity consumers. Increased revenues from KEPCO dividends should cover the increased financial responsibility for the government. However, the government is also considering collecting the revenues for this fund from electricity consumers. If this approach is preferred, the funds should be raised in a transparent and equitable way, for example, a separate surcharge transmission fees.

Many of the industrial consumers, on the other hand, will be in a position to benefit from market prices in the relatively near future. Once an industrial customer has been liberalised, if there is effective competition among generators, then there is no longer a need to offer a regulated rate to that customer.

#### *Time of use pricing*

Finally, the use of time-of-use pricing of power is currently very limited. However, significant growth in commercial and residential demand can be expected that would lead to much sharper peaks in demand during the day. Action at this point to implement time of use pricing for electricity for all customers would send proper price signals to customers and encourage a more economically efficient demand for electricity.

#### **5.6. *Liberalisation of electricity consumers***

Liberalisation of the electricity consumers is expected to increase economic efficiency by requiring the electricity market players to offer electricity services at competitive prices to meet the individual consumers needs. The Basic Plan provides only an outline of the timetable for the liberalisation of electricity consumers and implies that most consumers will not be able to choose suppliers until after the year 2009.

This current plan is not sufficient. Customers and potential investors in Korea's electricity sector would benefit from the certainty of a firm timetable to liberalise consumers. Moreover, there is scope to liberalise more quickly to prevent the loss of very substantial consumer benefits. While experience with full retail competition in OECD countries is still relatively limited, it is quickly becoming common. In 1999, there is full liberalisation of retail electricity supply in Germany, Norway, Sweden, Finland, England and Wales of the United Kingdom, and several U.S. states. Within the next few years full liberalisation is expected in several states in Australia, New Zealand, Denmark, Spain, some Canadian provinces, and Switzerland.

By the time Korea has finished restructuring its electric utility sector (by the beginning of Phase 3) it will have the opportunity to learn from experience elsewhere with full retail liberalisation. The government should put itself in a position to take advantage of this information as soon as practical by studying carefully this experience and the experience with larger consumers in Korea. This study will be stimulated if a firm timetable is adopted for full retail liberalisation and a much earlier date is adopted for Phase 4 *i.e.*, full retail liberalisation.

### **5.7. Security of supply**

The Basic Plan recognises the continued importance of security of supply and of nuclear power in the overall energy mix. The government intends to continue to play a co-ordinating role in the development of new generating capacity in Korea, although how it intends to do so is not made explicit.

The continuation of the co-ordinating role reflects a concern over the security of the long-term electricity supply. Will the electricity market build sufficient capacity to meet the needs of an expanding Korean economy? What role, if any should the government play in ensuring security of supply?

The electricity market mechanism will help ensure short-run reliability. Whenever available supplies closely match demand, prices will rise in response. This price rise will be mitigated by the willingness of some customers to reduce their electricity demand in response, much as the customers under interruptible contracts do today. At other times, when available supply greatly exceeds demand, prices in the market could be expected to track short-run marginal costs.

In the longer term, unlike in other capital-intensive industries with varying prices, such price behaviour could make it difficult to encourage adequate levels of investment in electricity generation. The more uncertain environment will also favour less capital-intensive plants, such as natural gas generation, than more capital intensive investments such as nuclear power.

In Korea there are some reasons to be less concerned about attracting adequate investment. First, the government is taking several steps to make investment in the power sector more attractive through reform. Second, the government has been taking a number of steps to make Korea more open to foreign investment in all sectors including the power sector. Third, and just as important, the substantial expected growth in electricity demand in Korea makes the sector that much more attractive for investment.

There are some other elements that could be included in the reform to enhance security of supply. One element is to make consumers and suppliers responsible for security of supply. Liberalised electricity customers can be expected to pay more to have a firm guarantee of supply through a contract with their supplier. Such contracts would make the supplier liable for failures to deliver. The premium customers who are willing to pay for security of supply will help finance the necessary investments. The development of financial markets, such as electricity futures contracts, will help investors hedge against such risks.

Given the potential system-wide impacts of a failure for a generator to deliver, the electricity system and market operator must play a complementary role. The system operator will have the responsibility of mitigating the impact of a failure to deliver. Electricity market rules can make a nonperforming supplier liable for increased system costs as a result of an inability to deliver power as contracted.

Korean security of supply is also affected by its lack of interconnection with other countries. In this regard, developing interconnections with Japan would be beneficial. The relatively low cost of generating electricity in Korea compared to that of Japan implies that there may be a significant export opportunity.

The government's main task will be to monitor the development of the market carefully and assess the adequacy of generation expansion of market participants. If problems appear to be emerging, it may need to consider further measures to encourage market participants to make investments in generation. Of course, the government, as the owner of the nuclear generating assets and the transmission assets of KEPCO, will remain a market participant for the foreseeable future.

### **5.8. *Nuclear power***

The decision to create a separate nuclear power subsidiary of KEPCO underlines the importance the Government of Korea places on nuclear power. Nuclear power is highly valued for energy security reasons (it does not require imported fossil fuels) and for its role in limiting the increase in greenhouse gas emissions from the electricity sector. According to the Korean government, nuclear power is the lowest cost option for new generating plant. On this basis, KEPCO is continuing with plans to construct an additional ten nuclear power plants over the next decade.

Nuclear power's role could be enhanced if the costs associated with emissions of carbon dioxide were reflected in electricity prices. This would increase the cost of fossil fuels and hence enhance the competitiveness of the nuclear option. The government is currently examining the feasibility of carbon taxes or other economic instruments in reducing carbon dioxide emissions. It should be noted that current fossil fuel taxation has the opposite effect of a carbon tax; much higher taxes are applied to natural gas, which has low emissions, than to coal, which has the highest emissions. The relatively high cost of LNG means that even if taxes are changed, LNG is not expected to compete with coal or nuclear for baseload electricity generation. Thus a significant carbon tax could help assure nuclear power's continued role as a baseload generator.

The creation of a separate nuclear business also means that the long-term liabilities associated with nuclear power such as decommissioning and waste disposal, are no longer the responsibility of an integrated utility. The future availability of adequate revenues to cover these expenses is thus less certain. The government should use this opportunity to review the adequacy of funds set aside for these future liabilities and may wish to consider creating segregated funds to ensure that these costs can be covered.

### **5.9. *Renewables and environmental regulation***

Renewable electricity generation will continue to require government support to be viable in the electricity market. There is no mention of the role of renewables in the Basic Plan, although the government still retains its objective of 2% of primary energy from renewable sources by 2006.

If the government is going to achieve its objectives for renewable energy, some intervention in the electricity market will be needed. The government has stated that consumers will provide financial support for renewables through a levy on all customers called the "public purpose programme levy". This follows the practice in the United Kingdom. With such a levy in place, a competitive tendering process for renewables similar to that used in the United Kingdom would encourage lower cost provision of renewables. Other market mechanisms for encouraging efficiency in the generation by renewables, such as the green certificates trading programme in the Netherlands, could also be considered.

Regulation of emissions from the power sector will also need to be revised to reflect the restructured sector. Formerly the government could apply regulations to KEPCO who in turn could pass on increased costs to the consumer. In the restructured sector, the government will be regulating the emissions from the successor companies and other new entrants who will not be able to pass on these increased costs automatically as increased prices. Given the expected growth in the power sector and the potential pressure on emissions, the government may well need to introduce tighter regulatory limits to maintain air quality.

The increased pressure to limit emissions and the need to regulate several companies instead of one company gives the government an opportunity to revamp its environmental regulation to improve efficiency by more extensive use of economic instruments. For example, capping emissions from the power sector as a whole and allowing emissions permit trading, would be compatible with the new structure and could reduce the total cost of emissions control.

#### *5.10. Labour adjustment*

Workforce impacts remain one of more sensitive issues in electricity reform. Other jurisdictions have reported rapid improvements in labour productivity as a result of such reforms. Overall sector employment fell because growth in electricity demand did not keep pace.

In the case of Korea, there are good reasons to believe that overall impacts on the electricity sector workforce will be much more positive. First of all, overall growth in the sector is expected to remain high. Jobs shed at existing plants may well be replaced by new jobs at new plants. Second, the creation of several power generating and distribution companies will create competitive pressures to fill these positions. Wages for some skilled employees may be expected to rise.

Nevertheless, attention to workforce adjustment policies, such as voluntary severance, early retirement programmes, and retraining can help smooth the transition to the new regime. Utilities in other jurisdictions such as the United Kingdom, Australia, and Canada negotiated such arrangements with labour unions at an early stage of the reform. KEPCO's efforts in these areas to date have had limited success. Dialogue between the government, KEPCO and the unions is an important mechanism for ensuring a successful adjustment by the workforce.

#### *Stranded costs*

A major issue in electricity reform in many countries with privately-owned utilities is stranded costs, the prudently incurred unamortised costs of prior investments such as generating facilities, or ongoing costs from contractual obligations such as independent power or fuel contracts, that cannot be recovered under the more market-based regime. In many of these countries, electricity consumers have been made responsible for paying the utilities at least some if not all of the stranded costs, after they have been mitigated.

In the case of KEPCO, the value of the separate generating companies may turn out to be less than the book value of the generating assets on KEPCO's balance sheet. It is conceivable that some individual plants, such as the new Donghae plant using an advanced coal-burning technology (circulating fluidised bed), market value equal its book value. However, other assets, such as older coal or hydroelectric facilities may be undervalued. It will be possible to determine whether there are net stranded costs arising from the nonnuclear generating assets when they are privatised. The market value of the companies will be influenced primarily by prices it is able to get in the electricity market and its expected future performance. There are also potential stranded costs because of liabilities with respect to IPP contracts, particularly as the government has indicated it will continue to honour these contracts.

The government intends to put finance stranded costs arising from domestic coal, the natural gas and combined heat and power plants, as well as the costs associated with renewables and demand side management programmes through the "public purpose programme" levy. Any stranded costs arising from the sale of generating assets will need to be addressed by the government and the private shareholders of KEPCO. The Basic Plan indicates that the government will deal with the minority shareholders concerning any reduction in the value of the shares that results from the restructuring of KEPCO. Korean law also requires that the shareholders approve of the restructuring plan and can require KEPCO to repurchase shares from dissatisfied minority shareholders.

It is important to avoid the temptation to allocate stranded cost recovery only to the captive consumers: cost recovery should be fairly allocated among all users of the system and shareholders. A more sophisticated design for recovery may be required if stranded costs prove to be a significant portion of the total electricity price.

## **6. CONCLUSIONS AND RECOMMENDATIONS**

Korea has begun far-reaching reforms to introduce market forces into its electricity sector. Development of this sector has been key to Korea's rapid growth, and therefore reform is particularly symbolic of a new reliance on the market to meet strategic needs. The Basic Plan for Restructuring of the Electricity Supply Industry reflects this basic commitment

Under the new regime, competition will be used to improve economic efficiency in the sector, and ultimately improve Korea's international competitiveness. If the reform introduces effective competition, then it would be expected to significantly reduce costs. One estimate, provided by the Korean Institute for Industrial Economics and Trade, is that total costs could fall by 9%, or won 1 034 billion, as productivity improves to international benchmarks.<sup>4</sup> Industrial and household electricity prices, including taxes, in Korea are above the OECD average, measured in terms of purchasing power parities. Low returns on equity suggest that prices do not cover all costs.

The Basic Plan's main elements, the structural reform of KEPCO, the creation of an independent sector regulator for the natural monopoly elements, the plans to develop an electricity pool, and a plan to introduce competition in retail supply provide a sound framework to guide the development of a reliable, competitive and more efficient electricity sector.

But many basic aspects greatly influential of the reform's success need to be elaborated. The timetable for liberalisation of consumers is very vague but appears to offer choice to most consumers only more than a decade after the reforms have begun. The degree of privatisation of generating subsidiaries, crucial for the success of the structural reform, is yet to be decided. The design of the regulatory institutions will not be finalised for at least another year. The pool based electricity market has been designed. The regulation that will be applied for captive customers' tariffs has not been announced.

The government's first priority must be to implement concrete legal reforms as quickly as practical which follow through on both the plan's stated aims and those basic points. To generate the benefits of electricity reform on schedule, the government's first priority should be to implement legal reforms that :

- Put into place a competitive structure of the industry before privatisation;
- Establish a regulator, independent, resourced, with transparent procedures, and requirements for accountability;
- Implement regulation to protect consumers and independent generators from abusively high prices or unfair terms and to provide incentives for monopolies to behave efficiently; and exploit the new ways to use regulation to efficiently achieve environmental and safety objectives;
- Facilitate the transition to competition.



Specifying and speeding up the current plan for liberalisation of consumers also would boost benefits for a wider range of consumers. Customers and potential investors in Korea's electricity sector would benefit from the certainty of a firm timetable. There is scope to liberalise more quickly. Experience with full retail competition in other OECD countries can inform the Korean plan.

The recommendations address further elements to be considered in the implementation of the Basic Plan. The recommendations come under the following headings – timing of reforms, KEPCO restructuring, corporate governance of the electricity sector, independent regulation, security of supply, nuclear power, environment and renewables.

### *Timing of Reforms*

The government should proceed with the legislative reforms outlined in the Basic Plan as expeditiously as possible. It should include in its reforms a timetable for the liberalisation of all consumers and move forward substantially the date for full retail liberalisation to avoid the loss of substantial consumer benefits.

### *KEPCO restructuring*

The government should proceed with reforms to create several independent generation and distribution companies. It should aim to ensure that all generation and distribution companies are no longer subsidiaries of KEPCO and do not have significant common ownership by 2003.

The design of the bid-based electricity market should be done with the active participation of future users of the electricity markets, including large and small consumers as well as KEPCO, and all generating companies. Market participants should also have an active role in governing the operations of the electricity market.

### *Transition to competition*

Ensure that long-term contracts do not delay the onset nor diminish the effectiveness of competition.

### *Corporate governance of the electricity sector*

The government should ensure that the reforms transform the relationship between the government and electricity companies to a more commercial basis. The government should expect to receive dividends at the same rate as a private shareholder and should not be responsible for guaranteeing any new debt in the companies. Furthermore, the management and boards of directors of publicly-owned electricity companies require sufficient autonomy so that they can make budgetary and investment decisions based on commercial criteria. Finally, to enhance the board's decisionmaking process, the government should make appointments to the board of directors that would represent the interest of the minority shareholders.

### *Regulatory institutions*

The government should create an independent regulator to carry out all major regulatory activities in the electricity sector. The regulator should operate transparently and be accountable to the public and market participants. Steps should be taken to ensure that the regulator has sufficient resources and legal powers to be independent both of the regulated firms and from day-to-day political pressures, that it has transparent procedures for decision-making, and that it is accountable to the public and to the firms subject to its regulation for the achievement of its objectives.

Strengthen competition law enforcement in the energy sector, particularly with respect to market access and anti-competitive conduct and mergers. Consider measures to strengthen co-operation between the sector regulator and the Fair Trade Commission.

### *Economic regulation*

Clarify the transmission pricing scheme. If congestion problems persist, or if there are problems of discriminatory access, then consider modifying the pricing scheme so as to allocate capacity by a price mechanism.

The regulation of the distribution companies should provide incentives for efficiency, including least-cost procurement of energy.

### *Cost reflective pricing*

The government should proceed with its intentions to reform electricity subsidies to the agricultural sector by removing the responsibility for paying for these subsidies from electricity customers.

Price distortions favouring industrial customers should also be eliminated. Eliminating regulated energy tariffs to liberalised industrial customers can facilitate this.

Standard electricity tariffs for nonliberalised customers and network and ancillary service tariffs for liberalised customers should reflect costs by time of use. Implementation of these standard tariffs can be phased in, beginning with the larger customers.

### *Security of supply*

The government should take the following steps to enhance the security of electricity supply in reforming the sector:

- Proceed with the plan to introduce a competitive, bid-based electricity market with oversight by the independent regulator.
- Ensure that the electricity market has appropriate financial mechanisms for ensuring suppliers are able to meet contractual obligations to supply
- Consider the development of financial instruments, such as electricity futures contracts, to enable potential investors to hedge against market risks.

- Investigate the costs and benefits of developing transmission links between Korea with Japan.
- Monitor the development of competition carefully and if necessary, consider further measures to encourage market participants to make investments in generation.

### *Nuclear Power*

The government should ensure that the nuclear generation company is not within the same corporate family as the transmission company. The nuclear company should not be permitted to have a much larger market share than currently and should not be involved in nonnuclear electricity generation.

### *Environment and renewables*

The government should consider economic instruments as part of its plan to limit the increase in greenhouse emissions in Korea. As a first step, it should consider whether to reform taxes and duties on fossil fuels to reflect carbon content.

The government should consider developing policies to achieve environmental goals in lower cost ways, such as tradeable “green electricity” permits for end-users and tradeable emissions permits for generators.

### *Stranded costs*

The government should explicitly identify any net stranded costs that arise from the reform that, after mitigation, will need to be recovered. Recovery mechanisms for stranded costs should ensure that any stranded cost recovery is shared equitably among all customers and shareholders.

## NOTES

1. All prices stated in the text are inclusive of applicable taxes, and converted at prevailing exchange rates, unless otherwise stated.
2. 1 tonne of oil equivalent is the energy equivalent of one tonne of oil and is defined equal to 41.868 gigajoules or 39.68 million British Thermal Units.
3. Bonds and other debt instruments with a maturity date more than one year later.
4. Ha, Byungki (1999), "Economic Effect of Regulatory Reform in Korea," Preliminary Report, July.

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