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ELECTRICITY PRICING IN KAZAKSTAN

Draft Report

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EXECUTIVE SUMMARY

This report contains an analysis and recommendations regarding the reform of wholesale and retail electricity tariffs in the Republic of Kazakstan The tariff study was funded by the United States Agency for International Development (USAID) and conducted in cooperation with the State Committee on Pricing and Anti-Monopoly Policy (AMC), the Ministry of Energy and Coal Industry (MECI), and the National Energy System Kazakstanenergo The main objectives of the study were to assist the AMC and MECI in the development of a wholesale pricing strategy and an implementation plan to introduce a rational system of wholesale electricity prices Hagler Bailly Consulting, Inc , was requested by USAID to conduct the following tasks

> " to develop and design tariff structures that reflect as closely as possible the true economic (marginal) costs to the nation of providing electricity to different customer segments This marginal cost structure establishes the fundamental economic frame of reference from the perspective of formulating pricing strategies that promote efficient resource utilization by discouraging waste and resource misallocation, that encourage economically optimal levels of conservation and demand/load management, and direct the usage of electricity to its most valued and productive uses "

> " [to] develop an appropriate implementation scheme and schedule for a smooth and efficient transition from the present pricing structure to the new efficiency pricing structure The time-phased plan should be "in sync" with the evolving organizational structure of the power sector under the ongoing restructuring and reform efforts of the government "

The power sector in Kazakstan is undergoing a rapid transformation from a state-owned monopolistic and vertically integrated structure to a sector with several generating companies, one national enterprise for the high-voltage network, and 19 local network companies and enterprises This tariff study is intended to support the transition to market competitive pricing at the wholesale level, and a system of government-regulated tariffs by the State Regulatory Commission (SRC) at the retail level

TARIFF METHODOLOGY

In accordance with the scope of work for this study, tariffs have been calculated according to the principles of long run marginal cost (LRMC) pricing Customer classes are distinguished by

voltage level as well as by industry and energy use Flat tariffs and three-part tariffs (capacity, peak energy, and off-peak energy) are calculated on the basis of four major cost components

- The capacity cost associated with generating stations is calculated from the estimated cost of a hypothetical new combustion turbine
- The energy cost associated with generating stations is the short run marginal cost (SRMC), averaged over all of the hours in a representative week SRMC is estimated using a computer model of power generation in Kazakstan
- The capacity cost of the networks is calculated from the estimated replacement cost of the networks at different voltage levels
- Network losses are estimated at different voltage levels on the basis of the latest available data Capacity and energy costs are adjusted to reflect network losses

Transmission tariffs have been calculated according to the financial revenue requirements based on the replacement cost of the network, which yields the same results as LRMC pricing Separate transmission tariffs are calculated for the Very High Voltage (VHV) network (220 kV and higher) and the High Voltage (HV) network (110 kV) To compensate for the cost of building the network, the capacity charge includes an allowance for a rate of return on net assets (replacement cost less depreciation) To compensate for network losses, the amount of energy received by the transmission network must be higher than the amount of energy delivered This difference can be between four and nine percent, depending upon the location of the transfer points on the network

RECOMMENDED ACTIONS

It is recommended that the Government of Kazakstan (GOK) take several steps to reform electricity tariffs These recommendations are based on the analysis in Chapters 3, 5 and 6

- Tariffs for customers directly connected to the VHV network should be distinguished from tariffs of customers directly connected to the HV network of the North and South Regions
- Wheeling tariffs should be introduced as soon as possible, for the VHV and HV networks
- MECI should conduct a program to revalue the networks at each voltage level, based on replacement cost less depreciation A detailed asset valuation could be used to improve the accuracy of the tariff calculations presented in this report

- Retail customer classes should be redefined according to voltage level [i e , industrial customers at HV and at Medium Voltage (MV)]
- Tariffs for the sale of electricity to VHV and HV customers should be restructured as 3-part tariffs (capacity, peak energy, off-peak energy) instead of flat tariffs
- Retail tariffs should be increased until they reach the level of LRMC, as discussed in Chapter 5 and 6
- A program of capital investment in 500 kV interconnections between the North and South Grids should be pursued to ensure that these regions are fully integrated This would enable the formation of a single power pool and thereby increase the level of competition among generators and imports

All of these actions could be taken before the SRC sets the exact level of capacity prices and energy prices

RECOMMENDED TARIFF LEVELS

For transmission tariffs in the VHV network, the capacity payment should be 228 Tenge/kW/month and the energy loss allowance should be 5 4 percent during peak periods and 4 4 percent during off-peak periods (Exhibit 3 6) For transmission tariffs in the HV network, the capacity payment should be 356 Tenge/kW/month and the energy loss allowance should be 9 1 percent during peak periods and 7 2 percent during off-peak periods

The cost of wholesale power purchased by the regional network enterprises is expected to rise to 3 74 Tenge/kWh and the average tariff to the customers of these enterprises is expected to be 5 06 Tenge/kWh when prices are raised to LRMC (Exhibit 5 19) The transition to this price level may be achieved in three steps in a relatively short time period initially a ten percent wholesale tariff increase and a seven percent retail tariff increase, next a transition to a competitive power pool, and then a final retail tariff increase (Exhibit 6 5) Because the projected tariffs in this study are expressed in Tenge ($1 00 US = 66 Tenge), additional increases may be needed to offset inflation

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

When the Republic of Kazakstan became independent, it inherited an industrial sector that was entirely developed under the planned economy of the former Soviet Union, and was largely based on energy-intensive industries such as mining and raw materials extraction Patterns of household and industrial energy use had been developed on the basis of low energy prices, state control of the energy sector, and energy interdependence among Russia, Kazakstan, and other Central Asian countries Following independence, there was a sharp rise in the prices of imported energy, including imported electricity, petroleum products, and natural gas The power sector was caught between rising cost of imported energy and the low prices of electricity Although Kazakstan is making a transition to a market economy, electricity prices have been low for several years, and the power sector has suffered from non-payment of electric bills Expenditures on maintenance of power stations and transmission lines have been deferred so that electricity prices can be kept at minimal levels The poor financial condition of the power sector has resulted in regular patterns of electricity outages in many parts of Kazakstan, and a sharp decline in the amount of generating capacity available to meet peak load

The existence of power shortages in a country with tremendous oil and gas and coal resources and low demand growth indicates the need for economic reforms in the power sector The present level of electricity consumption is about 30 percent below the 1990 level The country's generating capacity in 1995 (13,165 MW after adjustment for derating) was higher than the peak load in that year (11,788 MW) These indicators suggest that the power sector is capable of providing a reliable supply of electricity, if economic reforms enable power sector enterprises to operate efficiently and recover their costs

Power sector restructuring and privatization started in July 1995 and is now proceeding rapidly Beforehand, the power sector was owned and operated by Kazakstanenergo, the state electric power engineering company subordinated to the Ministry of Energy and Coal Industry (MECI) Kazakstanenergo owned ten regional *energos* as well as various regional construction and maintenance enterprises, design and research institutes, and the "Inter-System" portion of the high-voltage network The regional energos owned the power stations, district heat networks, and most of the electric network On July 28, 1995 the Government of Kazakstan (GOK) approved Resolution 1033, changing this structure and creating a new organization called National Energy System Kazakstanenergo which would own several large generating stations and the high-voltage networks, but not the regional energos This resolution created three independent generating

companies (gencos) and eliminated one of ten energos The resolution gave Kazakstanenergo a monopoly over the sale of electricity to the regional energos, because it made Kazakstanenergo the sole purchaser of electricity from the gencos, the sole owner of the large power stations that were not given to the gencos, and the sole purchaser of imported electricity

On May 30, 1996 the GOK adopted Resolution 663, which took power generation assets away from Kazakstanenergo, leaving only the high-voltage (HV) networks, the dispatch center, and administrative offices Resolution 663 also took various Combined Heat and Power (CHP) plants and boiler houses away from the regional energos and transferred these assets to "communal ownership," (i e , city and local government) Resolution 663 supported a program of privatization of practically the entire power sector, excluding Kazakstanenergo On July 19, 1996 the GOK adopted a resolution breaking up the nine energos into 19 low-voltage networks and a large number of generating companies Plans to form one or two power pools are currently proceeding and Kazakstanenergo may no longer exist USAID/Hagler Bailly Consulting is assisting the GOK in the organization and development of a competitive wholesale market for electricity

1.2 STUDY OBJECTIVES

In response to a request from the State Committee On Pricing and Anti-Monopoly Policy (AMC), the United States Agency for International Development (USAID) agreed in September 1995 to provide funding for a study of electricity tariffs The concept of the study was originally developed in coordination with the European Bank for Reconstruction and Development (EBRD), which was considering a possible loan to the GOK to refurbish a power facility, Ekibastuz 1 The request for technical assistance was originally directed to the EBRD USAID requested that Hagler Bailly Consulting conduct a definitional mission, prepare a work plan, and execute the work plan USAID drafted a Statement of Work (SOW) to focus on marginal costs and on the transition from the present pricing scheme to the new tariff structure

> " the contractor is to develop and design tariff structures that reflect as closely as possible the true economic (marginal) costs to the nation of providing electricity to different customer segments This marginal cost structure establishes the fundamental economic frame of reference from the perspective of formulating pricing strategies that promote efficient resource utilization by discouraging waste and resource misallocation, that encourage economically optimal levels of conservation and demand/load management, and direct the usage of electricity to its most valued and productive uses "
>
> "The contractor will develop an appropriate implementation scheme and schedule for a smooth and efficient transition from the present pricing structure to the new efficient pricing structure The time-phased plan should be "in sync" with the

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evolving organizational structure of the power sector under the ongoing restructuring and reform efforts of the Government "

When this SOW was written, the wholesale market had just been created but the price reform was needed at the wholesale level For example, price controls were used to create cross-subsidies among geographic regions with separate and isolated electric grids The wholesale market had been created without economic incentives for low load management and without demand charges or economic penalties for the load factor customers of Kazakstanenergo In the Southern region, electricity imported for 4 5 Cents per kWh was resold for as little as 1 0 Cents per kWh Reform of wholesale market structure and wholesale electricity prices was the first logical step toward the reform of retail prices

A definitional mission for the tariff study was conducted on October 15-24, 1995 and the proposed work plan was submitted to USAID in December 1995 The work plan was developed to support two objectives

- Assist the AMC and MECI to develop a wholesale pricing strategy and an implementation plan to introduce a rational system of wholesale electricity prices
- Assist EBRD in its efforts to modernize the power sector of Kazakstan

Initially, EBRD was planning to use the results of the USAID tariff study to support the financial feasibility of a public sector loan to Kazakstanenergo for the refurbishment of Ekibastuz 1 However, on July 9, 1996 EBRD withdrew its loan proposal, since it became public that the GOK signed an agreement to sell the power station to AES/Suntree

The work plan described a study involving a substantial amount of data collection To calculate marginal cost of generation, for example, the project team prepared data requests required to collect detailed power station and hourly load data needed to run a computer simulation model (Generation Planning Tools) which has been successfully used by USAID/Hagler Bailly Consulting in tariff studies in other countries However, neither the AMC nor MECI possessed staff resources and information comparable to Kazakstanenergo

MECI gave official approval for Kazakstanenergo to release information to Hagler Bailly for tariff study purposes Meetings at Kazakstanenergo were held in November 1995 to identify the departments and specialists who could provide the necessary information From December 1995 through August 1996, technical cooperation was conducted primarily at Kazakstanenergo since it was where the data was kept From Kazakstanenergo's perspective there were at least two advantages to technical cooperation (1) the possibility that a solid tariff study would persuade the Government of Kazakstan to raise electricity prices to the levels needed to cover costs, and (2) the possibility that EBRD would issue a loan for reconstruction of Ekibastuz 1

A preliminary set of projections of installed capacity, electricity generation, fuel cost, and purchased power costs (Appendices A, B, C and D) were submitted to Kazakstanenergo in late March 1996 The data collection process continued through August

The work plan included an analysis of retail tariffs as well as wholesale tariffs Based on a case study of Almatyenergo, the work plan included the development of a long-run marginal cost (LRMC) based tariff schedule by customer class Although the analysis in this study is based on data concerning Almatyenergo, it was not necessary to set up a program of technical cooperation with that organization Detailed technical data on Almatyenergo, through 1995, was kept at Kazakstanenergo and financial data was kept at the AMC

In July 1996 the GOK passed a Decree abolishing Almatyenergo and replacing it with two network enterprises (Almaty and Taldy-Korgan) and a number of generating companies The GOK also signed an agreement to sell one of the network enterprises to Tractebel, a Belgian power company This is the first privatization of a network enterprise in Kazakstan and a number of financial issues remain to be clarified

A separate team of USAID/Hagler Bailly consultants was charged with the task of reviewing the power sector privatization and restructuring process and advising the GOK on policy alternatives in this area The review revealed that the GOK was interested in forming a competitive wholesale market based on a power pool Therefore in the beginning of September 1995 it was necessary to revise the study assumptions about the wholesale market structure, to ensure consistency between the tariff study and the evolving organizational structure of the power sector The existence of Kazakstanenergo's monopoly over the wholesale trade in electricity was assumed to be a temporary phase in the transition to a spot market

1.3 ANTICIPATED CHANGES IN THE WHOLESALE MARKET

Instead of calculating tariffs only for the market structure that exists today, projected tariffs on the basis of assumptions about the market structure of the future have been included The power sector in Kazakstan is undergoing restructuring and privatization, with the development of wholesale competition and a power pool Therefore, these projections incorporate the assumption that the competitive wholesale market will soon develop Wholesale tariffs will be needed only for those energy sales that are not transacted through the pool or through bilateral or multilateral agreements Such sales will be regulated by the State Regulatory Commission (SRC)

To calculate wholesale prices, assumptions have been made concerning the development of wholesale competition and the implementation of a power pool For the generating stations that are pool members, the inferred pool price is based upon projections of LRMC and short-run marginal cost (SRMC) Where competition is not feasible, wholesale power sales will be regulated by the SRC and prices will be based upon asset revaluation and a rate of return on

assets The wholesale price to individual buyers of bulk power [i e , industrial customers connected directly to the HV grid, as well as the low-voltage (LV) network entities] will include wheeling charges

Projections of wholesale prices, whether tariffed rates, pool purchase price, or negotiated rates, are needed by the LV network enterprises for the purpose of planning their tariff increases For Almaty and Taldy-Korgan recommended retail tariffs were calculated for 1996 on the basis of a recommended wholesale tariff and the projected pool purchase price

1.4 CONTENTS OF THIS REPORT

Chapter 2 summarizes assumptions about the structure of the market and the costs to be included in tariffs Chapter 3 recommends a methodology for calculating transmission tariffs In Chapter 4 the LRMC of electricity generation, generating capacity, and energy is calculated In Chapter 5 customer classes are defined and tariffs for each customer class in 1996 is recommended Chapter 6 provides a forecast of wholesale and retail tariffs in 1997 and 1998

CHAPTER 2
POWER SECTOR STRUCTURE

The starting point of any tariff study must be a set of assumptions about the physical assets that fall within the scope of the study, the organizations which own these assets, the types of transactions that are possible, and the physical structure of the transmission interconnections needed to support a wholesale market for electricity After these issues are clarified it is possible to develop methods of forecasting prices or calculating tariffs Therefore the purpose of this chapter is to describe these assumptions and explain the terminology used in this study

2 1 PHYSICAL ASSETS IN THE POWER SECTOR

This study is an analysis of the prices associated with sales and wheeling transactions within the power sector *The power sector* of Kazakstan is defined as the set of physical assets which are used to generate, transmit, and distribute electricity within the networks and within the borders of Kazakstan The power sector includes all of the electric networks plus all of the generating units connected to these networks, regardless of ownership In other words, the power sector includes the following assets

- Combined Heat and Power (CHP) plants, which use fossil fuel and provide heat for heat networks and electricity for the grid Typically a heat network provides heat for the population of a city or town as well as steam or heat for industrial use
- Hydroelectric power stations
- A nuclear station located at the Mangestau Energy Complex near the Caspian Sea
- Cogeneration plants, which are used to provide heat for industrial facilities located near the generating unit and power for the use in the plant, with any excess being sent to the grid A very small heat network could exist in this case but it would be used for industrial steam or process heat and owned by the industrial plant
- Thermal power stations, which are any generating units that are neither CHP, hydro, nuclear, nor cogeneration In Kazakstan most of the larger thermal stations have been classified as State Regional Electric Stations (GRES)

- Electric networks, which receive energy from generating stations or other countries and deliver energy to consumers or other countries All networks are part of the power sector

It is assumed that most customers will continue to receive electricity from the networks instead of generating their own In some countries (for example, India and Indonesia) there are many generating units which are not connected to the grid and not owned by power sector enterprises In these countries many of the industrial and commercial customers have back-up power generators that are used to generate power during periods when there is no electricity available from the grid In Kazakstan there are very few industrial sites with their own generating units, and nearly all of these sites have cogeneration units connected to the grid

The *high-voltage network* includes the overhead lines at 110 kV and higher voltages, plus the substations connected to these lines The *low-voltage network* includes the overhead lines and underground cables at 35 kV and lower, plus substations and transformers that receive power at 35 kV, 10 kV, or 6 kV In some CIS countries there are low-voltage electric networks that are behind the meter, which electricity is supplied to an industrial plant or a state-owned farm Such networks are part of the power sector even if they contain delivery points without meters

The following assets are <u>not</u> included in the power sector

- Heat networks These networks can be owned and operated by city governments or oblasts, independent of power sector enterprises Heat tariffs are outside the scope of this electric tariff study

- Boilerhouses used to provide heat for heat networks

- Coal mines

- Any other assets which are used to produce or deliver fuel for electric power generation In Kazakstan and in international practice these assets are normally owned by fuel suppliers, railroads, and other organizations that do not own any part of the electric network

2.2 TYPES OF COMPANIES AND ENTERPRISES IN THE POWER SECTOR

The following terms describe different legal structures for organizations that own power sector assets

- *Companies* are organizations that are legally registered as joint stock companies under the laws of the Republic of Kazakstan *Private companies* are those in

which at least 51 percent of the stock is owned by individuals or by other private companies Under the laws of Kazakstan an *open-end joint stock company* is a joint stock company in which there is no legal limit on the percentage of shares that may be owned by individuals or private companies

- *Enterprises* are organizations that are not registered as joint-stock companies and are legally owned by the GOK, an oblast, or a municipality

The power sector assets that were owned by MECI until July1995 are now distributed among the following types of organizations

- *Generating companies* own generating units and are organized as joint stock companies

- *Generating enterprises* own generating units and have been restructured as generating companies according to Resolution 499, *On Approval of the Power Industry Facilities Corporatization Plan for 1996 (Appendix I),* which was adopted on July 16, 1996

- National Energy System Kazakstanenergo This is a *network enterprise* which owns the national dispatch center and most of the HV network

- *Regional network companies* own medium-voltage (MV) and LV networks and are organized as joint stock companies

Regional network enterprises own MV and LV networks and have been restructured as regional network companies according to Resolution 499

An *autoproducer* is a generating unit that was not owned by MECI For example, the Chardarinskaya hydropower station was owned by the Ministry of Water Resources The Mangestau nuclear station was owned by the Ministry of Atomic Energy

An electricity *customer* is a person, household, or organization which is connected to a network and has a meter Customers may be grouped as follows

- *Resellers* are organizations which buy and sell electricity Under existing legislation a reseller must own a portion of the network For example, regional network enterprises are resellers

- *Consumers or end-users* use the electricity they purchase Electricity recorded on meters and billed to customers is *billed electricity consumption*

Where electricity from the network is consumed by a person, household, or organization (outside of the power sector) without a meter, the amount of consumption is called *non-technical losses* The total of billed electricity consumption plus non-technical losses is called *electricity consumption* (Appendix B) In an electric energy balance, gross generation can be allocated to station losses, network losses, and billed electricity consumption (Appendix B)

The *wholesale market* is the HV market, that is, the market for power sales and wheeling in the HV network (110 kV and higher voltages) Under this definition, a customer in the wholesale market can be either a consumer or a reseller A *wholesale customer* is a customer which receives power at 110 kV and above, within the borders of the country

The *retail market* is the MV and LV market, that is, the market for power sales and wheeling at 35 kV and lower voltages In the future, most resellers in Kazakstan will buy power in the wholesale market A *MV consumer* receives power at 35 kV and is probably not a reseller A *LV consumer* receives power at 10 kV or lower voltages and is not a reseller

An *independent regulatory commission* is a government agency that regulates the activities of the electric power engineering sector, including setting and enforcing tariff rates and pricing schedules

2.3 ELECTRICITY PRICING TERMINOLOGY

A *commodity* may be defined as a commercial product that can be measured in units, such that every unit has the same level of production quality and the same price in a competitive marketplace From the customer's standpoint, units are equally valuable and it does not matter which units are received For example, precious metals such as gold, silver, and platinum are commodities when they are produced to a standard level of purity Arguably, when the wholesale price of electricity is adjusted on an hourly basis, electricity can become a commodity in the wholesale market Under other circumstances the supply of electricity or the wheeling of electricity is a *service* to the customer The cost of providing this service depends upon the customer's voltage level, load profile, and location, as well as the reliability of the service

For the purposes of this study four types of services are distinguished

- *Sales service*, which is the supply of capacity and energy to the customer, at a meter owned by the customer or the seller

- *Wheeling service,* which includes (1) the supply of capacity needed to transmit energy through a network, from a receipt point to a delivery point, and (2) the transmission of electric energy through the network, from the receipt point to the delivery point

- *Unbundled sales service,* which is the supply of capacity and energy at some point on the network, other than a meter This service requires the customer to make a separate arrangement for wheeling service

- *Ancillary services,* which include frequency control, voltage control, reactive power control, maintenance of reserve capacity, and other services necessary to support network operations and ensure reliability of power supply In Kazakstan, ancillary services are largely provided by Russia and the Central Asian Republics, and therefore these services are largely outside the scope of this tariff study

The power sector can be divided into three vertical levels

- *Generation* the ownership and operation of generating units

- *Transmission* the ownership and operation of HV networks and dispatch centers

- *Distribution* the ownership and operation of MV and LV networks Normally, distribution networks are used to provide services to electricity consumers, not to resellers

Vertical integration exists when a power sector organization operates at two or more of these levels Prior to July 1995 the power sector was totally vertically integrated

A *power system* might be defined as a set of generation, transmission, and distribution assets which are linked by the transmission grid and are separated from neighboring systems by either a lack of transmission interconnection or by an ownership and administrative structure in which the power system is considered to be an independent unit

In the wholesale market, prices should reflect costs Therefore the prices for sales service in the wholesale market should include two kinds of charges

- *Capacity charges* are measured in Tenge per kW of customer load per month, and are used to recover the cost of generating capacity and network capacity used to provide electric service to the customer

- *Energy charges* are measured in Tenge per kWh and are used to recover the cost of fuel for power generation, as well as pollution taxes or other generating station costs that vary in proportion to the number of kWh produced Energy charges reflect an allowance for energy losses in the networks

In principle it is possible to set up *customer charges,* which are fixed monthly amounts that have no relationship to the capacity and energy received by the customer Such charges are used to recover the cost of electric meters and the administrative cost of preparing electricity bills These

charges do not exist in Kazakstan and these kinds of costs may be recovered through network capacity costs, without a serious distortion in price signals

A *tariff* is a price which is established by government regulation, instead of competitive bidding or negotiation between buyers and sellers A *flat tariff* has only energy charges and therefore it is simpler to administer but it is an ineffective method of setting different prices to different customers according the cost of providing electric service A *two-part tariff* has separate capacity charges and energy charges A *three-part tariff* is similar to a two-part tariff, except that the price of energy during peak periods is higher than the price of energy during off-peak periods

During the former Soviet Union the concept of wholesale market for electricity was not clearly defined, but there was a vague idea that the "true" price of electricity is the tariff to the customer and any other price is an arbitrary accounting number used to regulate the allocation of the state budget within the power sector, or between the industrial sector and the power sector According to this concept the wholesale prices of electricity could be higher than the true production cost or lower than production cost but it didn't really matter because the only prices that influence resource allocation are the prices of electricity sold to customers Most customers were given flat tariffs on the basis of the assumption that tariff structure has no effect on consumption A related idea was that wholesale electricity prices should be flat tariffs with no differentiation by voltage or by geographic area because there is no need to force resellers to pay for the true cost of the electricity they receive

This study takes an entirely different view the prices in the wholesale market are just as important as the prices to customers, and there should be a more complex pricing structure in the wholesale market than in the retail market Moreover, prices should be charged by resellers, adjusted to suit the prices in the wholesale market and are determined by supply and demand There should be no possibility for resellers to calculate their average tariff on the basis of the customers' ability to pay However, resellers can select the quantity of electricity that they purchase from the wholesale market and bring down the price by purchasing a lower quantity

2.4 EVOLUTION OF THE STRUCTURE OF THE POWER SECTOR

The *structure* of the power sector may be defined as the pattern of ownership and types of transactions that occur

Before July 1995 the structure of the power sector in Kazakstan was very simple (Exhibit 2 1) because practically all of the assets were owned by Kazakstanenergo The regional energos owned the power stations, district heat networks, and all of the electric networks except for the "Inter-System" portion of the HV network

However, after Resolution 1033 was adopted, the power sector was restructured which created a new organization called National Energy System Kazakstanenergo (Exhibit 2 2) This Resolution was to create three independent generating companies (gencos) but in fact it created only two — Yermakovskaya (thermal) and Kapchagayskaya (hydro) The Bukhtarminstkaya (hydro) generating company was not created because Decree 1268 removed this company from the list of gencos The Bukhtarminskaya plant was owned by Altayenergo Resolution 1033 eliminated Ekibastuzenergo, one of the regional energos, and divided it into three administrative units Ekibastuz 1, Ekibastuz 2, and a "filial of Ekibastuzenergo" containing the remaining assets (including a MV and LV network and a CHP plant) All three administrative units were still owned by Kazakstanenergo

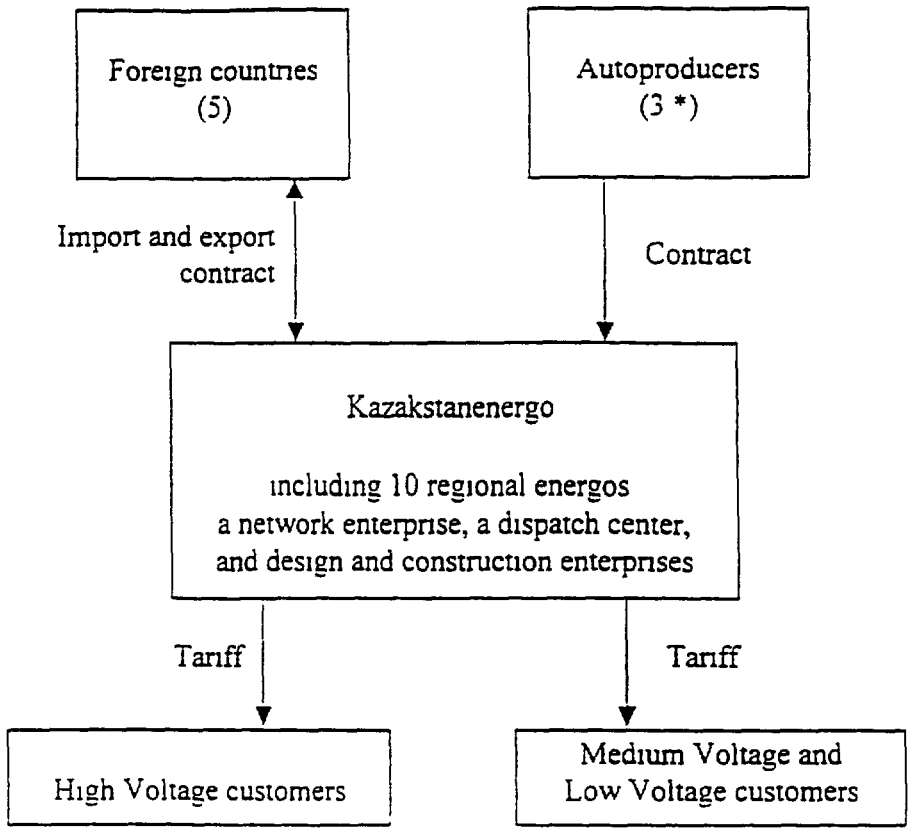
On May 30, 1996 the GOK adopted Resolution 663, which took power generation assets away from Kazakstanenergo, leaving only the HV networks, the dispatch center, and administrative offices Resolution 663 also took various CHP plants and boiler houses away from the regional energos and transferred these assets to "communal ownership," (i e , city and local government) Resolution 663 supported a program of privatization of most power engineering assets, excluding Kazakstanenergo

On July 16, 1996 the GOK adopted Resolution 499, which broke up the nine energos into 19 LV networks and a large number of generating companies

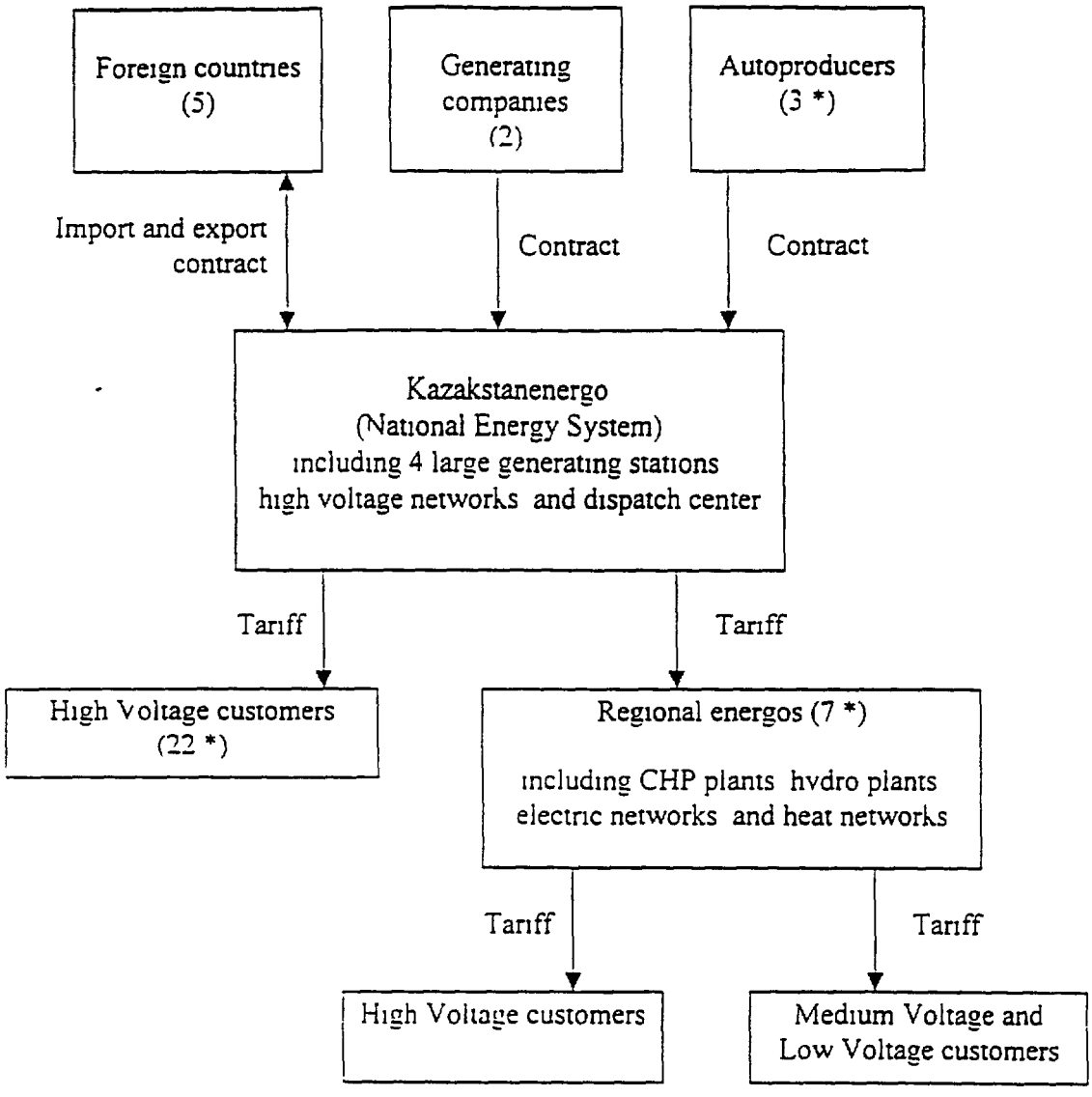
The next step in restructuring will be the creation of a power pool The details of this concept have not been finalized, but this tariff study is based on the assumptions shown in Exhibit 2 3

Electricity tariffs should be developed to facilitate the transition to the power pool so that

- Wholesale electricity prices and capacity charges will move toward the price levels that are expected when the power pool is fully operational
- Retail electricity prices will be raised to ensure that LV network enterprises will be able to pay for the cost of wholesale electricity under market conditions

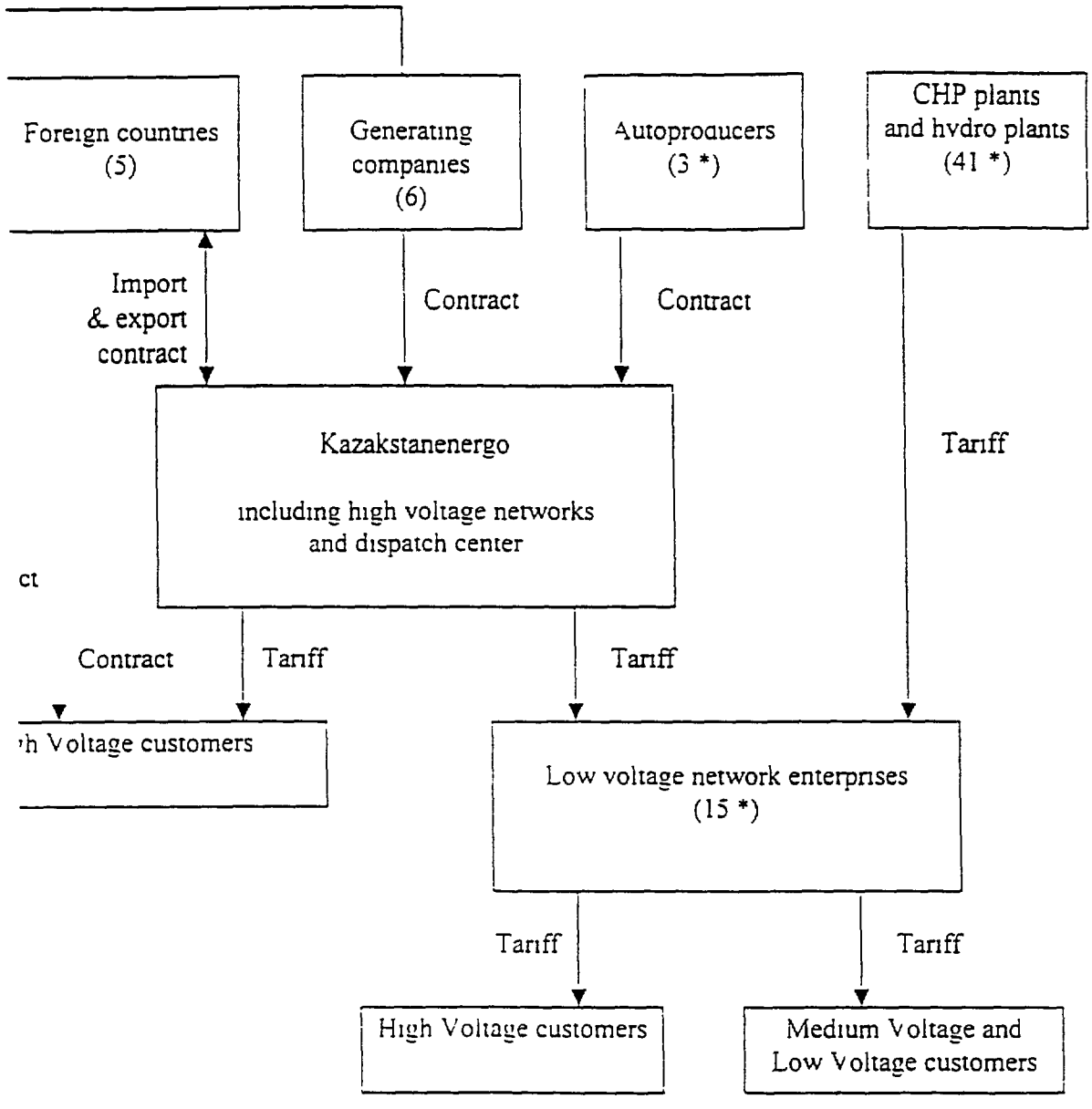


* Figures in this chart refer to the North and South regions only



res in this chart refer to the North and South regions only In the West region there were
egional energos, 3 autoproducers, and 2 high voltage customers of Kazakstanenergo

assets of Ekibastuzenergo one of the regional energos that existed in June 1995 were
transferred to Kazakstanenergo



* Figures in this chart refer to the North and South regions only
n the West region there are 4 low voltage network enterprises and 3 autoproducers

2.5 INTERCONNECTIONS AMONG POWER GRIDS IN KAZAKSTAN

One of the difficulties with the old structure of the power sector, as shown in Exhibit 2 1, is that electric tariffs in each oblast or region were not related to the cost of generating, transmitting, and delivering electricity to that region In fact, Kazakstanenergo operated several separate grids under an administrative structure that was based on political boundaries — the grouping of two or three oblasts for each regional energo — rather than the boundaries of the HV grid There are two problems with this type of structure First, the tariffs in each region were not based on the cost of supplying electricity in that region, and therefore the customers were not given "price signals" that encourage economically efficient patterns of electricity consumption Second, Kazakstanenergo did not really have an accurate understanding of its own production cost on a regional basis There were no internal transfer prices that would give accurate "price signals" for future investments in generation and transmission

Under the new power sector structure involving the creation of power pools, it will be necessary to know the geographic locations of the power pools, based on the existing network infrastructure It would not be reasonable to create a competitive "marketplace" in which the pool company is unable to buy from particular generators and sell to particular wholesale market customers, as a result of transmission capacity limitations or a lack of transmission connections Rather, the pool company should be in a position to receive competitive bids from different generators, and meet the needs of wholesale customers under a wide variety of bidding outcomes

It is possible to imagine bidding outcomes under periods of low load (for example, summer off-peak hours) that could create grid stability problems in the existing transmission system because all of the supply might be concentrated in a small geographic area A power pool would not necessarily require the transmission capability to handle such an extreme case, but it should have a reasonable range of flexibility to handle a wide range of output levels from the different generating units participating in the wholesale market

This report has analyzed the structure of the power system of Kazakstan to identify the actual geographic regions in which the HV network is operated independently The best measure of the degree of interconnection is the load flow at the coincident system peak, and the most recent data available for this study were the figures contained in the 1995 Annual Report of Kazakstanenergo There are four types of power systems, as shown in Exhibit 2 4

- *Strongly interconnected systems* Each system in this group has the HV network connections needed to transfer at least 500 MW to another system in the group, at the time of the coincident system peak, without dependence on transit through a foreign country Therefore the whole group is ready to operate as a power pool

Exhibit 2-4

Load Flow at the 1995 Coincident System Peak (in MW)

	Strongly interconnected systems (load flows over 500 MW)					Weakly interconnected systems (load flows under 250 MW)			Portions of foreign interconnected systems		Island systems		Total for Kazakstan
Grid region	Kustanay	Tselin	Ekibastuz	Pavlodar	Karaganda	Altay	Almaty	South Kaz	Aktyubinsk	Uralsk	Atyrau	Mangestan	
Production	122	497	1,973	2,651	1,586	1,430	875	786	71	18	180	213	10 402
Plus Imports from other countries	522	0	402	22	0	0	0	1 096	339	222	15	0	2 618
from Russia	522		402	22					339	222	15		1 522
from Turkmenistan								900					900
from Uzbekistan								196					196
Plus Imports from other energos	599	2 060	862	121	855	32	367	80	0	0	26	0	5 002
from Tselin	599												599
from Ekibastuz		1,574											1 574
from Pavlodar directly			862		855	32							1 749
from Pavlodar via Russia		481											481
from Karaganda		5					247						252
from Altay via Russia				121									121
from Almaty								80					80
from S Kaz via Kyrgyzstan							120						120
from Uralsk											26		26
Less Exports to other countries	0	234	421	213	0	0	0	364	0	0	0	0	1 232
to Russia	0	234	421	213	0								868
to Kyrgyzstan								364					364
Less Exports to other energos	0	599	2 429	1 375	252	121	80	120	0	26	0	0	5 002
to Kustanay		599											599
to Tselin directly			1 574		5								1 579
to Tselin, via Russia				481									481
to Ekibastuz				862									862
to Pavlodar via Russia						121							121
to Karaganda			855										855
to Altay				32									32
to Almaty directly					247								247
to Almaty via Kyrgyzstan								120					120
to South Kaz							80						80
to Atyrau										26			26
Equals Gross consumption	1 243	1 724	387	1,206	2 189	1 341	1 162	1,478	410	214	221	213	11 788
Summary													
Production	122	497	1,973	2 651	1 586	1 430	875	786	71	18	180	213	10 402
Plus Net imports from Russia	522	(234)	(19)	(191)	0	0	0	0	339	222	15	0	654
Plus Net imports from Central Asia	0	0	0	0	0	0	0	732	0	0	0	0	732
Plus Net imports from other energos	599	1 461	(1 567)	(1 254)	603	(89)	287	(40)	0	(26)	26	0	0
Equals Gross consumption	1 243	1 724	387	1 206	2 189	1 341	1 162	1 478	410	214	221	213	11 788

- *Weakly interconnected systems* Each system in this group cannot transfer more than 250 MW to another system in Kazakstan, at the time of the coincident system peak, except possibly by transit through a foreign country However, each system in this group has some domestic transfer capability and there are plans to improve the level of interconnection After new HV lines are built, a power system in this group could "graduate" to the group of strongly interconnected systems

- *Portions of foreign interconnected systems* Each system in this group has a relatively small generating capability and has HV connections to a foreign company which is able to act as the principle source of supply Each system in this group therefore operates as a part of a foreign system from a technical standpoint Because of the high cost of connecting these systems with the strongly interconnected group, it is possible that these systems will never join the strongly interconnected group

- *Island systems* Each system in this group operates largely in isolation and because of its remote geographic location, there is only a weak economic justification (or perhaps no justification) for investing in the transmission capability needed to connect these systems with the strongly interconnected group

In 1995 there were five energos in Kazakstan (Kustanai, Tselin, Ekibastuz, Pavlodar, and Karaganda), which were already strongly interconnected These are all located in the northern part of the country and the connections are largely in an east-west direction It would not be difficult to add Altay to this group, by building a stronger transmission connection between Altay and Pavlodar The result would be a set of six systems defined as the *North Grid* As a result of power sector restructuring it is no longer accurate to speak of only six systems, these six regional energos have been superseded by a number of LV network enterprises under Resolution 499

In 1995 there were only weak interconnections between Almatyenergo and South Kazakstanenergo The system serving Chimkent, Dzhambyl, and Kzyl-Orda was named "South Kazakstanenergo" while the combination of this system plus Almatyenergo was given a very similar name — the "South Kazakstan Grid " In this report the combination of the two systems is called the *South Grid* Comparing the North Grid and the South Grid, it is clear that the North Grid is much better prepared for the development of a power pool Ideally the transfer capability between the North and South should be improved by constructing new HV transmission lines The resulting combination would then become a North and South Grid, with the capability of operating a single power pool Until that time, it would be reasonable to try to set up a power pool in the South Grid, perhaps using the interconnections through Kyrgyzstan to implement pool transactions on an east-west axis before new power lines are built to improve the east-west transfer capability within Kazakstan

To calculate the LRMC of the very high-voltage (VHV) network and the HV network, it is useful to combine the data for the North Grid and South Grid so that costs are "averaged" over a large

number of power lines It would be impossible to use historical data to develop accurate LRMC estimates for the South Grid alone Therefore in Chapter 5 LRMC for the North and South Grid is calculated using historical data, despite the fact that this region is not fully interconnected To calculate the SRMC of energy in the 1997-1998 period, the North Grid and South Grid are viewed separately, assuming that a full interconnection will not be achieved before 2000 Therefore in Chapter 4, energy costs are calculated for both regions

A similar pattern of regional dependence and independence is shown by energy flows (Exhibit 2 5) and by the simplified load flow diagram (Exhibit 2 6) and the simplified energy flow diagram (Exhibit 2 7) In the absence of a unified national grid, Kazakstanenergo (in the first half of 1996) continued to be a holding company with different lines of businesses in different grid regions (Exhibit 2 8) The actual services provided by Kazakstanenergo varied from region to region The HV industrial customers represented a large part of the annual energy sales of Kazakstanenergo prior to restructuring These customers were widely dispersed geographically (Exhibit 2 9)

The two oblasts combined as Zapkazenergo are actually separate systems that are linked to the Russian Power Grid Therefore Aktyubinsk and Uralsk are portions of a foreign interconnected system (Exhibit 2 6) Atyrau and Mangestau are both island systems Although it would be technically possible to build transmission interconnections needed to set up a West Grid, or to connect these four systems to the future North and South Grid, there does not seem to be an economic justification for doing so Therefore these four systems are largely outside the scope of tariff calculations in this study

If the list of likely participants in separate power pools in the North Grid and South Grid were closely examined, it is clear that the South Grid has a smaller number of suppliers with over 500 MW of capacity and therefore the level of competition in the South Grid may be weak Where competition is not strong, the SRC will have to consider the establishment of price ceilings applied to the bids received by the South power pool from generating companies Clearly the best solution from a competitive standpoint is to construct the transmission interconnections needed to achieve a single wholesale market in the North and South Grid

The tariff structure of Kazakstanenergo before July 1995 was somewhat confusing, since Kazakstanenergo was not just a wholesale company providing electricity to the regional energos, it sold electricity to selected HV industrial customers and to customers of the former Ekibastuzenergo Some of the regional energos, such as Pavlodar, purchased very little energy from Kazakstanenergo The industrial customer tariff in the fourth quarter of 1995 (0 722 Tenge/kWh) was lower than the annual average tariff for sales to the regional energos (0 84 Tenge/kWh) Both wholesale tariffs — for sales to industrial customers and sales to regional energos — involved a substantial amount of regional cross-subsidization Tariff levels were

Exhibit 2-5

Energy Flow Among Grid Regions in 1995 (in GWh)

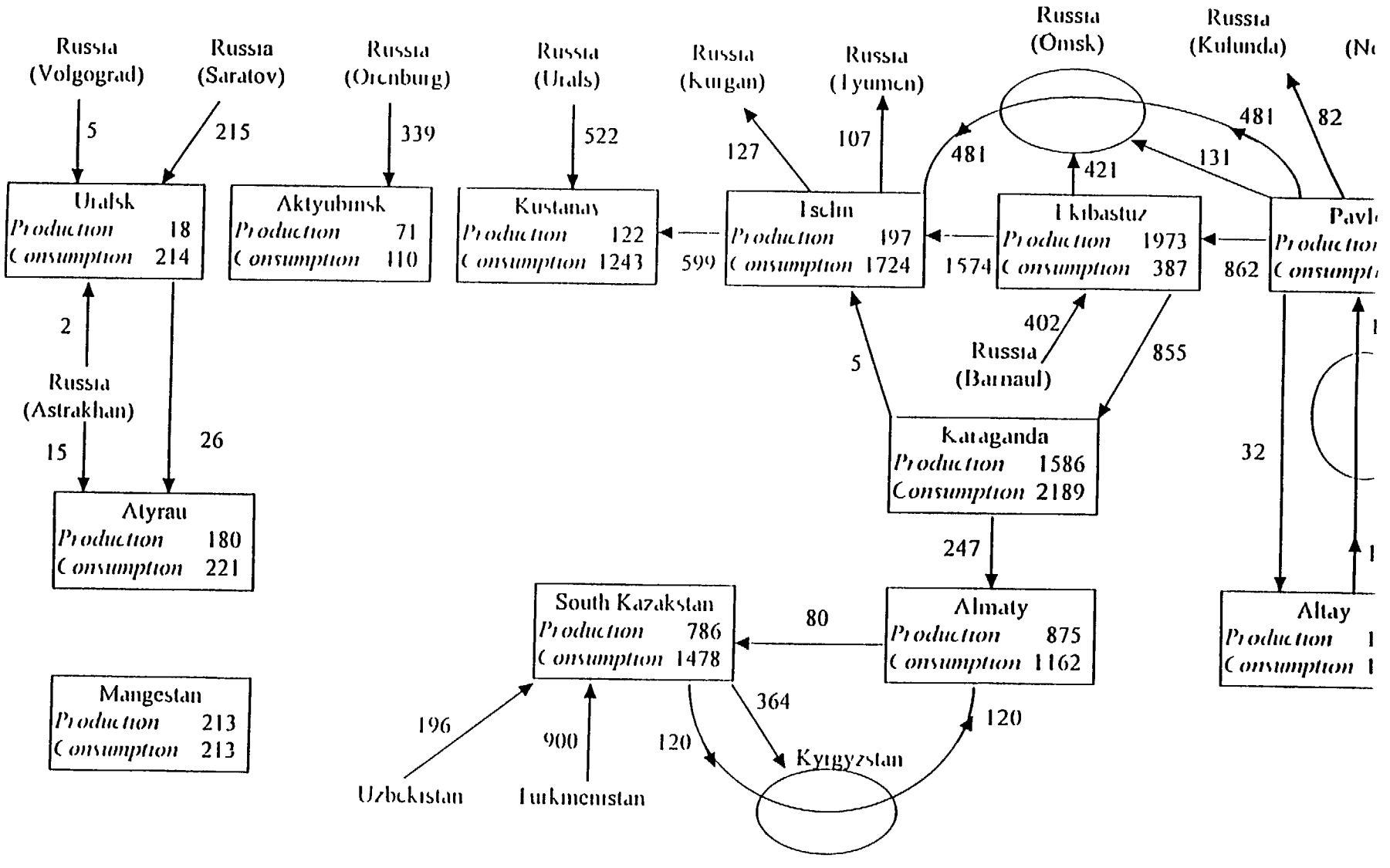
	Strongly interconnected systems (energy flows over 5000 GWh)					Weakly interconnected systems (energy flows under 1000 Gwh)			Portions of foreign interconnected systems		Island systems		Total for
Grid region	Kustanay	Tselin	Ekibastuz	Pavlodar	Karaganda	Altay	Almaty	South Kaz	Aktyubinsk	Uralsk	Atyrau	Mangestan	Kazakstan
Production	**646**	**3471**	**12341**	**15641**	**10235**	**8238**	**4903**	**5557**	**350**	**149**	**794**	**900**	63225
Plus Imports from other countries	313	0	2828	1654	0	0	708	2493	2474	968	105	0	11543
from Russia	**313**		**2828**	**1654**					**2474**	**968**	**105**		8342
from Turkmenistan								**1682**					1682
from Uzbekistan								**427**					427
from Kyrgyzstan							**708**	**75**					783
from Tajikistan								**309**					309
Plus Imports from other energos	6170	12267	4861	190	5446	0	741	586	0	91	0	0	30352
from Tselin	**6170**				**117**								6287
from Ekibastuz		**9752**											9752
from Pavlodar directly			**4861**		**5329**								10190
from Pavlodar via Russia		**2515**											2515
from Karaganda							**741**	**384**					1125
from Altay directly				**20**									20
from Altay via Russia				**170**									170
from Almaty								**202**					202
from Atyrau directly										**91**			91
Less Exports to other countries	0	1013	1890	1245	0	0	0	0	0	0	2	0	4150
to Russia	**0**	**1013**	**1890**	**1245**	**0**								4148
to Uzbekistan											**2**		2
Less Exports to other energos	0	6287	15081	7376	1125	190	202	0	0	0	91	0	30352
to Kustanay		6170											6170
to Tselin directly			9752										9752
to Tselin via Russia				2515									2515
to Ekibastuz				4861									4861
to Pavlodar directly						20							20
to Pavlodar via Russia						170							170
to Karaganda		117	5329										5446
to Almaty directly					741								741
to South Kazakstan directly					384		202						586
to Uralsk											91		91
Equals Gross consumption	7129	8438	3059	8864	14556	8048	6150	8636	2824	1208	806	900	70618

Exhibit 2 5, continued

Energy Flow Among Grid Regions in 1995 (in GWh)

	Strongly interconnected systems (energy flows over 5000 GWh)					Weakly interconnected systems (energy flows under 1000 Gwh)			Portions of foreign interconnected systems		Island systems		Total for Kazakstan
Grid region	Kustanay	Tselin	Ekibastuz	Pavlodar	Karaganda	Altay	Almaty	South Kaz	Aktyubinsk	Uralsk	Atyrau	Mangestan	
Summary													
Production	646	3471	12341	15641	10235	8238	4903	5557	350	149	794	900	63225
Plus Net imports from Russia	313	1013	938	409	0	0	0	0	2474	968	105	0	4194
Plus Net imports - Central Asia	0	0	0	0	0	0	708	2493	0	0	2	0	3199
Plus Net imports - other energos	6170	5980	-10220	7186	4321	190	539	586	0	91	91	0	0
Equals Gross consumption	7129	8438	3059	8864	14556	8048	6150	8636	2824	1208	806	900	70618

Note Total production and consumption for Uralsk and Aktyubinsk is reported by Kazakstanenergo Figures for these grid regions are estimated by Hagler Bailly Similarly total production and consumption for Atyrau and Mangestan is reported by Kazakstanenergo and the figures for these grid regions are estimates


Russia (Volgograd)
Russia (Saratov)
Russia (Orenburg)
Russia (Urals)
Russia (Kurgan)
Russia (Tyumen)
Russia (Omsk)
Russia (Kulunda)
5
215
339
522
127
107
481
481
421
131
82
Uralsk
Production 18
Consumption 214
Aktyubinsk
Production 71
Consumption 110
Kustanay
Production 122
Consumption 1243
Tselin
Production 197
Consumption 1724
Ekibastuz
Production 1973
Consumption 387
Pavl
Production
Consumpt
599
1574
862
2
402
Russia (Barnaul)
5
855
Russia (Astrakhan)
15
26
Karaganda
Production 1586
Consumption 2189
32
Atyrau
Production 180
Consumption 221
247
South Kazakstan
Production 786
Consumption 1478
80
Almaty
Production 875
Consumption 1162
Altay
Production
Consumption
Mangestan
Production 213
Consumption 213
196
900
120
364
120
Uzbekistan
Turkmenistan
Kyrgyzstan

Energy Flow Among Grid Regions in 1993 (in GWh)

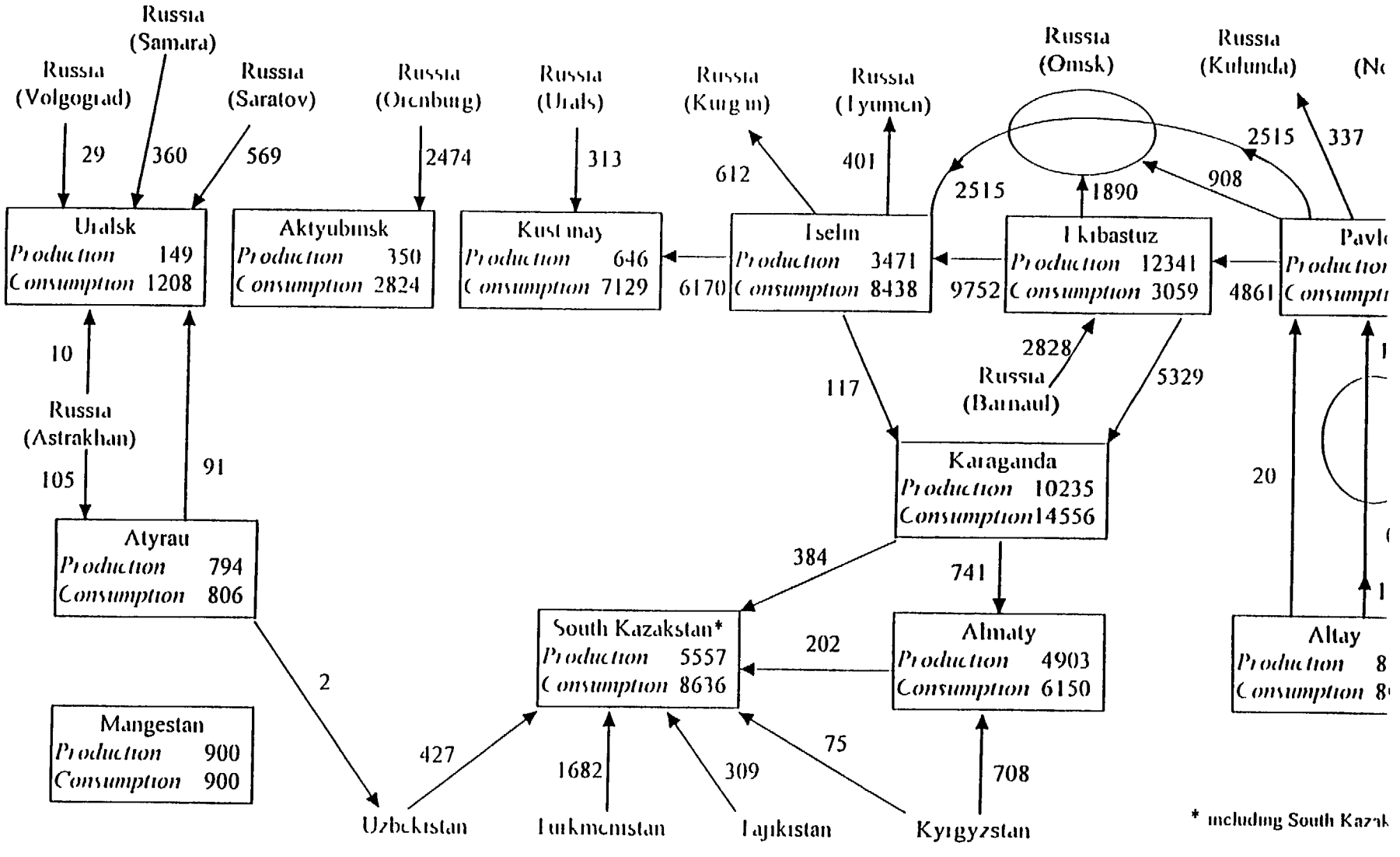


Exhibit 2 6

Functions of Kazakstanenergo in Different Grid Regions in the First Half of 1996

	Strongly interconnected systems (load flows over 500 MW)					Weakly interconnected systems (load flows under 250 MW)			Portions of foreign interconnected systems		Island systems		Total for Kazakstan
	Kustanay	Tselin	Ekibastuz	Pavlodar	Karaganda	Altay	Almaty	South Kaz	Aktyubinsk	Uralsk	Atyrau	Mangestan	
Functions of Kazakstanenergo													
High voltage grid operator	Yes	Yes	Yes	Yes	Yes	planned	planned	Yes	Yes	Yes	minor		Yes
Purchases from generators			Yes		Yes			Yes					Yes
Purchases from autoproducers		Yes			Yes			Yes	Yes		minor		Yes
Imports	Yes		Yes	minor				Yes	Yes	Yes	minor		Yes
Exports		Yes	Yes	Yes				Yes					Yes
Sales to large industrials	Yes				Yes	Yes		Yes	Yes				Yes
Projected 1996 total sales Gwh (before restructuring)	1 910		956	3 364	3 210	1 950		4 020	1 090				16 934
Percent of projected sales by Kazakstanenergo in this region	29%	0%	100%	100%	43%	52%	0%	46%	38%	0%	0%		41%
Sales to the regional energo	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes	minor		Yes
Projected 1996 total sales Gwh (before restructuring)	4 611	4 830	0	(224)	4 281	1 821	1,554	4 745	1 753	800	98	0	24 269
Role of Large Thermal Power Stations													
IPP selling directly to customers				Yermakovskaya									
Generating stations owned by Kazakstanenergo in January 1996			Ekibastuz 1					Zhambyl					
			Ekibastuz 2		Karaganda 2								

Sources Patterns of import and export in 1996 are estimated on the basis of the 1995 coincident system peak
Projections of 1996 sales were provided by Kazakstanenergo in February 1996 when Kazakstanenergo intended to maintain a complete monopoly of the wholesaele market
As a result of privatization and restructuring these projections are no longer valid but they illustrate the size of the wholesale market
Autoproducers are listed in the Kazakstan Power System Least Cost Development Study (April 1995) Table 1 12

EXHIBIT 2 9

High Voltage Customers of Kazakstanenergo

Segment of power sector	Grid region	Regional energo	Customer no	Customer name		Estimated purchases in 1996, Gwh	Percent of total	Transferred to Yermakovskaya power station?
Strongly interconnected systems	Kustanay	Kustanay	10	Sokolov-Sarbay Mining Association		1,910	11 3%	
	Tselin	Tselin	-	[no customers]		0		
	Ekibastuz	Pavlodar	22	State Holding Company "Ekibastuzkomir"		556	3 3%	Probably *
				[unidentified]		400	2 4%	Probably *
					Total	956	5 6%	
	Pavlodar	Pavlodar	11	Yermak Ferroalloys Plant		3,300	19 5%	Yes, definitely *
			12	Pavlodar section of the "Irtysh-Karag" channel		64	0 4%	Probably *
					Total	3,364	19 9%	
	Karaganda	Karaganda	6	Karaganda section of the "Irtysh-Karag" channel		140	0 8%	
			7	Joint-stock company "Jezkazgantsvetmed"		2,720	16 1%	
			8	Joint-stock company "Balkhashmed"		0	0 0%	
			24	"Baykonur" cosmodrome		350	2 1%	
					Total	3,210	19 0%	
Weakly interconnected systems	Altay	Altay	3	Ust-Kamenogorsk titanium-magnesium plant		730	4 3%	
			4	Leninogorsk polymettalico combine		1,055	6 2%	
			23	Ulbinsk metallurgical combine		165	1 0%	
					Total	1,950	11 5%	
	Almaty	Almaty	1	Almaty Railway Road		0		
			2	Taldykorgan section of Almaty Railway Road		na		
	South Kaz	South Kaz	13	Kentau joint-stock company "Achpolymetall"		na		
			14	Chimkent joint-stock company "Phosphorus"		310	1 8%	
			15	Jambyl joint-stock company "Nodfos"		2,000	11 8%	
			16	Jambyl joint-stock company "Chimprom"		1,000	5 9%	
			17	Jambyl section of Almaty Railway Road		500	3 0%	
			18	S Kazakstan section of Almaty Railway Road		188	1 1%	
			19	S Kaz section of Central Asian Railway Road		22	0 1%	
			20	S Kaz section of West-Kaz Railway Road		na		
			21	Kzyl-Orda section of West-Kaz Railway Road		na		
					Total	4,020	23 7%	

* Yermakovskaya station was sold to a mining company which has an exclusive right to sell power directly to high voltage industrial customers
The buyer obtained the right to make direct sales to customers

Exhibit 2 9, continued

High Voltage Customers of Kazakstanenergo

Segment of power sector	Grid region	Regional energo	Customer no	Customer name	Estimated purchases in 1996, Gwh	Percent of total	Transferred to Yermakovskaya power station?
Island systems	Aktyubinsk	Zapkaz	5	Aktyubinsk joint-stock company "Ferrochrom"	1,054	6 2%	
			9	State joint stock company "Yuzhneftegas"	36	0 2%	
				Total	1,090	6 4%	
	Uralsk	Zapkaz	-	[no customers]	0		
	Atyrau	Atyrau	-	[no customers]	0		
	Mangestan	Atyrau	-	[no customers]	0		
				Total for "other" customers	434	2 6%	
Total					16,934		

raised substantially in 1996 The AMC Resolution of September 27, 1996, *On Electricity Tariffs* (Appendix J) raised the price of sales to the regional energos to 2 866 Tenge/kWh Therefore in 1996 the GOK has already achieved substantial progress in the reform of electricity pricing in wholesale market prices and the preparation for introduction of competitive power pools In the following chapters, proposals for a tariff structure are developed which energy prices in the North Grid and the South Grid are different, and capacity charges and energy charges are both included in wholesale tariffs

CHAPTER 3
PROPOSED TRANSMISSION TARIFFS

The purpose of this chapter is to present a methodology for calculating transmission tariffs and to present a set of tariff recommendations that are consistent with the LRMC analysis presented in Chapter 5, which deals with the calculation of sales tariffs to all customer classes at the wholesale and retail levels The methodology presented here is slightly different from the LRMC analysis but the results are practically the same

Transmission tariffs are needed under any form of power sector structure in which the generation sector has a degree of competition and therefore the generating companies are not subject to strict price regulation For example, transmission tariffs are needed to implement a power sector structure in which generating companies are given the opportunity to sell capacity and energy directly to HV customers — the regional network companies, and the large industrial customers connected to the HV grid Transmission tariffs are also needed when a spot market exists in the power sector and there are frequent adjustments in the wholesale price of electricity In Kazakstan a spot market is a possibility but the concept is still under consideration In this chapter assumptions are not made about the specific form of power sector restructuring that will be implemented in Kazakstan, except to assume that large industrial customers and regional network companies will be given the option of buying capacity and energy from two or more sources of supply (generating companies, autoproducers, and foreign countries)

The VHV network includes the 1150 kV, 500 kV, 330 kV, and 220 kV lines and all of the substations that are directly connected to these lines The HV network includes the 110 kV lines and cables and all of the substations that take power from 110 kV to lower voltages *Transmission service* includes (1) the supply of capacity needed to transmit energy through a network, and (2) the transmission of electric energy through the network The business of providing transmission service may be called a *natural monopoly*, that is, an industry sector in which economic efficiency is more likely to be achieved under a monopoly than under a competitive industry structure A *tariff* is a price which is established by government regulation, instead of competitive bidding or negotiation between buyers and sellers Because transmission service is generally a natural monopoly, prices are regulated, and therefore this chapter refers to transmission tariffs rather than transmission prices

3 1 INVESTMENT REQUIREMENTS OF THE HIGH-VOLTAGE NETWORK

To develop a tariff methodology regarding transmission service it is necessary to have a general understanding of the amount of capital investment needed in the HV grid, and the likely sources of funds for these investments If a large amount of investment is needed, the tariff must be developed to support a strategy for obtaining the necessary investment funds Normally a tariff increase is needed to support increased investment

Major investments in the VHV and HV networks will be needed during the next five to ten years, for the following reasons

- The South Grid is heavily dependent upon imported supplies of electricity that have been more expensive than the supplies that can be produced domestically in the North Grid, but transmission constraints block the flow of capacity and energy from the North Grid Supplies of electricity from Uzbekistan are priced at 4 5 Cents/kWh in 1996 and supplies from Turkmenistan are priced at 4 4 Cents/kWh (that is, 4 0 Cents/kWh at the Turkmenistan border plus wheeling charges of 0 4 Cents/kWh, Appendix D) A north-south transmission connection might cause these prices to be reduced, as a result of competition, or might enable Kazakstan to reduce its dependence on higher-cost electricity imports

- The GOK is planning to privatize generating stations and create a competitive market for capacity and energy at the wholesale level To maximize the level of competition it will be necessary to link the North and South Grids and create a single power pool spanning these two regions This linkage is particularly important to ensure supplies to the South Grid at competitive prices

- During the 1997-2000 period it will be necessary to "catch up" on maintenance and refurbishment that was delayed during the 1992-1996 period, when the power sector had very little funding for major repair and reconstruction of older transmission lines or construction of new transmission lines According to Kazakstanenergo's annual report, the technical condition of 16 percent of the 110 kV and 35 kV overhead lines in the North and South regions was unsatisfactory in 1995 (Appendix L, Exhibit L 4)

- Additions to the HV grid will be needed to link the grid to new generating stations that are sited to give the least cost delivered electricity, whether motivated by fuel supply, transmission constraints or demand Given the GOK's interest in attracting private investment in power generation, it will be necessary to offer investors flexibility in site selection for new power stations

A very rough indication of the magnitude of investment required in the high voltage grid is the cost of the 500 kV lines needed to interconnect the North and South Grids during the 1996-2010 period This cost is about $983 million, of which $741 million is needed by 2002 (Exhibit 3 1) This figure excludes the 1150 kV, 330 kV, and 110 kV grids and excludes reconstruction or replacement of any portion of the existing grid

Transmission tariffs will need to be established at levels that will permit the owner(s) of the HV grid to either raise capital through depreciation charges and other tariff components that provide cash flow in excess of operating expenses, or raise capital through long-term borrowing in international capital markets

3.2 PROPOSED TRANSMISSION TARIFFS

On average, the cost of providing transmission service to customers who receive energy at 220 kV is lower than the cost of providing transmission service to customers who receive energy at 110 kV Therefore two sets of transmission tariffs are required

- VHV tariffs for customers who receive energy at 220 kV These customers receive lower rates because they do not pay for the 110 kV grid Electricity is delivered to these customers at specific locations called *VHV delivery points*

- HV tariffs for customers who receive energy at 110 kV Electricity is delivered to these customers at specific locations called *HV delivery points*

Each transmission tariff should be a three-part tariff consisting of a capacity payment, a peak energy loss allowance, and an off-peak energy loss allowance The transmission tariff includes an allowance for energy losses, instead of setting a price per kWh designed to recover the cost of losses For a wheeling customer, the owner of the network will deliver a quantity of energy that is less than the quantity received There are no monetary charges for electricity losses

A capacity payment for transmission service is a payment for use of the network There are different ways to address the question of who uses the network and how this use should be measured For example, three alternatives may be considered

- *Coincident peak load basis* Under this approach, each customer pays for a share of the capacity cost of the network (in the North and South Grid) according to his share of the coincident peak load The capacity payment is a mechanism for spreading the fixed cost of transmission capacity among customers, according to each customer's load at the time of the coincident peak load in the North and South Grid

Exhibit 3.1
Proposed Investments in the 500 kV Grid, 1996-2010

Description	Length, km	Cost $ million	Date of operation	Purpose	Date of operation, per EBRD	ID no	Voltage level
Topar Chiganak	545	109	2000	link North grid to South Kaz	1997	2	500
Chiganak - Dzhambyl	485	97	2000	strengthen South Kaz	1997	3	500
Almaty Taldy Kurgan	260	52	2000	strengthen Almaty	1997	5	500
Chimkent Kentau Kzyl Orda	520	101	2000	strengthen South Kaz	2000	9	500
Topar Shubarkol Dzhezkazgan	560	112	2002	strengthen North grid	1998	10	500
link Nura Agadyr line to Topar	34	7	2002	strengthen North grid	1998	22	500
Taldy Kurgan Aktogai	320	61	2002*	link Almaty to Altay	2010		500
Aktogai Shulbinsk HPP	400	80	2002*	link Almaty to Altay	2010		500
Yermak Shulbinsk HPP	380	76	2002	link North grid to Altay	1998	15	500
Chiganak-Chu	200	40	2002	strengthen South Kaz	2002	21	500
Ust Kamenogorsk Shulbinsk HPP	144	29	2003	strengthen Altay	1998	12	500
Karachaganak Aktyubinsk	320	61	2003	link Aktyubinsk to Uralsk	1997	11	500
Ekibastuz Shakat	170	31	2005	strengthen North grid	2005	17	500
Ekibastuz Uzlovya	38	8	2005	strengthen North grid	2005	19	500
link Almaty Bishkek line to Chu	60	12	2005	strengthen South Kaz	2005	25	500
Ekibastuz Uzlovya Akmolinsk	300	60	2010	strengthen North grid	2010	20	500
Akmolinsk Nura	180	36	2010	strengthen North grid	2010	21	500
Total	4,916	983					

Cost per km 500 kV 0.2 million $/km

* Kazakstanenergo plans initial operation in 2005

Source This is a selection among the projects listed in the EBRD report "Kazakstan Power System Least Cost Development Study," Table 4.1 page 128 The proposal shown here was developed by Hagler Bailly and is intended to show the construction program targets needed to provide an integrated North and South grid by 2002 to enable a single power pool to operate in the North and South regions in 2002 This table does not represent the development plan of Kazakstanenergo

This approach is reasonable, although it does not reflect the complexities of transmission system planning In reality, the transmission system must be designed to accommodate a variety of load flows, during all of the hours of the year that can be considered peak periods The load flow at the coincident peak offers only a snapshot of transmission capacity requirements

- *Modified coincident peak load basis* Under this approach, transmission charges are established for all types of transactions with foreign countries, including transit service, imports during off-peak periods, and exports during peak and off-peak periods The domestic customers pay only for the portion of network costs that is not recovered through charges to foreign countries Domestic customers make capacity payments on a coincident peak load basis

  Although this approach is theoretically appealing, it is not very practical because it makes tariff calculations dependent on the outcome of negotiations with other countries These negotiations are normally confidential and involve a variety of trade issues as well as electricity import and export In practice the electricity transmission revenue received from foreign countries may be considered a kind of offset against the cost of electricity imports

- *Transactional basis* Under this approach, the customer receives transmission service for specific transactions Each transaction has a receipt point and delivery point The customer pays for the amount of capacity required for each transaction

  There are two problems with this approach First, it leads to double-counting, when electricity is resold in the wholesale market Second, it forces the customer to pay for the use of transmission capacity during off-peak periods when there is no economic reason to do so, there is no real capacity cost of off-peak service because there is no need to build transmission capacity to provide off-peak service

The coincident peak load basis — the first approach — is recommended because it gives the most accurate reflection of the true cost of providing transmission capacity in an interconnected network

Under the coincident peak load approach, every electricity consumer who has used the VHV network pays a price which includes a share of the cost of the VHV network The regional network enterprises and large consumers who buy from the VHV network should make capacity payments for the use of the VHV network on the basis of their contribution to the coincident peak load of the North and South Grids

3 3 CALCULATION OF THE REVENUE REQUIREMENT FOR CAPACITY CHARGES

The first step in calculating transmission capacity charges is to calculate the revenue requirements for the fixed costs of the VHV network and the HV network The revenue requirement for VHV capacity charges is the projected annual cost of building and operating the VHV network, excluding the energy losses that are recovered through energy loss allowances When this is divided by the coincident peak load measured at VHV delivery points, the result is the annual VHV capacity payment, in Tenge/kW Similarly the revenue requirement for HV capacity charges is the projected annual cost of building and operating the HV network, excluding the energy losses When this is divided by the coincident peak load measured at HV delivery points, the result is the annual HV capacity payment, in Tenge/kW

Kazakstan and the United States use similar concepts to describe the total annual cost of electric sales and services for a power sector enterprise In the United States there are regulated monopolies for which the independent regulatory commission must determine a *revenue requirement*, that is, the total annual revenue which must be collected through electricity sales and electric transmission services The revenue requirement is measured in dollars per year In Kazakstan and other CIS countries the revenue requirement is normally divided by the total quantity of electricity sold, and this ratio is called the *average tariff* The average tariff is measured in Tenge/kWh or Cents/kWh The average tariff is meaningful when it is calculated for an enterprise which provides sales service but not transmission service

In the former Soviet Union, the average tariff was normally calculated so that it provides for depreciation of assets based on historical costs, with no allowance for a rate of return on assets A different financial criterion is proposed in this chapter depreciation of assets based on replacement cost, plus an allowance for a reasonable rate of return on revalued net assets The *replacement cost* of an asset is the estimated cost of constructing and installing a replacement at today's prices The "reasonable" rate of return should be selected by the independent regulatory commission, and in principle this rate of return should equal the minimum rate of return needed for the transmission company or enterprise to obtain the amount of capital required to fulfill its capital investment plans

For the VHV network the revenue requirement for capacity charges includes three components

- *Operating expenses* These expenses include labor costs and employee welfare expenditures, parts and materials, and all other operation and maintenance expenses except energy losses in the networks, calculated on an annual basis The repair fund is included in operating expenses, but the repair fund should not include major replacement and reconstruction of older transmission lines that have reached the end of their useful life

- *Depreciation* This can be measured by depreciating the gross value of each asset on a straight-line basis over its economic lifetime If the economic lifetime of network assets is set at a standard (for example, 30 years) the annual depreciation allowance is one-thirtieth of total gross asset value

- *Return on net asset value* This amount equals the net asset value at the beginning of the year multiplied by the *allowable rate of return*, that is, the rate of return allowed by the independent regulatory commission

In Kazakstan, there are legal restrictions on the way assets can be revalued for accounting purposes, and many of the accounting rules are enforced by GosComStat Therefore the methodology presented here is based on accounts that are maintained for tariff-setting purposes *Gross asset value* is the estimated replacement cost of assets that are currently being used to provide transmission service Capital investments in new facilities (such as overhead lines, substations, and underground cables) create additions to gross asset value when construction is completed and the new facilities are placed in operation *Net asset value* equals gross asset value minus accumulated depreciation

The gross asset value of the Inter-Electric System on January 1, 1996 is estimated to be $1 211 billion or about 80 billion Tenge (Exhibit 3 1 and Appendix L) If it is assumed that the assets are 65 percent depreciated — they have reached 65 percent of their economic lifetime — the net asset value is about 28 billion Tenge, which is 2 9 times the "market value" estimate developed by Kazakstanenergo in December 1995 Net asset value is far higher than the net book value of three billion Tenge at January 1, 1996 based on GosComStat regulations The replacement cost of the VHV portion of the North and South Grids is estimated to be $3 736 billion and the replacement cost of the HV portion of the North and South Grids is estimated to be $1 859 billion (Exhibit 3 2)

If there were no new investments in the network, gross asset values would remain constant and net asset values would decline over the 1997-2000 period This scenario would yield declining transmission capacity charges but it would not be reasonable, given the need for substantial investment as discussed above For the VHV network, additions to gross asset value is assumed to be ten billion Tenge in 1997 and 15 billion Tenge in 1998, 1999, and 2000 For the HV network, additions to gross asset value is assumed to be five billion Tenge in 1997 and ten billion Tenge in 1998, 1999, and 2000 These are rough estimates which are intended to project a relatively stable net asset value and relatively stable tariff levels through 2000

The projected operating expenses, the ratio of 1996 operating expenses to gross asset value for the Inter-Electric System, is about about 0 9 percent (Exhibit 3 3), so one percent is used

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Exhibit 3 2
Replacement Cost of Network Capacity

Network component	Replacement cost		Kazakstan, total Inter Electric System Quantity	Kazakstan, total Inter Electric System Cost, $million	North & South Grid Very High Voltage (VHV) Quantity	North & South Grid Very High Voltage (VHV) Cost, $million	North & South Grid High Voltage (HV) Quantity	North & South Grid High Voltage (HV) Cost, $million
Overhead lines (km)								
1150 kV	0 75	$million/km	1,402 5	1,051 9	1,402 5	1,051 9		
500 kV	0 2	$million/km	78 5	15 7	4,603 4	920 7		
330 kV	0 1	$million/km		0 0	497 4	49 7		
220 kV	0 07	$million/km		0 0	15,499 0	1,084 9		
110 kV	0 045	$million/km	37 9	1 7			34,489 0	1,552 0
Total			1,518 9	1,069 3	22,002 3	3,107 2	34,489 0	1,552 0
Substations (kVA)								
1150 kV	0 02	$million/kVA	7,005 0	140 1	7,005 0	140 1		
500 kV	0 02	$million/kVA		0 0	11,214 0	224 3		
220 kV	0 02	$million/kVA	80 0	1 6	13,225 1	264 5		
110 kV	0 02	$million/kVA	31 5	0 6			15,329 6	306 6
Total			7,116 5	142 3	31,444 1	628 9	15,329 6	306 6
Total replacement cost, $million				1,211 6		3,736 1		1,858 6
Total replacement cost, thousand Tenge				79,966,293		246,583,062		122,667,402
Net asset value at 1 1 96 based on "market value" estimate by Kazakstanenergo				9,504,000				
Net book value at 1 1 96 based on GosComStat regulations				3,168,000				
Average annual book value of assets in 1995 based on GosComStat				3,388,503				
Hagler Bailly estimate of physical depreciation of assets at 1 1 96				65%		65%		65%
Accumulated depreciation, 000 Tenge				51,978,090		160,278,990		79,733,811
Replacement cost less depreciation, 000 Tenge				27,988,203		86,304,072		42,933,591
Index of "market" estimate by Kazakstanenergo				2 9				
Projected 1996 operating expenses				740,400				
Ratio of operating expense to gross asset value Replacement cost basis (Hagler Bailly)				0 9%				
Ratio of operating expense to net asset value "Market value" est by Kazakstanenergo				7 8%				
Economic lifetime assumed for depreciation, years				30		30		30
Annual depreciation rate based on economic life				3 33%		3 33%		3 33%
Average age of assets, years				19 5		19 5		19 5

Exhibit 3 3
Operating Expenses for Networks Owned by Kazakstanenergo, 1996

Cost category	Inter Electric System Network (1150 kV)	National Electric System Network (500, 220 kV)	Central Dispatch Administration (CDA)	Total for networks & CDA owned by Kazakstan-energo*
Production Services	29 0	68 9		97 9
Auxiliary Materials	15 6	127 2		142 8
Energy	181 1	158 5		339 6
Wage Costs	108 1	147 9		256 0
Employee welfare expenditures	34 4	54 4		88 8
Social Development Fund	16 0	0 0		16 0
Repair Fund	277 0	1,000 4		1,277 4
Environmental fees	0 0	0 1		0 1
Other Cash Expenditures	29 0	71 7		100 7
Land and Property Taxes	50 2	74 5		124 7
Total expenses excluding depreciation	740 4	1,703 6	88 0	2,532 0

Source Data provided by Kazakstanenergo in February 1996 regarding the wholesale tariff expenses projected for 1996 and approved by the government

3.4 ESTIMATING THE REQUIRED RATE OF RETURN

If assets are revalued annually, net asset value will be adjusted for inflation and therefore the allowable rate of return should not include an inflation component The allowable rate of return must be designed to include the following elements

- *Basic rate of return on capital employed* This is the basic cost or rent which must be paid for money in the absence of risk and inflation A good proxy for this would be the interest rate on long-term U S Treasury bonds in the low-inflation environment of the 1930's and 1940's In that period, the return on U S Treasury bonds was approximately two to three percent A value of three percent has been used for this component

- *Additional return required to reflect industry risk* The electricity industry supplies essential requirements whose demand is relatively predictable under normal conditions A typical industry premium under state conditions for electricity would be about two percent A risk premium would therefore be in the range of three percent for the electricity industry under changing conditions For Kazakstanenergo under current conditions three percent is used

- *Additional return required to reflect corporate or financial structure <u>within</u> the industry* An additional premium may be required to reflect the specific characteristics of a particular firm or organization, or the structure of the industry The power sector is operating under conditions of great uncertainty at this time No independent regulatory commission has yet been formally established As a result, there is no adequately defined system for determining and evaluating tariffs In addition, a large portion of electricity delivered to consumers is not being paid for It is clearly desirable that this risk premium be reduced by the introduction of an adequate regulatory framework, and a degree of stability into the structure of the industry Providing these conditions occur two percent is used as a premium for industry structure risk

- *Additional return required to reflect country risk* Country risk reflects the premium required to finance electricity investment between various countries Country risk reflects issues such as the regulatory environment and its responsiveness, and other factors of a socio-political nature It could vary from zero percent in the United States and United Kingdom to ten percent in the CIS countries at the present time A value of eight percent for Kazakstan is used in this report

- *Technical and Environmental Risk* Every electricity project has associated technical risks, which vary with the specifics of the project Investors recognise

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that due diligence in their investment appraisal does not precisely delineate such risks Investments in VHV or HV transmission involve a modest degree of technical risk, indicating a two percent risk premium

Given all of these considerations, a total rate of return on revalued net fixed assets of 18 percent appears reasonable

	Percent per year
Basic return on capital	3 0
Industry risk for electricity	3 0
Industry structure risk	2 0
Country risk	8 0
Technical/ environmental risk	2 0
Total target rate of return	18 0

This total of 18 percent may be regarded as an estimate of the true cost of capital to the economy of Kazakstan, when capital is invested in the VHV network and the HV network and there are no hidden subsidies or loan guarantees which artificially lower the level of interest rates and earnings required by investors In the final analysis, only the collective judgement of the market can properly or adequately evaluate the overall required rate of return for a given industry in a given country at a given time In the absence of a market, the analyst must substitute judgement based on research, experience, and international comparisons

3.5 RESULTS OF THE TARIFF CALCULATION

For the VHV network this report calculates that the capacity payment in 1997 should be 228 Tenge per kW per month, or $3 46 per kW per month (Exhibit 3 4) This estimate is based on the assumption that the peak load at VHV delivery points in the North and South Grids in 1997 will be 9,126 MW This estimate (Exhibit 5 11) is taken from an analysis of network losses conducted in connection with the LRMC tariff calculations in Chapter 5 If an 85 percent load factor is assumed for VHV industrial customers as a class, the average cost of VHV capacity payments for these customers would be 0 3677 Tenge/kWh or 0 56 Cents/kWh

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Exhibit 3 4

Calculation of the Capacity Payment Required for the Very High Voltage Network

	1996	1997	1998	1999	2000
Rate of return on net asset value (revalued)	**18 0%**	**18 0%**	**18 0%**	**18 0%**	**18 0%**
Real annual escalation in operating expenses		**10 0%**	**10 0%**	**10 0%**	**10 0%**
Exchange rate -- Tenge/USD	**66**	66	66	66	66
Annual depreciation rate	3 33%				
Operating expenses / Gross asset value	**1 0%**				
Balance sheet items, in thousand Tenge					
Gross asset value at start of year	246,583,062	246,583,062	256,583,062	271,583,062	286,583,062
Plus Additions to gross asset value	**0**	**10,000,000**	**15,000,000**	**15,000,000**	**15,000,000**
Equals Gross asset value at end of year	246,583,062	256,583,062	271,583,062	286,583,062	301,583,062
Gross asset value at start of year	246,583,062	246,583,062	256,583,062	271,583,062	286,583,062
Less Accumulated depreciation	160,278,990	168,498,426	177,051,194	186,103,963	195,656,732
Equals Net asset value at start of year	86,304,072	78,084,636	79,531,868	85,479,099	90,926,330
Revenue requirement, in thousand Tenge					
Operating expenses	2,465,831	2,712,414	2,983,655	3,282,021	3,610,223
Depreciation	8,219,435	8,219,435	8,552,769	9,052,769	9,552,769
Return on Net asset value at start of year	15,534,733	14,055,235	14,315,736	15,386,238	16,366,739
Total revenue requirement	26,219,999	24,987,084	25,852,160	27,721,027	29,529,731
Tariff calculation					
Peak load at VHV delivery points, MW	**9,107**	**9,126**	**9,226**	**9,411**	**9,665**
VHV capacity payment, Tenge/kW/month	240	228	234	245	255
VHV capacity payment, USD/kW/month	3 64	3 46	3 54	3 72	3 86
Sales to VHV industrial customers					
Contribution to coincident peak load, MW	**712**	**710**	**727**	**748**	**786**
Capacity payment revenue, 000 Tenge	2,049,922	1,943,987	2,037,126	2,203,308	2,401,487
Estimated cost per kWh					
Coincident peak load factor (assumed)	**85%**	85%	85%	85%	85%
Annual energy consumption, GWh	5,302	5,287	5,413	5,570	5,853
Average cost of capacity, Tenge/kWh	0 3867	0 3677	0 3763	0 3956	0 4103
Average cost of capacity, cents/kWh	0 59	0 56	0 57	0 60	0 62

The capacity payment for the HV network in 1997 should be 128 Tenge per kW per month, or $1 94 per kW per month (Exhibit 3 5) This estimate is based on the assumption that the peak load at HV delivery points in the North and South Grids in 1997 will be 8,089 MW This estimate (Exhibit 5 11) is also taken from the LRMC analysis For an 85 percent load factor for HV industrial customers as a class, the average cost of HV capacity payments for these customers would be 0 2064 Tenge/kWh or 0 31 Cents/kWh

In summary, the recommended transmission tariffs are shown in Exhibit 3 6 The energy loss factors are taken from the analysis of energy losses presented in Chapter 5 in connection with the LRMC tariff calculation (Exhibit 5 10) The transmission service tariffs shown in Exhibit 3 6 are consistent with the sales tariffs shown in Exhibit 5 18 In Chapter 6 a tariff reform plan is presented based on these levels of transmission tariffs (Chapter 3) and transmission cost components of sales tariffs (Chapter 5)

Exhibit 3 5

Calculation of the Capacity Payment Required for the High Voltage Network

	1996	1997	1998	1999	2000
Rate of return on net asset value (revalued)	18 0%	18 0%	18 0%	18 0%	18 0%
Real annual escalation in operating expenses		10 0%	10 0%	10 0%	10 0%
Exchange rate -- Tenge/USD	66	66	66	66	66
Annual depreciation rate	3 33%				
Operating expenses / Gross asset value	**1 0%**				
Balance sheet items, in thousand Tenge					
Gross asset value at start of year	122,667,402	122,667,402	127,667,402	137,667,402	147,667,402
Plus Additions to gross asset value	**0**	**5,000,000**	**10,000,000**	**10,000,000**	**10,000,000**
Equals Gross asset value at end of year	122,667,402	127,667,402	137,667,402	147,667,402	157,667,402
Gross asset value at start of year	122,667,402	122,667,402	127,667,402	137,667,402	147,667,402
Less Accumulated depreciation	79,733,811	83,822,725	88,078,305	92,667,218	97,589,465
Equals Net asset value at start of year	42,933,591	38,844,677	39,589,097	45,000,184	50,077,937
Revenue requirement, in thousand Tenge					
Operating expenses	1,226,674	1,349,341	1,484,276	1,632,703	1,795,973
Depreciation	4,088,913	4,088,913	4,255,580	4,588,913	4,922,247
Return on Net asset value at start of year	7,728,046	6,992,042	7,126,038	8,100,033	9,014,029
Total revenue requirement	13,043,634	12,430,297	12,865,893	14,321,650	15,732,249
Tariff calculation					
Peak load at HV delivery points, MW	**8,069**	**8,089**	**8,168**	**8,326**	**8,533**
HV capacity payment, Tenge/kW/month	135	128	131	143	154
HV capacity payment, USD/kW/month	2 04	1 94	1 99	2 17	2 33
Sales to HV industrial customers					
Contribution to coincident peak load, MW	**1,880**	**1,876**	**1,920**	**1,976**	**2,076**
Capacity payment revenue, 000 Tenge	3,039,042	2,882,833	3,024,304	3,398,941	3,827,511
Estimated cost per kWh					
Coincident peak load factor (assumed)	**85%**	85%	85%	85%	85%
Annual energy consumption, GWh	13,998	13,969	14,296	14,713	15,458
Average cost of capacity, Tenge/kWh	0 2171	0 2064	0 2115	0 2310	0 2476
Average cost of capacity, cents/kWh	0 33	0 31	0 32	0 35	0 38

Exhibit 3 6
Recommended Transmission Tariffs for 1997

	Customer class	
	Very High Voltage	**High Voltage**
Delivery voltage	220 kV	110 kV
Basis for capacity charges	Customer load at the time of the annual coincident peak load in the North and South Grid	Customer load at the time of the annual coincident peak load in the North and South Grid
Capacity payment, Tenge/kW/month	228	356
Capacity payment, USD/kW/month	3 46	5 40
Peak energy charge, given as a percentage of energy received by the networks during peak periods*	5 4%	9 1%
Off-peak energy charge, given as a percentage of energy received by the networks during off-peak periods*	4 4%	7 2%

* Peak periods are 7 00 to 11 00 and 18 00 to 21 00 hours, Monday through Friday

CHAPTER 4
ECONOMIC COST OF POWER SUPLIES

The design of electricity tariffs involves a build-up of power supply costs in a chain of components that goes from the power resource through the different voltage levels of transmission and distribution to the final user In order to arrive at an efficient use of resources the price of electricity must be such that it recovers exactly the least cost of providing the electricity service taking into account the opportunity cost of all resources invested including capital, fuels and labor In this chapter, the calculation of the economic price of electricity at the generation level is derived This cost of generation is calculated before the cost of transmission nd distribution is included

4.1 EXISTING GENERATION SYSTEM

The Kazakstan electric system can be divided into the North, South, and West Regions The North and South Regions are loosely interconnected, while the West region could be considered indirectly interconnected with the North by way of Russia Until July 1995 the operation of the production and distribution systems was organized into ten regional energos, as follows

- *North Region* Altayenergo, Ekibastuzenergo, Karagandaenergo, Kustanayenergo, Pavlodarenergo, and Tselinenergo
- *South Region* Almatyenergo and South Kazakstanenergo
- *West Region* Atyrauenergo and Zapkazenergo

The North and South Regions are already weakly interconnected and the interconnection is expected to be strengthened in the next decade The West Region will probably remain isolated from the North and South Regions until the next decade or beyond For the purposes of the tariff study only the North and South Regions will be analyzed in detail

The structure of total electricity supply in the North and South Regions is shown in Exhibit 4 1 Billed electricity consumption for the two regions in 1995 was about 48 88 TWh compared with a peak of 76 86 TWh in 1990 Since the breakup of the former Soviet Union, electricity consumption has continuously decreased and it is estimated that the 1990 level of consumption will not be recovered until the year 2010 This decrease is mainly due to the reduction in industrial output and higher losses in the power system In 1990 the industrial sector accounted

Exhibit 4 1

Peak load forecast for Kazakhstan

1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
							Electrowatt Low growth rates														
				1,458		1,243	1,215	1,210	1 215	1,231	1,254	1,283	1 309	1 336	1 361	1,387	1,411	1 433	1 453	1 473	1 491
				2,027		1,724	1,685	1 678	1 685	1,707	1,740	1 779	1 815	1 852	1,888	1,924	1 957	1 987	2,016	2,043	2 067
				467		387	378	377	378	383	391	399	407	416	424	432	439	446	453	459	464
				1,449		1,206	1 178	1 174	1,179	1 194	1 217	1 245	1,270	1,296	1,321	1 346	1 369	1,390	1,410	1 429	1 446
				2,539		2,189	2,139	2,130	2,139	2 167	2,209	2,259	2,305	2 352	2 397	2 443	2,484	2,523	2 560	2 594	2,625
				1,605		1,341	1,310	1,305	1 310	1 328	1,353	1,384	1 412	1 441	1 469	1,497	1,522	1 546	1 568	1,589	1,608
				9 545		8,090	7,905	7 874	7 906	8 009	8,163	8,349	8 518	8 693	8 860	9,030	9,182	9 325	9 459	9 585	9,702
				1,269		1,162	1 146	1 152	1,170	1,200	1 238	1 284	1 329	1,372	1,414	1 454	1 493	1,532	1,570	1 606	1 641
				1,856		1,478	1,458	1,465	1,488	1 526	1 575	1 633	1,690	1,745	1 799	1 850	1 899	1,949	1 996	2 043	2 087
				3,125		2 640	2,604	2,617	2 658	2 726	2 813	2,917	3,019	3 117	3 213	3,304	3,393	3,481	3 566	3 648	3,727
				779		624	624	631	643	660	682	704	726	748	770	791	810	828	846	862	877
				469		434	434	439	447	459	475	490	505	520	535	550	563	576	588	600	610
				1,248		1,058	1,057	1,070	1,091	1 119	1 157	1 194	1,232	1,268	1 305	1 341	1 373	1,405	1,434	1 462	1 487
				13,918		11 788	11,566	11,561	11 655	11,854	12 133	12,461	12,769	13 078	13 377	13,675	13,948	14,210	14 459	14 695	14 916
				12,670		10,730	10,509	10 491	10 564	10,735	10,976	11,267	11 537	11 810	12,072	12,334	12,575	12 806	13 025	13,234	13 429
						8,484	8 290	8,257	8,291	8,399	8,561	8,756	8,933	9,116	9,291	9,470	9,629	9,779	9,920	10,052	10,174
						2 914	2,874	2,889	2,934	3,009	3,105	3,220	3,332	3,441	3,546	3,647	3,745	3,842	3,936	4,027	4,114
						1,328	1,327	1,343	1,369	1,405	1,452	1,499	1,546	1,592	1,638	1,683	1,724	1,763	1,800	1,835	1,867
						12,726	12,491	12 489	12 594	12,813	13,118	13,475	13 811	14,149	14,475	14,800	15,098	15 384	15,656	15,914	16,155
						11,398	11 164	11 146	11,225	11,408	11,666	11,976	12,265	12,557	12,837	13,117	13 374	13 621	13,856	14 079	14 288
							-2 3%	-0 4%	0 4%	1 3%	1 9%	2 3%	2 0%	2 0%	1 9%	1 9%	1 7%	1 6%	1 4%	1 3%	1 2%
							-1 4%	0 5%	1 6%	2 6%	3 2%	3 7%	3 5%	3 3%	3 1%	2 8%	2 7%	2 6%	2 4%	2 3%	2 2%
							0 1%	1 2%	1 9%	2 6%	3 3%	3 2%	3 1%	3 0%	2 9%	2 7%	2 4%	2 3%	2 1%	1 9%	1 7%
							-1 8%	-0 0%	0 8%	1 7%	2 4%	2 7%	2 5%	2 4%	2 3%	2 2%	2 0%	1 9%	1 8%	1 6%	1 5%
					Est																
10,092	10,274	10,175	10,061	9,852	8,849	8,484	8,290	8,307	8,391	8,552	8,770	9,023	9,262	9,508	9,749	9,998	10,226	10,448	10,663	10,870	11,069
4,101	4,263	4,201	3,785	3,412	3,050	2,914	2,874	2,907	2,969	3,063	3,180	3,318	3,455	3,589	3,721	3,850	3,978	4,105	4,230	4,354	4,476
1,364	1,434	1,404	1,403	1,409	1,350	1,328	1,327	1,351	1,385	1,431	1,487	1,545	1,603	1,661	1,719	1,777	1,831	1,884	1,935	1,984	2,031
15,557	15 971	15 780	15 249	14,673	13 249	12,726	12,491	12 565	12,745	13,046	13,437	13,886	14 320	14,758	15,189	15,625	16,035	16 437	16,828	17,208	17 576
						11,398	11,164	11,214	11,360	11,615	11,950	12,341	12,717	13,097	13,470	13 848	14,204	14,553	14,893	15 224	15 545
	1 8%	-1 0%	-1 1%	2 1%	-10 2%	4 1%	-2 3%	0 2%	1 0%	1 9%	2 5%	2 9%	2 6%	2 7%	2 5%	2 6%	2 3%	2 2%	2 1%	1 9%	1 8%
	4 0%	1 5%	-9 9%	-9 9%	-10 6%	-4 5%	-1 4%	1 1%	2 1%	3 2%	3 8%	4 3%	4 1%	3 9%	3 7%	3 5%	3 3%	3 2%	3 0%	2 9%	2 8%
	5 1%	-2 1%	-0 1%	0 4%	4 2%	-1 6%	0 1%	1 8%	2 5%	3 3%	3 9%	3 9%	3 8%	3 6%	3 5%	3 4%	3 0%	2 9%	2 7%	2 5%	2 4%
							-1 8%	0 6%	1 4%	2 4%	3 0%	3 3%	3 1%	3 1%	2 9%	2 9%	2 6%	2 5%	2 4%	2 3%	2 1%

Exhibit , continued

Peak load forecast for Kazakhstan

1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
						8 484	8,290	8 307	8,458	8,689	8,982	9,315	9,638	9,973	10,308	10,656	10,987	11,315	11,640	11,961	12,277
						2,914	2 874	2,907	2,993	3,113	3,257	3,425	3,595	3,765	3,935	4,103	4,274	4,445	4,618	4,791	4,964
						1 328	1,327	1 351	1,397	1,454	1,523	1,595	1,668	1,742	1,818	1,894	1,967	2,040	2,112	2,183	2,253
						12,726	12 491	12 565	12 848	13,256	13 762	14,335	14 901	15,480	16 061	16 653	17,228	17,800	18 370	18,935	19 494
						11,398	11,164	11 214	11,451	11 802	12,239	12 740	13,233	13,738	14,243	14 759	15,261	15 760	16,258	16 752	17,241
							-2 3%	0 2%	1 8%	2 7%	3 4%	3 7%	3 5%	3 5%	3 4%	3 4%	3 1%	3 0%	2 9%	2 8%	2 6%
							-1 4%	1 1%	3 0%	4 0%	4 6%	5 2%	5 0%	4 7%	4 5%	4 3%	4 2%	4 0%	3 9%	3 7%	3 6%
							-0 1%	1 8%	3 4%	4 1%	4 7%	4 7%	4 6%	4 4%	4 4%	4 2%	3 9%	3 7%	3 5%	3 4%	3 2%
							-1 8%	0 6%	2 3%	3 2%	3 8%	4 2%	3 9%	3 9%	3 8%	3 7%	3 5%	3 3%	3 2%	3 1%	3 0%

for almost 75 percent of the billed electricity consumption compared to 64 percent in 1995 On the other hand residential consumption has experienced an increase in its share from eight percent in 1990 to 15 percent in 1995

Peak load is the maximum hourly load during the calendar year, and is the sum of loads measured at generating stations and import points The historic peak load for both North and South Kazakstan occurred in 1990 From 1990 to 1995 the annual peak load gradually decreased from 14537 MW to 10729 MW The simultaneous peak load of 1995 occurred on February 21 at 20 00 hours Almaty time

Despite a marked decrease in demand for electricity in recent years, Kazakstan is not self-sufficient in power production as the system has severe constraints in capital, resulting in delayed investment in new plants as well as shortages of maintenance and spare parts and difficulties in securing fuel and power purchase contracts The structure of energy sources is shown in Exhibit 4 2

About 83 percent of the North-South Region production is located in the North, based largely on coal from Ekibastuz and Karaganda However the Northern Region is also the largest consumer 77 percent of the North-South system consumption In 1995 the Northern Region was a net exporter of energy In the Southern Region there is an imbalance of energy generated and consumption Almost 29 percent of the total consumption must be imported from the Central Asia Republics (CAR) and from the Northern Region

From the energy supply structure for the North-South Region in 1995 it is important to note that while the exchange with Russia is comprised of large amounts of imports and exports, the exchange with the CAR is constituted mostly of imports Imports from Russia supplies the North Region, while imports from the CAR supplies the South Region The electricity exchange between Russia and the North Region is complicated because part of the exchange consists of transfers between supply areas, wheeled through the neighboring grid

4 2 EXISTING GENERATING PLANTS

Electricity production by thermal power plants is mainly concentrated in the North Region The Southern Region has limited resources for thermal production

The *installed capacity* of a generating unit is the capacity it was designed to produce when it was first installed The *available capacity* of a generating unit in a particular year is an estimate of the maximum output that it can produce during the year Kazakstanenergo does not publish statistics on available capacity, although the national dispatch center maintains information on available capacity on a daily basis Appendix A provides estimates of available capacity used in this

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Exhibit 4 2
Energy Supplies for the North and South Systems, 1995

	Annual energy supply, GWh			Percent of total
Total electricity supplied in 1995	61,602			100 0%
MECI generating stations		56,346		91 5%
Thermal			48,377	78 5%
Hydroelectric			7,969	12 9%
Autoproducers		1,408		2 3%
Net imports		3,848		6 2%
Turkmenistan			1,682	2 7%
Uzbekistan			427	0 7%
Kyrgyzstan			783	1 3%
Tajikistan			309	0 5%
Russia			647	1 1%

report The total installed capacity of Kazakstan (including autoproducers) in June 1996 was 16,271 MW, of which the North-South Region has a total of 15,953 MW Thermal generation in the North-South Region provides 13,901 MW, hydropower represent only 2,030 MW, and the installed capacity of diesel power plants is 21 MW

All major thermal plants in the system are coal-fired, except for a few gas and oil plants in the Almaty, and Chimkent/Dzhambul areas Most of the coal comes from the open-cast mine of Ekibastuz and the Karaganda mine Almost two-thirds of the total installed thermal capacity is for electricity production only The remaining capacity is installed in combined heat and power (CHP) plants, which are commonly located next to major cities to provide district heating and hot water Of the 38 existing thermal plants, 30 are CHPs

Capacity derating due to deterioration or damage is very high The available capacity of the thermal power plants is very low Some of them operate at less than 25% of their design capacity due to the lack of financial resources for spare parts and preventive maintenance

The major existing hydro cascade is located on the Irtysh river in the Semipalatinsk area The cascade is comprised of the following plants

- *Bukhtarminsk HPP* With an installed capacity of 675 MW, it is the most important hydro-plant of the Republic The associated reservoir has approximately a two year usable storage capacity This plant is used as a peaking plant, but its operational regime is restricted because of water regulation requirements for shipping

- *Ust-Kamenogorsk HPP* This plant with an installed capacity of 332 MW has a reservoir with weekly storage capability

- *Shulbinsk HPP* The installed capacity of this plant is 585 MW The operating regime of this plant is constrained due to water regulation downstream This plant delivers its full capacity only during the spring

Another large hydro plant, the Kapchagay HPP, is located east of Almaty Its installed capacity is 434 MW The power and peaking capability of the plant is restricted, mainly because of hydrological and flood control reasons The four hydro plants represent about 95% of the total hydro development There exist several small plants, that make up for the remainder The Ministry of Agriculture owns and operates two hydro plants

As mentioned previously, the GOK has begun its progarm on privatization, including thermal units such as Ekibastuz 1, and is currently negotiating private ownership of new power generation projects, such as the ABB project in South Kazakstan (formerly a project managed by Kazakstanenergo) In addition, the GOK is in the process of establishing a competitive market

for generation which will encompass the North and South Regions as well Therefore it is difficult to predict the timing and technical characteristics of additions to generating capacity

On the basis of the *Kazakstan Power System Least Cost Development Study* completed in April 1995 as well as internal planning studies conducted by Kazakstanenergo in 1996, there are three categories of capacity additions in the North and South Regions that should be examined in any forecast of capacity additions

- Large coal-fired units, such as the units of the proposed South Kazakstan power station (2x320 MW) or additional 525 MW units proposed for Ekibastuz 2 This was the preferred form of thermal power plant construction in the North and South Grid under central planning, but during the 1990's the financial problems of the power sector brought new construction to a halt

- Expansion and reconstruction of CHP plants needed to provide district heat The expansion plan developed by Kazakstanenergo in 1995 includes the following additions to existing CHPs

  Semipalatinsk CHP (1x185 MW)
  Ust-KamenogorskCHP-1 (1x80 MW) and CHP-2 (2x185 MW)
  Karaganda CHP-2 1x185 MW) and CHP-3 (1x110 MW + 1x140MW)
  Balkash CHP-1 (1x115MW)
  Kustanay CHP-2 (2x115 MW)
  Akmolinsk CHP-2 (1x115 MW)
  Taldi-Kurgan CHP-1 (1x115 MW)
  Chimkent CHP (1x80 MW)

- Gas-fired combined cycle stations that have a lower capital cost but higher fuel cost, relative to new coal-fired units New combined cycle turbines (CCTs) should be able to achieve a higher thermal efficiency than the six 200 MW boilers installed at Zhambyl in 1967-76 On the other hand, investors may prefer to locate new gas-fired generating units in Turkmenistan or Uzbekistan rather than in Kazakstan The likely contribution of CCTs will become clearer only after current plans for power sector restructuring have been implemented

A small amount of hydro plant construction in the Altay region is possible — for example, Shulbinsk HPP-1 (15 MW) and HPP-2 (78 MW) — but Kazakstan is not likely to increase its hydro capacity significantly Kazakstan is not expected to pursue a nuclear plant construction program, although this alternative is currently being examined

4.3 LONG RUN MARGINAL COST OF A GENERATION SYSTEM

The least cost of providing power to the high voltage grid is captured by the LRMC of generation, which is defined as the lowest cost required to meet a sustained increment of load with no change in reliability While the definition is simple, the determination of LRMC is quite complex Before going into the computational methodology for LRMC it is first necessary to very briefly review some properties of the least cost generation mix which serve to explain the economic efficiency benefits associated with marginal cost pricing

4 3 1 Properties of the Optimal Generation Mix

Due to the variation of electricity load with time and due to the fact that electrical energy cannot be directly stored in large quantities, the least cost of power generation can only be achieved with a mix of different assets with various combinations of fixed costs and variable costs *Fixed costs* do not vary in relation to the amount of energy generated, while *variable costs* are considered to vary in direct proportion to the amount of energy generated High load levels that have a short duration are better served with assets that have low fixed costs at the expense of more expensive fuels, while lower load levels that are permanent or of a long duration are better served with assets that have higher fixed costs but less expensive variable costs

It can be shown that if the generation mix is optimal, that is, if the amount of capacity in units of different types is exactly that which will result in the lowest total cost of power supply, then there are two possible ways to recover the total cost of production of each power plant These are known as

- *Coupled Costs* In this approach each plant is paid for its specific lowest fixed and variable cost This method of payment is typical of transfer prices in vertically integrated power utilities

- *Decoupled Costs* In this approach each plant is paid for capacity according to a price per kW based upon the lowest fixed cost per kW of any unit in the system Usually the unit with the lowest fixed cost per kW is a gas turbine or comparable peaking unit with low capital cost

These two approaches are illustrated in Exhibit 4 3 which shows three different types of generating facilities, such that their variable costs (V) decrease as their fixed costs (F) increase The annual cost of one unit of capacity from these facilities can be plotted against the number of hours of operation as shown in Figure A The intersecting points of these lines indicate the optimum number of hours that each facility should operate In Figure B the annual load duration curve is shown together with the ideal generation mix to serve the load at minimum cost

EXHIBIT 4.3
PROPERTIES OF THE OPTIMAL GENERATION MIX

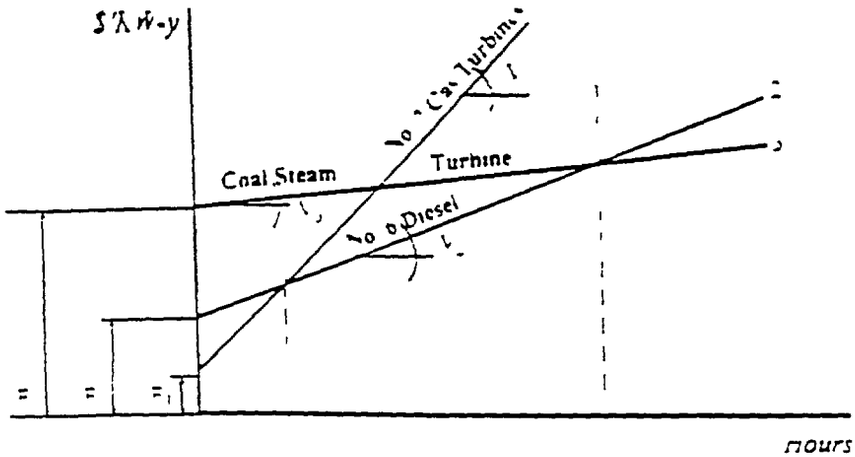


Fig A

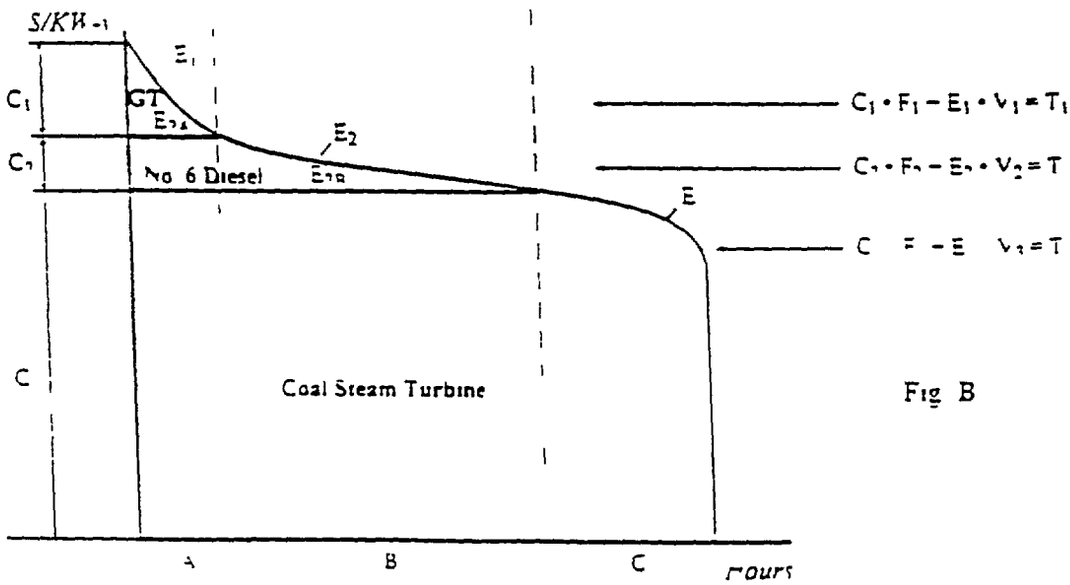


Fig B

$t_A = V_1 \cdot (E_{1A} + E_{2A} + E_{3A})$	Short Run Marginal Cost
$t_B = V_2 \cdot (E_{2B} + E_{3B})$	+
$t_C = V_3 \cdot E_{3C}$	
$CAP = F_1 \cdot (C_1 + C_2 + C_3)$	Capacity Cost
	=
T = Total Cost	Long Run Marginal Cost

4 3 2 Alternatives for Achieving a Least-cost Generation System

From the property of the optimal generation mix described above it can be concluded that there exist two alternative routes to ensure that a generation system will evolve towards its least cost configuration One alternative is for all the generation resources to be under a central authority responsible for covering the fixed and variable costs of each plant The central authority will periodically perform a rigorous optimization of the capacity expansion plan on the basis of the best forecast of the economic environment in which the system will have to operate and will then make sure that the system adheres to that plan In this case the dispatch of the plants will be done economically (i e , in order of increasing variable costs), but it is not relevant to each individual plant as to how much energy it produces, since the plant is assured recovery of all of its fixed and variable costs regardless of production

Another alternative is to allow each plant to operate as an independent financial entity that must compete against other plants for its right to sell energy in the system at prices based on marginal cost The plants will be dispatched, as before, in order of increasing variable costs, but in this case the plants will have to make sure they get to sell enough energy at the highest variable cost (which is usually higher than their own variable cost) in order to make up for a capacity payment based on the lowest fixed cost (which is usually lower than the fixed cost of the plant) In this case there is no strict need for a central authority to plan the evolution of the system, the competition for sales and the ambition to maximize profit will drive the system towards its optimal mix

4 3 3 Short-run Marginal Cost

The marginal cost of generation is defined as the cost of increasing production by one small increment Since plants are dispatched in order of increasing variable costs the cost of increasing production by one increment at a given point in time is the highest variable cost of the units in operation at that time Thus, the plant with the highest variable cost is called "marginal" plant and its variable cost is called "marginal" cost of energy Since this value changes at every instant depending on load variation and the availability of different plants, the marginal cost of energy is really an average of the marginal costs over time

This particular interpretation of the concept of marginal cost of generation applies only over the short term since there is a limit to how much load can be carried by a generation system before its variable cost and its reliability reach unacceptable levels and capital investments are required Thus, the marginal cost of energy is also called SRMC and is the cost of serving incremental loads without additional capital investments

4 3 4 Long-run Marginal Cost

As the load grows over time a stable system must constantly add capacity in order to keep its reliability within acceptable levels The type of capacity that will be added should be such that the total cost of the system, fixed and variable, will be the minimum possible and thus the optimal generation mix must be preserved

It was shown above that when such an optimum generation mix exists then the total cost is recovered paying each plant the highest variable cost of any plant in operation at each time interval plus the lowest fixed cost of any plant Thus, the minimum cost of maintaining a stable system over the long term results from adding to the marginal cost of energy (or SRMC) the lowest fixed cost of generation which is also known as the marginal capacity cost This results in the LRMC of the generation system

4 4 ADOPTED METHODOLOGY FOR LRMC COMPUTATION

It follows from the discussion above that the strict LRMC of a system can be obtained by forecasting its SRMC under stable conditions and then adding to it the marginal cost of capacity

In calculating an adequate transfer price at generation level for the generating system of Kazakstan it is important to take into account the particular circumstances of the power sector and the limitations involved in both calculating and recommending an LRMC value based on strict principles Some of these particular circumstances are

- The power sector of Kazakstan is in transition from a centrally planned to a market driven expansion The existing capacity expansion plan is therefore of dubious value to forecast long term marginal costs

- The system is not fully interconnected and there are numerous imports of electricity It is unclear how these imports would be dispatched in a competitive situation or whether the current mix of supplies is indeed optimal

- The most pressing need is to determine a transfer price at generation level that would reasonably allow recovery of costs within the existing supply mix while providing signals towards an optimum mix of resources

Under these circumstances it appears that it is best to forecast the SRMC of the system as it is expected to evolve in the medium term (1997-2000) and add to it the marginal cost of capacity derived from the fixed capital and operating costs of an open cycle combustion turbine

This methodology is consistent with the expectations of the development of a market for privately owned generation in Kazakstan In this case the SRMC is equivalent to a forecast of average spot energy prices in a competitive environment and the LRMC results from the addition to it of a capacity cost based on the fixed costs of an open cycle gas turbine

4.5 MODELING THE GENERATION SYSTEM

The implementation of this methodology requires a simulation of the operation of the system under the load This simulation is complex, since it must take into consideration the following concerns

- the growth in demand with time
- the hourly and seasonal fluctuation of the load
- the potential of hydroelectric production
- the operating restrictions of combined heat and power plants
- the probability of mechanical failures in all generating plants
- the planned retirement and addition of new generating plants
- the terms and conditions of power import agreements
- the least cost mix of technologies and fuels in new capacity not yet committed

Therefore the analysis relies heavily on advanced computer models that can incorporate all these elements and produce a reasonably accurate forecast The computer models used for the analysis of production costs are components of the software package Generation Planning Tools (GPT) Three models have been used to model the power generation system of Kazakstan as follows

- *Analysis of the load, Model GPT-L* This model is used to read one year of historical hourly load data and examine the pattern of the load The model was used to prepare two types of load representation The first type is a load duration curve and is used for the simulation of the system over many years The second type is a load pattern for an entire week representative of an entire year and used for the detailed hourly simulation of the system

- *Analysis of long term generation cost, Model GPT-G* This model calculates the fixed and variable costs of the generation system over a series of many years by dispatching the generating resources under a load duration curve in the most economic way The model can also select capacity additions from a set of candidate resources so as to meet a prescribed reliability target at least cost

- *Analysis of short term production cost, Model GPT-M* This model utilizes data prepared by the GPT-G model to perform a very detailed, hour by hour simulation of the operation of the system during one week and produces a set of tables

showing, for every hour of the week the average cost, the marginal cost and the reliability of the system measured in terms of the deficit of capacity and energy in the system

4.6 ANALYSIS OF SHORT RUN MARGINAL COSTS

4 6 1 Analysis of the Load

For the North and South Regions the annual hourly load data for 1995 was analyzed using the GPT-L model to produce the hourly loads of a synthetic week containing the annual peak load and with a mean load equal to the annual This analysis was performed from 1997 to 2000 The results for the year 1997 are shown in Exhibits 4 4n and 4 4s for the North and South Regions respectively A dispatch of the system under this synthetic week would provide a reasonable indication of the hourly cost and reliability of the system during the entire year The corresponding load duration curves for these two systems are shown in Exhibits 4 5n and 4 5s

4 6 2 Hourly Load Dispatch Analysis

The hourly dispatch of the system under the load was carried out for each system and for the period 1997-2000 The process involved two steps First, the GPT-G model was used to analyze the system and determine, from 1997 until 2000, the characteristics of the load and various plants in operation and, most importantly, the variable cost of each resource To this end, the model used a comprehensive data file on each system Using the results of the GPT-G model, separate runs of the GPT-M model were made from 1997 until 2000 In each case the GPT-M model prepared an analysis of the hourly cost and reliability of the system

4 6 3 Short-run Marginal Cost

For the North Region the mean annual SRMC is forecasted to drop very rapidly, due to the addition of planned capacity, from 2 24 Cents/kWh in 1997 to 1 28 Cents/kWh in 2000 The average SRMC for 1997-2000 is 1 89 Cents/kWh The hourly distribution of marginal costs, averaged over the 1997-2000 period is shown in Exhibit 4 6n Three levels of marginal cost can be identified

- a valley level during the night hours
- a peak level during the evening hours of working days
- an off-peak period during all diurnal hours outside the peak period

Exhibit 4 4N

NORTH KAZAKSTAN SYSTEM - HOURLY LOADS 1997

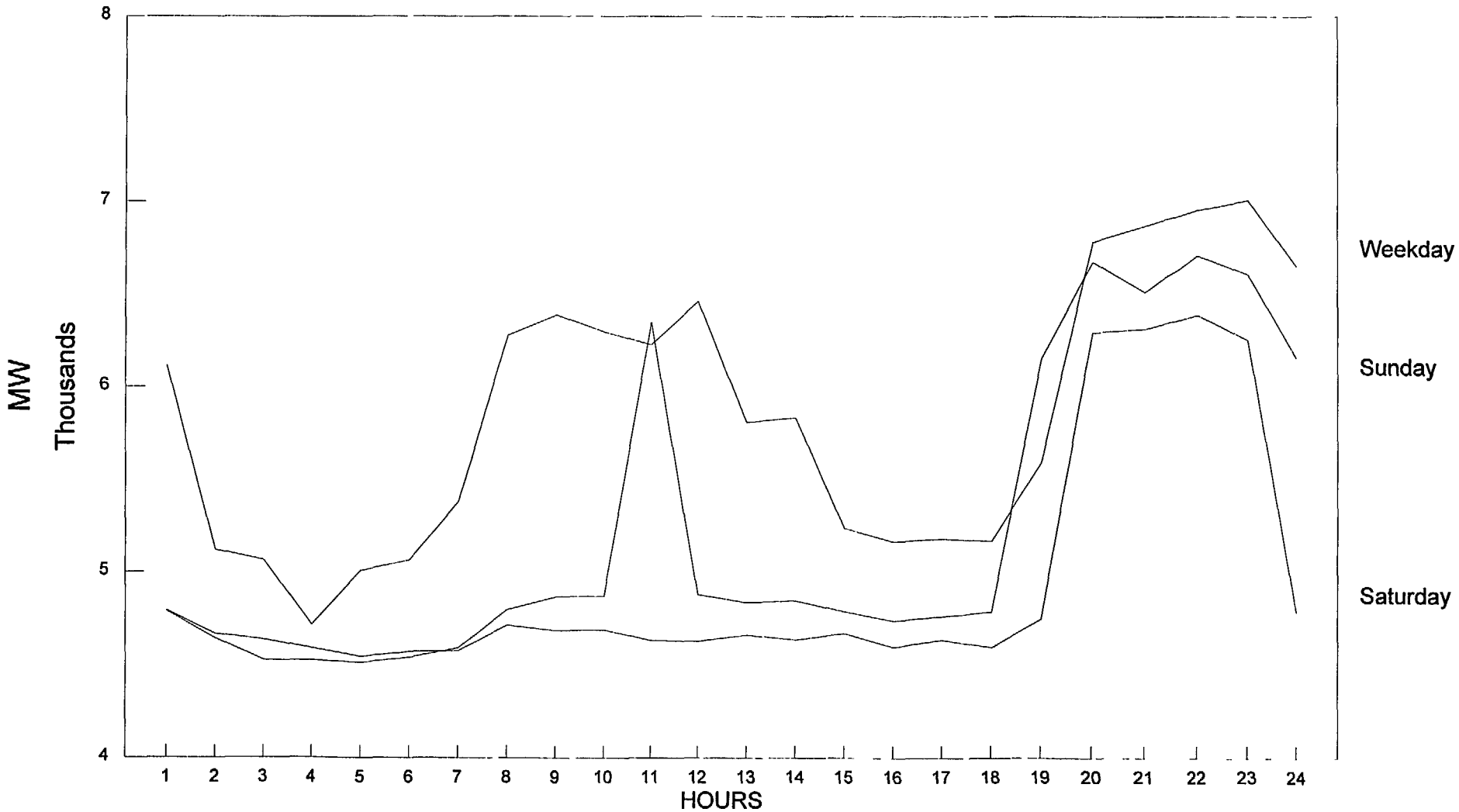


Exhibit 4 4S
SOUTH KAZAKSTAN SYSTEM - HOURLY LOADS 1997

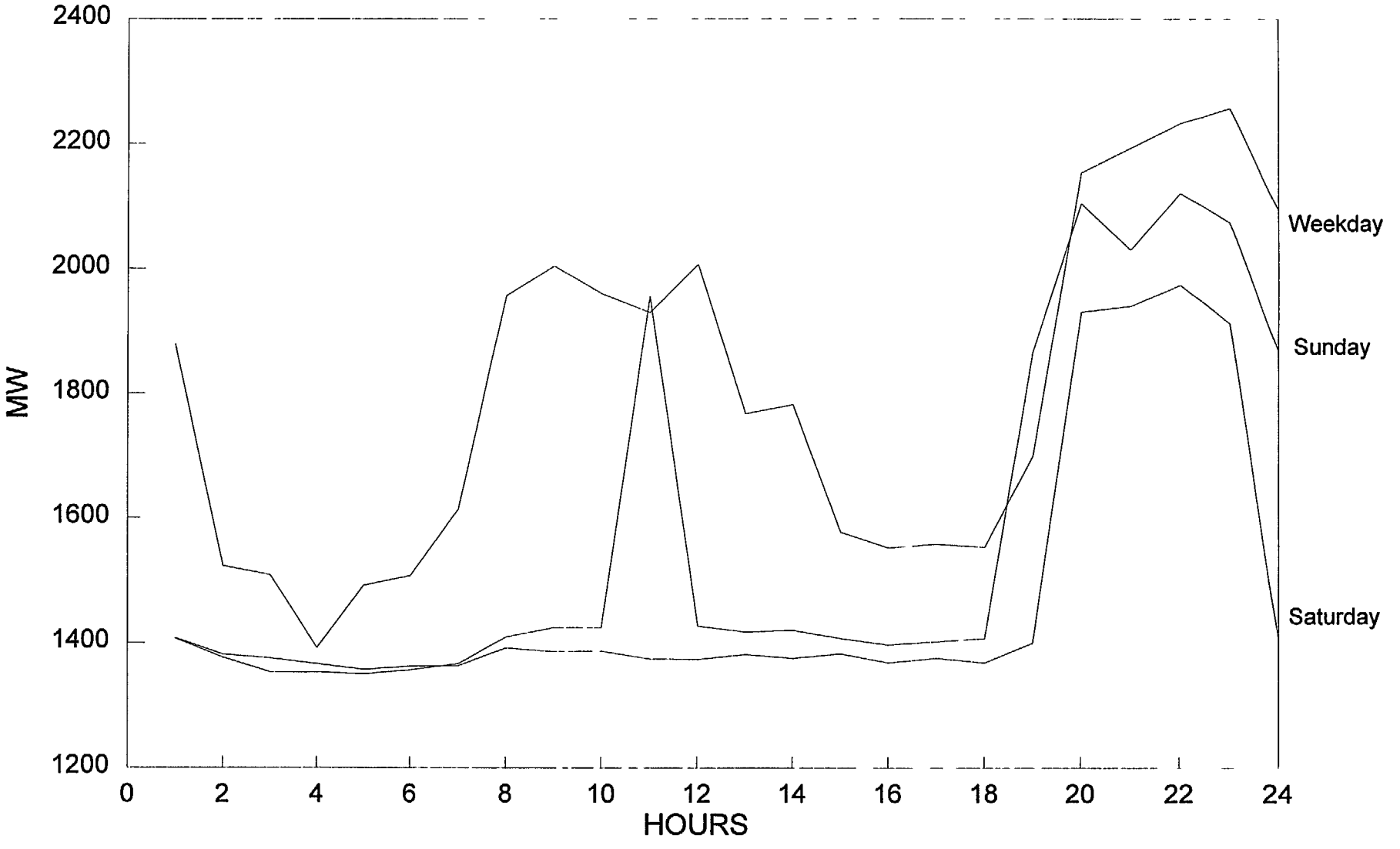


Exhibit 4 5N

NORTH KAZAKSTAN SYSTEM - LOAD DURATION CURVE

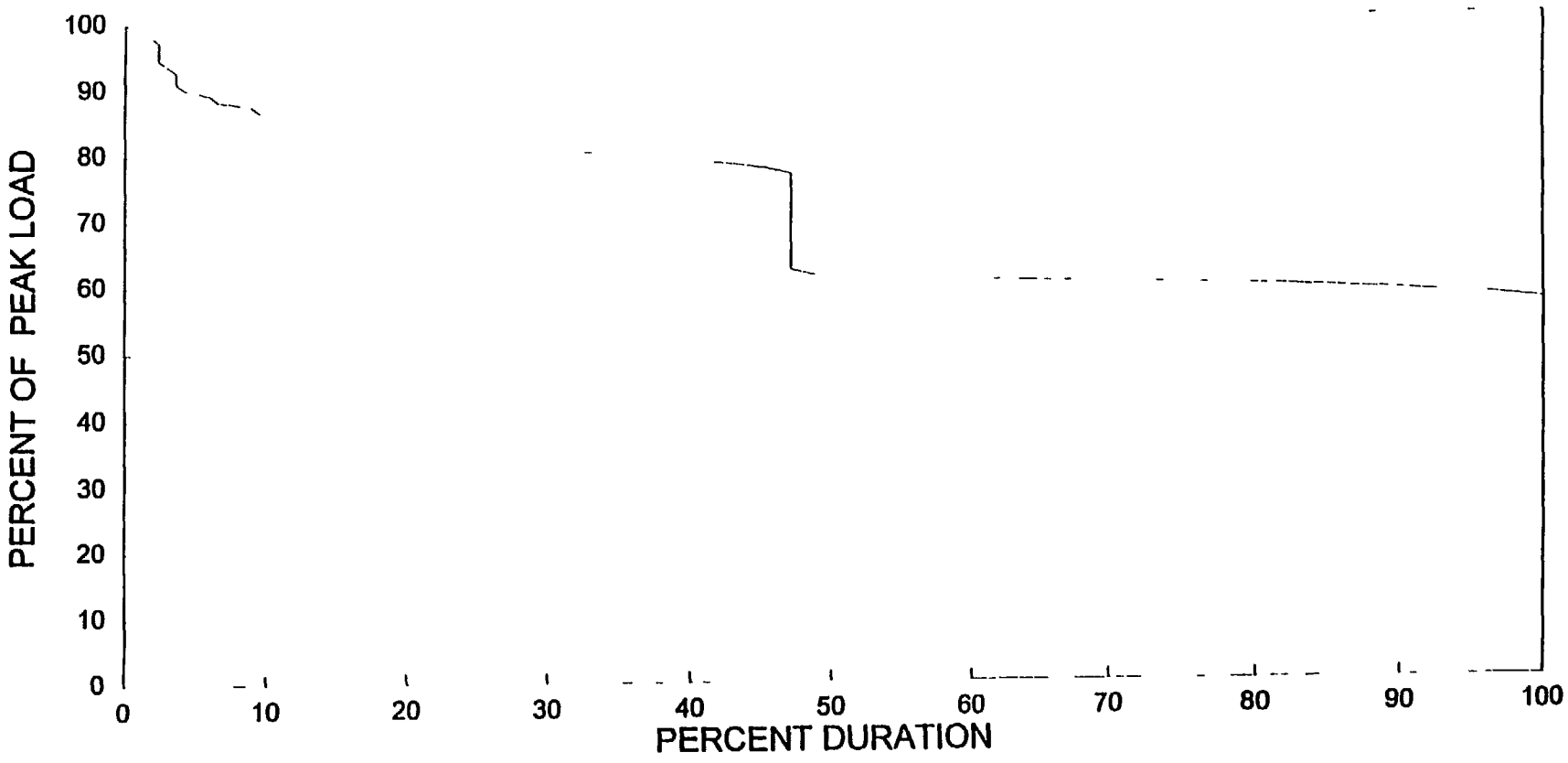


Exhibit 4 5S

SOUTH KAZAKSTAN SYSTEM - LOAD DURATION CURVE

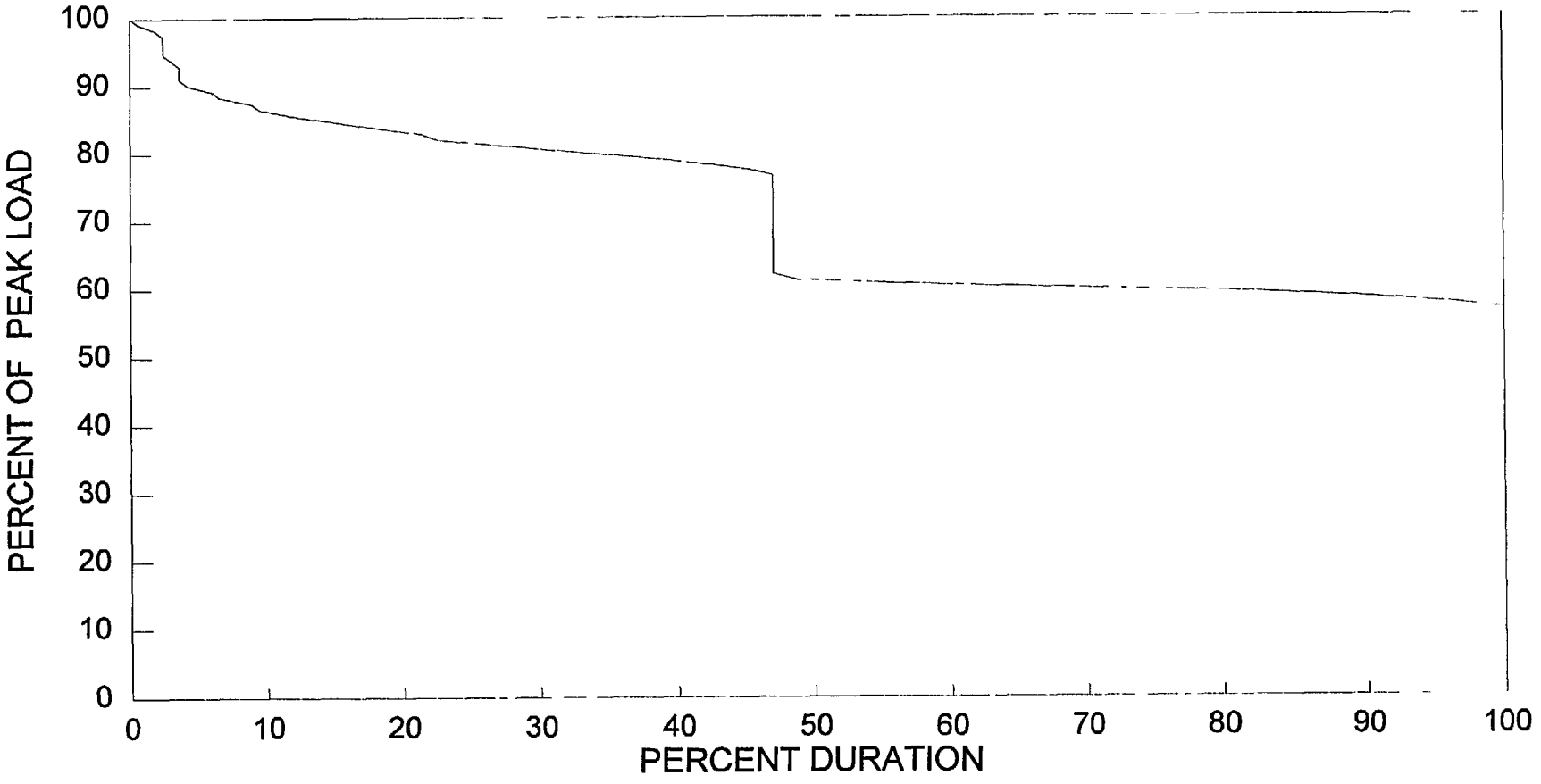
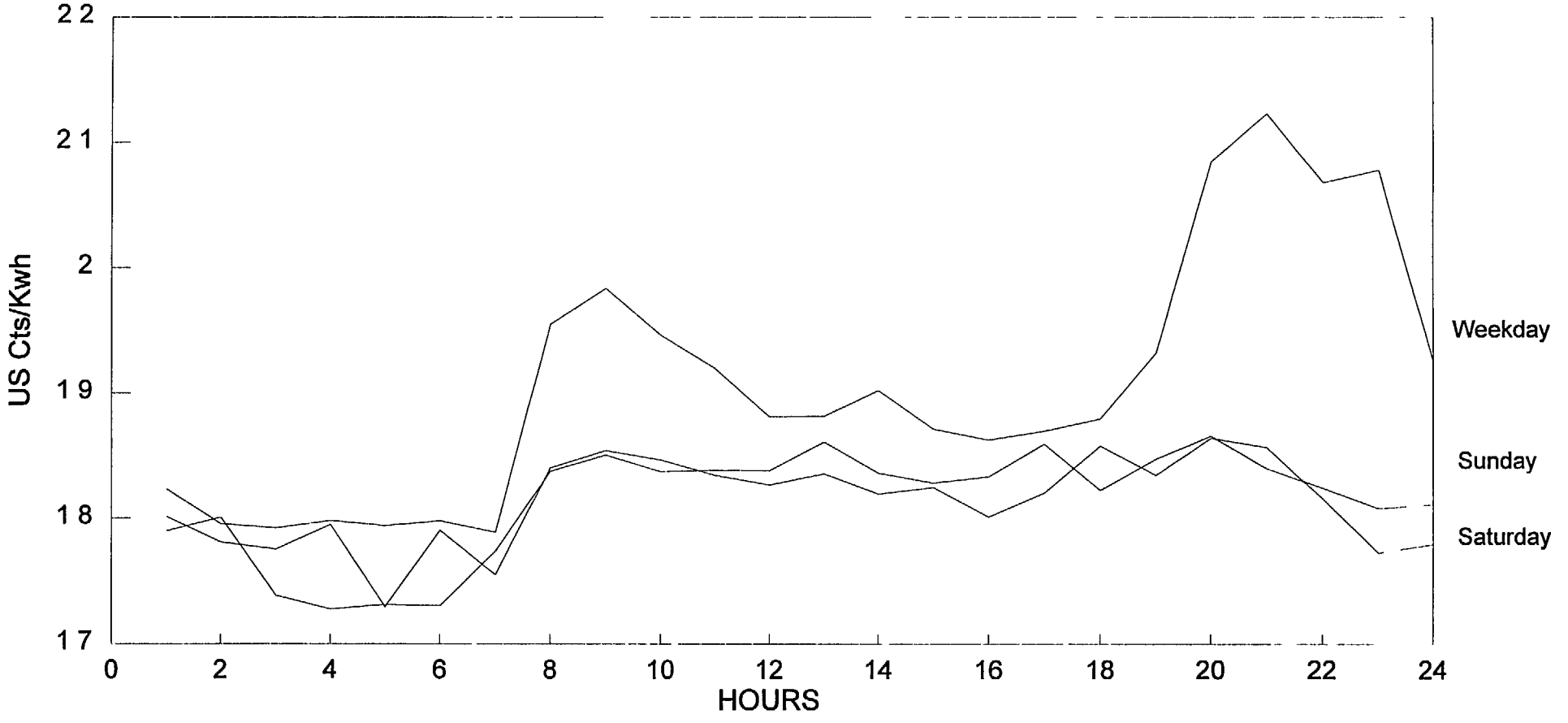


Exhibit 4 6N

NORTH KAZAKSTAN SYSTEM - SHORT RUN MARGINAL COST 1997-2000



For the South Region the mean annual SRMC fluctuates between 2 00 Cents/kWh and 3 37 Cents/kWh with a mean of 2 75 Cents/kWh for the 1997-2000 period The hourly distribution of marginal costs is shown in Exhibit 4 6s and is noticeably different from that of the North Region in that peak periods persist during the weekends and only two levels of marginal cost can be identified, peak and off-peak

4.7 MARGINAL CAPACITY COST

The total marginal cost can be calculated by adding to the SRMC the cost to serve incremental needs for capacity This cost can be readily calculated from an analysis of the capital investment and fixed operating costs of an open cycle gas turbine, which remains the cheapest way of providing capacity when all that is required is reliability support at a very low capacity factor

Exhibits 4 7 and 4 8 show the total marginal cost which has been calculated for the North and South Regions under different conditions The marginal cost of capacity is calculated before it is added to the SRMC to result in the total marginal cost The marginal cost of capacity is calculated in three steps as follows

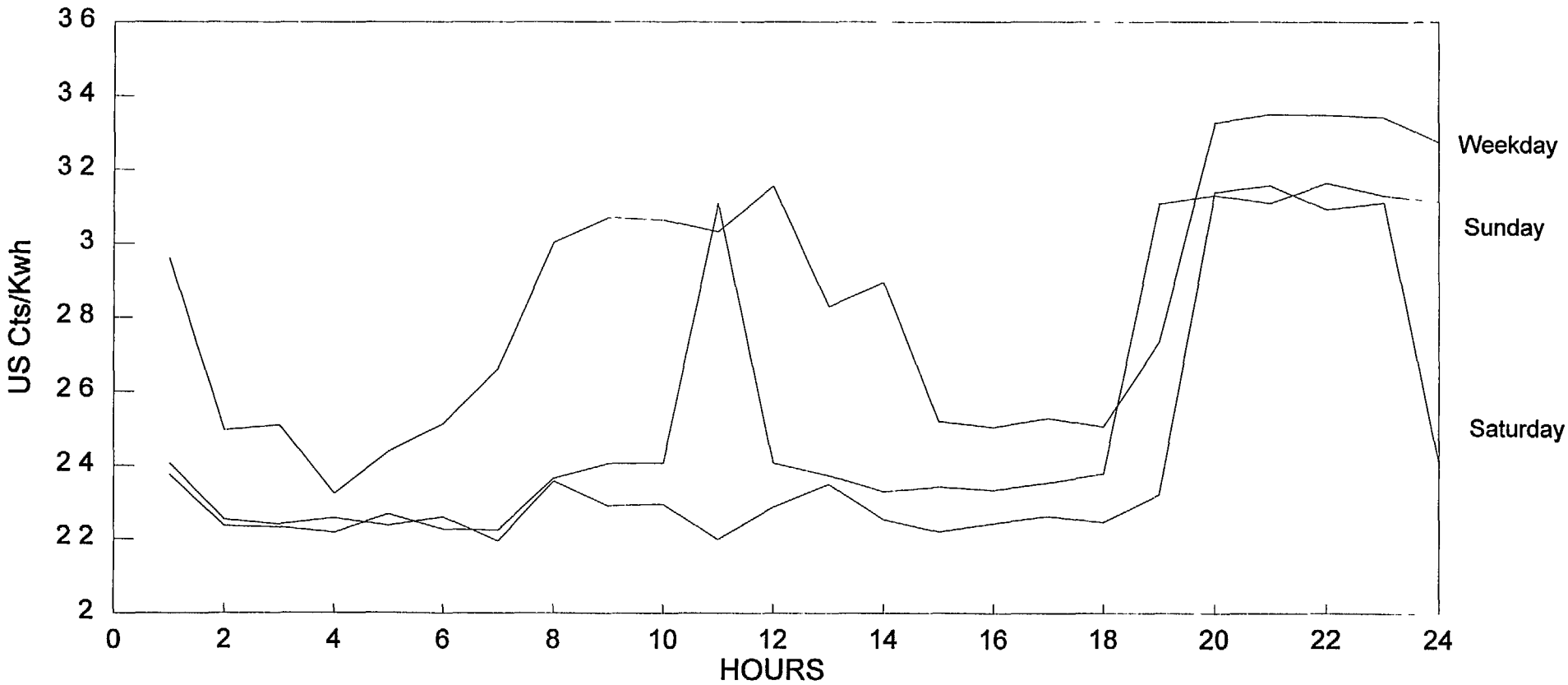
1 ***Cost of individual peaking capacity*** This is strictly the cost of peaking capacity without any considerations about the needs of the system First, the annual fixed cost of an open cycle gas turbine is computed and this involves two components capital and operation The annual capital cost is obtained by calculating the annual payments necessary to recover the investment cost of an open cycle gas turbine plus the interest carried during the construction period An important parameter in this calculation is the expected rate of return on capital The fixed operating expenses of the plant are based on statistical data and in this case are expressed as a percent of its initial investment

2 ***Cost of peaking capacity to the system.*** Once the cost of incremental peaking capacity is calculated it is necessary to determine how much capacity will be needed for the system to maintain adequate reliability Usually, the total capacity must exceed the peak load by a certain margin in order for the system to have adequate reserves in case of mechanical failures and other contingencies The reserve margin depends on the conditions of the existing system and can vary widely From the point of view of a tariff study, the cost of capacity must be recovered from customers who will only pay as a function of their power demand Thus, the reserve margin must be added to the cost of individual peaking capacity resulting in the cost of capacity to the system

3 ***Capacity cost per unit of energy*** Because the SRMC is the marginal cost of energy it is expressed in monetary units divided by energy units In order to add the marginal cost of

Exhibit 4 6S

SOUTH KAZAKSTAN SYSTEM - SHORT RUN MARGINAL COST 1997-2000



capacity it is necessary to first convert this cost into the same units by taking into account the load factor of the system

4.8 LONG-RUN MARGINAL COST

Having determined the SRMC and described a fairly simple process for the computation of marginal capacity cost, the LRMC of the system can be calculated by adding these two

However, systems in transition have two types of total marginal cost

1 The total marginal cost that results by adding the SRMC and the marginal capacity cost calculated under transitional conditions

2 The mature marginal cost which would correspond to post-transition conditions and reflect the cost of a system growing in a steady balance of supply and demand

This distinction is very important because the qualification of "long run" in LRMC merely refers to the fact that both energy (SRMC) and capacity are included and not necessarily to a value reflecting conditions far into the future

In a transitional period, both the SRMC and the marginal capacity cost can be very distorted by a number of issues The SRMC is heavily influenced by the availability and cost of existing units and the marginal capacity cost is distorted by the high rates of return that will be expected by investors to compensate for the higher political, regulatory, and operational risks that characterize any power sector reform

To provide values that are practical under the current circumstances the analysis of system marginal cost has been performed from two perspectives

- under conditions forecasted during the transition period 1997-2000
- under stable conditions beyond 2000

Exhibits 4 7n and 4 7s show the computation of LRMC for the North and South Regions, respectively In both cases, the conditions are those expected to prevail during the transitional period 1997-2000 They are characterized by a high rate of return on capital (18 percent in real terms) that will be demanded by private investors to offset risks, a high capacity reserve requirement (35 percent) to compensate for the low availability of the existing machines, and a high SRMC computed as the average for the 1997-2000 period, as discussed above

Exhibit 4 7N

System Marginal Cost of the North Kazakstan System in 1997-2000

COST OF INDIVIDUAL PEAKING CAPACITY		
RATE OF RETURN ON CAPITAL	18 00%	
CAPITAL COST	350 00	$/KW
CONSTRUCTION PERIOD	2 00	YEARS
ECONOMIC LIFE	15 00	YEARS
ANNUAL CAPITAL COST	112 94	$/KW YR
FIXED ANNUAL OPERATING COST AS PERCENT OF CAPITAL INVESTMENT	2 00%	
CAPACITY PAYMENTS TO PRODUCERS	**119 94**	**$/KW-YR**
	10 0	**$/KW-MO**
	13 7	**$/MW-HR**
COST OF PEAKING CAPACITY TO THE SYSTEM		
RESERVE MARGIN	35 00%	
CAPACITY COST TO THE SYSTEM	**161 92**	**$/KW-YR**
	13 5	**$/KW-MO**
	18 5	**$/MW-HR**
SYSTEM MARGINAL COST		
SYSTEM LOAD FACTOR	71 00%	
CAPACITY COST PER UNIT OF ENERGY PRODUCED	**2 60**	**Cents/KWH**
MARGINAL ENERGY COST (1997-2000 HOURLY AVERAGE)	**1 88**	**Cents/KWH**
TOTAL MARGINAL COST	**4 48**	**Cents/KWH**

Exhibit 4 7S

System Marginal Cost of the South Kazakstan System in 1997-2000

COST OF INDIVIDUAL PEAKING CAPACITY		
RATE OF RETURN ON CAPITAL	18 00%	
CAPITAL COST	350 00	$/KW
CONSTRUCTION PERIOD	2 00	YEARS
ECONOMIC LIFE	15 00	YEARS
ANNUAL CAPITAL COST	112 94	$/KW YR
FIXED ANNUAL OPERATING COST AS PERCENT OF CAPITAL INVESTMENT	2 00%	
CAPACITY PAYMENTS TO PRODUCERS	**119 94**	**$/KW-YR**
	10 0	**$/KW-MO**
	13 7	**$/MW-HR**
COST OF PEAKING CAPACITY TO THE SYSTEM		
RESERVE MARGIN	35 00%	
CAPACITY COST TO THE SYSTEM	**161 92**	**$/KW-YR**
	13 5	**$/KW-MO**
	18 5	**$/MW-HR**
SYSTEM MARGINAL COST		
SYSTEM LOAD FACTOR	64 00%	
CAPACITY COST PER UNIT OF ENERGY PRODUCED	**2 89**	**Cents/KWH**
MARGINAL ENERGY COST (1997-2000 HOURLY AVERAGE)	**2 75**	**Cents/KWH**
TOTAL MARGINAL COST	**5 64**	**Cents/KWH**

4 8 1 Computation of LRMC Under Post-transitional Conditions

Exhibits 4 8n and 4 8s show the computation of LRMC for conditions expected to prevail after 2000 In this case, the rate of return on capital is expected to be about 15 percent, a reasonable expectation in mature competitive markets, such as those of Argentina or Chile Capacity reserve requirements will probably be acceptable at about 25 percent (compared with 20 percent, which is typical of a thermal system in industrialized countries), and the SRMC will be that calculated for 2000

Under these conditions the total marginal cost will be 3 25 Cents/kWh for the North Region and 4 19 Cents /kWh for the South Region

4.9 ANALYSIS OF THE INTERCONNECTED SYSTEM

The same analysis performed for the North and South Regions was carried-out, using the assumption that a perfect interconnection would allow fully economic dispatch of all resources to meet all loads in the system

Under these conditions the system would experience an average annual SRMC which starts at 2 35 Cents/kWh in 1997 and decreases to 1 46 Cents/kWh in 2000 The average annual SRMC for the 1997-2000 period is forecasted to be 1 96 Cents/kWh with the hourly distribution shown in Exhibit 4 9

The total marginal costs during the transitional period 1997-2000 is 4 56 Cents/kWh, as shown in Exhibit 4 10 The LRMC (beyond the 2000) is shown in Exhibit 4 11 as 3 43 Cents/kWh

4 10 RESULTS AND RECOMMENDATIONS

The primary results of the economic analysis of the generation system are in Exhibit 4 12 Some of the results and recommendations include

Considering that the electric power system is in a state of transition it is necessary to calculate economic costs within two different time periods a transitional period from 1997 to 2000 and a post-transition period Furthermore, since the North and South Regions are weakly interconnected, it is necessary to consider a North System and a South System separately, with the possibility of a Fully Interconnected System in the future

During the transition period, the total marginal cost of the system is 4 48 Cents/kWh for the North Region and 5 64 Cents/kWh for the South Region A Fully Interconnected System under

Exhibit 4 8N

System Marginal Cost of the North Kazakstan System Under Long Run Conditions

COST OF INDIVIDUAL PEAKING CAPACITY		
RATE OF RETURN ON CAPITAL	15 00%	
CAPITAL COST	350 00	$/KW
CONSTRUCTION PERIOD	2 00	YEARS
ECONOMIC LIFE	15 00	YEARS
ANNUAL CAPITAL COST	91 03	$/KW YR
FIXED ANNUAL OPERATING COST AS PERCENT OF CAPITAL INVESTMENT	2 00%	
CAPACITY PAYMENTS TO PRODUCERS	**98 03**	**$/KW-YR**
	8 2	**$/KW-MO**
	11 2	**$/MW-HR**
COST OF PEAKING CAPACITY TO THE SYSTEM		
RESERVE MARGIN	25 00%	
CAPACITY COST TO THE SYSTEM	**122 54**	**$/KW-YR**
	10 2	**$/KW-MO**
	14 0	**$/MW-HR**
SYSTEM MARGINAL COST		
SYSTEM LOAD FACTOR	71 00%	
CAPACITY COST PER UNIT OF ENERGY PRODUCED	**1 97**	**Cents/KWH**
MARGINAL ENERGY COST	**1 28**	**Cents/KWH**
TOTAL MARGINAL COST	**3 25**	**Cents/KWH**

Exhibit 4 8S

System Marginal Cost of the South Kazakstan System Under Long Run Conditions

COST OF INDIVIDUAL PEAKING CAPACITY			
RATE OF RETURN ON CAPITAL		15 00%	
CAPITAL COST		350 00	$/KW
CONSTRUCTION PERIOD		2 00	YEARS
ECONOMIC LIFE		15 00	YEARS
	IDC FACTOR	1 5209	
	AUXILIARY	8 1371	
	CRF FACTOR	0 1710	
ANNUAL CAPITAL COST		91 03	$/KW YR
FIXED ANNUAL OPERATING COST AS PERCENT OF CAPITAL INVESTMENT		2 00%	
CAPACITY PAYMENTS TO PRODUCERS		**98 03**	**$/KW-YR**
		8 2	**$/KW-MO**
		11 2	**$/MW-HR**
COST OF PEAKING CAPACITY TO THE SYSTEM			
RESERVE MARGIN		25 00%	
CAPACITY COST TO THE SYSTEM		**122 54**	**$/KW-YR**
		10 2	**$/KW-MO**
		14 0	**$/MW-HR**
SYSTEM MARGINAL COST			
SYSTEM LOAD FACTOR		64 00%	
CAPACITY COST PER UNIT OF ENERGY PRODUCED		**2 19**	**Cents/KWH**
MARGINAL ENERGY COST		**2 00**	**Cents/KWH**
TOTAL MARGINAL COST		**4 19**	**Cents/KWH**

Exhibit 4 9

INTERCONNECTED SYSTEM - SHORT RUN MARGINAL COST 1997-2000

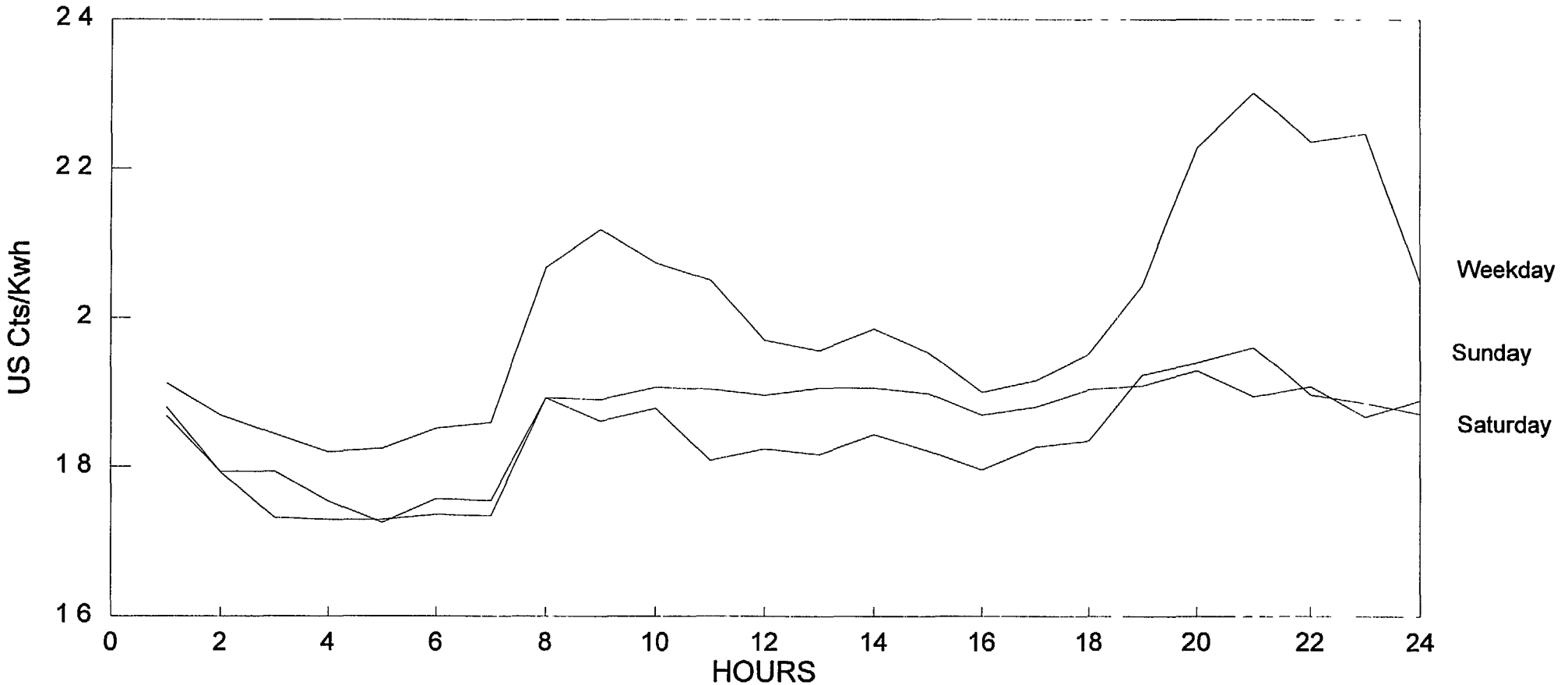


Exhibit 4 10

System Marginal Cost of the Interconnected System in 1997-2000

COST OF INDIVIDUAL PEAKING CAPACITY		
RATE OF RETURN ON CAPITAL	18 00%	
CAPITAL COST	350 00	$/KW
CONSTRUCTION PERIOD	2 00	YEARS
ECONOMIC LIFE	15 00	YEARS
ANNUAL CAPITAL COST	112 94	$/KW-YR
FIXED ANNUAL OPERATING COST AS PERCENT OF CAPITAL INVESTMENT	2 00%	
CAPACITY PAYMENTS TO PRODUCERS	**119 94**	**$/KW-YR**
	10 0	**$/KW-MO**
	13 7	**$/MW-HR**
COST OF PEAKING CAPACITY TO THE SYSTEM		
RESERVE MARGIN	35 00%	
CAPACITY COST TO THE SYSTEM	**161 92**	**$/KW-YR**
	13 5	**$/KW-MO**
	18 5	**$/MW-HR**
SYSTEM MARGINAL COST		
SYSTEM LOAD FACTOR	71 00%	
CAPACITY COST PER UNIT OF ENERGY PRODUCED	**2 60**	**Cents/KWH**
MARGINAL ENERGY COST (1997-2000 HOURLY AVERAGE)	**1 96**	**Cents/KWH**
TOTAL MARGINAL COST	**4 56**	**Cents/KWH**

Exhibit 4 11

System Marginal Cost of the Interconnected System Under Long Run Conditions

COST OF INDIVIDUAL PEAKING CAPACITY		
RATE OF RETURN ON CAPITAL	15 00%	
CAPITAL COST	350 00	$/KW
CONSTRUCTION PERIOD	2 00	YEARS
ECONOMIC LIFE	15 00	YEARS
ANNUAL CAPITAL COST	91 03	$/KW YR
FIXED ANNUAL OPERATING COST AS PERCENT OF CAPITAL INVESTMENT	2 00%	
CAPACITY PAYMENTS TO PRODUCERS	**98 03**	**$/KW-YR**
	8 2	**$/KW-MO**
	11 2	**$/MW-HR**
COST OF PEAKING CAPACITY TO THE SYSTEM		
RESERVE MARGIN	25 00%	
CAPACITY COST TO THE SYSTEM	**122 54**	**$/KW-YR**
	10 2	**$/KW-MO**
	14 0	**$/MW-HR**
SYSTEM MARGINAL COST		
SYSTEM LOAD FACTOR	71 00%	
CAPACITY COST PER UNIT OF ENERGY PRODUCED	**1 97**	**Cents/KWH**
MARGINAL ENERGY COST	**1 46**	**Cents/KWH**
TOTAL MARGINAL COST	**3 43**	**Cents/KWH**

Exhibit 4 12
System Marginal Cost in 1997-2000 and Under Long Run Conditions

		1997-2000 TRANSITION PERIOD			LONG RUN CONDITIONS		
		NORTH	SOUTH	INTER CONNECTED	NORTH	SOUTH	INTER CONNECTED
CAPACITY							
Transfer Price to Individual Generators	$/KW-month	10 00	10 00	10 00	8 20	8 20	8 20
Marginal Capacity Cost to the System	**US Cents/KWh**	**2 60**	**2 89**	**2 60**	**1 97**	**2 00**	**1 97**
ENERGY							
(Short Run Marginal Cost - SRMC)	**US Cents/KWh**	**1 88**	**2 75**	**1 96**	**1 28**	**2 00**	**1 46**
Peak Period (Mon-Fri 19 01 to 24 00)	US Cents/KWh	2 10	3 23	2 19	1 43	2 35	1 63
Off-Peak	US Cents/KWh	1 83	2 64	1 91	1 25	1 92	1 42
SYSTEM MARGINAL COST	**US Cents/KWh**	**4 48**	**5 64**	**4 56**	**3 25**	**4 00**	**3 43**

stable conditions would have a total marginal cost (or LRMC) of 3 43 Cents/kWh However, since a Fully Interconnected System may not materialize in the near future, it is advisable that this last value be used as a reference only and not directly for determining prices throughout the system

The marginal cost of energy presents a relatively modest fluctuation between the periods of high load (peak periods) and the rest of the week (off-peak periods) For tariff design purposes and in order to provide efficient signals, the difference can be increased by allocating most or all of the capacity cost to energy consumption during peak hours

CHAPTER 5
RETAIL TARIFFS BASED ON LONG-RUN MARGINAL COST

This chapter presents a calculation of the tariffs in each customer class, for the wholesale market customers with direct connections to the high-voltage grid and for retail customers served by the low-voltage network enterprises of Almaty and Taldykorgan (the two oblasts which were served by Almatyenergo until July 1996) The region served by Almatyenergo was selected as an example to illustrate the methodology presented in this chapter The calculation of tariffs is based on the prices of capacity and energy in a power pool, the network losses, and the LRMC of network capacity

The parameters used to calculate LRMC tariffs have been estimated from available data but it will be necessary to update them and to improve their accuracy One of the tasks of the State Regulatory Commission for Electric Power Engineering (SRC) should be to collect and review data used in tariff calculations

5.1 TARIFF STRUCTURE

The first step in calculating tariffs for a power system is to define the tariff structure by addressing the following questions

- Does a wholesale market exist? How are prices established in the wholesale market? Are there two sets of tariffs — one for the wholesale market and one for the retail market?
- How are the customer classes defined? Will certain customer classes subsidize tariff rates of others?
- Which customer classes have a flat tariff, and which customers have separate charges for energy and capacity?
- Do the energy charges reflect differences in the cost of energy at diferent times of the day or seasons of the year? Are there time-of-use rates, seasonal rates, monthly changes in rates, or hourly changes in prices in the wholesale market?

The present tariff structure is very similar to the structure that existed during the former Soviet Union period Therefore one of the best sources of information on the existing tariff structure is a Soviet document written in 1990 and entitled *Price List No 09-01 Tariffs for Electric and Heat Energy* It contains very detailed and precise definitions of the customer classes and electricity tariffs effective January 1991, including demand and energy charges for large industrial customers in each of the ten regional energos The electricity tariff structure in *Price List No 09-01* is the basic foundation of the tariff structure in Kazakstan in 1995, but it has been modified as described below

- *Wholesale market* Until 1995 nearly all the power sector was included in a single vertically integrated enterprise owned by the MECI A wholesale market was created in the third quarter of 1995 through the restructuring of Kazakstanenergo The GOK approved a wholesale tariff at which Kazakstanenergo sold electricity to the regional energos This was a flat tariff which was calculated on the basis of projected annual expenses and sales and was revised during 1996 Two-part tariffs applied to Kazakstanenergo sales to large industrial customers (Appendix H) The tariff for sales to the regional energos and to industrial customers was adopted by the GOK on the basis of recommendations from AMC and MECI In 1991, a very limited wholesale market existed, bulk power sales by the Ministry of Power and the Ministry of Atomic Power Industry to networks under the jurisdiction of other ministries or organizations Within the Ministry of Power there was no wholesale market, but it was necessary to establish prices at which electricity could be sold to networks outside its jurisdiction *Price List No 09-01* gives instructions for calculating a flat tariff, without demand charges or time-of-use charges, by applying a discount to the average tariff to customers This customer class was known as Group III "Wholesale customers — resellers " During 1995 there was a customer class known as Group IX "Wholesale customers" and the definition of this class is similar to the 1991 definition In 1995 Group IX accounted for five percent of the combined sales of the regional energos and Kazakstanenergo (Exhibit 5 1)

- *Customer classes* There were eight end-use customer classes in 1991 industrial enterprises with a connected load larger than 750 kVA, industrial enterprises up to 750 kVA, electrified railway transport, electrified city transport, non-industrial customers, agriculture, population (residential customers), and population points (residential customers in rural areas) The same eight groups are shown in the *Kazakstanenergo Annual Technical Report for 1995* (Exhibit 5 1) In September 1995, however, AMC and MECI issued a *Provision on National Regulation of Tariffs of Electricity and Thermal Energy of the Republic of Kazakstan* which shows two additional customer classes industrial enterprises with a connected load larger than 200 mVA, and budget organizations The tariff for industrial

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Exhibit 5 1
Kazakstanenergo Customer Sales and Revenues, 1995
Including All Regional Energos

Customer class number	Customer class	Average tariff in 1994, tyn/kWh	Average tariff in 1995, tyn/kWh	Sales, million kWh	Sales revenue, million tenge	Ratio to average tariff	Percent of sales	Percent of revenues
1	Industrial enterprises >=750kV	**91 75**	**118 10**	**28,251 6**	33,365	0 91	53 7%	48 6%
2	Industrial enterprises <750kVA	**108 20**	**182 21**	**2,130 0**	3,881	1 40	4 0%	5 7%
3	Electrified railroad transport	**119 25**	**177 56**	**2,046 6**	3,634	1 36	3 9%	5 3%
4	Electrified city transport	**131 36**	**185 76**	**115 2**	214	1 42	0 2%	0 3%
5	Non-industrial customers	**107 40**	**205 45**	**3,173 0**	6,519	1 58	6 0%	9 5%
6	Agricultural customers	**81 38**	**161 52**	**6,617 1**	10,688	1 24	12 6%	15 6%
7	Population							
	City	**31 30**	**95 62**	**3,622 7**	3,464	0 73	6 9%	5 0%
	Rural	**22 12**	**89 62**	**1,599 0**	1,433	0 69	3 0%	2 1%
8	Population points							
	City	**49 98**	**127 10**	**1,096 0**	1,393	0 97	2 1%	2 0%
	Rural	**44 77**	**118 30**	**1,033 0**	1,222	0 91	2 0%	1 8%
9	Wholesale customers	**44 42**	**85 78**	**2,645 0**	2,269	0 66	5 0%	3 3%
10	Transmission to other systems	**18 18**	**189 89**	**277 0**	526	1 46	0 5%	0 8%
11	Total	**82 45**	**130 42**	52,606 2	68,609	1 00	100 0%	100 0%

customers larger than 200 mVA is actually a wholesale price and should be part of a separate tariff schedule pertaining to the wholesale market

- *Tariff components* For industrial enterprises up to 750 kVA, there was a two-part tariff in 1991 with separate charges for energy and capacity For all other customer classes there was a flat tariff Approximately the same tariff structure exists in Kazakstan today

- *Time-of-use* There were no published time-of-use rates in 1991 However, power supplying organizations were "granted the right to differentiate power tariffs on a time-of-use basis (peak, semi-peak, night) as agreed to with the customer " Today time-of-use rates exist in Atyrau and Uralsk (both of the regions that were a part of Zapkazenergo) because the import contracts with Russia contain time-of-use rates There appear to be no time-of-use rates in the North and South Regions

The following changes in tariff structure are proposed

- *Wholesale market* For the North and South Regions there would be two sets of tariffs — one for the wholesale market and one for the customers of the regional network enterprises In the wholesale market, there will be a transition from tariffs set by the SRC to prices determined by a competitive market Although it may be possible to have a single unified North and South Grid in the near future, the transition to a competitive market will probably occur in the short term and therefore wholesale prices in the North and South will be determined separately by the marketplace The existing practice of setting wholesale tariffs at the national level (excluding Uralsk and Aktybinsk) will be replaced by competitive prices when pool prices take effect In the retail market, tariffs will continue to be set by the SRC The Western Region will have a wholesale market that is completely independent from the North and South Regions

- *Tariff Group IX "Wholesale customers" should be eliminated* If there is a need to sell power to a network enterprise which was not owned by MECI in 1995, the appropriate tariff is the tariff to the regional network enterprises If there is a need for a regional network enterprise to sell power to a network enterprise which was not owned by MECI in 1995, the latter can be treated as an industrial customer for tariff purposes No special tariff category is needed

- *Two end-user customer classes should be created in the wholesale market* (1) VHV customers that do not utilize the 110 kV grid and (2) HV customers served by the 110 kV grid *Similarly, two customer classes should be created from the class of industrial customers with a connected load larger than 750 kVA and are served by the regional network enterprises* (1) HV customers who are served by the 110 kV grid, and (2) MV customers who are served by the 35 kV grid

Because all of the residential customers receive electricity at low voltage, they can all be placed in one customer class

- *All tariffs for electricity sold by Kazakstanenergo should consist of three parts* (1) demand charge, (2) peak energy charge, and (3) off-peak energy charge For each grid (North and South), the peak period should be defined for approximately 1750 hours per year, which includes the hours when the system reserves are at their lowest level and hours when the SRMC of energy is at its highest level Time-of-use tariffs could be established initially on the basis of a peak period defined as 7 00 to 11 00 hours and 18 00 to 21 00 hours from Monday through Friday This definition is based upon the load shed (or load regulation) periods for Almatyenergo on January 20, 1995 Customers should face higher energy prices during the hours when the system reserves are at their lowest A more precise selection of the peak period should be recommended by the SRC, based on an analysis of reserve margin as well as SRMC of energy

- For industrial enterprises with a connected load larger than 750 kVA there should be three-part tariffs instead of two-part tariffs The peak and off-peak periods used in retail tariffs should match the peak and off-peak periods used in wholesale tariffs For other customers of the regional network enterprises, three part tariffs should be offered as one of the options available Most customers will prefer flat tariffs, but some customers may be able to lower their electricity cost by switching to a three-part tariff and installing the necessary metering equipment

When power pools are created, they should establish hourly prices in the wholesale market The three-part tariffs proposed at this time represent a transition between the flat energy prices of the old tariff system and the hourly pricing that becomes possible in a competitive pool From the standpoint of economic efficiency, hourly pricing is preferable because it gives the most accurate "price signals" to buyers and sellers of electricity in the wholesale market

During the periods of the year and times of the day when load is near the annual coincident peak, operating reserve margins and system reliability are low, therefore customer load may be interrupted The true "cost" of electricity consumed during peak periods should reflect not only the peak losses in the network but also a surcharge reflecting the reduction in system reliability caused by incremental consumption The LRMC-based tariffs proposed in this chapter do not include such a surcharge To fully address this issue it would be necessary to re-examine the power system's approach to demand management and establish a new framework based on market-oriented principles This will become part of the operating rules of the pool

5 2 SUMMARY OF METHODOLOGY

The tariff methodology in this chapter is an example of *marginal cost pricing*, which is the practice of administratively setting prices on the basis of an estimate of the marginal cost of supplying goods and services Since the 1970's this approach has been widely favored by the World Bank and other multilateral development banks, and many power sector loans have included conditionalities related to the implementation of marginal cost pricing or have been issued only after the Bank has conducted a tariff study and recommended tariff reforms During the 1970's marginal cost pricing was widely considered in the United States but not fully implemented In international practice there are two well-known forms of marginal cost pricing in the electric sector

- *Strict LRMC* In this approach, tariffs are set at the level of LRMC regardless of the profitability of the power sector enterprise In a power system with low reserve margins and capacity deficits, prices based on strict LRMC can lead to a situation whereby the power sector enterprise has a financial surplus, or extra profit The average tariff level will be larger than the amount needed to cover the enterprise's financial revenue requirement

- *Revenue neutral LRMC* In this approach, strict LRMC tariffs are multiplied by the ratio of the average tariffs based on financial revenue requirements to the average tariff based on strict LRMC In other words, a multiplier is used to lower all of the strict LRMC tariffs (or, as necessary, raise all of the strict LRMC tariffs) to the level that is consistent with the financial revenue requirements of the power enterprise

In a wholesale market prices based on strict LRMC are expected to reflect prices that will result from competition Therefore, strict LRMC pricing may be used in a short transition period when competition is expected to replace administrative pricing If the transition to a competitive market will take a long time, and its implementation is uncertain, prices based on revenue neutral LRMC are normally preferred by governments and regulatory authorities This chapter is based on the calculation of strict LRMC pricing, while Chapter 6 includes a discussion of revenue neutral LRMC pricing

Under a marginal cost pricing system, the networks are natural monopolies Every customer has the opportunity to purchase and own a transformer that will enable him to receive power at voltage levels above 0 38 kV, but very few (if any) customers will own networks Therefore an industrial customer who receives power at 35 kV, for example, should be located near the 35 kV grid The rationale for adopting the policy of giving every customer the opportunity to own a transformer is to ensure that all customers will receive electricity at the voltage level which is logical, from a technical perspective, given their location and their size Network enterprises will not be able to force the customers to pay higher electricity prices by forcing them to receive electricity at low voltage Industries which need to buy the lowest-cost electricity must either locate their factories near the 220 kV network, or build cogeneration units

The foundation of the LRMC tariff methodology is the calculation of the three-part tariffs for the VHV company, and for the lower voltage network companies Once these values are known, it is possible to calculate flat tariffs or two-part tariffs for different classes of customers, given certain parameters that describe the annual load curve for each customer class The calculation of a flat tariff is the last step in the analysis, however, and for some customer classes it will not be necessary to calculate flat tariffs unless revenue neutral LRMC tariffs are desired In general the higher-voltage customers should not have flat tariffs, because the cost of metering equipment needed to implement three-part tariffs can be borne by them Flat tariffs fail to give accurate price signals to consumers The only advantage of flat tariffs is that they do not require expensive metering equipment

For Kazakstan, it is necessary to develop an LRMC tariff methodology that is based on available historical data but reflects the power sector restructuring process that is in progress The following exceptions to the simplified LRMC-based power sector structure may be noted

- The VHV and HV networks in the North and South are not part of a single interconnected grid Full interconnection may not be achieved in the near term Therefore, different tariffs should be calculated for both the North Region and the South Region on the basis of different marginal energy costs

- Power supplies are obtained from imports as well as domestic power generation To simplify the tariff calculation, it was assumed that the wheeling services provided by Kazakstan to other countries are reflected in the prices of energy imported or exported In the strict LRMC tariff calculation, all of the costs of the network are allocated to domestic electricity sales

- The MV and LV grids (and part of the HV grid) are owned by various regional network enterprises Until July 1996 there were regional energos, such as Almatyenergo, and the historical data on networks are reported only for regional energos In this chapter we use the data for Almatyenergo networks

- In the first half of 1996 some of the HV customers were served by Kazakstanenergo and some of them were served by regional energos Two sets of HV tariffs have been calculated one for the wholesale market, or customers of Kazakstanenergo, and one for the customers of the Almaty and Taldykorgan network The second category is called HV(A) The HV(A) tariffs were calculated to define whether they are higher or lower than HV tariffs (whether 110 kV customers in Almaty and Taldykorgan will have lower tariffs according to strict LRMC) if they become customers of Kazakstanenergo

Therefore a *modified LRMC-based power sector structure* was used to develop a tariff methodology suited to the special circumstances existing in Kazakstan The modified approach is summarized in Exhibit 5 2 At the generation level, marginal energy costs are estimated for the

South Grid All other VHV and HV costs are estimated for the North and South Grids The HV(A), MV, and LV costs are estimated for Almaty and Taldykorgan For each cost or loss factor identified in Exhibit 5 2, this exhibit is a guide for the remainder of this chapter

The allocation of network costs to the various voltage levels is summarized in Exhibit 5 3 Three-part tariffs are calculated in this chapter according to the modified LRMC-based power sector structure No inflation is assumed in the strict LRMC tariffs, and a relatively low interest rate (ten percent) is used because (1) this is a standard assumption in World Bank tariff studies, and (2) the network enterprises may be able to obtain long-term financing at ten percent real interest rates, after the sector is restructured

5.3 ENERGY SALES

To calculate strict LRMC tariffs it is necessary to know how much electricity is sold to customers at each voltage level, so that the energy losses and capacity losses can be estimated accurately To calculate the average tariff (or the revenue neutral LRMC tariffs) it is necessary to develop a forecast of sales by customer class The sales forecast in Exhibit 5 4 is based upon the growth rates projected in the "Low Forecast" shown in the *EBRD Kazakstan Power System Least Cost Development Study* (April 1995), referred to as "EBRD Low "

Kazakstanenergo does not report sales by voltage level or classify customers by voltage level In estimating sales by voltage level, the energy balance projections shown in Appendix B were used The energy balance in the North Grid and the South Grid was estimated, based on limited information

Although there are significant non-technical losses according to the EBRD study, all technical and non-technical losses have been allocated to the network on the basis of the data provided by Kazakstanenergo and Almatyenergo Therefore, the customers whose electricity is metered and included in Kazakstanenergo statistics on energy sales are forced to pay for non-technical losses, under this tariff methodology It is in the economic interest of all paying customers and all power sector enterprises to try to reduce non-technical losses Estimates of electric energy sales and non-technical losses in the North Grid, the South Grid, and the Western Region are provided in Appendix B

Exhibit 5.2
Costs and Loss Factors Used to Calculate Tariffs Based on LRMC

Portion of the power system			Energy costs	Marginal cost of energy: Energy loss factors		Marginal cost of capacity: Capacity costs		Capacity loss factors
				Peak	Off peak	Capital related	Operation and maintenance	
Generation		Power stations	Marginal energy cost (peak and off peak)	Station use (peak)	Station use (average)	Gas turbine cost adjusted by reserve margin	Gas turbine O&M cost adjusted by reserve margin	
			South Grid	*North and South grid*	*North and South grid*	*North and South grid*	*North and South grid*	
			Exhibit 5.15	Exhibit 5.10	Exhibits 5.8 and 5.10	Exhibit 5.15	Exhibit 5.15	
VHV	Very High Voltage	1150, 500, 330, 220 kV		Network losses (peak)	Network losses (average)	Replacement cost	Percentage of capital cost	Network losses (peak)
				North and South grid	*North and South grid*	*North and South grid*	*North and South grid*	*North and South grid*
				Exhibit 5.10	Exhibits 5.8 and 5.10	Exhibits 5.12 and 5.15	Exhibit 5.15	Exhibit 5.10
HV	High Voltage	110 kV		Network losses (peak)	Network losses (average)	Replacement cost	Percentage of capital cost	Network losses (peak)
				North and South grid	*North and South grid*	*North and South grid*	*North and South grid*	*North and South grid*
				Exhibit 5.10	Exhibits 5.8 and 5.10	Exhibits 5.12 and 5.15	Exhibit 5.15	Exhibit 5.10
HV (A)	High Voltage (Almaty & Taldykorgan)	110 kV		Network losses (peak)	Network losses (average)	Replacement cost	Percentage of capital cost	Network losses (peak)
				Almaty & Taldykorgan	*Almaty & Taldykorgan*	*Almaty & Taldykorgan*	*Almaty & Taldykorgan*	*Almaty & Taldykorgan*
				Exhibit 5.10	Exhibits 5.8 and 5.10	Exhibits 5.12 and 5.15	Exhibit 5.15	Exhibit 5.10
MV	Medium Voltage	35 kV	–	Network losses (peak)	Network losses (average)	Replacement cost	Percentage of capital cost	Network losses (peak)
				Almaty & Taldykorgan	*Almaty & Taldykorgan*	*Almaty & Taldykorgan*	*Almaty & Taldykorgan*	*Almaty & Taldykorgan*
				Exhibit 5.10	Exhibits 5.8 and 5.10	Exhibits 5.12 and 5.15	Exhibit 5.15	Exhibit 5.10
LV	Low Voltage	10, 6, 0.38 kV	–	Network losses (peak)	Network losses (average)	Replacement cost	Percentage of capital cost	Network losses (peak)
				Almaty & Taldykorgan	*Almaty & Taldykorgan*	*Almaty & Taldykorgan*	*Almaty & Taldykorgan*	*Almaty & Taldykorgan*
				Exhibit 5.10	Exhibits 5.8 and 5.10	Exhibits 5.12 and 5.15	Exhibit 5.15	Exhibit 5.10

* The default assumption in the model is that domestic generating stations are the marginal source of peak energy. In the South grid in 1997 imports are the marginal source.

Exhibit 5.3
Allocation of Costs to Voltage Levels and Grid Regions

Voltage level	Overhead lines and underground cables for which costs are allocated to this voltage level	Substations and transformers for which costs are allocated to this voltage level	Grid region
Generation	none	none	North & South
VHV	1150, 500, 330, 220 kV	from 220 kV or higher	North & South
HV	110 kV	from 110 kV	North & South
HV (A)	110 kV	from 110 kV	Almaty & Taldykorgan
MV	35 kV	from 35 kV	Almaty & Taldykorgan
LV	10, 6, 0.38 kV	from 10 kV or 6 kV*	Almaty & Taldykorgan

* Pole mounted transformers are included in the LV category

Note: LRMC is measured for the North and South grid from the generation level down to 220 kV. At 110 kV LRMC is measured on a national level for the North and South grid and on a regional level for Almaty and Taldykorgan. At lower voltages LRMC is measured only on a regional level. Marginal energy costs are estimated for Almaty and Taldykorgan. All other data at the Generation level, VHV and HV level are based on the characteristics of the North and South grid.

Exhibit 5 4
Forecast of Energy Sales by Tariff Class
for the Wholesale Market and for Almaty & Taldykorgan

	Wholesale market sales in GWh					Almaty & Taldykorgan sales to end users in GWh									
								High volt	Medium voltage			Low voltage			
Year	Growth rate	Total sales	Regional energos	VHV industrial	HV industrial	Growth rate	Total sales	1 2 HV industrial	1 2 MV industr >=750kVA	1 2 MV industr <750kVA	3 Railroad transport	4 Urban transport	5 Non industrial	6 Agricultural	7 8 Population
			66 9%	16 4%	16 7%			23 1%	3 5%	2 7%	2 5%	0 5%	15 9%	13 0%	38 9%
1995		**32 166**	21 526	5 278	5 362		**4,322 3**	**1 000 0**	**150 0**	**116 5**	108 0	**20 0**	**686 8**	**559 9**	**1 681 1**
1996	0 4%	**32,303**	21 618	**5,300**	5 385	**0 0%**	4 322	1 000	150	117	108	20	687	560	1 681
1997	0 2%	**32 229**	21 568	5 288	5 373	**1 8%**	4 400	1 018	153	119	110	20	699	570	1 711
1998	2 4%	**32 995**	22 081	5 414	5 500	**2 9%**	4 528	1 048	157	122	113	21	719	587	1 761
1999	2 9%	**33 946**	22 718	5 570	5 659	**3 9%**	4 704	1 088	163	127	118	22	747	609	1 830
2000	5 1%	**35 673**	23 873	5 853	5 947	**4 5%**	4 916	1 137	171	133	123	23	781	637	1 912
2001	**4 0%**	37 100	24 828	6 087	6 185	**4 4%**	5 132	1 187	178	138	128	24	816	665	1 996
2002	**4 0%**	38 584	25 821	6 331	6 432	**4 1%**	5 343	1 236	185	144	133	25	849	692	2 078
2003	**4 0%**	40 127	26 854	6 584	6 689	**3 9%**	5 551	1 284	193	150	139	26	882	719	2 159
2004	**4 0%**	41 732	27 928	6 847	6 957	**3 7%**	5 756	1 332	200	155	144	27	915	746	2 239
2005	**4 0%**	43 402	29 046	7 121	7 235	**3 5%**	5 958	1 378	207	161	149	28	947	772	2 317

Note Growth rates for Almaty & Taldykorgan are based on the Electrowatt Low forecast in the Kazakstan Power System Least Cost Development Study
Wholesale market sales 1995 2000 are forecast in Appendix B

5.4 NETWORK LOSSES

The higher the losses in the electric network, the higher the capacity and energy charges In the LRMC calculation, losses have been estimated on the basis of 1995 data reported by Kazakstanenergo (Exhibit 5 5) and by Almatyenergo (Exhibits 5 6 and 5 7) By international standards the 1995 losses in Almatyenergo — 17 9 percent — are high In the LRMC calculation, average losses were used based on Exhibits 5 5 through 5 7 and as shown in Exhibit 5 8 The data in Exhibit 5 8 was used to calculate the average losses shown in Exhibits 5 9 and 5 10

For the North and for the South Grids, the model requires estimates of total electricity supplied, which includes gross generation, imports, and receipts from autoproducers Station use is subtracted from this figure, to estimate the annual energy received by the network For Almaty and Taldykorgan the model requires an estimate of the annual energy and the power supply received by the network at the regional system peak In Almatyenergo, total electricity supplied in 1995 was 6122 4 GWh, but output to the networks was 5512 1 GWh Therefore station losses and power sector use of electricity amounted to ten percent of total electricity supplied The January 20, 1995 peak load at the generating stations and import receipt points was 1224 MW and peak output to the networks was assumed to be ten percent lower, or 1100 MW (Exhibit 5 11)

If electricity tariffs were raised to LRMC, the service to large industrial customers would be much more reliable Therefore the modified LRMC-based power sector structure assumes that all industrial customers with two-part or three-part tariffs should pay for capacity charges according to the amount of capacity used at the coincident system peak There is no tariff category called interruptible industrial service, and there is no discount for interruption of supply during peak hours When actual historical data is used to measure peak load, however, it is clear that some customers (probably large industrials) were interrupted for long periods of time No attempt was made to estimate the peak load that would have existed if there had been no power supply problems during the 1994-95 winter

In Exhibit 5 10, peak losses are estimated to be one percentage point higher than average losses A more accurate estimate could be developed by Kazakstanenergo on the basis of load flow studies The decline in electricity consumption since 1990 should cause a decline in peak losses, but deterioration of the network due to lack of maintenance (Appendix L, Exhibit L 4) should cause an increase in peak losses A precise estimate is not really needed, however, to justify a tariff structure which discourages electricity consumption during peak periods — either though higher capacity charges or through higher peak energy charges

Exhibit 5.5
Calculation of Network Losses in 1995

			500 kV and higher	220 kV	110 kV and lower	All voltages
Energy input to the network				Energy flows in GWh		
	Sendout from busbars of power stations owned by Ministry of Energy & Coal	1	16 427 4	15 563 4	21 088 0	53 078 8
Plus	Energy received from power stations owned by other agencies	3		1 426 5	427 1	1 853 6
Minus	Useful output not distributed from the busbars of electric stations	8			2,369 9	2 369 9
Plus	Energy received from other republics [including purchased & wheeled energy]	2	13 825 9	5 127 0	1 540 9	20 493 8
Plus	Energy received by lower voltage networks from higher voltage networks	5		20 189 5	31 144 6	
Equals	Total energy received	6	30 253 3	42 306 4	51 830 7	73 056 3
Energy output from the network						
	Useful output received by consumers	7		5 261 5	45 217 8	50 479 3
Minus	Useful output not distributed from the busbars of electric stations	8			2 369 9	2 369 9
Plus	Energy delivered to other republics [including energy sold & wheeled]	9	7 873 7	3 917 5	1 445 9	13,237 1
Plus	Energy delivered to the consumers for the electric stations owned by other agencies	10	742 7	245 1	0 4	988 2
Plus	Energy delivered to the lower voltage networks from higher voltage networks	12	20,189 5	31,144 6		
Equals	Total energy output from the network	13	28 805 9	40 568 7	44 294 2	62 334 7
Energy losses in the network plus system use						
	Losses in transformers at substations and at power stations	16 17	72 5	177 6	984 6	1 234 7
Plus	Corona losses	18	360 8	279 4		640 2
Plus	Other substation losses	19	21 5	47 1	173 2	241 8
Plus	Other working losses	20	116 1	15 0	58 2	189 3
Equals	Working losses	15	570 9	519 1	1 216 0	2 306 0
Plus	Transmission losses	21	876 5	1,218 6	5 821 7	7 916 8
Equals	Total energy losses in the network	22	1 447 4	1 737 7	7 037 7	10 222 8
Plus	Energy used for the production needs of the energy system	14			498 8	498 8
Equals	Total energy losses plus system use		1 447 4	1 737 7	7 536 5	10 721 6
Ratio of energy loss and use to energy received at each voltage level						
	Losses in transformers at substations and at power stations	16 17	0 2%	0 4%	1 9%	1 7%
Plus	Corona losses	18	1 2%	0 7%		0 9%
Plus	Other substation losses	19	0 1%	0 1%	0 3%	0 3%
Plus	Other working losses	20	0 4%	0 0%	0 1%	0 3%
Equals	Working losses	15	1 9%	1.2%	2 3%	3.2%
Plus	Transmission losses	21	2 9%	2 9%	11.2%	10 8%
Equals	Total energy losses in the network	22	4 8%	4 1%	13 6%	14 0%
Plus	Energy used for the production needs of the energy system	14			1 0%	0 7%
Equals	Total energy losses plus system use		4 8%	4 1%	14 5%	14 7%
Ratio of energy loss and use to total energy received at all voltage levels						
	Total energy losses plus system use		2 0%	2 4%	10 3%	14 7%

Source Kazakstanenergo Annual Report, 1995

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Network Losses, 1993-1995

	1993	1994	1995
Network losses + non-technical losses GWh			
reported by Kazakstanenergo,1995 Annual Report Table 6 3 2 p 66			
Kustenay		792 9	772 3
Tselin		1,377 7	1,363 3
Ekibastuz		531 6	511 9
Pavlodar		921 7	988 2
Karaganda		1,314 5	1,280 4
Altay		1,248 3	1,643 6
Almaty		990 3	1,054 9
South Kaz		1,707 9	1,770 9
Zapkaz		387 9	638 6
Atyrau		281 9	193 3
South Kaz GRES		7 5	5 4
Total		9 562 2	10 222 8
Energy indicator, GWh selected			
by Kazakstanenergo to calculate percentage losses			
Kustenay		7 341 7	6 715 7
Tselin		9 271 2	7 790 3
Ekibastuz		10,423 5	19,688 5
Pavlodar		14,842 2	22,459 1
Karaganda		13,537 6	12 804 0
Altay		8 038 0	10 145 7
Almaty		6 170 1	5 893 3
South Kaz		9,012 7	8,432 9
Zapkaz		4,248 6	6 386 0
Atyrau		3 118 4	1 823 6
Total		69 899 1	68 609 4
Network losses + non technical losses %			
reported by Kazakstanenergo,1995 Annual Report, Table 7, p 180			
Kustenay		10 80%	11 50%
Tselin		14 86%	17 50%
Ekibastuz		5 10%	2 60%
Pavlodar		6 21%	4 40%
Karaganda		9 71%	10 00%
Altay		15 53%	16 20%
Almaty		16 05%	17 90%
South Kaz		18 95%	21 00%
Zapkaz		9 13%	10 00%
Atyrau		9 04%	10 60%
Total		13 68%	14 90%
Network + non technical losses			
calculated by Hagler Bailly			
Energy delivered to the grid, GWh	79,526		
Network losses GWh	7,261		
Non technical losses, GWh	2,925		
Network + non technical losses	10,186 0		
Network + non-technical losses	12 8%		

Exhibit 5.7
Structure of Losses of Electric Energy in Almatyenergo in 1995 (Normative)

Elements of the structure	Losses (in GWh) at different voltage levels					Total losses of electric energy
	500 kV	220 kV	110 kV	35/10/6 kV	0 4 kV	
High-voltage lines						
Losses related to electric load	23 1	110 1	212 8	100 6	165 6	612 2
Corona losses	42 0	28 0				70 0
Transformers						
Losses related to electric load	2 1	11 0	51 8	52 5		117 4
Losses related to idling	5 5	13 8	25 0	85 8		130 1
Substations' internal needs	3 6	3 6	10 6	6 0		23 8
Synchronous compensator and synchronous compensator battery			0 2	0 4		0 6
Reactive power generators	10 8					10 8
Total losses at each voltage level	87 1	166 5	300 4	245 3	165 6	964 9
as a % of total losses	9 03%	17 26%	31 13%	25 42%	17 16%	100 00%
as a % of output to the network	1 58%	3 02%	5 45%	4 45%	3 00%	17 51%

* Output to the network in 1995 was 5512 1 million kWh

Source Almatyenergo, Annual Technical Report for 1995, page 111, Table 6 2 2

Exhibit 5 8
Parameters Used to Forecast Energy Sales and Losses, by Voltage Level, for the North & South Grid and for Almaty & Taldykorgan

	North & South Grid			Almaty & Taldykorgan			
	Power station use	VHV	HV	HV (A)	MV	LV	Total
Station use as a percentage of gross generation + net imports	7 8%						
Average losses as a percentage of net generation + net imports		4 4%	2 5%				6 9%
Average losses as a percentage of net generation + net purchases		4 4%		5 5%	3 0%	5 0%	17 9%
Coincident peak load factor for sales to end users		0 85	0 85	0 70	0 60		

Sources Station use is estimated from 1993 data shown in Appendix B Losses are estimated from Kazakstanenergo s Annual Report for 1995
Coincident peak load factor assumptions are rough estimates load factor data were not available from Kazakstanenergo

Exhibit 5 9
Forecast of Energy Sales and Losses, by Voltage Level, for the North & South Grid and for Almaty & Taldykorgan

	North & South Grid			Almaty & Taldykorgan		Energy sales in GWh by voltage level					
						North & South Grid			Almaty & Taldykorgan		
Year	Coincident peak load MW	Gross generation + net imports GWh	System load factor	Peak load MW	Net generation + purchases GWh	NES sales at power stations	VHV	HV	HV (A)	MV	LV
1995	**10,729**	64 852	69 0	**1 100**	**5,512**	**0**	5 300	14 000	1 000	375	2 948
1996	**10,551**	63 950	69 2	**1 100**	**5 512**	**0**	5 300	**14 000**	1 000	375	2 948
1997	**10,573**	64 266	69 4	1 120	5 611	**0**	5 288	13 968	1 018	381	3 001
1998	**10,688**	65 144	69 6	1 152	5 774	**0**	5 414	14 300	1 048	392	3 088
1999	**10,903**	66 641	69 8	1 197	5 999	**0**	5 570	14 712	1 088	408	3 208
2000	**11,197**	68 268	69 6	1 251	6 269	**0**	5 853	15 461	1 137	426	3 353
2001	**11,487**	70 612	70 2	1 306	6 545	**0**	6 087	16 079	1 187	445	3 500
2002	**11,760**	72 498	70 4	1 360	6 813	**0**	6 331	16 722	1 236	463	3 644
2003	**12,034**	74 402	70 6	1 413	7 079	**0**	6 584	17 391	1 284	481	3 786
2004	**12,300**	76 269	70 8	1 465	7 341	**0**	6 847	18 087	1 332	499	3 926
2005	**12,564**	78 146	71 0	1 516	7 598	**0**	7 121	18 810	1 378	516	4 063

	Average losses in GWH by voltage level					
	North & South Grid			Almaty & Taldykorgan		
Year	Power station use	VHV	HV	HV (A)	MV	LV
1995	5 030	2 632	1 496	303	165	276
1996	4 960	2 596	1 475	303	165	276
1997	4 985	2 608	1 482	309	168	281
1998	5 053	2 644	1 502	318	173	289
1999	5 169	2 705	1 537	330	180	300
2000	5 295	2 771	1 574	345	188	313
2001	5 477	2 866	1 628	360	196	327
2002	5 623	2 942	1 672	375	204	341
2003	5 771	3 020	1 716	389	212	354
2004	5 916	3 096	1 759	404	220	367
2005	6 061	3 172	1 802	418	228	380

Note The coincident peak load excludes the load used by autoproducers Therefore NES sales at power stations are zero
The estimates of network losses are not affected by the exclusion of autoproducers own load

Exhibit 5 10
Losses Expressed as a Percentage of Energy Received at Each Voltage Level for the North & South Grid and for Almaty & Taldykorgan

	North & South Grid						Almaty & Taldykorgan					
	Station use		VHV		HV		HV (A)		MV		LV	
Year	Average losses (Exhibit 4)	Peak losses	Average losses (Exhibit 4)	Peak losses	Average losses (calculated)	Peak losses	Average losses (Exhibit 4)	Peak losses	Average losses (calculated)	Peak losses	Average losses (calculated)	Peak losses
1995	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
1996	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
1997	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
1998	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
1999	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
2000	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
2001	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
2002	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
2003	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
2004	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
2005	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	6 5%
Average	7 8%	8 8%	4 4%	5 4%	2 9%	3 9%	5 5%	6 5%	3 2%	4 2%	5 5%	5 5%

Note Average losses are either values assumed in Exhibit 4 or values calculated from Exhibit 5
Data on peak losses were not available from Kazakstanenergo and therefore these values are rough estimates

Exhibit 5 11
Forecast of Coincident Peak Load (MW) by Voltage Level

North & South Grid

	Generation level			VHV			HV			
Year	Coincident peak load MW	Power station use MW	NES sales at power stations MW	Network losses MW	Load at delivery points MW	Consumption by VHV customers MW	Network losses MW	Load at delivery points MW	Consumption by HV industrials MW	Delivery to regional energos MW
1995	10 729	939	0	529	9 261	712	332	8 217	1 880	6 337
1996	10 551	924	0	520	9 107	712	326	8 069	1 880	6 189
1997	10 573	926	0	521	9 126	710	327	8 089	1 876	6 213
1998	10 688	936	0	527	9 226	727	330	8 168	1 920	6 248
1999	10 903	955	0	537	9 411	748	337	8 326	1 976	6 350
2000	11 197	980	0	552	9 665	786	346	8 533	2 076	6 456
2001	11 487	1 006	0	566	9 915	817	355	8 743	2 159	6 584
2002	11 760	1 030	0	579	10 151	850	363	8 938	2 246	6 692
2003	12 034	1 054	0	593	10 387	884	371	9 132	2 336	6 796
2004	12 300	1 077	0	606	10 617	920	379	9 318	2 429	6 889
2005	12 564	1 100	0	619	10 845	956	387	9 501	2 526	6 975

Almaty & Taldykorgan

	Supply	HV (A)			MV			LV	
Year	Peak load MW	Network losses MW	Load at delivery points MW	Consumption by HV (A) customers MW	Network losses MW	Load at delivery points MW	Consumption by MV customers MW	Network losses MW	Load at delivery points MW
1995	1 100	72	1 029	163	36	829	71	49	709
1996	1 100	72	1 029	163	36	829	71	49	709
1997	1 120	73	1 047	166	37	844	73	50	722
1998	1 152	75	1 077	171	38	869	75	51	743
1999	1 197	78	1 119	177	39	903	78	53	772
2000	1 251	81	1 170	185	41	943	81	56	806
2001	1 306	85	1 221	194	43	985	85	58	842
2002	1 360	88	1 271	202	45	1 025	88	61	876
2003	1 413	92	1 321	209	46	1 065	92	63	911
2004	1 465	95	1 370	217	48	1 104	95	65	944
2005	1 516	99	1 418	225	50	1 143	98	68	977

Note The coincident peak load excludes the load used by autoproducers Therefore NES sales at power stations are zero
The estimates of network losses are not affected by the exclusion of autoproducers own load

5.5 NETWORK CAPACITY COST

For each voltage level, an estimate was made of the annual cost per kW of capacity used These capacity costs are included in the capacity charges contained in three-part tariffs to customers In a LRMC-based tariff, it is necessary to estimate the incremental cost of expanding the network to meet incremental loads This issue could be addressed by developing alternative network expansion plans based on alternative load forecasts, taking into account the location of the incremental loads as well as the amount of the incremental load In this study, however, the replacement cost of the network at each voltage level was estimated, and then the replacement cost per kW of load capability at that voltage level was determined The replacement cost is the capital cost that would be required to build the network at today's prices It was assumed that this capital cost can be financed at a fixed real interest rate (ten percent) over a long time period (30 years), so that the annual cost to the customer is relatively modest Without long-term financing, the cost of replacing the HV network would be prohibitively expensive

A detailed statistical description of the technical condition of the networks is contained in Appendix L The assumptions on replacement costs per kilometer are shown in Exhibit 5 12 and Exhibit L 2 The estimate of the replacement cost of 500 kV overhead lines matches the estimate in the EBRD study A rough estimate is used to estimate the replacement cost of substations and transformers Based on experiences in other countries, the results reflected in Exhibit 5 12 are reasonable An important aspect of these results is the high cost of the LV network Due to large geographic areas with low population density, it is relatively expensive to provide electric service in such areas Network costs per kW in Kazakstan are much higher than in small densely populated countries

5 5 1 Energy Cost and Capacity Cost of Generation

Exhibit 5 13 shows an analysis by Almatyenergo of the sources of energy used to meet its 1995 peak load (which occurred on January 20), while Exhibit 5 14 shows a similar analysis for a summer day (June 21) In Exhibit 4 12, estimates of the peak and off-peak values of the marginal cost of energy are shown for the South Grid under stable conditions These values are shown in Exhibit 5 15 Although these capacity costs are reasonable as long-term targets, they are optimistic for the 1997-2000 period, and therefore an alternative method is recommended

5.6 LRMC TARIFFS

The data in the preceding tables is used to calculate the LRMC of capacity and energy by voltage level, as shown in Exhibits 5 16 and 5 17 The numbers in Exhibit 5 18 show the parameters for three-part tariffs (assuming that the capacity charges are applied to the customer's *coincident kW*), which is the wholesale market customer's contribution to the annual coincident system peak

in the South Grid (or the retail customer's contribution to the annual coincident system peak in Almaty and Taldykorgan) In practice, it is difficult to measure the customer's contribution to the annual coincident system peak at the MV or LV level Therefore, the tariffs shown in Exhibit 5 18 can be implemented only at the VHV, HV, and HV(A) levels Either a flat tariff or a different form of demand charge is needed to develop tariffs at lower voltage levels

The results of this analysis are presented in Exhibit 5 18, which shows an estimate of the flat tariff that could be applied to each customer class and the capacity and energy components of this flat tariff These figures are shown as "total marginal cost" in Tenge/kWh and in Cents/kWh Given the projected sales of each customer class, it is possible to calculate the average tariff in the wholesale market (3 58 Tenge/kWh) and the average tariff of the customers for the Almaty and Taldykorgan network enterprises (5 06 Tenge/kWh) All of these numbers are sensitive to the assumptions made regarding the coincidence factor and load factor of each customer class In addition, the peak energy tariff has been applied to a peak period representing only 20 percent of the hours in the year An analysis of the SRMC of energy might reveal the need to extend this peak period to a larger fraction of the year

The recommendations regarding the structure of strict LRMC tariffs are a three-part tariff for all of the customers in the wholesale market, and a choice of either a flat tariff or a three-part tariff for the customers of the regional network enterprises In the wholesale market, the creation of a competitive market with privatized generating companies will eventually raise prices to the level of strict LRMC tariffs In the retail market, the tariffs shown in Exhibit 5 19 represent a set of targets for the price reform process It is likely that the sooner these targets are achieved, the sooner the financial health of the power sector will be restored

Exhibit 5 12
Replacement Cost of Network Capacity

Network component	Replacement cost		North & South Grid VHV Quantity	Cost $million	HV Quantity	Cost $million	Almaty & Taldykorgan HV (A) Quantity	Cost $million	MV Quantity	Cost $million	LV Quantity	Cost $million
Overhead lines (km)												
1150 kV	0 75	$million/km	1 402 5	1 051 9								
500 kV	0 2	$million/km	4,603 4	920 7								
330 kV	0 1	$million/km	497 4	49 7								
220 kV	0 07	$million/km	15,499 0	1 084 9								
110 kV	0 045	$million/km			34,489 0	1 552 0	4,325 3	194 6				
35 kV	0 025	$million/km							5 018 8	125 5		
10 kV	0 018	$million/km									30 735 7	553 2
6 kV	0 016	$million/km									212 9	3 4
0 38 kV	0 01	$million/km									17 473 6	174 7
Total			22 002 3	3 107 2	34 489 0	1 552 0	4 325 3	194 6	5 018 8	125 5	48 422 2	731 4
Underground cables (km)												
110 kV	0 18	$million/km					5 4	1 0				
35 kV	0 1	$million/km							45 8	4 6		
10 kV	0 072	$million/km									1,115 4	80 3
6 kV	0 064	$million/km									1 337 6	85 6
0 38 kV	0 04	$million/km									1,304 7	52 2
Total							5 4	1 0	45 8	4 6	3 757 7	218 1
Substations (kVA)												
1150 kV	0 02	$million/kVA	7,005 0	140 1								
500 kV	0 02	$million/kVA	11,214 0	224 3								
220 kV	0 02	$million/kVA	13,225 1	264 5								
110 kV	0 02	$million/kVA			15 329 6	306 6	2 709 4	54 2				
35/6 10 kV	0 02	$million/kVA							1,237 0	24 7		
35/ 38 kV	0 02	$million/kVA									2 3	0 0
6 10/ 38 kV	0 02	$million/kVA									2 841 9	56 8
Total			31 444 1	628 9	15 329 6	306 6	2 709 4	54 2	1 237 0	24 7	2 844 2	56 9
Total replacement cost $million				3 736 1		1 858 6		249 8		154 8		1 006 4
1995 coincident peak load for the grid MW			9 260 9		8 217 2							
1995 peak load for Almatyenergo MW							1 028 5		829 3		709 0	
Adjustment for load capability			20%		20%		20%		30%		40%	
Estimated peak load capability MW			11 113 1		9 860 7		1 234 2		1 078 1		992 7	
Replacement cost $/kW				336		188		202		144		1 014

Exhibit 5 13

Load Schedule of Annual Maximun
for Alamtvenergo for 20 01 95

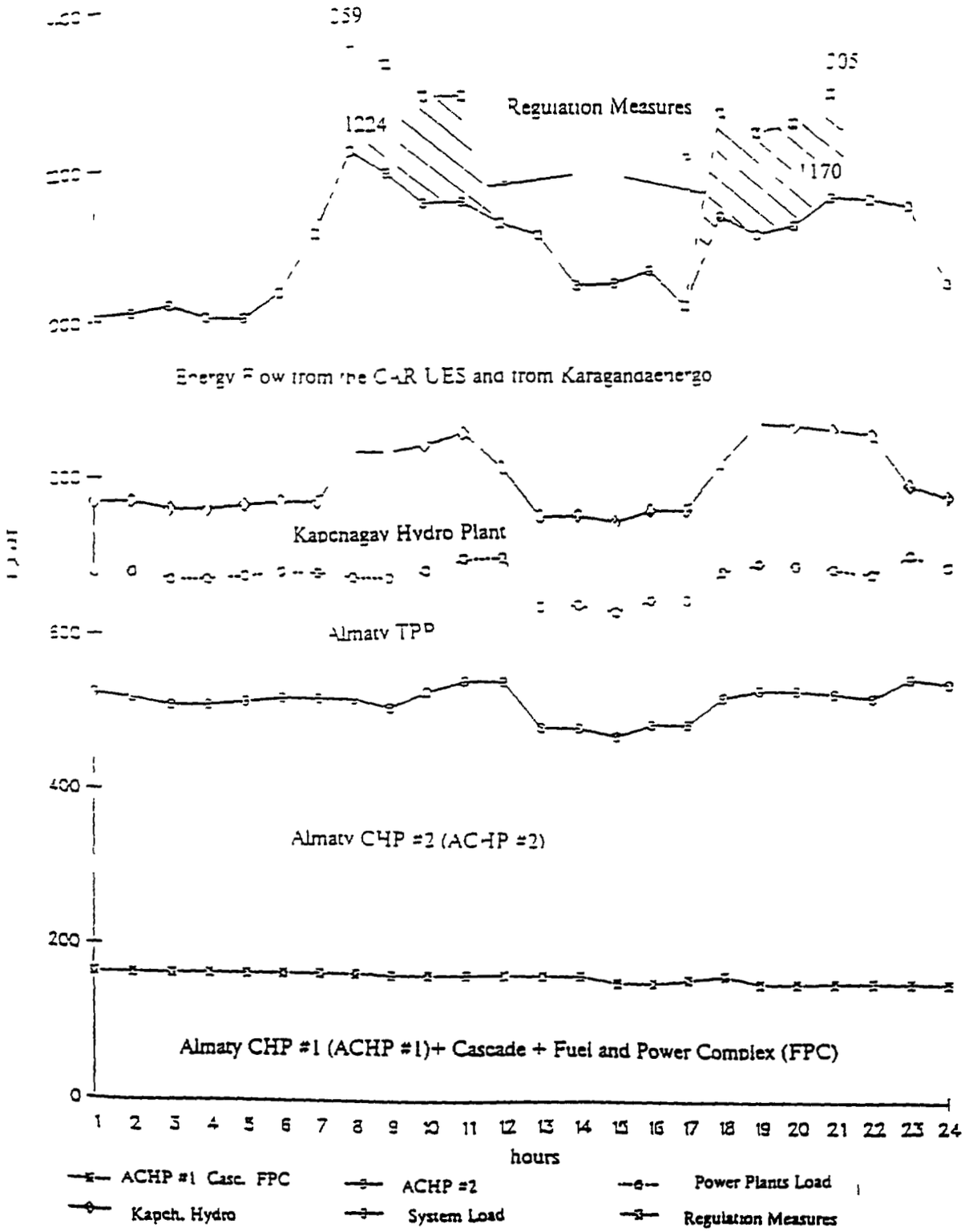

Exhibit 5 14

Load Schedule for Almatvenergo for 21 06 95

(when the measures were made)

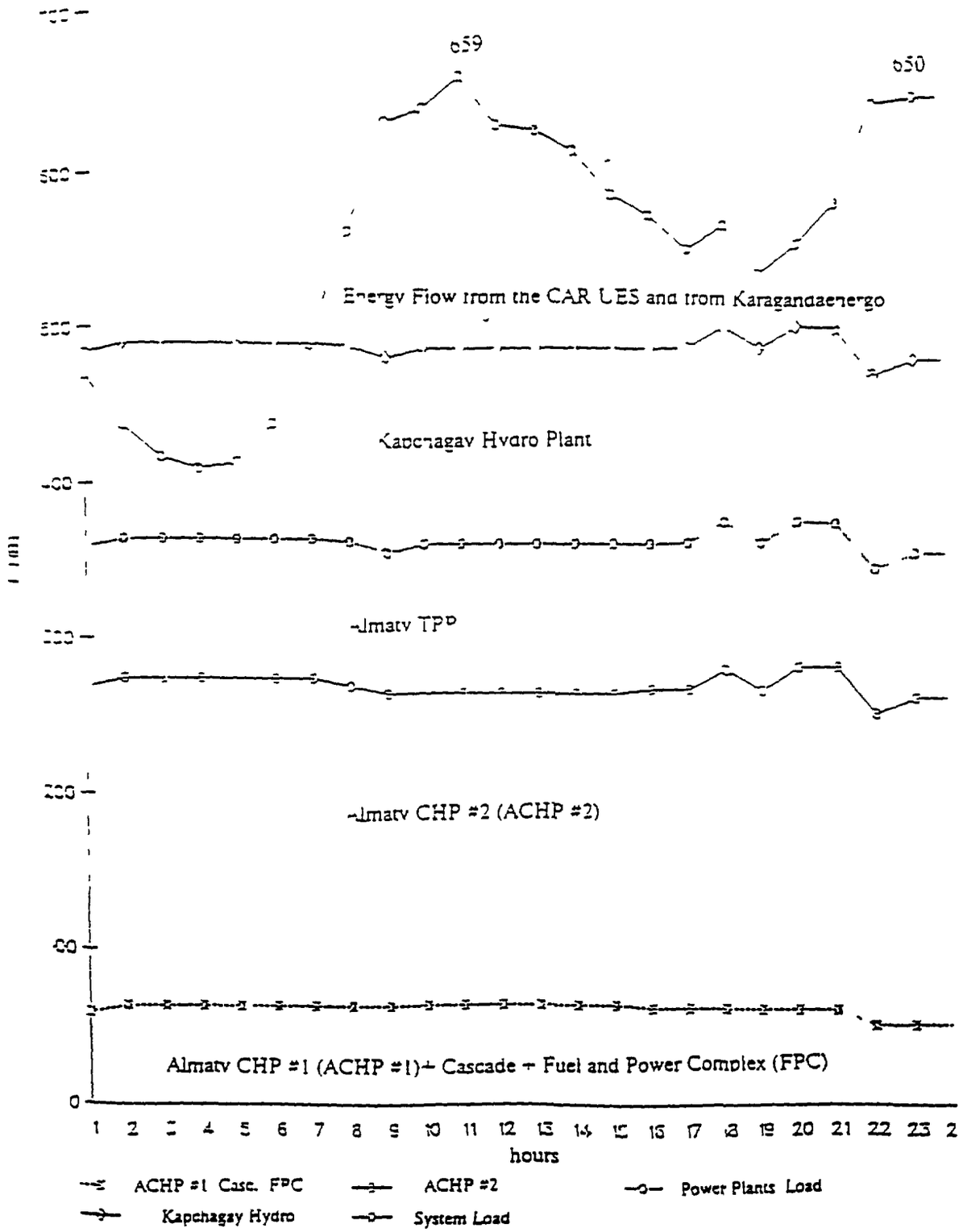

Exhibit 5 15
Marginal Costs of Capacity and Energy for the South Grid and for Almaty & Taldykorgan

Generation Capacity and Energy for the South Grid

Marginal capacity cost	**122 54 $/kW year**	8087 64	Tenge/kW year
		673 97	Tenge/kW month
Marginal energy cost peak	**2 35** Cents/kWh	1 5510	Tenge/kWh
Marginal energy cost off peak	**1 92** Cents/kWh	1 2672	Tenge/kWh

Transmission and Distribution Capacity

Cost measure	Voltage level: North & South Grid		Almaty & Taldykorgan		
	VHV	HV	HV (A)	MV	LV
Capital cost $/kW	336	188	202	144	1 014
Capital cost Tenge/kW	22 189	12 440	13 358	9 476	66 912
Capacity life (years) used to compute annual cost	**30**	**30**	**30**	**25**	**25**
Interest rate used to compute annual cost	10 0%	10 0%	10 0%	10 0%	10 0%
Annual capital cost Tenge/kW/year	2 354	1 320	1 417	1 044	7 372
Operation & maintenance cost % of capital cost	**2 0%**	**2 0%**	**2 0%**	**2 5%**	**2 5%**
Operation & maintenance cost Tenge/kW/year	444	249	267	237	1 673
Annual capacity cost Tenge/kW/year	2 798	1 568	1 684	1 281	9 044
Annual capacity cost $/kW/year	42	24	26	19	137
Monthly capacity cost Tenge/kW/month	233	131	140	107	754

Note These costs measure the cost of 1 kW at the coincident peak load for the North & South grid or for Almaty and Taldykorgan networks

Exhibit 5 16
Marginal Cost of Capacity, by Voltage Level, for the South Grid and for Almaty & Taldykorgan

Long Run Marginal Cost of capacity in Tenge per coincident kW per month

Grid region	Voltage level	LRMC of generation capacity	LRMC of transmission and distribution capacity						Generation transmission & distribution
			VHV	HV	HV (A)	MV	LV	Total	
South grid	Net generation	674						0	674
	VHV	712	233					233	946
	HV	741	243	131				373	1 115
Almaty & Taldyk	VHV	712	233						
	HV (A)	762	249		140			390	1 152
	MV	795	260		146	107		513	1 309
	LV	841	275		155	113	754	1 297	2 138

Exhibit 5 17
Marginal Cost of Energy, by Voltage Level,
for the South Grid and for Almaty & Taldykorgan

Long Run Marginal Cost of energy In Tenge per kWh

Grid region	Voltage level	Peak	Off peak
South grid	Gross generation	1 55	1 27
	Net generation	1 70	1 37
	VHV	1 80	1 44
	HV	1 87	1 48
Almaty & Taldyk	Gross generation	1 55	1 27
	Net generation	1 70	1 37
	VHV	1 80	1 44
	HV (A)	1 92	1 52
	MV	2 01	1 57
	LV	2 12	1 66

Exhibit 5 18
Wholesale Market Prices and Strict LRMC Tariff Yields for 1996

	Tariff class	Voltage level	1996 sales GWh	October 96 yield Tenge/kWh	Coincidence factor	Load factor	Peak energy share of total	Monthly capacity cost Tenge/class kW/month Generation	Network	Total	Equivalent capacity cost Tenge/kWh	Energy cost Tenge/kWh	Total marginal cost Tenge/kWh	Total marginal cost cents/kWh	March 1996 yield as a percent of LRMC	Tariff change needed to reach LRMC
	Cost of electricity purchased in the wholesale market *															
	Cost incurred by generators	Gross generation			1 00	0 70	20%	674	0	674	1 32	1 32	2 64	4 00		
	Purchases from generators	Net generation			1 00	0 70	20%	674	0	674	1 32	1 44	2 76	4 18		
	Sales to customers	VHV			1 00	0 70	20%	712	233	946	1 85	1 51	3 36	5 09		
	Transmission charges for VHV service	VHV Net generation			1 00	0 70	20%	38	233	272	0 53	0 07	0 60	0 91		
	Sales to customers	HV			1 00	0 70	20%	741	373	1 115	2 18	1 56	3 74	5 67		
	Transmission charges for HV service	HV Net generation			1 00	0 70	20%	67	373	441	0 86	0 12	0 98	1 49		
	Tariff yields in the wholesale market (for customers of Kazakhstanenergo)															
1	VHV industrial	VHV	5 300 0	2 8660	0 85	0 70	20%	606	198	804	1 57	1 51	3 08	4 67	93%	8%
1	HV industrial	HV	5 385 0	2 8660	0 85	0 70	20%	630	317	947	1 85	1 56	3 41	5 17	84%	19%
	Industrial customers total		10 685 0	2 8660	0 85	0 70	20%			876	1 71	1 53	3 25	4 92	88%	13%
	Regional networks	HV	21 618 0	2 8660	1 00	0 70	20%	741	373	1 115	2 18	1 56	3 74	5 67	77%	30%
	All customers total		32 303 0	2 8660			20%			1 036	2 03	1 55	3 58	5 42	81%	25%
	Tariff yields for customers of Almaty Network & Taldykorgan Network															
1	HV industrial >750 kVA	HV (A)	1 000 0	2 8793	0 85	0 85	20%	648	331	979	1 58	1 60	3 18	4 82	91%	10%
1	MV industrial >750 kVA	MV	150 0	2 8793	0 85	0 75	20%	676	436	1 112	2 03	1 66	3 69	5 59	78%	28%
2	MV industrial <750 kVA	MV	116 5	4 4424	0 85	0 75	20%	676	436	1 112	2 03	1 66	3 69	5 59	120%	17%
3	Railroad transport	MV	108 0	4 3290	0 85	0 75	20%	676	436	1 112	2 03	1 66	3 69	5 59	117%	15%
4	Urban transport	LV	20 0	4 5289	0 70	0 50	25%	589	908	1 497	4 10	1 78	5 88	8 90	77%	30%
5	Non industrial	LV	686 8	5 0090	0 70	0 50	25%	589	908	1 497	4 10	1 78	5 88	8 90	85%	17%
6	Agricultural	LV	559 9	3 9379	0 70	0 50	25%	589	908	1 497	4 10	1 78	5 88	8 90	67%	49%
7 8	Population	LV	1 681 1	2 4915	0 70	0 50	25%	589	908	1 497	4 10	1 78	5 88	8 90	42%	136%
	All customers total		4 322 3	3 2900			23%			1 343		1 73	5 06	7 67	69%	65%

Separate prices for capacity peak energy and off peak energy are used to characterize wholesale market prices in the spreadsheet model used to prepare this table
The coincidence factor load factor and peak energy share shown for the wholesale market are the values assumed for the regional networks

Note For the customers of Almaty Network and Taldykorgan Network the March 1996 tariffs are estimated based on 1995 ratios

Exhibit 5 19
Tariffs Based on Competitive Power Pool Prices

Wholesale Electricity Prices (South Grid)

Wholesale market yield based on pool prices	3 58	Tenge/kWh
Wholesale market sales (GWh)	32,995	
Wholesale market sales revenue (million Tenge)	118,014	

Tariff class	Annual sales, GWh	Average yield at Oct 1996 prices Tenge/kWh	Yield with proposed tariffs, Tenge/kWh	Increase relative to Oct 96 prices	Energy charge Tenge/kWh		Demand Tenge per coincident kW per mo
					Peak	Off-peak	
HV customers	5,414	2 8660	3 0818	8%	1 80	1 44	946
IV customers	5,500	2 8660	3 4119	19%	1 87	1 48	1 115
egional energos	22,081	2 8660	3 7391	30%	1 87	1 48	1 115
Wholesale market, total	32 995	2 8660	3 5767	25%			

Almaty Network & Taldykorgan Network Tariffs

verage tariff at the retail level for Almaty & Taldykorgan	5 0627	Tenge/kWh
lmaty & Taldykorgan sales (GWh)	4,528	
lmaty & Taldykorgan sales revenue (million Tenge)	22,922	

Tariff class	Annual sales GWh	Average yield at Oct 1996 prices Tenge/kWh	Yield with proposed tariffs, Tenge/kWh	Increase relative to Oct 96 prices
V industrial >750 kVA	1 048	2 8793	3 1785	10%
V industrial >750 kVA	157	2 8793	3 6890	28%
V industrial <750 kVA	122	4 4424	4 4424	0%
ailroad transport	113	4 3290	4 3290	0%
rban transport	21	4 5289	5 8764	30%
on-industrial	719	5 0090	5 8764	17%
gricultural	587	3 9379	5 8764	49%
opulation	1,761	2 4915	5 7831	132%
Total	4,528	3 2900	5 0627	54%

Tariff class	Voltage level	Option 1 1-part tariff	Option 2 3-part tariff		
		Energy charge, Tenge/kWh	Energy charge Tenge/kWh		Demand charge, Tenge per coincident kW /month
			Peak	Off-peak	
/ industrial >750 kVA	HV (A)	3 18	1 92	1 52	1,152
/ industrial >750 kVA	MV	3 69	2 01	1 57	1,309
/ industrial <750 kVA	MV	4 44	2 42	1 89	1 576
ilroad transport	MV	4 33	2 35	1 84	1,536
oan transport	LV	5 88	2 12	1 66	2 138
n-industrial	LV	5 88	2 12	1 66	2,138
ricultural	LV	5 88	2 12	1 66	2,138
pulation	LV	5 78	2 09	1 63	2 104

CHAPTER 6
PROPOSED TARIFF REFORM PLAN

This chapter presents a proposal for tariff reform over a short-term transitional period The transition is intended to permit a gradual phase-in of these reforms

- *Creation of a power pool* The wholesale market will be restructured to create power pools in which competitive bids are received from generating companies, and the price of electricity in the wholesale market will be determined by competition rather than by regulation of a monopolistic enterprise

- *Retail tariffs based on LRMC* For each regional network enterprise the average tariff will be calculated as the sum of the wholesale market price plus a distribution margin It is recommended that the distribution margin be raised as soon as it is practicable to the level of LRMC

- *Adjustment of tariff levels for different customer classes* The existing tariffs for different customer classes are not related to the true cost of providing electric service to each customer class The existing tariffs for the population are too low, relative to the average tariff During a short transition period population would receive a modest subsidy from other customer classes At the end of transition, tariff levels will all be based upon LRMC

The end result of these reforms is the set of LRMC-based tariffs presented in Exhibit 5 19 As in Chapter 5, the tables in Chapter 6 do not include adjustments for inflation The final target for the reform process was described in Chapter 5, the interim targets are presented in Chapter 6

The recommendations presented in this chapter are based upon the stated policy objectives of the GOK regarding power sector privatization and restructuring The actual timing of tariff reform will depend upon decisions made by the AMC, MECI, and GOK

One objective of this study is to provide analytical tools that are flexible for the modification of the reform plan presented in this chapter, or to design a different tariff reform plan, if necessary The tables in this chapter were developed from a computer model which serves this purpose

6.1 AMOUNT AND TIMING OF TARIFF INCREASES

It is well known that currently the amount and timing of tariff increases in the power sector is a function of political factors This concern will only be alleviated when the SRC is truly made an independent agency, thereby minimizing the influence of politics on tariff-setting and non-payments enforcement

There are at least three arguments in favor of increasing tariffs rapidly to the levels shown in Exhibit 5 19

1 The percentage increase required in the wholesale market (23 percent) is modest relative to the increases that have already been made in 1996

2 The GOK has begun a power sector privatization and restructuring program which cannot be completed and sustained without electricity price reform

3 There is no sound economic reason for the GOK to raise oil and gas prices to "market" levels without raising electricity prices to "market" levels

To implement a restructuring and privatization program successfully, the GOK must allow investors the expectation that the assets being sold can be used to run a profitable business The prices established by the September 27, 1996 *Resolution on Electricity Tariffs* vary widely and do not reflect the price levels that will exist when a competitive wholesale market is established

Petroleum product and gas price increases have already been implemented, indicating that the GOK has already allowed the prices of natural gas and heavy fuel oil in the domestic market to rise to the level of border prices (Appendix B) Although some domestic coal prices are low by world standards (i e , the cost of Ekibastuz coal sold to Kazakstanenergo in the first quarter of 1996), there are indications that coal prices are approaching "market" levels

A transition to LRMC tariffs would involve the following steps

- Initially, wholesale tariffs would be restructured as three-part tariffs, in preparation for the introduction of power pools in the North Grid and the South Grid The operator of the transmission grid will have a single tariff schedule for both grids The average tariff will not change and will remain at its current level Tariffs to customers of the regional network enterprises will increase as a result of the wholesale price increase, but the distribution margin will be below LRMC (Exhibit 6 1)

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Exhibit 6 1
Tariff Reforms Based on the October 1996 Wholesale Price Level

Wholesale Electricity Tariffs

\verage tariff in the wholesale market	**2 866**	Tenge/kWh	80 1% of LRMC for 1996
ncrease applied to LRMC	**0 0%**	relative to the LRMC for 1996	
\azakstanenergo sales (GWh)	32 303		
\azakstanenergo sales revenue (million Tenge)	92,580		

Tariff class	1996 sales GWh	Average yield at Oct 1996 prices Tenge/kWh	Strict LRMC yield Tenge/kWh	Revenue neutral yield Tenge/kWh	Increase relative to Oct 96 prices	Energy charge Tenge/kWh Peak	Energy charge Tenge/kWh Off-peak	Demand Tenge per coincident kW per mo
HV customers	5 300	2 8660	3 0818	2 4694	-14%	1 44	1 15	758
V customers	5 385	2 8660	3 4119	2 7339	-5%	1 50	1 19	893
egional energos	21 618	2 8660	3 7391	2 9961	5%	1 50	1 19	893
azakstanenergo total	32 303	2 8660	3 5767	2 8660	-0%			

Almaty Network & Taldykorgan Network Tariffs

crease applied to LRMC	0 0%	relative to the LRMC for 1996
azakstanenergo yield + LRMC of distribution	4 3197	Tenge/kWh
phase-in of LRMC of distribution	**40%**	
azakstanenergo yield + phased-in LRMC of distribution	3 5255	Tenge/kWh
maty & Taldykorgan sales (GWh)	4 322	
maty & Taldykorgan sales revenue (million Tenge)	15 238	
inimum percent increase in tariff class yield	**0%**	

Tariff class	1996 sales GWh	Average yield at Oct 1996 prices Tenge/kWh	Strict LRMC yield Tenge/kWh	Revenue neutral yield Tenge/kWh	Increase relative to Oct 96 prices	0 percent adjusted yield Tenge/kWh	Increase relative to Oct 96 prices	Ratio of strict LRMC yield
/ industrial >750 kVA	1 000	2 8793	3 1785	2 2134	-23%	2 8793	0%	0 91
V industrial >750 kVA	150	2 8793	3 6890	2 5690	-11%	2 8793	0%	0 78
V industrial <750 kVA	117	4 4424	3 6890	2 5690	-42%	4 4424	0%	1 20
ailroad transport	108	4 3290	3 6890	2 5690	-41%	4 3290	0%	1 17
ban transport	20	4 5289	5 8764	4 0922	-10%	4 5289	0%	0 77
on-industrial	687	5 0090	5 8764	4 0922	-18%	5 0090	0%	0 85
ricultural	560	3 9379	5 8764	4 0922	4%	4 0922	4%	0 70
pulation	1 681	2 4915	5 8764	4 0922	64%	3 0458	22%	0 52
Total	4 322	3 2900	5 0627	3 5255	7%	3 5255	7%	0 70

Tariff class	Voltage level	Option 1 1-part tariff Energy charge Tenge/kWh	Option 2 3-part tariff Energy charge Tenge/kWh Peak	Energy charge Tenge/kWh Off-peak	Demand charge Tenge per coincident kW /month
industrial >750 kVA	HV (A)	2 88	1 74	1 38	1 043
' industrial >750 kVA	MV	2 88	1 57	1 23	1 021
' industrial <750 kVA	MV	4 44	2 42	1 89	1 576
lroad transport	MV	4 33	2 35	1 84	1 536
ban transport	LV	4 53	1 63	1 28	1,648
n-industrial	LV	5 01	1 81	1 42	1 822
icultural	LV	4 09	1 48	1 16	1 489
pulation	LV	3 05	1 10	0 86	1 108

- During the next phase, the operator of the transmission grid would require a ten percent tariff increase to cover the increased cost of purchased electricity Tariffs to the customers of the regional networks will be raised for two reasons (1) to cover the wholesale price increase, and (2) to move closer to LRMC (Exhibit 6 2)

- The next step would require that the wholesale market be transformed into two power pools The operator of the transmission grid would cease operations as a buyer and seller of electricity in the wholesale market If this were to happen early, the ten percent tariff increase for the operator of the transmission grid would never take effect, since the wholesale market would proceed directly to pool prices If the power pools do not start operations soonafter, the wholesale market would initially experience the tariff increase followed by the pool prices When pool prices take effect, the tariffs to the customers of the regional networks will again be raised to cover the wholesale price increase and to move closer to LRMC (Exhibit 6 3)

- As the final phase, tariffs to the customers of the regional networks will be raised to the level of LRMC in each customer class Cross-subsidies will be eliminated This step in the reform process will have no effect on the wholesale market, which will continue to set pool prices on a competitive basis (Exhibit 6 4 and Exhibit 5 19)

This four step process encompasses the creation of a power pool by developing retail tariffs based on LRMC and adjusting tariff levels for different customer classes (Exhibit 6 1 through 6 4)

6 2 CREATION OF A POWER POOL

The power sector of Kazakstan is undergoing a transition from a wholesale monopoly to a system of power pools (North Grid and South Grid) The Wholesale Electricity Tariffs in Exhibits 6 1 and 6 2 refer to the monopoly situation, while Wholesale Electricity Prices (South Grid) in Exhibits 6 3 and 6 4 describe the pool situation

Any wholesale monopolist will achieve a better balance between revenues and expenses when its tariffs are designed to reflect costs Therefore the wholesale monopolist should develop a set of three-part tariffs which include monthly demand charges, peak energy charges, and off-peak energy charges and should propose that all customers pay for electricity according to these tariffs On the basis of the forecast pattern of electricity usage in each customer class, it is possible to estimate the total amount of revenue collected under the tariffs and the total number of kWh sold The *average yield* is shown in Exhibit 6 1, for each customer class, it is the annual

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Exhibit 6 2
1997 Tariffs Based on a 10 Percent Increase in Wholesale Prices

Wholesale Electricity Tariffs

\verage tariff in the wholesale market	**3 1526**	Tenge/kWh	88 1% of LRMC for 1996
ncrease applied to LRMC	**0 0%**	relative to the LRMC for 1996	
\azakstanenergo sales (GWh)	32 229		
\azakstanenergo sales revenue (million Tenge)	101,605		

Tariff class	1997 sales GWh	Average yield at Oct 1996 prices Tenge/kWh	Strict LRMC yield Tenge/kWh	Revenue neutral yield Tenge/kWh	Increase relative to Oct 96 prices	Energy charge Tenge/kWh Peak	Energy charge Tenge/kWh Off-peak	Demand Tenge per coincident kW per mo
HV customers	5 288	2 8660	3 0818	2 7164	-5%	1 58	1 27	833
IV customers	5 373	2 8660	3 4119	3 0073	5%	1 65	1 30	982
egional energos	21 568	2 8660	3 7391	3 2957	15%	1 65	1 30	982
azakstanenergo total	32 229	2 8660	3 5767	3 1526	10%			

Almaty Network & Taldykorgan Network Tariffs

crease applied to LRMC	0 0%	relative to the LRMC for 1996
azakstanenergo yield + LRMC of distribution	4 6193	Tenge/kWh
phase-in of LRMC of distribution	**60%**	
azakstanenergo yield + phased-in LRMC of distribution	4 0899	Tenge/kWh
maty & Taldykorgan sales (GWh)	4 400	
maty & Taldykorgan sales revenue (million Tenge)	17 996	
inimum percent increase in tariff class yield	**0%**	

Tariff class	1997 sales GWh	Average yield at Oct 1996 prices Tenge/kWh	Strict LRMC yield Tenge/kWh	Revenue neutral yield Tenge/kWh	Increase relative to Oct 96 prices	0 percent adjusted yield Tenge/kWh	Increase relative to Oct 96 prices	Ratio of strict LRMC yield
V industrial >750 kVA	1 018	2 8793	3 1785	2 5677	-11%	2 8793	0%	0 91
V industrial >750 kVA	153	2 8793	3 6890	2 9802	4%	2 9802	4%	0 81
V industrial <750 kVA	119	4 4424	3 6890	2 9802	-33%	4 4424	0%	1 20
ailroad transport	110	4 3290	3 6890	2 9802	-31%	4 3290	0%	1 17
ban transport	20	4 5289	5 8764	4 7472	5%	4 7472	5%	0 81
on-industrial	699	5 0090	5 8764	4 7472	-5%	5 0090	0%	0 85
jricultural	570	3 9379	5 8764	4 7472	21%	4 7472	21%	0 81
ipulation	1 711	2 4915	5 8764	4 7472	91%	4 2670	71%	0 73
Total	4 400	3 2900	5 0627	4 0899	24%	4 0899	24%	0 81

Tariff class	Voltage level	Option 1 1-part tariff Energy charge Tenge/kWh	Option 2 3-part tariff Energy charge Tenge/kWh Peak	Energy charge Tenge/kWh Off-peak	Demand charge Tenge per coincident kW /month
industrial >750 kVA	HV (A)	2 88	1 74	1 38	1 043
' industrial >750 kVA	MV	2 98	1 62	1 27	1 057
' industrial <750 kVA	MV	4 44	2 42	1 89	1 576
ilroad transport	MV	4 33	2 35	1 84	1 536
ban transport	LV	4 75	1 71	1 34	1 727
n-industrial	LV	5 01	1 81	1 42	1 822
icultural	LV	4 75	1 71	1 34	1 727
pulation	LV	4 27	1 54	1 21	1 552

Exhibit 6 3
1997 Tariffs Based on Competitive Power Pool Prices

Wholesale Electricity Prices (South Grid)

Vholesale market yield based on pool prices	3 58	Tenge/kWh	100 0% of LRMC for 1996
ıcrease applied to LRMC	**0 0%**	relative to the LRMC for 1996	
Vholesale market sales (GWh)	32,229		
Vholesale market sales revenue (million Tenge)	115 274		

Tariff class	1997 sales GWh	Average yield at Oct 1996 prices Tenge/kWh	Strict LRMC yield Tenge/kWh	Revenue neutral yield Tenge/kWh	Increase relative to Oct 96 prices	Energy charge Tenge/kWh Peak	Energy charge Tenge/kWh Off-peak	Demand Tenge per coincident kW per mo
HV customers	5 288	2 8660	3 0818	3 0818	8%	1 80	1 44	946
V customers	5 373	2 8660	3 4119	3 4119	19%	1 87	1 48	1 115
egional energos	21 568	2 8660	3 7391	3 7391	30%	1 87	1 48	1 115
/holesale market total	32 229	2 8660	3 5767	3 5767	25%			

Almaty Network & Taldykorgan Network Tariffs

crease applied to LRMC	0 0%	relative to the LRMC for 1996
'holesale market yield + LRMC of distribution	5 0627	Tenge/kWh
phase-in of LRMC of distribution	**80%**	
holesale yield + phased-in LRMC of distribution	4 7980	Tenge/kWh
maty & Taldykorgan sales (GWh)	4 400	
maty & Taldykorgan sales revenue (million Tenge)	21 112	
inimum percent increase in tariff class yield	**0%**	

Tariff class	1997 sales GWh	Average yield at Oct 1996 prices Tenge/kWh	Strict LRMC yield Tenge/kWh	Revenue neutral yield Tenge/kWh	Increase relative to Oct 96 prices	0 percent adjusted yield Tenge/kWh	Increase relative to Oct 96 prices	Ratio of strict LRMC yield
/ industrial >750 kVA	1 018	2 8793	3 1785	3 0123	5%	3 0123	5%	0 95
V industrial >750 kVA	153	2 8793	3 6890	3 4962	21%	3 4962	21%	0 95
V industrial <750 kVA	119	4 4424	3 6890	3 4962	-21%	4 4424	0%	1 20
ilroad transport	110	4 3290	3 6890	3 4962	-19%	4 3290	0%	1 17
ban transport	20	4 5289	5 8764	5 5691	23%	5 5691	23%	0 95
ın-industrial	699	5 0090	5 8764	5 5691	11%	5 5691	11%	0 95
ricultural	570	3 9379	5 8764	5 5691	41%	5 5691	41%	0 95
pulation	1 711	2 4915	5 8764	5 5691	124%	5 4501	119%	0 93
Total	4 400	3 2900	5 0627	4 7980	46%	4 7980	46%	0 95

Tariff class	Voltage level	Option 1 1-part tariff Energy charge Tenge/kWh	Option 2 3 part tariff Energy charge Tenge/kWh Peak	Energy charge Tenge/kWh Off-peak	Demand charge Tenge per coincident kW /month
industrial >750 kVA	HV (A)	3 01	1 82	1 44	1 091
industrial >750 kVA	MV	3 50	1 90	1 49	1 240
industrial <750 kVA	MV	4 44	2 42	1 89	1 576
lroad transport	MV	4 33	2 35	1 84	1 536
ban transport	LV	5 57	2 01	1 57	2 026
n-industrial	LV	5 57	2 01	1 57	2,026
icultural	LV	5 57	2 01	1 57	2 026
pulation	LV	5 45	1 97	1 54	1 983

Exhibit 6 4
1999 Tariffs Based on Competitive Power Pool Prices

Wholesale Electricity Prices (South Grid)

Vholesale market yield based on pool prices	3 58	Tenge/kWh	100 0% of LRMC for 1996
ncrease applied to LRMC	**0 0%**	relative to the LRMC for 1996	
Vholesale market sales (GWh)	33 946		
Vholesale market sales revenue (million Tenge)	121 415		

Tariff class	1999 sales GWh	Average yield at Oct 1996 prices Tenge/kWh	Strict LRMC yield Tenge/kWh	Revenue neutral yield Tenge/kWh	Increase relative to Oct 96 prices	Energy charge Tenge/kWh Peak	Energy charge Tenge/kWh Off-peak	Demand Tenge per coincident kW per mo
HV customers	5 570	2 8660	3 0818	3 0818	8%	1 80	1 44	946
IV customers	5 659	2 8660	3 4119	3 4119	19%	1 87	1 48	1 115
egional energos	22 718	2 8660	3 7391	3 7391	30%	1 87	1 48	1 115
/holesale market total	33 946	2 8660	3 5767	3 5767	25%			

Almaty Network & Taldykorgan Network Tariffs

crease applied to LRMC	0 0%	relative to the LRMC for 1996
/holesale market yield + LRMC of distribution	5 0627	Tenge/kWh
phase-in of LRMC of distribution	**100%**	
/holesale yield + phased-in LRMC of distribution	5 0627	Tenge/kWh
maty & Taldykorgan sales (GWh)	4 704	
maty & Taldykorgan sales revenue (million Tenge)	23 816	
inimum percent increase in tariff class yield	**0%**	

Tariff class	1999 sales GWh	Average yield at Oct 1996 prices Tenge/kWh	Strict LRMC yield Tenge/kWh	Revenue neutral yield Tenge/kWh	Increase relative to Oct 96 prices	0 percent adjusted yield Tenge/kWh	Increase relative to Oct 96 prices	Ratio of strict LRMC yield
/ industrial >750 kVA	1 088	2 8793	3 1785	3 1785	10%	3 1785	10%	1 00
V industrial >750 kVA	163	2 8793	3 6890	3 6890	28%	3 6890	28%	1 00
V industrial <750 kVA	127	4 4424	3 6890	3 6890	-17%	4 4424	0%	1 20
ailroad transport	118	4 3290	3 6890	3 6890	-15%	4 3290	0%	1 17
ban transport	22	4 5289	5 8764	5 8764	30%	5 8764	30%	1 00
on-industrial	747	5 0090	5 8764	5 8764	17%	5 8764	17%	1 00
iricultural	609	3 9379	5 8764	5 8764	49%	5 8764	49%	1 00
pulation	1 830	2 4915	5 8764	5 8764	136%	5 7831	132%	0 98
Total	4 704	3 2900	5 0627	5 0627	54%	5 0627	54%	1 00

Tariff class	Voltage level	Option 1 1-part tariff Energy charge Tenge/kWh	Option 2 3-part tariff Energy charge Tenge/kWh Peak	Energy charge Tenge/kWh Off-peak	Demand charge Tenge per coincident kW /month
industrial >750 kVA	HV (A)	3 18	1 92	1 52	1 152
' industrial >750 kVA	MV	3 69	2 01	1 57	1 309
industrial <750 kVA	MV	4 44	2 42	1 89	1 576
lroad transport	MV	4 33	2 35	1 84	1 536
ban transport	LV	5 88	2 12	1 66	2 138
n-industrial	LV	5 88	2 12	1 66	2 138
icultural	LV	5 88	2 12	1 66	2 138
pulation	LV	5 78	2 09	1 63	2 104

revenue divided by the annual sales There are also three calculations of the *average tariff* based on the forecast of 1996 sales by customer class

- The average tariff that would be realized at October 1996 prices is shown in the column marked "average yield at October 1996 prices " Because all of the customer classes had the same tariff, the result is obvious

- The average tariff that would be realized if all tariffs were raised to 100 percent of LRMC is shown in the column marked "strict LRMC yield "

- The average tariff that matches the target price level is shown in the column marked "revenue neutral yield " This is a technical term that is commonly used in tariff studies when the target level of revenue is established for a regulated monopoly on the basis of financial targets, such as a rate of return on net revalued assets The numbers in the table are calculated so that this number equals the "average tariff in the wholesale market" shown at the top of the page

The power pool situation is shown in Exhibit 6 3 and 6 4 In the wholesale market the customer buys power from a supplier that purchases energy at pool prices, paying for firm generating capacity as needed and for the use of the HV grid It is assumed that the wholesale customer pays the supplier, as follows

- To obtain a kW of generation capacity, the customer must pay the marginal cost of generation capacity (Exhibit 5 15)

- To purchase energy the wholesale customer must pay the marginal cost of energy (Exhibit 5 17) This includes an allowance for the losses in the network

- To gain access to the HV grid the customer must pay for the network capacity according to its replacement cost (Exhibits 5 12 and 5 15) When generation capacity costs and network capacity costs are combined, the result is the LRMC of capacity (Exhibit 5 16)

Therefore the wholesale market yield, based on pool prices, equals the average tariff based on LRMC In Exhibit 6 3, the "revenue neutral yield" and the "strict LRMC yield" are the same at the wholesale level

For the wholesale electricity market, a LRMC is projected that is higher than the wholesale tariff that was effective October 1, 1996 The competitive market leads to higher wholesale prices, since it enables the power sector to attract foreign capital investment which would not be otherwise available

The regional energos represent a customer class in the wholesale market The projected trend in the wholesale market price of electricity sold to the regional energos is shown in Exhibit 6 5

6.3 RETAIL TARIFFS BASED ON LRMC

After wholesale prices are raised to the levels shown in Exhibit 6 1, the average cost of generation from CHP and hydro stations in Almaty and Taldykorgan (outside the wholesale market) equals the cost of power purchased in the wholesale market The average tariff (Exhibit 6 1 as the "revenue neutral yield," total) therefore equals the wholesale price plus a distribution margin This distribution margin is initially only 40 percent of the LRMC of distribution (Exhibit 6 1), but it is increased to 60 percent (Exhibit 6 2), then 80 percent (Exhibit 6 3), then 100 percent (Exhibit 6 4) Given the projection of electricity sales to various customer classes, the strict LRMC yield for sales to the regional energos, and the strict LRMC yield for each customer class, the LRMC of distribution is calculated to be 1 3468 Tenge/kWh (Exhibit 6 6)

6.3 1 Adjustment of Tariff Levels for Different Customer Classes

The third type of phase-in shown in Exhibits 6 1 through 6 4 is a softening of the transition to LRMC-based tariffs for the population This is achieved by ensuring that no customer class receives a lower tariff as a result of the phase-in of the distribution margin This rule results in a modest subsidy to the population, as shown in Exhibits 6 1 through 6 3 By 1998 the subsidy is practically eliminated because the tariff to the population is 98 percent of the strict LRMC tariff (Exhibit 6 4)

The model used in this analysis can be used to calculate the effect of increases or reductions in the amount of cross-subsidy to the population The input variable used to determine the level of cross-subsidy is the minimum percentage increase in the average yield for each of the other tariff classes This variable is shown as "minimum percent increase in tariff class yield" in Exhibit 6 1 through 6 4

Exhibit 6 5
Summary of the Tariff Reform Plan

		End of 1996	1997 (monopoly)	1997 (pool)	1998 (pool)
verage price level in the wholesale market					
verage yield at October 96 prices	Tenge/kWh	2 8660	2 8660	2 8660	2 8660
nancial revenue requirement	Tenge/kWh	2 8660	3 1526		
/holesale market yield based on pool prices	Tenge/kWh			3 5767	3 5767
/erage yield at October 96 prices	Cents/kWh	4 34	4 34	4 34	4 34
ice level needed to meet financial revenue requirement	Cents/kWh	4 34	4 78		
ice level based on pool prices	Cents/kWh			5 42	5 42
ercent increase above October 96 prices		-0%	10%	25%	25%
ercent increase with respect to the preceding year			10 0%	13 5%	0 0%
holesale market price for the regional energos					
erage yield at October 96 prices	Tenge/kWh	2 8660	2 8660	2 8660	2 8660
nancial revenue requirement	Tenge/kWh	2 9961	3 2957		
holesale market yield based on pool prices	Tenge/kWh			3 7391	3 7391
erage yield at October 96 prices	Cents/kWh	4 34	4 34	4 34	4 34
ce level needed to meet financial revenue requirement	Cents/kWh	4 54	4 99		
ce level based on pool prices	Cents/kWh			5 67	5 67
rcent increase above October 96 prices		5%	15%	30%	30%
rcent increase with respect to the preceding year			10 0%	13 5%	0 0%
erage price of electricity sold in Almaty and Taldykorgan					
MC of distribution	Tenge/kWh	1 3236	1 3236	1 3236	1 3236
rcent phase-in of LRMC of distribution		40%	60%	80%	100%
erage yield at October 96 prices	Tenge/kWh	3 2900	3 2900	3 2900	3 2900
ce level during the transitional period	Tenge/kWh	3 5255	4 0899	4 7980	
e level based on pool prices and LRMC of distribution	Tenge/kWh				5 0627
erage yield at October 96 prices	Cents/kWh	4 98	4 98	4 98	4 98
e level during the transitional period	Cents/kWh	5 34	6 20	7 27	
e level based on pool prices and LRMC of distribution	Cents/kWh				7 67
cent increase above October 96 prices		7 2%	24 3%	45 8%	53 9%
cent increase with respect to the preceding year			16 0%	17 3%	5 5%

Exhibit 6 6
Summary of Price Increases, by Customer Class

	March 1996	End of 1996	1997 (monopoly)	1997 (pool)	1998 (pool)
Wholesale market customers - Very High Voltage					
Average yield	2 866	2 4694	2 7164	3 0818	3 0818
Percent increase above October 96 prices		-14%	-5%	8%	8%
Percent increase with respect to the preceding year			10 0%	13 5%	0 0%
Wholesale market customers - High Voltage					
Average yield	2 866	2 7339	3 0073	3 4119	3 4119
Percent increase above October 96 prices		-5%	5%	19%	19%
Percent increase with respect to the preceding year			10 0%	13 5%	0 0%
Customers of Almaty Network & Taldykorgan Network					
High Voltage industrial >750 kVA					
Average yield	2 8793	2 8793	2 8793	3 0123	3 1785
Percent increase above October 96 prices		0%	0%	5%	10%
Percent increase with respect to the preceding year			0 0%	4 6%	5 5%
Medium Voltage industrial >750 kVA					
Average yield	2 8793	2 8793	2 9802	3 4962	3 6890
Percent increase above October 96 prices		0%	4%	21%	28%
Percent increase with respect to the preceding year			3 5%	17 3%	5 5%
Medium Voltage industrial <750 kVA					
Average yield	4 4424	4 4424	4 4424	4 4424	4 4424
Percent increase above October 96 prices		0%	0%	0%	0%
Percent increase with respect to the preceding year			0 0%	0 0%	0 0%
Railroad transport					
Average yield	4 3290	4 3290	4 3290	4 3290	4 3290
Percent increase above October 96 prices		0%	0%	0%	0%
Percent increase with respect to the preceding year			0 0%	0 0%	0 0%
Urban transport					
Average yield	4 5289	4 5289	4 7472	5 5691	5 8764
Percent increase above October 96 prices		0%	5%	23%	30%
Percent increase with respect to the preceding year			4 8%	17 3%	5 5%
Non-industrial					
Average yield	5 0090	5 0090	5 0090	5 5691	5 8764
Percent increase above October 96 prices		0%	0%	11%	17%
Percent increase with respect to the preceding year			0 0%	11 2%	5 5%
Agricultural					
Average yield	3 9379	4 0922	4 7472	5 5691	5 8764
Percent increase above October 96 prices		4%	21%	41%	49%
Percent increase with respect to the preceding year			16 0%	17 3%	5 5%
Population					
Average yield	2 4915	3 0458	4 2670	5 4501	5 7831
Percent increase above October 96 prices		22%	71%	119%	132%
Percent increase with respect to the preceding year			40 1%	27 7%	6 1%

APPENDIX A
GENERATING CAPACITY IN KAZAKSTAN, 1993-2005

The following table shows the generating capacity projection used to support the energy balance projection presented in Appendix B These tables in this Appendix were produced using the calculational model developed for this study

Many of the generating stations in Kazakstan started operation before 1970 and therefore will be more than 30 years old in 2000 This table assumes that the repairs necessary to extend the operating lifetimes of these units to 40 years (or in the case of hydroelectric stations, 50 years) will be made, so that the need to replace this capacity is postponed The table then shows the composition of the net increase in capacity after 1996, including the loss of generating capacity from existing power stations (other than Ekibastuz 1, which is projected to restore 400 MW in 2000) The names of projects which add capacity are shown in italics in the left column of the table

APPENDIX B
ELECTRIC ENERGY BALANCE FOR KAZAKSTAN, 1989-2000

The following table shows the electric energy balance projection was used to develop projections of wholesale market supply This table was produced using the same calculational model as was used in Appendix A

APPENDIX C
FUEL COST PROJECTION FOR MAJOR POWER STATIONS, 1996-2000

The following table was produced using the same calculational model as was used in Appendices A and B

APPENDIX D
PURCHASED POWER COST PROJECTION, 1996-1997

The following table was produced using the same calculational model as was used in Appendices A, B, and C

APPENDIX E
REVALUATION OF GENERATING STATION ASSETS

This appendix includes the following documents

1 *Asset Revaulations Competed by Kazakstanenergo in May 1996* This is a summary table prepared by Hagler Bailly Consulting, showing the results of asset revaluations for the four power stations, together with data on installed capacity and capacity utilization The "market value"is the replacement cost estimated by Kazakstanenergo, while the "gross book value" is calculated using the conversion factors and procedures approved by the government

2 *Overall Revaluation Sheet On Groups of Basic Energy Equipment For 01 01 96 With Expert Evaluation* This is a set of five tables prepared by Kazakstanenergo on May 21, 1996, presenting asset revaluations for four power stations - Zhambyl GRES, Karaganda GRES #2, Ekibastuz GRES #1, and Ekibastuz GRES #2 The first table is a summary of the data presented on the following four pages

3 *Depreciation Calculation and Maintenance Fund for the Year 1996* This is a preliminary table prepared by Kazakstanenergo in December 1995, showing a comparison between the asset valuations consistent with GosComStat regulations and the asset valuations based on "market value "

4 Cabinet of Ministers of the Republic of Kazakstan, Resolution No 1178, October 21, 1994 *Provision on the Procedure of the Fixed Asset Indexation of the Enterprises, Organizations and Institutions*

5 *Minutes of the Meeting on the Discussion of the MECI Proposal on the Fixed Assets Revaluation*, January 12, 1996

6 Regulation on Fixed Assets Revaluation, January 16, 1996 This regulation was based on the report included as item 5 below

7 *Valuation of the Capital Assets Owned by the Republic of Kazakstan Ministry of Energy and Coal Industry Enterprises*, November 1995 This report presents six alternative methods for revaluating the assets of Ekibastuz GRES 1 and recommends a multiplier of 17 to be applied to book values in effect at January 1, 1996 The results of the six methods

are compared in the table entitled "Changes in Cost Indicators Calculated in Accordance With the Various Options "

APPENDIX F
EXAMPLE OF WHOLESALE TARIFF CALCULATION BASED ON RATE OF RETURN

Because the power sector is making a transition to a competitive wholesale market, it is not worthwhile to calculate wholesale tariffs based on rate of return Instead, in Chapter 6, we project transitional tariffs on the basis of a moderate 10 percent increase in the average tariff at the wholesale level The methodology presented in Chapter 3 for the calculation of transmission charges could be modified to calculate sales tariffs for Kazakstanenergo Several steps would be involved

1 *Energy balance* Estimate the amount of electricity purchased and sold by Kazakstanenergo, including imports and exports (See Appendix B for sample calculations)

2 *Asset revaluation* Estimate the value of the high-voltage network owned by Kazakstanenergo (See Appendix L for sample calculations)

3 *Strict marginal cost tariffs* Calculate the marginal cost of energy and the marginal cost of capacity at different voltage levels Using marginal costs at high voltage, calculate demand and energy charges for different classes of customers of Kazakstanenergo Calculate the system average tariff based on marginal cost (See Chapter 5 for sample calculations)

4 *Transmission system revenue requirement* Estimate the rate of return that would be needed to attract capital investment in the company Then calculate the sum of three components (1) depreciation, based on revalued assets (2) a rate of return on net revalued assets (3) annual operation and maintenance expenses associated with the transmission system and the dispatch department

5 *Purchased power cost* For each generating company, autoproducer, and foreign country selling electricity to Kazakstan, estimate the prices at which Kazakstanenergo will purchase capacity and energy (See Appendix D for a sample short-term projection)

6 *Average tariff based on rate of* return Calculate the total annual revenue requirement, which equals the cost of purchased electricity plus the transmission system revenue requirement Then calculate the average tariff by dividing the total annual revenue requirement by the quantity of energy sold by Kazakstanenergo

7 *Adjustment of marginal cost tariffs* The marginal cost tariffs for customers of Kazakstanenergo are multiplied by the ratio of the average tariff based on rate of return to the average tariff based on marginal cost The result is a set of *wholesale tariffs*

A sample calculation of the average tariff based on the rate of return (Step 6) is shown on the following pages The estimates of power purchases and sales were made in March 1996 and now outdated

Step 7 is required because the average tariff based on the rate of return or other financial criteria is normally different from the average tariff based on marginal cost There are several reasons why this result is normal

- In most power systems there are some older generating stations with costs below LRMC - for example, hydrostations which cannot be duplicated in the future

- The LRMC calculation is typically based on the least-cost mix of generation sources under stable conditions The actual mix of generation sources usually does not represent the perfect least-cost solution to the power system's needs based on the level of customer peak load, the fuel prices, restrictions on the fuel availability, and other parameters For example, it is common to find that the actual reserve margin is either too high or too low relative to the optimal reserve margin needed to achieve a reliability target

- The actual rate of return on capital for existing power stations and networks usually does not match the simple theoretical parameters used to show the rate of return on capital in the LRMC calculation For example, the actual rate of return may be negative during periods of high inflation

In some situations Step 7 should not be implemented at all For example, a large industrial customer may argue that he should receive a lower price for electricity because he is able to generate electricity more cheaply, for his own consumption, than he can buy it from the network - either from generating companies or from resellers such as regional networks In this situation the prices charged by the owner of the network (a natural monopoly) should equal the long-run marginal cost of network services, and the prices charged by generating companies should be competitive prices If the industrial customer is able to generate electricity very cheaply, he should do so, but the network enterprise should not offer to sell electricity at a price which is lower than long-run marginal cost

APPENDIX G
ACTUAL AND PROPOSED TARIFFS FOR KAZAKSTANENERGO

This appendix contains the following tables

1 *Kazakstanenergo's December 1995 Calculation of the 1996 Tariff* This table shows a tariff proposal which was submitted by Kazakstanenergo in December 1995 but not approved by the government This table was prepared by Hagler Bailly Consulting on the basis of tables provided by Kazakstanenergo This is the only tariff calculation for which Hagler Bailly received complete supporting information, including projections of generating capacity, energy generated, and fuel cost

2 *Calculation of the Electricity Sales Tariff for the Period from 1 February 96 to 31 March 96* This table shows tariffs approved by the chairman of the AMC on 31 January 96 Average tariffs for all of the energos are shown, in addition to the average tariff for Kazakstanenergo This table was prepared by Kazakstanenergo

3 *Kazakstanenergo's February 1996 Calculation of the 1996 Tariff* These tables show the tariff effective at the beginning of the second quarter (1 April 96) The first table shows the tariff proposal submitted by Kazakstanenergo and the second table shows the tariff approved by the government in February 1996 These tables were prepared by Hagler Bailly Consulting on the basis of tables provided by Kazakstanenergo

4 *Kazakstanenergo's 1996 Tariff Calculation for Purchased Power* These tables were prepared by Kazakstanenergo This is a set of four tables corresponding to four calendar quarters The tenge is projected to lose its value against the dollar, the exchange rate moves from 65 tenge/$ in the first quarter to 75 tenge/$ in the fourth quarter

5 *Comparison Table of Electricity Tariffs Before and After Fixed Assets Revaluation* This table was prepared by Kazakstanenergo The proposed tariff in Option 1 is based upon the status quo - the calculation of Net Fixed Assets according to coefficients established by the government The tariff proposal presented in Option 2 is to calculate Net Fixed Assets on the basis of the market value of these assets, to allocate "profits" to the Repair Fund and the Capital Investment Fund, and to lower the amount of profit taxes

APPENDIX H
WHOLESALE POWER CONTRACTS

The purchase and sale of electricity by Kazakstanenergo is subject to the terms and conditions of contracts This appendix contains four sample contracts

1 Contract for the purchase of electric energy from a generating station

2 Contract for the purchase of electric energy from an industrial company with surplus electric generating capacity

3 Contract for the sale of electric energy to a regional energy system (energo)

4 Contract for the sale of electric energy to a large industrial customer

APPENDIX I
DECREES ON POWER SECTOR RESTRUCTURING

1 Regulation of the Cabinet of Ministers of the Republic of Kazakstan, No 1033, July 28, 1995 *On Reorganizing the Administrative Structure of the Electric Power Engineering Industry of the Republic of Kazakstan*

2 Regulation of the Cabinet of Ministers of the Republic of Kazakstan, No 1268, September 19, 1995 *On Making Amendments to Decree 1033 of July 28, 1995 enacted by the Cabinet of Ministers of the Republic of Kazakstan*

3 Decree of the President of the Republic of Kazakstan, December 23, 1995 *On Electric Power Engineering*

4 Resolution of the Government of the Republic of Kazakstan, No 663, May 30, 1996 *On Approval of the Privatization and Restructuring Program in the Electric Power Sector*

5 Resolution of the State Committee for the State Property Management, No 499, July 16, 1996 *On Approval of the Power Industry Facilities Corporatization Plan for 1996*

6 Instruction of the Ministry of Energy and Coal Industry, No T-57/4, July 18, 1996 *On Implementation of the Plan of Electric Power Facilities Corporatization for 1996*

APPENDIX J
DECREES ON ELECTRICITY TARIFFS

This appendix contains selected decrees obtained by Hagler Bailly Consulting

1 Decree of the Government of the Republic of Kazakstan, No 1311, October 6, 1995 *On the additional measures to stimulate the development of industry and agriculture*

2 Regulation of the Government of the Republic of Kazakstan, No 102, January 26, 1996 *On Electricity Tariffs*

3 Regulation of the Anti-Monopoly Committee, June 10, 1996 (pending approval from the Ministry of Justice) *Special Procedure for Price and Tariff Formation for the Products (Works and Services) Produced and Sold by the Economic Entities - Natural Monopolists*

4 Resolution of the State Committee for Pricing and Antimonopoly Policy of the Republic of Kazakstan and the Ministry of Energy and Coal Industry of the Republic of Kazakstan, September 27, 1996 *On Electricity Tariffs*

APPENDIX K
FINANCIAL STATEMENTS FOR KAZAKSTANENERGO

Because Kazakstanenergo was restructured in the third quarter of 1995, this appendix contains financial statements for the first half of the year as well as the statements for the year as a whole

1 Income Statement for 1995 *Report on Financial Results and Use of the Results, 1995*

- *I* *Financial Results*
- *II* *Distribution of Profit*
- *III* *Payments to the Budget*

2 Balance Sheet for 1995 *Financial Statement*

- *I* *Internal Funds Flow*
- *II* *Borrowed Funds Flow*
- *III* *Financial Investments*
- *IV* *Intangible Assets*
- *V* *Fixed Assets Availability and Flow*
- *VI* *Social Indices*

3 Income Statement for First Half 1995 *Report on Financial Results and Use of Results, 1 January to 1 July, 1996*

- *I* *Financial Results*
- *II* *Distribution of Profit*
- *III* *Payments to the Budget*

APPENDIX L
DESCRIPTION OF THE NETWORKS

The following tables describe the physical characteristics of the high-voltage networks and the low-voltage networks of Kazakstan, based on data from the 1995 Annual Report of Kazakstanenergo

Valuations based on replacement cost are shown in U S dollars and are based upon unit values estimated by Hagler Bailly Consulting, i e , replacement cost per km of transmission line and replacement cost per kVA of substation capacity For the 500 kV power lines, the estimated replacement cost per km is taken from the EBRD report, *Kazakstan Power System Least Cost Development Study*

The average annual book value of fixed assets is shown in Tenge, as reported in the 1995 Annual Report of Kazakstanenergo, and converted to U S dollars based on July 1996 exchange rates

APPENDIX M
WORK PLAN

A Statement of Work for this tariff study was contained in a draft Delivery Order issued by USAID in August 1995 This Delivery Order was not signed until May 17, 1996 However, USAID provided interim funding for the study for the September 1995 through March 1996 period The initial mission for this tariff study was conducted on October 15-24, 1995 and the proposed Work Plan was submitted to USAID on December 15, 1995 The Russian version was submitted to Kazakstanenergo in January 1996 This work plan remains in effect

ELECTRICITY PRICING IN KAZAKSTAN

Draft Report

Volume II
Appendices

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Appendix A

Generating Capacity in Kazakstan, 1993-2005

The following table shows the generating capacity projection used to support the energy balance projection presented in Appendix B These tables in this Appendix were produced using the calculational model developed for this study

Many of the generating stations in Kazakstan started operation before 1970 and therefore will be more than 30 years old in 2000 This table assumes that the repairs necessary to extend the operating lifetimes of these units to 40 years (or in the case of hydroelectric stations, 50 years) will be made, so that the need to replace this capacity is postponed The table then shows the composition of the net increase in capacity after 1996, including the loss of generating capacity from existing power stations (other than Ekibastuz 1, which is projected to restore 400 MW in 2000) The names of projects which add capacity are shown in italics in the left column of the table

Generating Capacity in Kazakhstan

	Nominal capacity	Units	Fuel	Years installed	Oldest unit	EBRD plan to 2000	Estimated economic life	Estimated end of operation	Capacity derating in 1993		1993	1994	1995	1996	1997	1998	1999	2000
Regional Energos																		
North Grid (including Altay)																		
Altayenergo (Oct 95 June 96)																		
Ust Kamenogorsk CHP 1	241									Total	230	208	188	188	188	150	150	150
No 8	*25*		coal	*54*	1954	Replace	*40*	1994	*20 0%*		20	20	0	0	0	0	0	0
No 4 5 6 7	*28*	*4+(3 x 8)*	coal	*51 59*	1951	Replace	*40*	1991	*20 0%*		22	0	0	0	0	0	0	0
No 10	*50*		coal	*66*	1966		*40*	2006	*0 0%*		50	50	50	50	50	50	50	50
No 9	*38*		coal	*67*	1967	Replace	*30*	1997	*0 0%*		38	38	38	38	38	0	0	0
No 11	*100*		coal	*70*	1970		*40*	2010	*0 0%*		100	100	100	100	100	100	100	100
Ust K CHP 1 extension	*80*		coal	*99*	1999		*30*	2029		Total	0	0	0	0	0	0	80	80
Leninogorsk CHP	47									Total	47	47	47	47	47	30	0	0
No 3 4	*17*	*5 + 12*	coal	*57 58*	1957	Replace	*40*	1997	*0 0%*		17	17	17	17	17	0	0	0
No 5	*30*		coal	*58*	1958	Replace	*40*	1998	*0 0%*		30	30	30	30	30	30	0	0
Sogrinskaya CHP	*50*	*2 x 25*	coal	*61 62*	1961	Replace	*36*	1997	*0 0%*	Total	50	50	50	50	50	0	0	0
Semipalatinsk CHP 1	*6*		coal	*59*	1959		*40*	1999	*0 0%*	Total	6	6	6	6	6	6	6	0
Ust Kamenogorsk (hydro)	*332*	*4 x 83*	hydro	*52 59*	1952		*50*	2002	*5 0%*	Total	315	315	315	315	315	315	315	315
Shulbinsk (hydro)	*585*	*5 x 117*	hydro	*87 93*	1987		*50*	2037	*31 6%*	Total	400	400	400	400	400	400	400	400
Bukhtarminskaya (hydro)	*675*	*9 x 75*	hydro	*60 66*	1960		*50*	2010	*1 2%*	Total	667	667	667	667	667	667	667	667
Leninogorsk (hydro)	*39*		hydro	*49*	1949		*50*	1999	*92 0%*	Total	3	3	3	3	3	3	3	0
Other small plants (hydro)	*2*		hydro	*60*	1960		*50*	2010	*50 0%*	Total	1	1	1	1	1	1	1	1
Karangandaenergo (Oct 95 June 96)																		
Karaganda Thermal PP 1	151									Total	75	75	75	75	75	75	75	75
No 1	*18*		coal	*42*	1942	Dismantle	*45*	1987	*100 0%*		0	0	0	0	0	0	0	0
	24	*2 x 12*	coal	*73 74*	1973		*40*	2013	*100 0%*		0	0	0	0	0	0	0	0
	25		coal	*89*	1989		*40*	2029	*100 0%*		0	0	0	0	0	0	0	0
	84	*2 x 42*	coal	*91 93*	1991		*40*	2031	*11 0%*		75	75	75	75	75	75	75	75
Karaganda CHP 1	32									Total	32	32	32	32	32	32	32	32
No 1	*8*		coal	*60*	1960		*40*	2000	*0 0%*		8	8	8	8	8	8	8	8
No 2 5	*24*	*4 x 6*	coal	*62 66*	1962		*40*	2002	*0 0%*		24	24	24	24	24	24	24	24
Karaganda CHP 2	435									Total	384	384	384	384	384	384	384	384
	300	*3 x 100*	coal	*74 75*	1974		*40*	2014	*17 0%*		249	249	249	249	249	249	249	249
	135		coal	*82*	1982		*40*	2022	*0 0%*		135	135	135	135	135	135	135	135
Karaganda CHP 3	440									Total	410	410	410	410	410	410	410	410
	330	*3 x 110*	coal	*77 78*	1977		*40*	2017	*9 0%*		300	300	300	300	300	300	300	300
	110		coal	*90*	1990		*40*	2030	*0 0%*		110	110	110	110	110	110	110	110
Tentekskaya CHP	*18*	*3 x 6*	coal	*64 65*	1964		*40*	2004	*0 0%*	Total	18	18	18	18	18	18	18	18
Balkhash CHP	120									Total	120	120	120	120	120	80	60	60
No 1 2	*40*	*2 x 20*	coal	*37 40*	1937	Replace	*60*	1997	*0 0%*		40	40	40	40	40	0	0	0
No 6	*20*		coal	*63*	1963	Replace	*35*	1998	*0 0%*		20	20	20	20	20	20	0	0
	60		coal	*63*	1963		*40*	2003	*0 0%*		60	60	60	60	60	60	60	60
Dzhezkazgan CHP	177									Total	152	152	152	152	152	152	119	99
No 4	*25*		coal	*59*	1959	Dismantle	*40*	1999	*20 0%*		20	20	20	20	20	20	20	0
No 5	*42*		coal	*60*	1960	Replace	*38*	1998	*20 0%*		34	34	34	34	34	34	0	0
	50		coal	*63*	1963		*40*	2003	*11 0%*		45	45	45	45	45	45	45	45
	60		coal	*69*	1969		*40*	2009	*10 0%*		54	54	54	54	54	54	54	54

Generating Capacity in Kazakhstan

	Nominal capacity	Units	Fuel	Years installed	Oldest unit	EBRD plan to 2000	Estimated economic life	Estimated end of operation	Capacity derating in 1993		1993	1994	1995	1996	1997	1998	1999	2000
Kustanayenergo (Oct 95 June 96)																		
Rudnenskaya CHP	123									Total	100	100	100	100	100	100	66	25
No 1	42		oil gas	61	1961	Replace	37	1998	20 0%		34	34	34	34	34	34	0	0
No 2	50		oil gas	62	1962	Replace	37	1999	18 0%		41	41	41	41	41	41	41	0
	31		oil gas	64	1964		40	2004	18 0%		25	25	25	25	25	25	25	25
Kustenay CHP	12	2 x 6	oil gas	57 61	1957		40	1997	0 0%	Total	12	12	12	12	12	0	0	0
Arkalyk CHP	6	4 + 2	oil	63	1963	Replace	35	1998	0 0%	Total	6	6	6	6	6	6	0	0
Pavlodarenergo (Oct 95 June 96)																		
Pavlodar CHP 1	350									Total	320	320	320	320	320	320	320	272
No 2	60		coal	64	1964	Replace	35	1999	20 0%		48	48	48	48	48	48	48	0
No 3 4	100	2 x 50	coal	67 69	1967	Replace 1	35	2002	18 0%		82	82	82	82	82	82	82	82
	80		coal	82	1982		40	2022	0 0%		80	80	80	80	80	80	80	80
	60		coal	89	1989		40	2029	0 0%		60	60	60	60	60	60	60	60
	50		coal	92	1992		40	2032	0 0%		50	50	50	50	50	50	50	50
Pavlodar CHP 2	110									Total	104	104	104	104	104	104	60	60
No 1 2	50	2 x 25	coal	61	1961	Replace	37	1998	12 0%		44	44	44	44	44	44	0	0
	60		coal	63	1963		40	2003	0 0%		60	60	60	60	60	60	60	60
Pavlodar CHP 3	440									Total	385	385	385	385	385	385	385	385
	60		coal	72	1972		40	2012	20 0%		48	48	48	48	48	48	48	48
	50		coal	73	1973		40	2013	20 0%		40	40	40	40	40	40	40	40
	330	3 x 110	coal	75 77	1975		40	2015	10 0%		297	297	297	297	297	297	297	297
Ekibastuzenergo (before Oct 95)																		
Ekibastuz CHP	12	2 x 6	coal	56 57	1956	Replace	40	1996	20 0%	Total	10	10	10	10	0	0	0	0
Tselinenergo (Oct 95 June96)																		
Akmolinsk CHP 1	26									Total	11	11	11	11	11	11	11	11
	8	2 x 4	coal	61 62	1961		40	2001	100 0%		0	0	0	0	0	0	0	0
	12		coal	72	1972		40	2012	40 0%		7	7	7	7	7	7	7	7
	6		coal	74	1974		40	2014	30 0%		4	4	4	4	4	4	4	4
Akmolinsk CHP 2	240	3 x 80	coal	79 83	1979		40	2019	10 5%	Total	215	215	215	215	215	215	215	215
Petropavlovsk CHP 2	380									Total	314	314	314	314	314	314	152	152
No 1	42		coal	61	1961	Replace	37	1998	0 0%		42	42	42	42	42	42	0	0
No 2 3	120	2 x 60	coal	63 91	1963	Replace 1	35	1998	0 0%		120	120	120	120	120	120	0	0
No 4 5	66	2 x 33	coal	64 65	1964	Dismantle	30	1994	100 0%		0	0	0	0	0	0	0	0
	152	2 x 76	coal	67 68	1967		40	2007	0 0%		152	152	152	152	152	152	152	152
South Grid																		
Almatyenergo (Oct 95 June 96)																		
Almaty CHP 1	145									Total	120	120	120	120	120	120	107	107
No 8	25		coal	60	1960	Replace	38	1998	50 0%		13	13	13	13	13	13	0	0
No 9 10	120	2 x 60	coal	70 71	1970		40	2010	10 5%		107	107	107	107	107	107	107	107
Almaty CHP 2	510									Total	410	410	410	410	410	410	410	410
	240	3 x 80	coal	80 82	1980	Rehab	40	2020	30 0%		168	168	168	168	168	168	168	168
	50		coal	86	1986	Rehab	40	2026	13 0%		44	44	44	44	44	44	44	44
	220	2 x 110	coal	88 89	1988	Rehab	40	2028	10 0%		198	198	198	198	198	198	198	198
Almaty Thermal Power P	173									Total	173	173	173	173	173	173	173	50
No 1 2 3	123	3 x 41	coal	62 64	1962	Replace 2	37	1999	0 0%		123	123	123	123	123	123	123	0
	50		coal	65	1965		40	2005	0 0%		50	50	50	50	50	50	50	50

Generating Capacity in Kazakhstan

	Nominal capacity	Units	Fuel	Years installed	Oldest unit	EBRD plan to 2000	Estimated economic life	Estimated end of operation	Capacity derating in 1993		1993	1994	1995	1996	1997	1998	1999	2000
Tekeliskaya CHP 2	*24*	*2 x 12*	coal	*59 60*	1959	Replace 1	*40*	1999	*0 0%*	Total	24	24	24	24	24	24	24	0
Almaty Cascade (hydro)	48									Total	45	45	45	45	45	45	30	30
	18	*11 x 1 6*	hydro	*43 59*	1943		*55*	1998	*16 5%*		15	15	15	15	15	15	0	0
	15 6	*3 x 5 2*	hydro	*53*	1953		*50*	2003	*0 0%*		16	16	16	16	16	16	16	16
	14 4	*3 x 4 8*	hydro	*63*	1963		*50*	2013	*0 0%*		14	14	14	14	14	14	14	14
Karatalskaya (hydro)	*10*	*3 x 3 3*	hydro	*53*	1953		*50*	2003	*70 0%*	Total	3	3	3	3	3	3	3	3
Other small plants (hydro)	*3*		hydro	*60*	1960		*50*	2010	*67 0%*	Total	1	1	1	1	1	1	1	1
Southkazenergo (new)																		
Chimkent CHP 1	30									Total	20	20	20	20	20	20	20	11
No 2	*6*		oil gas	*55*	1955	Replace	*40*	1995	*100 0%*		0	0	0	0	0	0	0	0
No 3	*12*		oil gas	*59*	1959	Replace	*40*	1999	*25 0%*		9	9	9	9	9	9	9	0
	12	*2 x 6*	oil gas	*63 64*	1963		*40*	2003	*10 0%*		11	11	11	11	11	11	11	11
Chimkent CHP 2	*12*	*2 x 6*	oil gas	*53 53*	1953	Dismantle	*40*	1993	*0 0%*	Total	12	0	0	0	0	0	0	0
Chimkent CHP 3	*160*	*2 x 80*	oil gas	*81 83*	1981		*40*	2021	*22 0%*	Total	125	125	125	125	125	125	125	125
Chimkent CHP 3 extension	*80*		oil gas	*97*	1997		*30*	2027		Total	0	0	0	0	80	80	80	80
Zhambul CHP 4	*60*	*2 x 30*	oil gas	*63*	1963		*40*	2003	*4 0%*	Total	58	58	58	58	58	58	58	58
Kentau CHP 5	*18*	*3 x 6*	coal	*52 55 59*	1952	Replace 2	*40*	1992	*15 0%*	Total	15	0	0	0	0	0	0	0
Kzyl Orda CHP 6	146									Total	65	65	65	65	65	65	65	65
	12		coal	*64*	1964		*40*	2004	*100 0%*		0	0	0	0	0	0	0	0
No 3 4	*50*	*2 x 25*	coal	*67 68*	1967		*40*	2007	*100 0%*		0	0	0	0	0	0	0	0
	84	*2 x 42*	coal	*74 76*	1974		*40*	2014	*23 0%*		65	65	65	65	65	65	65	65
Western Region																		
Atyrauenergo (Oct 95 June 96)																		
Atyrau CHP	227									Total	203	203	203	203	203	203	203	203
	12		oil gas	*63*	1963		*40*	2003	*100 0%*		0	0	0	0	0	0	0	0
	120	*2 x 60*	oil gas	*68 74*	1968		*40*	2008	*10 0%*		108	108	108	108	108	108	108	108
	45		oil gas	*76*	1976		*40*	2016	*0 0%*		45	45	45	45	45	45	45	45
	50	*2 x 25*	oil gas	*85 92*	1985		*40*	2025	*0 0%*		50	50	50	50	50	50	50	50
Zapkazenergo (Oct 95 June 96)																		
Aktyubinsk CHP 1	73									Total	55	55	55	55	53	53	53	53
	14		oil gas	*52*	1952		*40*	1992	*100 0%*		0	0	0	0	0	0	0	0
	6		oil gas	*56*	1956		*40*	1996	*60 0%*		2	2	2	2	0	0	0	0
	12	*2 x 6*	oil gas	*91 92*	1991		*40*	2031	*0 0%*		12	12	12	12	12	12	12	12
	16		oil gas	*93*	1993		*40*	2033	*0 0%*		16	16	16	16	16	16	16	16
	25		oil gas	*93*	1993		*40*	2033	*0 0%*		25	25	25	25	25	25	25	25
Aktyubinsk CHP 1 extension	*140*		gas	*97*	1997		*40*	2037		Total	0	0	0	0	140	140	140	140
Aktyubinsk Combined Cycle	950									Total	0	0	0	0	0	0	475	950
Unit 1	*475*		gas	*99*	1999		*30*	2029			0	0	0	0	0	0	475	475
Unit 2	*475*		gas	*2000*	*2000*		*30*	2030			0	0	0	0	0	0	0	475
Uralsk CHP 1	18									Total	18	18	18	18	18	18	18	18
	10		oil gas	*61*	1961		*40*	2001	*0 0%*		10	10	10	10	10	10	10	10
	8		oil gas	*69*	1969		*40*	2009	*0 0%*		8	8	8	8	8	8	8	8

Generating Capacity in Kazakhstan

	Nominal capacity	Units	Fuel	Years installed	Oldest unit	EBRD plan to 2000	Estimated economic life	Estimated end of operation	Capacity derating in 1993		1993	1994	1995	1996	1997	1998	1999	2000
Independent Power Plants		(independent at 1 January 1996 formerly owned by Ministry of Energy & Coal Industry)																
North Grid (including Altay)																		
Yermakovskaya GRES	2400									Total	2 200	2 200	2 200	2 200	2 200	2 200	2 200	1 930
No 1 3	*600*	*2 x 300*	coal	*69 71*	1969		*40*	2009	*10 0%*		540	540	540	540	540	540	540	540
No 2	*300*	*3 x 300*	coal	*69 71*	1969	Replace	*30*	1999	*10 0%*		270	270	270	270	270	270	270	0
	300		coal	*73*	1973		*40*	2013	*9 8%*		271	271	271	271	271	271	271	271
	900	*3 x 300*	coal	*73 74*	1973		*40*	2013	*9 0%*		819	819	819	819	819	819	819	819
	300		coal	*75*	1975		*40*	2015	*0 0%*		300	300	300	300	300	300	300	300
South Grid																		
Kapchagayskaya (hydro)	*434*	*4 x 108*	hydro	*70 71*	1970		*50*	2020	*35 5%*	Total	280	280	280	280	280	280	280	280
Power Plants to be Privatized		(owned by Kazakhstanenergo at 1 January 1996)																
North Grid (including Altay)																		
Ekibastuz GRES 1	4000									Total	3 200	1 600	1 600	1 600	1 600	1 600	1 600	2 000
Unit 1	*500*		coal	*80*	1980	Rehab	*40*	2020	*20 0%*		400	*0*	0	0	0	0	0	*400*
Unit 2	*500*		coal	*81*	1981	Rehab	*40*	2021	*20 0%*		400	*0*	0	0	0	0	0	0
Unit 3	*500*		coal	*81*	1981	Rehab	*40*	2021	*20 0%*		400	*0*	0	0	0	0	0	0
Unit 4	*500*		coal	*82*	1982	Rehab	*40*	2022	*20 0%*		400	*0*	0	0	0	0	0	0
Unit 5	*500*		coal	*82*	1982	Rehab	*40*	2022	*20 0%*		400	400	400	400	400	400	400	400
Unit 6	*500*		coal	*83*	1983	Rehab	*40*	2023	*20 0%*		400	400	400	400	400	400	400	400
Unit 7	*500*		coal	*83*	1983	Rehab	*40*	2023	*20 0%*		400	400	400	400	400	400	400	400
Unit 8	*500*		coal	*84*	1984	Rehab	*40*	2024	*20 0%*		400	400	400	400	400	400	400	400
Ekibastuz GRES 2	2100									Total	490	1 015	1 015	1 015	1 015	1 015	1 540	1 540
Unit 1	*525*		coal	*90*	1990		*40*	2030	*6 6%*		490	490	490	490	490	490	490	490
Unit 2	*525*		coal	*94*	1994		*40*	2034			0	525	525	525	525	525	525	525
Unit 3	*525*		coal	*99*	1999		*40*	2039			0	0	0	0	0	0	525	525
Unit 4	*525*		coal	*2002*	2002		*40*	2042			0	0	0	0	0	0	0	0
Karaganinsk GRES 2	608									Total	608	608	608	608	608	558	458	458
No 2	*50*		coal	*62*	1962	Dismantle	*35*	1997	*0 0%*		50	50	50	50	50	0	0	0
No 3	*100*	*100*	*coal*	*63*	1963	Replace	*35*	1998	*0 0%*		100	100	100	100	100	100	0	0
	200	*2 x 100*	coal	*63 64*	1963		*40*	2003	*0 0%*		200	200	200	200	200	200	200	200
	258	*3 x 86*	coal	*65 67*	1965		*40*	2005	*0 0%*		258	258	258	258	258	258	258	258
South Grid																		
Zhambyl GRES	1230									Total	1 105	1 105	1 105	1 105	1 105	1 105	1 105	1 105
	600	*3 x 200*	oil gas	*67 69*	1967		*40*	2007	*10 3%*		538	538	538	538	538	538	538	538
	630	*3 x 210*	oil gas	*72 76*	1972		*40*	2012	*10 0%*		567	567	567	567	567	567	567	567
South Kazakhstan GRES	1040									Total	0	0	0	0	0	0	0	0
Unit 1	*520*		coal	*2001*	*2001*		*30*	2031			0	0	0	0	0	0	0	0
Unit 2	*520*		coal	*2004*	*2004*		*30*	2034			0	0	0	0	0	0	0	0
Other capacity additions	*520*		coal	*2010*	*2010*		*30*	2040		Total	0	0	0	0	0	0	0	0

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Generating Capacity in Kazakhstan

	Nominal capacity	Units	Fuel	Years installed	Oldest unit	EBRD plan to 2000	Estimated economic life	Estimated end of operation	Capacity derating in 1993		1993	1994	1995	1996	1997	1998	1999	2000
Autoproducers & Other Generators																		
North Grid (including Altay)																		
Karagandinsk Metallurgical	*162*		?	?	?	?	?	2010	*58.0%*	Total	68	68	68	68	68	68	68	68
Tselinograd Chemical	*180*		?	?	?	?	?	2010	*0.0%*	Total	180	180	180	180	180	180	180	180
South Grid																		
Chardarinskaya Hydro Plant	*100*		hydro	?	?	?	?	2010	*53.0%*	Total	47	47	47	47	47	47	47	47
West Region																		
Alginsky Chemical Plant	*4*		?	?	?	?	?	2010	*0.0%*	Total	4	4	4	4	4	4	4	4
Gurevsky Refinery	*6*		?	?	?	?	?	2010	*33.3%*	Total	4	4	4	4	4	4	4	4
Mangishlak Energy Complex	*630*		nuclear	?	?	?	?	2010	*38.1%*	Total	390	390	390	390	390	390	390	390
Total Generating Capacity																		
Altayenergo (Oct 95 June 96)										10	1 720	1 698	1 678	1 678	1 678	1 573	1 623	1 613
Karaganduenergo (Oct 95 June 96)										7	1 191	1 191	1 191	1 191	1 191	1 151	1 098	1 078
Kustanayenergo (Oct 95 June 96)										3	118	118	118	118	118	106	66	25
Pavlodarenergo (Oct 95 June 96)										3	809	809	809	809	809	809	765	717
Ekibastuzenergo (before Oct 95)										1	10	10	10	10	0	0	0	0
Tselinenergo (Oct 95 June 96)										3	540	540	540	540	540	540	378	378
Almatyenergo (Oct 95 June 96)										7	775	775	775	775	775	775	748	601
Southkazenergo (Oct 95 June 96)										7	294	267	267	267	347	347	347	338
Atyrauenergo (Oct 95 June 96)										1	203	203	203	203	203	203	203	203
Zapkazenergo (Oct 95 June 96)										4	73	73	73	73	211	211	686	1 161
Regional energos total										16	5 734	5 684	5 664	5 664	5 872	5 715	5 914	6 114
Independent Power Plants (since Oct 95										2	2 480	2 480	2 480	2 480	2 480	2 480	2 480	2 210
Power Plants to be Privatized										5	5 404	4 329	4 329	4 329	4 329	4 279	4 704	5 104
Autoproducers and Other Generators										6	693	693	693	693	693	693	693	693
Total										59	14 310	13 185	13 165	13 165	13 373	13 166	13 790	14 120
Hydro stations										10	1 763	1 763	1 763	1 763	1 763	1 763	1 747	1 744
Thermal stations										44	11 902	10 777	10 757	10 757	10 965	10 758	11 396	11 730
Nuclear stations										1	390	390	390	390	390	390	390	390
Autoproducers fuel not specified										4	256	256	256	256	256	256	256	256
Total										59	14 310	13 185	13 165	13 165	13 373	13 166	13 790	14 120
New or expanded stations										6	490	1 015	1 015	1 015	1 235	1 235	2 315	2 790
Ekibastuz GRES 1										1	3 200	1 600	1 600	1 600	1 600	1 600	1 600	2 000
Other existing power stations										52	10 620	10 570	10 550	10 550	10 538	10 331	9 874	9 330
Total										59	14 310	13 185	13 165	13 165	13 373	13 166	13 790	14 120
Net increase in capacity since 1996																		
New or expanded stations														0	220	220	1 300	1 775
Ekibastuz GRES 1														0	0	0	0	400
Other existing power stations														0	12	219	676	1 220

Generating Capacity

	Nominal capacity	2001	2002	2003	2004	2005
Regional Energos						
North Grid (including Altay)						
Altayenergo (Oct 95 June 96)						
Ust Kamenogorsk CHP 1	241	150	150	150	150	150
No 8	*25*	0	0	0	0	0
No 4 5 6 7	*28*	0	0	0	0	0
No 10	*50*	50	50	50	50	50
No 9	*38*	0	0	0	0	0
No 11	*100*	100	100	100	100	100
Ust K CHP 1 extension	*80*	80	80	80	80	80
Leninogorsk CHP	47	0	0	0	0	0
No 3 4	*17*	0	0	0	0	0
No 5	*30*	0	0	0	0	0
Sogrinskaya CHP	*50*	0	0	0	0	0
Semipalatinsk CHP 1	*6*	0	0	0	0	0
Ust Kamenogorsk (hydro)	*332*	315	315	0	0	0
Shulbinsk (hydro)	*585*	400	400	400	400	400
Bukhtarminskaya (hydro)	*675*	667	667	667	667	667
Leninogorsk (hydro)	*39*	0	0	0	0	0
Other small plants (hydro)	*2*	1	1	1	1	1
Karangandaenergo (Oct 95 June 96)						
Karaganda Thermal PP 1	151	75	75	75	75	75
No 1	*18*	0	0	0	0	0
	24	0	0	0	0	0
	25	0	0	0	0	0
	84	75	75	75	75	75
Karaganda CHP 1	32	24	24	0	0	0
No 1	*8*	0	0	0	0	0
No 2 5	*24*	24	24	0	0	0
Karaganda CHP 2	435	384	384	384	384	384
	300	249	249	249	249	249
	135	135	135	135	135	135
Karaganda CHP 3	440	410	410	410	410	410
	330	300	300	300	300	300
	110	110	110	110	110	110
Tentekskaya CHP	*18*	18	18	18	18	0
Balkhash CHP	120	60	60	60	0	0
No 1 2	*40*	0	0	0	0	0
No 6	*20*	0	0	0	0	0
	60	60	60	60	0	0
Dzhezkazgan CHP	177	99	99	99	54	54
No 4	*25*	0	0	0	0	0
No 5	*42*	0	0	0	0	0
	50	45	45	45	0	0
	60	54	54	54	54	54

Generating Capacity

	Nominal capacity	2001	2002	2003	2004	2005
Kustanayenergo (Oct 95 June 96)						
Rudnenskaya CHP	123	25	25	25	25	0
No 1	*42*	0	0	0	0	0
No 2	*50*	0	0	0	0	0
	31	25	25	25	25	0
Kustenay CHP	*12*	0	0	0	0	0
Arkalyk CHP	*6*	0	0	0	0	0
Pavlodarenergo (Oct 95 June 96)						
Pavlodar CHP 1	350	272	272	190	190	190
No 2	*60*	0	0	0	0	0
No 3 4	*100*	82	82	0	0	0
	80	80	80	80	80	80
	60	60	60	60	60	60
	50	50	50	50	50	50
Pavlodar CHP 2	110	60	60	60	0	0
No 1 2	*50*	0	0	0	0	0
	60	60	60	60	0	0
Pavlodar CHP 3	440	385	385	385	385	385
	60	48	48	48	48	48
	50	40	40	40	40	40
	330	297	297	297	297	297
Ekibastuzenergo (before Oct 95)						
Ekibastuz CHP	*12*	0	0	0	0	0
Tselinenergo (Oct 95 June96)						
Akmolinsk CHP 1	26	11	11	11	11	11
	8	0	0	0	0	0
	12	7	7	7	7	7
	6	4	4	4	4	4
Akmolinsk CHP 2	*240*	215	215	215	215	215
Petropavlovsk CHP 2	380	152	152	152	152	152
No 1	*42*	0	0	0	0	0
No 2 3	*120*	0	0	0	0	0
No 4 5	*66*	0	0	0	0	0
	152	152	152	152	152	152
South Grid						
Almatyenergo (Oct 95 June 96)						
Almaty CHP 1	145	107	107	107	107	107
No 8	*25*	0	0	0	0	0
No 9 10	*120*	107	107	107	107	107
Almaty CHP 2	510	410	410	410	410	410
	240	168	168	168	168	168
	50	44	44	44	44	44
	220	198	198	198	198	198
Almaty Thermal Power P	173	50	50	50	50	50
No 1 2 3	*123*	0	0	0	0	0
	50	50	50	50	50	50

Generating Capacity

	Nominal capacity	2001	2002	2003	2004	2005
Tekeliskaya CHP 2	*24*	0	0	0	0	0
Almaty Cascade (hydro)	48	30	30	30	14	14
	18	0	0	0	0	0
	15 6	16	16	16	0	0
	14 4	14	14	14	14	14
Karatalska (hydro)	*10*	3	3	3	0	0
Other small plants (hydro)	*3*	1	1	1	1	1
Southkazenergo (new)						
Chimkent CHP 1	30	11	11	11	0	0
No 2	*6*	0	0	0	0	0
No 3	*12*	0	0	0	0	0
	12	11	11	11	0	0
Chimkent CHP 2	*12*	0	0	0	0	0
Chimkent CHP 3	*160*	125	125	125	125	125
Chimkent CHP 3 extens n	*80*	80	80	80	80	80
Zhambul CHP 4	*60*	58	58	58	0	0
Kentau CHP 5	*18*	0	0	0	0	0
Kzyl Orda CHP 6	146	65	65	65	65	65
	12	0	0	0	0	0
No 3 4	*50*	0	0	0	0	0
	84	65	65	65	65	65
Western Region						
Atyrauenergo (Oct 95 June 96)						
Atyrau CHP	227	203	203	203	203	203
	12	0	0	0	0	0
	120	108	108	108	108	108
	45	45	45	45	45	45
	50	50	50	50	50	50
Zapkazenergo (Oct 95 June 96)						
Aktyubinsk CHP 1	73	53	53	53	53	53
	14	0	0	0	0	0
	6	0	0	0	0	0
	12	12	12	12	12	12
	16	16	16	16	16	16
	25	25	25	25	25	25
Aktyubinsk CHP 1 extension	*140*	140	140	140	140	140
Aktyubinsk Combined Cycle	950	950	950	950	950	950
Unit 1	*475*	475	475	475	475	475
Unit 2	*475*	475	475	475	475	475
Uralsk CHP 1	18	18	8	8	8	8
	10	10	0	0	0	0
	8	8	8	8	8	8

Generating Capacity

	Nominal capacity	2001	2002	2003	2004	2005
Independent Power Plants						
North Grid (including Altay)						
Yermakovskaya GRES	2400	1 930	1 930	1 930	1 930	1 930
No 1 3	*600*	540	540	540	540	540
No 2	*300*	0	0	0	0	0
	300	271	271	271	271	271
	900	819	819	819	819	819
	300	300	300	300	300	300
South Grid						
Kapchagayskaya (hydro)	*434*	280	280	280	280	280
Power Plants to be Privatized						
North Grid (including Altay)						
Ekibastuz GRES 1	4000	2 000	2 000	2 000	2 000	2 000
Unit 1	*500*	*400*	*400*	*400*	*400*	*400*
Unit 2	*500*	0	0	0	0	0
Unit 3	*500*	0	0	0	0	0
Unit 4	*500*	0	0	0	0	0
Unit 5	*500*	400	400	400	400	400
Unit 6	*500*	400	400	400	400	400
Unit 7	*500*	400	400	400	400	400
Unit 8	*500*	400	400	400	400	400
Ekibastuz GRES 2	2100	1 540	2 065	2 065	2 065	2 065
Unit 1	*525*	490	490	490	490	490
Unit 2	*525*	525	525	525	525	525
Unit 3	*525*	525	525	525	525	525
Unit 4	*525*	0	525	525	525	525
Karagandinsk GRES 2	608	458	458	458	258	258
No 2	*50*	0	0	0	0	0
No 3	*100*	0	0	0	0	0
	200	200	200	200	0	0
	258	258	258	258	258	258
South Grid						
Zhambyl GRES	1230	1 105	1 105	1 105	1 105	1 105
	600	538	538	538	538	538
	630	567	567	567	567	567
South Kazakhstan GRES	1040	520	520	520	1 040	1 040
Unit 1	*520*	520	520	520	520	520
Unit 2	*520*	0	0	0	520	520
Other capacity additions	*520*	0	0	0	0	0

Generating Capacity

	Nominal capacity	2001	2002	2003	2004	2005
Autoproducers & Other Generators						
North Grid (including Altay)						
Karagandinsk Metallurgical	*162*	68	68	68	68	68
Tselinograd Chemical	*180*	180	180	180	180	180
South Grid						
Chardarinskaya Hydro Plant	*100*	47	47	47	47	47
West Region						
Alginsky Chemical Plant	*4*	4	4	4	4	4
Gurevsky Refinery	*6*	4	4	4	4	4
Mangishlak Energy Complex	*630*	390	390	390	390	390

Total Generating Capacity	*2001 2005 data exclude some proposed stations*				
Altayenergo (Oct 95 June 96)	1 613	1 613	1 298	1 298	1 298
Karangandaenergo (Oct 95 June 96)	1 070	1 070	1 046	941	923
Kustanayenergo (Oct 95 June 96)	25	25	25	25	0
Pavlodarenergo (Oct 95 June 96)	717	717	635	575	575
Ekibastuzenergo (before Oct 95)	0	0	0	0	0
Tselinenergo (Oct 95 June 96)	378	378	378	378	378
Almatyenergo (Oct 95 June 96)	601	601	601	582	582
Southkazenergo (Oct 95 June 96)	338	338	338	269	269
Atyrauenergo (Oct 95 June 96)	203	203	203	203	203
Zapkazenergo (Oct 95 June 96)	1 161	1 151	1 151	1 151	1 151
Regional energos total	6 106	6 096	5 675	5 423	5 380
Independent Power Plants (since Oct 95	2 210	2 210	2 210	2 210	2 210
Power Plants to be Privatized	5 624	6 149	6 149	6 469	6 469
Autoproducers and Other Generators	693	693	693	693	693
Total	14 632	15 147	14 726	14 795	14 751
Hydro stations	1 744	1 744	1 429	1 410	1 410
Thermal stations	12 242	12 757	12 651	12 738	12 695
Nuclear stations	390	390	390	390	390
Autoproducers fuel not specified	256	256	256	256	256
Total	14 632	15 147	14 726	14 795	14 751
	2001 2005 data exclude some proposed stations				
New or expanded stations	3 310	3 835	3 835	4 355	4 355
Ekibastuz GRES 1	2 000	2 000	2 000	2 000	2 000
Other existing power stations	9 322	9 312	8 891	8 439	8 396
Total	14 632	15 147	14 726	14 795	14 751
Net increase in capacity since 1996					
New or expanded stations	2 295	2 820	2 820	3 340	3 340
Ekibastuz GRES 1	400	400	400	400	400
Other existing power stations	1 228	1 238	1 659	2 111	2 154

Appendix B

Electric Energy Balance for Kazakstan, 1989-2000

The following table shows the electric energy balance projection was used to develop projections of wholesale market supply This table was produced using the same calculational model as was used in Appendix A

Electric energy balance for Kazakhstan

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	All amounts are in GWh											
North Grid (including Altay)												
Billed electricity consumption	*53 776*	54 480	53 245	51 149	47 518	*41 503*	*38 208*					
Altayenergo		*9 820*	*9 690*	*9 089*	*8 065*							
Ekibastuzenergo (old)		*1 771*	*1 574*	*1 613*	*1 429*							
Karagandaenergo		*16 609*	*16 192*	*15 588*	*14 394*							
Kustanayenergo		*7 977*	*7 907*	*7 644*	*7 172*							
Pavlodarenergo		*9 562*	*9 067*	*8 575*	*7 882*							
Tselinenergo		*8 741*	*8 815*	*8 640*	*8 576*							
Plus Non technical losses	*518*	*549*	*937*	*1 380*	*1 662*	1 452	1 336					
% of billed elec consumption	1 0%	1 0%	1 8%	2 7%	3 5%	*3 5%*	*3 5%*					
Equals Electricity consumption	54 294	55 029	54 182	52 529	49 180	42 955	39 544	38 832	38 871	39 221	39 927	40 925
Increase over previous year		1 4%	1 5%	-3 1%	6 4%	12 7%	-7 9%	*1 8%*	*0 1%*	*0 9%*	*1 8%*	*2 5%*
By voltage level												
VHV lines 220 kV and higher					5 664	4 958	4 548	4 493	4 520	4 585	4 693	4 836
HV lines 110 kV					15 171	13 279	12,182	12 034	12 106	12 281	12 571	12 953
MV lines 35 kV					4 262	3 731	3 422	3 381	3 401	3 450	3 532	3 639
LV lines 10 kV and 6 kV					10 623	9 298	8 529	8 426	8 476	8 599	8 802	9 069
LV lines 0 38 kV					13 459	11 780	10 807	10 675	10,739	10,895	11 152	11 491
Multiplier applied to DPC	*(Not used to compute VHV consumption)*				*0 666*							
Plus Network losses					5 014	4 389	4 026	3 977	4 001	4 059	4,155	4 281
By voltage level												
VHV lines 220 kV and higher					1 322	1 157	1 061	1 048	1 055	1,070	1 095	1 129
HV lines 110 kV					1 375	1 203	1 104	1,091	1 097	1 113	1 139	1 174
MV lines 35 kV					1 179	1 032	947	935	941	955	977	1 007
LV lines 10 kV and 6 kV					735	643	590	583	586	595	609	627
LV lines 0 38 kV					404	353	324	320	322	327	335	345
Percentage losses	Expressed as a % of energy delivered at the lower voltage level											
VHV lines 220 kV and higher					*2 5%*	2 5%	2 5%	2 5%	2 5%	2 5%	2 5%	2 5%
HV lines 110 kV					*3 0%*	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%
MV lines 35 kV					*4 0%*	4 0%	4 0%	4 0%	4 0%	4 0%	4 0%	4 0%
LV lines 10 kV and 6 kV					*3 0%*	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%
LV lines 0 38 kV					*3 0%*	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%
Percentage losses	Expressed as a % of total energy delivered to the grid											
VHV lines 220 kV and higher					2 4%	2 4%	2 4%	2 4%	2 5%	2 5%	2 5%	2 5%
HV lines 110 kV					2 5%	2 5%	2 5%	2 5%	2 6%	2 6%	2 6%	2 6%
MV lines 35 kV					2 2%	2 2%	2 2%	2 2%	2 2%	2 2%	2 2%	2 2%
LV lines 10 kV and 6 kV					1 4%	1 4%	1 4%	1 4%	1 4%	1 4%	1 4%	1 4%

Electric energy balance for Kazakhstan

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
LV lines 0 38 kV					0 7%	0 7%	0 7%	0 7%	0 8%	0 8%	0 8%	0 8%
Over all voltage levels					9 3%	9 3%	9 2%	9 3%	9 3%	9 4%	9 4%	9 5%
Equals Energy delivered to grid					54 194	47 344	43 570	42 810	42,872	43 280	44 082	45 207
Less Net generation CHP & hydro					20 377	20 205	19 456	18 766	18 766	18,766	19 116	19 116
Altayenergo					6 999	7 520	7 405	7,318	7,318	7 318	7 668	7 668
Ust Kamenogorsk CHP 1					*828*	787	747	710	710	710	710	710
Ust K CHP 1 extension											*350*	350
Leninogorsk CHP					*215*	204	194	184	184	184	184	184
Sogrinskaya CHP					*250*	238	226	214	214	214	214	214
Semipalatinsk CHP 1					*26*	25	23	22	22	22	22	22
Ust Kamenogorsk (hydro)					*1 533*	*1 900*	*1 874*	*1 702*	1702	1702	1702	1702
Shulbinsk (hydro)					*1 650*	*1 870*	*1 844*	*1 585*	1585	1585	1585	1585
Bukhtarminskaya (hydro)					*2 446*	2 446	2 446	*2 849*	2 849	2 849	2 849	2 849
Leninogorsk (hydro)					*48*	48	48	48	48	48	48	48
Other small plants (hydro)					*3*	3	3	3	3	3	3	3
Karangandaenergo					5 787	5 498	5 223	4 962	4 962	4 962	4 962	4 962
Karaganda Thermal PP 1					*256*	243	231	219	219	219	219	219
Karaganda CHP 1					*110*	105	99	94	94	94	94	94
Karaganda CHP 2					*2 167*	2 059	1 956	1 858	1 858	1,858	1 858	1 858
Karaganda CHP 3					*2,133*	2 026	1 925	1 829	1,829	1 829	1 829	1 829
Tentekskaya CHP					*55*	52	50	47	47	47	47	47
Balkhash CHP					*580*	551	523	497	497	497	497	497
Dzhezkazgan CHP					*486*	462	439	417	417	417	417	417
Kustanayenergo					530	504	478	454	454	454	454	454
Rudnenskaya CHP					455	432	411	390	390	390	390	390
Kustenay CHP					51	48	46	43	43	43	43	43
Arkalyk CHP					24	23	22	21	21	21	21	21
Pavlodarenergo					3 894	3 699	3 514	3 339	3,339	3 339	3 339	3 339
Pavlodar CHP 1					*1 824*	1 733	1 646	1 564	1 564	1 564	1 564	1 564
Pavlodar CHP 2					*505*	480	456	433	433	433	433	433
Pavlodar CHP 3					*1 565*	1 487	1 412	1 342	1 342	1 342	1 342	1 342
Ekibastuzenergo (before Oct 95)					25	0	0	0	0	0	0	0
Ekibastuz CHP					*25*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Tselinenergo					3 142	2 985	2 836	2 694	2 694	2 694	2 694	2 694
Akmolinsk CHP 1					*35*	33	32	30	30	30	30	30
Akmolinsk CHP 2					*1 061*	1 008	958	910	910	910	910	910
Petropavlovsk CHP 2					*2 046*	1 944	1 847	1 754	1 754	1 754	1 754	1 754

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Electric energy balance for Kazakhstan

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Equals Wholesale Market Supply					33 817	27 138	24 114	24 043	24 106	24 514	24 966	26 090
Growth rate						19 8%	11 1%	0 3%	0 3%	1 7%	1 8%	4 5%
Less Net imports from Russia				3 637	1 897			1,355	*1 300*	*1 300*	*1 300*	*1 800*
Altayenergo				*2 936*	*1 728*							
Ekibastuzenergo				*1 362*	*671*							
Kustanayenergo				*6 910*	*4 393*							
Pavlodarenergo				*5 256*	*4 265*							
Tselinenergo				*409*	*712*							
Less Supply from autoproducers			913	972	1 065	1 065	1 065	1 065	1 065	1 065	1 065	1 065
Karagandinsk Metallurgical			*657*	*647*	*642*	642	642	642	642	642	642	642
Tselinogradsk Chemical			*256*	*325*	*423*	423	423	423	423	423	423	423
Less Net generation by IPPs					12 255			10 323	10 323	10 323	10 323	10 323
Yermakovskaya GRES					*12 255*			*10 323*	10 323	10 323	10 323	10 323
Plus Exports to the South grid					1 325			0	0	0	600	1 200
Equals Net gener to be privatized					19 925			11 300	11 418	11 826	12 878	14,102
Ekibastuz GRES 1					12 764			5 521	5 521	5 521	5 521	*8 000*
Ekibastuz GRES 2					3 054			3 307	3 424	3,832	4,884	3 630
Karagandinsk GRES 2					4 107			2,472	2 472	2 472	2 472	2 472
Percent of total												
Ekibastuz GRES 1					64 1%	44 6%	46 0%	48 9%	48 9%	46 7%	42 9%	56 7%
Ekibastuz GRES 2					15 3%	29 7%	30 6%	29 3%	29 3%	32 4%	37 9%	25 7%
Karagandinsk GRES 2					20 6%	25 8%	23 4%	21 9%	21 9%	20 9%	19 2%	17 5%
Plus Station use to be privatized					1 569			1 073	1 082	1 113	1 195	1 344
Ekibastuz GRES 1					948			548	548	548	548	794
Ekibastuz GRES 2					195			256	266	297	379	282
Karagandinsk GRES 2					426			268	268	268	268	268
Percent of gross generation												
Ekibastuz GRES 1					6 9%	8 9%	9 2%	9 0%	9 0%	9 0%	9 0%	9 0%
Ekibastuz GRES 2					6 0%	6 7%	7 3%	7 2%	7 2%	7 2%	7 2%	7 2%
Karagandinsk GRES 2					9 4%	9 7%	9 7%	9 8%	9 8%	9 8%	9 8%	9 8%
Equals Gross gen to be privatized					21 495			12 373	12 500	12 939	14 073	15 446
Ekibastuz GRES 1					13 712			6 069	6 069	6 069	6 069	8 794
Ekibastuz GRES 2					3 249			3 563	3 690	4 130	5 263	3 911
Karagandinsk GRES 2					4 533			2 741	2 741	2 741	2 741	2 741

Electric energy balance for Kazakhstan

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Less Net generation CHP & hydro					5 230	4 982	4 747	4 523	4 873	4,873	4 873	4 873
Almatyenergo (Oct 95 June 96)					4 144	3 950	3 766	3 592	3 592	3 592	3 592	3 592
Almaty CHP 1					*615*	584	555	527	527	527	527	527
Almaty CHP 2					*2 193*	2 083	1 979	1 880	1 880	1 880	1 880	1 880
Almaty Thermal Power P					*910*	865	821	780	780	780	780	780
Tekeliskaya CHP 2					*154*	146	139	132	132	132	132	132
Almaty Cascade (hydro)					*222*	222	222	222	222	222	222	222
Karatalska (hydro)					*36*	36	36	36	36	36	36	36
Other small plants (hydro)					*14*	14	14	14	14	14	14	14
Southkazenergo (Oct 95 June 96)					1 086	1 032	980	931	1 281	1 281	1 281	1 281
Chimkent CHP 1					*90*	86	81	77	77	77	77	77
Chimkent CHP 2					*0*	0	0	0	0	0	0	0
Chimkent CHP 3					*487*	463	440	418	418	418	418	418
Chimkent CHP 3 extens n									*350*	350	350	350
Dzhambul CHP 4					*255*	242	230	219	219	219	219	219
Kentau CHP 5					*55*	52	50	47	47	47	47	47
Kzyl Orda CHP 6					*199*	189	180	171	171	171	171	171
Equals Wholesale Market Supply					12 118	9 678	8 052	8,259	8 123	8,481	8 980	9 583
Growth rate						20 1%	-16 8%	2 6%	1 6%	4 4%	5 9%	6 7%
Less Net imports from Cent Asia				5 960	5 598			2 740	2 740	2,740	2 740	2 740
Almatyenergo				*1 128*	*590*							
Southkazenergo				*4 832*	*5 008*							
By country												
Turkmenistan				*3 972*	*3 186*			*1 405*	1 405	1,405	1 405	1 405
Uzbekistan				*169*	*946*			*400*	400	400	400	400
Kyrgyzstan				*1 736*	*1 022*			*935*	935	935	935	935
Tadjikistan				83	444			*0*	0	0	0	0
Less Supply from autoproducers			457	522	544	544	544	544	544	544	544	544
Chardarinsk Hydro Power Pl			*457*	*522*	*544*	544	544	544	544	544	544	544
Less Net generation by IPPs					1 095			866	866	866	866	866
Kapchagayskaya (hydro)					*1 095*			*866*	866	866	866	866
Less Imports from the North grid					*1 325*			*0*	*0*	*0*	*600*	*1200*
Equals Net gener to be privatized					3 556			4 109	3 973	4 331	4 230	4 233
Zhambyl GRES					3 556			4 109	3 973	4 331	4 230	4 233
South Kazakhstan GRES								*0*	*0*	*0*	*0*	*0*
Other capacity additions								0	0	0	0	0
Percent of total												
Zhambyl GRES					100 0%			100 0%	100 0%	100 0%	100 0%	100 0%

Electric energy balance for Kazakhstan

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
South Grid												
Billed electricity consumption	*21 991*	22 381	20 457	17,756	14 606	*12 294*	*10 672*					
Almatyenergo		*6 133*	*6 231*	*5 715*	*5 541*							
Southkazenergo		*16 248*	*14 226*	*12 041*	*9 065*							
Plus Non technical losses	*206*	*219*	*400*	*677*	*1 044*	879	763					
% of billed elec consumption	0 9%	1 0%	2 0%	3 8%	7 1%	*7 1%*	*7 1%*					
Equals Electricity consumption	22 197	22 600	20 857	18 433	15 650	13 173	11 435	11 435	11 641	11,979	12 446	13 006
Increase over previous year		1 8%	-7 7%	11 6%	-15 1%	15 8%	13 2%	*0 0%*	*1 8%*	*2 9%*	*3 9%*	*4 5%*
By voltage level												
VHV lines 220 kV and higher					622	544	499	493	496	504	515	531
HV lines 110 kV					5 239	4 586	4 207	4 156	4,181	4 241	4 341	4 473
MV lines 35 kV					1,472	1 288	1 182	1 168	1 175	1 192	1 220	1 257
LV lines 10 kV and 6 kV					3 669	3 211	2 946	2 910	2 927	2 970	3 040	3 132
LV lines 0 38 kV					4 648	4 068	3 732	3 687	3 709	3 763	3 851	3 968
Multiplier applied to DPC	*(Not used to compute VHV consumption)*				*0 23*							
Plus Network losses					1 698	1 487	1 364	1 347	1,355	1 375	1 407	1 450
By voltage level												
VHV lines 220 kV and higher					423	370	340	336	338	343	351	361
HV lines 110 kV					475	416	381	377	379	384	393	405
MV lines 35 kV					407	356	327	323	325	330	337	348
LV lines 10 kV and 6 kV					254	222	204	201	202	205	210	217
LV lines 0 38 kV					139	122	112	111	111	113	116	119
Percentage losses	Expressed as a % of energy delivered at the lower voltage level											
VHV lines 220 kV and higher					*2 5%*	2 5%	2 5%	2 5%	2 5%	2 5%	2 5%	2 5%
HV lines 110 kV					*3 0%*	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%
MV lines 35 kV					*4 0%*	4 0%	4 0%	4 0%	4 0%	4 0%	4 0%	4 0%
LV lines 10 kV and 6 kV					*3 0%*	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%
LV lines 0 38 kV					*3 0%*	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%
Percentage losses	Expressed as a % of total energy delivered to the grid											
VHV lines 220 kV and higher					2 4%	2 5%	2 7%	2 6%	2 6%	2 6%	2 5%	2 5%
HV lines 110 kV					2 7%	2 8%	3 0%	2 9%	2 9%	2 9%	2 8%	2 8%
MV lines 35 kV					2 3%	2 4%	2 6%	2 5%	2 5%	2 5%	2 4%	2 4%
LV lines 10 kV and 6 kV					1 5%	1 5%	1 6%	1 6%	1 6%	1 5%	1 5%	1 5%
LV lines 0 38 kV					0 8%	0 8%	0 9%	0 9%	0 9%	0 8%	0 8%	0 8%
Over all voltage levels					9 8%	10 1%	10 7%	10 5%	10 4%	10 3%	10 2%	10 0%
Equals Energy delivered to grid					17 348	14 660	12 799	12 782	12 996	13,354	13 853	14 456

Electric energy balance for Kazakhstan

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
South Kazakhstan GRES					0 0%			0 0%	0 0%	0 0%	0 0%	0 0%
Other capacity additions								0 0%	0 0%	0 0%	0 0%	0 0%
Plus Station use to be privatized					234			254	246	268	262	262
Zhambyl GRES					234			254	246	268	262	262
South Kazakhstan GRES					0			0	0	0	0	0
Other capacity additions					0			0	0	0	0	0
Percent of gross generation												
Zhambyl GRES					6 2%	6 8%	5 9%	5 8%	5 8%	5 8%	5 8%	5 8%
South Kazakhstan GRES								*6 0%*	6 0%	6 0%	6 0%	6 0%
Other capacity additions								*6 0%*	6 0%	6 0%	6 0%	6 0%
Equals Gross gen to be privatized					3 790			4 364	4 219	4 599	4 492	4 495
Zhambyl GRES					3 790			4,364	4 219	4 599	4 492	4 495
South Kazakhstan GRES					0			0	0	0	0	0
Other capacity additions								0	0	0	0	0
West Region												
Billed electricity consumption	*7 520*	7 604	7 738	7 583	7 216							
Atyrauenergo		*3 042*	*3 191*	*3 229*	*3 038*							
Zapkazenergo		*4 562*	*4 547*	*4 354*	*4 178*							
Plus Non technical losses	*79*	*84*	*124*	*197*	*219*							
% of billed elec consumption	1 1%	1 1%	1 6%	2 6%	3 0%							
Equals Electricity consumption	7 599	7 688	7,862	7 780	7,435	*7 122*	7 044	7 051	7 149	7,300	7 504	7 767
Increase over previous year		1 2%	2 3%	-1 0%	4 4%	4 2%	*1 1%*	*0 1%*	*1 4%*	*2 1%*	*2 8%*	*3 5%*
By voltage level												
VHV lines 220 kV and higher					3 260	2 853	2 617	2 586	2 601	2 639	2 701	2,783
HV lines 110 kV					1 456	1 274	1,169	1 155	1 161	1 178	1,206	1 243
MV lines 35 kV					409	358	328	324	326	331	339	349
LV lines 10 kV and 6 kV					1 019	892	818	808	813	825	844	870
LV lines 0 38 kV					1 291	1 130	1 037	1 024	1 030	1 045	1 070	1 103
Multiplier applied to DPC	*(Not used to compute VHV consumption)*				*0 0639*							
Plus Network losses					549	481	441	435	438	444	455	469
By voltage level												
VHV lines 220 kV and higher					195	170	156	154	155	158	161	166
HV lines 110 kV					132	115	106	105	105	107	109	113
MV lines 35 kV					113	99	91	90	90	92	94	97
LV lines 10 kV and 6 kV					70	62	57	56	56	57	58	60
LV lines 0 38 kV					39	34	31	31	31	31	32	33
Percentage losses	Expressed as a % of energy delivered at the lower voltage level											

Electric energy balance for Kazakhstan

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
VHV lines 220 kV and higher					2 5%	2 5%	2 5%	2 5%	2 5%	2 5%	2 5%	2 5%
HV lines 110 kV					3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%
MV lines 35 kV					4 0%	4 0%	4 0%	4 0%	4 0%	4 0%	4 0%	4 0%
LV lines 10 kV and 6 kV					3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%
LV lines 0 38 kV					3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%
Percentage losses	Expressed as a % of total energy delivered to the grid											
VHV lines 220 kV and higher					2 4%	2 2%	2 1%	2 1%	2 0%	2 0%	2 0%	2 0%
HV lines 110 kV					1 7%	1 5%	1 4%	1 4%	1 4%	1 4%	1 4%	1 4%
MV lines 35 kV					1 4%	1 3%	1 2%	1 2%	1 2%	1 2%	1 2%	1 2%
LV lines 10 kV and 6 kV					0 9%	0 8%	0 8%	0 7%	0 7%	0 7%	0 7%	0 7%
LV lines 0 38 kV					0 5%	0 4%	0 4%	0 4%	0 4%	0 4%	0 4%	0 4%
Over all voltage levels					6 9%	6 3%	5 9%	5 8%	5 8%	5 7%	5 7%	5 7%
Equals Energy delivered to grid					7 984	7 603	7 484	7 486	7 587	7,744	7 959	8 235
Less Net generation CHP & hydro					1 653	1 570	1 492	1 417	2,214	2 214	4 214	4 153
Atyrauenergo (Oct 95 June 96)					1 288	1 224	1 162	1 104	1 104	1 104	1 104	1 104
Atyrau CHP					1 288	1 224	1 162	1,104	1 104	1 104	1 104	1 104
Zapkazenergo (Oct 95 June 96)					365	347	329	313	1 110	1 110	3 110	3 049
Aktyubinsk CHP 1					275	261	248	236	236	236	236	236
Aktyubinsk CHP 1 extension									797	797	797	736
Aktyubinsk Combined Cycle											2 000	2 000
Uralsk CHP 1					90	86	81	77	77	77	77	77
Equals Wholesale Market Supply					6 331	6 032	5 993	6 069	5 373	5 530	3 745	4 082
Growth rate						4 7%	0 7%	1 3%	11 5%	2 9%	-32 3%	9 0%
Less Net imports from Cent Asia				5	7			0	0	0	0	0
Atyrauenergo				5	7							
Less Supply from autoproducers			2 267	2 208	2 122	2 122	2,122	2,897	2 897	2,897	2 897	2 897
Mangishlak Energy Complex			2 232	2 168	2 101	2101	2101	2101	2101	2101	2101	2101
Gurevsk Refinery			27	25	13	13	13	13	13	13	13	13
Alginsk Chemical Plant			8	15	8	8	8	8	8	8	8	8
AkTurbo								775	775	775	775	775
Equals Net imports from Russia				4 420	4 216			3 172	2 476	2 633	848	1 185
Atyrauenergo				17	13							
Zapkazenergo				4 403	4 203							
Assumptions Used in All Regions												
Rate of decline of generation												
Distcos existing thermal stations						5 0%	5 0%	5 0%	0 0%	0 0%	0 0%	0 0%
Distcos existing hydro stations						0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%
Autoproducers						0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%

Electric energy balance for Kazakhstan

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Totals for North and South grid												
Electricity consumption	76 491	77 629	75 039	70 962	64 830	56 128	50 980	50 268	50 512	51 200	52 373	53 931
Wholesale Market Supply					45 936	36 816	32 166	32 303	32 229	32 995	33,946	35 673
Totals for Kazakstan												
Billed electricity consumption	83 287	84 465	81 440	76 488	69 340							
Plus Non technical losses	803	852	1 461	2 254	2 925							
% of energy delivered to the grid					3 7%							
Equals Electricity consumption	84 090	85 317	82 901	78 742	72 265	63 250	58 023	57 318	57 662	58 499	59 877	61 698
Growth rate		1 5%	-2 8%	5 0%	8 2%	12 5%	8 3%	-1 2%	0 6%	1 5%	2 4%	3 0%
Plus Network losses					7 262	6 356	5 831	5 760	5 794	5 879	6 017	6 200
Equals Energy delivered to grid					79 527	69 606	63 854	63 078	63 456	64 378	65 894	67 898
Less Net generation CHP & hydro					27 260	26 758	25 695	24 707	25 854	25,854	28 204	28 143
Equals Wholesale Market Supply					52 267	42 848	38 159	38,372	37 603	38 524	37 690	39 755
Less Net imports from Russia				8 057	6 113			4 527	3 776	3,933	2 148	2 985
Less Net imports from Cent Asia				5 955	5 591			2 740	2 740	2 740	2 740	2 740
Less Supply from autoproducers			3 637	3 702	3 731	3 731	3 731	4 506	4 506	4 506	4 506	4 506
Less Net generation by IPPs					13 350			11 189	11,189	11 189	11 189	11 189
Equals Net gener to be privatized					23 482			15 410	15 391	16 157	17 108	18 335
Plus Station use to be privatized					1 803			1 327	1 328	1 381	1 457	1 606
Equals Gross gen to be privatized					25 285			16 737	16 719	17,538	18 565	19 941
Calculation of gross generation												
Gross generation to be privatized					25 285			16 737				
Plus Gross generation by IPPs					16 562			14 794				
Yermakovskaya GRES					*13 021*			*11 200*				
Bukhtarminskaya (hydro)					*2 446*			*2 723*				
Kapchagayskaya (hydro)					*1 095*			*871*				
Plus Gross generation by distcos					28 942							
Altayenergo					4 885							
Ust Kamenogorsk CHP 1					*1 076*							
Ust K CHP 1 extension												
Leninogorsk CHP					*250*							
Sogrinskaya CHP					*295*							
Semipalatinsk CHP 1					*30*							
Ust Kamenogorsk (hydro)					*1 533*	*1 902*	*1 876*	*1 704*				

Electric energy balance for Kazakhstan

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Shulbinsk (hydro)					*1 650*	*1 876*	*1 850*	*1 591*				
Leninogorsk (hydro)					*48*							
Other small plants (hydro)					*3*							
Karangandaenergo					6 925							
Karaganda Thermal PP 1					*375*							
Karaganda CHP 1					*135*							
Karaganda CHP 2					*2 510*							
Karaganda CHP 3					*2 481*							
Tentekskaya CHP					*64*							
Balkhash CHP					*710*							
Dzhezkazgan CHP					*650*							
Kustanayenergo					629							
Rudnenskaya CHP					*540*							
Kustenay CHP					*60*							
Arkalyk CHP					*29*							
Pavlodarenergo					4 686							
Pavlodar CHP 1					*2 185*							
Pavlodar CHP 2					*625*							
Pavlodar CHP 3					*1 876*							
Ekibastuzenergo (before Oct 95)					35							
Ekibastuz CHP					*35*							
Tselinenergo					3 725							
Akmolinsk CHP 1					*43*							
Akmolinsk CHP 2					*1 260*							
Petropavlovsk CHP 2					*2 422*							
Almatyenergo					4 852							
Almaty CHP 1					*763*							
Almaty CHP 2					*2 592*							
Almaty Thermal Power P					*1 049*							
Tekeliskaya CHP 2					*176*							
Almaty Cascade (hydro)					*222*							
Karatalska (hydro)					*36*							
Other small plants (hydro)					*14*							
Southkazenergo					1,309							
Chimkent CHP 1					*110*							
Chimkent CHP 2					*0*							
Chimkent CHP 3					*573*							
Chimkent CHP 3 extens n												

Electric energy balance for Kazakhstan

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Dzhambul CHP 4					*300*							
Kentau CHP 5					*69*							
Kzyl Orda CHP 6					*257*							
Atyrauenergo					1,410							
Atyrau CHP					*1 410*							
Zapkazenergo					486							
Aktyubinsk CHP 1					*366*							
Akt CHP 1 extension												
Uralsk CHP 1					*120*							
Equals Gross generation					70 789							
Station use												
Percent of gross generation												
Station use - to be privatized					7 1%	8 3%	8 1%	7 9%	7 9%	7 9%	7 8%	8 1%
Station use by IPPs					19 4%			24 4%				
Station use by distcos					5 8%							
Total losses and station use												
Station use - to be privatized					1 803							
Plus Station use by IPPs					3,212							
Plus Station use by distcos					1 682							
Equals Station use (total)					6 697							
Plus Network losses					7,262							
Plus Non technical losses					2 925							
Equals Losses and station use					16 884							
as a % of billed elec consumption					24 3%							
Valuation per kWh					$0 05							
Valuation in millions of USD												
Station use - to be privatized					90							
Plus Station use by IPPs					161							
Plus Station use by distcos					84							
Equals Station use (total)					335							
Plus Network losses					363							
Plus Non technical losses					146							
Equals Losses and station use					844							

Appendix C

Fuel Cost Projection for Major Power Stations, 1996-2000

The following table was produced using the same calculational model as was used in Appendices A and B

Fuel Cost Projection for Selected Generating Stations

	1996 (KE)	1996	1997	1998	1999	2000
Fuel price projection						
Coal price FOB mine, $/ton						
Ekibastuz coal	3 54	3 48	*4 5*	*5 5*	*6 5*	*7*
Karaganda coal		18 18	*25*	*25*	*25*	*25*
Coal price FOB mine, $/million Btu						
Ekibastuz coal	0 25	0 24	0 32	0 39	0 46	0 49
Karaganda coal		1 09	1 50	1 50	1 50	1 50
Coal shipping cost, $/ton						
Ekibastuz to Ekibastuz GRES1	0 4769	0 4697	*1*	*1*	*1*	*1*
Ekibastuz to Ekibastuz GRES2	0 4846	0 4773	*1*	*1*	*1*	*1*
Karaganda to Karagandinsk GRES2		0 4545	*1*	*1*	*1*	*1*
Ekibastuz to Karagandinsk GRES2	1 0262	1 0106	*4*	*4*	*4*	*4*
Ekibastuz to South Kazakstan GRES			*8*	*8*	*8*	*8*
Ekibastuz to new capacity			*8*	*8*	*8*	*8*
Ekibastuz to Ekibastuz CHP	0 1538	0 1515	*0 4*	*0 4*	*0 4*	*0 4*
Ekibastuz to Yermakovskaya	0 6006	0 5915	*2*	*2*	*2*	*2*
Heavy fuel oil price, $/ton						
Delivered to Zhambyl GRES	67 46	*68*	*76*	*76*	*76*	*76*
Heavy fuel oil price, $/million Btu						
Delivered to Zhambyl GRES	1 77	1 79	2 00	2 00	2 00	2 00
Gas price, $/thousand cubic meters						
Delivered to Zhambyl GRES	63 97	*64 3*	*64 3*	*64 3*	*64 3*	*64 3*
Gas price, $/million Btu						
Delivered to Zhambyl GRES	1 99	2 00	2 00	2 00	2 00	2 00
Exchange rate, tenge/$	*65*	*66*	66	66	66	66
Exchange rate, cents/tenge	1 54	1 52	1 52	1 52	1 52	1 52

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Fuel Cost Projection for Selected Generating Stations

	1996 (KE)	1996	1997	1998	1999	2000
Coal price FOB mine, tenge/ton						
Ekibastuz coal	*230*	*230*	297	363	429	462
Karaganda coal		*1200*	1650	1650	1650	1650
Coal shipping cost, tenge/ton						
Ekibastuz to Ekibastuz GRES1	*31*	31	66	66	66	66
Ekibastuz to Ekibastuz GRES2	*31 5*	31 5	66	66	66	66
Karaganda to Karagandinsk GRES2		30	66	66	66	66
Ekibastuz to Karagandinsk GRES2	*66 7*	66 7	264	264	264	264
Ekibastuz to South Kazakstan GRES			528	528	528	528
Ekibastuz to new capacity			528	528	528	528
Ekibastuz to Ekibastuz CHP	*10*	10	26 4	26 4	26 4	26 4
Ekibastuz to Yermakovskaya	*39 04*	39 04	132	132	132	132
Heavy fuel oil price, tenge/ton						
Delivered to Zhambyl GRES	*4384 77*	4488	5016	5016	5016	5016
Gas price, tenge/ton						
Delivered to Zhambyl GRES	*4200 13*	4286 67	4286 67	4286 67	4286 67	4286 67

For stations other than Zhambyl, heavy fuel oil prices are adjusted by an amount equal to the difference between the 1996 price projected by Kazakhstanenergo and the 1996 price for oil delivered to Zhambyl

1 kgSF = 1 Kilogram Standard Fuel =	7000	kcal				
1 TSF = 1 Ton Standard Fuel =	7,000,000	kcal =	27 77	million Btu		
1 kWh =	860	kcal =	3412	Btu		
1 kcal =	3 967	Btu				
1 Btu =	0 252	kcal				
Heat content of Ekibastuz coal =	0 514	TSF per ton	14 28	mln Btu/ton	3,600	kcal/kg
Heat content of Karanganda coal =	0 6	TSF per ton	16 66	mln Btu/ton	*4,200*	kcal/kg
Heat content of heavy fuel oil =	1 370	TSF per ton	38 05	million Btu per ton		
Heat content of natural gas =	1 170	TSF per ton	32 49	million Btu per ton		
Density of natural gas =	0 99	ton per thousand cubic meters				

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Fuel Cost Projection for Selected Generating Stations

	1996 (KE)	1996	1997	1998	1999	2000
Ekibastuz GRES 1 (coal/oil)						
Electric generation						
Net generation, GWh	7 050	5,521	5,521	5,521	5,521	8,000
Heat rate, TSF per net GWh	*427 3*	427 3	427 3	427 3	427 3	427 3
Fuel requirement, 000 TSF	3,013	2,359	2,359	2,359	2,359	3,418
% of total fuel requirement	99 8%	99 7%	99 7%	99 7%	99 7%	99 8%
Gross generation, GWh	7,750	6,069	6 069	6,069	6,069	8,794
Heat rate, Btu per gross kWh	10,796	10,796	10,796	10,796	10,796	10,796
District heat output						
Net generation, 000 Gcal	*35*	35	35	35	35	35
Heat rate, kg SF per net Gcal	*191 4*	191 4	191 4	191 4	191 4	191 4
Fuel requirement, 000 TSF	7	7	7	7	7	7
Total fuel requirement	3,019 3					
Total, 000 TSF	3,019 3	2,365 9	2,365 9	2,365 9	2,365 9	3,425 1
Coal, % of total	95 5%	*95 0%*	*95 0%*	*95 0%*	*95 0%*	*95 0%*
Heavy fuel oil, % of total	4 5%	5 0%	5 0%	5 0%	5 0%	5 0%
Coal						
Quantity, 000 tons st fuel	*2884 8*	2,247 6	2,247 6	2,247 6	2,247 6	3,253 8
Heating value, TSF per ton	0 514289	0 514289	0 514289	0 514289	0 514289	0 514289
Quantity, 000 tons	*5,609 3*	4,370 3	4,370 3	4,370 3	4,370 3	6,326 9
Price FOB mine, tenge/ton	230	230	297	363	429	462
Shipping cost, tenge/ton	31	31	66	66	66	66
Total cost of fuel, 000 tenge	1,464,027	1,140,653	1,586,426	1,874,867	2,163,308	3,340,593
Heavy fuel oil						
Quantity, 000 tons st fuel	*134 5*	118 3	118 3	118 3	118 3	171 3
Heating value, TSF per ton	1 372449	1 372449	1 372449	1 372449	1 372449	1 372449
Quantity, 000 tons	*98 0*	86 2	86 2	86 2	86 2	124 8
Price FOB mine, tenge/ton	*5500*	5500	6131 23	6131 23	6131 23	6131 23
Total cost of fuel, 000 tenge	539,000	474,060	528,467	528,467	528,467	765,058
Total						
Total cost of fuel, 000 tenge	2,003,027	1,614,713	2,114,893	2,403,334	2,691,775	4,105,652
Cost of fuel for electric generation	*1 998 232*	1,610,141	2,108,905	2,396,529	2,684,154	4,097,622
Cost of fuel, cents/net kWh	0 436	0 442	0 579	0 658	0 737	0 776

Fuel Cost Projection for Selected Generating Stations

	1996 (KE)	1996	1997	1998	1999	2000
Ekibastuz GRES 2 (coal/oil)						
Electric generation						
Net generation, GWh	4,223	3,307	3,424	3,832	4,884	3,630
Heat rate, TSF per net GWh	*401 1*	401 1	401 1	401 1	401 1	401 1
Fuel requirement, 000 TSF	1,693 6	1,326	1,374	1,537	1,959	1,456
% of total fuel requirement	97 7%	97 0%	97 1%	97 4%	98 0%	97 3%
Gross generation, GWh	4,550	3,563	3,690	4,130	5,263	3,911
Heat rate, Btu per gross kWh	10 338	10,338	10 338	10,338	10 338	10,338
District heat output						
Net generation, 000 Gcal	*220*	220	220	220	220	220
Heat rate, kg SF per net Gcal	*184 5*	184 5	184 5	184 5	184 5	184 5
Fuel requirement, 000 TSF	40 6	41	41	41	41	41
Total fuel requirement	1,734 2					
Total, 000 TSF	1,733 8	1,366 9	1,414 1	1,577 7	1,999 5	1,496 4
Coal, % of total	95 0%	*95 0%*	*95 0%*	*95 0%*	*95 0%*	*95 0%*
Heavy fuel oil, % of total	5 0%	5 0%	5 0%	5 0%	5 0%	5 0%
Coal						
Quantity, 000 tons st fuel	*1647 1*	1,298 5	1,343 4	1,498 9	1,899 5	1,421 6
Heating value, TSF per ton	0 52856	0 52856	0 52856	0 52856	0 52856	0 52856
Quantity, 000 tons	*3,116 2*	2,456 8	2,541 6	2,835 7	3,593 8	2,689 6
Price FOB mine, tenge/ton	230	230	297	363	429	462
Shipping cost, tenge/ton	31 5	31 5	66	66	66	66
Total cost of fuel, 000 tenge	814,886	642,441	922,610	1,216,527	1,778,938	1,420,101
Heavy fuel oil						
Quantity, 000 tons st fuel	*86 7*	68 3	70 7	78 9	100 0	74 8
Heating value, TSF per ton	1 371835	1 371835	1 371835	1 371835	1 371835	1 371835
Quantity, 000 tons	*63 2*	49 8	51 5	57 5	72 9	54 5
Price FOB mine, tenge/ton	*5001 03*	5001 03	5632 26	5632 26	5632 26	5632 26
Total cost of fuel, 000 tenge	316 065	249,150	290,291	323,882	410,466	307,190
Total						
Rounding error	*6*					
Total cost of fuel, 000 tenge	1,130,957	891,591	1,212,900	1,540,409	2,189,404	1,727,291
Cost of fuel for electric generation	*1,057 301*	865,115	1,178,086	1,500,779	2,144,960	1,680,439
Cost of fuel, cents/net kWh	0 385	0 396	0 521	0 593	0 665	0 701

Fuel Cost Projection for Selected Generating Stations

	1996 (KE)	1996	1997	1998	1999	2000
Zhambyl GRES (oil/gas)						
Electric generation						
Net generation, GWh	5 650	4,109	3,973	4,331	4,230	4,233
Heat rate, TSF per net GWh	*349 5*	349 5	349 5	349 5	349 5	349 5
Fuel requirement, 000 TSF	1,975	1,436	1 389	1,514	1,478	1,479
% of total fuel requirement	99 8%	99 7%	99 7%	99 7%	99 7%	99 7%
Gross generation, GWh	6 000	4,364	4,219	4,599	4,492	4,495
Heat rate, Btu per gross kWh	9,141	9,141	9 141	9 141	9,141	9,141
District heat output						
Net generation, 000 Gcal	*22*	22	22	22	22	22
Heat rate, kg SF per net Gcal	*175 3*	175 3	175 3	175 3	175 3	175 3
Fuel requirement, 000 TSF	4	4	4	4	4	4
Total fuel requirement	1,978 6					
Total 000 TSF	1 979 0	1,440 1	1,392 6	1,517 4	1,482 3	1,483 3
Heavy fuel oil, % of total	50 0%	*50 0%*	*50 0%*	*50 0%*	*50 0%*	*50 0%*
Gas, % of total	50 0%	50 0%	50 0%	50 0%	50 0%	50 0%
Heavy fuel oil						
Quantity, 000 tons st fuel	*989 5*	720 1	696 3	758 7	741 2	741 7
Heating value, TSF per ton	1 369929	1 369929	1 369929	1 369929	1 369929	1 369929
Quantity, 000 tons	*722 3*	525 6	508 3	553 8	541 0	541 4
Price tenge/ton	4384 77	4488	5016	5016	5016	5016
Total cost of fuel, 000 tenge	3,167 119	2,358,968	2,549,413	2 778,015	2,713,738	2,715,566
Gas						
Quantity, 000 tons st fuel	*989 5*	720 1	696 3	758 7	741 2	741 7
Heating value, TSF per ton	1 170037	1 170037	1 170037	1 170037	1 170037	1 170037
Quantity, 000 tons	*845 7*	615 4	595 1	648 4	633 4	633 9
Price, tenge/ton	4200 13	4286 667	4286 667	4286 667	4286 667	4286 667
Total cost of fuel, 000 tenge	3,552,050	2,638,078	2,550,945	2,779,685	2,715,369	2,717,197
Total						
Rounding error	*4*					
Total cost of fuel, 000 tenge	6,719,173	4,997,046	5,100,358	5,557,700	5,429,106	5,432,763
Cost of fuel for electric generation	*6,706,370*	4,983,664	5,086,233	5,543,574	5,414,981	5,418,638
Cost of fuel, cents/net kWh	1 826	1 837	1 940	1 940	1 940	1 940

Fuel Cost Projection for Selected Generating Stations

	1996 (KE)	1996	1997	1998	1999	2000
Karagandinsk GRES 2 (coal/oil)						
Electric generation (net)						
Net generation, GWh	3,157	2 472	2,472	2 472	2,472	2,472
Heat rate, TSF per net GWh	*419 7*	419 7	419 7	419 7	419 7	419 7
Fuel requirement, 000 TSF	1,325 1	1,038	1,038	1,038	1,038	1,038
% of total fuel requirement	87 6%	84 8%	84 8%	84 8%	84 8%	84 8%
Gross generation, GWh	3,500	2,741	2,741	2,741	2,741	2,741
Heat rate, Btu per gross kWh	10,515	10,515	10,515	10,515	10,515	10,515
District heat output (net)						
Net generation, 000 Gcal	*996 9*	996 9	996 9	996 9	996 9	996 9
Heat rate, kg SF per net Gcal	*187 3*	187 3	187 3	187 3	187 3	187 3
Fuel requirement, 000 TSF	186 7	187	187	187	187	187
Total fuel requirement	1,511 8					
Total, 000 TSF	1,512 4	1 224 4	1,224 4	1,224 4	1,224 4	1,224 4
Coal, % of total	95 4%	*95 0%*	*95 0%*	*95 0%*	*95 0%*	*95 0%*
Heavy fuel oil, % of total	4 6%	5 0%	5 0%	5 0%	5 0%	5 0%
Coal						
Quantity, 000 tons st fuel	*1442 4*	1,163 2	1,163 2	1,163 2	1,163 2	1,163 2
Heating value, TSF per ton	0 51999	0 51999	0 51999	0 51999	0 51999	0 51999
Quantity, 000 tons	*2,773 9*	2,237 0	2,237 0	2,237 0	2,237 0	2,237 0
Price FOB mine, tenge/ton	230	230	297	363	429	462
Shipping cost, tenge/ton	66 7	66 7	264	264	264	264
Total cost of fuel, 000 tenge	823,016	663,709	1,254,940	1,402,580	1,550,220	1,624,040
Heavy fuel oil						
Quantity, 000 tons st fuel	*70*	61 2	61 2	61 2	61 2	61 2
Heating value, TSF per ton	1 367188	1 367188	1 367188	1 367188	1 367188	1 367188
Quantity, 000 tons	*51 2*	44 8	44 8	44 8	44 8	44 8
Price, tenge/ton	*5100*	5100	5731 23	5731 23	5731 23	5731 23
Total cost of fuel, 000 tenge	261,120	228,372	256,638	256,638	256,638	256,638
Total						
Total cost of fuel, 000 tenge	1,084,136	892,081	1,511,578	1,659,218	1,806,859	1,880,679
Cost of fuel for electric generation	*951 381*	756,043	1,281,069	1,406,195	1,531,320	1,593,883
Cost of fuel, cents/net kWh	0 464	0 463	0 785	0 862	0 938	0 977

Fuel Cost Projection for Selected Generating Stations

	1996 (KE)	1996	1997	1998	1999	2000
South Kazakhstan GRES (coal/oil)						
Electric generation						
Net generation, GWh	15	0	0	0	0	0
Heat rate, TSF per net GWh	*420*	*420*	420	420	420	420
Fuel requirement, 000 TSF	6 3	0	0	0	0	0
% of total fuel requirement	25 9%	0 0%	0 0%	0 0%	0 0%	0 0%
Gross generation, GWh	17	0	0	0	0	0
Heat rate, Btu per gross kWh	10,604	NA	NA	NA	NA	NA
District heat output (net)						
Net generation, 000 Gcal	*110*	110	110	110	110	110
Heat rate, kg SF per net Gcal	*164*	*164*	164	164	164	164
Fuel requirement, 000 TSF	18 0	18	18	18	18	18
Total fuel requirement	24 3					
Total, 000 TSF	18	18	18	18	18	18
Coal, % of total	0 0%	*0 0%*	*0 0%*	*95 0%*	*95 0%*	*95 0%*
Heavy fuel oil, % of total	100 0%	100 0%	100 0%	5 0%	5 0%	5 0%
Coal						
Quantity, 000 tons st fuel		0 0	0 0	17 1	17 1	17 1
Heating value, TSF per ton		*0 52*	0 52	0 52	0 52	0 52
Quantity, 000 tons		0 0	0 0	33 0	33 0	33 0
Price FOB mine, tenge/ton		230	297	363	429	462
Shipping cost, tenge/ton		0	528	528	528	528
Total cost of fuel, 000 tenge		0	0	29,365	31,541	32,628
Heavy fuel oil						
Quantity, 000 tons st fuel	*18*	18 0	18 0	0 9	0 9	0 9
Heating value, TSF per ton	1 363636	1 363636	1 363636	1 363636	1 363636	1 363636
Quantity, 000 tons	*13 2*	13 2	13 2	0 7	0 7	0 7
Price, tenge/ton	*4688 64*	4688 64	5319 87	5319 87	5319 87	5319 87
Total cost of fuel, 000 tenge	61,890	62,028	70 378	3,519	3,519	3,519
Total						
Total cost of fuel, 000 tenge	61,890	62,028	70,378	32,884	35,059	36,147
Cost of fuel for electric generation	*0*	0	0	0	0	0
Cost of fuel, cents/net kWh	0 000					

Fuel Cost Projection for Selected Generating Stations

	1996 (KE)	1996	1997	1998	1999	2000
Ekibastuz CHP						
District heat output						
Net generation, 000 Gcal	*2,305 6*	2305 6	2305 6	2305 6	2305 6	2305 6
Heat rate, kg SF per net Gcal	*178*	178	178	178	178	178
Fuel requirement, 000 TSF	424 4	410	410	410	410	410
Coal, % of total	*94 9%*	*95 0%*	*95 0%*	*95 0%*	*95 0%*	*95 0%*
Heavy fuel oil, % of total	5 1%	5 0%	5 0%	5 0%	5 0%	5 0%
Coal						
Quantity, tons st fuel	*402 6*	389 9	389 9	389 9	389 9	389 9
Heating value, TSF per ton	0 578615	0 578615	0 578615	0 578615	0 578615	0 578615
Quantity, 000 tons	*695 8*	673 8	673 8	673 8	673 8	673 8
Price FOB mine, tenge/ton	230	230	297	363	429	462
Shipping cost, tenge/ton	10	10	26 4	26 4	26 4	26 4
Total cost of fuel, 000 tenge	166,992	161,715	217,911	262,382	306,854	329,089
Heavy fuel oil						
Quantity, 000 tons st fuel	*21 8*	20 5	20 5	20 5	20 5	20 5
Heating value, TSF per ton	1 379747	1 379747	1 379747	1 379747	1 379747	1 379747
Quantity, 000 tons	*15 8*	14 9	14 9	14 9	14 9	14 9
Price tenge/ton	*5000*	5000	5631 23	5631 23	5631 23	5631 23
Total cost of fuel, 000 tenge	79,000	74,361	83,749	83,749	83,749	83,749
Total						
Total cost of fuel, 000 tenge	245,992	236,076	301,659	346,131	390,602	412,838
Cost of fuel for electric generation	NA	NA	NA	NA	NA	NA

Fuel Cost Projection for Selected Generating Stations

	1996 (KE)	1996	1997	1998	1999	2000
Kazakhstanenergo (January 96) total						
Electric generation (net), Gwh	20 096	15,410	15,391	16,157	17,108	18,335
Dist heat output (net), 000 Gcal	3,689 5	3,689 5	3,689 5	3,689 5	3,689 5	3,689 5
Coal						
Quantity, 000 tons st fuel	6,376 9	5,099 2	5 144 1	5,316 7	5,717 4	6,245 7
Heating value, TSF per ton	0 522902	0 52365	0 523692	0 523822	0 524151	0 522204
Quantity 000 tons	12 195 2	9,737 9	9,822 7	10,149 8	10,907 9	11,960 2
Total cost of fuel, 000 tenge	3,268,922	2,608 518	3,981,886	4 785 722	5,830,861	6,746,453
Heavy fuel oil						
Quantity, 000 tons st fuel	1,320 5	1,006 5	985 1	1,038 5	1,042 1	1,070 4
Heating value, TSF per ton	1 37024	1 370273	1 370285	1 370386	1 370423	1 370489
Quantity, 000 tons	963 7	734 5	718 9	757 8	760 4	781 0
Total cost of fuel, 000 tenge	4 424 195	3,446,938	3,778 936	3,974,270	3,996,577	4,131,720
Gas						
Quantity, 000 tons st fuel	989 5	720 1	696 3	758 7	741 2	741 7
Heating value, TSF per ton	1 170037	1 170037	1 170037	1 170037	1 170037	1 170037
Quantity, 000 tons	845 7	615 4	595 1	648 4	633 4	633 9
Total cost of fuel, 000 tenge	3,552,050	2,638,078	2,550,945	2,779,685	2,715,369	2,717,197
Total						
Rounding error	9					
Total cost of fuel, 000 tenge	11,245,175	8,693,535	10,311,768	11,539,676	12,542,806	13,595,370

Fuel Cost Projection for Selected Generating Stations

	1996 (KE)	1996	1997	1998	1999	2000
Yermakovskaya GRES (coal/oil IPP)						
Electric generation						
Net generation, GWh	10,323	10,323	10 323	10 323	10,323	10,323
Heat rate, TSF per net GWh	*375*	375	375	375	375	375
Fuel requirement, 000 TSF	3,871	3,871	3,871	3,871	3,871	3,871
% of total fuel requirement	96 6%	98 2%	98 2%	98 2%	98 2%	98 2%
Heat rate, Btu per net kWh	10,415	10,415	10 415	10,415	10,415	10,415
District heat output						
Net generation, 000 Gcal	*380*	380	380	380	380	380
Heat rate, kg SF per net Gcal	*185*	185	185	185	185	185
Fuel requirement, 000 TSF	70	70	70	70	70	70
Total fuel requirement	3,941 4					
Total, 000 TSF	4,007 4	3,941 4	3,941 4	3 941 4	3,941 4	3 941 4
Coal, % of total	97 0%	*97 0%*	*97 0%*	*97 0%*	*97 0%*	*97 0%*
Heavy fuel oil, % of total	3 0%	3 0%	3 0%	3 0%	3 0%	3 0%
Coal						
Quantity, 000 tons st fuel	*3 886 8*	3,823 2	3,823 2	3,823 2	3,823 2	3,823 2
Heating value, TSF per ton	0 527997	0 527997	0 527997	0 527997	0 527997	0 527997
Quantity, 000 tons	*7,361 4*	7,240 9	7,240 9	7,240 9	7,240 9	7,240 9
Price FOB mine, tenge/ton	230	230	297	363	429	462
Shipping cost, tenge/ton	39 04	39 04	132	132	132	132
Total cost of fuel, 000 tenge	1,980,511	1,948,095	3,106,351	3,584,251	4,062,151	4,301,101
Heavy fuel oil						
Quantity, 000 tons st fuel	*120 6*	118 2	118 2	118 2	118 2	118 2
Heating value, TSF per ton	1 368899	1 368899	1 368899	1 368899	1 368899	1 368899
Quantity, 000 tons	*88 1*	86 4	86 4	86 4	86 4	86 4
Price tenge/ton	*4697 49*	4697 49	5328 72	5328 72	5328 72	5328 72
Total cost of fuel, 000 tenge	413,849	405,760	460,284	460,284	460,284	460,284
Total						
Rounding error	*12*					
Total cost of fuel, 000 tenge	2,394,372	2,353,855	3,566,635	4,044,535	4,522,435	4,761,385
Cost of fuel for electric generation	2,312 949	2,311,871	3,503,020	3,972,396	4,441,772	4,676,460
Cost of fuel, cents/net kWh	0 345	0 345	0 514	0 583	0 652	0 686

Appendix D

Purchased Power Cost Projection, 1996-1997

The following table was produced using the same calculational model as was used in Appendices A, B, and C

Purchased Power Cost Projection

	Kazakstanenergo's December 1995 calculation of the 1996 tariff *	Revision based on October 1996 prices and power sector restructuring	Revision based on 1997 prices and volumes
Prices of electricity sold by generating stations			
in cents/kWh			
Ekibastuz GRES 1		2 80	4 11
Ekibastuz GRES 2		2 24	4 11
Zhambyl		1 89	4 11
Karaganda 2		1 32	4 11
Yermakovskaya GRES	1 28	0 97	4 11
Bukhtarminskaya (hydro)	0 12	0 22	1 00
Kapchagayskaya (hydro)	0 19	0 19	1 00
in tyn/kWh			
Ekibastuz GRES 1		184 8	271
Ekibastuz GRES 2		148	271
Zhambyl		125	271
Karaganda 2		87	271
Yermakovskaya GRES	83 05	63 75	271
Bukhtarminskaya (hydro)	8 12	14 5	66
Kapchagayskaya (hydro)	12 55	12 55	66
Prices of imported electricity, in cents/kWh			
Russia	3 3	3 3	3 3
Turkmenistan	4 0	4 0	4 0
Uzbekistan	4 5	4 5	4 5
Kyrgyzstan	3 0	3 0	3 0
Tajikistan	3 0	3 0	3 0
Transit fees for imported electricity			
in cents/kWh/1000km			
By Uzbekistan from Turkmenistan	0 5	0 5	0 5
By Uzbekistan from Kyrgyzstan	0 5	0 5	0 5
Exchange rate, tenge/$	65	66	66
VAT	20%	20%	20%
Prices of electricity sold by autoproducers in cents/kWh			
AkTurbo	2 5	2 5	4
Purchases from generating stations			
Electric energy purchased Gwh			
Ekibastuz GRES 1		5 521	5 521
Ekibastuz GRES 2		3 307	3 424
Zhambyl		4 109	3 973
Karaganda 2		2 472	2,472
Yermakovskaya GRES	10,323	10 323	10,323
Bukhtarminskaya (hydro)	2,849	2 849	2,849
Kapchagayskaya (hydro)	866	866	866
Cost thousand tenge			
Ekibastuz GRES 1	0	10 203 150	14,962 412
Ekibastuz GRES 2	0	4 893 842	9 280 060
Zhambyl	0	5 136 835	10 767 839
Karaganda 2	0	2,151 066	6 700 446
Yermakovskaya GRES	8 573 252	6 580 913	27 975,330
Bukhtarminskaya (hydro)	231 339	413 105	1 880 340
Kapchagayskaya (hydro)	108 683	108 683	571 560
Total	8,913,273	29 487 593	72 137,987

Purchased Power Cost Projection

	Kazakstanenergo's December 1995 calculation of the 1996 tariff *	Revision based on October 1996 prices and power sector restructuring	Revision based on 1997 prices and volumes
Purchases from other countries			
Electric energy purchased, Gwh			
Russia	4,527	4,527	3 776
Turkmenistan	1,405	1,405	1,405
Uzbekistan	400	400	400
Kyrgyzstan	935	935	935
Tajikistan	0	0	0
Cost excluding transit fees thous tenge			
Russia	9,710 415	9,859 806	8 224 676
Turkmenistan	3 653,000	3,709 200	3 709 200
Uzbekistan	1,170,000	1,188,000	1,188,000
Kyrgyzstan	1 823,250	1,851 300	1 851,300
Tajikistan	0	0	0
Total	16,356 665	16,608,306	14 973 176
Transit through other countries			
Electric energy wheeled Gwh			
By Uzbekistan from Turkmenistan	1405	1405	1405
By Uzbekistan from Kyrgyzstan	*467 5*	467 5	467 5
Distance wheeled km			
By Uzbekistan, from Turkmenistan	*807*	807	807
By Uzbekistan from Kyrgyzstan	*555*	555	555
Cost of transit, thousand tenge			
By Uzbekistan from Turkmenistan	368 496	374 166	374 166
By Uzbekistan from Kyrgyzstan	84 325	85 623	85,623
Total	452 822	459 788	459 788
Purchases from autoproducers			
Electric energy purchased Gwh			
AkTurbo	775	775	775
Cost thousand tenge			
AkTurbo	1 259,375	1,278 750	2 046 000
Total cost of purchased power	26 982 135	47,834 437	89 616,950
Less VAT	4 497 022		
Equals Total cost less VAT	22 485 112		
Total electric energy purchased GWh	22 080	37 490	36 721
Average cost, tyn/kWh **	101 83	127 59	244 05
Average cost, cents/kWh **	1 57	1 93	3 70

* This calculation of purchased power costs was used to project an average tariff of 150 88 tyn/kWh
See Appendix G Kazakstanenergo s December 1995 Calculation of the 1996 Tariff

** These averages are presented only for comparison with Kazakstanenergo s February 1996 projection
All of these averages include the West region of Kazakstan as well as the North and South regions

Appendix E

Revaluation of Generating Station Assets

This appendix includes the following documents

1 *Asset Revaulations Competed by Kazakstanenergo in May 1996* This is a summary table prepared by Hagler Bailly Consulting, showing the results of asset revaluations for the four power stations, together with data on installed capacity and capacity utilization The "market value"is the replacement cost estimated by Kazakstanenergo, while the "gross book value" is calculated using the conversion factors and procedures approved by the government

2 *Overall Revaluation Sheet On Groups of Basic Energy Equipment For 01 01 96 With Expert Evaluation* This is a set of five tables prepared by Kazakstanenergo on May 21, 1996, presenting asset revaluations for four power stations - Zhambyl GRES, Karaganda GRES #2, Ekibastuz GRES #1, and Ekibastuz GRES #2 The first table is a summary of the data presented on the following four pages

3 *Depreciation Calculation and Maintenance Fund for the Year 1996* This is a preliminary table prepared by Kazakstanenergo in December 1995, showing a comparison between the asset valuations consistent with GosComStat regulations and the asset valuations based on "market value "

4 Cabinet of Ministers of the Republic of Kazakstan, Resolution No 1178, October 21, 1994 *Provision on the Procedure of the Fixed Asset Indexation of the Enterprises, Organizations and Institutions*

5 *Minutes of the Meeting on the Discussion of the MECI Proposal on the Fixed Assets Revaluation*, January 12, 1996

6 Regulation on Fixed Assets Revaluation, January 16, 1996 This regulation

was based on the report included as item 5 below

7 *Valuation of the Capital Assets Owned by the Republic of Kazakstan Ministry of Energy and Coal Industry Enterprises,* November 1995 This report presents six alternative methods for revaluating the assets of Ekibastuz GRES 1 and recommends a multiplier of 17 to be applied to book values in effect at January 1, 1996 The results of the six methods are compared in the table entitled "Changes in Cost Indicators Calculated in Accordance With the Various Options "

Exhibit E 1
Asset Revaluations Completed by Kazakstanenergo in May 1996

	Power station			
	Ekibastuz GRES 1	Ekibastuz GRES 2	Zhambyl GRES	Karaganda GRES 2
"Market value" @1 Jan 96				
million tenge	*70,304*	*24,737*	*10,035*	*11,501*
million USD	1,065	375	152	174
Gross book value @1 Jan 96				
million tenge	*44,180*	*23,064*	*9,269*	*10,895*
million USD	669	349	140	165
1996 available capacity, MW	*1,600*	*1,015*	*1,105*	*608*
Design capacity, MW	*4,000*	*1,050*	*1,230*	*608*
"Market value" / available capacity				
USD per kW	666	369	138	287
Gross book value / available capacity				
USD per kW	418	344	127	272
Gross book value / design capacity				
USD per kW	167	333	114	272
Fuel	coal	coal	gas,oil	coal
Type	boiler	boiler	boiler	boiler
1st group of units	3 x 500	1 x 525	3 x 200	50
Year installed	1980-81	1990	1967-69	1962
2nd group of units	5 x 500	1 x 525	3 x 210	3 x 100
Year installed	1982-84	1994	1972,76	1963-64
3rd group of units	-	-	-	3 x 86
Year installed	-	-	-	1965-67
Capacity utilization				
1996 gross generation, GWh	6,069	3,563	4,364	2,741
1996 plant factor based on available capacity	43 3%	40 1%	45 1%	51 5%
Gross generation that could be achieved at 80% plant factor, GWh	11,213	7,113	7,744	4,261

Exchange rate, tenge per $ 66

Overall Revaluation Sheet On Groups Of
'Basic Energy Equipment For 01 01 96 With Expert Evaluation

Energy System 5252 Sheet No 2 2

Name of the power plant	Balance cost before reval on (the facility data)	Data after revaluation for 01 01 9		Data with expert evaluation		Deviations from market value
		Balance cost	Net depreciated value	Balance cost	Net depreciated value	
1	2	3	5	6	8	9
Zhambyl GRES	848950525	10035106860	1706496355	9269493654	1589644709	765613206
Karaganda GREs #2	1092015822	11500863779	1257349345	10894901348	1182778315	605962431
Ekibastuz GRES #1	5570463727	70304134320	32017977202	44180225044	22396789490	-26123909276
Ekibastuz GRES #2	2293381668	24737461621	20587326377	23063654184	19249079702	-1673807437
TOTAL	9804811742	116577566580	55569149279	87408274230	44418292216	-29169292350

A number of equipment units revaluated 2524 Data reflected in accounting report Balance cost - 87408274230
Net depreciated value - 44418292216

Director of Information and Automation Center
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May 21, 1996
Seal

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Overall Sheet of Revaluation On Groups of 'Basic Energy Equipment For 01 01 96 With Expert Evaluation

Enterprise 527801 Zhambyl GRES Sheet No 2 Data are given in tenge

Group of rate of depreciation	Balance cost before reval on (the facility data)	The facility data after revaluation for 01 01 96			Data with expert evaluation taken into account			Deviations from market value	Average reval on coeff (with expert evaluation)
		Balance cost	Sum of depreciation	Net depreciated value	Balance cost	Sum of depreciation	Net depreciated value		
1	2	3	4	5	6	7	8	9	10
100	229245071	573112678	226519373	346593305	573112678	226519373	346593305		2 5
201	24990808	62477022	24062447	38414575	62477022	24062447	38414575		2 5
202	22390744	55976863	46544053	9432810	55976863	46544053	9432810		2 5
300	2671764	45419992	14698732	30721260	45419992	14698732	30721260		17
301	80008516	1360144765	11701725536	189972229	1360144765	1170172536	189972229		17
400	242435713	4121407201	3399038596	722368605	3815728174	3155892772	659835402	305679027	15 74
401	119828545	2037085151	1729165774	307919377	1593333015	1335027998	258305017	-443752136	13 3
402	15649656	266044139	260034376	6009763	266044139	260034376	6009763		17
403	4945	84065	64345	19720	84065	64345	19720		17
407	85106425	1446809223	1400377206	46432017	1446809223	1400377206	46432017		17
440	3543	8858	8858		8858	8858			2 5
470	19152647	47881538	45269896	2611642	47881538	45269896	2611642		2 5
480	7462148	18655365	12654313	6001052	2473322	1176353	1296969	-16182043	0 33
TOTAL	848950525	10035106860	8328610505	1706496355	9269493654	7679848945	1589644709	765613206	

A number of equipment units revaluated - 1534

Data reflected in accounting report Balance cost - 9269493654
Depreciation sum - 7679848945
Net depreciated value - 1589644709

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Overall Sheet of Revaluation On Groups of 'Basic Energy Equipment For 01 01 96 With Expert Evaluation

Data are given in tenge | Enterprise 528201 | Karaganda GRES | Sheet No 2

Group of rate of depreciation 1	Balance cost before reval on (the facility data) 2	The facility data after revaluation for 01 01 96 Balance cost 3	Sum of depreciation 4	Net depreciated value 5	Data with expert evaluation taken into account Balance cost 6	Sum of depreciation 7	Net depreciated value 8	Deviations from market value 9	Average reval On coeff (with expert evaluation) 10
100	128919897	322299753	112800955	209498798	322299753	112800955	209498798		2 5
201	175093076	437732693	400420173	37312520	437732693	400420173	37312520		2 5
202	22314612	55786537	30106488	25680049	55786537	30106488	25680049		2 5
203	155636202	389090515	188698661	200391854	389090515	188698661	200391854		2 5
300	10034395	170584715	120179749	50404966	170584715	120179749	50404966		17
301	60275373	1024681341	924740653	99940688	1024681341	924740653	99940688		17
400	233216248	3964676216	3704866151	259810065	3784391394	3549229878	235161516	-180284822	16 23
401	69149049	1175533833	1003919071	171614762	753426164	630223089	123203075	-422107669	10 9
402	1429493	24301381	23300251	1001130	24301381	23300251	1001130		17
407	230779869	3923257773	3724387183	198870590	3923257773	3724387183	198870590		17
418	490287	1225719	480079	745640	1225719	480079	745640		2 5
456	24360	60900	7100	53800	60900	7100	53800		2 5
470	2921337	7303343	7109262	194081	7303343	7109262	194081		2 5
• 480	1731624	4329060	2498658	1830402	759120	439512	319608	3569940	0 44
TOTAL	1092015822	11500863779	10243514434	1257349345	10894901348	9712123033	1182778315	-605962431	

A number of equipment units revaluated 427

Data reflected in accounting report Balance cost - 10894901348
Depreciation sum - 9712123033
Net depreciated value 1182778315

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Overall Sheet of Revaluation On Groups Of 'Basic Energy Equipment For 01 01 96 With Expert Evaluation

Data are given in tenge Enterprise 528501 **Ekibastuz GRES-1** Sheet No 2

Group of rate of depreciation	Balance cost before reval on (the facility data)	The facility data after revaluation for 01 01 96			Data with expert evaluation taken into account			Deviations from market value	Average reval on coeff with expert evaluation
		Balance cost	Sum of depreciation	Net depreciation value	Balance cost	Sum of depreciation	Net depreciation value		
1	2	3	4	5	6	7	8	9	10
100	1181042692	2952606723	435771786	2516834937	2952606723	435771786	2516834937		2 5
201	200646030	501615076	68978652	432636424	501615076	68978652	432636424		2 5
202	93522190	233805475	79794439	154011036	233805475	79794439	154011036		2 5
203	191205084	500401175	104372563	396028612	500401175	104372563	396028612		2 62
300	7824790	133021430	33474989	99546441	133021430	33474989	99546441		17
301	223133571	3793270715	2382509795	1410760920	3793270715	2382509795	1410760920		17
400	1925400283	32731804811	15777249687	16954555124	20361474904	9675211927	10686262977	-12370329907	10 58
401	1055053141	17935903397	13630594084	4305309313	4199035348	3239494850	959540498	-13736868049	3 98
402	1642378	27920426	10951638	16968788	27920426	10951638	16968788		17
407	664110957	11289886269	5661328100	5628558169	11289886269	5661328100	5628558169		17
448	504896	1262240	558225	704015	1262240	558225	704015		2 5
456	64048	160120	61159	98961	160120	61159	98961		2 5
458	16632	41580	41580		41580	41580			2 5
470	7464323	18660806	13832373	4828433	18660806	13832373	4828433		2 5
480	9405657	23514142	14251844	9262298	6802822	4667274	2135548	-16711320	0 72
500	9427055	160259935	72386204	87873731	160259935	72386204	87873731		17
TOTAL	5570463727	70304134320	38286157118	32017977202	44180225044	21783435554	22396789490	-26123909276	

A number of equipment units revaluated 285

Data reflected in accounting report Balance cost - 44180225044
Depreciation sum - 21783435554
Net depreciated value 22396789490

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Overall Sheet of Revaluation On Groups Of 'Basic Energy Equipment For 01 01 96 With Expert Evaluation

Enterprise 528502 Ekibastuz GRES 2 Sheet No 2

Group of rate of depreciation 1	Balance cost before reval on (the facility data) 2	The facility data after revaluation for 01 01 96 Balance cost 3	Sum of depreciation 4	Net depreciated value 5	'Data with expert evaluation taken into account Balance cost 6	Sum of depreciation 7	Net depreciated value 8	Deviations from market value 9	Average reval on coeff (with expert evaluation) 10
100	620037044	1550092614	155743741	1394348873	1550092614	155743741	1394348873		2 5
201	291458155	728645388	79316486	649328902	728645388	79316486	649328902		2 5
202	67082026	167705066	24565298	143139768	167705066	24565298	143139768		2 5
300	82173068	1396942156	176708015	1220234141	1396942156	176708015	1220234141		17
301	128408674	2182947458	876948145	1305999313	2182947458	876948145	1305999313		17
400	773870435	13155797395	1824998994	11330798401	12461686989	1675070517	10786616472	-694110406	16 07
401	170526274	2898946658	520160458	2378786200	1926488312	337255290	1589233022	-972458346	9 95
407	153858877	2615600909	473559854	2142041055	2615600909	473559854	2142041055		17
461	1783875	30325875	13775202	16550673	30325875	13775202	16550673		17
470	666556	1666392	1017104	649288	1666392	1017104	649288		2 5
480	3516684	8791710	3341947	5449763	1553025	614830	938195	7238685	0 43
TOTAL	2293381668	24737461621	4150135244	20587326377	23063654184	3814574482	19249079702	1673807437	

A number of equipment units revaluated 278

Data reflected in accounting report Balance cost - 23063654184
Depreciation sum - 3814574482
Net depreciated value - 19249079702

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Depreciation Calculation and Maintenance Fund for the Year 1996

Electric station	*Data provided by Kazakhstanenergo in million tenge*									*Columns added by HBC*		
	Fixed cost		Depreciation (7 8% of fixed cost)		Included in the tariff		Maintenance Fund (10% of fixed cost)		Maint Fund calculated from maintenance costs	Net generation million kWh	Cost increase associated with a switch to market" depreciation	
	GosCom Stat	Market	GosCom Stat	Market	Depreciation	Capital investment	GosCom Stat	Market			tenge/kWh	cents/kWh
Ekibastuz GRES 1	*3 296*	*41 859*	257	3 265	*1 027*	*1 027*	330	4,186	*3 300*	*7 050*	0 32	0 49
Ekibastuz GRES 2	*2 826*	*35 980*	220	2 806	*2 799*	*2 940*	283	3 598	*1 200*	*4 222*	0 00	0 00
Zhambyl GRES	*344*	*4 369*	27	341	*100*	*59*	34	437	*214*	*5 650*	0 04	0 07
Karagandinsk GRES 2	*333*	*4 229*	26	330	*330*	*671*	33	423	*1 150*	*3 157*	(0 00)	(0 00)
Ust-Kamenogorsk hydro	*167*	*668*	13	52	*50*		17	67	*19*	*1 702*	0 00	0 00
Shulbinsk hydro	*253*	*1 012*	20	79	*79*	*315*	25	101	*28*	*1 585*	(0 00)	(0 00)
South-Kazakhstan GRE	*390*	*4 958*	30	387	*387*	*611*	39	496	*50*			
Filial of Ekibastuzenerg	*2 222*	*21 478*	173	1 675	*470*	*470*	222	2,148	*600*			
Electric networks	*4 967*	*14 901*	387	1 162	*1 162*	*2 717*	497	1 490	*1 049*			
Inter-system networks	*3,168*	*9 504*	247	741	*582*	*582*	317	950	*300*			
Total	17,966	138 958	1 401	10,839	6 986	9 392	1,797	13 896	7 910			

* These figures are related to a tariff request submitted by Kazakhstanenergo, not an approved tariff

Depreciation rate	*7 8%*	which is eq	12 82 years, on average
Repair fund	*10 0%*		
Energy sales 1996	*43 800* Gwh		
Exchange rate, 1996	*65* tenge/$		

Attachment 1
to the Order of the
Ministry of Energy and Coal
Industry
No _____ dated _____

APPROVED
by the Resolution of the
Cabinet of Ministers of the
Republic of Kazakstan
No 1178 dated October 21, 1994

PROVISION
on the Procedure of the Fixed Assets Indexation of the Enterprises,
Organizations and Institutions

1 The present Provision establishes the unified procedure of the fixed assets indexation of the associations, enterprises, organizations and institutions to provide the economically sound basis and conditions for the generation of the capital assets renewal funds and for the adapting the fixed assets value to the acting prices

2 The value of buildings (except the residential ones), structures, transfer devices or transmission mechanisms, machinery and equipment, transportation facilities and other types of fixed assets are subject to be indexed regardless of the technical status and depreciation (wear) rate, no matter whether the above fixed assets are operating, conserved, in reserve, under the construction in progress, leased to the temporary use or upon mortgage

3 The initial data for the fixed assets indexation are the latter's total balance cost determined by the results of the inventory as at October 1, 1994, and the coefficients of fixed assets value increase determined on the basis of the average indices (conversion factors) of the wholesale prices of the industrial producers (according to the Attachment)

4 Beginning from January 1, 1995 the conversion factors of the fixed assets value shall be established by the RK State Committee for Statistics and Analysis and shall be brought to the notice of the enterprises, organizations and institutions via the territorial bodies of Statistics

5 In case the expenditures for the construction (construction in progress included) and purchase of the buildings, structures and transfer devices (transmission mechanisms) were made in different time periods, the above assets indexation shall be performed separately by the periods of the construction and purchase and by the coefficients related to these periods

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6 The results of the fixed assets indexation and the depreciation deductions shall be reflected in the accounting and statistical records according to the procedure established by the RK Ministry of Finance and RK State Committee for Statistics and Analysis

18'

MINUTES
of the Meeting on the Discussion of the MECI
Proposal on the Fixed Assets Revaluation

January 12, 1996 Almatv

Participated

A representative of the State Committee for Statistics and Analysis,
A representative of the RK Ministry of Finance,
A representative of the RK Ministry of Economy,
A representative of the Ministry of Energy and Coal Industry

Having listened to Mr Dukenbavev's (Kazakstanenergo Chief Engineer) proposal on the fixed assets revaluation of the MECI energy enterprises and having discussed the options of calculating the book value conversion factors, the participants came to the following mutual opinion

1 It is necessary to reconsider the fixed assets value coefficients of the MECI Enterprises because in the Electric Power Industry the equipment of the individual or single-item production is used and the construction of the power facilities was carried out till 1991

2 In accordance with the Resolution of the RK Cabinet of Ministers No 958 dated July 10, 1995 the proposed options of the coefficients calculation do not contradict with the fixed assets market value and may be used in case the positive expert advice is obtained and the expert has a License of the Government of the Republic of Kazakstan

Kulekeev J , (signature)
the State Committee for Statistics
and Analysis

Guzieva L , (signature)
Ministry of Finance

Luchinskava N , (signature)
Ministry of Economy

Galinova V , (signature)
Dukenbayev K , (signature)
Ministry of Energy and Coal Industry

APPROVED
by Khrapounov V ,
Minister of Energy and
Coal Industry of the
Republic of Kazakstan

(signature)
January 16, 1996

In pursuance of RK Cabinet of Ministers No 1178 dated October 21, 1994 and wishing to establish an economically sound basis for the generation of capital asset renewal funds and valuation of the assets of the Ministry of Energy and Coal Industry enterprises as part of the process of their privatization i recognition of the fact that the prices charged for their products are subject to Government control aimed at achieving objective parity of all Gross Domestic products, we hereby approve the following book value-to-replacement value conversion factors to be used in the revaluation of the enterprises fixed assets as at 1 July 1995

Groups of Fixed Assets	Conversion Factor
Buildings, installations, structures	2 5
Railway transport facilities Electricity transmission and telecommunication lines pipelines Power generating machinery and equipment	17 0
• Heat engineering equipment (Power generating and hot-water boilers)	17 0
• Turbine equipment	17 0
• Electric motors	17 0
Special tools equipment and appliances, computers, peripherals and data processing equipment	2 5

Notes

1 General-purpose non-energy related facilities shall be index-linked in the usual way
2 In line with the President's Decree No 2235 dated 04 24 95 'On Taxation and Other Mandatory Budget Payments", the fixed assets groups have been aggregated
3 Basic equipment depreciation deductions is 8%, buildings and structures depreciation deductions - 7% Average depreciation charges in Power industry - 7 8% The normative service life of the energy equipment is 13 years

First Deputy Minister of Energy and Coal Industry — S Tiesov

Director General of NES Kazakstanenergo — B Orazbayev

Director of the Automation and Information Center - Organization on Expert Advice issue — Tajikenov S

VALUATION OF THE CAPITAL ASSETS OWNED BY THE REPUBLIC OF KAZAKSTAN MINISTRY OF ENERGY AND COAL INDUSTRY ENTERPRISES

Almaty
1995

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AGREED BY

RK Ministry of the Economy
RK Ministry of Finance
RK Ministry of Energy
and Coal Industry

APPROVED BY

National Statistical Committee
of the Republic of Kazakstan

In pursuance of RK Cabinet of Ministers Resolution No 1178 dated 21 October 1994 and wishing to establish an economically sound basis for the generation of capital asset renewal funds and valuation of the assets of Ministry of Energy and Coal Industry enterprises as part of the process of their privatization, in recognition of the fact that the prices charged for their products are subject to Government control aimed at achieving objective parity of all Gross Domestic products we hereby approve the following book value-to-replacement value conversion factors to be used in the revaluation of the enterprises' fixed assets as at 1 July 1995

Fixed asset group	Conversion factor
Buildings installations structures	2 5
Railway transport facilities Electricity transmission and telecommunication lines pipelines Power generating machinery and equipment	17 0
Heat engineering equipment (Power generating and water-heating boilers)	17 0
Turbine equipment	17 0
Electric motors	17 0
Special tools equipment and appliances computers peripherals and data processing equipment	2 5

Notes

1 General-purpose non-energy related facilities shall be index-linked in the usual way

2 In line with Presidential Decree No 2235 dated 24 04 95 "On taxation and other mandatory budget payments" the fixed asset groups have been aggregated

BOOK VALUE TO REPLACEMENT VALUE CONVERSION FACTORS TO BE USED IN THE REVALUATION OF FIXED ASSETS AS AT 1 JULY 1995

EXPLANATORY NOTE

The following options for calculating the conversion factors were considered

Option 1

A market method of calculating the replacement value of fixed assets by conducting a producer survey

Option 2

Comparing the cost of fixed assets with the production cost of the commercial product

Option 3

Conversion based on the official rouble/dollar and tenge/dollar exchange rate

Option 4

Asset revaluation based on changing the capital investment - construction work ratio prevailing at the time of construction to those applying on 01 01 96

Option 5

Fixed asset revaluation based on the actual cost of equipment repair and replacement

Option 6

Calculating the replacement value of fixed assets on the basis of the cost of equipment at world prices ruling at the time of construction of a power station allowing for operational wear and tear

THE DESIGN AND ACTUAL INDICATORS
OF EKIBASTUZ NO 1 REGIONAL THERMAL POWER STATION AS AT
1 JANUARY 1996

Designation	Unit of measurement	Amount	
		Design	Actual 1995 figures
Cost of power station	mln roubles/ mln tenge	447 28	5 918 7
Investment in construction per unit of output	roubles/KW	119 32	1 479 7
Capacity	000 KW	4 000	4 000
Annual power generation	$kWhx10^6$	25,924	7,700
Fuel consumption (reference fuel) per unit of output	kg/KWh	0 336	457 5
Annual natural fuel consumption including losses	tpa	$15\ 6x10^6$	$5\ 9x10^6$
Staff numbers per unit of output	No /1000 KW	0 4	1 6
Of which operational staff	No /1000 KW	0 168	0 335
Power generation costs	Kopecks/KWh Tyin/KWh Cents/KWh	0 382	102 55

THE COMMISSIONING OF POWER GENERATING UNITS
AT THE NO 1 EKIBASTUZ THERMAL POWER STATION

Power unit No	Commissioning date	Full cost at 1969 prices, mln roubles
1	31 03 80	134 7
2	20 12 80	17 5
3	31 03 81	54 4
4	31 05 82	44 1
5	30 12 82	68 0
6	30 04 83	38 0
7	31 12 83	75 2
8	14 12 84	166 2
TOTAL		598 1

CAPITAL ASSET VALUES
AT EKIBASTUZ NO 1 THERMAL POWER STATION
IN THE SECOND HALF OF 1995

mln tenge

Capital asset group	Gross book value as at 01 07 1995	Conversion factor	Gross book value recalculated for 01 08 1995
Buildings	848 7	1 5	1,273 1
Installations	342 8	1 5	514 2
Transmission systems	340 9	1 2	469 8
Machinery and equipment, including	2,579 4	1 4	3,594 3
Power generation machinery and equipment	2,654 5	1 4	3,439 2
Operating machinery and equipment	110 8	1 4	155 1
Measuring and control instrumentation and equipment, laboratory equipment	4 9	1 6	7 8
Computers	7 1	1 4	9 9
Other machinery and equipment	0 1	1 7	0 2
Transport facilities Rail	6 7	1 2	46 9
Others	31 5		
Tools	0 06	2 0	0 1
Minor manufacturing and auxiliary equipment	1 4	1 7	2 4
TOTAL	4,201 7	1 4	5,918 7

CHANGES IN COST INDICATORS
CALCULATED IN ACCORDANCE WITH THE VARIOUS OPTIONS

mln tenge

Indicator	Periods						
	Actual values as at 01 08 95	Options					
		1	2	3	4	5	6
Fixed asset value							
Absolute, mln tenge	5,918 7	93,083 8	91,438 1	96,006 4	106165 4	120,763 8	95,309 5
Change of multiplier	1 0	15 7	15 4	16 2	17 9	20 4	16 1
Annual depreciation charges							
Absolute, mln tenge	236 7	3,728 4	3,657 5	3,840 2	4,246 6	4,830 6	3,812 4
Change of multiplier	1 0	15 7	15 4	16 2	17 9	20 4	16 1
Cost of major overhaul							
Absolute, mln tenge	591 9	9,308 4	9,143 8	96,006 6	10,616 6	12,076 4	9,530 9
Change of multiplier	5 9	2 7	2 6	2 8	3 0	3 5	2 7
Property tax							
Absolute, mln tenge	29 6	465 4	457 2	480 0	530 8	603 8	476 5
Change of multiplier	1 0	15 7	15 4	16 2	17 9	20 4	16 1

Note The multipliers relate to values for 01 08 95

EQUIPMENT COST ESCALATION FACTORS
CALCULATION BASED ON COMPARISON OF 1995 PRICES WITH 1991 PRICES

Equipment type	List price in 1984, tenge	Price converted to 1991 levels, tenge	Equipment acquired during 1994-1995, tenge	VAT - 28% Transport - 20% Services not covered by contracts - 3%	Cost escalation factor
1 Major equipment					
Boiler PP-1650	7,213,663	111,776,178	187,150,000		165
Turbine K-500/240	3,248,518	5,035,203	475,125,000	1 51	142
Turbogenerator TGV-500	1,340,000	2,077,000	342,090,000		165
Transformer TTS-630000	585,000	906,750	86,789,500	1 51	145
Forced-draft blower	595,550	923,102	26,781,485	1 51	44
Turbine K-11, OP-1	175,000	271,250	30,408,000		173
Electrostatic filters	42,180	65,379	4,833,522		74
Pump OPV-5-145	22,500	34,875	1,762,487	1 51	115
Pump TSN-3000-197	66,500	103,075	7,172,792	1 51	159

CAPITAL ASSET REPLACEMENT COSTS AND DEPRECIATED COSTS AT EKIBASTUZ NO 1 THERMAL POWER STATION

Capital asset group	Gross book value (in 1984 1991) prices before revaluation) mln roubles	Conversion factors					Gross book value recalculated for 01 08 1995 mln tenge
		K1	K2	K3	K4	K5	
Buildings	154 0	14 2	34	81	5 51	1 5	1,273 1
Installations	62 2	19 7	34	81	5 51	1 5	514 2
Transmission systems	42 5	41 4	47	48	9 21	1 2	469 8
Machinery and equipment, including	397 3	55 8				1 4	3,594 3
Power generation machinery and equipment	377 3	55 0	37	88	6 51	1 4	3,439 2
Operating machinery and equipment	17 0	73 0	37	88	6 51	1 4	155 1
Measuring and control instrumentation and equipment laboratory equipment	1 0	67 7	24	105	5 04	1 6	7 8
Computers	1 9	55 4	20	92	3 68	1 4	9 9
Other machinery and equipment	0 02	25 2	37	88	6 51	1 7	0 2
Transport facilities Rail	0 8	42 8	52	81	8 42	1 2	46 9
Others	4 5	28 7	38	93	7 07		
Tools	0 01	28 0	22	102	4 49	2 0	0 1
Minor manufacturing and auxiliary equipment	0 3	7 4	22	102	4 49	1 7	2 4
TOTAL	661 6	42 9				1 4	5,918 7

Note K1 - Depreciated to gross value ratio,
K2 - Revaluation for 01 01 93
K3 - Revaluation for 01 10 94
K4 - Rouble to tenge conversion factor (K2 x K3) 500
K5 - Revaluation for 01 08 95

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EQUIPMENT COST ESCALATION FACTORS
CALCULATION BASED ON COMPARISON OF 1995 PRICES WITH 1991 PRICES
CONT'D

Equipment type	List price in 1984, tenge	Price converted to 1991 levels, tenge	Equipment acquired during 1994-1995, tenge	VAT - 28% Transport - 20% Services not covered by contracts - 3%	Cost escalation factor
1 Major equipment cont'd					
Raw water heaters	28,790	44,624	2,264, 250	1 51	77
Electric motor ABKA 1000/1500	45,800	70,990	5,434,218	1 51	115
Separators	17,560	27,218	2,062,558	1 51	114
High voltage equipment	350,000	542,500	23,206,105	-	43
Switch VVD 220-40/2000	72,000	111,600	6,545,322	1 2	70
Turbocompressors	21,480	33,294	3,708,492	1 51	168
Transformer TRDNS-4000/20	79,000	122,450	14,654,165	1 21	144
GROUP 1 EQUIPMENT TOTAL	13,903,541	127,028,488			
2 Other equipment					
	307,010	590,951	32,855,450	1 51	109
TOTAL					

MARKET VALUE OF MAJOR ITEMS OF EQUIPMENT AS AT 01 01 96

OPTION 1

tenge

Capital asset group	Values as at 01 08 1995	Market value	Factor
Buildings	1,273,089,406	1,909,634,107	1 5
Installations	514,205,926	771,308,888	1 5
Transmission systems	469,820,341	657,748,477	1 4
Machinery and equipment including	3,594,253,024	89,031,824,183	24 8
Power generation machinery and equipment	3, 439,167,851	85,039,929,512	24 7
Operating machinery and equipment	155,085 173	3,991,894,671	23 7
Measuring and control instrumentation and equipment, laboratory equipment			
Computers	9,950,379	82,907,240	8 3
Other machinery and equipment	171,370	254,286	1 5
Transport facilities Rail	46,853,774	120,906,092	2 6
Tools	120,878	401,283	3 3
Minor manufacturing and auxiliary equipment	2,388,654	3,394,965	1 5
TOTAL	5,918,679,839	93,083,769,968	15 7

CAPITAL ASSET VALUE COMPARED WITH PRODUCTION COSTS
OPTION 2

Capital asset group	Relative value	Necessary replacement value	
		At Kazakstan electricity prices as at 01 01 96	At world electricity prices
Buildings	20 2	18,460 5	33,300 1
Installations	8 2	7,495 9	13,512 8
Transmission systems	9 3	8,503 7	15,332 5
Machinery and equipment including			
Power generation machinery and equipment	58 5	53,491 3	96,442 8
Operating machinery and equipment	2 6	2,375 4	4,276 7
Measuring and control instrumentation and equipment, laboratory equipment	0 12	105 7	197 5
Computers	0 17	155 4	280 3
Other machinery and equipment	0 002	1 8	3 2
Transport facilities Rail	0 9	821 0	1,473 8
Tools	0 0015	1 4	2 5
Minor manufacturing and auxiliary equipment	0 03	27 4	49 5
TOTAL	100%	91,438 1	164,876 7

Note 1 At Kazakstan prices Design output x price of 1 kWh x depreciation charge factor x service life = 25924 X 1 19 x 0 078 x 38 = 91438 1
2 At world prices 25924 x 6 0 x 0 053 x 20 = 164876 7

RECALCULATION OF FIXED ASSET VALUES
BASED ON ROUBLE TO TENGE EXCHANGE RATES

OPTION 3

Capital asset group	Gross book value at 1984-1991 prices before revaluation mln roubles	Gross replacement value as at 01 08 1995, mln tenge
Buildings	154 0	23,664 6
Installations	62 2	9,558 3
Transmission systems	42 5	5,220 6
Machinery and equipment including	397 3	56,966 2
Power generation machinery and equipment	377 3	54,107 3
Operating machinery and equipment	17 0	2,299 9
Measuring and control instrumentation and equipment, laboratory equipment		
Computers	1 9	276 9
Other machinery and equipment	0 02	2 7
Transport facilities Rail	0 8	98 3
Others	4 5	
Tools	0 01	2 8
Minor manufacturing and auxiliary equipment	0 3	56 3
TOTAL	661 6	96,006 4

Note 1 The official rouble to tenge exchange rate on 01 07 95 was 109 42
2 the revaluation factor applied to 01 08 95 was 1 4

THE GROSS REPLACEMENT COST OF EKIBASTUZ NO 1 THERMAL POWER STATION
AS AT 01 07 95 CALCULATED ON THE BASIS OF A CONSOLIDATED BUDGET AND MARKET-BASED
CAPITAL CONSTRUCTION INFLATION RATES

OPTION 4

Form of Expenditure	Consolidated budget cost at 1969 prices, 000 roubles	PRICES CONVERSION FACTORS				Depreciated replacement cost at 01 08 85 prices, mln tenge
		K 1	K 2	K 3	K 4	
Building and construction	213,770 6	1 18	1 54	49,651		19,287 6
Installation	85,046 9	1 18	1 54	49,651		7,673 4
Equipment	240,878 2	1 13	1 55	125 0	1 4	73,832 2
Other expenditure	58,391 8	1 0	1 09	49,651	1 7	5,372 2
TOTAL	598,087 5					106,165 4

Note K 1 - 1969 to 1984 price conversion factor
K 2 - 1984 to 1991 price conversion factor
K 3 - Conversion factor used to arrive at 1995 market prices
K 4 - 01 07 95 to 01 08 95 price conversion factor

REPLACEMENT AND DEPRECIATED VALUE OF CAPITAL ASSETS
AT EKIBASTUZ NO 1 THERMAL POWER STATION
CALCULATION BASED ON ACTUAL AND STANDARD
COSTS OF A MAJOR OVERHAUL

OPTION 5

Capital asset group	Gross book value as at 01 07 1995 (not indexed to 01 07 1995), mln tenge	The cost of actual major overhauls carried out in 1995, mln tenge	Standard essential fixed asset replacement cost, mln tenge
Buildings	848 7	102 0	3,519 0
Installations	342 8	155 7	5,371 7
Transmission systems	399 9	177 0	6,106 5
Machinery and equipment, including	2,579 4	2,877 0	99,256 5
Power generation machinery and equipment	2,456 5	2,689 9	92,801 5
Operating machinery and equipment	110 8	52 7	1,818 2
Measuring and control instrumentation and equipment, laboratory equipment	4 9	124 0	4,278 0
Computers	7 1	10 4	358 7
Other machinery and equipment	0 1		
Transport facilities Rail	6 7	37 7	1,300 7
Others	31 5		
Tools	0 06	3 3	113 9
Minor manufacturing and auxiliary equipment	1 4		
Non-industrial operations		13 3	458 9
TOTAL	4,201 7	3,500 4	120,763 8

Note The maintenance fund support factor K = 34 5

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FIXED ASSET REPLACEMENT VALUE CALCULATED ON THE BASIS OF WORLD PRICES FOR EQUIPMENT AT THE TIME OF CONSTRUCTION OF THE POWER STATION, WITH ALLOWANCE FOR OPERATIONAL WEAR AND TEAR
OPTION 6

mln tenge

Capital asset group	Gross book value as at 01 07 95 (not indexed to 01 07 95)	Relative value, %	Gross value at world prices	Depreciation	Depreciated value	
					Upper limit	Lower limit
Buildings	848 7	20 2	64,640 0	28,441 6	36,198 4	19,198 1
Installations	342 8	8 2	26,240 0	11,545 6	14,694 4	7,793 3
Transmission systems	390 9	9 3	29,760 0	13,094 4	16,665 6	8,838 7
Machinery and equipment, including	2,579 4	61 4	196,480 0	86,451 2	110,028 8	58,354 6
Power generation machinery and equipment	2,456 5	58 5	187,200 0	82,368 0	104,832 0	55,598 4
Operating machinery and equipment	110 8	2 6	8,320 0	3,660 8	4,659 2	2,471 0
Measuring and control instrumentation and equipment, laboratory equipment						
Computers	7 1	0 17	544 0	239 4	104 6	161 6
Other machinery and equipment	0 1	0 002	6 4	2 8	3 6	1 9
Transport facilities Rail	6 7	0 16	512 0	225 3	286 7	152 1
Others	31 5	0 7	2,240 0	985 6	1,254 4	665 3
Tools	0 06	0 015	4 8	2 1	2 7	1 4
Minor manufacturing and auxiliary equipment	1 4	0 03	96 0	42 2	53 8	28 5
TOTAL	4,201 7	100%	320,907 2	141,199 2	179,708 0	95 309 5

Notes 1 The service life of fixed assets is assumed to be 25 years This assumption is based on Russian operational practice, whereby the machinery operates for 150 000 hours after its service life has been extended and has 2 such consecutive periods, each of 20 000 hours The depreciation factor = 0 44

2 Equipment efficiency factor = Actual output/Design output = 0 297

AVERAGED-OUT COST OF EQUIPMENT ESCALATION FACTORS
CALCULATION BASED ON A COMPARISON OF 1995 PRICES WITH 1991 PRICES

Equipment type	List price in 1994, tenge	Number of machines installed	Contribution to total cost of power station equipment, %	Equipment cost escalation factor	Unit cost factor
1 Major equipment					
Boiler PI-1650	7,213,663	8	21 2	165	3,498
Turbine K-500/240	3,248,518	8	9 5	142	1,349
Turbogenerator TGB-500	1,340,000	8	3 9	165	644
Transformer TTS-630000	585,000	8	1 7	145	247
Forced-draft blower	595,500	16	3 5	44	154
Turbine K-11, OP-1	175,000	8	0 5	173	87
Electrostatic filters	42,180	16	0 3	74	17
Pump OPV-5-145	22,500	18	0 25	115	17
Pump TSN-3000-197	66,500	8	0 2	159	32

AVERAGED-OUT COST OF EQUIPMENT ESCALATION FACTORS
CALCULATION BASED ON A COMPARISON OF 1995 PRICES WITH 1991 PRICES
CONT'D

Equipment type	List price in 1994, tenge	Number of machines installed	Contribution to total cost of power station equipment, %	Equipment cost escalation factor	Unit cost factor
1 Major equipment					
Raw water heaters	28,780	8	0 1	77	8
Electric motor ABKA 1000/1500	45,800	16	0 3	115	35
Separators	17,560	8	0 05	114	6
High voltage equipment	350,000	8	1 0	43	43
Switch VVD 220-40/2000	72,000	8	0 2	70	14
Turbocompressors	21,480	8	0 6	168	101
Transformer TRDNS-4000/20	79,000	8	0 2	144	29
GROUP 1 EQUIPMENT TOTAL	13,903,541		43 4		6,286
2 Other equipment					
			56 6	109	6,170
TOTAL			100 0		12,456

K=109 - arithmetic average factor for equipment cost escalation for the two groups

The relative contribution of equipment to costs was determined taking into account the total cost of Ekibastuz No 1 equipment at 1984 prices (272 2 mln roubles)

K=125 - averaged equipment cost escalation factor

Appendix F

Example of Wholesale Tariff Calculation Based on Rate of Return

Because the power sector is making a transition to a competitive wholesale market, it is not worthwhile to calculate wholesale tarifs based on rate of return Instead, in Chapter 6, we project transitional tariffs on the basis of a moderate 10 percent increase in the average tariff at the wholesale level The methodology presented in Chapter 3 for the calculation of transmission charges could be modified to calculate sales tariffs for Kazakstanenergo Several steps would be involved

1 *Energy balance* Estimate the amount of electricity purchased and sold by Kazakstanenergo, including imports and exports (See Appendix B for sample calculations)

2 *Asset revaluation* Estimate the value of the high-voltage network owned by Kazakstanenergo (See Appendix L for sample calclations)

3 *Strict marginal cost tariffs* Calculate the marginal cost of energy and the margianl cost of capacity at different voltage levels Using marginal costs at high voltage, calculate demand and energy charges for different classes of customers of Kazakstanenergo Calculate the system average tariff based on marginal cost (See Chapter 5 for sample calculations)

4 *Transmission system revenue requirement* Estimate the rate of return that would be needed to attract capital investment in the company Then calculate the sum of three components (1) depreciation, based on revalued assets (2) a rate of return on net revalued assets (3) annual operation and maintenance expenses associated with the transmission system and the dispatch department

5 *Purchased power cost* For each generating company, autoproducer, and foreign country selling electricity to Kazakstan, estimate the prices at which

Kazakstanenergo will purchase capacity and energy (See Appendix D for a sample short-term projection)

6 *Average tariff based on rate of return* Calculate the total annual revenue requirement, which equals the cost of purchased electricity plus the transmission system revenue requirement Then calculate the average tariff by dividing the total annual revenue requirement by the quantity of energy sold by Kazakstanenergo

7 *Adjustment of marginal cost tariffs* The marginal cost tariffs for customers of Kazakstanenergo are multiplied by the ratio of the average tariff based on rate of return to the average tariff based on marginal cost The result is a set of *wholesale tariffs*

A sample calculation of the average tariff based on the rate of return (Step 6) is shown on the following pages The estimates of power purchases and sales were made in March 1996 and now outdated

Step 7 is required because the average tariff based on the rate of return or other financial criteria is normally different from the average tariff based on marginal cost There are several reasons why this result is normal

- In most power systmes there are some older generating stations with costs below LRMC - for example, hydrostations which cannot be duplicated in the future

- The LRMC calculation is typically based on the least-cost mix of generation sources under stable consitions The actual mix of generation sources usually does not represent the perfect least-cost solution to the power system's needs based on the level of customer peak load, the fuel prices, restrictions on the fuel availability, and other parameters For example, it is common to find that the actual reserve margin is either too high or too low relative to the optimal reserve margin needed to achieve a reliability target

- The actual rate of return on capital for existing power stations and networks usually does not match the simple theoretical parameters used to show the rate of return on capital in the LRMC calculation For example, the actual

rate of return may be negative during periods of high inflation

In some situations Step 7 should not be implemented at all For example, a large industrial customer may argue that he should receive a lower price for electricity because he is able to generate electricity more cheaply, for his own consumption, than he can buy it from the network - either from generating companies or from resellers such as regional networks In this situation the prices charged by the owner of the network (a natural monopoly) should equal the long-run marginal cost of network services, and the prices charged by generating companies should be competitive prices If the industrial customer is able to generate electricity very cheaply, he should do so, but the network enterprise should not offer to sell electricity at a price which is lower than long-run marginal cost

Example of Wholesale Tariff Calculation

	1996	1997	1998	1999	2000
Target Rate of Return	20 0%	on revalued net fixed assets			
Per cent of Target Return each year	100%	100%	100%	100%	100%
Exchange Rate -- Tenge/US $	65				
Purchase Costs					
Net generation by NES gencos, GWh					
Ekibastuz 1	6,967	6,967	6,967	6,967	8,000
Ekibastuz 2	4,173	2,968	3,864	3,414	2,514
Karaganda 2	3,120	3,120	3,120	3,120	3,120
Zhambyl	5,583	5,583	5,583	5,583	5,583
Total	19,843	18,638	19,534	19,084	19,217
Unit purchase tariff, Tenge/kWh					
Ekibastuz 1	2 652	2 630	2 574	2 519	2 377
Ekibastuz 2	2 994	3 994	3 050	3 286	4 108
Karaganda 2	1 048	1 261	1 297	1 332	1 340
Zhambyl	1 557	1 612	1 599	1 587	1 575
Average	2 164	2 313	2 186	2 190	2 202
Energy purchase costs, million Tenge					
Ekibastuz 1	18,475	18,323	17,936	17,550	19,014
Ekibastuz 2	12,494	11,856	11,785	11,216	10,329
Karaganda 2	3,270	3,934	4,045	4,157	4,180
Zhambyl	8,695	8,998	8,930	8,861	8,793
Total	42,933	43,109	42,696	41,785	42,316
Net generation by other Kaz producer	GWh				
Auto producer -- AK Turbo	775	775	775	775	775
IPP -- Yermakovskaya	10323	10323	10323	10323	10323
Bukhtarminskaya	2,849	2,849	2,849	2,849	2,849
Kapchagayskaya	866	866	866	866	866
Total	14,813	14,813	14,813	14,813	14,813
Unit purchase tariff, Tenge/kWh					
Auto producer -- AK Turbo	1 625	1 625	1 625	1 625	1 625
IPP -- Yermakovskaya	0 831	1 591	1 636	1 680	1 703
Bukhtarminskaya	0 081	0 650	1 300	1 300	1 300
Kapchagayskaya	0 126	0 650	1 300	1 300	1 300
Average	0 687	1 357	1 551	1 582	1 598
Energy purchase costs, million Tenge					
Auto producer -- AK Turbo	1259	1259	1259	1259	1259
IPP -- Yermakovskaya	8573	16422	16884	17346	17577
Bukhtarminskaya	231	1852	3704	3704	3704
Kapchagayskaya	109	563	1126	1126	1126
Total	10173	20096	22973	23435	23666

Example of Wholesale Tariff Calculation

	1996	1997	1998	1999	2000
Purchases from other countries, GWh					
Russia	4,527	4,600	4,600	4,600	4,600
Turkmenistan	1,405	1,405	1,405	1,405	1,405
Uzbekistan	400	400	400	400	400
Kyrgistan	935	935	935	935	935
Total	7,267	7,340	7,340	7,340	7,340
Unit purchase tariff, US cents/kWh					
Russia	3 300	3 300	3 300	3 300	3 300
Turkmenistan	4 000	4 000	4 000	4 000	4 000
Uzbekistan	4 500	4 500	4 500	4 500	4 500
Kyrgistan	3 000	3 000	3 000	3 000	3 000
Transit fee US cents/kwh/1000km					
by Uzbek from Turkmen	0 500	0 500	0 500	0 500	0 500
by Uzbek from Kyrgiz	0 500	0 500	0 500	0 500	0 500
Average Purchase Tariff (cents/kwh)	3 559	3 556	3 556	3 556	3 556
Average Purchase Tariff (Ten/kwh)	2 313	2 311	2 311	2 311	2 311
Energy purchase costs, million Tenge					
Russia	9,710	9,867	9,867	9,867	9,867
Turkmenistan	3,653	3,653	3,653	3,653	3,653
Uzbekistan	1,170	1,170	1,170	1,170	1,170
Kyrgistan	1,823	1,823	1,823	1,823	1,823
Plus Transit by Uzbek from Turkmen	368	368	368	368	368
by Uzbek from Kyrgiz	84	84	84	84	84
Total	16,809	16,966	16,966	16,966	16,966
Less VAT on Purchased Power (IPP's plus Other Countries)	4,497	6,177	6,656	6,734	6,772
Total Net Energy Purchased (Gwh)	41,923	40,791	41,687	41,237	41,370
Av Energy Cost (Tenge/kwh)	1 560	1 814	1 823	1 830	1 841
Total Energy Purchase Costs	65,418	73,994	75,978	75,452	76,176

Example of Wholesale Tariff Calculation

		1996	1997	1998	1999	2000
Revalued Fixed Assets of the NES network						
Gross Book Value @	08 01 95					
Accumulated Depreciation						
Net Book Value @	08 01 95					
Revaluation Factor @	17/11/95					
Revalued Fixed Assets @		Jan 1,1996				
Gross Book Value (opening)		14,901	14,901	14,901	14,901	14,901
Accumulated Depreciation		0	1,162	2,325	3,487	4,649
Net Book Value (opening)		14,901	13,739	12,576	11,414	10,252
Annual Depreciation Rate		0 078				
Capital Expenditure						
Generation						
Transmission						
Total		0	0	0	0	0
Revalued Fixed Assets of the Inter System Networks						
Gross Book Value @	08 01 95					
Accumulated Depreciation						
Net Book Value @	08 01 95					
Revaluation Factor @	17/11/95					
Revalued Fixed Assets @		Jan 1,1996				
Gross Book Value (opening)		9,504	9,504	9,504	9,504	9,504
Accumulated Depreciation		0	741	1,483	2,224	2,965
Net Book Value (opening)		9,504	8,763	8,021	7,280	6,539
Annual Depreciation Rate		0 078				
Capital Expenditure						
Generation						
Transmission						
Total		0	0	0	0	0

Example of Wholesale Tariff Calculation

	1996	1997	1998	1999	2000
Expenses of the NES network					
Production Services	68 9	68 9	68 9	68 9	68 9
Auxiliary Materials	127 2	127 2	127 2	127 2	127 2
Energy	158 5	158 5	158 5	158 5	158 5
Wage Costs	147 9	147 9	147 9	147 9	147 9
Employee welfare expenditures	54 4	54 4	54 4	54 4	54 4
Social Development Fund					
Repair Fund	1,000 4	1,000 4	1,000 4	1,000 4	1,000 4
Emission/Pollution Control	0 1	0 1	0 1	0 1	0 1
Other Cash Expenditures	71 7	71 7	71 7	71 7	71 7
Land and Property Taxes	74 5	74 5	74 5	74 5	74 5
Total Expenses (excl Amortization)	1,703 6	1,703 6	1,703 6	1,703 6	1,703 6
Expenses of the Inter Electric System Network					
Production Services	29 0	29 0	29 0	29 0	29 0
Auxiliary Materials	15 6	15 6	15 6	15 6	15 6
Energy	181 1	181 1	181 1	181 1	181 1
Wage Costs	108 1	108 1	108 1	108 1	108 1
Employee welfare expenditures	34 4	34 4	34 4	34 4	34 4
Social Development Fund	16 0	16 0	16 0	16 0	16 0
Repair Fund	277 0	277 0	277 0	277 0	277 0
Emission/Pollution Control					
Other Cash Expenditures	29 0	29 0	29 0	29 0	29 0
Land and Property Taxes	50 2	50 2	50 2	50 2	50 2
Total Expenses (excl Amortisation)	740 4	740 4	740 4	740 4	740 4
Total network expenses	2,444 0	2,444 0	2,444 0	2,444 0	2,444 0

Example of Wholesale Tariff Calculation

	1996	1997	1998	1999	2000
Tariff calculation At constant prices, ignoring taxation of profits					
Target Rate of Return --	20 0%	20 0%	20 0%	20 0%	20 0%
Revalued Net Fixed Assets (NES plus Intersystem)	24,405	22,501	20,598	18,694	16,791
Required Net Income	4,881	4,500	4,120	3,739	3,358
Depreciation on Revalued Assets	1,904	1,904	1,904	1,904	1,904
Forecast Expenses	2,444	2,444	2,444	2,444	2,444
Total Energy Purchase Costs	65,418	73,994	75,978	75,452	76,176
Total Revenue Required	74,647	82,842	84,446	83,539	83,882
Less Revenue from Heat					
Net Revenue Required from Electricity	74,647	82,842	84,446	83,539	83,882
Net Purchases by NES (Gwh)	41,923	40,791	41,687	41,237	41,370
Less Transmission Losses -- %	3 36%	3 35%	3 35%	3 35%	3 35%
--	1,410	1,367	1,397	1,381	1,386
Net Sales by NES (Gwh)	40,513	39,425	40,290	39,855	39,984
Required Tariff -- Tenge/kwh	1 843	2 101	2 096	2 096	2 098
Required Tariff -- US cents/kwh	2 83	3 23	3 22	3 22	3 23

Appendix G

Actual and Proposed Tariffs for Kazakstanenergo

This appendix contains the following tables

1 *Kazakstanenergo's December 1995 Calculation of the 1996 Tariff* This table shows a tariff proposal which was submitted by Kazakstanenergo in December 1995 but not approved by the government This table was prepared by Hagler Bailly Consulting on the basis of tables provided by Kazakstanenergo This is the only tariff calculation for which Hagler Bailly received complete supporting information, including projections of generating capacity, energy generated, and fuel cost

2 *Calculation of the Electricity Sales Tariff for the Period from 1 February 96 to 31 March 96* This table shows tariffs approved by the chairman of the AMC on 31 January 96 Average tariffs for all of the energos are shown, in addition to the average tariff for Kazakstanenergo This table was prepared by Kazakstanenergo

3 *Kazakstanenergo's February 1996 Calculation of the 1996 Tariff* These tables show the tariff effective at the beginning of the second quarter (1 April 96) The first table shows the tariff proposal submitted by Kazakstanenergo and the second table shows the tariff approved by the government in February 1996 These tables were prepared by Hagler Bailly Consulting on the basis of tables provided by Kazakstanenergo

4 *Kazakstanenergo's 1996 Tariff Calculation for Purchased Power* These tables were prepared by Kazakstanenergo This is a set of four tables corresponding to four calendar quarters The tenge is projected to lose its value against the dollar, the exchange rate moves from 65 tenge/$ in the first quarter to 75 tenge/$ in the fourth quarter

5 *Comparison Table of Electricity Tariffs Before and After Fixed Assets Revaluation* This table was prepared by Kazakstanenergo The proposed tariff in Option 1 is based upon the status quo - the calculation of Net Fixed Assets according to coefficients established by the government The tariff proposal presented in Option 2 is to calculate Net Fixed Assets on the basis of the market value of these assets, to allocate "profits" to the Repair Fund and the Capital Investment Fund, and to lower the amount of profit taxes

Kazakstanenergo s December 1995 Calculation of the 1996 Tariff

(Expenses are shown in thousand tenge)

		Ekibastuz GRES 1	Ekibastuz GRES 2	Zhambyl GRES	Karaganda GRES 2	South Kazakhstan GRES	Ekibastuz CHP	National Electric System network	Inter Electric System network	Purchased electric energy	Central Dispatch Admin	Admin expenses	Subtotal	Ust Kamenogorsk	Shulbinsk	Total
1	Production related services	674 400	558 522	18 300	2 231	2 591	225 573	72 780	30 000				1 584 397	21 780	15 350	1 621 527
2	Raw basic materials							420					420			420
3	Auxiliary materials	48 000	42 000	70 200	40 136	28 000	40 000	126 130	15 961				410 427	3 700	6 000	420 127
4	Fuel	2 003 027	1 130 957	6 719 173	1 084 136	61 890	245 992	0	0				11 245 176			11 245 176
	including fuel for elec gen	1 998 232	1 057 301	6 706 370	951 381	0	0						10 713 284			10 713 284
	fuel for heat supply	4 795	73 656	12 803	132 755	61 890	245 992						531 892			531 892
5	Energy from outside	9 671	27 291	6 840	13 739	66 000	36 000	133 530	217 307				505 323	6 000	11 900	523 223
	Subtotal cost of materials	2 735 048	1 758 770	6 814 513	1 140 242	158 481	547 565	332 860	258 263				13 745 743	31 480	33 250	13 810 473
6	Labor cost	527 764	342 780	167 775	183 560	87 897	381 074	147 927	117 079				1 950 056	20 352	52 802	2 023 210
7	Deduction for social security	154 718	119 973	60 299	67 658	26 369	171 928	51 774	35 109				667 828	7 635	19 668	695 131
9	Depreciation of assets	1 077 000	2 799 000	100 000	330 000	397 000	470 000	1 167 000	587 000				6 857 000	50 000	79 000	6 986 000
10	Deduction into repair fund	3 300 000	1 700 000	714 000	1 150 000	50 000	600 000	1 049 000	300 000				7 863 000	18 700	28 000	7 909 700
11	Miscellaneous cash expenses	42 000	25 000	23 457	28 930	4 267	152 470	40 930	25 000				341 944	613	4 364	346 921
12	Interest on loans												0			0
13	Cover for repair fund deficit	855 000											855 000			855 000
14	Fees for emissions	150 333	8 200	25 997	320 244	1 561	22 794	145					559 269			559 269
15	Fees for land use												0			0
16	Purchase of wheeled energy												0			0
17	Medical insurance	26 388	19 853	8 953	10 057	4 395	20 956	8 136	6 436				104 174	1 119	2 905	108 198
18	Expenses of future periods												0			0
	Subtotal expenses	8 878 251	6 272 576	7 409 984	3 229 891	719 965	2 316 737	2 792 772	1 323 837				32 944 014	129 899	219 989	33 293 902
19	Employment fund	10 555	6 856	3 256	3 657	1 758	7 670	2 959	2 341				39 002	407	1 056	40 465
20	Road fund	135 555	75 000	76 810	51 677	4 794	16 539	29 419	12 446				402 240	1 111	2 183	405 534
21	Transport tax												0			0
22	Land tax												0			0
23	Deductions for R&D												0			0
24	Property tax												0			0
25	Financial regulation fund												0			0
26	Production cost of products	9 024 361	6 354 432	7 490 050	3 285 225	726 517	2 340 896	2 825 150	1 338 624	22 485 112	88 800	375 000	56 334 169	131 417	223 228	56 688 814
A	including electric energy	8 990 652	6 143 868	7 475 906	2 890 998	632 772	198 397	2 825 150	1 338 624	22 485 112	88 800	375 000	53 445 281	131 417	223 228	53 799 926
	thermal energy	33 250	206 309	14 144	394 227	77 890	1 962 975									
	other products	459	4 255	0	0	15 865	179 574									
B	27 Useful output of electric energy Gwh	7 050 4	4 222 5	5 650 3	3 157 3	15				20 434			40 515	1 702	1 585	43 802
	28 Useful output of thermal energy 000 Gcal	35	220	22	996 9	110	2 305 6							7 72	14 08	122 83
C	29 Cost of electricity tyn/kWh	127 52	145 50	132 31	91 57	4218 48										
	30 Cost of heat tenge/Gcal	950	937 77	642 91	395 45	708	851 37									
	31 Output of electric energy at the busbar Gwh	7 050 4	4 222 5	5 650 3	3 157 3										1 585	
	32 Output of thermal energy at the collector 000 Gcal	35	220	22	996 9	110	2 305 6									
D	33 Fuel cost component of the cost of electricity tyn	28 34	25 04	118 69	30 13											
	34 Fuel cost component of the cost of heat tenge	137	334 8	581 97	133 17	562 64	106 69									

Kazakstanenergo s December 1995 Calculation of the 1996 Tariff

(Expenses are shown in thousand tenge)

	Ekibastuz GRES 1	Ekibastuz GRES 2	Zhambyl GRES	Karaganda GRES 2	South Kazakhstan GRES	Ekibastuz CHP	National Electric System network	Inter Electric System network	Purchased electric energy	Central Dispatch Admin	Admin expenses	Subtotal	Ust Kamenogorsk	Shulbinsk	Total
Other revenue excluded from inc tax	180 000	555 500	1 000	130 200	235 500	783 900		89 300				1 975 400	12 400	71 200	2 059 000
E Repair fund				727 000								727 000			727 000
Expenses excluded from income tax															
Transport tax								700				700			700
Land tax	11 300		400	2 800	300	6 500		2 000				23 300	300		23 600
Property tax	209 300	122 900	21 900	21 100	24 800	22 700	74 500	47 500				544 700	3 300	5 100	553 100
Total	220 600	122 900	22 300	23 900	25 100	29 200	74 500	50 200	0	0	0	568 700	3 600	5 100	577 400
Income tax	118 243	80 400	75 429	NA	111 257	127 843	279 129	62 357	0	0	438 000	NA	7 543	124 071	NA
Distribution of after tax income															
I Capital expenditures				341 000	224 000		555 000				1 000 000	2 120 000		236 000	2 356 000
G Fund for social development	207 000	581 200	105 400	133 200	239 500	900 000		197 500			2 300	2 266 100	17 500	94 700	2 378 300
H Consumption fund	248 900	161 900	71 600	84 000	31 600	287 200	96 300	37 300			19 700	1 033 500	12 500	30 000	1 076 000
I Total	455 900	743 100	177 000	558 200	495 100	1 082 200	651 300	234 800	0	0	1 022 000	5 419 600	30 000	360 700	5 810 300
J 2nd part of rev inc requirement	794 743	946 400	274 729	983 629	631 457	1 239 243	1 004 929	347 357			1 460 000	7 682 486	41 143	489 871	8 213 500
K Total expenses plus profit	9 785 395	7 090 268	7 750 635	3 874 627	1 264 229	1 437 640	3 830 079	1 685 981	22 485 112	88 800	1 835 000	61 127 766	172 560	713 099	62 013 426
L Tariff tyn/kWh	138 79	167 92	137 17	122 72								150 88	10 14	44 99	141 58
Amounts requested															
M Depreciation	1 027 000	2 799 000	100 000	330 000	387 000	470 000	1 162 000	582 000				6 857 000	50 000	79 000	6 986 000
N Capital expenditures	1 027 000	2 799 000	59 000	671 000	611 000	470 000	1 717 000	582 000			1 000 000	8 936 000		315 000	9 251 000
O Repair fund	3 300 000	1 200 000	214 000	1 150 000	50 000	600 000	1 049 000	300 000			3 000	7 866 000	18 700	28 000	7 912 700

Kazakstanenergo s December 1995 Calculation of Purchased Power Costs

	Russia	Turkmenistan	Uzbekistan	Kyrgyzstan	Tajikistan	AO AkTurbo	Subtotal	Yermakovskaya GRES	Bukhtarminskaya GRES	Kapchagayskaya GRES	Total
Purchases GWh	4 527	1 405	400	935	0	775	8 042	10 323	2 849	866	22 080
Tariff for purchases											
cents/kWh	3 30	4 00	4 50	3 00		2 50					
tyn/kWh								83 05	8 12	12 55	
Cost of purchases											
thousand USD	149 391	56 200	18 000	28 050	0	19 375	271 016				
thousand tenge								8 573 252	231 339	108 683	
Transit for Kazakstan GWh		1 405		468		775					
Transit tariff c/kWh/1000km		0 50		0 50							
Distance km		807		555							
Transit tariff cents/kWh		0 40		0 28							
Cost of transit thousand USD		5 669		1 297							
Cost of purchases plus transit thousand tenge	9 710 415	4 021 496	1 170 000	1 907 575	0	1 259 375	18 068 862	8 573 252	231 339	108 683	26 982 135
Cost of purchases plus transit without VAT thousand tenge	8 092 013	3 351 247	975 000	1 589 646	0	1 049 479	15 057 385	7 144 376	192 782	90 569	22 485 112
Cost of purchased power net of transit fees tyn/kWh	178 75	238 52	243 75	170 02		135 42	187 23	69 21	6 77	10 46	101 83

Exchange rate 1USD = 65 tenge
VAT = 20%

AGREED
Chairman of AMC (signature)
January 31 1996

APPROVED
Minister of Energy (signature)
Dated

Calculation of the Electricity Sales Tariff for the Period from 1 February to 31 March 1996

	Cost based Expenses mln tenge	Useful output of e/energy mln KWh	Production cost tyn/kWh	Revenue Requirement (mln tenge) Social development fund	Consumption fund	Total	Profit + Losses	Aggregate income mln tenge	Tariff tyn/kWh	Profitability %	Reference Tariff in 4Q 1995	Index of tariff growth as compared to 4Q 1995 %
Ermakovskaya GRES	671	1720 5	39				-	671	39	-	36 28	107 5
Bukhtarminskaya Hydro	22 8	474 8	4 81				+2 8	25 6	5 4	4	5 38	100
Kapchgayskaya Hydro	10 9	144 3	7 55				+1 8	12 7	8 8	6	8 75	100
NES Kazakstanenergo	5898 7	6752 2	87 36				-	5898 7	87 36	-	84	104
Almatyenergo	1002 9	710	141 3				+133 1	1136	160	13 2	155 67	102 8
Altayenergo	1129 8	930	121 48				0	1129 8	121 48	-	116 81	104
Atyrauenergo	291 5	162 2	179 72				-32	259 5	160	-	151 49	105 6
Zapkazenergo	599 3	411 1	145 8				+46 1	645 4	157	7 7	151 88	103 4
Karagandaenergo	2045 8	1317 4	155 3				+25 2	2070 9	157 2	1 2	151 22	103 95
Kostanayenergo	1010 4	698 8	144 59				-	1010 4	144 6	-	139 03	104
Pavlodarenergo	445 8	514 9	86 57				+79 4	525 2	102	17 8	99 25	102 8
Tselinenergo	1459	1063 3	137 21				-108 6	1350 4	127	-	118 93	106 8
Yuzhkazenergo	1469 4	654 8	224 4				-159 8	1309 6	200	-	191 47	104 46
Total for regions		6462 5						9437 2	146 03		140 36	104

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Kazakstanenergo's February 1996 Calculation of the 1996 Tariff

(Expenses are shown in million tenge)

	Ekibastuz GRES 1	Ekibastuz GRES 2	Zhambyl GRES	Karaganda GRES 2	South Kazakhstan GRES	Ekibastuz CHP	National Electric System network	Inter Electric System network	Purchased electric energy	Central Dispatch Admin	Admin expenses	Calculated total	Reported total
Tariff Proposal Submitted by Kazakstanenergo													
Total revenue requirement	7 908 3	4 191 7	5 421 1	3 154 5			3 037 3	1 484 5	21 785 4			46 982 8	50 988 2
1st part of rev req t production cost	7 108 9	3 245 2	5 213 9	2 891 0	*Data*	*Data*	2 825 3	1 138 7	21 785 4	*Data*	*Data*	44 208 3	45 503 2
including					*have not*	*have not*				*have not*	*have not*		
1 Production related services	*459 0*	*439 0*	*18 3*	*2 0*	*been*	*been*	*72 8*	*30 0*		*been*	*been*	1 021 1	*1 101 5*
2 Auxiliary materials	*99 6*	*46 0*	*99 8*	*33 9*	*provided by*	*provided by*	*126 5*	*16 0*		*provided by*	*provided by*	421 8	*503 6*
3 Fuel	1 998 0	*1 086 0*	*4 490 9*	*951 4*	*Kazakstan*	*Kazakstan*				*Kazakstan*	*Kazakstan*	8 526 3	8 526 3
4 Energy from outside	*9 7*	*39 0*	*6 8*	*11 7*	*energo*	*energo*	*133 5*	*212 3*		*energo*	*energo*	413 0	*486 4*
Subtotal cost of materials	2 566 3	1 610 0	4 615 8	999 0			332 8	258 3				10 382 2	10 617 8
5 Labor cost	528 0	*315 0*	162 8	*158 3*			147 9	*117 1*				1 429 1	*1 752 5*
6 Deduction for social security	168 9	117 0	*52 4*	61 8			54 4	37 4				491 9	*595 3*
Social insurance	*158 4*	*111 0*	*39 9*	*58 6*			*51 4*	*35 1*				454 4	*551 4*
Employment fund	*10 5*	*6 0*	*3 2*	*3 2*			*3 0*	*2 3*				28 2	*34 6*
Medical insurance												0 0	
Purchased electric energy									*21 785 4*			21 785 4	21 785 4
7 Depreciation of assets	*212 0*	*74 0*	*28 8*	*291 3*			*1 161 9*	*382 0*				2 150 0	*2 521 9*
8 Other expenditures	3 633 7	1 129 2	354 1	1 380 6			1 128 2	343 9				7 969 7	8 230 3
Repair fund	*3 331 7*	*1 100 0*	*216 0*	*1 017 8*			*1 049 0*	*300 0*				7 014 5	*7 117 0*
Interest on loans	*20 0*	*0 0*	*0 0*	*0 0*			*0 0*	*0 0*				20 0	*20 0*
Fees for emissions	180 0	8 2	26 0	*283 3*			0 1	0 0				497 6	*499 0*
Other cash expenditures	*102 0*	*21 0*	*112 1*	*79 5*			*79 1*	*43 9*				437 6	*594 3*
Production cost of electric energy tyn/kWh	100 83	76 86	92 28	91 57								109 12	112 32
2nd part of revenue requirement	799 4	946 5	207 2	263 5			212 1	345 8				2 774 5	5485 0
1 Expenses excluded from income tax	220 2	122 9	13 2	9 0			74 5	50 2				490 0	564 6
Land tax	*11 2*	*0 0*	*0 4*	*2 8*			*0 0*	*2 0*				16 4	16 4
Property tax	209 0	122 9	*12 8*	*6 2*			74 5	47 5				472 9	*547 5*
Transport tax	0 0	0 0	0 0	0 0			0 0	0 7				0 7	*0 7*
Other revenue excl from income tax	*168 2*	*555 2*	*1 6*	*130 2*			*0 0*	*0 0*				855 2	*1 922 0*
Income subject to income tax	411 0	268 4	192 4	124 3			137 6	295 6					2998 4
2 Income tax (30% of taxable income)	123 3	80 5	57 7	37 3			41 3	88 7				428 8	899 5
3 Distribution of after tax income	455 9	743 1	136 3	217 2			96 3	206 9				1 855 7	4 020 9
Social development fund	207 0	581 2	*91 3*	133 2			0 0	*176 5*				1 189 2	*2 230 8*
Consumption fund	248 9	161 9	*45 0*	84 0			96 3	*30 4*				666 5	*1 000 1*
Capital expenditures	0 0	0 0	0 0	*0 0*			*0 0*	0 0				0 0	*790 0*
Useful output of elec energy Gwh	7 050 4	4 222 0	5 650 3	3 157 3					20 434			40 514	*40 513*
Sales tariff tyn/kWh	112 17	99 28	95 94	99 91								115 97	125 86

Kazakstanenergo's February 1996 Calculation of the 1996 Tariff

(Expenses are shown in million tenge)

	Ekibastuz GRES 1	Ekibastuz GRES 2	Zhambyl GRES	Karaganda GRES 2	South Kazakhstan GRES	Ekibastuz CHP	National Electric System network	Inter Electric System network	Purchased electric energy	Central Dispatch Admin	Admin expenses	Calculated total	Reported total
Tariff Approved by the Government													
Total revenue requirement	5 005 0	2 100 0	5 421 1	1 543 4			2 160 1	968 6	19 536 4			36 734 7	40 463 1
1st part of rev req't production cost	4 622 5	2 100 0	5 213 9	1 389 9			1 948 1	829 1	19 536 4			35 639 8	36 789 9
including					*Data*	*Data*				*Data*	*Data*		
1 Production related services	*439 0*	*178 0*	*18 3*	*1 0*	*have not*	*have not*	*68 9*	*29 0*		*have not*	*have not*	734 2	*1 019 5*
2 Auxiliary materials	*90 0*	*46 0*	*99 8*	*16 9*	*been*	*been*	*127 2*	*15 6*		*been*	*been*	395 5	*470 7*
3 Fuel	*1 637 6*	*1 086 0*	*4 490 9*	*478 4*	*provided by*	*provided by*				*provided by*	*provided by*	7 692 9	7 692 9
4 Energy from outside	*9 0*	*39 0*	*6 8*	*5 8*	*Kazakstan*	*Kazakstan*	*158 5*	*181 1*		*Kazakstan*	*Kazakstan*	400 2	*458 7*
Subtotal cost of materials	2 175 6	1 349 0	4 615 8	502 1	*energo*	*energo*	354 6	225 7		*energo*	*energo*	9 222 8	9 856 0
5 Labor cost	*527 0*	*315 0*	162 8	*158 3*			147 9	*108 1*				1 419 1	*1 742 8*
6 Deduction for social security	160 0	117 0	*52 4*	61 8			54 4	34 4				480 0	*587 4*
Social insurance	*154 0*	*111 0*	*39 9*	*58 6*			*51 4*	*32 3*				447 2	*547 5*
Employment fund	*6 0*	*6 0*	*3 2*	*3 2*			*3 0*	*2 1*				23 5	*34 3*
Medical insurance												0 0	
Purchased electric energy									*19 536 4*			19 536 4	19 536 4
7 Depreciation of assets	*159 0*	*0 0*	*28 8*	*52 2*			*318 9*	*154 9*				713 8	*754 3*
8 Other expenditures	1 600 9	319 0	354 1	615 5			1 072 2	306 0				4 267 7	4 313 0
Repair fund	*1 523 9*	*290 0*	*216 0*	*288 7*			*1 000 4*	*277 0*				3 596 0	*3 334 5*
Interest on loans	*5 0*	*0 0*	*0 0*	*0 0*			*0 0*	*0 0*				5 0	*5 0*
Fees for emissions	*45 0*	8 0	26 0	*283 3*			0 1	0 0				362 4	*453 6*
Other cash expenditures	*27 0*	*21 0*	*112 1*	*43 5*			*71 7*	*29 0*				304 3	*519 9*
Production cost of electric energy tyn/kWh	65 56	49 74	92 28	44 02								87 97	90 81
2nd part of revenue requirement	382 5	0 0	207 2	153 5			212 1	139 5				1 094 8	3673 2
1 Expenses excluded from income tax	110 2	0 0	13 2	9 0			74 5	50 2				257 1	448 7
Land tax	*5 6*	*0 0*	*0 4*	*2 8*			*0 0*	*2 0*				10 8	*13 6*
Property tax	*104 6*	*0 0*	*12 8*	*6 2*			74 5	47 5				245 6	*434 4*
Transport tax	0 0	0 0	0 0	0 0			0 0	0 7				0 7	*0 7*
Other revenue excl from income tax	*79 2*	*0 0*	*1 6*	*76 2*			*0 0*	*0 0*				157 0	*155 8*
Income subject to income tax	193 1	0 0	192 4	68 3			137 6	89 3					3068 7
2 Income tax (30% of taxable income)	57 9	0 0	57 7	20 5			41 3	26 8				204 2	920 6
3 Distribution of after tax income	214 4	0 0	136 3	124 0			96 3	62 5				633 5	2 303 9
Social development fund	*103 4*	*0 0*	*91 3*	*76 0*			0 0	*16 0*				286 7	*1 606 1*
Consumption fund	*111 0*	*0 0*	*45 0*	*48 0*			96 3	*46 5*				346 8	*697 8*
• Capital expenditures	0 0	0 0	0 0	*0 0*			*0 0*	0 0				0 0	*0 0*
Useful output of elec energy Gwh	7 050 4	4 222 0	5 650 3	3 157 3					20 434			40 514	*40 513*
Sales tariff tyn/kWh	70 99	49 74	95 94	48 88								90 67	99 88

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Kazakstanenergo' 1996 Tariff Calculation For Purchased Power in 1 Quarter

Energy Systems	Electric energy purchased Gwh	Tariff on energy purchased curr unit/Kwh	Cost of energy purchased thous curr units	Electric energy wheeled Gwh	Transit tariff (1000km) curr unit/Kwh	Distance wheeled km	Calculated transit tariff curr unit/Kwh	Cost of energy wheeled thous curr unit	TOTAL with VAT thous curr unit	TOTAL without VAT thous curr unit	Tariff curr unit/Kwh
Russia	1700	3 3	56100						3646500	3038750	178 75
Turkmenistan	800	4	32000	800					2080000	1733333	216 67
Uzbekistan	200	4 5	9000						585000	487500	243 75
Kyrgyzstan											
AkTurbo	135	2 5	3375	135					219375	182813	135 42
TOTAL	2835									5442396	191 97
Yermakovskaya GRES	3029	46 8	1417572						1417572	1181310	39
Bukhtarminskaya (hydro)	773	6 5	50245						50245	41871	5 42
Kapchagayskaya (hydro)	184	10 6	19504						19504	16253	8 83
TOTAL	6821									6681830	97 96

Exchange rate tenge/$ 65

NOTE Annual amount of electricity purchased 21450 mln kWh -- 19072237 thous tenge
Currency units for Yermakovskaya GRES and two hydros - tenge for other countries - USD and cents

Kazakstanenergo s 1996 Tariff Calculation For Purchased Power in 2 Quarter

Energy Systems	Electric energy purchased Gwh	Tariff on energy purchased curr units/Kwh	Cost of energy purchased thous curr unit	Electric energy wheeled Gwh	Transit tariff (1000 km) curr units/Kwh	Distance wheeled km	Calculated transit tariff curr units/Kwh	Cost of energy wheeled thous curr unit	TOTAL with VAT thous curr unit	TOTAL without VAT thous curr unit	Tariff curr unit/Kwh
Russia	600	3 3	19800						1326600	1105500	184 25
Turkmenistan											
Uzbekistan											
Kyrgyzstan	399	3	11970	200					801990	668325	176 5
AkTurbo	189	2 5	4725	189					316575	263813	139 58
TOTAL	1188									2037638	171 52
Yermakovskaya GRES	2610	2 4	1258020						1258020	1048350	40 17
Bukhtarminskaya (hydro)	792	6 7	53064						53064	44220	5 58
Kapchagayskays (hydro0	249	10 9	27141						27141	22618	9 08
TOTAL	4839									3152825	65 15
Exchange rate tenge/$	67										

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Kazakstanenergo's 1996 Tariff Calculation For Purchased Power in 3 Quarter

Energy Systems	Electric energy purchased Gwh	Tariff on energy purchased curr units/Kwh	Cost of energy purchased thous curr unit	Electric energy wheeled Gwh	Transit tariff (1000 km) curr units/Kwh	Distance wheeled km	Calculated transit tariff curr units/Kwh	Cost of energy wheeled thous curr unit	TOTAL with VAT thous curr unit	TOTAL without VAT thous curr unit	Tariff curr units/Kwh
Russia											
Turkmenistan											
Uzbekistan											
Kyrgyzstan	546	3	16380	273					1146600	955500	175
AkTurbo	171	2 5	4275	171					299250	249375	145 83
TOTAL	717									1204875	168 04
Yermakovskaya GRES	2373	51 6	1224468						1224468	1020390	43
Bukhtarminskaya (hydro)	684	7 2	49248						49248	41040	6
Kapchgayskaya (hydro)	243	11 64	28285						28285	23571	9 7
TOTAL	4017									2289876	57
Exchange rate tenge/$	70										

Kazakstanenergo's 1996 Tariff Calculation For Purchased Power in 4 Quarter

Energy Systems	Electric energy purchased Gwh	Tariff on energy purchased curr units/Kwh	Cost of energy purchased thous curr units	Electric energy wheeled Gwh	Transit tariff (100 km) curr units/Kwh	Distance wheeled km	Calculated transit tariff curr units/Kwh	Cost of energy wheeled thous curr unit	TOTAL with VAT thous curr unit	TOTAL without VAT thous curr unit	TOTAL Tariff curr unit/Kwh
Russia	1700	3 3	56100						4207500	3506250	206 25
Turkmenistan	585	4	23400	585					1755000	1462500	250
Uzbekistan	200	4 5	9000						675000	562500	281 25
AkTurbo	189	2 5	4725	189					354375	295313	156 25
Kyrgyzstan											
TOTAL	2674									5826563	217 9
Yermakovskaya GRES	2311	55 2	1275672						1275672	1063060	46
Bukhtarminskaya (hydro)	600	7 7	46200						46200	38500	6 42
Kapchagayskaya (hydro)	188	12 5	23500						23500	19583	10 42
TOTAL	5773									6947706	120 35
Exchange rate tenge/$	75										

Comparison Table

of Electricity Tariffs Before and After Fixed Assets Revaluation

Options	Net Fixed Assets million tenge	Depreciation Deductions million tenge	Repair Fund Total	Repair Fund based on cost	Repair Fund based on profit	Capital Investment Total	Capital Investment based on cost	Capital Investment based on profit	Profit Taxes	Tariff tiin/KWh
Option 1 based on current coefficients	26052	2032	7912 7	2605	5307 7	9251	2032	7219	5368 6	150 82
Option 2 based on market value of fixed assets	138868	6986	7912 7	7185 7	727	9251	6986	2356	1321 3	141 58

NOTE

* NES "Kazakstanenergo" fixed assets value was used
* to compare the options equal expenses for overhaul and capital investments were used
* Property taxes were considered with regard to different cost of fixed assets
* Other taxes have similar value

Appendix H

Wholesale Power Contracts

The purchase and sale of electricity by Kazakstanenergo is subject to the terms and conditions of contracts This appendix contains four sample contracts

1 Contract for the purchase of electric energy from a generating station

2 Contract for the purchase of electric energy from an industrial company with surplus electric generating capacity

3 Contract for the sale of electric energy to a regional energy system (energo)

4 Contract for the sale of electric energy to a large industrial customer

CONTRACT

Almaty
1995

National Energy System "Kazakstanenergo" in the person of the General Director Mr Orazbayev B E , hereinafter referred to as "The Buyers" on the one part and _____, hereinafter referred to as "The Sellers" on the other part, governed by Rules and Regulations, have concluded the present Contract for the following

1 Subject of the Contract

1 1 "The Sellers" sell electric energy and National Energy System "Kazakstanenergo" buys it in the volume _____, according to the conditions listed in the Attachment 1, being an integral part of the present Contract

2 The Conditions of Electric Energy Output

2 1 Electric energy output is performed on buses _____

2 2 Parallel operations with other regional energy systems are carried out in accordance with the relevant documents and technical instructions of the Unified Dispatch Department of Kazakstan when the devices of relay protection of ani-emergency automatic equipment operate

2 3 Dispatching procedure is based on mutual understanding and mutual benefit and is identified by the regulations, instructions and other normative documents of the Unified Dispatch Department of Kazakstan

2 4 In accordance with the present Contract the electric energy transmisison is performed on the base of the daily load curve after its being co-ordinated with the Sellers and the Buyers within the monthly contractual value under direct participation and control of the Unified Dispatch Department of Kazakstan

2 5 All the offers related to the monthly volume of the co-ordinated quarter delivery of the electric energy are being correlated between both Parties not later than 15 days before the corresponding quarter begins

Prompt changes of daily volumes of electric energy don't require the monthly delivery volume adjustment Mutual settlements are focused on the monthly delivery volume and the changes of the contractual values relevant to the months of the current quarter are not stipulated

3 Procedure of Billing and Payment

3 1 Cost of the present Contract is 1031 5 mln tenge

3 2 30 days is a period which is considered to be an accounting period The Buyers should pay for the contractual monthly volume of the electric energy delivery

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3 2 1 Actual amount of the electric energy delivered to the Buyers is determined by the Sellers every month at 24 00 of the last day of the reporting period according to the indicators of the billing meters (meters location, their performance parameters are given in the Attachment 2) and is confirmed by the Buyers not later than within 7 days after the accounting month ends

After the monthly volume of electric energy delivery is conformed, the Buyers submit the unilateral Act which includes the delivery volume and the cost of delivery data

In case there is a discrepancy or difference in the Sellers' and the Buyers' data related to the volume of electric energy delivered or transmitted, all the disputes are to be settled by the Commission which should be created on the base of equal number of the representatives of each Party

Payment for the electric energy delivery is performed within the accounting month twice a month (12 and 25) with equal shares (portions) out of the contractual cost of monthly delivery volume The final settlement is performed on the 12th of the month following the accounting month

4 The Responsibilities of the Parties

4 1 Attachment 1 contains the payment rates for the deviation of actual monthly electric energy delivery value out of the contractual monthly volume

4 2 In case of incomplete or partial payment for the actual volume of the monthly delivery, 10 days after the date of final payment the Buyers should pay a fine at the rate of 0 1% of the sum of payment for the previous month for each day of delay

In case of 10 days (and more) delay in payment after the date of final payment for actual volume of energy delivery within the accounting period, the Sellers have a right to implement certain restrictions of electric energy sendout right up to the switching off the incoming power transmisison lines The Buyers should be informed about the restrictions mentioned 5 days before them being implemented

4 3 Paying a penalty and recovery of damages and losses do not release the Parties of the obligations stipulated in the present Contract

5 Force Majeure

The Parties will be released from their responsibilities for partial or complete non-execution of their liabilities under the present Contract, should this non-execution be caused by the circumstances of force majeure, namely natural disaster, military operations and other actions being the obstacles to execute the conditions of the present Contract In this case none of the Parties has a right to recover the damages and losses

The Party which is unable to fulfil its obligations under the present Contract due to the circumstances of force majeure is to inform the other Party within 3 days period in a written form In this case on demand of any of Parties an ad hoc Commission may be

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created and it will determine the possibility of further fulfilment of mutual obligations under the present Contract

6 Changes and Cancellation of the Contract

6 1 Disputes of the Parties related to the execution, changing and cancellation of the Contract are settled by the letters (cables) exchange, by concluding the documentary agreements and by other necessary measures

6 2 In case the Buyers do not execute the conditions of the present Contract, the Sellers have a right to cancel the Contract unilaterally without recovering the Buyers' damages and losses

6 3 Conditions of the Contract may be reconsidered at one of the Parties' initiative To do this within 15 days period a corresponding additional Attachment to the present Contract is to be drawn up and signed by the representatives of both Parties

7 Other Conditions

7 1 Electric energy delivery under the present Contract may be decreased or temporarily stopped in the following cases

- if both parties agreed
- if force majeure circumstances occur
- if the Buyers do not execute the conditions of the Contract

7 2 The Parties are to inform immediately each other about the cessation of energy delivery or decrease of energy output no matter what a reason might be

8 Term of Validity of the Contract and Legal Addresses of the Parties

8 1 The present Contract comes into effect from the moment of its signing by both Parties and is valid from January 1 to December 31, 1996

8 2 In case the requisites are changed the Parties are to inform each other about all the changes made within a 3 days period Otherwise a guilty Party bears responsibility for all the losses and damages

8 3 Legal addresses of the Parties and their settlement accounts

The Sellers	The Buyers
_____	_____
_____	_____
(signature)	(signature)
Seal	Seal

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9 Attachments

The Attachments which are an integral part of the present Contract

1 Electric energy delivery volume Price (tariff) Payment for deviation
2 A list of billing meters, their performance parameters and location

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CONTRACT

November 14, 1995
Almaty

National Energy System "Kazakhstanenergo" in the person of the General Director Mr Orazbayev B , hereinafter referred to as "The Sellers" on the one part and the Stock Corporation "Akturbo" in the person of the Executive Director Mr Iova N , hereinafter referred to as "The Buyers" on the other part, governed by Rules and Regulations, have concluded the present Contract for the following

1 Subject of the Contract

1 1 The Stock Corporation "Akturbo" sells electric energy and National Energy System "Kazakhstanenergo" purchases electric energy as much as 684 mln Kwh through the electric networks of the West Kazakhstan energy sysytem "Zapkazenergo" on the terms and conditions stipulated in the Attachment 1 which is an integral part of the present Contract

2 Conditions of the Electric Energy Output

2 1 Electric energy output is performed on the 220 KV buses of the 500 KV sub-station "Ulke"

2 2 Parallel operations of "Akturbo" with other regional energy systems are carried out in accordance with the relevant documents and instructions of the United Dispatch Department of Kazakhstan when devices of relay protection of anti-emergency automatic equipment operate

2 3 Dispatching procedure is based on mutual understanding and mutual benefit and is identified by the regulations, instructions and other normative documents of the United Dispatch Department of Kazakhstan

2 4 In accordance with the present Contract the electric energy transmission is performed on the base of the daily load schedules co-ordinated with the Sellers and the Buyers in the range of the monthly contractual value under the direct participation and control of the United Dispatch Department of Kazakhstan

2 5 All the offers related to the monthly volume of the co-ordinated quarter delivery of electric energy shall be correlated between both Parties not later than 15 days before the corresponding quarter begins

Prompt changes of daily volumes of electric energy don't require the monthly delivery volume adjustment Mutual settlements are focused on the contractual monthly delivery volume and the changes of the contractual values by the months of the current quarter are not stipulated

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3 The Procedure of Billing and Payments

3 1 Cost of the present Contract is 1031 5 mln tenge

3 2 30 days is a period which is considered to be an accounting period The Buyers should pay for the contractual monthly volume of the electric energy delivery

3 2 1 Actual amount of electric energy delivered to the Buyers is determined by the Sellers every month at 12 00 p m in the last day of the reporting month according to the indications of the billing meters (meters location, their performance parameters are given in the Attachment 2) and is confirmed by the Buyers not later than within 7 days after the accounting month ends

After the monthly volume of the electric energy delivery is approved, the Buyers shall submit the unilateral Act which includes the data of the delivery volume and the cost of delivery

In case there is discrepancy or difference in the Sellers' and the Buyers' data related to the volume of electric energy transmitted or delivered, all the disputes are regulated by the Commission which should be created on the base of equal number of the representatives of each Party

Payment for the electric energy delivery is performed within the accounting month on the 12th and 25th dates with equal shares (portions) out of the contractual monthly delivery volume The final payment shall be made on the 12th date of the month which goes after the accounting one

4 The Responsibilities of the Parties

4 1 Attachment 1 contains the payment rates for the deviation of actual monthly electric energy delivery out of the contractual monthly volume above the allowable rate

4 2 In case of partial payment for the actual volume of the monthly delivery, 10 days after the deadline of the final settlement the Buyers should pay a 0 1% fine out of the sum of the previous month for every day of delay

In case of 10 days (and more) delay in payment after the deadline of final and complete payment for actual volume of energy delivery within the accounting period the Sellers have a right to introduce certain restrictions of electric energy sendout right up to the switching off the incoming power transmission lines The Buyers should be informed about the restrictions 5 days prior them being implemented

4 3 Paying a penalty and recovery of damages do not relieve the Parties of the obligations stipulated in the present Contract

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5 Force Majeure

The Parties will be released from their responsibility for partial or complete non-execution of their liabilities under the present Contract, should this non-execution be caused by the circumstances of force majeure, namely natural disaster, military operations and other actions being the obstacles to execute the conditions of the present Contract In this case none of the Parties has a right to recover the damages

The Party which is unable to fulfil its obligations under the present Contract due to the circumstances of force majeure is to inform the other Party within 3 days in a written form In this case on demand of any Party an ad hoc Commission will be created and it will determine the possibility of further fulfilment of mutual obligations under the present Contract

6 Changes and Cancellation of a Contract

6 1 Disputes of the Parties related to the execution and changing of the Contract are regulated by the letters (cables) exchange, by concluding the documentary agreements and by other necessary measures

6 2 In case the Buyers do not execute the conditions of the present Contract, the Sellers have a right to cancel the Contract unilaterally without recovering the Buyers' damages and losses

6 3 The conditions of the Contraact may be reconsidered at one of the Parties' initiative To do this withih 15 days a correspondent additional Attachment to the present Contract is to be drawn up and signed by the representatives of both Parties

7 Other Conditions

7 1 Electric energy delivery under the present Contract may be decreased or temporarily stopped in the following cases

- if both Parties agreed
- if force majeure circumstances occur
- if the Buyers do not fulfil the conditions of the Contract

7 2 The Parties are to inform each other about the cessation of delivery or expected decrease of electric energy sendout no matter what a reason might be

8 Term of Validity of the Contract and Legal Addresses of the Parties

8 1 The present Contract comes into effect from the moment of its signing and is valid from January 1 to December 31, 1996

8 2 In case the requisites are changed the Parties are to inform each other about all the changes within a 3 days period Otherwise a guilty Party bears responsibility for all the losses and damages

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8 3 Legal Addresses of the Parties and their settlements accounts

The Buyers	The Sellers
480008, Almaty	463016, Aktyubinsk,
162, Shevchenko Str ,	42, Strelkovaya divisiya 312 pr
tel 682954,682955,684300	
Settlement account number·	Settlement account number·
221236 in Kazenergoinvestbank	000467808, Aktyubinsk deprt
Code 712, MFO 190501712	of Alembank Kazakstan,
RNN 600700050778	MFO 190301107
Teletype 751517 "Watt"	Fax 531387
Telefax 684390, 684308	
_____	_____
(signature)	(signature)
Seal	Seal

9 Attachments

Attachments which are an integral part of the Contract

1 Electric energy delivery volume Price (tariff) Payment for deviation
2 A list of billing meters, their performance parameters and location

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Attachment 1

Volumes of Electric Energy Delivery Price (tariff)
Payment for the Deviations of the Contractual Obligations

1 Purchase, sale of electric energy for the period of January - December 1996

Total 684 mln Kwh
including
1 quarter 135 mln Kwh (January - 30 mln Kwh, February - 45 mln Kwh, March - 60 mln Kwh)
2 quarter 189 mln Kwh
3 quarter 171 mln Kwh
4 quarter 189 Kwh

2 Average monthly tariff for electric energy delivery in 1996 is accepted at the reate of 150 8 tiin/KWh (without V A T)

2 1 Due to the mutual agreement between the Parties the indexation of the tariff rate is acceptable

3 Payment for non-fulfilment of the contractual obligations

3 1 Payment for the deviation of the actual monthly delivery volume out of the contractual monthly value is determined in the following way

a) if the elctric energy sales is above 10% compared to the contractual value the Sellers are paid according to the tariff rate of 125 tiin/KWh (V A T is not included)

b) if the decrease of electric energy delivery volume exceeds 5% of the contractual value through the Sellers' fault, the Buyers are paid according to the contractual tariff rate increased by 5%

The Buyers	The Sellers
_____	_____
(signature)	(signature)
Date	Date
Seal	Seal

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CONTRACT

October 1, 1995
Almaty

National Energy System "Kazakstanenergo" in the person of the General Director Mr Orazbayev B E , hereinafter referred to as "The Sellers" on the one part and the Republican State-owned enterprise in the person of the General Director of the Energy System, hereinafter referred to as "The Buyers" on the other part, governed by Rules and Regulations, have concluded the present Contract for the following

1 Subject of the Contract

1 1 The Sellers sell and the Buyers purchase electric energy sent out to the National grid "Kazakstanenergo" in accordance with tariffs and conditions, co-ordinated in Attachment 1 which is an integral part of the present Contract

2 Conditions of the Electric Energy Output

2 1 Electric energy output is performed through the transmission lines which connect the Sellers and the Buyers (given in the Attachment 2)

2 2 Parallel operations with other regional energy systems are carried out in accordance with the relevant documents and instructions of the Unified Dispatch Department of Kazakhstan when the devices of relay protection of anti-emergency automatic equipment operate

2 3 Dispatching procedure is identified by the regulations, instructions and other normative documents of the Unified Dispatch Department of Kazakstan and the Contract for the prompt and efficient service

2 4 In accordance with the present Contract the electric energy transmission is performed on the base of the daily load curve after its being co-ordinated with the Sellers and the Buyers within the monthly contractual value under direct participation and control of the Unified Dispatch Department of Kazakstan

2 5 All the offers related to the monthly volume of the co-ordinated quarter delivery of the electric energy are being correlated between both Parties not later than 15 days before the corresponding quarter begins

Prompt changes of daily volumes of the electric energy don't require the contractrual monthly delivery volume adjustment Mutual settlements are focused on the contractual monthly delivery volume and the changes of the contractual values relevant to the months of the current quarter are not stipulated

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3 Procedure of Billing and Payments

3 1 Cost of the present Contract is tenge

3 2 30 days is a period which is considered to be an accounting period The Buyers should pay for the contractual monthly volume of the elctric energy delivery

3 2 1 Actual amount of the elctric energy delivered to the Buyers is determined by the Sellers every month at 24 00 p m of the last day of the reporting period according to the indicators of the billing meters (meters location, their performance parameters are given in Attachment 2) and is confirmed by the Buyers not later than within 3 days after the accounting month ends

After the monthly volume of electric energy delivery is conformed, the Buyers submit the unilateral Act which includes the delivery volume and the cost of delivery data

Prior to billing meters are installed registration and payment for the electric energy delivery is performed according to the existing systems of technical accounting taking into consideration the check calculation of the electric energy balance on the previous points of commercial accounting, calculation of electric energy losses in the network of the national energv company in accordance with the established normative parameters of losses

In case there is discrepancy or difference in the Sellers' and the Buyers' data related to the volume of electric energy transmitted or delivered, all the disputes are regulated by the Commission which should be created on the base of equal number of the representatives of each Party

Pavment for the electric energy delivery is performed within the accounting month every 10 days (10, 20 and 30) with equal shares (portions) out of the contractual monthly delivery volume

4 The Responsibilities of the Parties

4 1 Deviation (+10%), (-10%) of the monthly delivery actual volume out of the contractual value is considered to be allowable

Attachment 1 contains the pavment rates for the deviation of actual monthly electric energy delivery out of the contractual monthly volume above the allowable rate

4 2 In case of partial pavment for the actual volume of the monthly delivery, 10 days after the date of complete payment the Buyer should pay a fine at the rate of 0 1% from non-paid sum of pavment for the previous month for every past due day

In case of 15 days (and more) delay in payment after the date of final and complete payment for actual volume of energy delivery within the accounting period the Sellers have a right to implement certain restrictions of electric energy sendout right up to the switching off the incoming power transmission lines The Buyers should be informed about the restrictions mentioned above 10 days before them being implemented

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4 3 Paying a penalty and recovery of damages do not relieve the Parties of their obligations stipulated in the present Contract

4 4 In case the Parties can not come to an agreement concerning the size of damages and their recovery, a concerned Party has a right to appeal to the arbitration court

5 Force Majeure

The Parties will be released from their responsibility for partial or complete non-execution of their liabilities under the present Contract, should this non-execution be caused by the circumstances of force majeure, namely natural disaster, military operations and other actions being the obstacles to execute the conditions of the present Contract In this case none of the Parties has a right to recover the damages

The Party which is unable to fulfil its obligations under this Contract due to the circumstances of force majeure is to inform the other Party within 3 days in a written form On demand of any of Parties in this case an ad hoc Commission will be created and it will determine the possibility of further fulfilment of mutual obligations under the present Contract

6 Changes and Cancellation of a Contract

6 1 Disputes of the Parties related to the execution, changing and cancellation of the Contract are regulated by the letters (cables) exchange, by concluding the documentary agreements and by other necessary measures up to the considering the disputes in the arbitrary court

6 2 Conditions of the Contract may be reconsidered at one of the Parties' initiative To do this within 15 days period a corresponding additional Attachment to the present Contract is to be drawn up with both Parties signatures

7 Other Conditions

7 1 Electric energy delivery under the present Contract may be decreased or temporarily stopped in the following cases

7 1 If both Parties agreed
7 1 2 If force majeure circumstances occur
7 1 3 In accordance with item 4 1 of the present Contract

7 2 The Parties are to inform immediately each other about the cessation of delivery or expected decrease of electric energy sendout no matter what a reason is

8 Term of Validity of the Contract and Legal Addresses of the Parties

8 1 The present Contract comes into effect from 00 00 o'clock October 1, 1995 and is valid till 00 00 o'clock December 31, 1995

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8 2 In case the requisites are changed the Parties are to inform each other about all the changes made within 3 days Otherwise a guilty Party bears responsibility for all the losses and damages

8 3 Legal addresses of the Parties and their settlement accounts

Attachment 1

Volumes of Electric Energy Deliveries Price (tariffs)
Payment for the Deviations of the Contractual Obligations

1 Purchase (sale) of electric energy for the period of October - December 1995

Total _____ mln kWh
including
Quarter IV _____ mln kWh

Breakdown of the quarter volume of electric energy by months is performed in accordance with mutual agreement between the Parties

2 Average monthly tariff for electric energy delivery in 1995 is accepted at the rate of _____ tiin/kWh (without V A T)

3 Pavment for non-fulfilment the contractual obligations

3 1 Deviations (+10%), (-10%) of the actual monthly delivery volume out of the contractual one are considered to be allowable

3 2 Payment for the deviation of the actual monthly electricity delivery volume out of the contractual monthly volume above the allowable one is calculated in the following wav

3 2 1 Delivery excess on quarter months is paid to the Sellers according to the tariff rate given in item 2 and increased by 5%

3 2 2 Electric energy delivery reduction out of the contractual value through the Sellers fault is paid to the Buyers in accordance with item 3 2 1

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Attachment 2

A List of Billing Meters (Performance parameters and location)

№	Location, power line	Meters			Current transformer	Voltage transformer
		№	Type	Accuracy class	Transformation coefficient	Transformation coefficient
1	2	3	4	5	6	7
1	"Frunzenskaya" s/s Overhead line-514					
	billing meter (reception/sendout)	107950	F44ZAR	0 5	1000/1	500000/100
	duplicate (sendout)	411341	DNrZ	0 7		
	duplicate (reception)	319567	SAZu4681	1 0		
2	"Almaty 500" s/s Overhead line-514					
	Main meter	10890	F44ZAR	0 5	2000/1	500000/100
	duplicate (sendout)	23255	SAZu4681	1 0		
	duplicate (reception)	163549	SAZu4681	1 0		
3	"Bystrovka" s/s L-B-Z					
	billing meter (sendout)	421089	SAZu4681	1 0		
	billing (reception)	932885	SAZu4681	1 0	1000/1	200000/100
	check meter	9745	F443A			
4	Zapadnaya s/s L-B-Z					
	sendout	23830	SAZu4681	1 0		
	reception	644841	SAZu4681	1 0	1000/5	220000/100
5	"Glavnava" s/s L-A-G					
	billing (sendout)	163545	SAZu4681	1 0		
	billing (reception)	841401	SAZu4681	1 0	1000/1	220000/100
6	Almaty 500 L-A-G					
	sendout	319374	SAZu4681	1 0		
	reception	319502	SAZu4681	1 0	1000/1	220000/100
7	'Agadyr Overhead line-530					
	billing (reception/sendout)	10033	F433AR	0 5		
	duplicate (sendout)	633589	SAZu4681	1 0	1000/1	500000/100
	duplicate (reception)	633580	SAZu4681	1 0		
8	"YuzhkasHEPP" Overhead line-530					
	billing (reception/sendout)	11838	F443AR	0 5		
	duplicate (sendout)	632080	SAZu4681	1 0		
	duplicate (reception)	258527	SAZu4681	1 0	1000/1	500000/100
9	Sarvshagan s/s Overhead line-230					

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	main meter	18575	F433AR	0 5	600/5	220000/100
	sendout	845506	SAZu4681	1 0		
	reception	845558	SAZu4681	1 0		
10	'Kiyakhty" s/s Overhead line-227					
	calculated operating variable (sendout)	214814	DNrZ	0 7		
	calculated operating variable (reception)	473303	DNrZ	0 7		
	repair variable (sendout)	473120	DNrZ	0 7		
	repair variable (reception)	411945	DNrZ	0 7	600/5	220000/100
11	'Otar 's/s Overhead line-140					
	billing (sendout)	643300	SAZu4681	1 0		
	billing (reception)	926603	SAZu4681	1 0		
	Bus system sendout	838681	SAZu4681	1 0		
	Bus system reception	23831	SAZu4681	1 0	75/5	100000/100
12	Gorny village s/s 117A Overhead line-140					
	sendout	790025	SAZu4681	1 0		
	reception	790094	SAZu4681	1 0	150/5	110000/100

Attachment 4

Quality of Power

Based on the State Standard 13109-87 "Requirements to the electric energy quality in the general-purpose electric networks" the National Energy System "Kazakstanenergo" and _____ undertake to provide the following indicators of power quality

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№	Power quality indicators	Allowable values of the indicator nominal	maximal
1	Deviation of frequancy	+/- 0 2%	+/- 0 4%
2	Coefficient of reverse sequence	2%	4%
3	Coiefficient of voltage non-sinusoidality	2%	4%
4	Coefficient of oscillations rate	-	1
5	Voltage deviations	Calculated in accordance with the normativw documents of Energy Supervision Department	

Technical limits of reactive energy generation and consumption are established every quarter in the range of interface in accordance with Attachment 4 1 The range of

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allowable voltage values in check points of the National Energy system is set up in accordance with Attachment 4 2

In case the consumers exceed the reactive energy generation and consumption limits mentioned in Attachment 4 1 , National Energy System "Kazakstanenergo" is not responsible for the voltage deviations in the check points

Attachment 4 1

Reactive Energy Generation and Consumption Limits (MVAR) in Kazakstanenergo and Power Generation and Supply Association (for 4th quarter 1995)

Check points	Connections	Q of consumption	Q of generation
1 Buses of 220 kV (substation)	L-209/207 L-208/206	10	10
2 Buses of 220 kV AlmatyHEPP	AT-5 L-211I	from 0 to -60 from 0 to +10	60 0
3 Buses 220 kV (substation 7A)	AT-1, AT-2	from 0 to -50	50
4 Buses 220 kV (s/s 140A)	AT-1, AT-2	from 0 to +10	0
5 Buses of 220 kV (s/s 143A)	T-1, AT-2	from 0 to +1	0
6 Buses of 220 kV YuzhkasHEPP	L-229	from 0 to +3	0
7 Buses of 220 kV (substation 126T)	AT-1, AT-2	from 0 to +6	0
8 Buses of 220 kV (substation 152T)	AT-1, AT-2	from 0 to +10	0
9 Buses of 220 kV (substation 149T)	T-1, T-2	from 0 to +4	0
10 Buses of 220 kV (substation 62A)	AT-1, AT-2	from 0 to +3	0

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Attachment 4 2

Check Points of Power Quality - Buses of 220 kV

№	Point of Quality Control	Network Voltage	Range of allowable voltage values in the network	
			maximum	minimum
1	Almaty 500 substation	220 kV	220-228	225-230
2	Almaty HEPP	220 kV	220-227	220-230
3	Almaty Cotton Plant (substation 7A)	220 kV	220-225	220-227
4	Zapadnaya s/station 140A	220 kV	220-225	220-228
5	Kapchagayskaya s/s 62A	220 kV	220-227	220-230
6	Robot s/station 143A	220 kV	220-227	220-230
7	YuzhkazHEPP	220 kV	220-228	225-235
8	Sary-Ozek s/s 126T	220 kV	220-227	220-230
9	Taldykorgam s/s 152T	220 kV	220-227	220-230
10	ZShchA s/s 149T	220 kV	220-227	220-230

2 Values of power quality indicators when the opeartion mode is normal should go beyond the maximal values and within not less than 95% of daily period of time they should not go beyond the normal values given in the Table

3 The fault of power quality deterioration is set up on the base of "Rules of concession (surchange) to tariffs for power quality"

4 Check metering is performed by the laboratories attested by the Energy Supervision Department within a given period or by a demand of one of the Parties The duration of check metering of power quality indicators should not be less than 24 hours The results of metering should be registered in three-party act (statement) and are the integral part of the Contract

5 The values of power quality indicators obtained in the process of check measurements and tariff concession (surchange) for power quality are valid till the next check (control) measurements which are to be performed at the demand of one of the Parties

Reactive Energy Consumption

Due to the absence of billing meters in the interface of National Energy System and the networks, due to the absence of normative documents related to the energy systems connection to NES, due to the absence of statistical data concerning the reactive energy transfer, the economic limits of tangens "f" are not established and the reactive energy consumption is not paid

CONTRACT

For Electric Energy Use

Almaty
_____ 1996

National Energy System "Kazakstanenergo", hereinafter referred to as "The Energy Supplier" in the person of the General Director Mr Orazbayev B , governed by the Charter on the one part, and _____, hereinafter referred to as "The Customer" in the person of _____, governed by _____ on the other part, have concluded the present Contract for energy output

1 The Energy Supplier undertakes

1 1 To deliver electric energy to the Customer in accordance with the conditions and the values of energy and capacity consumption stipulated in the present Contract (Attachment 1)

2 The Customer undertakes

2 1 To pay for energy and capacity consumtion To make other payments for the accounting period in accordance with the present Contract A monthly period is considered to be an accounting period

2 2 For the purpose of determining the amount of energy delivered and consumed, to take the meters indications (subcustomers' meters indications and regional tariffs included) and to submit them to the Energy Supplier through the communication channels such as fax or teletype The Customer is to settle accounts with the Energy Supplier for energy reselling to the subcustomers by regional tariffs used for the corresponding categories of consumers All the data (and all the possible amendments) related to the subcustomers are to be reflected in the Attachment 2 1 The meters readings are to be taken on the 1st date of every month and are to be delivered to the Energy Supplier prior to the 3rd date of the month following the accounting one The meters readings of active and reactive power are to be reflected in the Attachment 2 The electric heaters data are to be reflected in the Attachment 2 2

The Attachments 2, 2 1 , 2 2 , 6 are to be co-ordinated with the Energy Supervision Bodies

2 3 Every day to submit the operative information regarding the load value in control hours and gross energy consumption value for the previous 24-hour period (without breakdown by subcustomers) to the Energy Supplier through the communication channels (fax, teletype or telephone)

2 4 Through the Energy Supplier to define more precisely the contractual values of energy and capacity consumption for the next year not later than December 1 of the current year

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3 Both the Energy Supplier and the Customer are to provide the proper quality of electric energy in the balance boundary of the elctrical network in accordance with the Asttachment 5

4 All the pavments for energy delivery under the present Contract are performed bv the Customer by means of payment orders three times a month in the time stipulated in item 4 2 of the present Contract by a tariff _____, if the capacity values (given in the Attachment 1) are kept in the terms of the Contract In case the capacity values are increased, the Customer is to pay penalty to the Energy Supplier which is determined in the Attachment 1 by a tariff _____ To make payments for the eletric energy delivery to the subcustomers a discount should be established at the rate of _____ An electric energy delivery tariff is to be defined more precisely and adjusted The Energy Supplier is to inform the Customer about the tariffs change after they have been approved in prescribed manner

All the issues related to the tariff preferences for a certain category of consumers who have a right to be given a discount for the energy payment are to be settled by the Customer together with the local financial bodies

4 1 Deviations +/- 5% of actual monthly delivery volume out of contractual value are considered to be acceptable Sanctions determined in the Attachment 1 (items 2 and 3) of the present Contract may be applied to the Parties if the contractual limits are violated

4 2 Payment dates

- 20% of sum of payment for the contractual monthly volume of energy consumption is paid on the 5th date of the accounting period,
- 50% of sum of payment for the contractual monthly volume of energy consumption is paid on the 15th date of the accounting period,
- 20% of sum of payment for the contractual monthly volume of energy consumption is paid on the 25th date of the accounting period,
- final payment for the month minus the 1st, 2nd and 3rd payments is to be performed within 5 days after the Energy Supplier received the payment document (order)

If money resources for energy and capacity (reactive included) consumption are not received at the "Kazakstanenergo" settlement account by 15th date of the month following the accountring one, the electric energy sendout to the consumer may be restricted up to the emergency reserve level Such restrictions are based on the Resolution of the Government of the Republic of Kazakstan No 1743, dated December 19, 1995

In case of energy outage for the reason of non-payment within the established period of time, the Energy Supplier doesn't bear responsibility for all the possible consequances caused by the electric energy outage

The non-payment penalty rate is 0 5% of the sum of debt for each day of delay

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5 The Energy Supplier doesn't establish the economic values of the reactive power consumption The consumer doesn't pay for reactive power consumed But the Energy Supplier doesn't bear responsibility for the voltage deviation higher than the allowable values on the balance boundary of the networks

6 The Energy Supplier establishes the contractual values of electric energy and capacity for the Customer in accordance with the resources availability In case of the resources shortage, the Energy Supplier in the person of the Unified Dispatch Department of the Republic of Kazakstan has a right to put limits for the consumption of electric energy and capacity in accordance with the Resolution of the Cabinet of Ministers No 8 dated January 5, 1993 In this case the Customer has a right to consume the unserved electric energy in other days and hours co-ordinated with the the Energy Supplier

7 The responsibility boundaries for the equipment state and maintenance are established with the statement of differentiation of the balance belonging of the networks (responsibility of the Parties for the equipment operation) Attachment 3

8 Parallel operations of the facility with other regional energy svstems are carried out in accordance with the relevant documents and instructions of the Unified Dispatch Department of the Republic of Kazakstan when the devices of relay protection of anti-emergency automatic equipment operate

8 1 Dispatching procedure is based on mutual understanding and mutual benefit and is identified by the regulations, instructions and other normative documents of the Unified Dispatch Department of the Republic of Kazakstan

8 2 The Energy Supplier dispatching provides the Customer with the co-ordinated load schedule

8 3 If the power plant load is below the level established by the dispatching schedule, the Energy Supplier has a right to put the power limits for the value of load decrease

9 The Customer gets the mutually co-ordinated load value The data related to the objects outage and their capacity values are given in the Attachment 6

10 All the issues which are not stipulated in the present Contract are to be settled by the Parties in accordance with the "Rules of electric energy use" , all the amendments included, in the part where they are not contrary to the legislative acts of the Republic of Kazakstan

11 The Parties will be released from their responsibilities for partial or complete non-execution of their liabilities under the present Contract, should this non-execution be caused by the circumstances of force majeure, namely natural disaster, military operations or other actions being the obstacles to execute the conditions of the present Contract In this case none of the Parties has a right to recover the damages and losses

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The Party which is unable to fulfil its obligations under thr present Contract due to the circumstances of force majeure is to inform the other Party within 3 days period in a written form In this case on demand of any of the Parties an ad hoc Commission may be created and it will determine the possibility of further fulfilment of mutual obligations under the present Contract

12 All disputes which may arise out of the present Contract are to be settled by the corresponding arbitral and judicial bodies The differences regarding the reactive power consumption, reliability of energy supply and all the technical issues as well are to be settled by the Energy Supervision Bodies of the Republic of Kazakstan

13 A scheme of external power supply and tariff accounting is enclosed

14 The present Contract comes into effect from the moment of its signing and is valid till December 31, 1996 In case none of the Parties notifies about the Contract cancellation 1 month prior to the expiration of the present Contract validity, it may be prolonged for the next year with more precise definition of electric energy delivery volume

15 Legal addresses of the Parties and their settlement accounts

The Parties are to inform each other in time and in a written form about all changes of the requisites, namely name of the organization, settlement account, etc

The present Contract is drawn up in 2 copies One copy is to be kept with the Energy Supplier, another with the Customer

Attachments No 1, 2, 2 1 , 2 2 , 3, 4, 5, 6 on _____ sheets and a single-line scheme of electrical installations for the consumers are enclosed

The Energy Supplier	The Customer
_____	_____
_____	_____
(date)	(date)
Seal	Seal

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Appendix I

Decrees on Power Sector Restructuring

1 Regulation of the Cabinet of Ministers of the Republic of Kazakstan, No 1033, July 28, 1995 *On Reorganizing the Administrative Structure of the Electric Power Engineering Industry of the Republic of Kazakstan.*

2 Regulation of the Cabinet of Ministers of the Republic of Kazakstan, No 1268, September 19, 1995 *On Making Amendments to Decree 1033 of July 28, 1995 enacted by the Cabinet of Ministers of the Republic of Kazakstan.*

3 Decree of the President of the Republic of Kazakstan, December 23, 1995 *On Electric Power Engineering*

4 Resolution of the Government of the Republic of Kazakstan, No 663, May 30, 1996 *On Approval of the Privatization and Restructuring Program in the Electric Power Sector*

5 Resolution of the State Committee for the State Property Management, No 499, July 16, 1996 *On Approval of the Power Industry Facilities Corporatization Plan for 1996.*

6 Instruction of the Ministry of Energy and Coal Industry, No T-57/4, July 18, 1996 *On Implementation of the Plan of Electric Power Facilities Corporatization for 1996.*

RESOLUTION
of the Cabinet of Ministers of the Republic of Kazakstan

No 1033
dated July 28, 1995

On Reorganizing the Administrative Structure of the Power Industry of the Republic of Kazakstan

With the goal of improving the current tight situation in the electric power industry and developing the organizational and economic mechanisms for its functioning in the market conditions, the Cabinet of Ministers of the Republic of Kazakstan RESOLVES

1 To approve the proposal of the Ministry of Energy and Coal Industry of the Republic of Kazakstan on reorganizing the State Power Engineering Company "Kazakstanenergo" and the production associations of the Power Sector as well as the proposal on establishing on their basis the republican state-owned enterprises in accordance with Attachment 1

The Ministry of Energy and Coal Industry of the Republic of Kazakstan shall perform the functions of the State Administrative Body and the owner of the rights of the state ownership with respect to the republican state-owned enterprises included into the Attachment 1

The Ministry of Energy and Coal Industry of the Republic of Kazakstan shall approve the Charters of the republican state enterprises within a two-month period

2 The republican state enterprise called the National Energy System Kazakstanenergo, shall be designated a legal successor of the State Electric Power Engineering Company Kazakstanenergo Intersystem and interstate electricity transmission lines as well as the substations which comprise the unified national electric network, the production bases for maintenance and operating services shall be transferred to Kazakstanenergo with the right of economic management according to the listing as approved by the Ministry of Energy and Coal Industry of the Republic of Kazakstan

3 The NES Kazakstanenergo of the republican state enterprise status shall be permitted to found the affiliated state enterprises in accordance with the Attachment 2

4 The NES Kazakstaneenrgo shall be invested with the following functions
- to develop the forecast of production and use of electric power in the republic,
- to supervise the interests of the country on issues concerning the export and import of electric energy and power,
- to regulate the electric energy and power market, including the signing and fulfillment of business agreements for the electric power purchase from domestic producers and from abroad, the sale of electric power abroad and to the republican state-owned power engineering enterprises, as well as to the consumers connected to the national electric network

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5 To establish the State Power Engineering Inspectorate Department within the Ministry of Energy and Coal Industry of the Republic of Kazakstan

The Ministry of Energy and Coal Industry shall submit in the established order the Provision on the State Power Engineering Inspectorate on the Republic of Kazakstan to the Cabinet of Ministers of the Republic of Kazakstan for its approval

The expenses for maintaining the structural subdivisions of the state Power Engineering Inspectorate of the Republic of Kazakstan shall be including the tariffs for electricity sold to the consumers An estimate for the above structural subdivisions maintaining shall be approved by the Ministry of Energy and Coal Industry of the Republic of Kazakstan and agreed upon by the Ministry of Finance of the Republic of Kazakstan

6 The Ministry of Energy and Coal Industry of the Republic of Kazakstan under the agreement with the State Committee on Pricing and Antimonopoly Policy shall approve the methodology for electric energy, power and heat rate The methodology specifies will be in effect since October 1, 1995 It shall specify the following

- regulating the regional electricity tariffs while taking into account the lower tariffs on the wholesale market and limiting the difference between the regional tariffs bv no more than 60%,
- setting the unified electricity tariffs for residential consumers throughout the territory of the country,establishing a system of differential rates on electric energy and power sold to the power-consuming industrial consumers

7 The Ministry of Energy and Coal Industry of the Republic of Kazakstan and the State Property Committee of the Republic of Kazakstan shall determine the status of the enterprises and organizations of the Power Engineering Industry by January 1, 1996 which are not included in the list of the state-owned enterprises in the Attachment 1

8 The Ministry of Energy and Coal Industry of the Republic of Kazakstan shall submit to the Cabinet of Ministers of the Republic of Kazakstan within a month its proposals for changing the structure of the central apparatus of the Ministry caused by the reorganizing the Power Industry administrative structure

Prime-Minister
of the Republic of Kazakstan A Kazhegeldin

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Attachment 1
to the Resolution of the
Cabinet of Ministers of
the Republic of Kazakstan
No _____ dated _____

A LIST
of the Republican State-Owned Enterprises
in the Electric Power Industry

National Energy System "Kazakstanenergo", Almaty
Almaty Energy System "Almatyenergo", Almaty
East-Kazakstan Energy System "Altayenergo", Ust-Kamenogorsk
Atyrau Energy System "Atyrauenergo", Atyrau
West-Kazakstan Energy System "Zapkazenergo", Aktyubinsk
Karaganda Energy System "Karagandaenergo", Karaganda
Kostanay Energy System "Kostanayenergo", Kostanay
Pavlodar Energy System "Pavlodarenergo", Pavlodar
Energy System "Tselinenergo", Akmola
South-Kazakstan Energy System "Yuzhkazenergo", Shymkent
Ermakovskaya Thermal Plant
Bukhtarminskaya Hydro Plant
Kapchagayskaya Hydro Plant

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Attachment 2
to the Resolution
of the Cabinet of Ministers
of the Republic of Kazakstan
No _____ dated _____

A LIST
of the Affiliated Organizations of the NES "Kazakstanenergo"

United Dispatch Administration (UDA of Kazakstan)
Ekibastuz Thermal #1
Ekibastuz Thermal #2
Jambyl Thermal
Karaganda Thermal #2
Ust-Kamenogorsk Hydro
Shulba Hydro

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ORDER
of the Ministry of Energy and Coal Industry

On Ownership and Reorganizing the Administrative
Structure of Electric Power Industry

No 75 dated September 7, 1995

In accordance with the RK President's Decree having a force of Law "On the Governmental Enterprise" and the Resolution of the RK Cabinet of Ministers "On Reorganizing the Administrative Structure of the Power Industry of the Republic of Kazakstan" No 1033 dated July 28, 1995, my ORDER is

1 To transfer to the balance of the State Electric Power Company "Kazakstanenergo" the intersystem and interstate electricity transmission lines and substations together with technical communications facilities, technological control means, safety automatic system and relay protection which, according to the Attachment 1 to the present Order, comprise the unified national electrical network,

To include to the State Electric Power Company "Kazakstanenergo" structure the following power plants Ekibastuz Thermal #1, Ekibastuz Thermal #2 Jambyl Thermal, Ust-Kamenogorsk Hydro, Shulba Hydro,

Ermak Thermal Plant, Bukhtarma Hydro and Kapchagay Hydro shall have the status of IPP They shall sell the total electric energy production to the national network, except the auxiliary electric energy and the energy sent out to the customers from the generating voltage busbars

2 In accordance with the Attachment 2 to the present Order, to reorganize the State Electric Power Company "Kazakstanenergo", Power Associations "Almatyenergo", "Altayenergo", "Atyrauenergo", "Zapkazenergo", "Karagandaenergo", "Kostanayenergo", "Pavlodarenergo", "Tselinenergo", "Yuzhkazenergo", Ermak Thermal Plant, Bukhtarma Hydro and Kapchagay Hydro to the republican state-owned enterprises With respect to the state-owned enterprises above, the Ministry of Energy and Coal Industry shall perform the functions of a State Administration Body and a legal subject of public ownership

3 To approve a list of NES "Kazakstanenergo"affiliated state-owned enterprises in accordance with the Attachment 3 to the present Order

4 To reorganize the Power Association "Ekibastuzenergo" to the NES "Kazakstanenergo" affiliated organization located in Ekibastuz Ekibastuz CHP, Ekibastuz Heat Networks, the Residential and Communal Services Department, the Head Training Center, a House of Culture "Energetik" shall be included to the structure of the affiliated organization

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To transfer the Ekibastuz enterprise of high-voltage electrical networks (except the facilities included to the 'Kazakstanenergo" structure according to the attachment 1) to Pavlodarenergo

All other enterprises and structural units of "Ekibastuzenergo" are to be corporatized according to the established order

5 The reorganizing measures (Articles 1-4 of the present Order) shall be performed up to September 15, 1995 based on the 1995 first 6 months balance

6 To identify the basic functions of "Kazakstanenergo" i e

- to provide the stable functioning of the National Energy System of Kazakstan
- to provide the centralized dispatching control of Power Industry of Kazakstan,
- to forecast the electric energy generation and consumption in the country,
- to regulate the electric energy and power market including the signing of the contracts on purchasing the electric energy from the domestic and foreign producers, on selling the electric energy to the regional energy systems as well as abroad and to the power-consuming customers which are connected directly to the national electrical network according to the Attachment 4,
- to work out and realize the Program of Electric Power Industry Development throughout the territory of the Republic of Kazakstan, to create in the country the mutual reserves of generating capacities,
- to meet the RK interests as related to the electric energy and power import and export,
- to solve the issues concerning the information services in Power Industry and the specialists qualification improving

7 The regional energy systems shall perform the following basic functions

- to forecast the electric and heat energy generation and consumption on the territories served and agreed with "Kazakstanenergo",
- to provide the customers with electric and heat energy produced by the local producers, to purchase electric energy from the National Energy System on the basis of the economic agreements concluded,
- to work out and realize the Program of Electric Power Industry Development for the territory served

8 NES "Kazakstanenergo" and regional energy systems shall conclude the contracts on mutual services and maintenance of the facilities transferred to the balance of "Kazakstanenergo" (Attachment 1) up to September 15, 1995

9 Power Industry Management Department (Mr Doubatov) up to September 15, 1995 shall

- submit for the approval the draft Provision on the State Power Industry Inspectorate which covers the establishing under the Ministry of Energy and Coal Industry the institution "State Inspection and Expert Examination of Energy Supervision" and its regional affiliated organizations maintained by gaining the profit by the regional and national energy systems according to the approved schedule of expenses,

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- to work out the normative documents which can regulate the mutual relations on development and operation of the energy facilities as well the electric and heat energy generation and consumption

10 The heads of the republican state-owned enterprises shall submit to the Ministry of Energy and Coal Industry the by-laws of the enterprises for the approval up to September 15, 1995

NES "Kazakstanenergo" up to September 1, 1995 shall also submit the by-laws of its affiliated organizations for them to be agreed with the Ministry of Energy and Coal Industry

11 The Personnel Department (Mr Mendybayev) up to September 15, 1995 shall work out the contract forms with the heads of the republican state-owned enterprises The contract forms shall be agreed with the departments and divisions of the Ministry of Energy and Coal Industry

12 The Economic Department (Mrs Galinova) up to September 15, 1995 shall prepare the draft documents to be submitted to the RK Cabinet of Ministers related to

- the list of the affiliated state-owned enterprises of the energy systems,
- the status of enterprises and organizations under the State Power Company "Kazakstanenergo" which were not included to the list of the republican state-owned energy enterprises and their affiliated organizations,
- the structure and the managerial staff of the Ministry of Energy and Coal Industry after the reorganizing the administrative structure of the Electric Power Sector

Minister of
Energy and Coal Industry V Khrapounov

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Attachment 2
to the Order No ___
dated_____1995

A LIST
of the Republican State-Owned Enterprises of Power Industry

National Energy System "Kazakstanenergo", Almaty
Almaty Energy System "Almatyenergo"
East-Kazakstan Energy System "Altayenergo", Ust-Kamenogorsk
Atyrau Energy System "Atyrauenergo", Atyrau
West-Kazakstan Energy System "Zapkazenergo", Aktyubinsk
Karaganda Energy System "Karagandaenergo", Karaganda
Kostanay Energy System "Kostanayenergo", Kostanay
Pavlodar Energy System "Pavlodarenergo", Pavlodar
Energy System "Tselinenergo", Akmola
South-Kazakstan Energy System "Yuzhkazenergo", Shymkent
Ermak Thermal Plant, Aksu
Kapchagay Hydro Plant, Kapchagay

Note
Bukhtarma Hydro, Serebryansk, was excluded from the List by the Resolution of the Cabinet of Ministers No 1268 dated ~~January~~ 19, 1995

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Attachment 3
to the Order No ____
dated _____ 11995

A LIST
of the NES "Kazakstanenergo" Affiliated Organizations

The United Dispatch Center of Kazakstan (UDC of Kazakstan)
Ekibastuz Thermal #1
Ekibastuz Thermal #2
Jambyl Thermal Plant
Karaganda Thermal #2

Note

Ust-Kamenogorsk Hydro and Shulba Hydro are both excluded from the List by the Resolution of the Cabinet of Ministers No 1268 dated ~~January~~ September 19, 1995

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Attachment 4
to the Order No _____
dated _____1995

A LIST
of the Industrial Customers Connected to the NES "Kazakstanenergo" Networks
(High-Voltage Customers)

1 Almaty Railway Road
2 Taldykorgan Section of Almaty Railway Road
3 Ust-Kamenogorsk Titanium-Magnesium Plant
4 Leninogorsk Polymetallic Combine
5 Aktyubinsk Joint-Stock Company "Ferrochrom"
6 Karaganda section of the "Irtysh-Karaganda" Channel
7 Joint-Stock Company "Jezkazgantsvetmed"
8 Joint-Stock Company "Balkhashmed"
9 Joint-Stock Company "Yuzhneftegas"
10 Sokolov-Sarbay Mining Association
11 Ermak Ferroalloys Plant
12 Pavlodar section of the "Irtysh-Karaganda" Channel
13 Kentau Joint-Stock Company "Atchpolymetall"
14 Shymkent Joint-Stock Company "Phosphorus"
15 Jambyl Joint-Stock Company "Nodfos"
16 Jambyl Joint-Stock Company "Chimprom"
17 Jambyl section of Almaty Railway Road
18 South-Kazakstan section of Almaty Railway Road
19 South-Kazakstan section of Central Asian Railway Road
20 South-Kazakstan section of West-Kazakstan Railway Road
21 Kzyl-Orda section of West-Kazakstan Railway Road
22 State Holding Company "Ekibastuzkomir"
23 Ulbinsk Metallurgical Plant
24 Cosmodrome "Baikonur"

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Republic of Kazakhstan
Cabinet of Ministers

DECREE 1268

September 19, 1995

On Making Amendments of the Decree 1033 of July 28, 1995 enacted by the Cabinet of Ministers, Republic of Kazakhstan

The Kazakhstan Kabinet of Ministers resolves

To amend the Decree 1033 of July 28,1995entitled "On Managerial Restructuring in Electricity Industry, Republic of Kazakhstan"

Supplement 1 " List of the Republic State Utilities in Electricity Industry" stated in the Decree is amended by striking out the words " Bukhtarminskaya HPP",

Supplement 2 "List of Electric Utilities affiliated to the National Energy Corporation System "Kazakhstanenergo" stated in the Decree is amended by striking out the words "Ust-Kamenogorskaya HPP", Shulbinskaya HPP"

Prime Minister
Republic of Kazakhstan

A Kazhageldin

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DECREE OF THE PRESIDENT OF THE REPUBLIC OF KAZAKHSTAN,

HAVING THE POWER OF THE LAW,

ON ELECTRIC POWER ENGINEERING.

In accordance with article 1 of the Law of the Republic of Kazakhstan, dated December, 10 1993 "On temporary delegation of additional powers to the President of the Republic of Kazakhstan and heads of local administration' and in order to create legal foundations for regulating production, transmission distribution and consumption of electric and heat power issue the present Decree

CHAPTER 1 GENERAL PROVISIONS

Article 1 Basic concepts used in the Decree

State regulatory commission in electric power engineering - a central state body which realizes regulation of prices (tariffs) on electric and heat energv (power)

The United electric energy system - the totality of energy systems which are technically connected, and united by a common operational dispatching and accident-preventing administration

The National electric energy system - a republican state enterprise which is the main component of the United energy system, providing connection between the energy systems within the Republic of Kazakhstan and neighboring countries

Object of electric power engineering - an electric power plant sub-plant electric transmission line, networks for production, transmission distribution and transformation of electric and heat energy

Special mode of operation of the objects of electric power engineering and power supply of consumers - emergency mode, introduced at the objects of electric power engineering during significant technological violations, absences of fuel resources and lack of electric energy and power

Consumer - a person or a legal entity, that uses electric and/or heat energy

Specialized organizations - organizations, that provide normal work and development of electric power engineering (repairing, designing, scientific-research, constructing organizations of electric power engineering type, as well as organizations for manufacturing of constructions, equipment, mechanisms and materials)

Central executive body for electric power engineering management - the state body, empowered by the President of the Republic of Kazakhstan or the Government of the Republic of Kazakhstan to carry out management of electric power engineering

Electric power engineering - a sphere of generation, transmission, distribution of electric and heat power

Power generating organization -organization carrying out the geberation of electric and heat power

Energy transmitting organization - organization carrying out transmission, transformation and distribution of electric and heat power

Power supplying organization - organization carrying out sales of either produced or bought electric and heat power

Electric power engineering complex - the totality of power generating power transmitting, power supplying and specialized organizations

Electric power engineering system - the totality of the objects of electric power engineering and means of exploitation and management, which are connected by the united process of power generation, transmission and distribution

Article 2 The legislation on electric power engineering

The legislation on electric power engineering is all-republican and consists of the present Decree and other legislation, Decrees and Decisions of the President of the Republic of Kazakhstan, Resolutions of the Government that regulate relations on the generation, transmission, distribution and consumption of the electric and heat power, and by-laws of the central executive body for electric power engineering management

CHAPTER 2 STATE REGULATION IN ELECTRIC POWER ENGINEERING

Article 3 The goals of the state management

1 The state management in electric power engineering is carried out in order to satisfy fully the demand of the power consumers and protect their rights by means of ensuring a reliable and stable operating of the electric power engineering complex of the Republic of Kazakhstan on the basis of competition and management unity, considering its extreme importance for life-support of the economy and social complexes of the country

2 The state management should ensure

- effective operation and development of electric power engineering complex,
- creation of a regulated market of electric and heat power,
- rational and economical use of electric and heat power,
- use of renewable and non-traditional energy sources,
- creation of conditions for attracting investments, including foreign ones, into development and re-equipment of the electric power engineering complex,
- creation of conditions for carrying out of the set of measures on environment protection, and on reliability and safety of the exploitation of the electric power engineering devices

Article 4 Competence of the central executive body for electric power engineering management

1 The central executive body for electric power engineering management ensures carrying out of the united scientific-technical policy in the branch, realization of the state power engineering program, carrying out of the licensing in electric power

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engineering, and performs other functions, provided by the present Decree and other legislation of the Republic of Kazakstan

2 The central executive body for electric power engineering management has the right to adopt by-laws in the following cases

- if there are direct instructions in the legislative acts, Decree of the President of the Republic of Kazakhstan or Resolution of the Government of the Republic of Kazakhstan,
- in order to perform legislative acts, Decrees of the President of the Republic of Kazakhstan or Resolution of the Government of the Republic of Kazakhstan (on the issues and within the limits provided by the mentioned acts),
- in order to approve the rules of organization and technical maintenance of electric power devices safety exploitation and use of electric and heat power repair services of the objects of electric power engineering and other issues of technical-technological character,
- jointly with the appropriate state bodies - on the issues of labor protection, fire-prevention, manufacturing sanitation, ecological safety, connected with the generation transmission, distribution and use of electric and heat power

3 The by-laws of the central executive body for electric power engineering management adopted within its competence, shall be implemented by all state bodies persons and legal entities

Article 5 Methods of the state management of the electric power engineering

The following activities are subject for the state management

- licensing of the activity in the field of generation, transmission and distribution of electric and/or heat power,
- state regulation of the prices (tariffs) on electric and heat power, produced by the power generating organizations and delivered by the power supplying organizations to the consumers,
- distribution of power, including its delivery to the consumers in accordance with the concluded contracts
- demonopolization and privatization of the objects of electric power engineering,
- state control over the reliability, safety and economy of the power generation, transmission, distribution and consumption
- licensing of export-import electric power energy operations in accordance with the procedure determined by the Government of the Republic of Kazakstan,
- common mandatory rules, connected with the power generation, transmission, distribution and consumption, and also with the reliability and safety of the construction of the electric power engineering devices and their exploitation,
- other rules stipulated by the legislation on electric power engineering

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Article 6 State regulation of power prices

1 The prices (tariffs) on electric and heat power due to the natural monopoly of the power supplying organizations and their social importance are subject for the state regulation

2 The following types of power prices (tariffs) are established

- purchasing price (tariff) on electric power,
- wholesale price (tariff) on electric power supplied by the National energy system,
- price (tariff) on electric power purchased or supplied by import or export,
- price (tariff) on electric power and heat power supplied to the consumers

3 The prices (tariffs) on electric and heat power should fully cover the costs of the power generating and power transmitting organizations, ensure the conduct of their operations without losses and self-financing from their own revenue to cover natural growth of the demands of the republican economic complex

Costs of the power supplying organizations connected with expansion and reconstruction of the objects of the power engineering for recover of the additional load are compensated by those organizations

Procedure and conditions of compensation of additional costs for expansion and reconstruction of the objects of power engineeering are determined bv the Regulation adopted by the Government of the Republic of Kazakstan

4 The state regulation of the prices (tariffs) on electric and heat power is carried out bv the authorized state bodv

Article 7 Central body for the state regulation of the prices (tariffs) in electric power engineering

1 State regulatory commission in electric power engineering is the central body of the state regulation of the prices (tariffs) in electric power engineering It is independent to make decisions within the limits of powers, granted by the present Decree and anti-monopoly legislation

2 State regulatory commission works on the unified legal-methodological basis that provides while establishing the prices (tariffs) on electric and heat power

- protection of the economic interests of consumers from the monopolistic increase of the prices (tariffs) on electric and heat power,
- creation of mechanism for coordination of the interests of the energy generating, energy supplying organizations and consumers of electric and heat power,
- formation of the competition environment in the electric power engineering complex to increase its effectiveness and minimize prices (tariffs),
- creating economic incentives, aimed at the use of the energy saving technologies and production processes,
- equal access to the republican wholesale electric power market for persons and legal entities - generators of electric power, regardless of the form of ownership,
- openness, availability of the materials of the commission for reviewing and establishing prices (tariffs) by consumers and the public

3 Regulation on state regulatory commission in electric power engineering is is confirmed by the Government of the Republic of Kazakstan

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Article 8 The National electric energy system

1 The National electric energy system provides work of the United electric energy system, including united operating-dispatching management, organizes united electric power market with the united reserves and an open competition access for all power generating organizations regardless of the ownership form, establishes business links within the electric power complex on consumers supply with electric power, and provides equal basis for regulation of the activity of state enterprises and private organizations

2 The National electric energy system has the right

- to introduce a special operation mode of the objects of electric power engineering, regardless of the ownership form, organizational-legal activity type and belonging to a certain ministry,
- to establish a special mode of the electric power supply to the regions to introduce limitations on supply and consumption, or stopping of the power supply to separate consumers or groups of consumers of the regional electric energy systems, connected to the National electric energy system These actions are subject for the permission of the central executive bodv for electric power engineering management and shall be agreed upon with the local executive bodies

3 The procedure for introduction of the special modes or operation of the objects of electric power engineering and power supply to consumers is established bv the Government

Article 9 Central dispatching management

1 The central dispatching management performs operational management of the electric modes of electric power plants and electric transmission lines of the United electric energy system

2 Distribution and installation of the accident-prevention means of automation as well as means of automation to regulate frequency and active power and any other automation systems and devices that influence the modes of operation of the United electric energy system is agreed upon with the Central dispatching management

3 Operational decisions of the Central dispatching management and its regional subdivisions regarding the mode of operation are mandatory for the personnel of all the objects of electric power engineering, regardless of the ownership form organizational-legal activity type and belonging to a certain ministry connected to the United electric power energy system and for consumers

4 The provision on the Central dispatching management of the United electric power energy system is established by the Central executive body for electric power engineering management

Article 10 State power supervision

1 State power supervision (further - GosEnergoNadzor (abbreviation for the state power supervision) is the republican body for state power supervision and energy expertise of the enterprises situated on the territory of the Republic of Kazakhstan, regardless of the belonging to a certain ministry, ownership form, control over a consistent implementation of the state energy saving policy

2 The bodies of GosEnergoNadzor have the right to impose administrative fines according to the procedure, established by the legislation on administrative violations

3 Rights and duties of the bodies of GosEnergoNadzor are defined by the Provision on GosEnergoNadzor, established by the Government

Article 11 Inadmissibility of interference into production-technological activity

Central executive bodies and local representative and executive bodies do not have the right to interfere into production-technological activity of organizations, which is connected with power generation, transmission and distribution or with a technological management of these processes excepting the cases stipulated by article 19 of the present Decree and legislative acts of the Republic of Kazakhstan

CHAPTER 3 ORGANIZATION OF POWER SUPPLY TO THE CONSUMERS

Article 12 The subjects of the relations on power generation, transmission and consumption

1 The subjects of the relations on power generation, transmission and consumption are

- the republican state enterprise the National electric energy system,
- regional power supplying organizations,
- independent power generating organizations, i e organizations enjoying the rights of a legal entity, and that are organizationally and technologically connected with the United electric energy system,
- independent power generating organizations, i e organizations enjoying the rights of a legal entity, and that are organizationally not connected with the United electric energy system,
- power consumers

2 The organizations, directly connected to the National electric energy system or regional power supplying organizations are considered to be independent power generating organizations which are connected with the United electric energy system

3 The state organizations, organizations, belonging to certain ministries or private organizations, which directly supply consumers with electric or heat power are considered to be independent power generating organizations These enterprises use either their own energy network, or the services of the United energy system The independent power generating organizations can sell the power surplus to the United electric energy system, acting in this case as independent organizations

Article 13 Organization of business links in the power supply system

1 The republican state enterprise - the National electric energy system on a contractual basis

- buys power from the independent power generating organizations subordinate to the National electric energy system and buys the power

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surplus from the regional electric energy systems and independent power generating organizations It also imports electric power to the National electric energy system from the electric energy systems of other countries,

- carries out distribution of electric power within the United electric energy system by means of selling power to the regional power supplying organizations and consumers, connected to the National electric energy system and also exports electric energy to other countries

2 Regional power supplying organizations on a contractual basis

- buy power from the independent power generating organizations, subordinate to the regional power supplying organizations and buy the power surplus from the independent power generating organizations
- buy power from the National electric energy system, or sell the power surplus to the National electric energy system,
- supply the consumers of the assigned region with power

3 Independent power generating organizations on a contractual basis

- supply the assigned consumers with power ,
- sell the power surplus to the National electric energy system or to the regional power supplying organizations

Article 14 Contractual relations on the delivery of electric and heat power

1 Delivery of electric energy (power) to the United electric energy system is legalized in a delivery contract, made in accordance with the Civil code of the Republic of Kazakhstan

2 Sales of electric and heat power (power) to consumers are carried out on the basis of a contract on power supply in accordance with the Civil code of the Republic of Kazakhstan

3 Relations of the independant power generating organization, that supplies electric power to its consumer through the electric line of the United electric energy system, with the National electric energy system or its regional power supplying organizations are regulated by the contract on power transmission with obligatory stipulation of the mode of transmission

Article 15 The rights of the consumers of electric and heat power

The consumers of electric and heat power have the right

- to receive power of a proper quality in the volumes and terms, provided by a contract,
- to demand from power supplying organizations compensation of losses, incurred by either misdelivery or delivery of the power of an improper quality,
- to apply to the organizations of GosEnergoNadzor and court instances to solve disputable issues, connected with a delivery and consumption of power

Article 16 The duties of consumers of electric and heat power

Consumers of electric and heat power should

- maintain a technical state of electric and heat-using devices power metering equipment in accordance with the requirements of the by-laws,

- observe contractual modes of power consumption
- meet the normative requirements on keeping electric power quality in an energy system,
- pay for the used power in time,
- actively implement energy saving policy

CHAPTER 4 PROVIDING OF ACTIVITY OF THE ORGANIZATIONS OF ELECTRIC POWER ENGINEERING

Article 17 The procedure for providing with fuel of the organizations of electric power engineering

1 A project type of fuel is used for electric power stations and boilers It ensures the highest effectiveness for the use of an energy device

The quality of coal is defined by the standard, developed by the central executive body for electric power engineering management jointly with the state body for state standards and approved by the Government

The use of fuel at electric power stations, which does not ensure a safety and reliability of a technological process of power generation, and which may lead to an environmental damage in the location of the electric energy object without additional measures to protect nature is prohibited

2 The size of a strategic fuel reserve at electric power stations the procedure for its storing, keeping and using is established by the Government upon the submission of the body of state electric power engineering management

3 Supply of power generating organizations with fuel is done on the basis of as a rule, direct and long-term delivery contracts, which should provide the volumes type and quality of fuel terms of delivery, and sanctions in case of either non-execution or improper execution of a contract

Article 18 The procedure for use of natural resources by the organizations of electric power engineering

1 The objects of electric power engineering are provided with land plots in accordance with the procedure established by land legislation with the right of a permanent use

The sizes of land plots given for locating and exploitation of the objects of electric power engineering, are defined according to the established project-technical documentation for these objects

2 The use of land plots given for construvtion of the objects of electric power engineering, including the land of a protected zone, is not admissible for other needs, if it's not stipulated while allocating of a land plot All types of business activity in a protected zone, permitted by a usage mode, can be realized only upon agreement with the administration of the object of electric power engineering

3 The organizations of electric power engineering should undertake technical and organizational measures, aimed at reduction of a harmful impact on environment and bear responsibility for the violations of legislation on nature protection and environmental safety promotion

Article 19 The work of electric power energy organizations under emergency situations

1 Upon emergency situations (earthquakes, floods other natural calamities, accidents at the objects of electric power engineering) execution of the contractual obligations of the organizations of electric power engineering on power delivery to consumers can be suspended upon the decision of the Government This decision is mandatory for all power supplying organizations, regardless of the ownership form, organizational-legal form of activity and belongong to a certain ministry

2 Upon deliveries of electric and heat power for public needs, caused by emergency situations, the expenses of power supplying organizations are compensated from the appropriate budget

3 In emergency cases, in order to carry out accident-restoration works all mobile sources of power supply of business entities, regardless of the ownership form, belonging to a certain ministry, are transferred into an operational subordination of the central executive body for electric power engineering management

The procedure for is established by the Government of the Republic of Kazakstan

Article 20 Ensuring safe keeping of objects of electric power engineering

1 Protection of the objects of electric power engineering is carried out by the specialized military guarding, following the procedure, established by the Government of the Republic of Kazakstan

The subdivisions of the military guarding of the objects of electric power engineering are provided with fire-arms and special means according to the established procedure

The procedure for using fire-arms and special means is performed according to the legislation

Protection of the most important objects of electric power engineering is carried out by the units of the internal troops of the Ministry of internal affairs and special units of the Ministry of defense The lists of such objects are established by the Government of the Republic of Kazakstan

2 The Government of the Republic of Kazakstan establishes the Rules (regulations) for guarding electric and heating networks considering their special danger and vulnerability, upon the submission by the central executive bodyfor electric power engineering management These Rules are mandatory for all persons and legal entities

3 Persons and legal entities, guilty in damaging and stealing the equipment or electric power engineering device, unauthorized connection to the electric and heating networks, stealing products of electric power engineering, other actions, that may result in damage of electric power engineering, safety reduction of the objects of electric power engineering and reliability of power supply of consumers, carry material, administrative and criminal responsibility in accordance with the legislative acts of the Republic of Kazakhstan

CHAPTER 5 CLOSING PROVISION

Article 21 Measures on realizing the present Decree

The Government of the Republic of Kazakstan should

- submit to the President of the Republic of Kazakhstan proposals on bringing the legislative acts of the Republic of Kazakhstan into of the President of the Republic of Kazakhstan, having the law power "On electric power engineering",
- bring the decisions of the Government of the Republic of Kazakstan into correspondence with the present Decree,
- ensure review and cancellation by the ministries and state committees of their by-laws and instructions, contradicting the present Decree,
- develop the Provision "On the state regulatory commission in electric power engineering", "On the state power supervision" "On the procedure and conditions of expenses compensating for expansion of energy objects while connecting additional load" as well as other bv-laws, provided bv the present Decree

Article 22 The procedure for implementing the present Decree

The present Decree shall be implemented from the promulgation date

President of the
Republic of Kazakhstan

N Nazarbaev

Almaty, December 23 1995

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May 30, 1996
No 663

Resolution
of the Government of the Republic of Kazakstan

On Approval Of Privatization And Restructuring Program In Electric Power Sector

Taking into account the significance of electric power engineering for viability of the economy of the republic, the peculiarities of the operation of Energy Sector and in the purpose of creation of organizational and economic conditions aimed at stabilization and development of electric power industry, the Government of the Republic of Kazakstan RESOLVES

1 To approve the Privatization and Restructuring Program in Electric Power Sector

2 Within a month the State Property Committee of the Republic of Kazakstan on MECI's presentation is to approve the Plan of corporatization of electric power facilities for 1996

3 In the second quarter of 1996 MECI shall transfer the state-owned enterprises and the organizational departments of the energy systems to the management of local executive bodies in accordance with legislation of the Republic of Kazakstan and Attachment 1

Heads of oblasts and Almaty city are to take organizational measures to found in the cities the joint-stock energy supply companies and to provide their normal performance before the heating period (1996-1997) starts

4 The State Property Committee of the Republic of Kazakstan and the Ministry of Energy and Coal Industry shall

- exclude large power plants from "Kazakstanenergo" and transform them to the independent joint-stock companies in accordance with Attachment 2,
- once a quarter are to submit to the Government of the Republic of Kazakstan the information about the procedure of implementing the Privatization and Restructuring Program

Prime-Minister
of the Republic of Kazakstan A Kazhegeldin

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Approved by the
Resolution of the Government
of the Republic of Kazakstan
No 663, dated May 30, 1996

PROGRAM
of Privatization and Restructuring of Electric Power Sector

The present Program was drawn up in the framework of the Program of State-Owned Property Privatization and Restructuring in the Republic of Kazakstan in 1996-1998

The Program specifies the procedure and sequence of restructuring process as well as the principal approaches to the privatizing the State Electric Energy Sector in the Republic of Kazakstan, taking into account the specific characteristics of the Sector All this allows to create all the necessary conditions to secure high level of reliability and effective energy supply of all the consumers groups and to attract both national and foreign investments by working out new organizational-and-economic mechanism of energy supply administering

The objectives of the Program will be accomplished by the following measures

- to create competition in the process of electric energy production and to arrange the independent delivery of electric energy by creation of electricity wholesale market,
- to implement the opened process of regulating high and low voltage electric networks and the activities as related to the electric and heat energy delivery,
- to transfer the rights to pricing regulation in Energy Sector to a newly established independent body, namely the State Regulatory Commission in electric power engineering,
- to create the financial and payment mechanism of responsibility of heat and electric energy producers and customers

The Electric Energy Sector will obtain the monopolistic and competitive features Monopolies (the work of high and low voltage electric networks, the activities regarding the electric and heat energy transportation) will be regulated by the Government As far as some specific elements of competition (e g electric energy production) is concerned they will be regulated by the market itself

Among the facilities of the national wholesale market of electric energy are big generating companies, national electric energy system, wholesale oblast electric network companies, neighboring countries (electric energy producers and consumers), industrial consumers which are directly supplied from the national networks

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The regional market entities are the National electric energy system, thermal plants, regional electric networks, other energy producing organizations, and electric energy consumers

Brief Characteristic of the Specific Features of Electric Power Engineering of Kazakstan

At present electric power industry of Kazakstan is a vertically integrated production structure as the United Energy System (UES of Kazakstan) which consists of 10 energy systems the National Electric Energy System and 9 energy systems which were formed on the basis of administrative and territorial principle

National Energy System "Kazakstanenergo" which includes the United Dispatching Department, base-load thermal and hydroelectric power plants, interregional and interstate electric networks provides the basic production of electric and heat energy in Kazakstan, purchase of excess electric energy from energy systems and other producers, works in parallel with the United Energy Systems of Russia and Central Asia, distributes electric energy among the regions of Kazakstan

A regional energy system which consists of power plants, electric and heat networks provides the electric and heat power production by its own power plants, purchase of electric energy from National Energy System (or sale to National Energy System), transmission, distribution and sale of electric and heat energy to the consumers of this or that particular region of Kazakstan

Balance between electric energy production and consumption which can be observed in every current moment within the whole territory of Kazakstan, is achieved by centralization of technological modes of control of electric energy systems in the United Energy System of Kazakstan according to the unified dispatching schedule in the most efficient mode

Functioning and development of the electric power sector is provided with specialized organizations of electric energy sector

- construction and equipment organizations as well as repair and adjustment enterprises which provide commissioning of new energy facilities, repair and adjustment, reconstruction, renovation and technical re-equipment of energy machinery, as well as buildings and industrial structures,
- design, scientific and research institutes

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The Specific Features of Energy Complex Which Were Taken Into Consideration for the Privatization and Restructuring Program

1 The specific role of the Energy Sector to provide the economic viability for population of the Republic of Kazakstan

2 Technological coincidence of the simultaneous processes of generation, transmission and distribution for electric and heat energy

3 The location of power plants throughout the territory of Kazakstan depending on availability of hydro and fuel resources, consumers, and meeting the requirements of environment protection Electric power deficit which is covered by import and redistribution of electric power from the regions where energy excess is observed

4 The necessity of an accelerating development of power capacities (according to the programs adjusted)

5 High demands on reliability and quality of energy supply, stability of the United Energy System in case of emergency and extreme situations which determines the procedure of centralized dispatching in the system and its components

6 High level of capital intensiveness of production, high level of depreciation of fixed assets, length of investment cycle

7 Crisis of the customers'non-payment for heat and electric energy consumed

Sequence of Corporatizing the Enterprises, Associations and Organizations of the Electric Energy Sector and Privatizing the State-Owned Property

The process of corporatizing and privatizing the objects of electric energy complex envisages several stages caused by the necessity of preliminary structural reorganization, forming the economically independent entities of the market and their potential following privatizing

a) Stage I (1996) - Transformation of Organizational Structure of Managing the Electric Energy Complex

1 In order to implement the President's Decree, having a force of Law, "On Electric Power Engineering", some sectoral normative and legislative acts shall be drawn up and approved The State Regulatory Commission in electric power engineering shall be established as the central body for governmental regulation of heat and electric energy prices (tariffs)

2 Formation of the National Energy System included ~~into~~ the National Electric Network, the national wholesale electric energy market and the Central Dispatch Administration is on the stage of being accomplished

3 Power facilities (thermal and hydroelectric plants), main heat networks which supply transport with heat energy from several heat sources, obtain economic and legal independence

Depending on technological and economic expediency, some heat networks can be transferred to the individual thermal plants

Some facilities of public heat power supply (individual thermal plants, boiler houses, heat networks) shall be transferred to municipal (public) ownership

4 In every oblast the independent electric network enterprise shall be founded It will be included in the regional energy system by uniting into one legal entity some subdivisions of electric networks located in their corresponding oblast

In the case that the regional energy system and the electric networks are located in the same oblast, the latter operate as affiliated organizations of this regional energy system

5 The social and public entities owned by energy systems, which are of social significance for certain region or for the whole Republic shall be transferred to local administrations or executive authorities

The social and public entities necessary for creating the social infrastructure of energy system remain the property of the relevant energy enterprises

b) Stage II - Corporatization and Privatization of the Electric Energy Sector Facilities (starting from 1996)

Corporatization and privatization of the state-owned property in Electric Energy Complex shall be carried out with MECI's participation in the process, with the characteristic features of energy system of Kazakstan on every stage of reorganization taken into account

1 Corporatization of the state-owned enterprises of Energy Sector shall be accomplished by transforming the following energy facilities to the independent joint-stock companies

- hydro electric power plants,
- big coal-, or gas- or oil-fired power stations which form the system of basic energy generating enterprises of Energy Sector,
- thermal power plants,
- oblast electric network enterprises excluded from the regional energy systems,
- production associations (enterprises) as well as organizational departments of energy systems which are engaged in repair, adjustment, construction and equipment operations in Energy Sector,

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- institutes for design and scientific and research

In some individual cases and by decision of the Government of the Republic of Kazakstan, there may be variants of the whole regional energy system transformation to a joint-stock company with the status of unified property complex including the electric and heat networks and heat power plants

The choice of any variant shall be based on working out the Plan of regional energy system corporatization and developing the case-by-case privatization model depending on peculiarities of every energy system, its place in Unified Energy System of Kazakstan and technical statusof equipment and machinery

When the joint-stock companies are founded their authorized fund shall be represented 100% by the state-owned property by way of stocks

2 All facilities of Energy Sector shall be privatized at a case-by-case basis The profile of the facility is not to be changed The government stake in the joint-stock company should not be less than 1/3 of voting stocks In the process of privatization the following principles and aspects are to be taken into account

- to transfer the state block of shares to the trust management or to sell it,
- to keep all the specific features of the Unified Energy System of Kazakstan operation as well as the UES of the CIS countries,
- to combine the self-administrative principle of energy supply with high level of coordination of electric energy production and transportation,
- to follow the national interests of the state in the issues of electric energy and capacity import and export,
- to provide the government regulation of electric energy production and to keep the sufficient reserves of energy capacities in the national wholesale market in order to provide the reliable energy supply of the economy of Kazakstan,
- to provide the effective policy of placing the stocks of privatized energy facilities and attracting the strategic investor,
- to create the pre-conditions for realization of the governmental policy in Energy Sector

3 To determine how necessary the investments are and what their volume should be, the Coordination Council on Privatization shall be established Representatives of the State Property Committee of the Republic of Kazakstan, the Ministry of Energy and Coal Industry of the Republic of Kazakstan, the State Committee on Privatization will be included in the Coordination Council

4 The following entities are not to be privatized

- untill 1997 the National Energy System "Kazakstanenergo" which includes the Central Dispatch Administration, facilities of high voltage interregional and interstate electric networks, 500 KV (and more) electric networks

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c) Stage III - Formation of Free Market of Electric Power (Production and Delivery) (1998)

On the basis of Central and Regional Dispatching Centers the Electric Energy Exchange shall be founded to implement the system dispatching, efficient sale and purchase of electric energy

Technical and economic activities of the energy market shall be based on the Regulations Code

National Energy System shall transport all the energy which is sold to the national wholesale market

Regional energy supplying organizations will provide distribution and sale of electric and heat power in their own regions

The State Regulatory Commission in electric power engineering will regulate tariff rates for electric and heat power and promote the competition in the framework of energy market, as well as to perform some other regulating functions established by the President's Decree having a force of Law "On Electric Power Industry"

Attachment 1
to the Resolution of the Government
of the Republic of Kazakstan
No 663, dated May 30, 1996

A LIST
of the state-owned enterprises and organizational departments
included into the energy system of the Ministry of Energy and Coal Industry
to be transferred to the communal ownership in 1996

a) Heat supply facilities (regional boiler houses, heat networks)

Kapchagay heat networks with regional boiler houses #1 and 2 (Almatyenergo)
Ust-Kamenogorsk regional boiler houses #1 and 2 (Altayenergo)
Ablaket boiler house (Altayenergo)
Atyrau heat networks with the regional boiler house (Atyrauenergo)
Karaganda heat networks (Karagandaenergo)
Petropavlovsk heat networks (Tselinenergo)
Kokshetau heat networks enterprise with boiler houses #1 and 2 (Tselinenergo)
Shulba regional boiler house (Altayenergo)
Aksu heat networks with the boiler house (Pavlodarenergo)
Shymkent heat networks with boiler houses #1, 2 and 3 (Yuzhkazenergo)
Ekibastuz heat networks (Ekibastuzenergo)
Kostanay heat networks enterprise with boiler houses #1, 2,and 3 (Kostanayenergo)
Kzyl-Orda heat networks with regional boiler house (Yuzhkazenergo)

b) CHP for communal use

Tentek CHP (Karagandaenergo)
Karazhal CHP (Karagandaenergo)
Arkalyk CHP (Kostanayenergo)
Ekibastuz CHP (Ekibastuzenergo)
Kentau CHP #5 (Yuzhkazenergo)
Tekely energy combine (Almatyenergo)

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Attachment 2
to the Resolution of the Government
of the Republic of Kazakstan
No 663, dated May 30, 1996

A LIST
of big power plants excluded from NES "Kazakstanenergo"
and transformed to the independent joint stock companies

Ekibastuz GRES#1
Ekibastuz GRES#2
Zhambyl GRES
Karaganda GRES 2

2B

THE RK STATE COMMITTEE FOR THE STATE PROPERTY MANAGEMENT

RESOLUTION

No 499
July 16, 1996

"On Approval of the Power Industry Facilities Corporatization Plan for 1996"

To implement the Resolution of the Government of the Republic of Kazakhstan dated May 30, 1996 No 663 " On Privatization and Restructuring Program in Electric Power Sector " and to create economically independent market entities, the State Property Committee RESOLVES

1 To approve the plan of the power facilities corporatization for 1996 submitted by the Ministry of Energy and Coal Industry according to Attachment 1

2 The territorial State Property Committees are to conduct in established order the corporatization process of the power enterprises with assignment of 100% of state shares with the rights of ownership use and management according to the approved Corporatization Plan for 1996 (Attachment 1) Prior to that, the electrical network facilities ownership shall transferred to Kazakstanenergo from the regional energy systems according to Attachments 2 and 3 to the present Resolution

As this takes place the RK State Property Committee reserves the right of shares disposal and withdrawal

3 To empower the State Property Committee to appoint the presidents for the distribution companies and JSC "Almaty Heat Networks" designated by the Ministry of Energy and Coal Industry of the Republic of Kazakhstan

4 Within the framework of the acting Legislation the powers of the below Agencies are as follows

4 1 The Ministry of Energy and Coal Industry of the Republic of Kazakhstan is to submit to the territorial State Property Committees its recommendations regarding the potential presidents of the joint stock companies

4 2 The territorial State Property Committees are to conclude the management contracts with the presidents of the joint stock companies

4 3 The territorial State Property Committees in agreement with the joint stock companies are to transfer the social assets ownership from the power industry enterprises to the local administration authorities ("Akims")

5 The joint stock companies, being created on the basis of the power sector enterprises, are the successors of their property rights and liabilities

6 Chief Administration of the basic industries in cooperation with the Ministry of Energy and Coal Industry has to elaborate the mechanism of case-by-case privatization of newly created joint stock companies

7 The execution of the present Resolution shall be under control of Mr A Shoukpoutov, the first Deputy Chairman of the State Property Committee

S Kalmourzayev,
Chairman of the State Committee
for State Property Management

ATTACHMENT 1
to the Resolution of the State Committee for the State Property Management
No 499, dated July 16,1996

PLAN
of Power industry Facilities Corporatization for 1996

No	Enterprises to be reorganized	Type of a joint stock company	Reorgan schedule	State shares to be transferred to
1	Industrial Association "Kazremenergo"	Will be corporatized by the individual program	July	Will be transferred by the individual program
2	Industrial enterprises for maintenance and adjustment of the regional power systems' equipment	Open-end joint stock companies		
	- Almatyenergoremont Almaty	Almatyenergoremont	July	Territorial committee
	- Tsentrkazenergoremont, Karaganda	Tsentrkazenergoremont	July	Territorial committee
	- Sevkazenergoremont Pavlodar	Sevkazenergoremont	July	Territorial committee
	- Yuzhkazenergoremont, Shymkent	Yuzhkazenergoremont	July	Territorial committee
	- "Kaztechenergo" Almaty	Kaztechenergo	July	Territorial committee
3	Specialized enterprises for maintenance and adjustment of the regional power systems' buildings and structures	Open-end joint stock companies		
	- Almatyenergospetsremont, Almaty	Almatyenergospetsremont	July	Territorial committee
	- Karagandaenergospetsre-	Karagandaenergospets-		Territorial

	mont. Karaganda	remont	July	committee
	- Yuzhkazenergospetsremont, Shymkent	Yuzhkazenergospetsremont	July	Territorial committee
4	Construction and installation companies removed from the regional power system	Open-end joint stock companies		
	- Uralskenergostroi, Uralsk	Uralskenergostroi	July	Territorial committee
	- Tselinenergostroi Akmola	Tselinergostroi	July	Territorial committee
	- Petropavlovskenergostroy, Petropavlovsk	Petropavlovskenergostroy	July	Territorial committee
5	Regional energy systems (property left after removal of network facilities the latter being subordinated to NES "Kazakhstanenergo" the enterprises reorganized into independent JS companies and the municipal heat supply facilities)	Open-end joint stock companies		
	Almatyenergo Almaty	1 JSC "Almaty distribution electrical network company" founded on the basis of the structural subdivisions of Almatyenergo Subsidiaries are founded within the company, provided 51% of state shares out of their authorized funds are transferred to the mother company authorized fund Almaty electrical networks (Almaty) based on Almaty electrical network facilities including Yessik electrical networks with rights of an affiliated organization, Almaty distribution	July	Ministry of Energy and Coal Industry

		electrical networks (Almaty)		
		2 JSC "Almaty CHP #1", Almaty	July	Territorial committee
		3 JSC "Almaty CHP #2, Almaty	July	Territorial committee
		4 JSC "Almaty Thermal Plant", Almaty oblast, Energetitchessky settlement	July	Territorial committee
		5 JSC "Almaty Heat Networks", Almaty	July	Territorial committee
		6 JSC "Taldykorgan distribution electrical network company" (Taldykorgan) based on the Taldykorgan electrical network facilities within the framework of Taldykorgan United Directorate of power stations	July	Ministry of Energy and Coal Industry
		8 JSC "Cascade of Almaty Hydroplants", Almaty oblast	July	Territorial committee
	Atyrauenergo, Atyrau	1 JSC "Atyrau distribution electrical network company" (Atyrau) on the basis of structural subdivisions of Atyrauenergo, Atyrau electrical networks Atyrau municipal electrical networks, Tengiz electrical networks	July	Ministry of Energy and Coal Industry
		2 JSC "Atyrau CHP"	July	Territorial committee
	Zapkazenergo, Aktyubinsk	1 JSC "Aktuybinsk distribution electrical network company"	July	Ministry of Energy and Coal Industry

		(Aktyubinsk), based on structural subdivisions of the energy system, Aktyubinsk western electrical networks, Aktyubinsk eastern electrical networks, Oktyabrsk electrical networks, Aktyubinsk municipal electrical networks		
		2 JSC "West-Kazakhstan distribution electrical network company" (Uralsk) based on the Uralsk left-bank electrical networks, Uralsk electrical network distribution networks, facilities of the Uralsk right-bank electrical networks	July	Ministry of Energy and Coal Industry
		3 JSC "Aktubinsk CHP" based on the Aktubinsk CHP and Aktyubinsk heat networks	July	Territorial committee
		4 JSC "Uralsk CHP" based on the Uralsk CHP and Uralsk heat networks	July	Territorial committee
	Karagandaenergo, Karaganda	1 JSC "Karaganda distribution electrical network company" based on the structural subdivisions of Karagandaenergo, Karaganda distribution electrical networks, Karaganda northern electrical networks, facilities of Karaganda high-voltage electrical networks	July	Ministry of Energy and Coal Industry
		2 JSC "Karaganda Thermal #1"	July	Territorial committee

		3 JSC "Karaganda CHP #1"	July	Territorial committee
		4 JSC "Karaganda CHP #3"	July	Territorial committee
		5 JSC "Jezkazgan distribution electric network company" (Jezkazgan) based on the Jezkazghan electrical network enterprise, facilities of Balkhash electrical networks	July	Ministry of Energy and Coal Industry
	Kostanayenergo, Kostanay	1 JSC "Kostanay distribution electrical network company" (Kostanay), based on the structural subdivisions of Kostanayenergo, facilities of Western electrical networks, Central electrical networks, and Northern electrical networks	July	Ministry of Energy and Coal Industry
		2 JSC "Rudny CHP"	July	Territorial committee
		3 JSC "Torgay distribution electrical network company" (Arkalyk) based on the Southern electrical networks, facilities of Yessil electrical networks	July	Ministry of Energy and Coal Industry
	Pavlodarenergo, Pavlodar	1 JSC "Pavlodar distribution electrical network company" (Pavlodar) based on the structural subdivisions of Pavlodarenergo, facilities of Pavlodar electrical networks, Aksu electrical networks, facilities of Ekibastuz high voltage	July	Ministry of Energy and Coal Industry

		electrical networks		
		2 JSC "Pavlodar CHP #2"	July	Territorial committee
		3 JSC "Pavlodar CHP #3"	July	Territorial committee
		4 JSC "Pavlodar Heat Networks"	July	Territorial committee
	Tselinenergo, Akmola	1 JSC "Akmola distribution electrical network company" (Akmola) based on the structural subdivisions of Tselinenergo, Akmola electrical networks, Akmola municipal electrical networks, Stepnogorsk electrical networks, facilities of Akmola high voltage electrical networks	July	Ministry of Energy and Coal Industry
		2 JSC "Akmola CHP #2" (Akmola)	July	Territorial committee
		3 JSC "Akmola Heat Networks" (Akmola) based on Akmola heat networks and Akmola CHP #1	July	Territorial committee
		4 JSC "North-Kazakstan distribution electrical network company" (Petropavlovsk), facilities of Petropavlovsk electrical networks, Sergeevsk electrical networks, Petropavlovski municipal electrical networks	July	Ministry of Energy and Coal Industry
		5 JSC "petropavlovsk CHP #2"	July	Territorial committee
		6 JSC "Kokshetau distribution electrical	July	Ministry of Energy and

		network company" (Kokshetau) based on Kokshetau electrical networks Kokshetau municipal electrical networks		Coal Industry
	Yuzhkazenergo, Shymkent	1 JSC "South-Kazakstan distribution electrical network company" based on the structural subdivisions of Yuzhkazenergo, Shymkent distribution electrical networks, Shardary electrical networks, fgacilities of Shymkent electrical networks, facilities of Kentau electrical networks	July	Ministry of Energy and Coal Industry
		2 JSC "Shvmkent CHPs" based on CHP #1 and 2 (Shymkent)	July	Territorial committee
		3 JSC "Shvmkent CHP #3"	July	Territorial committee
		4 JSC "Kzyl-Orda distribution electrical network company" (Kzyl-Orda) based on the facilities of Kzyl-Orda electrical networks	July	Ministry of Energy and Coal Industry
		5 JSC "Kzyl-Orda CHP #6" (Kzyl-Orda)	July	Territorial committee
		6 JSC "Jambyl distribution electrical network company" (Jambyl) based on the facilities of Jambyl electrical networks, Jambyl municipal electrical networks	July	Ministry of Energy and Coal Industry
		7 JSC "Jambyl energy combine" (Jambvl), based	July	Territorial

		on Jambyl CHP #4 Jambyl heat networks		committee
6	Ekibastuz Thermal #2	JSC "Ekibastuz Thermal #2" (Ekibastuz)	July	NES "Kazakhstan-energo"
7	Jambyl Thermal	JSC "Jambyl Thermal" (Jambyl)	July	NES "Kazakhstan-energo"
8	Karaganda Thermal #2	JSC "Karaganda Thermal #2" (Temirtau)	July	NES "Kazakhstan-energo"
9	The following companies are removed from the Mangyshlak nuclear power industrial complex	Open-end joint stock companies		
	Mangistau electrical network enterprise Aktau	1 JSC "Mangistau distribution electrical network company", (Aktau)	July	Ministry of Energy and Coal Industry
	Mangistau CHP #3, Aktau	2 JSC "Mangistau CHP #3" (Aktau)	July	Territorial committee

Attachment 3
to the Resolution of the
RK State Property Management
Committee No 499, dated July 16, 1996

A LIST
of Repair Bases of the Regional Energy Systems Which Shall Be Transferred
to the Structure and Balance of Kazakstanenergo

Kazakstanenergo Subsidiaries and the Districts of Electrical Networks (DEN)	Repair Bases of the Structural Units of the Energy Systems
Sarbay subsidiary Intersystem electrical networks of NES Kazakstanenergo Rudny	Base of Sarbay High Voltage DEN of the North electrical networks of Kostanayenergo
Rudny DEN	Base of 500 KV sub-station Sokol
Jetygary DEN	Base of Jetygary DEN of West Electrical Networks of Kostanayenergo
Essyl DEN	A part of working areas of the Essyl Electrical Networks Arkalyk Electrical Networks of Kostanayenergo
Aktyubinsk DEN	A part of the central base of the Aktyubinsk East Electrical Networks of Zapkazenergo
Uralsk DEN	A part of the Uralsk Pravoberezhny Electrical Networks Uralsk Electrical Networks of Zapkazenergo
Akmola subsidiary of Intersystem Electrical Networks of Kazakstanenergo Akmola	The caentral base of the AkmolaHigh Voltage Electrical Networks of Tselinenergo
Akmola DEN	Sergeevskaya 500 KV sub-station, (Akmola)
Atabssar DEN	Base of South DEN of the Akmola High Voltage Electrical Networks of Tselinenergo
Smirnovsky DEN	500 KV sub-station Aurora, base of the Smirnovsky DEN Petropavlovsk Electrical Networks of Tselinenergo
Central subsidiary Intersystem Electrical Networks of Kazakstanenergo Karaganda	A part of working areas of the administartive building of Karagandaenergo
Nourinsky DEN	500 KV sub-station Noura

INSTRUCTION

No T- 57/4 dated July 18, 1996

On Implementation of the Plan of Electric Power Facilities Corporatization for 1996

To implement the Resolution of the Republic of Kazakhstan No 663 dated May 30, 1966 "On Privatization and Restructuring Program in Power Industry" the State Property Managment Committee of the Republic of Kazakhstan has approved the Plan of Power Industry Facilities Corporatization for 1996 by issuing the Resolution No 499 dated July, 16, 1996

I COMMIT

The General Directors of energy systems to do the following

1 To adopt and implement the above mentioned Resolution of the State Property Managment Committee as a governing document (Resolution attached)

2 In accordance with the Corporatization Plan to adopt the separation balances in prescribed manner as on July 01 1996 taking into consideration the article 2 2 of the MECI order No 84 dated June 20, 1996 "On Implementation of the Privatization and Restructuring Program of of Electric Energy Industry

3 When elaborating the By-Laws of joint-stock companies, particularly the articles concerning the electric and heat power production transmission and distribution, as well as the Power Industry management to act in accordance with the RK President s Statutorv Decree " On Electric Power Engineering", the Resolutions of the Government of the Republic of Kazakstan, and normative acts and regulations of the Ministry of Energy and Coal Industry, adopted in accordance with the above Law

4 Within 10 days to submit to the Ministry a list of candidates to the positions of Chairmen of joint stock companies (according to Attachment 1 to the Resolution of State Property Committee) for the further submisson to the State Property Managment Committee of the Republic of Kazakstan and its territorial committees

5 To bring the present Instruction to the notice of all the subsidiaries and affiliated and enterprises of energy systems

First Deputy Minister S A Tiyesov

Appendix J

Decrees on Electricity Tariffs

This appendix contains selected decrees obtained by Hagler Bailly Consulting

1 Decree of the Government of the Republic of Kazakstan, No 1311, October 6, 1995 *On the additional measures to stimulate the development of industry and agriculture*

2 Regulation of the Government of the Republic of Kazakstan, No 102, January 26, 1996 *On Electricity Tariffs*

3 Regulation of the Anti-Monopoly Committee, June 10, 1996 (pending approval from the Ministry of Justice) *Special Procedure for Price and Tariff Formation for the Products (Works and Services) Produced and Sold by the Economic Entities - Natural Monopolists*

4 Resolution of the State Committee for Pricing and Antimonopoly Policy of the Republic of Kazakstan and the Ministry of Energy and Coal Industry of the Republic of Kazakstan, September 27, 1996 *On Electricity Tariffs*

DECREE OF THE GOVERNMENT
OF THE REPUBLIC OF KAZAKHSTAN

October, 6 1995
N 1311

On the additional measures to stimulate the development of industry and agriculture.

In order to ensure a stable work of the industrial and agricultural enterprises, the Government of the Republic of Kazakhstan issues the decree

1 To establish as of October, 1 1995 the energy price in accordance with the tariffs of the National energy system for the following enterprises energy-consuming industrial enterprises (power - 100 Mwt), railroad transportation companies, and energy-consuming agro-enterprises (green houses, poultry and cattle farms) The tariffs will be applicable only if the payment is made before the 10th day of the following month Should the payment be delayed, the regional tariff will be applied

2 The decision of the State Committee of the Republic of Kazakhstan on price and anti-monopoly policy, dated October, 3 1995 shall be taken into consideration According to this decision the price on Ekibastuz coal will remain 190 tenge during the third quarter of this year

3 The State Committee of the Republic of Kazakhstan on price and anti-monopoly policy and Ministry of Energy and Coal Industry of the Republic of Kazakhstan shall realize until December, 1 1995 the introduction of the internal payment prices between the energy systems and the power-stations within them

4 The railroad transportation enterprises with the annual volumes exceeding 100 000 tons within Republic and its regions, shall be eligible for 30% discount off the present tariff, starting October, 1 1995 The discount will be applied only if the payment is made before the fifth day of the following month and the previous debts are paid off

The Decision of the State Committee of the Republic of Kazakhstan, dated March, 23 1995 N2/11 "On railroad shipping tariffs", which established 50% decreasing co-efficient for the coal shipping within the Republic, shall be taken into consideration

The penalties for the railroad transportation payment delays shall be canceled These penalties are provided by the Decree of the Cabinet of Ministers of the Republic of Kazakhstan, dated April, 14 1995 N306 "On the liability of the enterprises and organizations for the

ATTACHMENT
to the Decree of the Cabinet of Ministers of the Republic of Kazakhstan
dated October, 6 1995 N1311

LIST of the NO LONGER VALID Decisions of the Cabinet of Ministers

1 Point 6 of the Decree of the Cabinet of Ministers of the Republic of Kazakhstan, dated April, 22 1992 N 369 "On the development of Tourism and Sports in the Republic of Kazakhstan"

2 Point 4 of the Decree of the Cabinet of Ministers of the Republic of Kazakhstan
dated June, 26 1992 N 556 "On realization of the President's Decree "On the immediate measures on protection of mass media, state bodies, state book-publishing during the period of transition to the market relations" (Collection of Acts of President and Government, 1992, N 25, article 398)

3 Point 8 of the Decree of the Cabinet of Ministers of the Republic of Kazakhstan
dated December, 27 1994 N 1472 "On measures of stabilizing the work of the Karaganda metallurgical plant"

4 Paragraph 5, point 14 of the Regulation "On inter-branch manufacturing association "Pavlodar industrial-financial alliance", established by the Decree of the Cabinet of Ministers of the Republic of Kazakhstan dated October, 6 1994 N 1122 "On creation of the inter-branch association "Pavlodar industrial-financial alliance" (Collection of Acts of President and Government, 1994, N 42, article 456)

5 Point 1 & 2 of the Decision of the Deputy Prime-Minister of the Republic of Kazakhstan, dated February 10, 1995, N 8-2

transportation and other services payment delays" (The collection of the Acts of President of Government), 1993, N13, article 158)

5 The State Committee of the Republic of Kazakhstan on price and anti-monopoly committee shall

within the week's term review the regional energy tariffs, taking into consideration the technological peculiarities of bringing energy to the consumer, and tariff differences between the regions,

together with the Chief Taxation Inspection of the Republic of Kazakhstan, establish a personal control over expenses and profit use by the enterprises, which are included in the State register of the natural monopolist-enterprises,

together with the oblast Akims (head of oblast) and Almaty akim, establish control over communal expenses,

report to the Government before December, 1 1995 on the completed work,

6 Ministry of Energy and Coal Industry of the Republic of Kazakhstan together with oblast and Almaty akims shall establish the separate energy consumption in the country side commodity producer, social sphere, population - before April, 1 1996

7 A number of the Decisions of the Government of the Republic of Kazakhstan on beneficial tariffs on energy and heating energy (attached) are considered to be no longer valid

Prime-Minister
of the Republic of Kazakhstan A Kazhegeldin

Regulation of the Government of the Republic of Kazakstan

No 102

January 26, 1996

On Electricity Tariffs

Government of the Republic of Kazakstan decrees

1 As an exception of item 2 provisions of the Resolution of the Cabinet of Ministers No 1171, October 19, 1994 "On Price Regulation for the Production of Economic Entities - Natural Monopolists" to permit the Ministry of Energy and Coal Industry and the State Committee of the Republic of Kazakstan on Pricing and Antimonopoly Policy to raise the acting electricity tariffs by 4% on the average beginning on February 1, 1996

2 To achieve the electric energy supply of the consumers who are connected to the National Electric Network in accordance with the wholesale tariff established by the National Energy System "Kazakstanenergo"

3 The State Committee for Managing State Property of the Republic of Kazakstan in cooperation with the Ministry of Energy and Coal Industry of the Republic of Kazakstan and the State Committee of the Republic of Kazakstan for Privatization within 2 months should provide the privatization process of the enterprises with social and cultural functions operating in power sector

The Ministry of Energy and Coal Industry, the Ministry of Economy, the Ministry of Finance of the Republic of Kazakstan, heads of oblast administrative bodies should transfer the enterprises with social and cultural functions to the balance of local executive bodies

The objects of social and cultural sphere of Ekibastus Heat and Electric Plant # 1, Ermak Heat and Electric Plant, Southern Kazakstan Energy System "Yuzhkazenergo", Energy System "Tselinenergo", Energy System "Atyrauenergo" should primarily be transferred to the balance of local executive bodies

The State Committee of the Republic of Kazakstan on Pricing and Antimonopoly Policy should

- to carry out certain work towards the restricting the groundless price rise of water, mazut, gas and to report the Government on the measures taken,

- in the provinces to perform inspection of the actual level of electric energy generation costs in the 1 quarter of the current year and to report the Government on the results by May 1

5 The Ministry of Economy, the Ministry of Finance, the Export and Import Bank of the Republic of Kazakstan should consider the proposals of the Ministry of Energy and Coal Industry of the Republic of Kazakstan related to the investment projects and within 1 month to submit the proposal to the Government

6 To admit the following items as invalidated beginning on February 1, 1996

- paragraph 2 of item 6 of the Regulation No 1033, July 28, 1995 "On Reorganization of the Structure of Management of the Electric Energy Sector",

- paragraph 3 of the Regulation of the Cabinet of Ministers of the Republic of Kazakstan No 1268, September, 19, 1995 "On making Amendments of the Decree 1033" of July 28, 1995,

- items 1, 2, paragraphs 1 and 2 of item 4 of the Regulation of the Government of the Republic of Kazakstan No 1311, October 6, 1995 "On Additional Measures To Stimulate the Development of Industry and Agriculture" (SAPP of the Republic of Kazakstan, No 32, 1995, p 405)

Prime-Minister
of the Republic of Kazakstan A Kazhegeldin

APPROVED
Chairman of the State Committee on
Pricing and Antimonopoly Policy of the
Republic of Kazakstan

_____ N Radostovets
June 10, 1996

AGREED

Ministry of Economy
of the Republic of Kazakstan
_____

Ministry of Finance
of the Republic of Kazakstan
_____

Ministry of Construction
of the Republic of Kazakstan
_____

State Committee for Statistics
and Analysis of the Republic
of Kazakstan _____

Ministry of Labor
of the Republic of Kazakstan
_____

SPECIAL PROCEDURE
for Price and Tariff Formation for the Products
(Works and Services) Produced and Sold by the
Economic Entities - Natural Monopolists

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GENERAL PROVISIONS

The present Special Procedure is worked out in accordance with the following documents

- Article 14 of the Republic of Kazakstan Law "On the Development of Competition and Restriction of Monopoly Activities" which states that in case the economic entity-monopolist or its market dominance is impossible or unexpedient to be broken up into smaller units, some specific antimonopoly measures shall be undertaken (e g setting of fixed prices, increased taxation, etc),
- Resolutions of the Government of the Republic of Kazakstan dated

* October 19, 1994, No 1171 "On Price Regulation for the Products of the Economic Entities - Natural Monopolists" according to which the State Committee on Pricing and Antimonopoly Policy is permitted to make decisions on regulation of high monopoly profit of the economic entities-monopolists on the basis of production cost changes, production output and inflation rate,

* May 13, 1996, No 587 "On Demonopolization of Residential and Communal Services and Regulation of Payments for Communal and Residential Services" according to which it is planned to regulate the expenses included to the product cost (works, services) produced and sold by the economic entities-natural monopolists operating in municipal economy

The present Specific Procedure working out was aimed at curb on prices for the products and services of the unrivaled enterprises-natural monopolists by regulating the expenses included to the product cost

The Specific Procedure shall be applied in the process of prices and tariffs formation for the products and services of the economic entities-natural monopolists regardless of the form of ownership which are included into the State Register of the economic entities-natural monopolists of the Republic of Kazakstan

In accordance with the Resolutions of the Government of the Republic of Kazakstan No 1171 "On Price Regulation for the Products of the Economic Entities-Natural Monopolists" dated October 19, 1994 and No 587 "On Residential and Municipal Services Demonopolization and Regulation of Payments" May 13, 1996, the natural monopoly sphere includes the enterprises for oil and gas pipeline transportation, gas- and oil refineries, enterprises of coal industry, railway transport, communications, electric power industry, water economy system and some municipal enterprises for water supply, sewage disposal, natural and liquified gas supply, heat and electric energy supply, communication services

The prices for the products (works, services) of the economic entities-natural monopolists shall be approved in accordance with the procedure and terms stipulated in the "Instruction on Procedure of Submission, Consideration and Approval of Prices and Tariffs for the Products and Services of the Economic Entities-Natural Monopolists" which was approved by the Resolution of the State Committee on Pricing and Antimonopoly Policy, No 4/75 dated June 7, 1996

As for the municipal (communal) enterprises-natural monopolists providing the consumers with cold and hot water, sewage disposal, natural and liquified gas, heat and electric energy, and communication services, the present Specific Procedure shall be effective and valid from July 1, 1996

For all other enterprises-natural monopolists the present Specific Procedure is valid from October 1, 1996

REGULATION OF THE EXPENSES FOR PRICES AND TARIFFS DETERMINATION

Prices for products and services of the economic entities-natural monopolists are based on the production cost which is determined in accordance with two documents a) the Provision on Production and Sale Expenses Included into the Production Cost (Cost of Works and Services), and (b) the Provision on the Procedure of Making Up the Financial Results, and (c) some other Provisions on the expenses structure The documents were adopted by the Resolutions of the Ministries of Economy and Finance, and the State Committee for Statistics No 01-3/5704-8, No 11-2/2139, No 01-3-20/46 dated July 30 1992 (additions and amendments dated July 27, 1994)

For the enterprises of the natural monopoly category the following procedure of the regulation of expenses included into the production cost and used in prices and tariff formation, shall be established

Material expenses shall be determined on the basis of the current norms of raw material, fuel and energy consumption per a unit of production (services) which were approved and evaluated by experts in the Competent Body [1] They are also based on actual prices at which all these types of resources were purchased (delivery, transportation and procurement expenses included)

In the process of price formation, the antimonopoly bodies are to check whether the standards and norms are available and used properly

In case standards and norms do not exist, the economic entities-natural monopolists within a month are to provide the working out and approval of the norms and standards in accordance with the established order

Wage-and-salary disbursement included into production (services) cost shall be calculated as a product of the average monthly salary which doesn't exceed the 4-fold rate of the first category salary, and the normative number of the staff The normatives of the staff number shall be agreed with the Ministry of Labor

The standardized funds for wage-and-salary disbursement shall be coordinated with the acting salary coefficients valid in remote, mountain or desert regions

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[1] The Competent Body for the republican state-owned enterprises means the ministries, state committees agencies and other bodies authorized by the Government of the Republic of Kazakstan, the Competent Body for state-owned public utilities means the local executive bodies authorized by the Head of local administration The Competent Body for non-state enterprises means the sectoral ministries agencies institutions of the similar activities determined by the antimonopoly authorities

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Wage-and-salary expenditures can not include material incentives (including bonuses) for the employees who are not the direct participants of the production process, in case the enterprise achieved high productive results (or high production capacity in energy and other sectors)

In accordance with the Republic of Kazakstan President's Decree "On the State-Owned Enterprise" the incentive system at the enterprise, the rate of pay-roll fund and the consumption fund for the state-owned enterprise as well as the rate of salary for the chief executive, his deputies, and the chief accountant shall be established by the Authorized Body

The rate of salary for the managerial staff shall be determined on the basis of the Unified Schedule of Rates which was adopted by the Resolution of the Republic of Kazakstan Government "On the Labor Payment in the Sectors of the Republic of Kazakstan Economy " No 31, dated January 9, 1996

The coefficient rates used by the economic entities-natural monopolists as applied to the Unified Schedule of Rates shall be considered and analyzed by the Antimonopoly Bodies and Labor Control Authorities

Other expenditures The following expenditures shall not be taken into account in the structure of the expenses in the process of price formation

- representation expenses, expenses for other enterprises representatives official reception (foreigners included), translation services payment if the translators are not the staff members, visiting places of entertainment, buffet services during business meetings and negotiations,
- expenses to support and maintain the enterprise-owned canteens which provides services to the staff (including depreciation deductions, expenditures for premises repair, expenditures for lighting, heating, water and electricity supply and fuel for cooking),
- payment for consulting, information and audit services,
- expenses to arrange exhibitions and competitions on invention and rationalization activities,
- expenses for health care and rest which are not directly connected with the employees' participation in the production process,
- expenses to rent broker and dealer places,
- expenses to maintain official vehicles and reimbursement to the vehicles' owners (wage, amortization, repair, fuel and lubricants purchase, etc),
- expenses to purchase and maintain expensive means of communication (cellular telephones, etc),
- expenses to subscribe newspapers, scientific and technical literature, normative and technical literature,
- expenses for advertising and participation in fairs, exhibitions, etc

The deductions to form the reserve funds (repair fund, guarantee reserve, reserve to pay vacations, etc) shall be included into the production cost in the process of price formation if it is agreed and coordinated with the Antimonopoly Committee

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LIMITATIONS IN THE PROFIT DETERMINATION INCLUDED IN PRICE

All legal taxes, other payments and funds necessary for the development of the industry or the economic entity shall be taken into account while determining the profit rate

To substantiate the revenue requirement the economic entity shall submit the schedule of measures and estimate of expenditures for financing the construction of new facilities, expansion, technical re-equipment and renovation of existing ones, purchase and use of equipment and other means of production under the antimonopoly bodies control

The normatives of profit distribution for the state-owned enterprises shall be approved by the Authorized Body

Assets for consumption should not exceed 20% of profit rate which is left at the disposal of the enterprises after all taxes and obligatory payments were paid

The following types of expenses shall not be taken into account in the process of price formation

- expenses to maintain the buildings and premises which are on the balance of the enterprise and which are used for cultural entertainment or sport competitions by the employees and their families (libraries, recreation and health rehabilitation houses and resorts, gyms, sport complexes, medical offices, polyclinics, hospitals, etc),
- expenses to organize cultural entertainments, sport competitions (shows, performances, concerts, lectures, discussions, meetings with artists, actors, etc),
- expenses to maintain kindergartens, labor and recreation camps, etc , which are on the balance of the enterprise,
- expenses to maintain educational institutions and specialized colleges which are on the balance of the enterprise,
- expenses to reimburse for damages of residential and communal entity which is on the balance of the enterprise,
- expenses to redeem the loans (interest-free included) which were lend to the employees to improve their residential conditions, to purchase dachas, etc ,
- expenses related to the improvement and development of dachas cooperatives (roads building, construction of energy and water supply systems, etc), building of garages,
- payment of the employees' places in the resorts for medical treatment and rest from the enterprise's funds,
- expenses for providing the employees with foodstuffs (free or at low prices),
- expenses to pay the services in the polyclinics in accordance with the contracts concluded with the health care authorities on rendering medical assistance to the employees,
- insurance payments (insurance premiums paid by the enterprise in accordance with the agreements on the employees' life and property insurance),
- payments for pollutants discharge,
- expenses related to all types of sponsorship,

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- other types of benefits (mass media subscription, making a prosthetic appliance, membership in clubs, sections etc)

The economic entitv is not allowed to use the profit for the following purposes

- to carry out deals or transactions at the result of which the natural monopolist gains the right of fixed assets ownership or use, if they are not designed for regulated production and sale of products
- to invest the natural monopolist's monev(by carrying out the capital construction, foundation of commandite partnerships, concluding the contracts on mutual activities with other economic entities) to the regulated production or sale of products

RESPONSIBILITY FOR VIOLATING THE SPECIFIC PROCEDURE

According to the "Provision on the Procedure of Economic Sanctions Use as a Result of Violation of the State Discipline of Prices" No 245 dated March 17, the economic sanctions may be applied to the natural monopolists if the latter violate the "Specific Procedure "

The economic sanctions use is based on the gaining the illegal income by the enterprise as a result of

- increasing the regulated (fixed) prices on products (goods, services),
- violating the procedure of the production cost formation by including into the calculation the unreasonablv increased cost of raw materials, salary and other items of expenditures

An amount of illegal income is to be transferred to the budget with simultaneous penalty payment equal to the income size If the second violation occurs within a year after the economic sanctions were imposed, a 3-fold penalty shall be paid

Executives and officials who are guilty in the violation of the pricing procedure and rules of the natural monopolists's behavior in the market, shall bear the administrative responsibility in accordance with the legislation of the Republic of Kazakstan

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The State Committee for Pricing
and Antimonopoly Committee
of the Republic of Kazakstan
No 7/104

Ministry of Energy and
Coal Industry of the
Republic of Kazakstan
No X 75/4

September 27 1996

RESOLUTION
on Electricity Tariffs

The State Committee for Pricing and Antimonopoly Policy of the Republic of Kazakstan and the Ministry of Energy and Coal Industry of the Republic of Kazakstan in accordance with the GOK Resolution No 1033 dated July 28, 1995 On Reorganizing the Administrative Structure of the Power Engineering Industry of the Republic of Kazakstan" and based on the decision of the State Regulatory Commission (Minutes No 2 dated September 25 1996)

RESOLVE

1 To establish the purchase tariffs for electricity wholesale tariffs for electricity sold by the National Energy System and average selling tariffs for electricity which is delivered to the customers by the regional grid companies (according to the Attachment) from October 1 1996

2 To grant a right to the territorial Committees for Pricing and Antimonopoly Policy to approve the purchase tariffs for the generating enterprises that do not participate in the wholesale power market formation

3 To consider the Attachment to the Resolution of the State Committee for Pricing and Antimonopoly Policy and the Ministry of Energy and Coal Industry No 5/82 and No 1/4 (') dated June 28 1996 to be ineffective

Chairman of the State Committee
for Pricing and Antimonopoly Policy
Republic of Kazakstan

_ _ _ Radostovets N

Minister of Energy and
Coal Industry of the
Republic of Kazakstan

_ _ Khrapounov V

Attachment
to the Resolution of the State Committee
for Pricing and Antimonopoly Policy and the
Ministry of Energy and Coal Industry of the
Republic of Kazakstan dated September 27, 1996
No 7/104 and X-75/4

I PURCHASE TARIFFS FOR ELECTRICITY SOLD BY THE GENERATING FACILITIES

	tiyn/KWh
Joint Stock Company "Ermakovskaya TPP"	63 75
Jambyl TPP	125 0
Karaganda TPP # 2	87 0
Ekibastuz TPP # 2	148 0
Taldykorgan oblast directorate of power plants	77 65
Bukhtarma Hydro plant	14 5
Ust Kamenogorsk Hydro	10 4
Ust-Kamenogorsk CHP	111 6
Leninogorsk CHP	156 4
Sogrinsk CHP	159 9
Shulba Hydro	30 5
Atyrau CHP	97 0
Uralsk CHP	117 0
Karaganda CHP # 1	115 7
Karaganda CHP # 3	107 2
Karaganda TPP # 1	195 2
Jezkazgan CHP	166 5
Rudny CHP	170 0
Pavlodar CHP # 1	67 7
Pavlodar CHP # 2	91 17
Pavlodar CHP # 3	99 72
Akmola CHP # 2	87 55
Petropavlovsk CHP # 2	94 7
Shymkent CHP # 3	178 6
Mangyshlak Power Combine	260 0
Ekibastus plant operated by AES	0 028 $

II WHOLESALE TARIFF FOR ELECTRICITY SOLD BY THE NATIONAL ENERGY SYSTEM "KAZAKSTANENERGO"

	tiyn/KWh
NES Kazakstanenergo"	286 6

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III AVERAGE SELLING TARIFFS FOR ELECTRICITY DELIVERED TO THE CUSTOMERS BY THE REGIONAL GRID ENTERPRISES

	tiyn/KWh
Aktiuba oblast	234 0
Atyrau oblast	202 0
East Kazakstan oblast	128 0
Jambyl oblast	180 0
Jezkazgan oblast	230 0
Karaganda oblast	282 0
Kzyl-Orda oblast	200 0*
Kokshetau oblast	358 0*
Kostanay oblast	311 0*
Mangistau oblast	290 0*
Pavlodar oblast	136 0
North Kazakstan oblast	170 1
Semipalatinsk oblast	128 0
Taldykorgan oblast	329 0
Torgay oblast	329 0
West Kazakstan oblast	300 0
South Kazakstan oblast	162 0

Note * - the average selling tariffs do not include the expenses of the wholesale customers - electricity resellers

Appendix K

Financial Statements for Kazakstanenergo

Because Kazakstanenergo was restructured in the third quarter of 1995, this appendix contains financial statements for the first half of the year as well as the statements for the year as a whole

1 Income Statement for 1995 *Report on Financial Results and Use of the Results, 1995*

I Financial Results

II Distribution of Profit

III Payments to the Budget

2 Balance Sheet for 1995 *Financial Statement*

I Internal Funds Flow

II Borrowed Funds Flow

III Financial Investments

IV Intangible Assets

V Fixed Assets Availability and Flow

VI Social Indices

3 Income Statement for First Half 1995 *Report on Financial Results and Use of Results, 1 January to 1 July, 1996*

I Financial Results

II Distribution of Profit

[III] Payments to the Budget

Form 2
Date (year, month, day) 03 27 96
Enterprise, organization Kazakstanenergo
Industry (type of industry) Industry

Report on Financial Results and Use of the Results

1995

I Financial Results

Name of the Article	Code	Profit	Losses (expenses)
Revenue (gross income from the sale of products (work, services)	10	18663801	
Value Added Tax	15		3325443
Excise tax	20		
“””	30		
Expenses related to the production of the sold products (work services)	40		12895254
Income and expenses of export transactions	50		
Expenses related to the production of sold export products (work services)	60		
Tenge equivalent to the portion of hard currency revenue that is sold under the terms of obligatory sale	65		
Result from sales (10+50+65-15-20-30-40-50-60)	70	2936993	493889
Result from other sales	75	232420	159006
Revenue and expenses from outside transactions out of which	80	125236	955054
securities and interest ownership in joint ventures	81	5996	
exchange rate differences in currency accounts and hard currency operations	82	46104	57305
Total of revenue and losses (70+75+80)	85	3294649	1607949
Balance (profit or losses)	90	2189949	503249
Note The actual amount of sold products according to the sale prices	101		

Chief Accountant (signature)

II Distribution of Profit

Name of the Article	Code	At the end of report period
Payments in the budget	200	968378
Deductions to the reserve (insurance) funds	210	
Alienated to accumulation fund	220	391448
consumption fund	230	1471004
other purposes	250	

Chief Accountant (signature)

III Payments to the Budget (1 half of the year)

Name of the article	Code	Due based on accounts	Actually paid
Profit (income) tax of legal entities	300	219693	3400
Value Added Tax	310	37092	107636
Excise tax	315		
Fixed (rental) payment	320		
Income tax of natural persons	330	190332	53905
Customs duties on imports	340		
Customs duties on export	345		
Tax on securities transactions	350		
Land tax	360	376	6
Special payments and taxes (of underground resource users)	365		
Transport tax	370	203	146
Property tax	375		
	380	12138	176023
Natural resources preservation and renewal fund	381	279	251
Road fund	382	43506	28730
Fund of employment cooperation	383	6374	4280
Fund for entrepreneurial support and development of competitiveness	384	-2789	526
Nature protection fund	385	13816	267
Other taxes	386		
“”””””””””””””””””””””” ”””””””””””””	390		
“”””””””””””””””””””””””””””””””””””””	400		
Economic penalty	410	738631	696749

Chief Accountant (signature)

Payments to the Budget (2 half of the year)

Name of the article	Code	Due based on accounts	Actually paid
Profit (income) tax of legal entities	300	7193	29319
Value Added Tax	310	745604	231319
Excise tax	315		
Fixed (rental) payment	320		
Income tax of natural persons	330	254925	107403
Customs duties on import	340		
Customs duties on export	345		
Tax on securities transactions	350		
Land tax	360	9224	10260
Payments and taxes of underground resources users	365		
Transport tax	370	442	10106
Property tax	375	46686	13469
""	380		
Deductions to			
natural resources preservation and renewal fund	381	271	290
road fund	382	58582	11338
fund of employment cooperation	383	18906	1965
fund for entrepreneurial support and development of competitiveness	384		
nature protection fund	385	5569	403
Other taxes	386	238576	53228
""	390		
""	400		
Economic penalty	410	5637	34214

Chief Accountant (signature)

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Attachment to the Kazakstanenergo's Balance Sheet (form 1)

Data (year, month, day) 03 27 96
Enterprise, organization NES Kazakstanenergo
Type of Industry Industry

Financial Statement

Assets and liabilities	Code	Beginning of the year	End of the year
1	2	3	4
1 FIXED ASSETS AND OTHER NON-CURRENT ASSETS			
Intangible assets			
initial cost (04)	10	91	1005
depreciation (05)	11	15	385
net depreciated value	12	76	620
Fixed assets			
initial replacement cost (01 03)	20	13659208	28201516
depreciation (02)	21	4381272	9344485
net depreciated value	22	9277936	18857031
Equipment to be installed (07)	30	680478	1489554
Incomplete capital investments (08 61)	40	5110001	9473788
Long-term financial investments (06)	50	72285	37705
Settlements with the founders (75)	60		
Other non-current assets	70		
Section 1 total	80	15140776	29858698
Stores (10, 15 16)	100	1930991	4494768
Livestock breeding and fattening (11)	110	5039	14354
Quick-wearing implements and equipment of little value			
initial cost (12 160	120	28200	211892
depreciation (13)	121	6662	60194
net depreciated value	122	21538	151698
Incomplete production (20 21,23 29 30,44)	130	5657	2127
Deferred charges (31)	140	2560	10140
End products (40)	150		107
Goods selling price (41)	160	39479	125426
Goods marketing margin or markup(42)	161	539	1688
Goods purchase price	162	38940	123738
Other stores and expenses	180	984803	8883089
Section 2 total	190	2989528	13680021
Accounts payable			
for goods, work and services (45 62 76)*	200	18890715	26540649
VAT on valuables realized (18)*	201		9660
for goods work and services less VAT	205	18890715	26530989
on bills received (62)	210	739	355
with subsidiaries (78)	220		

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1	2	3	4
with budget (68)	230	10971	291851
with staff on other transactions (73)	240	9665	29528
with other debtors (76)	250	808864	522816
Prepayment to the suppliers and contractors (61)	260	28599	165864
Short-term financial investments (58)	270	14	87535
Monetary resources			
fund (50)	280	26	5409
settlement account (51)	290	32844	67250
currency account (52)	300	2673	3036
other monetary funds (55 56,57)	310	12665	88913
Other current assets	320	60	130336
Section 3 total	330	19797835	27923882
BALANCE (sum of lines 80, 190, 330)	360	37928139	71462601

Sources of Internal Funds

Name of the article	Code	Beginning of the year	End of the year
1	2	3	4
Authorized fund (capital) (85)	400	7229	12510429
Reserve fund (86)	410		
Funds for special purposes (88)	420	14349422	14364812
Purpose-oriented financing and receipts (96)	430	626354	300203
Rental liabilities (97)	440		
Undistributed profit for prior period (87)	460		
Profit for the report period (80)	470		2189949
profit expended*	471		2830830
Undistributed profit for the report period	472		
Losses for the prior period (87)**	475	516707	
Losses for the report period (80)**	476		1144130
Section 1 total	480	14466298	26031314
Long-term bank credits (92)	500	150278	751528
Long-term loans (95)	510		
Short-term bank credits (90)	600	1146255	816464
Bank credits for the employees (93)	610		
Short-term bank loans (94)	620	38157	
Payable accounts			
for goods,work and services (60 76)*	630	19784926	41383965
VAT on valuables purchased (17)*	631		1840283
for goods work and services less VAT	635	19784926	39445386
on bills passed (60)	640		
on payment for work (70)	650	144402	289976
on social insurance and security (69)	660	156040	589774

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1	2	3	4
on property and private insurance (65)	670	361	1115
with subsidiaries (78)	680		
on extra-budgetary payments (67)	690	57869	307843
with budget (68)	700	779019	1888367
with other creditors	710	1070776	964524
Advances received from buyers and customers (64)	720	185	1208
Settlemenrs with the founders (75)	725		
Deferred income (83)	730		
Consumption funds (88)	735	76455	135554
Reserves of forthcoming expenses and payments (89)	740	57118	141252
Reserves on doubtful debts (82)	750		
Other short-term liabilities	760		
Section 2 total	770	23461841	45431287
BALANCE (sum of lines 480, 770)	800	37928139	71462601

* - Data related to these lines are not included to the currency of the balance
** - In calculating the line 480 (Section 1 total) data related to these lines are subtracted

Chief Accountant (signature)

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Attachment to the Kazakstanenergo Balance sheet for 1995 (form 3)

Date (year, month, day) 03 27 96
Enterprise, organization Kazakstanenergo
Type of Industry Industry

I Internal Funds Flow

Name of the article	Code	Balance of the amount in the beginning of the year	Receipts in the report year	Amount expended in the report year	Balance of the amount in the end of the year
Authorized fund (capital)	10	7229	12503200		12510429
Reserve fund	20				
Undistributed profit of the prior period	30				
Accumulation funds, total	40	552107	3639721	990574	3201254
“””””””””””””””””””””””””	41	526485	3543921	764864	3305542
“””””””””””””””””””””””””	42	25338	62400	10529	77209
“””””””””””””””””””””””””	43	284	33400	215181	-181497
Social security fund	44	94649	206676	28257	273068
Property indexation fund	45	13661788	14008815	16820989	10849614
Fund of internal current assets replenishment	46	40878	1	3	40876
Purpose-oriented financing from budget	50		20000	20000	
Purpose-oriented financing and receipts from sectoral and intersectoral funds	60	626354	6870427	7196578	300203
“””””””””””””””””””””””””	70		142668	142668	
“””””””””””””””””””””””””	80				
“””””””””””””””””””””””””	90				
Section I total	91	14983005	37391508	25199069	27175444
Consumption funds, total	100	76455	2204932	2145833	135554
“””””””””””””””””””””””””	101	523	286177	285611	1089
“””””””””””””””””””””””””	102	1075	485816	485591	1300

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Qualifying References

Name of the article	Code	From the budget	From the sectoral and intersectoral funds
Received for capital investments financing	110	20000	567244
R&D financing	120		65210
recovery of losses	130		749858
social development	140		5814266
other purposes	150		

II Borrowed Funds Flow

Name of the article	Code	Balance of the amount in the beginning of the year	Received	Repaid	Balance of the amount in the end of the year
Long-term bank credits	210	150278	601447	197	751528
including purpose-oriented state credit	211				
Long-term bank credits with delay in repayment	212				
""	213				
Long-term loans	220				
including the loans not repaid in time	221				
Short-term bank credits	230	1146255	1273656	1603447	816464
including the credits not repaid in time	231	56123		17077	39046
""	232				
""	233				
""	234				
Short-term loans	240	38157		38157	
including the loans not repaid in time	241				
Bank credits for the employees	250				
including the credits not repaid in time	251				

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III Financial Investments

Name of the article	Code	Long-term investments		Short-term investments	
		in the beginning of the year	in the end of the year	in the beginning of the year	in the end of the year
Shares and stocks of other enterprises	310	72285	37705		27524
Bonds and other securities	320			14	60011
Loans received	330				
Other	340				
Qualifying reference					
issue of stocks and other securities	350				
including stocks and securities sold	360				

IV Intangible Assets

Name of the article	Code	In the beginning of the year	In the end of the year
Rights to invention and other objects of intellectual (industrial) ownership	410	91	1005
Rights to natural resources use	420		
Establishment charges	430		
Other	440		

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V Fixed Assets Availability and Flow

Name of the article	Code	Balance of the amount in the beginning of the year	Assets received	Assets retired	Balance of the amount in the end of the year
1 FIXED ASSETS,					
Buildings	500	2611796	2018464	116342	4513918
Structures	501	1244493	1333744	35221	2543016
Transmission devices	502	3901461	6954056	26341	10829176
Machines and equipment	503	5368115	4004375	153501	9218989
Transport facilities	504	311833	331673	93494	550012
Tools and implements	505	50200	127425	81070	96555
Workstock	506				
Productive livestock	507	194	1150	1150	194
Perennial plantations	508	11	22		33
Other types of fixed assets	509	171105	280143	1625	449623
TOTAL (sum of lines 500 -509)	510	13659208	15051052	508744	28201516
including production assets	511	13326901	14336611	248443	27415069
non-productive assets	512	332307	714441	260301	786447
2 INCOMPLETED CONSTRUCTION	520	5109999	6914375	2550586	9473788

Qualifying Reference

Name of the article	Code	Beginning of the year	End of the year
Fixed assets in line 510, columns 3 and 6 are leased out	530	18398	25918

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VI Social Indices

Name of the article	Code	Due based on accounts	Expended at the enterprise	Transferred to the funds
Deductions to				
the social insurance fund	610	102308	64609	13714
the pension fund	620	624956	4233	210974
the state fund of employment	630	40723		14855
“ ””	640			
A number of employees for average wages calculation	650	13722		
Pay-roll fund (payments in natural form included)	660	2340226		
Including money for material (cash) aid and social benefits	661	56768		
Sums calculated on the stocks and deposits basis (dividents percentage)	665			
Including the sums to be paid the employees not included to the enterprise’s pay-roll	666			

Chief Accountant (signature)

Attachment 2
Approved by the Ministry of Finance
of Kazahstan for periodical accounting in 1995

Report on financial results and use of the results

1January to 1 July, 1995

			Codes
		Form #2 based on ОКУД	
		Date (year, month, day)	
Enterprise, organization	Kazahstanenergo	ОКПО	
Industry (type of industry)	Industry	ОКОНХ	
Body regulating state owned property		ОКПО	
Units of measurement (thousand of tenge)		Control figure	

I FINANCIAL RESULTS

Name of the article 1	Code 2	Profit 3	Losses (expenses)
Revenue (gross income) from the sale of products (work services)	010	50885890	x
Value Added Tax	015	x	9754493
Excise tax	020	x	
	030		
Expenses related to the production of the sold products (work services)	040	x	37784348
Income and expenses of export transactions	050		
Expenses related to the production of sold export products (work, services)	060	x	
Ruble equivalent to the portion of hard currency revenue that is sold under the terms of obligatory sale	065		
Result from sales (010 + 050 + 065 - 015 - 020 - 030 - 040 - 050 -060)	070	5135266	1788217
Result from other sales	075	1165925	8634
Revenue and expenses from outside transactions out of which	080	1547781	319616
securities and interest ownership in joint ventures	081	78981	x
exchange rate differences in currency accounts and hard currency operations	082	50320	60162
Total of revenue and losses (070 + 075 + 080)	085	7848972	2116467
Balance (profit or loss)	090	6446666	714161
Note The actual amount of sold products according the sale prices	101	11295319	x

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II DISTRIBUTION OF PROFIT

Name of the article 1	Code 2	At the end of report period 3
Payments to the budget	200	2735122
Deductions to the reserve (insurance) funds	210	
Alienated to accumulation fund	220	3282681
consumption fund	230	2191147
other purposes	250	74097

Chief operating officer [signature]

Chief accountant [signature]

Note on the translation In the column headings and definitions of line items a parenthesis is used to indicate alternative definitions which the enterprise is permitted to use if applicable Thus expenses are shown for example in the column used to present Losses

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Attachment 2
Approved by the Ministry of Finance
of Kazahstan for periodical accounting in 1995

Attachment to the report on financial results and use of the results

1January to 1 July, 1995

			Codes
	Attachment to the form #2 based on ОКУД		
From 1 January to 1 July, 1995		Date (year, month, day)	
Enterprise, organization	SPC **Kazahstanenergo**	ОКПО	
Industry (type of industry)	Industry	ОКОНХ	
Body regulating state owned property		ОКПО	
Units of measurement thousands of tenge		Control figure	

PAYMENTS TO THE BUDGET

Name of the article 1	Code 2	Due based on accounts 3	Actually paid 4
Profit (income) tax	300	1276468	398872
Value Added Tax	310 2	2318202	- 665031
Excise tax	315		
Fixed payment	320	757	535
Income tax	330	986821	820316
Customs duties on imports	340	1096	1096
Customs duties on exports	345	433	433
Tax on securities transactions	350		
Land tax	360	48559	10295
	370		
Deduction to			
fund of economic restructuring	380	1189111	1384361
natural resources preservation and renewal fund	381	590	800
road fund	382	629949	376792
state fund of employment cooperation	383	98610	69898
fund for entrepreneurial support and development competitiveness	384	10335	2760
nature protection fund	385	441976	24019
Other taxes	386	784289	893672
	390		
	400		
Economic penalty	410	1485513	573444

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COSTS AND EXPENSES TAKEN INTO ACCOUNT FOR PROFIT TAX RELIEF

Name of the article 1	Code 2	Actual for the reported period 3
Capital investments directed to the development of industry, scientific and research work, development and application of new and progressive technologies and new types of products	500	1647087
To maintain the medical facilities, children pre-school organizations, recreational facilities, sport and culture facilities, national education institutions, housing facilities which are included in the balance of the enterprise, and the same categories of expenses in facilities under partial ownership in accordance with the legislative acts approved by local authorities	510	1005662
For expenses used from the profit to deposit in special loan-saving accounts of the employees for the construction or purchase of housing	520	1198
Dividends	530	316

Chief operating officer [signature]

Chief Accountant [signature]

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Appendix L

Description of the Networks

The following tables describe the physical characteristics of the high-voltage networks and the low-voltage networks of Kazakstan, based on data from the 1995 Annual Report of Kazakstanenergo

Valuations based on replacement cost are shown in U S dollars and are based upon unit values estimated by Hagler Bailly Consulting, i e replacement cost per km of transmission line and replacement cost per kVA of substation capacity For the 500 kV power lines, the estimated replacement cost per km is taken from the EBRD report, *Kazakstan Power System Least Cost Development Study*

The average annual book value of fixed assets is shown in Tenge, as reported in the 1995 Annual Report of Kazakstanenergo, and converted to U S dollars based on July 1996 exchange rates

Exhibit L 1
Replacement Cost of the Existing Lines and Cables at 1 January 96

	1150 kV	500 kV	330 kV	220 kV	110 kV	35 kV	10 kV	6 kV	0 4 kV	Total	1995 peak load MW	Amount per kW
Estimated replacement cost of power lines in the grid $million/km												
Overhead lines	0 75	0 2	0 1	0 07	0 045	0 025	0 018	0 016	0 01			
Underground cables					0 18	0 1	0 072	0 064	0 04			
Estimated replacement cost of power lines in the integrated high voltage grid million $												
National grid												
Inter Electric System	1,051 9	15 7			1 7	0 4	1 4	0 1	4 5	1,075 7	10 730	100 3
Strongly interconnected												
Kustanay		142 4		92 4	237 4					472 3	1 243	379 9
Tselin		226 0		189 3	285 5					700 8	1 724	406 5
Ekibastuz		60 8		65 2	25 0					150 9	387	390 0
Pavlodar		49 4	17 6	26 8	108 8					202 6	1,206	168 0
Karaganda		216 3		253 2	237 0					706 5	2,189	322 8
Weakly interconnected												
Altay		13 6	32 1	71 4	266 9					384 0	1 341	286 4
Almaty		140 7		113 7	195 6					450 0	1 162	387 3
South Kazakstan		55 7		272 9	195 1					523 7	1,478	354 3
Total	1 051 9	920 7	49 7	1 084 9	1 553 0	0 4	1 4	0 1	4 5	4 666 7	10,730	434 9
Estimated replacement cost of power lines in the low-voltage grids and non integrated grids million $												
Strongly interconnected												
Kustanay						220 6	464 5	4 7	157 1	846 9	1,243	681 3
Tselin						278 2	423 3	6 2	191 6	899 3	1 724	521 7
Ekibastuz						27 8	70 1	2 0	20 4	120 3	387	310 8
Pavlodar						57 1	210 4	1 5	77 6	346 5	1 206	287 3
Karaganda						204 7	356 3	34 5	102 6	698 1	2 189	318 9
Weakly interconnected												
Altay						130 4	361 6	71 7	156 2	719 8	1 341	536 8
Almaty						130 0	633 6	89 0	226 9	1 079 5	1 162	929 0
South Kazakstan						249 4	664 7	80 1	279 3	1 273 4	1 478	861 6
Subtotal						1 298 3	3 184 4	289 7	1 211 6	5 983 9	10 730	557 7
Portions of foreign interconnected systems												
Zapkaz		31 8		100 2	233 1	220 5	578 7	1 6	148 4	1 314 3	624	2 106 3
Island systems												
Atyrau				34 4	103 1	22 7	81 0	10 1	21 6	272 8	434	628 6
Total		31 8		134 5	336 2	1 541 5	3 844 1	301 3	1 381 5	7 571 1	11,788	642 3

Exhibit L 2
Estimated Replacement Cost of Power Lines

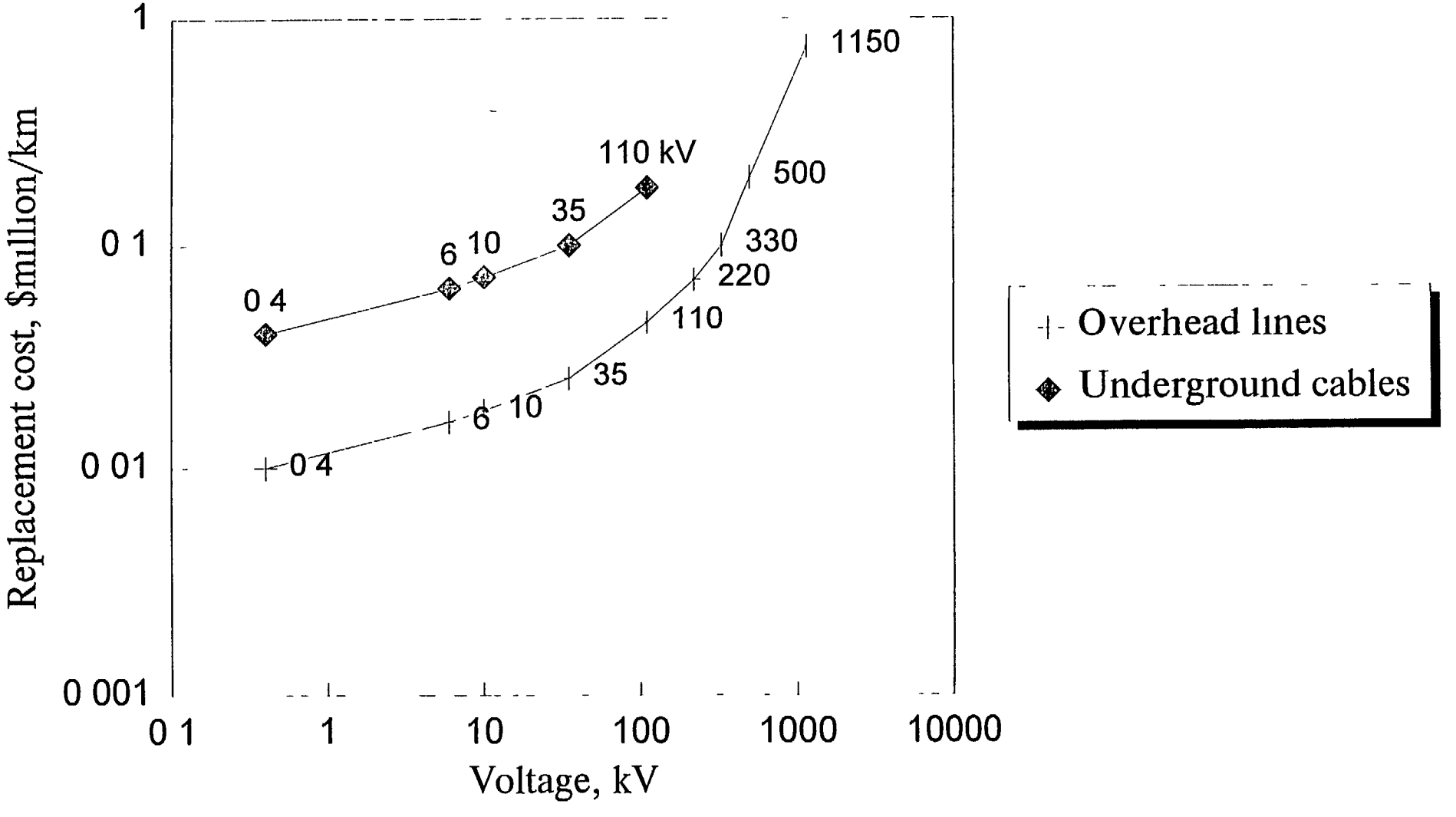

Exhibit L 3
Replacement Cost of the Existing Substations

	1150 kV	500 kV	220 kV	110 kV	35/6 10 kV	Subtotal	35/ 38 kV	6-10/ 38 kV	Subtotal
	Estimated replacement cost of substations in the grid $million/kVA								
Substations	0 02	0 02	0 02	0 02	0 02		0 02	0 02	
	Estimated replacement cost of substations in the integrated high voltage grid million $								
National grid									
Inter Electric System	140 1		1 6	0 6		142 3			
Strongly interconnected									
Kustanay		42 5	36 4	31 6		110 4			
Tselin		44 9	37 0	55 4		137 3			
Ekibastuz			19 2	2 8		22 1			
Pavlodar			1 0	20 5		21 5			
Karaganda		40 1	50 0	46 3		136 4			
Weakly interconnected									
Altay		20 0	44 6	45 1		109 7			
Almaty		23 4	30 9	54 2		108 5			
South Kazakstan		53 4	43 7	50 1		147 2			
Total	140 1	224 3	264 5	306 6		935 5			1 870 9
	Estimated replacement cost of substations in low voltage & non-integrated grids, million $								
Strongly interconnected									
Kustanay					23 9	23 9	0 0	43 3	43 3
Tselin					34 3	34 3	7 0	42 4	49 4
Ekibastuz					4 4	4 4	0 0	4 8	4 8
Pavlodar					8 8	8 8	0 1	22 9	23 0
Karaganda					25 7	25 7	1 9	18 6	20 5
Weakly interconnected									
Altay					16 4	16 4	0 1	37 2	37 3
Almaty					24 7	24 7	0 0	56 8	56 9
South Kazakstan					37 3	37 3	0 1	52 1	52 1
Subtotal					175 5	175 5	9 3	278 2	287 4
Portions of foreign interconnected systems									
Zapkaz			21 8	30 6	16 1	68 5	0 1	24 6	24 7
Island systems									
Atyrau			14 0	17 4	4 4	35 8	0 0	7 4	7 4
Total			35 8	48 1	196 0	279 9	9 4	310 1	319 5

Exhibit L 4
Evaluation of the Technical Status of the Network, 1995

	35 kV - 110 kV overhead lines			6 kV - 10 kV overhead lines			0 38 kV 110 kV transmission lines			6/0 38 kV - 35/0 38 kV substations		
	Satisfactory	Unsatis-factory	Not applicable	Satisfactory	Unsatis-factory	Not applicable	Satisfactory	Unsatis factory	Not applicable	Satisfactory	Unsatis-factory	Not applicable
	Length of power lines km									Number of substations		
National grid												
Inter Electric System	54 1			42 6			39 2					
Strongly interconnected												
Kustanay	9,938 0	2,895 0	15 0	19,418 1	3,181 0	2,204 8	7,779 9	3,072 6	2,792 3	8,313	2,441	614
Tselin	14 030 7	1 854 2	308 9	22,614 4	3 604 5	1,163 6	17 430 0	2,331 5	1,312 4	10,048	2,163	404
Ekibastuz	1,396 0	194 0		2,635 0	580 0		848 0	293 0		840	75	
Pavlodar	3,833 0	334 0	226 0	8,053 0	737 0	1 255 0	3,120 0	281 0	2,759 0	4,853	592	1
Karaganda	8,906 9	2,434 1	43 0	12 938 7	4,617 2	991 8	3 954 9	1,801 5	1,519 5	4,717	758	521
Weakly interconnected												
Altay	9,819 0	1,101 0	226 0	15,408 0	3,773 0	1,147 0	8,355 3	4,171 0	500 0	8,467	1,060	222
Almaty	5,405 4	2,188 3	84 0	26,296 1	3,945 3	703 0	13,364 0	4,881 7	845 3	13,876	1,169	284
South Kazakstan	11,002 2	1,805 6	268 3	24,065 4	9 692 7	2,288 8	13,534 1	7,752 7	2,644 0	13,837	2,734	397
Subtotal	64,385 2	12 806 1	1 171 2	131,471 2	30 130 7	9 754 0	68 425 4	24 584 9	12 372 4	64,951	10 992	2 443
Portions of foreign interconnected systems												
Zapkaz	11,117 7	2,457 5	25 7	17 991 7	11,277 7	753 7	7,571 1	4,557 7	869 6	5,948	2,711	559
Island systems												
Atyrau	2,804 0	395 0		4,231 0	311 0		1,361 0	133 0		1,435	344	75
Total	78 307 0	15 658 6	1,196 9	153 693 9	41 719 3	10 507 7	77 357 5	29 275 6	13,242 0	72 334	14,047	3 077

Source Kazakstanenergo Annual Report 1995, page 58

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Exhibit L 4, continued
Evaluation of the Technical Status of the Network, 1995

	35 kV 110 kV overhead lines			6 kV - 10 kV overhead lines			0 38 kV 110 kV transmission lines			6/0 38 kV - 35/0 38 kV substations		
	Satisfactory	Unsatis factory	Not applicable	Satisfactory	Unsatis factory	Not applicable	Satisfactory	Unsatis-factory	Not applicable	Satisfactory	Unsatis-factory	Not applicable
	Percent of total line length			Percent of total line length			Percent of total line length			Percent of total substations		
National grid												
Inter Electric System	100 0%			100 0%			100 0%					
Strongly interconnected												
Kustanay	77 4%	22 5%	0 1%	78 3%	12 8%	8 9%	57 0%	22 5%	20 5%	73 1%	21 5%	5 4%
Tselin	86 6%	11 4%	1 9%	82 6%	13 2%	4 2%	82 7%	11 1%	6 2%	79 7%	17 1%	3 2%
Ekibastuz	87 8%	12 2%		82 0%	18 0%		74 3%	25 7%		91 8%	8 2%	
Pavlodar	87 3%	7 6%	5 1%	80 2%	7 3%	12 5%	50 6%	4 6%	44 8%	89 1%	10 9%	0 0%
Karaganda	78 2%	21 4%	0 4%	69 8%	24 9%	5 3%	54 4%	24 8%	20 9%	78 7%	12 6%	8 7%
Weakly interconnected												
Altay	88 1%	9 9%	2 0%	75 8%	18 6%	5 6%	64 1%	32 0%	3 8%	86 8%	10 9%	2 3%
Almaty	70 4%	28 5%	1 1%	85 0%	12 7%	2 3%	70 0%	25 6%	4 4%	90 5%	7 6%	1 9%
South Kazakstan	84 1%	13 8%	2 1%	66 8%	26 9%	6 3%	56 6%	32 4%	11 0%	81 5%	16 1%	2 3%
Subtotal	82 2%	16 3%	1 5%	76 7%	17 6%	5 7%	64 9%	23 3%	11 7%	82 9%	14 0%	3 1%
Portions of foreign interconnected systems												
Zapkaz	81 7%	18 1%	0 2%	59 9%	37 6%	2 5%	58 2%	35 1%	6 7%	64 5%	29 4%	6 1%
Island systems												
Atyrau	87 7%	12 3%		93 2%	6 8%		91 1%	8 9%		77 4%	18 6%	4 0%
Total	82 3%	16 5%	1 3%	74 6%	20 3%	5 1%	64 5%	24 4%	11 0%	80 9%	15 7%	3 4%

Source Kazakstanenergo, Annual Report 1995, page 58

Exhibit L 5
Book Value and Expenditures on Repair of the Network, 1995

	Average annual book value of fixed assets		Expenditures on capital repair, 000 tenge							Expenditures on current repair	
	000 tenge	000 USD	Lines, 35-1150 kV	Lines 0 38-10 kV	Substations, 35-1150 kV	Substations 0 38-10 kV	Other assets	Total, 000 tenge	Total, 000 USD	000 tenge	000 USD
National grid											
Inter Electric System	3,388,503	50,575	78,075 0	50 0	15,351 0		22,952 0	116 428 0	1,738		
Strongly interconnected											
Kustanay	4,712,365	70 334	5,676 9	42 044 7	25,713 1	12,826 7	33,245 9	119,507 3	1,784	38,263 6	571
Tselin	5,426,899	80 998	8,392 9	123,252 7	18,166 7	6,129 4	52,808 4	208,750 1	3,116	27,641 9	413
Ekibastuz	1,245,812	18,594	1,930 0	6,329 0	608 4	910 0	6,191 6	15,969 0	238	7,712 0	115
Pavlodar	1,731,794	25,848	1,740 0	49,818 0	17,953 0	9,216 0	26,374 0	105,101 0	1,569	45,073 0	673
Karaganda	4,211,029	62,851	52,023 4	118,953 2	54,471 0	1,957 8	85,974 5	313,379 9	4,677	16,717 0	250
Weakly interconnected											
Altay	4,687,004	69 955	25,604 0	95,656 3	29,098 0	18,688 0	102,778 7	271,825 0	4 057	47,519 0	709
Almaty	6,514,503	97,231	26,617 7	96,497 1	57,758 7	17,970 7	106,728 2	305,572 4	4,561	51,977 4	776
South Kazakstan	7,549	113	64,285 0	114,566 3	97,841 3	51,670 7	97,831 3	426,194 6	6,361	71,763 1	1 071
Subtotal	31,925,458	476,499	264 344 9	647,167 3	316,961 2	119 369 3	534,884 6	1 882,727 3	28,100	306,667 0	4,577
Portions of foreign interconnected systems											
Zapkaz	3,850,668	57,473	12,184 5	51 105 5	10,847 4	10,805 6	36,817 9	121,760 9	1,817	12,686 8	189
Island systems											
Atyrau	944,300	14,094	2,400 0	10,200 0	4,700 0	1,100 0	5,800 0	24,200 0	361		
Total	36,720,426	548,066	278,929 4	708 472 8	332,508 6	131 274 9	577,502 5	2,028,688 2	30,279	319,353 8	4,766

Conversion rate 1 USD = 67 tenge

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Exhibit L 6
Length of Overhead Lines and Underground Cables at 1 January 96

	1150 kV	500 kV	330 kV	220 kV	110 kV	35 kV	10 kV	6 kV	0 4 kV	Total	1995 peak load, MW	Amount per kW
				Length of overhead lines, km								
National grid												
Inter Electric System	1,402 5	78 5			37 9	16 2	42 6	3 5	35 2	1,616 4	10,730	150 6
Strongly interconnected												
Kustanay		712 1		1,320 7	5,275 6	8,825 0	24 750 0	57 0	13,645 0	54 585 4	1 243	43 914 2
Tselin		1,130 0		2,704 0	6,345 0	11,129 0	20 358 0	361 0	17,675 0	59,702 0	1 724	34 629 9
Ekibastuz		304 0		931 0	555 0	1,112 0	3,104 0	111 0	1,141 0	7,258 0	387	18 754 5
Pavlodar		247 0	176 0	383 0	2 417 0	2,282 0	9,990 0	55 0	6,080 0	21,630 0	1 206	17 935 3
Karaganda		1,081 7		3,616 7	5,267 1	8,165 5	18,048 4	545 0	7,304 7	44,029 1	2 189	20 113 8
Weakly interconnected												
Altay		68 0	321 4	1,020 0	5,931 0	5,215 0	19 480 0	904 0	13,079 0	46 018 4	1 341	34 316 5
Almaty		703 5		1,624 8	4,325 3	5,018 8	30,735 7	212 9	17,473 6	60 094 6	1 162	51 716 5
South Kazakstan		278 6		3,898 8	4,335 1	9,977 8	34,886 3	1,102 7	23,920 9	78,400 2	1 478	53,044 8
Subtotal	1,402 5	4 603 4	497 4	15,499 0	34 489 0	51 741 3	161 395 0	3 352 1	100,354 4	373 334 1	10,730	34 793 5
Portions of foreign interconnected systems												
Zapkaz		159 2		1,430 8	5 180 0	8,821 3	29,971 7	51 9	13,414 7	59 029 6	624	94 598 7
Island systems												
Atyrau				491 0	2,291 0	908 0	4,173 0	487 0	1,828 0	10 178 0	434	23 451 6
Total	1 402 5	4 762 6	497 4	17 420 9	41,960 0	61,470 6	195 539 7	3,891 0	115 597 1	442 541 7	11 788	37 541 7
				Length of underground cables km								
National grid												
Inter Electric System							9 5		104 1	113 6	10,730	10 6
Strongly interconnected												
Kustanay							263 8	59 2	515 2	838 2	1,243	674 4
Tselin							789 4	6 8	371 9	1,168 2	1 724	677 6
Ekibastuz							197 0	4 0	225 0	426 0	387	1 100 8
Pavlodar							425 0	9 0	419 0	853 0	1 206	707 3
Karaganda						6 0	437 0	402 9	737 7	1 583 6	2 189	723 4
Weakly interconnected												
Altay							152 0	894 0	634 0	1 680 0	1 341	1 252 8
Almaty					5 4	45 8	1 115 4	1,337 6	1,304 7	3 808 9	1,162	3 277 9
South Kazakstan							509 9	975 2	1,001 8	2 487 0	1 478	1 682 6
Subtotal					5 4	51 8	3 899 0	3 688 8	5 313 5	12 958 4	10,730	1 207 7
Portions of foreign interconnected systems												
Zapkaz							545 0	11 7	356 5	913 2	624	1 463 5
Island systems												
Atyrau							82 1	35 5	81 8	199 4	434	459 4
Total					5 4	51 8	4 526 1	3 736 0	5 751 8	14 071 1	11 788	1 193 7

Exhibit L 7
Percentage Distribution of Overhead Lines and Underground Cables, by Voltage Level

	1150 kV	500 kV	330 kV	220 kV	110 kV	35 kV	10 kV	6 kV	0 4 kV	Total
	Percent of total overhead line length at 1 January 96 km									
National grid										
Inter Electric System	86 8%	4 9%			2 3%	1 0%	2 6%	0 2%	2 2%	100 0%
Strongly interconnected										
Kustanay		1 3%		2 4%	9 7%	16 2%	45 3%	0 1%	25 0%	100 0%
Tselin		1 9%		4 5%	10 6%	18 6%	34 1%	0 6%	29 6%	100 0%
Ekibastuz		4 2%		12 8%	7 6%	15 3%	42 8%	1 5%	15 7%	100 0%
Pavlodar		1 1%	0 8%	1 8%	11 2%	10 6%	46 2%	0 3%	28 1%	100 0%
Karaganda		2 5%		8 2%	12 0%	18 5%	41 0%	1 2%	16 6%	100 0%
Weakly interconnected										
Altay		0 1%	0 7%	2 2%	12 9%	11 3%	42 3%	2 0%	28 4%	100 0%
Almaty		1 2%		2 7%	7 2%	8 4%	51 1%	0 4%	29 1%	100 0%
South Kazakstan		0 4%		5 0%	5 5%	12 7%	44 5%	1 4%	30 5%	100 0%
Subtotal	0 4%	1 2%	0 1%	4 2%	9 2%	13 9%	43 2%	0 9%	26 9%	100 0%
Portions of foreign interconnected systems										
Zapkaz		0 3%		2 4%	8 8%	14 9%	50 8%	0 1%	22 7%	100 0%
Island systems										
Atyrau				4 8%	22 5%	8 9%	41 0%	4 8%	18 0%	100 0%
Total	0 3%	1 1%	0 1%	3 9%	9 5%	13 9%	44 2%	0 9%	26 1%	100 0%
	Percent of total underground cable length at 1 January 96, km									
National grid										
Inter Electric System							8 4%		91 6%	100 0%
Strongly interconnected										
Kustanay							31 5%	7 1%	61 5%	100 0%
Tselin							67 6%	0 6%	31 8%	100 0%
Ekibastuz							46 2%	0 9%	52 8%	100 0%
Pavlodar							49 8%	1 1%	49 1%	100 0%
Karaganda						0 4%	27 6%	25 4%	46 6%	100 0%
Weakly interconnected										
Altay							9 0%	53 2%	37 7%	100 0%
Almaty					0 1%	1 2%	29 3%	35 1%	34 3%	100 0%
South Kazakstan							20 5%	39 2%	40 3%	100 0%
Subtotal					0 0%	0 4%	30 1%	28 5%	41 0%	100 0%
Portions of foreign interconnected systems										
Zapkaz							59 7%	1 3%	39 0%	100 0%
Island systems										
Atyrau							41 2%	17 8%	41 0%	100 0%
Total					0 0%	0 4%	32 2%	26 6%	40 9%	100 0%

Exhibit L 8
Substations Installed in the Network in 1995

	1150 kV	500 kV	220 kV	110 kV	35/6-10 kV	Subtotal	35/ 38 kV	6-10/ 38 kV	Subtotal
			Number of substations						
National grid									
Inter Electric System	3		1	3		7		30	30
Strongly interconnected									
Kustanay		3	5	105	299	412	8	11,368	11,376
Tselin		2	14	148	449	613	1 846	8,481	10,327
Ekibastuz			7	8	34	49	4	911	915
Pavlodar			3	73	113	189	19	5 427	5,446
Karaganda		3	14	75	252	344	67	5,929	5,996
Weakly interconnected									
Altay		1	8	131	202	342	21	9,734	9,755
Almaty		1	9	131	203	344	13	14,421	14,434
South Kazakstan		3	19	105	469	596	19	17,149	17,168
Subtotal	3	13	80	779	2 021	2 896	1,997	73 450	75 447
Portions of foreign interconnected systems									
Zapkaz			6	79	270	355	40	9,178	9,218
Island systems									
Atyrau			3	40	42	85	4	1,848	1,852
Total	3	13	89	898	2 333	3 336	2 041	84 476	86,517
			Capacity of substations, kVA						
National grid									
Inter Electric System	7,005 0		80 0	31 5		7 116 5		19 1	19 1
Strongly interconnected									
Kustanay		2,123 0	1,818 0	1,580 5	1,195 6	6,717 1	1 5	2,165 3	2,166 8
Tselin		2,244 0	1,850 0	2,769 7	1,714 5	8 578 2	349 3	2,122 4	2,471 7
Ekibastuz			962 0	142 2	218 4	1 322 6	0 4	242 0	242 4
Pavlodar			50 0	1,023 6	438 1	1 511 7	4 6	1,143 4	1,148 0
Karaganda		2,004 0	2,501 0	2,314 8	1,287 0	8 106 8	93 3	931 4	1,024 7
Weakly interconnected									
Altay		1,002 0	2,231 0	2 254 1	818 2	6 305 3	6 9	1,858 7	1,865 6
Almaty		1,169 0	1,546 5	2,709 4	1 237 0	6 661 9	2 3	2,841 9	2,844 3
South Kazakstan		2,672 0	2,186 6	2,503 8	1 866 7	9 229 1	4 3	2,602 8	2 607 1
Subtotal	7,005 0	11 214 0	13,225 1	15 329 6	8 775 5	55 549 2	462 6	13,927 0	14 389 5
Portions of foreign interconnected systems									
Zapkaz			1,090 0	1,532 2	803 9	3 426 1	6 8	1,229 2	1,236 0
Island systems									
Atyrau			698 0	871 5	222 3	1,791 8	1 0	369 8	370 8
Total	7 005 0	11,214 0	15,013 1	17 733 4	9 801 7	60 767 1	470 4	15,525 9	15,996 3

Exhibit L 9
Types of Poles Used for Overhead Lines in 1995

	1150 kV	500 kV	330 kV	220 kV	110 kV	35 kV	6 20 kV	0 4 kV	Total
	Length of overhead lines, km								
National grid									
Inter Electric System									
Wooden poles								4 0	4 0
Metallic poles	1,402 5	9 9							1,412 4
Reinf'd concrete		68 6			37 9	16 2	42 6	35 2	200 4
Strongly interconnected									
Kustanay									
Wooden poles					108 8	375 6	1,132 4	12,585 1	14 201 9
Metallic poles		437 9		184 2	100 2	16 6			738 9
Reinf'd concrete		274 2		1,036 6	4,387 0	8 209 4	23,672 5	1,059 7	38,639 4
Tselin									
Wooden poles							2 352 4	16,379 4	18 731 8
Metallic poles		316 4		700 9	424 2		13 5	19 6	1,474 6
Reinf'd concrete		814 2		1,848 3	4,918 4	10 386 9	18,312 7	1,269 1	37,549 6
Ekibastuz									
Wooden poles						49 0	324 0	1,028 2	1,401 2
Metallic poles		113 0		6 0		70 0			189 0
Reinf'd concrete		191 0		922 0	548 0	923 0	2,891 0	113 0	5 588 0
Pavlodar									
Wooden poles					12 0	100 0	1 877 0	5,836 0	7 825 0
Metallic poles		80 8		29 8	56 4	23 0			190 0
Reinf'd concrete		166 9		533 0	2,117 0	2,098 0	8,168 0	244 0	13,326 9
Karaganda									
Wooden poles						514 0	10,657 2	4,136 8	15,308 0
Metallic poles		146 6		1 070 3	1,192 6	352 2			2 761 7
Reinf'd concrete		939 1		2,311 9	2,415 8	6,923 8	4,042 7	485 4	17 118 7
Weakly interconnected									
Altay									
Wooden poles					598 6	1,094 7	16,731 8	12,294 2	30 719 3
Metallic poles		68 0		756 2	1,266 6	182 5	62 5	22 8	2,358 6
Reinf'd concrete				584 1	4,064 8	3,937 7	3 573 7	718 0	12,878 3
Almaty									
Wooden poles						1,530 4	13 148 4	15,900 1	30 578 9
Metallic poles				233 9	279 3	161 7			674 9
Reinf'd concrete		703 5		1,332 0	3,704 8	3,045 2	17 602 3	1,573 4	27 961 2
South Kazakstan									
Wooden poles						432 1	15,814 5	18,171 0	34 417 6
Metallic poles		111 6		1 032 3	895 1	299 4			2 338 4
Reinf'd concrete		166 5		2,866 5	3,441 0	9,240 1	20,174 6	5,748 8	41,637 4

Exhibit L 9, continued
Types of Poles Used for Overhead Lines in 1995

	1150 kV	500 kV	330 kV	220 kV	110 kV	35 kV	6 20 kV	0 4 kV	Total
	Length of overhead lines, km								
National grid plus all of the interconnected grid									
Subtotal									
Wooden poles					719 4	4 095 7	62 037 8	86 334 8	153 187 7
Metallic poles	1 402 5	1,284 2		4 013 5	4 214 4	1 105 4	76 0	42 4	12 138 5
Reinf'd concrete		3 324 0		11 434 4	25 634 6	44 780 3	98 479 9	11,246 7	194 899 9
Portions of foreign interconnected systems									
Zapkaz									
Wooden poles						661 1	20 987 4	12,744 1	34 392 7
Metallic poles		106 5		330 9	123 6	19 9		17 0	597 9
Reinf'd concrete		44 0		1,108 9	4,767 4	7 899 6	9,035 5	653 2	23 508 5
Island systems									
Atyrau									
Wooden poles						127 0	2 378 0	1,770 0	4 275 0
Metallic poles					692 0	111 0	31 0	3 0	837 0
Reinf'd concrete				491 0	1,370 0	632 0	2,251 0	50 0	4 794 0
Total									
Wooden poles					719 4	4 883 8	85 403 2	100 848 9	191 855 3
Metallic poles	1 402 5	1 390 7		4 344 4	5 030 0	1 236 3	107 0	62 4	13 573 4
Reinf'd concrete		3 368 0		13,034 3	31 772 0	53 311 9	109 766 4	11,949 9	223 202 5
Total	1,402 5	4 758 7		17,378 7	37 521 4	59,432 0	195 276 6	112,861 1	428 631 1

Exhibit L 10
Estimated Annual Investment Requirements for the Existing Lines and Cables

	1150 kV	500 kV	330 kV	220 kV	110 kV	35 kV	10 kV	6 kV	0 4 kV	Total	1995 peak load, MW	Amount per kW
	Ratio of replacement cost to annual investment											
All lines and cables	25	25	25	25	25	20	20	15	15			
	Estimated annual investment in the national grid million $											
National grid												
Inter Electric System	42 08	0 63			0 07	0 02	0 07	0 00	0 30	43 17	10 730	4 0
Strongly interconnected systems												
Kustanay		5 70		3 70	9 50					18 89	1,243	15 2
Tselin		9 04		7 57	11 42					28 03	1 724	16 3
Ekibastuz		2 43		2 61	1 00					6 04	387	15 6
Pavlodar		1 98	0 70	1 07	4 35					8 10	1 206	6 7
Karaganda		8 65		10 13	9 48					28 26	2,189	12 9
Weakly interconnected												
Altay		0 54	1 29	2 86	10 68					15 36	1 341	11 5
Almaty		5 63		4 55	7 82					18 00	1 162	15 5
South Kazakstan		2 23		10 92	7 80					20 95	1 478	14 2
Total	42 08	36 83	1 99	43 40	62 12					186 41	10,730	17 4
	Estimated annual investment in power lines in the regional grids, million $											
Strongly interconnected systems												
Kustanay						11 03	23 22	0 31	10 47	45 04	1 243	36 2
Tselin						13 91	21 16	0 41	12 78	48 26	1 724	28 0
Ekibastuz						1 39	3 50	0 14	1 36	6 39	387	16 5
Pavlodar						2 85	10 52	0 10	5 17	18 64	1,206	15 5
Karaganda						10 24	17 82	2 30	6 84	37 19	2,189	17 0
Weakly interconnected												
Altay						6 52	18 08	4 78	10 41	39 79	1,341	29 7
Almaty						6 50	31 68	5 93	15 13	59 24	1 162	51 0
South Kazakstan						12 47	33 23	5 34	18 62	69 66	1 478	47 1
Subtotal						64 92	159 22	19 31	80 77	324 22	10 730	30 2
Portions of foreign interconnected systems												
Zapkaz		1 27		4 01	9 32	11 03	28 94	0 11	9 89	64 57	624	103 5
Island systems												
Atyrau				1 37	4 12	1 14	4 05	0 67	1 44	12 79	434	29 5
Total	42 08	38 10	1 99	48 78	75 57	77 08	192 21	20 09	92 10	587 98	11 788	49 9

Appendix M

Work Plan

A Statement of Work for this tariff study was contained in a draft Delivery Order issued by USAID in August 1995 This Delivery Order was not signed until May 17, 1996 However, USAID provided interim funding for the study for the September 1995 through March 1996 period The initial mission for this tariff study was conducted on October 15-24, 1995 and the proposed Work Plan was submitted to USAID on December 15, 1995 The Russian version was submitted to Kazakstanenergo in January 1996

KAZAKHSTAN ELECTRICITY TARIFF STUDY

PROPOSED WORK PLAN, 20 DECEMBER 95

1 Summary Description of Task

The consultant will assist the State Committee on Pricing and Antimonopoly Policy (AMC), the Ministry of Energy and Coal Industry (MECI), and Kazakhstanenergo to develop a wholesale pricing strategy and an implementation plan to introduce a rational system of wholesale electricity prices and open access to the transmission grid Reform of wholesale prices will promote both public and private investment in power generation This work will require close cooperation with specialists in Kazakhstanenergo The study is intended to support analysis of the financial feasibility of a proposed loan from EBRD

2 Background

Pursuant to a July 28, 1995 decree of the Cabinet of Ministers, the electric power sector of Kazakhstan is undergoing a restructuring process in which a wholesale electric market is being created and an increasing degree of autonomy is being given to the nine regional power companies (energos) Until December 1995 there was no wholesale tariff and there was a single nationwide tariff schedule for the customers of the nine energos The present structure of the sector enables Kazakhstanenergo to hold a monopoly on bulk power sales, and enables each regional energo to calculate its own tariffs, subject to government approval

In Kazakhstan the power sector has two or three gencos, a large vertically integrated genco and transco, and nine distcos with district heat networks and CHP plants The sector is organized in three tiers

1) Independent generating companies, which must sell all of their net electric generation to Kazakhstanenergo There are at least two such companies - Ermakovskaya, a 2200 MW coal-fired station in the Pavlodarenergo region, and Kapchagayskaya, a 280 MW hydro station in the Almatyenergo region These stations have been classified as State Regional Electric Stations (GRES) since the Soviet period, and are now given the legal status of "republican enterprises " The status of the third independent generating company is in dispute, it is the 667 MW Bukhtarminsk station, one of the hydro stations in the Altay region Its independent status was approved by the Cabinet of Ministers in July 1995 and then rescinded in September 1995, but practical terms it operates as an independent station rather than a division of Altayenergo

2) Kazakhstanenergo, which is called a "National Energy System" has the legal status of a republican enterprise This includes the high-voltage network plus at least four large power stations

(1) Ekibastuz GRES #1, a 3200 MW coal-fired station in the Pavlodarenergo region
(2) Ekibastuz GRES #2, a 490 MW coal-fired station in the Pavlodarenergo region
(3) Zhambyl GRES, an 1105 MW oil- amd gas-fired station in the South Kazakhstanenergo region
(4) Karagandinsk GRES, a 608 MW coal-fired station in the Karagandaenergo region

The ownership of two additional power stations is disputed with Altayenergo

(5) Ust-Kamengorsk, a 315 MW hydro station in Altay
(6) Shulbinsk, a 400 MW hydro station in Altay

Kazakhstanenergo controls all available capacity except CHP stations, a few small thermal stations, and about 500 MW from autoproducers Through ownership and through its monopoly on purchases of power from gencos and other countries, Kazakhstanenergo controls nearly 12,400 MW, i e , 5403 MW through ownership plus 2480 MW from gencos plus about 3000 MW of peak day capacity available from imports (Russia, Uzbekistan, and Kyrgyzstan) plus 1,382 MW from the disputed hydro stations in Altay In 1993 the peak day power import was 2,125 MW from Russia and 842 MW from Central Asia The available capacity of all of the energos in 1993 was 13,514 MW, excluding imports and autoproducers, while the coincident peak load was 13,918 MW

3) the nine regional energos, which own CHP stations, small thermal plants, and the low voltage network Four of the energos are located in North Kazakthstan and are reasonably well interconnected Kustenayenergo, Tselinenergo, Pavlodarenergo, and Karagandaenergo A fifth, Altayenergo, is connected to Pavolodar via high-voltage lines in Russia Two energos in the south, Almatyenergo and South Kazakhstanenergo, are interconnected with each other but the north-south connection is relatively weak Two energos in the west, Atyrauenergo and Zapkazenergo, are practically isolated systems Zapkazenergo depends very heavily on electricity imports from Russia There is a tenth network surrounding the Mangestan nuclear complex near the Caspian Sea, but it is small and isolated and managed by the atomic energy ministry

There are two sources of legal authority that provide guidance for the restructuring program (a) decrees issued by the Cabinet of Ministers, and (b) orders issued by the AMC or the Ministry of Energy and Coal Industries to implement these decrees The structure of the power sector is legally defined by three documents

(1) Cabinet of Ministers Decree No 1033, "On Reorganizing the Administrative Structure of the Energy Power Engineering Industry of the Republic of Kazkhstan," July 28, 1995 (restructuring the power sector, transforming Kazakhstanenergo into a state enterprise called the National Energy System, and establishing an October 1 deadline for defining a tariff methodology)

(2) Cabinet of Ministers Decree No 1268, issued September 19, 1995 (amending Decree No 1033 by transferring ownership of three hydro power stations to Altayenergo)

(3) an order issued by the Minister of Energy, "On reorganization of the administrative structure of the power sector," September 7, 1995 (implementing Decree No 1033)

Electric tariff setting procedures are defined by two documents

(1) Decree No 1311, issued October 6, 1995 (establishing a December 1 deadline for establishing wholesale prices and reviewing the regional energy tariffs)

(2) a regulation issued by the Chairman of the AMC and the Minister of Energy, "On national regulation of tariffs of electricity and thermal energy of the Republic of Kazakhstan," September 1995 (This document defines the format of tables and formulas to be used to calculate tariffs under the new industry structure Through this document, data was requested from independent power stations, Kazakhstanenergo, and the regional energos Hagler Bailly has a copy of the September 5 draft, which is very close to the final draft)

The present tariff study will build upon work conducted by IRG for USAID on energy price reform in Kazakhstan in 1992-93 The study will also build upon two major power sector studies in Kazakhstan that were completed in 1995

EWI Engineers + Consultants *Kazakhstan Power System Least Cost Development Study* Final Report Zurich, Switzerland Electrowatt Engineering Service Ltd , April 1995 (Funded by the European Bank and developed in cooperation with Kazakhstanenergo The initial mission was conducted in April 1994 and the Draft Final Report was submitted in March 1994)

Danish Power Consult A-S *Assistance to Kazakhstanenergo for the elaboration of new electricity tariffs and the introduction of DSM techniques* Final Report (in four volumes) June 1995 (Funded by the Commission of the European Communities, TACIS I/E/4 The field work was carried out during the period March 1993 through June 1994 Power sector restructuring was not addressed, the power sector is assumed to be a single entity with nationwide tariffs)

The European Bank for Reconstruction and Development (EBRD) is planning to conduct feasibility studies needed to prepare a project to loan money for the rehabilitaion of at least one of the blocks of Ekibastuz 1

In March 1995, the Chairman of the AMC asked the EBRD to finance a study on electricity tariffs in Kazakhstan USAID and EBRD agreed that USAID, through its contract with Hagler Bailly, would carry out the study

A definitional mission was conducted in October 15-22 by a Hagler Bailly team consisting of Charles Zimmermann, Leonardo Zaragocin, and Harry Norris A second mission was conducted by Charles Zimmermann in November 28-December 8, 1995 to establish a working relationship with Kazakhstanenergo

This study has three counterparts the AMC, the MECI, and Kazakhstanenergo

This task has two objectives

(1) to help the AMC and MECI to develop a wholesale pricing strategy and an implementation plan to introduce a rational system of wholesale electricity prices

(2) to support EBRD in its effort to modernize the power sector of Kazakstan

4 Scope of Work

To develop a tariff reform plan for wholesale tariffs, the consultant team will project tariff levels under three criteria

1) *LRMC* The study team will calculate the long run marginal cost of bulk power supply

2) *Financial targets* Revenue requirements of Kazakstanenergo to meet adequate financial performance criteria will be calculated

3) *Social objectives* Tariffs based on socially acceptable rates of annual increase will be estimated, based on guidelines provided by the AMC and the MECI

The contractor will be responsible for the following tasks

(1) *Review the existing structure of the wholesale market* The contractor will collect information on the power sector restructuring process, with a focus on tariff issues Existing decrees and orders related to tariff-setting in Kazakhstan will be translated Meetings with the AMC and MECI will be held to determine the government's present plans for tariff reform [Responsibility Charles Zimmermann]

(2) *Calculate the LRMC of generation, and project variable costs for each generating station* The contractor will develop the data sets necessary to project the LRMC of generation under alternative scenarios, using appropriate tools such as Generation Planning Tools (GPT) This software may be used to develop a generation capacity planning model of Kazakhstan GPT provides a variety of outputs, including the LRMC of generation capacity, the LRMC of energy at the generation level, and the variable costs and annual net GWh generated at each generating station over the first five years (1996-1990) of the planning period Variable costs include fuel costs plus variable operation and maintenance costs

(2a) Data gathering This step will also provide a forecast of the installed capacity of each of the seven generating stations selected for the financial analysis in step 3 At least two trips to Almaty (October 15-22, 1995 and November 28-December 8, 1995) are required [Responsibility Leonardo Zaragocin, October 15-22, Charles Zimmermann, November 28-December 8]

(2b) GPT runs [Responsibility Carlos Yermoli and Leonardo Zaragocin]

(2c) Calculation of LRMC of capacity and energy at the generation level One trip to Almaty (late February 1996) is required [Responsibility Carlos Yermoli]

(3) *Estimate the LRMC of HV transmission* This will be done on the basis of long run average incremental cost, by evaluating Kazakstanenergo's investmentplan, and estimate of HV transmission losses [Responsibility Charles Zimmermann and Harry Norris]

(4) *Project revenue requirements for the medium term for Kazakstanenergo* [Responsibility Charles Zimmermann and Harry Norris]

(5) Determine target retail tariffs Estimate LRMC of distribution for different customer segments, by voltage level Based on case study of Almatyenergo, estimate the margin required for Kazakstan's distribution companies to sustain commercial operations Develop an LRMC-based retail tariff schedule by customer class, building up from bulk supply LRMC Develop financial revenue requirement per unit of supply at retail level Reconcile financial revenue requirement with LRMC to design practical target retail tariffs [Responsibility Charles Zimmermann and Harry Norris]

(6) *Propose an implementation plan for reform of wholesale and retail tariffs* Compare results with existing levels [Responsibility Charles Zimmermann]

(7) *Final report* [Responsibility Charles Zimmermann, Carlos Yermoli, and Harry Norris]

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5 Deliverables

The following deliverables will be produced

1) A report proposing a tariff reform plan for wholesale tariffs

2) Training and computer models developed for the analyses

6 Expected Results

This study is intended to support the preparation of an EBRD loan for the rehabilitation of at least one of the blocks of Ekibastuz 1

This study will provide recommendations to the government of Kazakhstan regarding wholesale tariffs and open access to the transmission grid, and recommendations to Kazakstanenergo regarding measures needed to improve the financial condition of the enterprise If these recommendations are accepted, the power sector will provide a higher degree of reliability, the cost of electricity will be closer to a least-cost expansion plan, and the sector will be in a better position to attract foreign investment

7 Schedule and Task Benchmarks

Technical assistance to AMC	CZ	September 9-15, 1995
Definitional mission	CZ,HN,LZ	October 15-24
Second mission	CZ	November 28-December 8
Third mission	CZ	late January 1996
Fourth mission	HN,CY	February 26-March 7
Draft report		May 1996
Presentation of report in Almaty		May 1996
Final report		July 1996

8 Staffing

Team leader	Charles Zimmermann
Senior power engineer	Carlos Yermoli
Financial analyst	Harry Norris
Junior power engineer	Leonardo Zaragocin

Key counterparts at Kazakhstanenergo are

Head of the economics and pricing department	Vladimir Nikolaevich Poshtashkov
Head of the forecasting department	Lydia Vitalievna Tronova

Support for this project will be provided by J Michael Biddison, Hagler Bailly's resident energy advisor in Kazakhstan, out of funding for Task 1 of Delivery Order No 5 Galina Semyonova has been hired as an energy policy analyst to participate in this tariff project as well as other energy projects managed by Hagler Bailly Logistical support will be provided by Dinara Karamouratova, Hagler Bailly's office manager in Almaty

9 Level of Effort

Expatriate professional	179 person-days
Local professional	50 person-days

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Appendix 1

Statement of Work provided by USAID (August 1995)

Task 4 Electricity Tariff Study

4 1 This study is being performed in concert with the EBRD, and will take into account the specific needs of that body The objective of this work is the formulation of an electricity pricing strategy and implementation plan for Kazakhstan

4 2 The contractor is expected to work closely with the Anti-Monopoly Committee, the Ministry of Power and Coal, the electric utilities, the EBRD, EU TACIS, the World Bank, and other USAID consultants in reviewing current electricity tariff prices and methodologies, taking into account social and fianancial objectives, as well as existing load forecasts, least-cost development programs for the power sector, amd fianancial analyses for power sector institutions

4 3 In concert with the above stakeholders, the contractor is to develop and design tariff structures that reflect as closely as possible the true economic (marginal) costs to the nation of providing electricity to different customer segments This marginal cost structure establishes the fundamental economic frame of reference from the perspective of formulating pricing strategies that promote efficient resource utilization by discouraging waste and resource misallocation, that encourage economically optimal levels of conservation and demand/load management, and direct the usage of electricity to its most valued and productive end uses

4 4 The contractor will develop an appropriate implementation scheme and schedule for a smooth and efficient transition from the present pricing structure to the new efficiency pricing structure The time-phased plan should be "in sync" with the evolving organizational structure of the power sector under the ongoing restructuring and reform efforts of the government

Deliverables

(1) To both the EBRD and USAID, the contractor will submit a report on tariff policies, methodologies, current and recommended pricing structures, including a plan for implementing the new pricing structure

(2) The contractor will submit a report on activities completed under task 4 The contractor will also report on tasks remaining, and on issues which need to be addressed in order to resolve any remaining tariff issues